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Editor:

Dr. H. A. Senn,
Division of Botany,
Science Service Dept. of Agriculture, Ottawa.

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BIRDS OF THE LOWER BACK RIVER NORTHWEST TERRITORIES, CANADA [1]

W. J. BRECKENRIDGE

Minnesota Museum of Natural History, University of Minnesota, Minneapolis.

FEW AREAS remain in North America for which at least distributional notes on the breeding bird life present are not available. The interior of Northern Keewatin, Canadian Northwest Territories, is such a practically virgin area which was visited by the University of Minnesota-Wilkie Expedition during July and early August of 1953. A simple annotated list of birds observed there to further round out our knowledge of the distribution of certain arctic breeding species as well as some discussion of the factors influencing bird distributions in this remote region may appropriately go on record. The area visited comprises the lower portion of the Back River below Garry and Macdougall Lakes. This region lies just south of the Arctic Circle and between 97° and 99° west longitude, and is roughly 600 miles NNW of Churchill, Manitoba.

C. H. D. Clarke, in his extensive report on the Thelon drainage area just to the south of the Back River (4), states, "... King with Back's expedition in 1834 still has the honour of being the only zoologist to visit Back River." Back's expedition was a fast moving exploration trip and King's biological notes (5) were meager. Since that time, J. Anderson (1), a Hudson Bay factor, again traversed the Back in 1855 in search of clues to the fate of the Franklin party, but no trained biologist accompanied his expedition and only scattered notes on the wildlife are contained in his reports.

Our party [2] left Churchill by plane on July 12 and arrived at the point selected for a base camp on July 13. This was a gravel point on the north side of the Back River at 66°-10′ north latitude and 96°-57′ west longitude. Intensive field work was carried on within 6-8 miles of this point until August 6. On July 28, Breckenridge and Taylor flew west to Macdougall Lake from which point they came approximately 85 miles down the Back River by small boat arriving back at camp on August 2. Three of the party, R. J. Wilkie, J. W. Wilkie, and Lawrence Larson, returned by plane on July 28. Unfortunately, this party was forced to make a crash landing in the Arctic Wings Norseman plane on Lake Kaminuriak 300 miles north of Churchill. The plane partially sank and, although the personnel escaped injury, the losses included approximately 50 prepared bird and mammal skins, a number of preserved fish specimens, all the terrestrial insects collected between July 13 and 28, about three thousand feet of exposed motion picture film and numerous rolls of exposed 35 mm. still pictures. The number of specimens lost does not seem great, but, considering the scarcity of wildlife in the area, and the difficulty of collecting, the small number takes on greater importance. The remaining 4 members of the party returned to Churchill on August 6 by plane.

The terrain surrounding the base camp was rugged and rocky for the most part with occasional boggy meadows interspersed, few exceeding two to three thousand acres in extent. Bold outcroppings of metamorphosed rocks rose to as much as four hundred and fifty feet above the river. Extensive sloping boulder fields of frost-shattered rocks and some talus slopes occupied much of the area

1) Received for publication May 10, 1954.

2) The expedition originated from a generous offer of financial assistance from R. J. and J. W. Wilkie of the Wilkie Foundation. An outline of the aims of the expedition brought substantial financial aid from the Quartermaster Corps of the U.S. Army and, through this connection, the R.C.A.F. extended much appreciated assistance in the form of aerial transportation. Further aid and cooperation were secured from the Wildlife Management Institute, the U.S. Fish and Wildlife Service, and the Geological Society of America. The expedition personnel included Dr. W. J. Breckenridge, leader, Mr. H. L. Gunderson, Mr. John Jarosz, Mr. Richard Spence Taylor, Mr. Robert Wilkie, Mr. James Wilkie, and Dr. Lawrence Larson.

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between the bedrock outcroppings. Many small clear lakes bordered here and there by narrow spongy peat meadows filled the depressions. Drainage slopes were often carpeted by dense hummocky mats of sphagnum moss, sedges, cottongrass, *Eriophorum* sp., Arctic labrador tea, *Ledum decumbens,* Dwarf birch, *Betula glandulosa,* bearberry, *Arctostaphylos* sp., etc.

The melting of the upper layers of permafrost left the ground saturated like a thick viscous liquid, thus causing such a mat of vegetation to move slowly and imperceptibly down the slope in a combination of a sliding and rolling movement. Under these conditions water draining to lower levels tended to filter through the surface vegetation rather than to gather into streams as is the case in temperate climates. Dry hillsides supported a minimum of plant life, but many of the tiny plants such as Arctic avens, *Dryas integrifolia,* Arctic poppy, *Papaver radicatum,* Arctic fireweed, *Epilobium latifolium,* Moss Pink, *Silene acaulis* var. *exscapa,* White Heather, *Cassiope tetragona,* had surprisingly showy blossoms. Numerous species of willow *(Salix* sp.) and Dwarf Birch *(Betula glandulosa)* sprawled prostrate over and between the rocks (Botanical Report by Dr. Ernst Abbe, University of Minnesota Botany Department, on the specimens collected in preparation).

The Back River at our camp was approximately 300 yards wide and every few miles along its course down from Macdougall Lake it plunged over roaring rapids and falls, the measured drop at some points amounting to as much as 50 feet per mile. The river banks at the rapids were formed of either bed rock or glacial boulders, many up to the size of a small house. Through most of its course from Macdougall Lake to our base camp the Back would be called a geologically immature river which had not as yet developed a well-defined valley. Its course often paralleled eskers and moraines of huge boulders and gravel or cut through them leaving tremendous steep-walled gashes of apparently very recent origin. The banks at many places appeared to have been shaped by enormous bulldozers. In this case, of course, this was the work of huge ice blocks shoved ashore by the tremendous force of the spring floods. At numerous points, notably a few miles below Sinclair Falls, the glacial deposits consisted of less hilly ground moraine. (Geological Report by expedition geologist, R. Spence Taylor, in preparation). Here, literally square miles of cottongrass and other plants grew on the slightly more productive soil and animal life was somewhat more abundant, or it might better be described as less scarce.

Under such barren surroundings one would hardly expect an abundance of wildlife and this was certainly true. In fact, much of this area resembles what the botanists have described as rock deserts or fellfields.

The following are approximate distances above our base camp of several locations (except # 4) named by Captain Back (2) and referred to in the distribution notes:

	Miles above camp
1. Macdougall Lake	85
2. Rock Rapids	80
3. Sinclair Falls	75
4. Arctic Loon Meadow	63
5. Escape Rapids	45
6. Wolf Rapids	25
7. Mouth of Meadowbank River	14

Early explorers' notes on bird distributions along the west coast of Hudson Bay and in the District of Mackenzie were very well summarized by Preble (9) (10) early in the century. C. H. D. Clarke in his report on the Thelon Game Sanctuary (4), continued the work up to 1937 and extended the coverage eastward from Mackenzie and northward from Manitoba. These reports have extensive bibliographies. Since those dates, Scott (12), cooperating with Harold Hanson and Paul Queneau, reported on the life of the Perry River region (1949) 150 miles to the northwest of the lower Back River; Savile (11) has published (1951) on the birds of Chesterfield Inlet 300 miles to the southeast, and Manning (6) has added data (1947) on the region to the south between Reindeer Lake and Baker Lake. It would seem to be unnecessary duplication to review the above reports. It is of primary interest here to note the extreme barrenness of the Back River regions and the absence from our lists of many species reported by the above workers. Of the 30 species observed by us, five were represented by single individuals; four, by only two individuals; and five others are in the list on the basis of three to five individuals.

The following is an annotated list of the 30 species of birds observed by the party near camp, July 13 to August 6, and on the

Table 1. BIRDS COLLECTED AT BACK RIVER

July 13 - August 6

		Sex	Museum Number
Old Squaw	Clangula hyemalis	♂	10587
" "	" "	♀	10588
" "	" "	♀	10589
Semipalmated Plover	Charadrius hiaticula	imm ♂	10592
Baird's Sandpiper	Erolia bairdii	juv ♀	10593
" "	" "	—	10605
" "	" "	yng ♂	10606
" "	" "	imm ♂	10607
Herring Gull	Larus argentatus	?	10594
Glaucous Gull	Larus hyperboreus	♂	10595
Rock Ptarmigan	Lagopus mutus	♀	10590
" "	" "	♀	10591
Lapland Longspur	Calcarius lapponicus	♀	10596
" "	" "	♀	10597
" "	" "	imm ♀	10598
" "	" "	imm ♀	10599
" "	" "	♂	10600
Snow Bunting	Plectrophenax nivalis	♀	10601
" "	" "	juv ♂	10602
" "	" "	♀	10603
" "	" "	♂	10604

Back River trip from Macdougall Lake down to camp, July 28 to August 2, 1953:

Yellow-billed Loon, *Gavia adamsi* (Gray). One was seen on the Back River a couple miles above Sinclair Falls on July 29, while another was noted just below Sinclair Falls on the Back on July 30.

Arctic Loon, *Gavia arctica* (L.). Two were seen on the Back River one-half mile below Sinclair Falls on July 30. A nest containing one egg (2.70" x 1.92") was found near a tiny pond on the Arctic Loon Meadow adjacent to the Back River on July 30. The incubating adult was wildly excited over my intrusion.

Red-throated Loon, *Gavia stellata* (Pontoppidan). A pair was found on the small lake across the Back River from camp on July 19. A careful search of the shore failed to reveal a nest. One bird flew over our camp nearly every evening (July 19-August 6) giving a peculiar "quok-quok" call. This was uttered 3 to 4 times per second, was a bit sharper and higher in quality than a female Mallard quack, and evidently was the odd call described by Savile (11). These birds' actions strongly suggested nesting in the vicinity. One other pair was seen on the Back River just above Sinclair Falls on July 29 and another pair two miles below the Escape Rapids camp on August 1.

Canada Goose, *Branta canadensis* (L.). The only Canada Geese recorded were 5, probably *B.c. parvipes,* the Lesser or Tundra Canada Goose, seen flying along the Back River near camp on July 15: A few primary feathers found along the shore of the bay near camp and at other points have been identified as of this species. These must have been shed previous to this season indicating that at least some of these geese were present in this area possibly the year previous (1952).

[**Lesser Snow Goose,** *Chen hyperborea* (Pallas). A single white goose was seen July 18 flying down the river near camp and veering off toward the south. Presumably it was of this species, although it could have been a Ross' Goose.]

Old Squaw, *Clangula hyemalis* (L.). The only duck positively identified in the area visited. Flocks of up to 23 birds, mostly, but

not all, males, were seen on several lakes within 5 miles of camp. A few small groups were made up of females only. No evidence of nesting was seen. Males showing white feathers in the head, indicating the beginning of moult, were seen as early as July 14. All birds appeared capable of flight until August 2 when two females were collected, one of which had shed the primaries and the other was just shedding them. No evidence of a flightless condition of males was seen. Four specimens were taken.

Rough-legged Hawk, *Buteo lagopus s.-johannis* (Gmelin). A single normal plumaged bird was seen only at a distance around the cliff two miles northwest of camp. A nest was found on a ledge near the top of a 100-foot cliff containing 4 white (!) eggs on July 24. On July 25 rechecking indicated the nest was deserted and the eggs were collected. A faint pattern was evident on the protected under side showing that the exposed parts were bleached. On being blown, they revealed dead embryos, and, since they were unbroken by freezing, they must have been laid earlier this year and deserted probably as the result of the disappearance of one of the pair.

A pair was seen on August 3, three and one-half miles west of camp. Both birds showed normal patterns, although one was markedly lighter than the other. A fresh-looking nest was found on a low cliff. This nest contained newly shed feathers but no indication of eggs or young. Murie (7) found Golden Eagles at Mt. McKinley repairing an old nest at the same time young were being raised in another. This might be the same situation with this hawk.

A pair of these birds screamed their concern near the cliffs along the portage around the Rock Rapids in the Back River. One of these was normal in pattern while the other was jet black except for white tail bands and light areas under wings.

Golden Eagle, *Aquila chrysaëtos canadensis* (L.). One adult was seen hunting along glacial boulder banks of the Back River about 5 miles above Wolf Rapids on August 1.

Peregrine Falcon *Falco peregrinus anatum* Bonaparte. One bird was seen about Mount Meadowbank on July 19. On July 21 the nest was discovered on a cliff ledge only a few feet from a deserted stick nest probably that of an American Rough-legged Hawk. The nest contained one newly-hatched young, one pipped and one unpipped egg. Another pair screamed at us at the foot of the portage around Rock Rapids on the Back River, indicating that it undoubtedly was nesting there.

Rock Ptarmigan, *Lagopus mutus rupestris* (Gmelin). A female with several young only a few days old was found 3 miles west of camp on July 15. Two young were collected but later lost in the plane crash. On August 3 a female and nine one-third grown young, found a half-mile farther west, might have been the same family, although we felt it was not. Two of the young were preserved. Two hatched Ptarmigan nests (presumably of this species) were found on portages along the Back River between Lake Macdougall and the base camp.

Semipalmated Plover, *Charadrius hiaticula semipalmatus* Bonaparte. A pair, seen along the gravel beach of the bay one mile west of camp on July 16 and 18, was concerned and evidently had young. An occasional individual was seen near camp throughout the period of our stay. One young not yet able to fly was collected on a small rocky island in the bay one-half mile north of camp on August 1.

Golden Plover, *Pluvialis dominica dominica* (Müller). One pair was seen along the Back River at the Arctic Loon Meadow on July 30. Both birds appeared concerned, sneaking away and dragging their wings. This suggested hidden young, but none could be located.

White-rumped Sandpiper, *Erolia fuscicollis* (Vieillot). One adult, seen July 31 along the Back about 5 miles above Escape Rapids, put on the broken wing act indicating probable nesting.

Baird's Sandpiper, *Erolia bairdii* (Coues), The only species of Sandpiper found breeding extensively but sparingly throughout the area. Three pairs were found on July 19 localized on breeding territories in swampy meadows adjacent to Mount Meadowbank one to three miles south of camp where two, perhaps 2-day-old, downy young were collected. A watercolor painting was made of this plumage, and colored movies taken of the birds. Another young on the wing was collected one-half mile west of camp on August 2. An adult was identified just

above Sinclair Falls on July 30. An adult and four two-thirds grown young were found on July 31 a mile above the Escape Rapids along the Back River. The adult and one young were collected. Another family of three young on the wing and an adult was found on August 1 about 15 miles above the mouth of the Meadowbank River. One young was collected. Five of the 9 specimens including the downy young were lost in the plane crash.

Red-backed Sandpiper, *Erolia alpina* (L.). One adult was seen along the Back River at the Arctic Loon Meadow on July 30. The bird joined the Golden Plover pair, noted above, in protesting the intrusion which at least suggested nesting.

Northern Phalarope, *Lobipes lobatus* (L.). Several birds including one flock of 6 or 8 were seen about the ponds on the Arctic Loon Meadow on July 30. No definite evidence of nesting was secured.

Parasitic Jaeger, *Stercorarius parasiticus* (L.). One pair flew over camp on July 23. Again on August 1, three were seen at camp while a single bird flying near camp on August 3 caused a great clamor among the gulls.

Long-tailed Jaeger, *Stercorarius longicaudus* Vieillot. From 6 to 10 were seen each day from July 28 to August 1 from Macdougall Lake down the Back River to near the mouth of the Meadowbank River. Through this area the terrain was largely glacial till, gravel and boulders with frequent extensive cottongrass meadows. No Jaegers, identified as Parasitic, were seen here. Lower down on the Back near camp the terrain was more barren bedrock outcroppings and frost shattered boulders, and no Long-tailed Jaegers were seen in this type of terrain, only an occasional Parasitic.

Herring Gull, *Larus argentatus smithsonianus* Coues. An occasional individual was seen along the Back River between Macdougall Lake and camp, July 28-August 2. One or two appeared about camp on July 14 and the number increased gradually during the period of our stay until 15 were counted at one time on August 5. No evidence of nesting was seen. Nearly all the birds were adult with only a few showing black in the tail or dark feathers in the back and wings. One bird was collected.

Glaucous Gull, *Larus hyperboreus hyperboreus* Gunnerus. An occasional individual was seen on the Back River from Macdougall Lake to camp July 28-August 2. One or two visited camp occasionally between July 14 and August 6. All birds appeared to be in adult plumage and no evidence of nesting was seen. One bird was collected.

Arctic Tern, *Sterna paradisaea* Pont. Several birds were seen each day on the Back River between Macdougall Lake and the Meadowbank River. These were somewhat more common near rocky islands above Sinclair Falls and near the mouth of the Meadowbank River. None were seen at base camp and no evidence of nesting was secured.

Horned Lark, *Eremophila alpestris* (L.). A few pairs were found widely scattered in the area about camp. All had young on the wing by the time of our arrival July 13. In a walk of 5 to 7 miles we would see perhaps 2 to 4 families. Pairs were seen at several points along the Back River between Macdougall Lake and camp, July 28-August 3. At no point were they as common as Lapland Longspurs. The yellow on the throats of these birds was hardly noticeable. An adult and several young were collected but later lost in the plane crash.

Cliff Swallow, *Petrochelidon pyrrhonota* (Vieillot). Single individuals were seen flying over camp on July 18 and July 24.

Raven, *Corvus corax principalis* Ridgway. One individual was seen one-half mile west of camp on August 1 and another flew over camp on August 4.

American Pipit, *Anthus spinoletta rubescens* (Tunstall). This bird was second in abundance to the Lapland Longspur in our camp area. Bare rock outcroppings and boulder fields were the typical habitat of the pipit, none being found in the cottongrass meadows. In such rocky areas 2 to 3 families would be encountered in each mile traversed. By the time of our arrival July 13, the adults were feeding young already out of the nest. The courting flight songs were no longer being given; only their characteristic twitters were heard. A series of these was collected but lost later in the plane crash.

Redpoll, *Acanthis* sp. This species was encountered once a mile northwest of camp

on July 15 and again about 3 miles NNW of camp on July 23. The latter bird was carrying food and undoubtedly had young. These were dark, probably *A. linaria*, but no specimens were collected to allow of specific recognition.

Savannah Sparrow, *Passerculus sandwichensis* (Gmelin). Nearly all of the scattered boggy meadows around camp were inhabited by this sparrow, and the species was seen in similar habitat on a portage just above Sinclair Falls on July 30. Several pairs were feeding young on the wing, and a series of specimens was taken but these were lost in the plane crash.

Gambel's Sparrow, *Zonotrichia leucophrys gambelii* (Nuttall). One pair was found and collected on July 24 in a particularly sturdy growth of dwarf birch and willow among large boulders about a mile west of camp. The specimens were later lost, but a careful watercolor sketch of the head of one shows definitely the light lores of the Gambel's Sparrow. The female's ova were reduced to pinhead size, but the male testes were still fairly large. They probably had nested, but we found neither nest nor young.

Lapland Longspurs, *Calcarius lapponicus lapponicus* (L.). The commonest bird throughout the area. Young just out of the nest were seen at the time of our arrival, July 13. Three to four families per mile would be encountered and they appeared to occupy both the boggy meadows and the rocky fields and hillsides. Fully grown young were regularly seen by July 25, and flocks of more than a single family began drifting by our camp on the rocky point by the last of July. The species was commonly seen all along the Back River from Macdougall Lake to camp, July 28 to August 2, flocks, mainly of young birds, often invading camp and walking about within 10 to 15 feet of our camp fires. A series of developing young was collected but lost in the plane crash.

Snow Bunting, *Plectrophenax nivalis nivalis* (L.). These birds were widespread throughout the area but were definitely less common than either the American Pipit or Lapland Longspur. Adults were feeding well-grown young on our arrival, July 13. Several families were seen at numerous points along the Back River between Lake Macdougall and camp July 28 to August 2. Boulder-strewn lake shores and river banks were frequented by adults seeking food for their young. Gathering of family groups into larger flocks was first noticed on July 30 when such groups appeared at camp where none had previously occurred.

One of the major objectives of our trip was to investigate the breeding population of geese, which both Back (2) in 1834 and Anderson (1) in 1855 mentioned as being abundant.

Back passed the location of our base camp on July 26 and camped a few miles below. In describing this camp, he stated, "It was opposite to a solitary bank that formed the western entrance to a small river apparently a favorite resort for geese, which, having frequented it in numberless flocks during the moulting season had left thousands of the finest quills strewn on the sand. Carts might have been laden with them."

Back gave no clue to the species of geese seen, but Anderson mentions repeatedly the abundance of Canada Geese. Anderson's party crossed Macdougall Lake and encamped at Sinclair Falls on July 25. (We camped there July 29). His notes for that day mentioned that they "killed 13 male Canada Geese". On July 28 while still above the mouth of the Montresor River (covered by us by plane on July 14 and again on July 28), Anderson reported that "immense numbers of Canada Geese were seen — 20 killed."

Considering the changes in waterfowl populations throughout North America during the last century, it would not be surprising to find the birds breeding in this region reduced in numbers, but the total absence of any evidence of either ducks or geese breeding in this area this year was not anticipated. There is evidence (returns from geese banded in Alaska, Sigurd Olson, Jr. correspondence) (3) indicating that local populations of geese have a strong tendency to winter in restricted areas in the United States. The particular local breeding population from this area might have been decimated or even completely eliminated by hunting during the past 75 years leaving little or no breeding stock whose ancestral nesting grounds was the Lower Back River. Nearly all other populations of geese wintering in the United States have been reduced,, and their breeding areas are probably becoming less rather than more crowded. Consequently, population pressures are not tend-

ing to push breeding birds back into this particularly barren area.

Another explanation of this lack of waterfowl centers around the possibility that this was a season of particularly late breakup of the ice. Pilots who flew us into the Back River from Churchill stated that although early in the season it threatened to be an unusually early breakup, the weather turned cold again and the season actually turned out to be unusually late.

The following explanation for the lack of birds during late seasons was suggested originally by Mr. Arthur Hawkins and Mr. Ed. Wellein, biologist of the U.S. Fish and Wildlife Service, working on Arctic waterfowl problems. Species of geese and ducks normally adapted to arctic nesting move northward along the west coast of Hudson Bay as rapidly as possible in spring. Encountering frozen, uninviting conditions, as the above reports suggest that they might have this year, they tend to follow the SE-NW isotherms toward the northwest where the ice disappears earlier and these birds would nest farther to the north and west as the breeding urge finally made nesting imperative, instead of moving directly north into this Back River area.

Similarly, wintering waterfowl, including Lesser Snow Geese and Ross's Geese from along the California coast, move northward along the Pacific and across the mountains to the Mackenzie Delta. The Lesser Snow Geese evidently move on from there northeastward along the Arctic Ocean to Banks Island, since large numbers of these birds were on their nesting grounds on Banks Island this year (1953) as early as May 30 (E. O. Höhn, correspondence, February 16, 1954). Ross's Geese evidently follow a similar route to the Mackenzie Delta but continue on eastward to Perry River. Perhaps those as well as Tule Geese and others may move on farther eastward and into the interior during early seasons but would be prevented from further advances in this direction in late seasons. Whether or not the Ross's Geese nested in normal numbers in the Perry River area this year is not now known.

Whether or not these theories apply to this year's barren situation in the Back River area depends entirely on whether or not this year's spring break-up could correctly be considered as "unusually late".

In this connection, Back (2) described in graphic terms how huge masses of ice from Lake Macdougall temporarily blocked the Back River at Rock Rapids on July 24, the year that geese occurred abundantly on the river. We saw no ice on Lake Macdougall or at Rock Rapids on July 28 and 29, indicating that this past spring (1953) breakup could not have been later and probably was not as late as in 1834. Furthermore, river temperatures recorded at our base camp dropped suddenly from 46° F. on July 18 to 43° on July 19, and some ice was seen on the bank above camp on July 21. This suggested some major mass of ice entering the Back on this date or earlier, and this could have been the same phenomenon mentioned by Back occurring several days earlier in July this year.

A study of the monthly weather maps issued by the Meteorological Division of the Canadian Department of Transport shows that during 1953, the central Keewatin region was considered to have had temperatures during April of 10° F. *above* the long term average; May, 3° F. *above* average; June, 2° *above* average; July, 1° *below* average; and August, 2° *above* average.

Admittedly, the Back River area has no reporting weather station,[3] and the above data are interpolated from Baker Lake and Cambridge Bay reports. Still these data do not seem to support the supposition that this past year (1953) was an unusually late season in the Back River area. These fragmentary bits of evidence, then, would suggest that our report on waterfowl breeding must be considered as representing a fairly typical season's conditions, and that, as far as temperatures are concerned, only occasional seasons might be expected to be more favorable.

One further possible explanation of the waterfowl scarcity would be that a major

3) BACK RIVER WEATHER CONDITIONS. Temperature readings were taken at two-hour intervals when time permitted, from July 15 to August 6. Maximum-minimum temperatures were recorded July 20 through July 29, and on August 4, 5, and 6. Precipitation, amount of cloudiness and wind velocity were recorded daily. The lowest temperature recorded was 34° on July 23 and the lowest average daily temperature recorded was 45° on July 28. The highest temperature tallied was 77° at noon on August 3. The highest daily average, 62°, was on August 5. The greatest daily variation recorded was 33° (43°-76°) on August 4. Precipitation occurred on 8 days but was so light that it was measurable only on three days when 5/16, 1/8, and 1/16 inches fell, for a total of ½ inch. Winds of 25-38 miles per hour (estimated from the Beaufort scale) were frequent and winds up to 46 miles per hour were recorded on two days.

shift in the breeding grounds of these geese may have taken place. If this has occurred, weather or food conditions must be the cause, since human interference in this area can not have changed materially in the past 100 years. There is some precedent for supposing that such a shift away from a large area as a breeding grounds could occur. Preble (9) did not mention finding in 1902 Blue and Snow Geese around Eskimo Point where Soper (13) reported they were nesting in 1944 and had been for sometime before that; and, where there were still large numbers breeding this past season (1953). Porsild (8) reported seeing no Snow Geese nesting on Banks Island in 1949, a particularly late season, where Pilot Ernie Boffa had seen large numbers in previous years. Many nested there again last year (1953) (correspondence, E. O. Höhn). Furthermore, Soper's report (15) of the unexplained shift of the migrating Blue and Snow Geese in spring from their Grant's Lake, Manitoba, resting area suggests that geese are capable of making major changes in what might be considered "permanent" ancestral flight lanes.

It might be suggested that another reason for our lack of evidence of breeding geese was that we simply missed the lakes where they bred this year. If they retained their habit of moving down onto the Back River, as both Back (2) and Anderson (1) found them doing at the same time as during the summer of our visit, then we should have encountered them somewhere on the 130 miles we covered along that river.

The extreme scarcity of predatory birds was also unexpected. No Snowy Owls were seen and as noted above, only one pair of Peregrine Falcons and one pair and a lone bird of the Roughlegged Hawk were found in the base camp area. Six transient Parasitic Jaegers and a few non-breeding Herring and Glaucous Gulls complete the list of predatory birds Competition from mammalian predators could hardly be a factor. (A report by Harvey L. Gunderson, John Jarosz, and Breckenridge on the mammals encountered appeared in Journ. Mam., Vol. 36, No. 2, May 1955, pp. 254-259.) One family of Arctic Foxes lived 3½ miles west of camp; another family den was located 13 miles up the Back River; and some distant barking heard one night from across the bay possibly indicated the range of another family. No wolves were seen or heard. A few apparently fresh tracks were seen, but we found the freshness of tracks in this region could be very deceiving. The population levels of the prey species probably was the determining factor. Lemmings, both Collared and Brown, occurred in the area. One hundred snap traps, set in lines intersecting various habitats, took 31 specimens in 1898 trap nights (.0162 specimens per trap night). Comparison of these data with Shelford's (13) Churchill figures would seem to justify our considering these rodents as hardly at an extreme low in population, but certainly not abundant.

Snowy Owls appeared in the northern states in moderate numbers in the winter of 1953-1954. Although this suggests a low in lemming populations during the previous summer (1953), such invasions usually result from low average regional population levels (14) and would not necessarily mean a minimum lemming population in this particular area.

Small, scattered populations of Parry's Ground Squirrel were also found. Five specimens of these were taken from the several small colonies which were located within 3 to 4 miles of camp. Avian prey for predators could have included Lapland Longspurs, American Pipits, Snow Buntings, Horned Larks and Baird's Sandpipers. All these, as noted previously, were widespread but definitely not abundant. Rock Ptarmigan were rare and could hardly have afforded much food.

It thus seems probable that if predatory birds ever move into this barren region in numbers, they probably do so only during periods of peak abundance of prey species, particularly Lemmings and Arctic Ground Squirrels.

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NOTES ON MOVEMENTS OF BANDED MUSKRATS [1, 2]

L. E. WRAGG

Dept. of Anatomy, University of Wisconsin, Madison.

DURING a study of the muskrat [3], observations on the movements of banded animals were made which add to the data already accumulated on this subject.

Locality and Method

Most banding was done between May and October 1947, near Oshawa, Ont., in a 25-acre section of a privately-trapped 175-acre marsh the population of which had been moderately reduced the previous year by disease. Traps used were Nationals; tags were 50 x 5 mm. metal bands secured around the tendon of Achilles. Final captures were made by commercial trappers.

Results

During the period indicated, 81 muskrats were tagged and released. Eleven live recaptures were made during banding operations — usually at or near the site where the individual was banded a few days previously. Twenty-six recoveries were made by commercial trappers in March, 1948, and three more in March, 1949. Another record was obtained from one of nine animals tagged in fall in a game preserve at Hamilton, Ont., and captured the following spring (see Table 1).

These data apparently show two types of movement; long wanderings involving redistribution of populations, and shorter local movements. Of the 30 recaptured animals, 15 were over 100 yd. from the banding site, and eight of these were more than ¼ mi. away. Nine animals were taken outside the home marsh. They had apparently travelled along watercourses, for not one was caught in creeks or marshes as close as 400 yd. distant, unless connected to the home marsh by a direct water route.

1) From an M.A. thesis submitted to the Department of Zoology, University of Toronto, financed in part by the Research Council of Ontario and the Royal Ontario Museum of Zoology.
2) Received for publication April 7, 1954.
3) Notes on the Life History of the Muskrat in Southern Ontario. Can. Field-Nat., 67: 174.

Table 1. Number of Muskrats Recovered at Various Distances from Banding Site.

Animal	No. Banded	Interval Between Captures	No. of Muskrats Recovered at these Distances Between Initial and Final Points of Capture.				
			0-100 yd.	100-400 yd.	400 yd-1 mi.	1-4 mi.	8 mi.
Adult	62	5-10 mo.	15	5	0	3	1
		17 mo.	0	1	2	0	0
Young in nest . . .	28	10 mo.	0	1	1	1	0
Total . . .	90	5-17 mo.	15	7	3	4	1

The one record of overland travel was that of a huge female killed by a dog along a railway track in winter. At this time a number of untagged muskrats which were frozen out of houses built in shallow water were found wandering over the ice of the marsh, across farmland, or frozen in snow.

All these emigrants (i.e. nine animals which left the home marsh) left what appeared excellent habitat the population of which was well below normal. In most cases they were recovered in less favorable habitat and some were in poorer condition than home marsh 'rats. It is highly improbable that population pressure or lack of food prompted their leaving the home marsh.

Five of these nine animals wandered over a mile, and were caught as follows. One was found frozen in a hole in a creek bank 2¼ miles away, where it had probably frozen or drowned. Another was a kit which had been tagged in the nest in July and the following spring was taken in poor condition along a small stony creek three miles from the banding site. A third stepped into a trap along a creek over a mile from the place where tagged. The huge female killed by a dog in winter has been mentioned. The other was in a small creek eight miles distant from the place where tagged.

Of 28 young tagged in the nest only three were recovered but each of these was a considerable distance from its home nest. A litter of 10 was tagged on June 5. Two of these were trapped the following spring — one 175 yd., the other 500 yd. away. The third was from a litter of 4 tagged July 26. It was taken in spring three miles distant.

In contrast with these longer wanderings, restricted local movements are suggested by the recaptures of 15 animals within 100 yd. of the place where banded at least five months earlier. For example a female live-trapped along a creek bank on October 24 was recaptured two days later at a small willow tree 100 ft. distant. Five months later it was killed at the same tree.

In October an adult male and an adult female were taken and banded on successive nights on a small house under construction. When captured the following spring, the female was only 150 ft. from the cabin but the male was half a mile upstream. Such an observation is in line with the idea that animals in pairs or families construct a winter house where they live till spring. At this time males appear to wander extensively, females less so.

Summary and Interpretation

Thirty of 90 tagged muskrats were recovered a total of 41 times within 1½ years after banding. These data from the area studied — a somewhat under-populated but apparently excellent marsh habitat — suggest:

1—During the year half the animals remain in a restricted locality, and possibly a half but more certainly a third move to new feeding grounds.

2—Of the adult population a) about half remains in a limited area throughout the year. Fifteen of 24 recaptures made after an interval of 5-10 months which included the active spring and fall periods were less

than 100 yd. away. All of three others taken after 17 months were at further distances.

b) At least 20% move to a different locality during the year. Of 30 animals, 4 after 5-10 months, and two after 17 months had moved at least ¼ mile and averaged one mile. These six, and two others taken a little less than 400 yd. from the banding site, all left the home marsh.

3—Young apparently distribute themselves away from the home cabin. Of 28 young banded in the nest, three were recovered 10 months later at distances of approximately 175 yd., 500 yd., and three miles.

4—Movement tends to be along water courses and does not appear to be stimulated necessarily by population pressure or lack of food.

MELANISM IN THE VARYING HARE, *LEPUS AMERICANUS* ERXLEBEN [1]

RALPH D. BIRD
Science Service, Entomology Division, Brandon, Man.

ON December 16, 1953, a young hunter, Clare Hillis, shot a completely melanistic varying hare 15 miles northwest of Brandon near Smart Siding. He notified the local press, The Brandon Sun, a representative of which in company with the writer visited Mr. Hillis. Mr. Hillis stated that he had been hunting rabbits in company with two other boys and that they had shot about fifty, as rabbits were very abundant in the willow and poplar scrub. They had seen the one black rabbit, which he was able to shoot. On the suggestion of the writer he readily agreed to donate it to The Manitoba Museum, Winnipeg. The museum director, R.W. Sutton, who made a study skin of the specimen, reported that it was a male in good flesh with a length of 15.7 inches and hind foot 4.75 inches. The specimen was completely black, with a bluish cast. The toe nails and eyes were also black. Mr. Sutton stated that he had no records for melanistic snowshoe rabbits from Manitoba, with the possible exception of a sight record in June 1951 on the road to The Pas, when he and two others thought they saw a black rabbit cross the highway, but he did not get a clear view of it as it ran through the bush.

A search of the literature has located only the following reference to melanism: Seton (Life Histories of Northern Animals, p. 624), "numerous melanisms, that is black freaks, of this hare, are on record; I have seen three — one in Montreal, two in New Hampshire."

Inquiries prompted by the scarcity of published records have brought the following replies.

National Museum of Canada — L.S. Russell. "I have examined the specimens of *Lepus americanus* in our collection and find that they include three melanistic examples, two of them from Quebec and one from Prince Edward Island. Among the specimens from western Canada there are several with unusually dark backs or rumps, but none that I should call melanistic."

Royal Ontario Museum — R.L. Peterson. "We have three such specimens in our collections as follows:

Lepus americanus virginianus.

No. 23-11-15-1 ♂, Sutton, York Co., Ont., Nov. 15, 1923, 18.75" — 1.63" — 5.30".

No. 10,017 ♀, Mont Albert, York Co., Ont., Jan. 8, 1937, 480-38-140, wt. 1725.

No. 16,962 ♀, Asphodel Twp., Peterborough Co., Feb. 15, 1947, 449-53-126, wt. 1200."

Provincial Museum, Province of Saskatchewan — Fred G. Bard. "We have only one specimen here on record in the Provincial Museum. This was taken on Wolverine Creek, North of Marchwell, Saskatchewan, by Amil Krewaltd. It was sent to us by Mr. W.H. Schwalm, Box 532, Russell, Manitoba. This was received on April 16th, 1953.

"Mr. Schwalm says he saw this melanistic phase Varying Hare with the normal brown members of the rest of the litter several times in 1952. This specimen is mounted and on display in the Provincial Museum."

The University of British Columbia, Department of Zoology — I. McT. Cowan. "I have no specimens of melanistic *Lepus* nor do I know of any being taken in the Province."

In Journal of Mammalogy, February, 1954, page 122, the taking of two melanistic snowshoe rabbits in New York in 1951 is recorded.

1) Received for publication February 4, 1954.

BADGERS IN KENT AND ELGIN COUNTIES, ONTARIO [1]

C. O. BARTLETT
Ontario Dept. of Lands and Forests, Aylmer, Ont.

SEVEN BADGERS *(Taxidea taxus* (Schreber) were captured in Kent and Elgin Counties of south-western Ontario in the period from June 1953 to May 1954.

A review of the literature indicates that there are no recent records of badger for either Kent of Elgin Counties. Cross and Dymond (1929) included the badger as among those species extinct in Ontario in the wild state. Downing (1948) indicated that they occurred occasionally in the western part of the Rainy River district and that there were a few early reports from the Lake Erie region. One recent record was available for a specimen secured near Port Dover, Norfolk County, in 1934.

I obtained the information presented here from (a) an examination of five specimens (Badgers 1, 4, 5, 6 and 7), (b) from interviews with persons responsible for the capture of all seven specimens and (c) from periodic visits made to the localities where the specimens were obtained.

BADGER 1 — Immature male; captured near Highgate, Orford Township, Kent County, by Mr. Thomas Hastings, on June 17, 1953; total body length 18.5 in., length of hind foot, 2.8 in., weight 2.6 lbs.; captured alive in an apple orchard approximately thirty feet from farm buildings; later killed by Mr. Hastings.

BADGER 2 — Sex unknown; captured near Highgate, Orford Township, Kent County, approximately one mile southeast of Badger 1, by Mr. Cecil Stewart, on August 14, 1953; estimated weight 13 lbs; kept in captivity at Rondeau Provincial Park, later sent to Riverdale Zoo, Toronto.

BADGER 3 — Immature female; captured near Clearville, Orford Township, Kent County, by Mr. Alfred Shute, in the latter part of April, 1954; captured alive with Badger 4 in a den and killed by Mr. Shute.

BADGER 4 — Immature male; captured with Badger 3; the small size (approximately six inches in total length), the short fur and the description of the den given by Mr. Shute indicate that Badgers 3 and 4 were two of a litter of badgers born in that area. Badger 4 is presently being held in captivity by Mr. Shute. The general appearance and small size of this animal, examined by the writer on June 13, 1954, is supporting evidence that a litter of badgers was born in that area.

BADGER 5 — Adult male; captured near Clearville, Orford Township, Kent County, by Mr. Alfred Shute, in the last week of April, 1954. The animal was caught in a trap approximately 500 yards from the location of Badgers 3 and 4. Mr. Shute, who killed the animal, estimated its weight at approximately 25 pounds. The carcass was examined by the writer on June 13th and the skull obtained.

BADGER 6 — Immature female; captured near New Glasgow, Aldborough Township, Elgin County, by Mr. Murray McLean, on May 8, 1954; found alive in rear of farm buildings, later killed by Mr. McLean; stretched pelt measured 21.8 in. in total length.

BADGER 7 — Immature female; captured near New Glasgow, Aldborough Township, Elgin County, by Mr. Norman McNichol, on May 25, 1954. The location is approximately two miles east of Badger 6. Captured alive, this badger weighed 4 pounds on June 9, 1954. It is presently on display at Rondeau Provincial Park.

It is interesting to note that all specimens described here were taken within a radius of nine miles from Muirkirk near the Kent-Elgin County boundary. Sand hills and gullies are numerous in this area, forming part of the Bothwell sand formation that extends south into Kent and Elgin Counties. This formation supports a large woodchuck *(Marmota monax* Linnaeus) population and signs of badger activity were more prevalent in the sandy knolls where woodchuck burrows were concentrated. Ground squirrels *(Citellus* sp.), an important food item for badgers in the western parts of North America, have not been reported in this part of Ontario. The badger-woodchuck association that exists in the Kent-Elgin

1) Received for publication June 29, 1954.

County area presents an interesting field for further investigation.

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THE GOLDEN EAGLE NESTING IN THE GASPÉ PENINSULA, QUEBEC [1]

JAMES L. BAILLIE
Royal Ontario Museum of Zoology and Palaeontology, Toronto.

A RECENT REVIEW of the breeding records of the Golden Eagle *(Aquila chrysaëtos)* in eastern Canada has been published by Snyder (1949), wherein evidence of nesting, past and present, is given for Nelson River (northern Manitoba), Cape Henrietta Maria on James Bay, Rainy River District, north shore of Lake Superior and north Frontenac County (Ontario), Fort Chimo, Michikamau, the north shore of the Gulf of St. Lawrence and Anticosti Island (Quebec), and for Prince Edward Island and Nova Scotia.

More recent nestings at Fort Chimo have been published elsewhere by Bateman (1953), and Palmer (1949) has stated that the bird still breeds in two or three counties in Maine.

No suggestion that the Golden Eagle summered or bred in the Gaspé Peninsula on the south shore of the Gulf of St. Lawrence in Quebec is given by Snyder, and there is no evidence of any occurrences at all there in the writings of Townsend (1920), Demille (1926), Lewis (1930) or Ball (1938, 1943) concerning the bird-life of that section of Quebec.

Recently, in conversation with Mr. David Lambden, I was assured, however, that a pair has nested for many years on the east slope of Mont Notre Dame on the Matane River, in Couq Township, Matane County, Que., roughly 50 miles southeast of Matane, on the south shore of the Gulf of St. Lawrence at the base of the Gaspé Peninsula.

Since a previously unrecorded breeding place seemed indicated, I asked Mr. Lambden to provide me with further details, which he was kind enough to do by letter. Mr. Lambden in 1951, was in the employ of the Hammermill Paper Company, on the edge of whose lands the nestings occurred, and it was during that year his observations were made.

Herewith are the significant parts of Mr. Lambden's letter:

"Further to our discussion [about]... Golden Eagles. I spoke to Mr. [L. S.] Lister, the local manager, and I understand that an injured immature bird was taken by him several years ago. It was mounted, and for a long time occupied a prominent place in the local grocery store of Desrosiers. With renovation of the store, it was given to an out-of-towner for his store and no one knows now who that was...

"Several times young birds have been seen and some captured and kept at the club at Lake Matane. They leave the nest and in learning to fly keep flopping down the steep hillside through the woods until reaching the road along the lake.

"The eagles have been carefully protected by the Company... The [nest] site is actually on the Crown Lands in Couq Township, leased by Price Brothers and Company, Ltd. The Pechedek River [a tributary of the Matane, west of Mont Notre Dame] is being cut now by mechanical logging methods. They could, by this method, log all Mont Notre Dame... [but] there is not a great amount of sawlog material on these east slopes.

"I don't know the elevation of Mont Notre Dame. It would be about 2200 feet with the eagles nesting at about 1600 feet. The elevation of the lower end of the lake [Matane] at the dam and club site is about 1100 feet.

"I have talked with workers of the Company who tell me that the pair has been here

1) Received for publication July 20, 1954.

more than 25 years. Michel Ouellet, a teamster, says he saw them in 1951 on March 20th. Michel first saw these birds when he was 18 years old. He is now [1954] 57, so that places the earliest record I can get at 1915...

"[All persons interrogated stated] that the birds were of a uniformly dark color, some mentioning a little white under the wings, and that all birds seen at close range had fully feathered legs...

"There... [was] no mention of Bald Eagles at all.

"On April 12th [1951] I saw one of the eagles for the first time, at a fair height, say 1500 feet, along the cliffs at the west side of Lake Matane and with 8x glasses in good light figured it to be a pretty uniform dark color.

"I saw the birds, singly or together, several times after that [that summer], but each time without glasses. On June 17th, in company with P. G. Machley, a student-assistant from U. N. B., who has had some mountaineering experience, I reached the nest, or rather the foot of a sheer cliff. Above us about 20 feet was a great rock fissure piled high with branches. The birds were nowhere around.

"On August 5th, while driving along the road below Mont Notre Dame we spotted an eagle soaring along the faces about 200 feet above us and with the glasses made the best observation of the season, which checked out completely with Taverner and Peterson field notes. Amazing size, isn't it?

"Again... Sept. 24th, I saw the birds over the flowage of the Trout River Dam. Several groups of scaups, and golden-eyes and some black ducks immediately took wing and kept passing haphazardly to and fro till the circling of the eagles carried them off to the east...

"Mont Notre Dame has been studied a number of times by the botanical-minded priests for its Arctic type flora. Caribou occur in the Gaspe National Park and wander occasionally into the property. I saw one here at the Trout Depot in March, apparently sick, and was told that one was killed by a truck about 6 miles east of the Depot."

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DISTRIBUTION AND POPULATIONS OF THE EUROPEAN HARE IN SOUTHERN ONTARIO [1, 2]

J. K. REYNOLDS

Division of Fish & Wildlife, Dept. of Lands and Forests, Maple, Ontario.

History of Introduction and Spread

THE PRESENT POPULATION of European hares (*Lepus europaeus hybridus* Desmarest) (*vide* Peterson and Reynolds 1954) is apparently descended from seven females and two males which escaped from captivity on the Bow Park Farm, about three miles south of the City of Brantford, Brant County, Ontario, in 1912 (Dymond 1922). Additional hares of this species may have entered Ontario by crossing the International Boundary between Canada and the United States in the vicinity of the Niagara Peninsula as a result of the introductions into Pennsylvania and New York described by Silver (1924) and Bump (1940), but this seems unlikely.

These "Jackrabbits", as they are commonly called in Ontario, attracted little attention

1) From a Ph.D. thesis, "The biology of the European hare (**Lepus europaeus** Pallas) in southwestern Ontario", Dept. of Zoology, University of Western Ontario, 1952; financed in part by the Research Council of Ontario.

2) Received for publication September 7, 1954.

during the first decade of their existence in the province, but subsequent accounts indicate that the population must have been increasing and extending its range rapidly during this period.

In its spread southwestward from Brant County the European hare reached Aylmer in Elgin County by 1919 (Anderson 1923), Ingersoll in Oxford County by 1921 (Dymond 1922), Simcoe in Norfolk County by 1923 (Anderson 1923), and Port Rowan, also in Norfolk County, by about 1925 (Snyder and Logier 1931). Silver (1924) credited Professor A. B. Klugh with a statement to the effect that by 1924 the European hare occupied 4,500 square miles of country immediately north of Lake Erie. By 1928 it had penetrated as far west as Highgate in Kent County (Dymond 1928a), and by the following year it occupied most of southwestern Ontario (Cross and Dymond 1929).

The northward extension of its range brought it to Waterloo and Wellington Counties by 1921 (Dymond 1922, Soper 1923, Howitt 1925), Walkerton in Bruce County by 1928 (Dymond 1928a), Flesherton and Meaford in Grey County by 1928 (Dymond 1928a, 1930), Tottenham, Collingwood, and Penetanguishene in Simcoe County by 1928 (Dymond 1928a, Baillie 1928, Saunders 1932), and Burk's Falls in the Parry Sound District by 1948 (Downing 1948).

The earliest reports of the hare's eastward extension of range showed that it occupied the Niagara Peninsula and Wentworth County in 1921 (Dymond 1922, Howitt 1925). It progressed eastward through the country north of Lake Ontario, reaching Woodbridge, Erindale, and Maple in York County in 1925 (Baillie 1929, Snyder and Logier 1930, Mayall 1939). Its range had extended to Markham and Uxbridge in Ontario County by 1928 (Dymond 1928a, Cross and Dymond 1929), and into Darlington Township in Durham County by 1930 (Allin 1940). Between 1930 and 1936 it must have crossed Northumberland County, for in the latter year it was first reported in Prince Edward County (Snyder *et al.* 1941). The earliest reports of its occurrence in Frontenac County came from Conservation Officer R. B. Page, Ontario Department of Lands and Forests, who reported *(in litt.* 1950) that one was killed on Highway No. 38 near Hartington in the autumn of 1948. According to District Biologist H. G. Lumsden, *(in litt.* 1952), of the same Department, this hare has not yet colonized Amherst or Wolfe Islands in the extreme eastern end of Lake Ontario and it is still rare in Pittsburg Township, the southeasternmost township of Frontenac County.

The foregoing extensions of range are shown in Figure 1.

At the present time the European hare occupies most of the area of Ontario south of the Precambrian Shield, exclusive of the islands off the Bruce Peninsula, in the west end of Lake Erie, and in the eastern end of Lake Ontario. It has not yet populated that part of extreme eastern Ontario east of the Precambrian Shield, but it will probably do so within the next few years.

According to Lt.-Col. L. S. Dear and Dr. A. E. Allin *(in litt.* 1950) the European hares transplanted from southern Ontario into the District of Thunder Bay, reported by Allin (1950), do not seem to have been successful. District Forester G. F. Meyer, Ontario Department of Lands and Forests, reported *(in litt.* 1949) that an attempt to introduce these hares near Cochrane at some time subsequent to 1940 was a complete failure.

Burt (1946) and Burt and Grossenheider (1952), in their maps intended to depict the range of the European hare in the Great Lakes area, have greatly exaggerated the situation as it applies to Ontario.

Populations

The majority of the foregoing reports of the hare's spread in Ontario were based on occurrences of single animals or small numbers as the hare extended the periphery of its range. Unfortunately, little was published about its abundance in the districts in which it was already established. Anderson (1923) stated that the hare was "very abundant" in a wide area of southwestern Ontario in 1923, and other early writers on the subject made similarly inconclusive statements about its abundance.

The only quantitative accounts of its numbers are those of Dymond (1928a, 1928b, 1929). He reported that in the winter of 1928-29, up until February 7, 300 hares were killed by hunters in an area of six square miles near Ilderton, Middlesex County. His informant, the late Roger T. Hedley, a well-known farmer-naturalist, reported to him that on February 18, 1929, seven hunters killed 10 hares and saw 80 more in an area of a little more than one square mile in Lobo Town-

ship, Middlesex County. In east Nissouri Township, Oxford County, similarly dense populations may have been present, for Dymond was able to report that "in organized hunts that were held each Thursday throughout the winter, 218 European hares were killed by the end of December (1928) and 86 had been killed on the last drive".

According to verbal reports of many sportsmen who hunted hares in Ontario south and west of Lake Simcoe, populations must have continued at or above the high levels which Dymond's accounts suggest from the late 1920's until the early 1940's. Since it seemed that "jackrabbits" could be most successfully hunted by groups of men operating in "drives", rather than by single hunters or small parties, during the 1930's small clubs, organized for the purpose of shooting European hares, sprang up all over the southern part of the province from about Oshawa westward. Many hunters also came from Michigan, New York, and Ohio to shoot hares.

Unfortunately, none of these hunters or clubs seems to have kept useful records of their activities. Today only verbal accounts remain as yardsticks by which to measure the past numbers of these hares. Yet, the very abundance of the accounts and their general consistency seem to add credibility to the belief that populations of the order of at least 50 hares per square mile may have been common in many parts of the province south and west of Lake Simcoe between 1929 and 1941. In some instances, as suggested by Dymond's accounts given above, populations of the order of 100 hares per square mile may have existed during those years.

It seems reasonable to suppose that between 1912, when the hare first escaped from captivity, and about 1928, when it first came prominently to the attention of hunters, extensions of range were absorbing most of the annual increments to the population. In addition to building up local densities, hares were flooding into hundreds of square miles of the province that were almost devoid of competitors and important predators.

By 1928, or thereabouts, it seems to have come to occupy almost all of southwestern Ontario, which then as now, apparently constituted the best range in the province. In the years that followed, further expansion of its range could take it only northeastward into areas progressively less well suited to it. Inevitably, some hares crossed into the State of Michigan (Burt 1946), but the Great Lakes and their connecting waterways seem to have presented an almost impenetrable barrier to further progress southwestward. With this removal of opportunities of further controlling population densities by emigration into unoccupied areas, the hare soon became an abundant animal in Ontario south and west of Lake Simcoe.

Between 1928 and 1941 many thousands of hares were killed annually by hunters without any apparent reduction in the size of the population during that period. But in the early 1940's hunters began to appreciate a widespread decline in the population. Curiously enough, this decline coincided with a marked diminution in hunting pressure dictated by war-time shortages of hunting equipment, transportation, and hunters. During the period of reduced hare population there does not, however, appear to have been an appreciable shrinkage in the area occupied by the hare. Rather the decline seems to have been essentially in population density and small numbers of hares were present in all or most of the areas previously populated.

Throughout most of southwestern Ontario this low level of the population lasted from 1941, or thereabouts, until about 1948. Some hunters believe that an increase was noticeable during the hunting season of 1947-48, but it was definitely recognizable in 1948-49. Judged by reported hunting success, the increase first became tangible in Middlesex, Oxford, Lambton, and Perth Counties, then it spread in all directions and engulfed the entire range of the hare in two or three years. Hunters in the vicinity of London believe that the rate of increase, which began about 1947 and was almost immediately followed by a considerable upsurge in hunting pressure, levelled off about 1950. The numbers of hares taken by hunters in that area during the hunting seasons of 1950-51, 1951-52, 1952-53, and 1953-54 seem to have been about the same each year, but in areas east of Toronto the populations are still increasing.

Thus, in the European hare's short history in Ontario, quite profound numerical fluctuations have occurred, but it is too soon to draw conclusions about their longterm nature. The spectacularly violent population fluctuations of *Lepus americanus* are especially well known, but other species of hares, including *Lepus europaeus*, are reported to oscillate

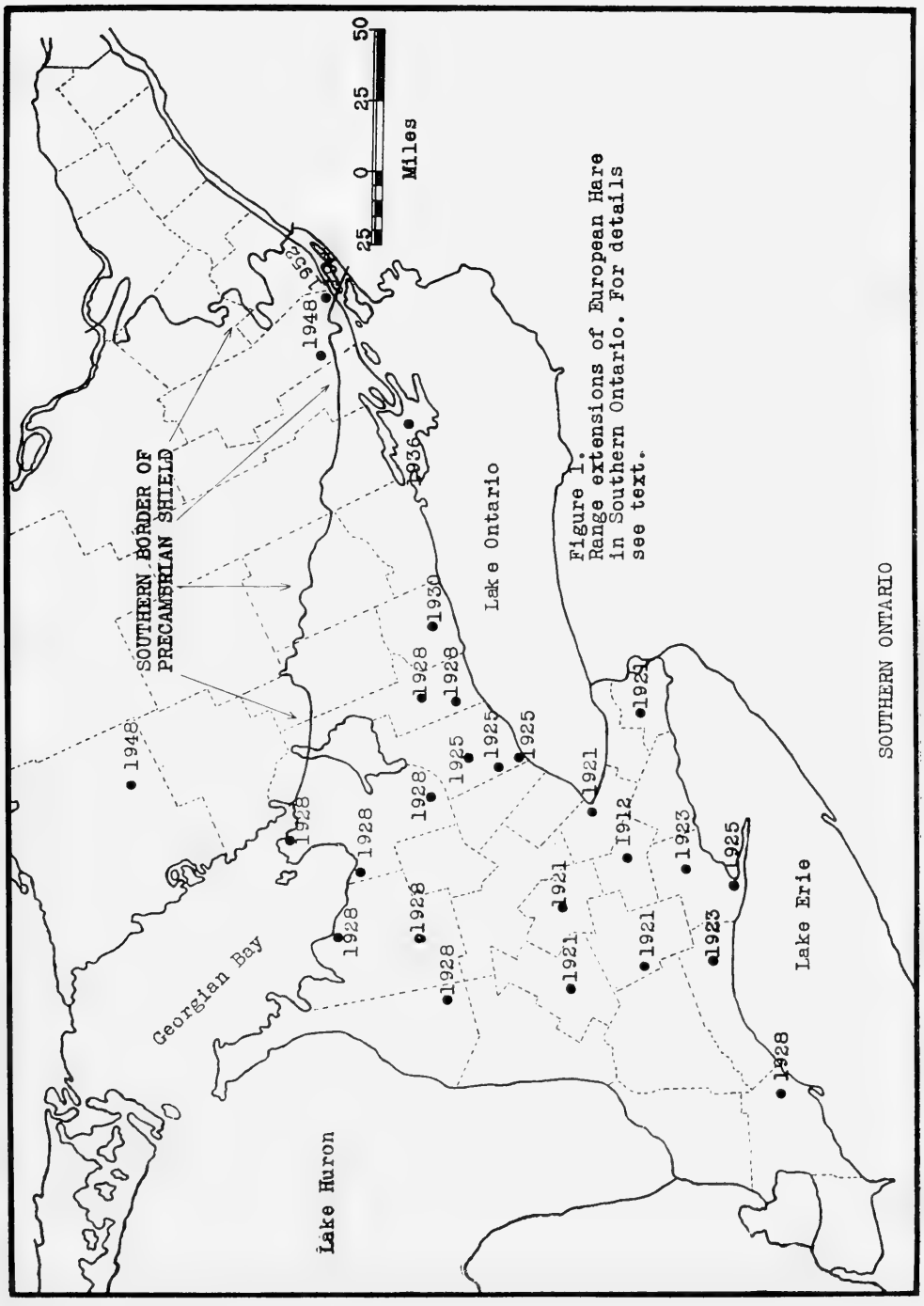

Figure 1.
Range extensions of European Hare in Southern Ontario. For details see text.

numerically in Europe (Middleton 1934, Migulin 1937, Kolosov 1941, Andersen 1953).

At the present time (1954) this hare is abundant in Lambton, Middlesex, Elgin, Norfolk, Haldimand, Brant, Lincoln, Welland, Oxford, Perth, Huron, Wellington, Waterloo, Dufferin and southern Simcoe Counties. There is a locally high density of hares in the "apple belt" of Grey and Simcoe Counties adjacent to Georgian Bay. In these areas of greatest abundance, in which the hares are designated "abundant" in Figure 2, it is estimated on the basis of field studies, interviews, questionnaires, reports of hunting success, and other sources of information that the average density is about 25 hares per square mile.

Successively smaller population densities occur in (a) Essex, Kent, Wentworth, Halton, southern Peel, and York Counties, and (b) the remainder of the range of the species in the province.

Discussion

In the main, two alternative destinies seem to face exotic plants and animals: they either die out more or less completely, or they thrive to the point of excess. Of all the different kinds of organisms that have been transplanted, accidentally or intentionally, into various parts of the world, few of the survivors seem to have "fitted in" with the existing flora and fauna without altering the generally balanced equilibrium present before the introduction.

The factors which decide the fate of an introduced species may seem to be more or less obvious in some cases, but in many they are far from apparent. It seems axiomatic that if an organism is introduced into an area whose climatic conditions are unsatisfactory for it, it will fail to survive. Similarly, if introduced plants or animals fail to encounter conditions of soil, food, and moisture which they require for survival, their eventual failure seems assured.

Regardless of what other factors may act to determine whether or not a transplanted species will survive, it seems apparent that even if the environmental conditions are satisfactory, it will survive only if introduced into a range in which its required ecological niche is not already occupied by species with which it cannot successfully compete.

Therefore if a species is transplanted into an ecologically suitable environment in numbers sufficient for its reproductive and social requirements, it ought to survive. However, the failure of early introductions of the starling into the New World indicates that this does not always follow. If the exotic species does survive, the degree to which it will thrive then depends jointly upon its reproductive potential and the environmental resistance which it encounters.

The spectacular biological success of European rabbits *(Oryctolagus cuniculus)* introduced into Australia is well known. They increased to such proportions and destroyed so much forage for sheep that the numbers of sheep in New South Wales were reduced from 60,000,000 in 1893 to 32,000,000 in 1923 (Henderson and Craig 1932). Apparently the rabbits encountered highly satisfactory ecological conditions. This, in conjunction with a high biotic potential, enabled them to populate the range quickly and in considerable density.

The increase and spread of the European hare in southern Ontario seems to have been somewhat similar. Following the clearing of the major portions of the forests of southern Ontario around the middle of the nineteenth century, a predominantly grassland biome developed. While it is probably true that woodchucks *(Marmota monax)* and several genera and species of cricetid rodents flourished, it seems likely that the biome was "faunally unsaturated".

There was apparently an unoccupied ecological niche well suited to a herbivore like the European hare when it escaped in 1912. Its increase and spread were favoured by both the ecological conditions it encountered and its own high reproductive potential.

In its present status, this hare does not seem to come into serious competition with native or domestic animals and it competes only locally with man's economic interests. It therefore seems probable that as long as its numbers can be maintained within present limits by hunting and other controls, it should continue indefinitely to be considered a beneficial addition to the fauna of southern Ontario.

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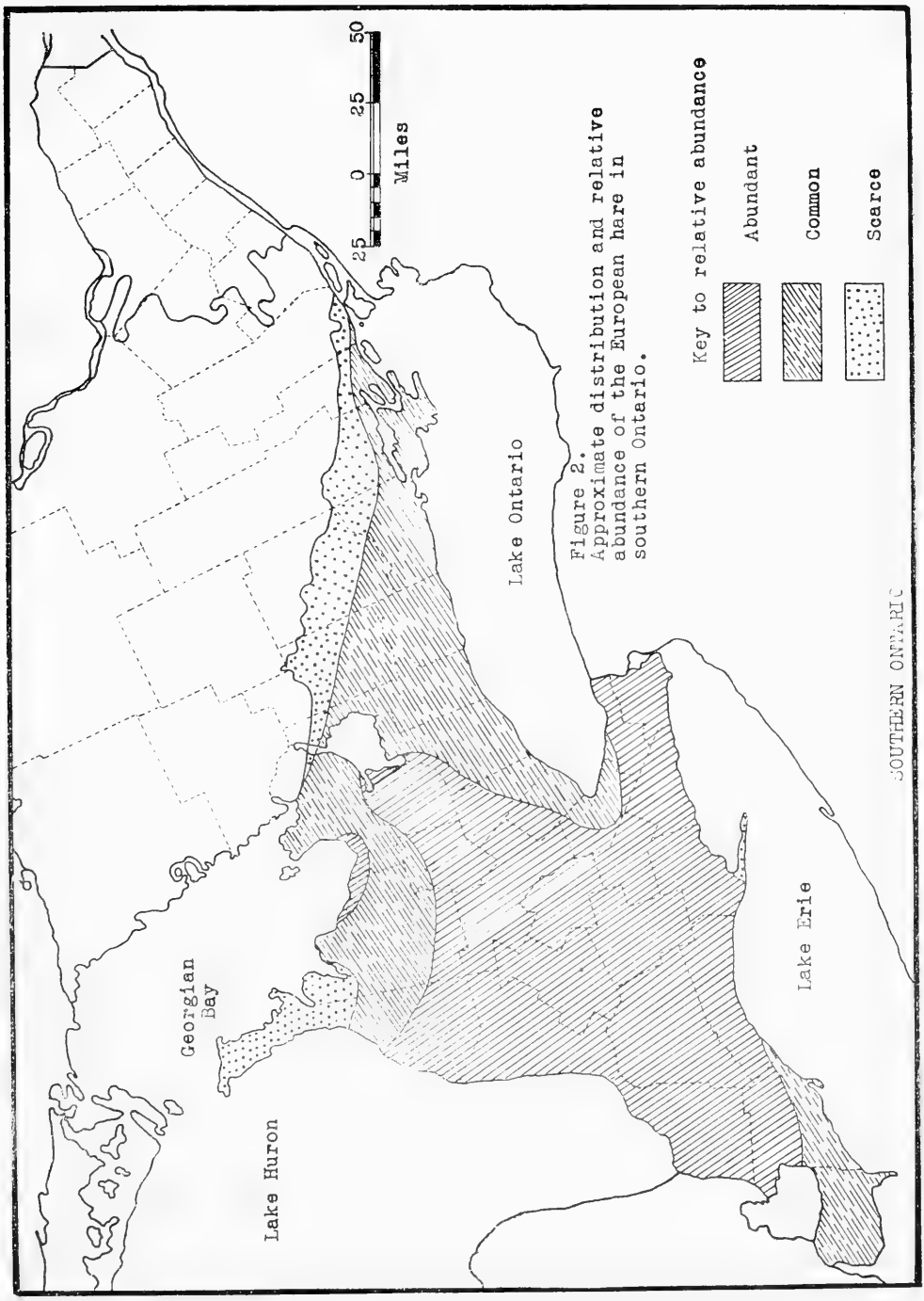

Figure 2.
Approximate distribution and relative abundance of the European hare in southern Ontario.

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THE SEVENTY-SIXTH ANNUAL MEETING OF THE OTTAWA FIELD-NATURALISTS' CLUB, DECEMBER 2, 1954

Report of Council

Since the last Annual Meeting, there were four meetings of Council: December 7, 1953, at St. Patrick's College, with 17 members present; February 25, 1954, at the home of Mr. and Mrs. Hoyes Lloyd, with 19 members present; September 24, 1954, at St. Patrick's College, with 15 members present; and November 8, 1954, at St. Patrick's College, with 22 members present.

Appointments were made for 1954 as follows:

Editor of the Canadian Field-Naturalist — Dr. H. A. Senn.

Business Manager — Mr. W. J. Cody.

Chairman of the Publications Committee — Dr. L. S. Russell.

Chairman of the Excursions and Lectures Committee — Dr. W. I. Illman.

Chairman of the Reserve Fund Committee — Mr. Hoyes Lloyd.

Chairman of the Special Lectures Committee — Dr. L. S. Russell.

Chairman of the Membership Committee — Mr. W. K. W. Baldwin.

Chairman of the Bird Census Committee — Mr. R. D. Harris.

Chairman of the Macoun Field Club Committee — Dr. E. L. Bousfield.

Chairman of the Gatineau Park Advisory Committee — Col. W. W. Mair.

Representatives, Canadian Section, International Committee for Bird Preservation — Dr. H. F. Lewis, Mr. Hoyes Lloyd.

Report of the Publications Committee

During the period December 1, 1953 to December 1, 1954, two numbers of Volume 68 of The Canadian Field-Naturalist were published, with a total of 94 pages. Papers, notes and reviews were distributed as follows:

	Papers	Notes	Reviews
Botany	5		
Ichthyology		3	
Invertebrate Zoology	1		
Mammalogy	1		
Ornithology	4	7	2
Palaeontology		1	
Miscellaneous			2

Three maps and eleven other illustrations were used. Sale of single and back numbers of the Naturalist during the year amounted to $487.55. Council approved the preparation of a guide-book to the geology of the Ottawa District, and this is being written by Dr. Alice E. Wilson.

Report of the Excursions and Lectures Committee

The Annual Dinner of the Club was held in April, the guest speaker being Dr. Alice E. Wilson, who gave an illustrated talk on her trip up the Amazon River. Displays provided by the Macoun Field Club were well received by the 132 persons in attendance. About 65 members and friends attended the Members' Night held on November 18 at the Ottawa Normal School, when talks were given by the Rev. Father F. E. Banim, Dr. H. H. J. Nesbitt, Dr. L. S. Russell, Dr. D. B. O. Savile, and Mr. E. A. O. Turnau. A refreshment hour, arranged by Miss Deborah Haight, was much enjoyed by all. The planned spring excursions suffered a surfeit of rain, except for the all-day trip to Pakenham, which was well attended. The study groups have been active during the year, holding both indoor meetings and excursions. A large number of local members took part in the activities.

One number of the Newsletter has been issued, and considerable material is in the hands of the editor, Mrs. Ken Bowles, toward another number. Contributions from members will be welcomed.

Report of the Special Lectures Committee

Three Audubon Screen Tours completed the 1953-54 series:

January 8 — A Missouri Story, by Alfred G. Etter.

March 22 — Western Discovery, by Laurel Reynolds.

April 20 — By Erie's Changing Shores, by G. Harrison Orians.

The following Audubon Screen Tours of the current season complete the programme for 1954:

October 19 — Land of the Scarlet Macaw, by Ernest P. Edwards.

November 27 — Wildlife of Marsh and Mountain, by Cleveland P. Grant.

Report of the Membership Committee

Following the recommendation of last year's chairman, the committee was divided at the beginning of the year into two groups. One subcommittee, headed by Mr. W. J. Cody, dealt with out-of-town membership; the other, headed by Miss Verna Ross, attended to the Ottawa membership. This proved a convenient division of the work of the committee and should be continued.

The subcommittee on out-of-town membership launched an enquiry to increase membership in Canada through present members scattered across the country at various biological institutions. It is recommended that membership campaigns follow a varying pattern of canvassing individuals in Canada and abroad, as well as libraries and scientific institutions.

The subcommittee on Ottawa membership made a strong appeal to the audience at the Audubon Screen Tours. Exhibits were displayed on one side of the auditorium rotunda and an information desk set up on the other side. Parents of Macoun Field Club members were canvassed by letter with an encouraging response. Memberships falling in arrears were canvassed by mail to keep up their subscriptions. A special evening was arranged by the Fern Group to welcome new members and this was addressed by the chairman.

A prospectus of the activities of the Club was drafted but not yet published. This is designed for use over several years and contains information which will not go quickly out of date.

The membership at large has been maintained in 1954 and the Ottawa membership increased.

Report of the Macoun Field Club Committee

The present committee consists of Miss V. Humphreys, Miss M. Godwin, and Mr. J. S. Bleakney, appointed by the National Museum; Mr. H. Groh and Mr. D. C. Maddox, appointed by the Ottawa Field-Naturalists' Club; and the chairman, Dr. E. L. Bousfield.

The meetings of the Macoun Field Club were held, as in previous years, at weekly intervals in the National Museum of Canada; the Senior Group (Grades 10 and up) on Tuesdays after school, and the Juniors (Grades 5-7) and Intermediates (Grades 8 and 9) at different hours on Saturday morning. The programme included 21 regular meetings, of which seven were field trips to various suitable nature spots in the vicinity of Ottawa. The Senior Group numbered 18 active members, headed by Earle Covert and a committee of four. Similar committees acted for the Intermediate Group of 28 under the chairmanship of Chris Durden, and for the Junior Group of 28 under Jim Ingles.

The programmes of all three groups were given over primarily to special talks and discussions led by members of the Museum staff, the Ottawa Field-Naturalists' Club, parents and friends of the Club members. A Christmas party was held in the Museum auditorium on Dec. 5, at which the election of officers for the year took place. The sixth annual birthday party also took place there on April 24. Badges were given out to 19 new members (2 Senior, 6 Intermediate, and 11 Junior) and prizes were donated to the winner of the attendance and merit game in both Intermediate and Junior Groups. A special party was held for other successful contestants in the game.

The Club's activities included the publication of a fall and spring issue of the "Little Bear" (No.'s 6 and 7), edited by Mr. Groh and Mr. Maddox, and very well contributed to by the members. The Club continued to provide a team of ushers, under the leadership of Earle Covert, for the Audubon Screen Tours. A large exhibit of the collections and hobbies of the members was displayed at the Annual Banquet of the O.F.-N.C. in April. All these activities have been reported upon in detail at previous meetings of the Council, and the special events reported upon in the Ottawa newspapers. A radio broadcast on part of the Club's activities was made in December. Plans are now being made for a televised showing of a club meeting, thus spreading more effectively and to larger audiences the work that these young Ottawa naturalists have been doing.

Report of the Bird Census Committee

The Christmas Bird Census was taken on December 27, 1953. A total of 33 species and 5,519 individuals was reported. The Christmas Bird Census for all of Canada was published in the January-March, 1954, issue of The Canadian Field-Naturalist.

R. FRITH, President,
H. J. SCOGGAN, Secretary.

STATEMENT OF FINANCIAL STANDING
THE OTTAWA FIELD-NATURALISTS' CLUB, NOVEMBER 26, 1954

CURRENT ACCOUNT

Assets		Liabilities	
Bal. in Bank, Nov. 26/54	3,745.57	Audubon Screen Tours, guarantee	750.00
Bills receivable	10.70	Bills outstanding	623.10
Lodge, estimated value	240.00	Balance	2,623.17
	$3,996.27		$3,996.27

Receipts			Expenditures	
Bal. in Bank, Nov. 30/53		2,134.66	Can. Field-Nat. (2 nos.)	998.40
Fees:			Editor's honorarium	100.00
Current	1,664.80		Business Mgr's Hon.	15.00
Advance and Arrears	337.89		Separates	398.10
Assoc.	39.00	2,041.69	Illustrations	74.44
			Postage and Stationery	95.56
			Miscellaneous	74.54
Separates		482.32	Bank discount	25.40
Single and Back Numbers		486.90	Foreign exchange	22.50
Miscellaneous		48.34	Cheques o/s 1953	115.00
Audubon Tours (net)		470.60	Bal. in Bank, Nov. 26/54	3,745.57
		$5,664.51		$5,664.51

RESERVE FUND

Assets		Liabilities
Hydro-Electric Power Comm. Ont., Bonds, 3%	3,000.00	NIL
Bal. in Bank, Nov. 26/54	475.80	
	$3,475.80	

Receipts		Expenditures	
Bal. in Bank, Nov. 30/53	382.28	Rent safety deposit box	5.00
Bank interest	8.52	Bal. in Bank, Nov. 26/54	475.80
Bond interest	90.00		
	$ 480.80		$ 480.80

PUBLICATION FUND

Assets		Liabilities
Hydro-Electric Power Comm. Ont., Bonds, 3%	1,500.00	
Bal. in Bank, Nov. 26/54	295.43	NIL
	$1,795.43	

Receipts		Expenditures	
Bal. in Bank, Nov. 30/53	245.18	Bal. in Bank, Nov. 26/54	295.43
Bank interest	5.25		
Bond interest	45.00		$ 295.43
	$ 295.43		

Audited and found correct.

(Signed) I. L. Conners,
C. Frankton.

Auditors.

Nov. 26, 1954.

R. J. Moore
Treasurer.

NOTES AND OBSERVATIONS

Mid-Atlantic migration of Long-tailed Jaegers and Terns *(sp?)*. — In May 1950, bird records were kept daily while I was a passenger aboard the Canadian Pacific S.S. "Empress of France" *en route* from Montreal to Liverpool via Cape Race and Inishtrahull.

On May 10, position at 12.00 hours, 53° 19′ N., 26° 45′ W., a remarkable flight of Long-tailed Jaegers *(Stercorarius longicaudus)* was recorded. The weather was bright, with fog patches, the wind southeast. Before 10.00 hours I had noted one hundred of the birds, all of which were light coloured. Their flight was light and airy as they drifted by in loose flocks; swift and erratic when one pursued another. As their maximum altitude did not exceed two or three hundred feet they were seen perfectly with field-glasses.

I was taken to the bridge by courtesy of Chief Officer, E. F. Aikman, R.D., R.N.R., to check their course which was roughly at right angles to ours. His calculation showed them to be following a route which would take them from North-west Africa to Greenland.

Fourth Officer, R. Stewart, who was on watch at the time, reported that the birds had been crossing our course since 4.30 hours.

The flight continued more or less intermittently as follows:

11.00 hours, a few;
14.30 hours, four to six;
15.15 hours, a few;
15.30 hours, 16 going north-east;
16.00 hours, 27.

Thus for about twelve hours we passed across the flight line of this migration. The last two groups of birds seen had a different course from the others.

Twenty or thirty Terns were seen about 13.30 hours and my notes state that they were feeding by diving. At 14.30, 12 Terns were seen and then 25 more, the latter resting on the sea and flying. Terns and Jaegers were seen together, but the Terns were not pursued. These were presumably Arctic Terns, and even without positive identification it seems of interest that they were migrating in mid-Atlantic, that they were apparently feeding on migration, that they were alighting on the water, and that they were associated with Long-tailed Jaegers. Wynne-Edwards[1] has reported upon Arctic Tern migration in the Atlantic and calls the Jaegers their inevitable companions. He found that the Terns stop to feed in the Atlantic only on the rarest occasions and "never by any chance settle on the water". Nicholson[2] has found them feeding at sea.

Wynne-Edwards *(loc. cit.)* tells of passing through a great flock of Long-tailed Jaegers on May 23, 1933 in 51° N., 23° 50′ W. The position where he met this flock, according to Mr. Aikman, is about two hundred miles from where I observed a migration on May 10, 1950, and about on the same great circle route from North-west Africa to Greenland.

It was an interesting chance that permitted Wynne-Edwards' unique observation of this trans-Atlantic migration to be confirmed by me.

HOYES LLOYD, *Rockcliffe Park, Ont.*

1 Wynne-Edwards, V. C. — On the habits and distribution of birds on the North Atlantic. Proc. of the Boston Soc. of Nat. Hist. Vol. 40, No. 4, pp. 233-346.
2 Nicholson, E. M. — Bird notes from the North Atlantic. British Birds 22: 122-133.

BIRD BREEDING CENSUS, 1953

Location. Burnet Que.; in Gatineau Valley 15 miles from Hull, P.Q.

Area. 19 acres in a strip 50 yards each side of a virtually disused road, and 750 yards in length. Area crossed by small stream.

Description. Well matured second growth deciduous forest. 60% maple, 20% beach, 10% elm, 10% mixed oak, basswood, yellow birch, spruce and hemlock. Many dead trees still standing. Strip along road, 25 yards wide, composed of willow, poplar, alder, sumac, and saplings of forest trees, to height of 10 feet.

Edge. Area bounded on all sides by similar thick bush for at least 500 yards. Strip of roadway provided 750 yards of edge for occupants of area.

Coverage. Average of 10 times per week from 1st May 1953 to 31st July 1953. Hours varied from 6.30 a.m. to 10 p.m. Total man-hours, over 100.

Breeding population. Actual numbers of breeding pairs; in parenthesis number of pairs per 100 acres where 3 or more pairs in area. Chestnut-sided Warbler 4 (21); Ovenbird 4 (21); White-throated Sparrow 4 (21); Robin 3 (16); Veery 3 (16); Yellow-throat 3 (16); Winter Wren 2; Red-eyed Vireo 2; Black-throated Blue Warbler 2; Black-throated Green Warbler 2; Mourning Warbler 2; Redstart 2; Song Sparrow 2; Yellow-shafted Flicker 1; Sapsucker 1; Hairy Woodpecker 1; Wood Peewee 1; White-breasted Nuthatch 1; Hermit Thrush 1; Philadelphia Vireo 1; Blackburnian Warbler 1; Rose-breasted Grosbeak 1. Total pairs 19 acres, 44; for 100 acres, 232.

Visitors. Individuals regularly seen in area but not believed to have nested in it. Ruffed Grouse 2, Pileated Woodpecker 1, Downy Woodpecker 2, Crested Flycatcher 1, Blue Jay 1, Wood Thrush 2, Warbling Vireo 2.

Remarks. The large population of Warblers and Sparrows may be due to the favourable feeding and nesting area provided by the partially grown up road area.

Observer: T. F. T. MORLAND,
Halifax, N.S.

Nutria, *Myocastor coypus*, in Thunder Bay District, Ontario. — On May 15, 1953, John Flontek trapped a strange animal in the Whitefish River near the village of Hymers, 20 miles west of Fort William in the District of Thunder Bay, Ontario. The skinned carcass was subsequently submitted to me for identification by Frank Sitch on whose property the animal had been taken. It proved to be a nutria, or coypu, *Myocastor coypus*, weighing seven pounds. The carcass was forwarded to the Royal Ontario Museum of Zoology and Palaeontology where my identification was confirmed by Dr. Randolph Petersen. On November 29, 1953, another trapper, Victor Ranta, trapped a second coypu eight miles farther up the same river. He gave it to George Whitefield, Wildlife Management Officer, Ontario Department of Lands and Forests, who permitted me to examine it. According to Mr. Sitch, John Flontek took two more nutria in January and February, 1954, near Hymers.

Dr. Petersen (1953: *in litt.*) informs me two nutria had previously been taken in southern Ontario but both were traced as recent escapes from fur-farms. It would appear therefore that the four specimens taken in the District of Thunder Bay were the first feral nutria to be taken in Ontario.

The nutria is a South American rodent originally introduced by fur-farmers into the United States and Canada. They were released, or escaped, in several States and are now established in Louisiana, Oregon, and probably California. In the mid-Western States they have been reported from Iowa and Michigan. Harvey L. Gunderson, Museum of Natural History, University of Minnesota *(1954: in litt.)* informs me several apparently feral nutria have been taken in Minnesota, the northern boundary of which lies only 20 miles south of Hymers. These may have originated from releases made in the Rat Root River, between 1941 and 1945, or from animals turned loose in Ontario across Rainy River from Baudette, Minnesota. Both these regions of north-western Minnesota are in the Hudson Bay Drainage and remote from the Whitefish River, a tributary of the Kaministiquia River, which enters Lake Superior at Fort William.

It is possible the nutria has become established in other Ontario localities and that its presence has been overlooked. Walter E. Howard (Jour. Mamm. 34: 512-513, 1953) reported 15 animals were trapped in a California swamp and it was assumed none survived. The following year, however, 30 more nutria were trapped in the same region. It is not a preferred fur-bearer and is considered a potential hazard due to its burrowing habits. In the Whitefish River area it is not likely to become a menace, although, should it

become established and multiply, it might compete with the muskrat and the beaver which occur commonly in the watershed.

A. E. ALLIN,
Fort William, Ontario.

COUGAR or MOUNTAIN LION reported in North-western Ontario. — On July 23, 1953, Albert Sideen, master mechanic and Edward Anderson, electrical superintendant for the Great Lakes Paper Co. Ltd. of Fort William, were driving on the Trans-Canada highway near Martin, about thirty miles west of Fort William when they saw by the side of the road what they are convinced was a mountain lion. They drove past, turned round and drove back again. As the animal was still there they were able to get a good view of it. They state that it was of the cat family, of a tawny colour and with a long tail. They estimated it to be about 5½ feet long and standing about thirty inches high. On their return they reported what they had seen to Mr. R. Windsor, chief Fish & Wild Life Officer of the Ontario Department of Lands & Forests, Port Arthur. I had subsequent confirmation from Mr. Sideen.

On August 6th. 1953, Leslie E. McCauley, route supervisor for Palm Dairies Ltd. of Fort William, asked me if I had ever heard of a mountain lion being seen in the district. As I knew nothing of the previous report at that time, I told him I had not. He then told me that on the previous evening while on a fishing trip about twenty-five miles west of Fort William, he was driving along a little used side road when he saw what he was sure could be nothing else but a mountain lion crossing the road. He has since told me that he saw it again in the same vicinity four days later. His description conformed to that given by Mr. Sideen. Like myself, he had no knowledge of any previous report. Unfortunately the weather was very dry and there was no opportunity to examine any foot prints.

During the first week in September of 1953, Winston Boyle, salesman of Port Arthur, was driving at night about five miles east of Beardmore when a cougar with two cubs crossed the road well within range of his headlights. Being at night he was unable to see the colour, but he states that the old one was between five and six feet long, had a long tail and stood at least thirty inches high. He says that he knows both the lynx and the bob-cat well and they were certainly not either of those species.

A further report has been published in an issue of the Times-Journal of Fort William under date of April 17, 1953. In substance the report is as follows.

About 6.40 p.m. on April 13, 1954, Charles Seal, engineer, and Glen Chisamore, fireman, were on a run on the C.N.R. between Port Arthur and Atikokan and saw a cougar about 43 miles west of Port Arthur. The report states that the animal cut across the tracks in front of the train and leaped up on a rock cut about six feet high without any trouble. They described it as about five feet long and brown in colour. At one point it was not more than twenty-five feet from them. It headed up a rocky hillside into the timber as the train passed. Both men have worked in British Columbia and have seen cougars in the Rocky Mountains. Mr. Chisamore says, "we saw it right there, on the hoof, and there was no mistake about it".

While we have only sight records so far, the evidence appears to be conclusive, beyond doubt. It is strengthened by the fact that there have been at least twenty-one sight records from Minnesota during the past five years, as reported in the 1952 September-October issue of the Conservation Volunteer, the official bulletin of the Minnesota Department of Conservation. Several of these records are from the north-eastern portion of the State, bordering on Ontario, at least three of them at no great distance from Fort William: one at Cascade River, about 100 miles south of Fort William on June 22, 1950; one at Crow Creek, about 166 miles south of Fort William on June 8, 1951; and one at Two Harbours about 174 miles south of Fort William in the fall of 1948.

There have been other reports from surrounding districts, but as I have been unable to get any first hand particulars, they have not been included.

L. S. DEAR,
Port Arthur, Ont.

Ross's Goose in Ontario. — During the annual meat harvest of the natives at Hannah Bay of James Bay, Ontario, an Indian shot a Ross's Goose *(Chen rossii)* on October 13, 1953. The bird was procured by Mr. Paul Holmes, preserved as a specimen and presented to the Royal Ontario Museum. The

specimen, an adult female, no. 81311, substantiates the first known occurrence of this species in Ontario. According to Bent (U. S. Natl. Mus. Bull., no. 130, p. 188) the nearest casual occurrence is for Winnipeg, Manitoba.

L. L. SNYDER,
Royal Ontario Museum of Zoology and Palaeontology, Toronto.

White Pelicans at Crescent Beach, B.C. — On June 1, 1954, Mr. Lawrence Berry, a commercial fisherman living on the bank of the Nicomekl River, arrived at our home about 8 a.m. to say that some large white birds which he took to be pelicans were resting and preening their feathers on the marsh just north of the mouth of the river. I drove up there at once. With an 18 power telescope there was no question. Four white pelicans *(Pelecanus erythrorhynchos)* were feeding in a back water just west of the Great Northern track. About half an hour later they took flight. After circling Mud Bay they spiraled to a great height and headed inland in a south-easterly direction. According to "The Bird Fauna of B.C." by Munro and Cowan there is a nesting colony at Stum Lake in the Cariboo Parklands. Reported to be casual on the coast there is a record from Comox, B.C., June 15, 1941. Mr. Berry who is a good observer and has been crab fishing for several years in Boundary Bay tells me he has never seen pelicans and I have no previous record for this part of the Fraser Valley.

MARTIN W. HOLDOM,
Crescent Beach, B.C.

First Record of the Starling in the Northwest Territories. — On April 27, 1954, a dead Starling *(Sturnus vulgaris)* was found at latitude 60° 04′, longitude 112° 25′, about 26 miles west of Fort Smith, N.W.T. This appears to be the first record of the Starling in the Northwest Territories and the northernmost record in North America to date. Formerly, the record was held by Churchill, Manitoba, in latitude 58° 45′ (Beckett, Can. Field-Nat., 1953, 67 (1): 44; and Mayfield Auk, 1954, 71 (2): 199) where an individual was first reported in June, 1940, and successful nesting was observed in 1952.

Circumstances surrounding the finding of the present specimen were as follows. All winter the writer had operated a line of poison stations in connection with the experimental wolf control project on some extensive prairies locally known as the "salt plains". With the advent of spring, the baits were being picked up and transported to Fort Smith for destruction by deep burial. On April 27, while loading two baits, the dead Starling was found. It seems probable that the bird had eaten some of the poisoned meat.

The weather at this time was abnormally cold. Winter conditions still prevailed with more than a foot of snow on the prairies and temperatures generally ranging between 0°F. and 32°F.

A study skin has been prepared which is at present in the representative collection of local birds and mammals in the writer's laboratory at Fort Smith, N.W.T.

W. A. Fuller,
Canadian Wildlife Service, Fort Smith, N.W.T.

Viviparus viviparus, L. **in eastern Canada.** — During the summer of 1953 a number of large, strikingly coloured, operculate snails were observed and collected in the tidal zone of the upper (fresh-water) part of the St. Lawrence estuary. The shell, approximately one inch in height and three-quarters of an inch in width, is typically cream-coloured and marked by three brown or purplish-brown spiral bands; occasional specimens are uniformly purplish-brown.

Specimens were sent to Dr. A. La Rocque, Ohio State University, who identified them as *Viviparus*, probably of European origin. At his suggestion, Germain's "Faune de France: Mollusques", 1930, was consulted and the shells proved to be *Viviparus viviparus* L. The species is new to Canada, and perhaps also to North America.

Specimens were obtained from the following localities in Quebec province: St. Lawrence south shore:—Lévis, St. Michel Plage, St. Vallier, Berthier, and Montmagny; empty shells at L'Islet, St. Jean Port Joli, and St. Roch des Aulnaies. St. Lawrence north shore:— Château Richer and Cap Tourmente; empty shells at St. Joseph de la Rive (Ile aux Coudres) and Pte-au-Pic. The dead shells were probably transported seaward to the salt water localities by strong tidal currents and by ice action in winter. No living specimens were observed along the south shore from Lévis upriver to Trois-Rivières in June 1954.

The fact that this species, abundant and conspicuous along the shores below Quebec City, was not recorded by Ami, Bell, Provancher, Whiteaves, and other early conchologists, supports the suggestion of Dr. La Rocque that the colony stems from recently released aquarium stock.

E. L. Bousfield,
National Museum of Canada, Ottawa.

REVIEWS

Audubon Guides. All the Birds of Eastern and Central North America. *By Richard H. Pough. Color Illustrations by Don Eckelberry. Line Drawings by Earl L. Poole. Small Land Birds, pp. I-XLII, 1-312; Water, Game, and Large Land Birds, pp. I-XXVIII, 3-352, 1953; Doubleday & Company, Inc., Garden City, N.Y.* (*$6.50*).

Pough's deservedly popular *Water Bird Guide* to water, game, and large land birds, published in 1951, (reviewed Can. Field-Nat., 1951, Vol. 65, No. 5, p. 190) and his *Audubon Bird Guide* to small land birds, published in 1946, are here combined apparently without revision under one cover. The text, covering the birds of eastern and central North America, gives useful information for each species on field identification, range, habits, habitat preferences, voice, nest, eggs, and other aspects of the subject. Seventy introductory pages contain much general information for those who enjoy observing birds in the field.

Some 885 excellent colored pictures by Eckelberry depict 533 bird species and show seasonal and age differences in plumage where these differences are appreciable in the field. Although all these pictures are grouped on 96 colored plates, postures are interesting and life-like and proportions and colours excellent. Poole's line drawings, which bring the total of illustrations to more than one thousand, are decorative and useful in showing aspects of some of the birds in flight.

Doubtless many will wonder why the contents of *Water Bird Guide* were not placed in the front, instead of the back, of the new volume. This would have brought the species into a natural sequence beginning with the Gaviiformes.

The coupling of elaborate illustrations with an informative text in this one light, compact volume will undoubtedly make it very popular with amateurs whose interests lie east of the Rockies in either Canada or the United States. — W. EARL GODFREY.

OUR WILDLIFE LEGACY. *By Durward L. Allen, published by Funk and Wagnalls Company, New York, 1954, x, 340 pages, Reference Notes 37 pages, Bibliography 29 pages, 26 illustrations, index 14 pages. Distributed by the Ryerson Press, Toronto, Canada. $6.00.*

It is not often that a reviewer has the pleasant opportunity to review a book with whose author he is in complete agreement. Durward Allen is a Senior Biologist in the Branch of Research of the United States Fish and Wildlife Service. The present work sets forth in clear, easily-read form the most important concepts of the most modern phase of wildlife management. Many workers in the field will be pleased to learn how much new information has been gathered on the subject in recent years, and will perhaps for the first time realize that the art of wildlife management has developed to the point where the word "Science" can be applied to it appropriately.

Despite the excellent works which have been written in recent years on the subject of wise use of wildlife resources, it has remained for Durward Allen to bring together in one place a story which is more arresting than fiction and at the same time completely factual and excellently documented both with detailed reference notes, and with a bibliography of more than 500 titles.

The book is written in a form which will make it readily useful to professional wildlife management personnel as a reference work. At the same time the style of writing is adapted to convenient use by the sportsmen and nature lovers who have much to gain by a careful reading of the material presented.

Beginning with the Indian's relation to and dependence on the buffalo, the progress of knowledge of ecology is traced up to 1953. Many of the mistaken ideas of the past are discussed at length, and the place of new knowledge in providing for more adequate understanding of such fundamentals as rep-

roductive rates and species inter-relations is clearly demonstrated.

The enormous productivity of most forms of wildlife under ideal conditions of habitat is impressively demonstrated, with data from a variety of areas and species. The true effect of harvesting of various sex and age classes on populations is discussed, and the necessity of harvesting surplus stocks is clearly defined. The chapters dealing with predators and their management are particularly well-prepared. The discussion of bounties and the exposition of their shortcomings is the most convincing statement of its kind that I have been privileged to read.

Throughout the book the point is made repeatedly that sufficient information is now available upon which to base really effective wildlife management. It is, however, impossible to put much of this modern knowledge into effect since public acceptance of many of the scientific data is not yet complete. Old traditions and beliefs, many of which are directly contrary to the results of carefully-controlled scientific studies, are difficult to dislodge from the public mind.

The political implications of wildlife management are dealt with in an excellent chapter under the heading of "Biopolitics", and in many cases the record of achievement of wildlife management agencies reflects a lack of understanding of biological principles on the part of those in the political arena who set up programs for the public.

Needless to say the author has shown by carefully documented facts that the ideas of the game farm and fish hatchery as sole means of maintaining public hunting and fishing have been left behind.

The book brings together much information which shows beyond all doubt the great complexity of the inter-relations of the wildlife species and of their relations to the flora. It clearly demonstrates the need for flexibility of mind and of policies in dealing with problems of wildlife management.

I sincerely hope the book will be widely read so that sportsmen, naturalists and other members of the public may be sufficiently well supplied with facts concerning their areas of interest, that they will urge the appropriate agencies to take well-advised action in regard to wildlife management. Administrators and other government officials who avail themselves of the information furnished in the book will be well able to deal with public demands for wise policies of wildlife management, and will be able to understand and work effectively with the wildlife scientists who continue to produce new information upon which ever more practical and effective methods of wildlife management may be based. It has been said that public understanding and acceptance of new ideas usually follows many years behind the development of new scientific information. If this book receives the public recognition and support that it deserves, it may well be a most effective means of shortening the time between the attainment of new knowledge in the wildlife field, and public acceptance and use of this knowledge. Such a situation will result in immediate benefit to all citizens, since all benefit from the most progressive type of renewable resource management.

The author expresses it, "My guiding thought is that the patient — our wildlife resource — is ill; and it is important to all of us that the patient get well".

The book is excellently printed and is illustrated with high-quality photographic illustrations. The editorial work has been carefully done and typographical errors are rare.

V. E. F. SOLMAN.

BIRDS OF WASHINGTON STATE, *by S. G. Jewett, W. P. Taylor, W. T. Shaw and J. W. Aldrich. University of Washington Press, pp. XXXII and 767, 12 color plates, 99 black and white plates, 51 distribution maps and 1 inserted map of Life Zones.*

This volume constitutes a valuable addition to the regional ornithological studies of North America.

The University of Washington Press is to be complimented on the excellence of the press work and the artistry of the binding, details that contribute much to the appeal and usefulness of the volume.

"Birds of Washington" is not designed primarily as a manual for the identification of the birds of that state. For each species and subspecies it gives the salient distinctive features of both adult and young, but for those species, such as the gulls, in which the plumage sequences are numerous and complicated, only the adult and downy plumages usually are dealt with. In general, distinctive differences between similar species are not emphasized. Obviously the beginning student of birds will need to combine the information given here with the details on identification presented so graphically in the modern handbooks to the birds of western North America.

The color plates have been chosen for the interest and appeal they give rather than for their aid in identification.

The real value of the study lies in its careful documentation of the occurrence of each of the 450 species and subspecies and the inclusion of all available information upon their life histories as observed in the state.

A typical species treatment contains information upon local status; description including measurements; nest and egg detail; distribution; dates of migration; habitat; call notes and other miscellaneous information.

The nomenclature both vernacular and scientific is with some exceptions that of the forthcoming revised edition of the American Ornithologists Union Check List. Though this reviewer decries the use of cumbersome compound vernaculars for subspecies that cannot be differentiated under field conditions, the authors here do so on good precept.

Equal status in treatment has been accorded all resident subspecies and the extreme view of the authors upon the degree of difference constituting a recognizable subspecies has led to a confusing situation. Several supposed subspecies based upon tenuous characteristics and not currently recognized by the American Ornithologist Union Committee on Classification and Nomenclature are included in "Birds of Washington". The systematics can be said to represent the extreme "splitters" view and will present a confusing interpretation to the many who do not understand the nature of the decisions involved and find only a disagreement between the local authority in this volume and the forthcoming revision of the A.O.U. Check List of North American Birds. For these it will be advisable to await the publication of the latter, before incorporating too many new subspecific names into their vocabulary. It should be emphasized however that these cases do not bulk large in the study and consequently do not detract too seriously from its general usefulness.

A number of subspecies assignments, e.g. *Regulus satrapa satrapa, Dendroica coronata coronata, Wilsonia pusilla pusilla, Sturnella neglecta neglecta* are based upon 1 to 3 specimens taken in migration. The nature of variation within the subspecies renders such action of doubtful scientific value unless supported by data of unequivocal interpretation.

In addition to the species treatments the book includes a most useful list of systematic and vernacular names; a brief characterization of the main geographic features and regions of the state; a *very* conventional treatment of ecological distribution based upon Merriam Life Zones, an excellent sketch of the history of bird study in Washington and a superficial treatment of some aspects of bird conservation.

A twenty-eight page Gazeteer will be welcomed by all those studying the details of distribution of birds in Washington. A 41 page bibliography and a well organized index to species, subspecies, and ornithologists complete the volume.

The 14" x 20" colored map of Life Zones embodies the innovation of separating the distinct phases of the Transition zone. Humid transition zone, timbered and timberless Arid Transition Zones are outlined and clearly distinguished. Within the former the small prairie areas are also indicated. The use of Arctic for Arctic-alpine implies a fallacy and is unfortunate.

All serious students of the birds of Western North America will find this a useful addition to their working library, while the amateur ornithologist in Washington, the adjacent states, and the Province of British Columbia will find in it much of the information they seek and, by implication, a clear indication of the information still needed.

I. McT. COWAN,
Dept. of Zoology,
University of British Columbia.

The Lives of Wild Birds. *By Aretas A. Saunders. 1954. Doubleday and Company, Inc., Garden City, New York. 256 pp. ($3.85).*

The ambitious amateur student of birds, desirous of making serious contributions to ornithological knowledge, will find plenty of suggestions on what to do and how to do it in this attractive little volume. The author, well known for his own meticulous field studies, draws from long experience to fill his book with pertinent information and good advice on how to study birds in the field. Finally there is a wisely chosen bibliography which is sure to be useful to the amateur. This book is very readably written, well printed, and is free of typographical errors. — W. EARL GODFREY.

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The Canadian Field-Naturalist

Vol. 69 OTTAWA, CANADA, APRIL-JUNE, 1955 No. 2

A SUMMER COLONY OF THE LEAST BAT, MYOTIS SUBULATUS LEIBII (AUDUBON AND BACHMAN) [1]

HAROLD B. HITCHCOCK
Middlebury College, Middlebury, Vermont.

SINCE 1841, when Dr. Leib collected the first specimen of the bat that now bears his name, comparatively little has been learned about the creature's summer activities. The recovery of two winter-banded individuals and the subsequent finding of a summer colony of the species are, therefore, of particular interest.

On July 6, 1953, Mrs. Leslie Gibbons found the bodies of two bats that had been crushed behind a shed door at her home near Northcote, Renfrew County, Ontario. One of the bats had been banded, and was reported by Mrs. Gibbons to the Fish and Wildlife Service, Washington. This bat had been banded the preceding February in a cave at Fourth Chute, about ten miles from the Gibbons farm. Its identification as *Myotis subulatus leibii* was confirmed by the United States National Museum, Washington, where the skeleton has been preserved. Although some 400 bats of this species have been banded in Canada (see Hitchcock, '49), and a lesser number in the United States, most of them by Mohr in Pennsylvania (see Mohr, '42), this is the first specimen whose summer as well as winter habitat has been known. It also led to the discovery of the first recognized summer colony of the species.

The colony was estimated by Mrs. Gibbons to have consisted of about a dozen bats, but as they dispersed after the accident, no detailed study could be made. The retreat was behind a sliding door that was customarily kept in the open position, up against the wall of the shed. Between the horizontally placed siding boards were grooved spaces more than adequate to accommodate bats even if the door were snugly against the wall, which it was not when inspected in November. Fecal pellets were clinging to the boards, but no accumulation was noted on the ground. The door is so located that sunlight strikes it only during the morning. Air could circulate freely from all sides behind the door, making it a somewhat cooler place than those selected by this bat's more common relative, the little brown bat, *Myotis l. lucifugus*.

On September 21, 1953, Mr. Ernest Wilson of Cobden, Renfrew County, Ontario, picked up another dead, banded *Myotis subulatus leibii* in his yard. This bat had been banded at Fourth Chute in December, 1949, and had been retaken at the cave in February, 1953. Cobden is about twelve miles from the cave.

The finding of these two specimens suggests that man's buildings provide suitable places for the summer shelter of this species, and that bats of this species may not go far from their summer home to hibernate if suitable places are available nearby.

Much information regarding the movements of banded animals must come from persons who happen to find them — frequently persons without knowledge of the purposes for which banding is done. All naturalists can perform a service to the banders by making known as widely as possible the importance of reporting the finding of banded birds and bats. Reports should be made to the Canadian Wildlife Service, Ottawa, or to the Fish and Wildlife Service, Washington, D.C., where duplicate records are kept.

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SPIDERS AND HARVESTMEN FROM WATERTON AND GLACIER NATIONAL PARKS [1]

LORNA R. LEVI *and* HERBERT W. LEVI
University of Wisconsin, Extension Center, Wausau, Wisconsin. [2]

THIS PAPER is largely the result of intensive summer collecting during 1953 at Waterton National Park in Alberta and Glacier National Park in Montana. Some of the specimens were collected at Waterton during a brief visit to that park in 1951. No list of spiders of this region is available at the present time, although Emerton collected in the Banff region, and in 1939 Gertsch and Jellison published a list of spiders, most of which came from Ravalli County, Montana.

This collection and paper were made possible through the kind cooperation of Park Naturalist M. E. Beatty and Superintendent J. W. Emmert who granted the permits necessary in order to collect in Glacier National Park. Many thanks are extended to them, to Dr. W. J. Gertsch of the American Museum of Natural History and Mr. W. Ivie, who helped determine many of the more difficult species, and to Dr. J. G. Edwards of San Jose State College for his additions to the collection. Representative samples of the collection will be deposited in the laboratory of the Ranger Naturalist at Glacier National Park, and in the American Museum of Natural History, which will receive also the types of the new species. For each species, reference is given to a readily available description.

For those not familiar with this area, it may be helpful to point out that the following localities are in Waterton National Park, Alberta: Bertha Lake, Cameron Lake, Carthew Lakes, Rowe Brook, Summit Lake, Upper Rowe Lake and Waterton Lake (east shore). All other localities, unless otherwise mentioned, are in Glacier National Park, Montana.

Order Phalangida (Harvestmen)
Phalangiidae [3]

Leiobunum paessleri Roewer, 1910. Davis, 1934, p. 684, figs. 25, 29. Summit Lake, 6300 ft.; Cameron Lake, 5500 ft.; Olson Creek Valley, 5000 ft.; Grinnell Lake, 5000 ft.; Canyon Creek, 5700 ft.; Bowman Lake, 4000 ft.

Phalangium opilio Linnaeus, 1758. Bishop, 1949, p. 183, figs. 29-33. Summit of Marias Pass, 5200 ft. Roewer, 1952, described a new species, *Opilio angulatichelis*, from Glacier Park. This new *Opilio* differs from *Phalangium opilio* chiefly in having poorly developed spurs on the second segment of the chelicerae and having the supra-cheliceral laminae unarmed. This condition is present in some juveniles of *Phalangium opilio* and it seems probable that the specimen in question may be an immature male of that species.

Order Araneae (Spiders)
Theridiidae (Comb-footed spiders)

Ctenium vigerens (Chamberlin and Ivie), 1933. Kaston, 1946, p. 13, figs. 9, 10, 29-31, 55. Under logs and stones. Waterton Lake, 4200 ft.; Grinnell Glacier trail, 5500 ft.; St. Mary River Valley, 4900 ft.; Two Medicine Lake, 5200 ft.; Avalanche Creek, 3500 ft.

Dipoena nigra (Emerton), 1882. Kaston, 1948, p. 90, figs. 88-90. Ole Creek, (coll. L. P. Schultz).

Steatoda hespera Chamberlin and Ivie, 1933, p. 9, figs. 4-6. On buildings. Many Glacier. (coll. J. G. Edwards); Josephine Lake, 4800 ft.; Cut Bank Creek, 5100 ft.; Two Medicine Lake, 5200 ft.; Bowman Lake, 4100 ft.

Theridion (Allotheridion) differens Emerton, 1882. Kaston, 1948, p. 103, figs. 123-124, 144-145. Sweeping in lodgepole forest. In North Fork Valley at Kintla Creek, 3900 ft., and near Logging Creek, 3400 ft.; Bowman Lake, 4100 ft.

Theridion (Allotheridion) montanum Emerton, 1882, p. 10, pl. 1, fig. 3. On vegetation. Rowe Brook, 6000 ft.; Bertha Lake, 5800 ft.; Grinnell Glacier trail, 5500 ft.; Two Medicine Lake, 5200 ft.

Theridion (Allotheridion) ohlerti Thorell, 1870. Levi and Levi, 1951, p. 220, figs. 3, 7,

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2 Present address: Dept. of Zoology, Univevsity of Wisconsin, Madison.

3 Homolophus biceps (Thorell) was not collected in Glacier Park, although it is abundant in the southern Rockies, the northernmost localities from which we have collected it being Fremont County, Idaho and the Jackson Hole area, Wyoming. A specimen from Togwotee Pass, Wyoming, was recently described as a new species and placed in a new genus (Togwoteeus granipalpus) by Roewer, 1952. A comparison of our own specimens from the type locality and the immediate vicinity, in which H. biceps is common, revealed that characters on which the new genus and species are based are variable. It is undoubtedly H. biceps.

8, ♀. T. simulatum Emerton, 1926, p. 115, figs. 1, 2, ♂. On vegetation. Grinnell Glacier trail, 5500 ft.; Bowman Lake, 4200 ft.

Theridion rugosa (Emerton), 1909. Enoplognatha pikes Chamberlin and Ivie, 1942, figs. 89-91. Under stones above timberline. Carthew Lakes, 6500-7200 ft.; Piegan Pass, 7900 ft.; Cut Bank Pass, 7600 ft.

Theridion (Allotheridion) sexpunctatum Emerton, 1882, p. 12, pl. 2, fig. 5. On vegetation. Bertha Lake Trail, 5400 ft.; Two Medicine Lake, 5200 ft.; Bowman Lake, 4100 ft.; North Fork road near Logging Creek, 3400 ft.

Theridion (Allotheridion) zelotypum Emerton, 1882, p. 11, pl. 4, fig. 4, ♀. Kaston, 1948, p. 109, fig. 150, ♂. Sweeping in lodgepole forest. Bowman Lake, 4100 ft.

Linyphiidae

Subfamily Linyphiinae. (Sheet-web weavers)

Bathyphantes sp. (close to *pullatus*). In lodgepole pine log. Bowman Lake, 4000 ft., ♀.

Lepthyphantes **aldersoni,** new species. Figure 10.

Female: Carapace, clypeus, chelicerae, maxillae, coxae, and legs yellow-brown. Labium dusky, sternum yellow-gray with margin dusky. Abdomen dorsum gray-white with three longitudinal rows of three gray spots each, followed by a series of transverse bars which become very narrow toward the spinnerets. Sides glossy gray with white flecks, venter glossy gray with a pair of lateral light lines. Spinnerets and epigastric region yellowish. Anterior eye row straight, posterior row slightly recurved. Anterior median eyes smallest, in a ratio of 3:5 to others which are subequal. Anterior medians one-fourth diameter apart, one diameter from laterals. Posterior medians three-fourths diameter apart, one-half diameter from laterals. Anterior and posterior laterals almost touching. Clypeus straight, undercutting eye region, and as high as three to four diameters of anterior median eyes. This species can be distinguished from other members of the genus by the epigynum (fig. 10). Total length, 2.90 mm. Carapace, 1.11 long, 0.85 wide. First femur, 1.28; patella and tibia, 1.53; metatarsus, 1.28; tarsus, 0.85. Second patella and tibia, 1.36; third, 1.19; fourth, 1.53.

Type locality: the female holotype was collected in Waterton National Park, Alberta, under stones near Lower Carthew Lake, 6500-7200 ft., on July 27, 1953.

Lepthyphantes arborea (Emerton), 1915. Zorsch, 1937, p. 885, figs. 64-66. Sweeping vegetation. Bertha Lake trail, 5400 ft.

Lepthyphantes **berthae,** new species. Figure 9.

Female: Carapace pale yellow with a dusky margin and central mark. Clypeus and labium yellow with dusky. Maxillae yellow with white tips. Sternum yellow shaded with dusky and with a dusky margin. Chelicerae, palpi, and legs yellow. Coxae whitish. Abdomen dorsum gray-white flecked with white and overlaid with an indistinct gray pattern of paired spots and transverse bars. Sides gray, flecked with white, venter gray-white. Both eye rows slightly recurved. Anterior median eyes smallest, in a ratio of 2:3 to others, which are subequal. Anterior median eyes three-fourths diameter apart, one diameter from laterals. Posterior median eyes separated by one diameter, one-half diameter from laterals. Anterior and posterior laterals almost touching. Clypeus as high as two diameters of anterior median eyes, slanting forward from below eyes. Chelicerae divergent distally. This species can be distinguished from other members of this genus by the epigynum (fig. 9). Total length, 2.38 mm. Carapace, 0.94 long; 0.76 wide. First femur, 1.36; patella and tibia, 1.53; metatarsus, 1.19; tarsus, 0.68. Second patella and tibia, 1.36; third, 1.02; fourth, 1.36.

Type locality: The female holotype was collected in Waterton National Park, Alberta, at Bertha Lake, 5800 ft., on July 29, 1953.

Lepthyphantes calcarata (Emerton), 1909. Zorsch, 1937, p. 874, figs. 40-43. On building. Cut Bank Creek, 5100 ft.

Lepthyphantes chamberlini Schenkel, 1950. Levi and Levi, 1951, p. 222, figs. 4, 6. This species has been collected with *L. calcarata* in the San Juan Mountains, Colorado, and may be the female of that rare species. Cut Bank Creek, 5200 ft.

Lepthyphantes pollicaris Zorsch, 1937, p. 897, figs. 91-93, ♂. Fig. 8. Under stones and logs. Carthew Lakes, 6500-7200 ft.; Grinnell Glacier trail, 5500 ft.; Bowman Lake, 4000 ft.; Numa Ridge, 5000 ft.

Lepthyphantes rainieri Emerton, 1926. Zorsch, 1937, p. 895, figs. 83-87. On vegetation. Bertha Lake trail, 5400 ft.

Lepthyphantes **sammamish,** new species. Figures 11-13.

Female: Carapace yellow with radiating dusky marks and dusky margin. Clypeus

and chelicerae yellow with light dusky shading. Maxillae, legs and palpi yellow, coxae yellow-white. Sternum and labium yellow, heavily shaded with dusky, anterior margin dark gray. Abdomen dorsum yellow-white, lightly shaded with dusky; venter slightly darker with indications of a pair of lateral light lines. Spinnerets yellow-white, surrounded by a dark dusky ring. The female paratype from Montana is darker in coloration. Both eye rows straight. Anterior median eyes slightly smaller than other eyes, which are subequal. Anterior median eyes one-half diameter apart, three-fourths diameter from laterals. Posterior medians three-fourths diameter apart, same distance from laterals. Anterior and posterior lateral eyes touching. Clypeus equals four diameters of anterior median eyes. Epigynum illustrated by figure 11. Total length, 3.2 mm. Carapace 1.53 long, 1.19 wide. First femur, 1.36; patella and tibia, 1.70; metatarsus, 1.15; tarsus, 0.72. Second patella and tibia, 1.36; third, 1.19; fourth, 1.62.

Male: In color the male is similar but darker than the female allotype. Carapace yellow-orange with dusky radiating marks and a dusky shield-shaped mark on the back of the head. The sternum is greenish shaded with dark dusky. The abdomen dorsum is dark dusky flecked with white and with a narrow median light line, venter glossy dark gray with a pair of lateral longitudinal light lines. Both eye rows straight. Anterior median eyes slightly smaller than others, which are subequal. Anterior medians less than one-half diameter apart, one-half diameter from laterals. Posterior medians less than one diameter apart, same distance from laterals. Anterior and posterior laterals touching. Clypeus slightly higher than three diameters of anterior median eyes. Palpus illustrated by figures 12 and 13. Total length, 2.8 mm. Carapace, 1.36 long, 1.10 wide. First femur, 1.36; patella and tibia, 1.62; metatarsus, 1.11; tarsus, 0.77. Second patella and tibia, 1.45; third, 1.19; fourth, 1.53. This species is tentatively placed in *Lepthyphantes* because of its similarity to the members of that genus. It differs, however, in that the epigynum lacks the characteristic scape.

Type specimens: The male holotype and female allotype were collected on May 23, 1953 at Lake Sammamish State Park in King County, Washington, by B. Malkin and C. Taylor. A female paratype was collected in Glacier National Park, Montana, in the St. Mary River valley, 4900 ft., on Aug. 7, 1953.

Linyphia marginata C. L. Koch, 1834. Kaston, 1948, p. 122, figs. 220-230. In webs between rocks or in shrubs. Many Glacier, 5000 ft.; Roes Creek, 5100 ft.; Bowman Lake, 4100 ft.; Numa Ridge, 5000 ft.; Fish Lake, 4100 ft.; Sprague Creek, 6000 ft.

Linyphia pusilla Sundevall, 1830. Kaston, 1948, p. 124, fig. 231-236. Sweeping in wet meadow. Bowman Lake, 4000 ft.

Meioneta ordinaria Chamberlin and Ivie, 1947, p. 59, figs 74, 75. Under logs and stones. Waterton Lake, 4200 ft.; Bowman Lake, 4000 ft.

Meioneta sp. Carthew Lakes, 6500-7200 ft., ♀; pass above Cobalt Lake, 7300 ft., ♂.

Pityohyphantes cristatus Chamberlin and Ivie, 1942, p. 58, figs. 141-143. Although females were very common in shrubs in forested parts of the parks, the identification of this species was based on the males. Only two males were collected, one from Rowe Brook, 6000 ft., the other from Cut Bank Creek, 6000 ft. Both were ascribed to *P. cristatus* in spite of the considerable differences in the tibial spurs of the two specimens.

Subfamily Erigoninae (Dwarf spiders)

Ceraticelus atriceps (O. P.- Cambridge), 1874. Crosby and Bishop, 1925, p. 15, figs. 15-18. Fig. 6. Sweeping vegetation. Josephine Lake, 4800 ft.; North Fork road at Kintla Creek, 3900 ft.

Ceraticelus crassiceps Chamberlin and Ivie, 1938, p. 68, figs. 52-54. Fig. 7. Sweeping vegetation. Near Babb, Glacier Co., 4500 ft.; Cut Bank Creek, 5200 ft.; North Fork road at Kintla Creek, 3900 ft.; Bowman Lake, 4100 ft. (very common).

Ceraticelus fissiceps (O. P.- Cambridge), 1874. Crosby and Bishop, 1925, p. 22, figs. 39-43, 111. Fig. 5. Sweeping in lodgepole. Bowman Lake, 4100 ft. (very common).

Ceraticelus **rowensis,** new species. Figures 1-4.

Female: Carapace brown to orange-brown, eye region black. Some specimens have dusky radiating marks on carapace. Clypeus black near eyes, orange-brown at margin. Sternum orange-brown to dark brown, labium dark brown. Chelicerae, maxillae and legs yellow-gray. Abdomen gray to light orange, sclerotized parts orange. Cephalothorax highest in eye region. Anterior eye row straight, posterior row slightly recurved. Anterior median eyes one diameter apart,

two diameters from laterals. Posterior medians one and one-half diameters apart, slightly more than one diameter from laterals. Anterior and posterior laterals nearly touching. Diameter of anterior medians 0.7 of posterior medians, which are equal in size to posterior laterals. Width of oval anterior laterals equals diameter of posterior medians. Clypeus as high as five diameters of anterior median eyes. Abdomen sparsely clothed with dark hairs, marked with four dorsal sclerotized muscle scars, a ring around pedicel and a band anterior to spinnerets ventrally. Epigynal area separated from epigastric plates by a narrow non-sclerotized strip on each side. Epigynum and female genitalia illustrated by figures 1 and 2. Total length 1.8-2.1 mm. Total length of female allotype, 1.85. Carapace 0.78 long, 0.65 wide, 0.34 high. First patella and tibia, 0.65; second, 0.59; third, 0.52. Fourth femur, 0.60; patella and tibia, 0.66; metatarsus, 0.42; tarsus, 0.30.

Male: Carapace orange-brown with a central dusky mark. Larger lobe of head dusky greenish with a pair of longitudinal dark dotted lines. Smaller lobe black. Sclerotized parts of abdomen orange, remainder dusky on yellowish background. A large scutum covers most of dorsum of abdomen, sclerotized rings around pedicel and spinnerets. Head region bulbous (fig. 3), divided into two lobes by a deep constriction between the anterior and posterior median eyes. Lateral eyes nearly touching. Diameter of anterior median eyes 0.7 of other eyes, which are subequal. Tibial apophysis deeply notched and with a large tooth (fig. 4) though both notch and tooth are reduced in a specimen from Sunwapta Pass, Alberta. The males of this species differ from all others in the genus in the shape of the carapace (fig. 3) and the palpus (fig. 4). Total length of male holotype, 1.75 mm. Carapace 0.84 long, 0.65 wide, 0.49 high at lobe on head. First patella and tibia, 0.65; second, 0.59; third, 0.52. Fourth femur, 0.60; patella and tibia, 0.68; metatarsus, 0.43; tarsus, 0.27.

All specimens were collected running on moss and rocks in sunshine.

Type locality: The male holotype, female allotype and one male and nine female paratypes were collected in Waterton National Park, Alberta, at Upper Rowe Lake, 7100 ft., on July 24, 1953.

Records: Hidden Lake Pass, 7100 ft., Aug. 8, 1953, 2 ♂, 1 ♀; Sunwapta Pass, 6900 ft., in Jasper National Park, Alberta, Aug. 10, 1951, 1 ♂.

Ceraticelus sp. Sweeping vegetation. Josephine Lake, 4800 ft., ♀.

Ceratinella brunnea Emerton, 1882, p. 36, pl. 8, fig. 3. Sweeping in lodgepole forest. Bowman Lake, 4100 ft.

Ceratinops sp. Two Medicine Lake, 5200 ft., ♀.

Collinsia clypiella (Chamberlin), 1920. Crosby and Bishop, 1928, p. 64, figs. 78-80, ♂. Fig. 17. Josephine Lake, 4800 ft.

Collinsia ksenia (Crosby and Bishop), 1928, p. 428, figs. 81-83. Fig. 18. At timberline under stones. Iceberg Lake, 6000 ft. Described from Mt. Rainier National Park, Washington, but also known from British Columbia and Alaska.

Collinsia plumosa (Emerton), 1882. Crosby and Bishop, 1928, p. 70, figs. 97-99, 101, ♂. Chamberlin, 1948, p. 490, figs. 6, 7, ♀. Fig. 16. Under rocks. Belly River (coll. J. G. Edwards).

Collinsia **wilburi,** new species. Figures 14-15, 27.

Male: Carapace orange with radiating dusky marks and dusky margin. Thoracic groove a short longitudinal brown mark. Clypeus orange shaded with dusky; chelicerae, maxillae, and legs orange. Coxae yellow-orange. Sternum orange shaded with dusky, a dark band inside orange margin. Abdomen gray flecked with whitish, faint indication of dorsal transverse whitish marks. Spinnerets and epigastric plates whitish. Both eye rows straight or nearly straight. Anterior median eyes smallest, in a ratio of 2:3 to others, which are subequal. Anterior medians one diameter apart, more than one diameter from laterals. Posterior medians almost one diameter apart, one diameter from laterals. Anterior and posterior laterals nearly touching. Clypeus straight, as high as three diameters of anterior median eyes. Chelicerae very large with a well developed tooth and a cluster of hair tipped tubercles on anterior face (fig. 27). It can be distinguished from other members of the genus by the palpus (figs. 14-15). Total length: 2.1 mm. Carapace, 1.06 long, 0.77 wide. First femur, 0.85; patella and tibia, 0.98; metatarsus, 0.59; tarsus, 0.47. Second patella and tibia, 0.89; third, 0.72; fourth, 0.98.

The placement of this species in *Collinsia* is tentative.

Type locality: The male holotype was found in Glacier National Park, Montana, at Iceberg Lake, 6000 ft., under stones, on July 15, 1953.

Coloncus ?siou Chamberlin, 1948, p. 525, fig. 48, 49. Under stones. Iceberg Lake, 6000 ft., ♀.

Coloncus sp. Sweeping vegetation. North Fork road near Ford Creek, 3800 ft., ♀.

Disembolus chera (Chamberlin and Ivie), 1933. D. stridulans Chamberlin and Ivie, 1945, p. 226, figs. 14-18. At timberline under rocks. Hidden Lake Pass, 7100 ft.

Dismodicus modicus Chamberlin and Ivie, 1947, p. 35, fig. 32. Sweeping vegetation. Josephine Lake, 4800 ft.; Bowman Lake, 4100 ft.

Erigone denticulata Chamberlin and Ivie, 1938, p. 57, fig. 2. Two Medicine Lake, 5200 ft.

Erigone sp. At timberline under rocks. Hidden Lake Pass, 7100 ft., ♀.

Islandiana alata (Emerton), 1919, p. 3, figs. 5-7. [not Aduva alata (Emerton), Bishop and Crosby, 1936] Above timberline under rocks. Swiftcurrent Mountain, 8000 ft.

Maso sundevalli (Westring), 1851. Kaston, 1948, p. 145, fig. 346-350. Sweeping wet meadow. Bowman Lake, 4,000 ft.

Pelecopsis sculptum (Emerton), 1917. Crosby and Bishop, 1931, p. 382, figs. 80-85. Grinnell Glacier trail, 5500 ft.

Sisicottus sp. Above timberline, under rocks. Swiftcurrent Mountain, 7500 ft., ♀.

? *Tigellinus* sp. At timberline, under stones. Upper Rowe Lake, 7100 ft., ♀; Iceberg Lake, 6000 ft., ♀; Swiftcurrent Mountain, 7500 ft., ♀.

Walckenaera vigilax (Blackwall), 1853. Kaston, 1948, p. 206, figs. 639-640, 659-661. At timberline under stones. Upper Rowe Lake 7100 ft.; Iceberg Lake, 6,000 ft.

erigonid In lodgepole pine log. Bowman Lake, 4000 ft., ♀.

Argiopidae (Orb weavers)

Araneus gemmoides Chamberlin and Ivie, 1935, p. 22, fig. 80, ♀. Levi, 1951, p. 12, figs. 14-16, ♂. Outside Many Glacier Hotel (coll. J. G. Edwards).

Araneus marmoreus Clerck, 1757. Epeira raji, Kaston, 1948, p. 257, figs. 816-822. In shrubs along meadows or in woods. Town of Waterton, 4300 ft.; Roes Creek, 5100 ft.; Cut Bank Creek, 5200 ft.; Bowman Lake, 4100 ft.

Araneus nordmanni (Thorell), 1870. Kaston, 1948, p. 250, figs. 783-784, 793-795. Very common in forested parts of the eastern slope, especially in the St. Mary River Valley.

Araneus patagiatus Clerck, 1757. E. dumetorum, Kaston, 1948, p. 255, figs. 788, 804, 813. Common throughout park on buildings at lower elevations.

Araneus solitarius (Emerton), 1884. Kaston, 1948, p. 250, figs. 785-786, 796-797. Sweeping in aspen woods. Marias Pass summit, 5200 ft.

Araneus trifolium (Hentz), 1847. Kaston, 1948, p. 258, figs. 823-825. Common in shrubs along forest edge up to an elevation of 5200 ft.

Araniella displicata (Hentz), 1847. Kaston, 1948, p. 258, fig. 806, ♀. Collected commonly by sweeping in light woods at low elevations.

Cyclosa conica (Pallas), 1772. Kaston, 1948, p. 236, figs. 711-713. Common on the west slope in light forest. On the east slope, collections were made at Josephine Lake, 4800 ft.; St. Mary River Valley, 4900 ft.

Neoscona arabesca (Walckenaer), 1841. Kaston 1948, p. 245, figs. 750, 771-773, 775. Sweeping shrubs. Josephine Lake, 4800 ft.

Singa variabilis Emerton, 1884. Kaston, 1948, p. 241, figs. 760-765. Bowman Lake, 4000 ft.

Tetragnatha extensa (Linnaeus), 1758 . T. manitoba Chamberlin and Ivie, 1942, p. 61, figs. 153-158. Sweeping meadows. Bowman Lake, 4000 ft.; North Fork road near Logging Creek, 3400 ft.

Tetragnatha laboriosa Hentz, 1850. Kaston, 1948, p. 269, figs. 850-851, 859-861. Collected

PLATE 1

Figs. 1-4. **Ceraticelus rowensis**, new species. 1. Female genitalia, dorsal view. 2. Epigynum. 3. Carapace of male, lateral view. 4. Left palpus, ectal view. Fig. 5. **Ceraticelus fissiceps** (O. P.-Cambridge), female genitalia, dorsal view. Fig. 6. **Ceraticelus atriceps** (O. P.-Cambridge), female genitalia, dorsal view. Fig. 7. **Ceraticelus crassiceps** (Chamberlin and Ivie), female genitalia, dorsal view. Fig. 8. **Lepthyphantes pollicaris** Zorsch, epigynum. Fig. 9. **Lepthyphantes berthae**, new species, epigynum. Fig. 10. **Lepthyphantes aldersoni** new species, epigynum. Figs. 11-13. **Lepthyphantes sammamish**, new species. 11. Epigynum. 12. Palpus, submesal view. 13. Palpus, subectal view. Figs. 14-15. **Collinsia wilburi**, new species. 14. Palpus, mesal view. 15. Palpus, ventral view. Fig. 16. **Collinsia plumosa** (Emerton) epigynum. Fig. 17. **Collinsia clypiella** (Chamberlin), epigynum. Fig. 18. **Collinsia ksenia** (Crosby and Bishop), epigynum.

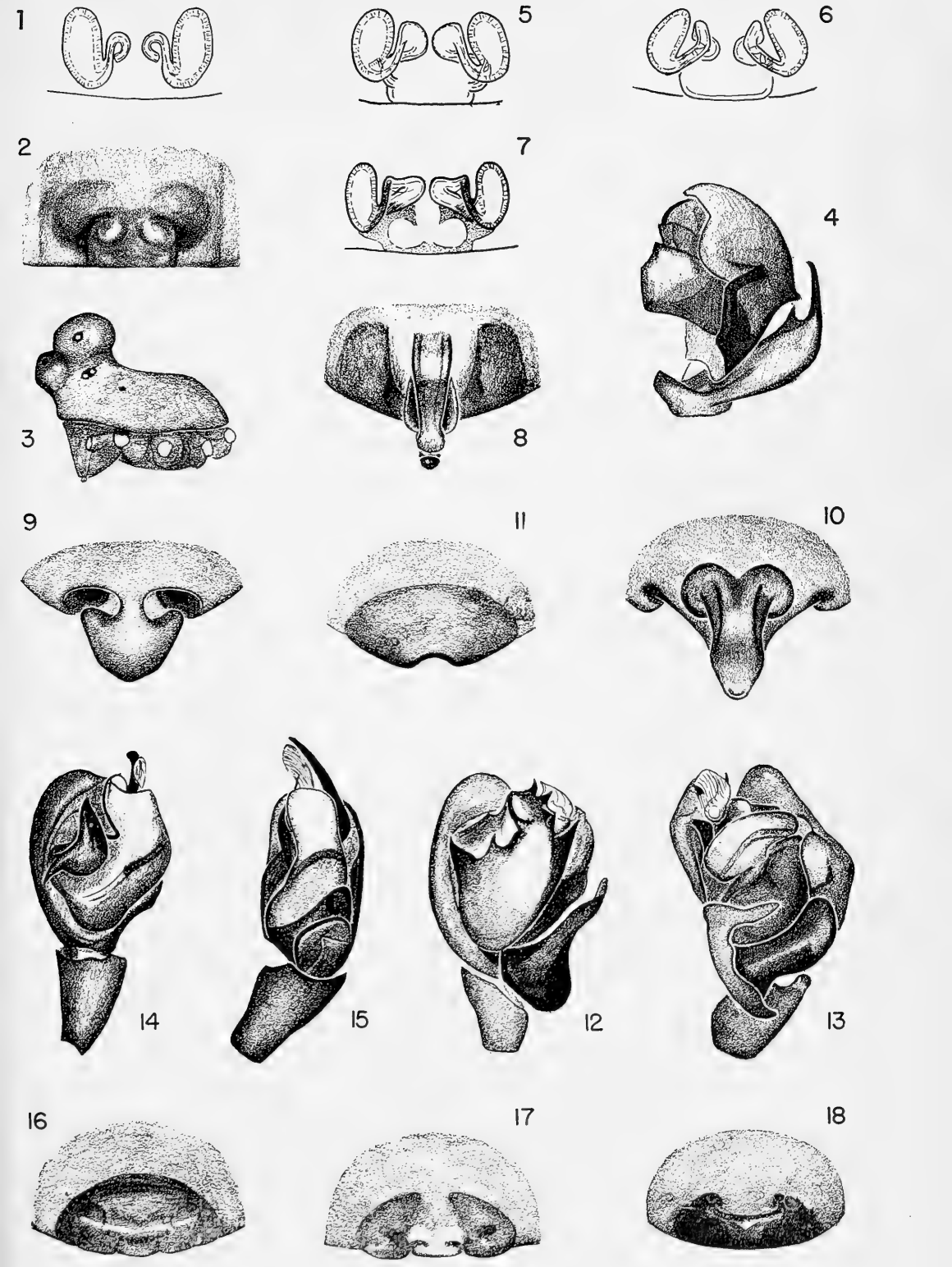

Plate 1

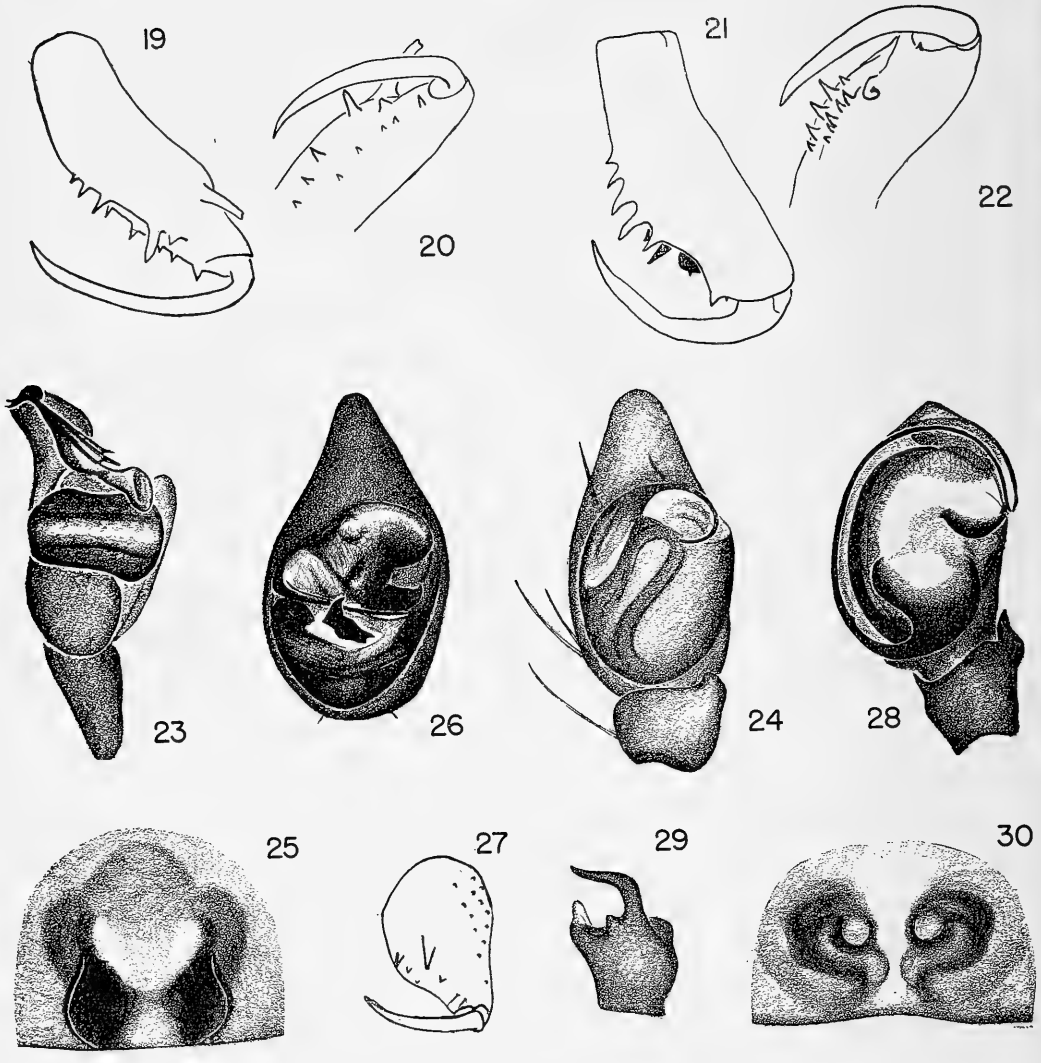

PLATE 2.

Figs. 19-23. **Tetragnatha numa,** new species. 19. Left male chelicera, anterior view. 20. Posterior view. 21. Female chelicera, anterior view. 22. Posterior view. 23. Palpus, ventral view. Figs. 24-25. **Thanatus** sp. 24. Palpus, ventral view. 25. Epigynum. Fig. 26. **Pardosa wyuta** Gertsch, palpus. Fig. 27. **Collinsia wilburi,** new species, left chelicera, anterior view. Figs. 28-30. **Cryphoeca peckhami** Simon. 28. Palpus, ventral view. 29. Tibia of palpus, dorsal view. 30. Epigynum.

commonly throughout park by sweeping in meadows and aspen groves.

Tetragnatha **numa,** new species. Figures 19-23.

Female: Carapace and maxillae yellow-gray with some dusky markings. Chelicerae yellowish, each with a median dusky line. Sternum sooty along margin, yellow centrally. Palpi and legs yellow, distal portions of tarsi and metatarsi dusky. Abdomen dorsum silver spotted on gray-pink background with an indistinct folium, and a pair of longitudinal yellow lines. Venter of abdomen has a broad black median stripe with a narrow line of silver spots on each side. Sides of venter tan with scattered silver spots. Spinnerets brown. Abdomen somewhat thicker at base and notched above pedicel; turned up at end above spinnerets. Both eye rows are slightly recurved. Anterior median eyes are one diameter apart, two diameters from anterior laterals, and almost one and one-half diameters from posterior medians. Posterior medians are one and three-fourths diameters apart and about the same distance from the posterior laterals which are about one and one-fourth diameters from anterior laterals. Posterior medians are about 1.1 diameters, anterior laterals about 0.8 diameter of other eyes, which are subequal. Chelicerae are slightly more than half the length of the carapace. Anterior margin of fang furrow has a medium sized tooth at the apex, and after a space, five more medium to small teeth (fig. 21). The posterior margin has a medium tooth at the apex, a space, then a rather large tooth which is twisted 180° on its axis, and a row of five teeth (fig. 22). The fangs are stout, evenly curved, and only slightly more than half the length of the chelicerae. Total length 7.5 mm. Carapace, 2.2 long, 1.3 wide, 0.7 high. First femur, 4.5; patella and tibia, 5.5; metatarsus, 5.0; tarsus, 1.2. Second patella and tibia, 3.2; third, 1.5; fourth, 3.0.

Male: Coloration of cephalothorax like that of the female except that carapace has a pair of dusky lines extending from the lateral eyes to the thoracic depression. Abdomen dorsum closely silver spotted on a gray-pink background. Posterior third of abdomen has three or four pairs of dark spots on yellow stripes. Venter gray-brown with a pair of longitudinal silver spotted yellow lines. Spinnerets brown. Posterior eye row slightly recurved, anterior row nearly straight. Anterior median eyes one diameter apart, one and one-half diameters from laterals, and slightly more than one diameter from posterior medians. Posterior medians one and one-half diameters apart, same distance from posterior laterals, which in turn, are two diameters from anterior laterals. In size the posterior median eyes are 1.2, posterior laterals 0.9, and anterior laterals 0.6 of anterior median eyes. The clypeus is as high as two diameters of the anterior median eyes. The chelicerae more than half the length of the carapace. The dorsal spur on the apical third of each chelicera is shallowly bifid. Anterior margin of the fang furrow has a small apical tooth and after a space, a large flattened tooth followed by three smaller teeth (fig. 19). The posterior margin has five well spaced teeth (fig. 20). The fangs are slightly sinuate and are about two-thirds the length of the chelicerae. The palp is illustrated by figure 23. Total length, 3.0 mm. Carapace, 1.4 long; 0.9 wide. First femur, 2.8; patella and tibia, 3.3; metatarsus, 2.5; tarsus, 1.0. Second patella and tibia, 2.2; third, 1.1; fourth, 2.1.

This species can be distinguished from other members of the genus by the large tooth on the posterior margin of each female chelicera and by the male palpus and chelicerae. It is named after Numa Ridge, near which the specimens were found.

Type locality: The male holotype and female allotype were collected by sweeping near Bowman Lake, 4100 ft., in Glacier National Park, Montana, on August 2, 1953.

Tetragnatha versicolor Walckenaer, 1841. Kaston, 1948, p. 270, figs. 852, 862-964. Commonly taken by sweeping in meadows. The webs may overhang water.

Agelenidae (Funnel-web weavers)

Agelenopsis utahana (Chamberlin and Ivie), 1933. Chamberlin and Ivie, 1941, p. 600, figs. 12, 23, 38. Collected from funnel webs among low shrubs in forest. Waterton Lake, west shore, 4200 ft.; Olson Creek, 5000 ft.; Many Glacier, 5000 ft.; Josephine Lake, 4800 ft.; Roes Creek, 5100 ft.; Bowman Lake, 4000 ft; Numa Ridge.

Cryphoeca peckhami Simon, 1898. Figs. 28-30. Under logs and stones. Bertha Lake, 5800 ft.; Waterton Lake, west shore, 4200 ft.; Iceberg Lake, 6000 ft.; Roes Creek, 5100 ft.

Lycosidae (Wolf spiders)

Arctosa alpigena (Doleschal), 1852. Levi and Levi, 1951, p. 223, figs. 9, 20. Running

on surface of ground. Summit Lake (Waterton Park), 6300 ft.; Upper Rowe Lake, 7100 ft.; Rowe Brook, 6000 ft.; Olson Creek, 5000 ft.; Iceberg Lake, 6000 ft.

Lycosa pratensis Emerton, 1885. Kaston, 1948, p. 330, figs. 1092-1094, 1117-1118. Gunsight Lake, 5300 ft.; Bowman Lake, 4000 ft.

Pardosa anomala Gertsch, 1933 (a), p. 26, fig. 36, ♀. Levi and Levi, 1951, p. 223, fig. 10, ♂. This species was commonly collected on the east slope running on the ground at elevations near timberline. It was not collected on the west slope.

Pardosa coloradensis Banks, 1894. P. sternalis Chamberlin, 1908, p. 185 (in part) pl. 14, fig. 2, ♀. P. ontariensis Gertsch, 1933 a, p. 18, fig. 27, ♂. Josephine Lake, 4800 ft.

Pardosa concinna (Thorell), 1877. P. muscicola Emerton, 1911, p. 401, pl. 5, fig. 2. Cut Bank Creek, 5200 ft.

Pardosa fuscula (Thorell), 1875. Levi and Field, 1954, p. 456, figs. 65, 69. Cameron Lake, 5500 ft.

Pardosa groenlandica (Thorell), 1872. Levi and Levi, 1951, p. 225, figs. 13, 14. Commonly found running on the ground above timberline.

Pardosa mackenziana (Keyserling), 1876. Kaston, 1948, p. 338, figs. 1133-1136. Very commonly found running along the ground in all parts of the park, though slightly less abundant above timberline.

Pardosa moesta Banks, 1892. Kaston, 1948, p. 334, figs. 1122, 1123, 1137. Bowman Lake, 4000 ft.; North Fork road at Anaconda Creek, 3400 ft.

Pardosa solituda Levi and Levi, 1951, p. 225, figs. 11, 16. Piegan Pass, 7900 ft.

Pardosa sternalis (Thorell), 1877. Chamberlin, 1908, p. 185, pl. 13, figs. 5-6. At timberline. Summit Lake, 6300 ft.

Pardosa wyuta Gertsch, 1934. P. atra Chamberlin, 1908, p. 188, pl. 8, figs. 3, 8, ♀. Fig. 26. Iceberg Lake trail, 5900 ft.

Tarentula aculeata (Clerck), 1757. Kaston, 1948, p. 312, figs. 1024-1025, 2139-2140. Many Glacier, 5000 ft.; Josephine Lake, 4800 ft.; Cracker Lake, 6000 ft.

Tarentula kochii Keyserling, 1876. Chamberlin, 1908, p. 263, pl. 21, figs. 4, 5. Numa Ridge, 4000 ft.; Glacier Park Headquarters, 3300 ft., (coll. J. Kendall).

Gnaphosidae (Running spiders)

Drassodes neglectus (Keyserling), 1887. Kaston, 1948, p. 351, figs. 1176, 1188-1189, 1195. Under rocks. Near Carthew Lakes, 7400 ft.

Gnaphosa brumalis Thorell, 1875. Kaston, 1948, p. 346, figs. 1156-1157, 1185. Under stones at or above timberline. Carthew Lakes, 6500-7200 ft.; Little Chief Mountain, 7500 ft. (coll. J. G. Edwards); Cut Bank Pass, 7600 ft.; pass above Cobalt Lake, 7300 ft.

Gnaphosa muscorum (L. Koch), 1866. Kaston, 1948, p. 344, figs. 1152-1155, 1160, 1177. Under stones. West shore of Waterton Lake, 4200 ft.; pass above Cobalt Lake, 7300 ft.

Gnaphosa parvula Banks, 1896. Kaston, 1948, p. 346, figs. 1161-1162, 1184. Under lodgepole log. Bowman Lake, 4000 ft.

Orodrassus coloradensis (Emerton), 1877. Drassodes melius Chamberlin, 1919, p. 246, pl. 16, figs. 4, 5. Under logs and rocks. West shore of Waterton Lake, 4200 ft.; Josephine Lake, 4800 ft.; Swiftcurrent Ranger Station (coll. J. G. Edwards); Two Medicine Lake, 5200 ft.; Bowman Lake, 4100 ft.; Numa Ridge, 5000 ft.

Poecilochroa montana Emerton, 1890, p. 175, pl. 4, fig. 2. Olson Creek, 5000 ft.; Canyon Creek, 5700 ft.

Zelotes subterraneus (C. L. Koch), 1839. Kaston, 1948, p. 356, figs. 1248-1251. Under rocks and logs. Summit Lake, 6300 ft.; Swiftcurrent Mountain, 8000 ft.; Josephine Lake, 4800 ft.; Cracker Lake, 6000 ft.; Roes Creek, 5100 ft.; Two Medicine Lake, 5200 ft.; Bowman Lake, 4100 ft.

Clubionidae (Sac-spiders)

Clubiona canadensis Emerton, 1890. Kaston, 1948, p. 376, figs. 1288-1290, 1344-1346. Common in forested parts of parks (4100-7000 ft.), rolled up in leaves (especially leaves of *Alnus* sp. and *Rubus* sp., and sometimes of *Acer* sp.).

Clubiona trivialis C. L. Koch, 1841. Locket and Millidge, 1951, p. 140, figs. 72, 73. Carthew Lakes, 6500-7200 ft., under stones in krummholz (very common); Bowman Lake, 4100 ft., sweeping.

Micaria altana Gertsch, 1933 (b), p. 6, fig. 5, ♀; 1935, p. 17, fig. 38, ♂. Running on trail. Swiftcurrent Valley, 5200 ft.

Micaria hesperella Gertsch and Jellison, 1939. M. constricta Emerton, 1894, p. 414, pl. 2, fig. 5. M. canadensis Roewer, 1951, p. 446. Under rocks or running on rocks at or near timberline. Carthew Lakes, 6500-7200 ft.; Summit Lake, 6300 ft.; Upper Rowe Lake, 7100 ft.; Iceberg Lake, 6000 ft.; Ptarmigan Lake, 6600 ft.; Cobalt Lake, 6800 ft.; pass above Cobalt Lake, 7300 ft.

Scotinella pelvicolens (Chamberlin and Gertsch), 1930, p. 138, figs. 6-8. West shore of Waterton Lake, 4200 ft.; Grinnell Glacier trail, 5500 ft.; Roes Creek, 5100 ft.

Thomisidae (Crab spiders)

Misumena vatia (Clerck), 1757. Kaston, 1948, p. 411, figs. 1481-1482, 1496-1498. Commonly collected by sweeping meadows.

Philodromus alascensis Keyserling, 1884. Levi and Levi, 1951, p. 230, figs. 33, 34. On snow. Boulder Pass (coll. J. G. Edwards).

Philodromus aureolus (Clerck), 1757. Kaston, 1948, p. 436, figs. 1557-1559. North Fork road near Logging Creek, 3400 ft.

Thanatus sp.[4] Figures 24-25. On and under rocks in talus. Many Glacier, 5000 ft., ♂, ♀; between Lincoln and Gunsight Passes, 6500-7000 ft., ♂. This species is currently being described from the Teton Mountains in Wyoming by Dr. D. C. Lowrie.

Tibellus oblongus (Walckenaer), 1802. Kaston, 1948, p. 440, figs. 1607-1608, 1616. Collected by sweeping meadow. Near town of Waterton; near Babb, Glacier County, 4500 ft.

Xysticus benefactor Keyserling, 1880. Gertsch, 1939, p. 399, figs. 246, 247, 260. Collected by sweeping in meadow. Near Babb, Glacier County, 4500 ft.

Xysticus labradorensis Keyserling, 1887. Gertsch, 1939, p. 401, figs. 248, 249, 268. Under rocks at or above timberline. Carthew Lakes, 6500-7200 ft.; Swiftcurrent Mountain, 8000 ft.; Dawson Pass, 7500 ft.

Xysticus lutulentus Gertsch, 1934. Gertsch, 1939, p. 396, figs. 242, 243, 262. Many Glacier, 5000 ft.; Iceberg Lake, under stones, 6000 ft.; Canyon Creek, rolled up in leaves, 5700 ft.

Salticidae (Jumping spiders)

Chalcoscirtus carbonarius Emerton, 1917, p. 271, fig. 23. On and under stones above timberline. Carthew Lakes, 6500-7200 ft. (very common); Cracker Lake, 6000 ft.; Cut Bank Pass, 7600 ft.; Dawson Pass, 7500 ft.

Evarcha hoyi (Peckham), 1883. Kaston, 1948, p. 469, figs. 1713-1717, 2134-2136. Collected from varied habitats, sweeping and under rocks. West shore of Waterton Lake, 4200 ft.; Many Glacier, 5000 ft.; Bowman Lake, 4100 ft.; North Fork road near Logging Creek, 3400 ft.; and near Anaconda Creek, 3400 ft.

Metaphidippus californicus (Peckham), 1888. Peckham and Peckham, 1909, p. 466, fig. 5. Under stones. Carthew Lakes, 6500-7200 ft.

Metaphidippus clematus Levi and Levi, 1951, p.232, figs. 37, 39, 40, 42. Sweeping in aspen grove. Near Babb, 4500 ft.

Metaphidippus nigromaculatus (Keyserling), 1884. Dendryphantes jeffersoni, Chamberlin and Gertsch, 1929, p. 110, fig. 51. Under stones above timberline. Carthew Lakes, 6500-7200 ft.; Piegan Pass, 7900 ft.; pass above Cobalt Lake, 7300 ft.

Metaphidippus uteanus (Chamberlin and Gertsch), 1929, p. 110, fig. 50, 51. Bertha Lake trail, 5400 ft.

Paraphidippus marginatus (Walckenaer), 1837. Kaston, 1948, p. 479, figs. 1762-1765, 1782-1784, 2131-2132. Near Babb, Glacier County, 4500 ft.

Pellenes lagganii Peckham and Peckham, 1909, p. 560, pl. 49, fig. 2, ♂. Levi and Levi, 1951, p. 232, figs. 47, 49, ♀. Under stones. Bertha Lake, 5800 ft.

Phidippus altanus Gertsch, 1934, p. 12, fig. 13, ♂. Levi and Levi, 1951, p. 232, figs. 48, 50, ♀. Ptarmigan Falls (coll. J. G. Edwards).

Phidippus johnsonii Peckham and Peckham, 1883. Peckham and Peckham, 1909, p. 404, pl. 31, fig. 1. Among stones. West shore Waterton Lake, 4200 ft.; Many Glacier, 5000 ft.; Josephine Lake, 4800 ft.; Roes Creek, 4800 ft.; near Triple Divide Pass, 7000-7600 ft.

Sitticus finschii (L. Koch), 1879. Levi and Levi, 1951, p. 232, figs. 38, 41, 44. Under stones near timberline. Near Triple Divide Pass. 7000 ft.; between Lincoln and Gunsight Passes, 6500-7000 ft.

Sitticus palustris (Peckham and Peckham), 1883. Kaston, 1948, p. 458, figs. 1660-1662, 1667-1668. Wet meadow. Bowman Lake, 4000 ft.

Sitticus ranieri Peckham and Peckham, 1909, p. 520, pl. 43, fig. 5. On and under rocks near timberline. Above Cameron Lake, (coll. J. G. Edwards); Grinnell Glacier trail, 6000 ft.; Cracker Lake, 6000 ft.; Hidden Lake Pass, 7100 ft.; between Lincoln and Gunsight Passes, 6500-7000 ft.

Uloboridae (Feather-foot spiders)

Hyptiotes gertschi Chamberlin and Ivie, 1935, p. 12, figs. 38, 39. Roes Creek, 5100 ft.

4 This species has been described as **Apollophanes patricia** Lowrie and Gertsch, 1955, Amer. Mus. Novitates, no. 1736, p. 18, figs. 25, 26, 28. An additional record is of one male, Rainbow Peak, 8000 ft., Glacier Park (coll. J. G. Edwards).

Dictynidae (Hackled band weavers)

Callobius nomeus (Chamberlin), 1919, p. 240, pl. 14, figs. 1, 2. Josephine Lake, 4800 ft.; Cut Bank Creek, 5100-5200 ft.; Two Medicine Lake, 5200 ft.; North Fork road at Kintla Creek, 3900 ft.; Avalanche Creek, 3500 ft.

Dictyna alaskae Chamberlin and Ivie, 1947, p. 13, figs. 2, 3. Rowe Brook, 6000 ft.; Bowman Lake, 4100 ft.

Dictyna annulipes Blackwall, 1846. D. muraria, Kaston, 1948, p. 506, figs. 1893, 1919-1926. Bowman Lake, 4100 ft.

Dictyna coloradensis Chamberlin, 1919, p. 241, figs. 6-8. West of Babb, Glacier County.

Dictyna major Menge, 1869. D. vincens Chamberlin, 1919, p. 243, figs. 1, 2. Collected fairly commonly by sweeping in high grass at lower elevations with the exception of one female which was collected at Upper Rowe Lake, 7100 ft.

Dictyna peragrata Bishop and Ruderman, 1946, p. 3, figs. 5-8. Rowe Brook, 6000 ft.; Josephine Lake, 4800 ft.; Two Medicine Lake, 5200 ft.; Bowman Lake, 4100 ft.; Sprague Creek camp ground, 3200 ft.

Dictyna phylax Gertsch and Ivie, 1936, p. 7, figs. 29, 30. Bowman Lake, 4100 ft.

Lathys alberta Gertsch, 1946, p. 3, fig. 11. Carthew Lakes, 6500-7200 ft.; Piegan Pass, 7900 ft.; Dawson Pass, 7500 ft.

Pagomys monticola Gertsch and Mulaik, 1936, p. 2, fig. 2. Under stones, Iceberg Lake, 6000 ft.; Cracker Lake, 6000 ft.

Titanoeca sp. Cracker Lake, 6000 ft., ♀; Hidden Lake Pass, 7100 ft., ♀; between Lincoln and Gunsight Passes, 6500-7000 ft., ♀.

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BIRDS AND MAMMALS OBSERVED ON A CRUISE IN AMUNDSEN GULF, N.W.T., July 29th - August 16th, 1953 [1]

E. O. HÖHN
Department of Physiology, University of Alberta, Edmonton, Alberta.

ON July 9, 1953 the native-owned motor schooners "North Star" and "Reindeer" left Sach's Harbour on S.W. Banks Island to take the Eskimos who had wintered there and myself who had spent the preceding three months with them, to Tuktuoyaktuk on the mainland. The journey normally takes three days but in this case extensive ice floes south and southeast of Banks Island forced us to make a very roundabout journey, as far East as Holman Island, which lasted nearly three weeks. In the course of this journey we anchored at various points on the Victoria Island and mainland shores of Amundsen Gulf. Although the only unexpected observation made was the finding of thick-billed Murres (Uria lomvia) breeding at Cape Parry, it is felt that the other observations I was able to make in the short period available at any one point may be of some interest as some of the places visited have probably not been visited by any naturalist. For the sake of readability the observations are presented as a narrative of the journey rather than grouped under species headings. The accompanying sketch map shows the place names mentioned and the route taken.

July 29 — Sach's Harbour to a position west of Cape Lampton, Banks Island. One bearded seal *(Erignathus barbatus)* was seen in Sach's Harbour Bay and by midnight 5 ringed seals *(Phoca hispida)* had been seen. We passed two Bowhead Whales *(Balaena mysticetus)* travelling along the floe edge. Birds observed were a flock of about 300 male King Eiders *(Somateria spectabilis)* a flock of about 50 Red Phalaropes *(Phalaropus fulicarius)* swimming at sea and 5 Long-tailed Jaegers *(Stercorarius longicaudus)*.

July 30 — South and southeast of southern Banks Island. Most of the day the vessels were moored to an ice floe as progress in any desirable direction was barred by ice. While I was asleep a polar bear *(Thalarctos maritimus)* was seen on the ice in the early hours by several of the natives. The following birds were noted — Long-tailed Jaegers 4, Pomarine Jaegers *(Stercorarius pomarinus)* 2, 2 male King Eiders, 1 Yellow-billed Loon *(Gavia adamsi)*, 2 Glaucous Gulls *(Larus hyperboreus)* and 3 Herring Gulls *(Larus argentatus)*. At 8:30 p.m. we were under way again and just before midnight sighted a polar bear on the ice. Rather than withdrawing at the sight of the vessels it approached, at times scenting towards them. It was shot by one of the natives and proved to be a male. It was interesting to note that after it had been disembowelled on the ice, 4 Glaucous and 1 Herring Gull appeared at once to feed on the remains while none had been in sight until then. In the course of the day 4 ringed seals were seen, two being shot.

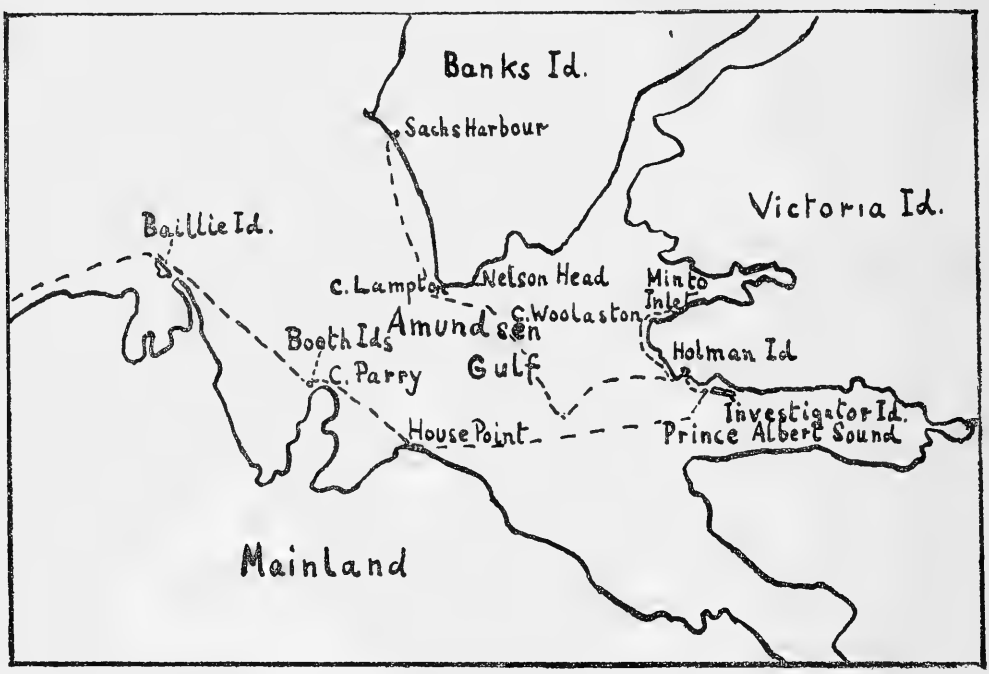
July 31 — Off Cape Woolaston, Victoria Island. As there were still ice floes south of us it was decided to make for the trading post of Holman Island on Victoria Island. Ten ringed seals were seen in the course of the day and an adult white whale *(Delphinapterus leucas)* accompanied by a grey calf. Birds seen were 2 Glaucous Gulls, 2 Longtailed and 1 Pomarine Jaegers.

August 1 — Holman Island, Victoria Island. We arrived here about 1:30 a.m. Two Yellow-billed Loons were observed in the bay. A number of Horned larks *(Eremophila alpestris)*, Lapland Longspurs *(Calcarius lapponicus)* and Snow Buntings *(Plectrophenax nivalis)* were seen here daily, throughout our stay, i.e., until August 9.

August 2 — Holman Island. At a point on the coast about 1 mile northwest of the post 20 Glaucous and 10 Herring Gulls were seen as well as 1 Raven *(Corvus corax)* and 2 Baird's Sandpipers *(Erolia bardi)*. A young female Arctic hare *(Lepus arcticus)* was brought in by a native.

August 3 — Holman Island. On a lakelet about 1 mile north of the post a female Old Squaw *(Clangula hyemalis)* and a female King Eider with two downy young were seen. About 6 American Pipits *(Anthus spinoletta)* were seen near the post. One was collected this day and three more the following day. The skins of these pipits

1) Received for publication May 17, 1954.



Map of Amundsen Gulf Area.

were examined for me by Mr. T. H. Manning at the National Museum of Canada and determined as *Anthus spinoletta rubescens.* An American Rough-legged Hawk *(Buteo lagopus s. johannis)* was also seen. On the coast 2 American Golden Plovers *(Pluvialis dominica)* were seen as well as five Ravens. A Herring Gull collected this day was also examined for me by Mr. Manning and determined as a Thayer's Gull *(Larus argentatus thayeri)* and is it probable that all the Herring Gulls observed on this journey belonged to this subspecies. A Baird's Sandpiper was collected also.

August 4 — Holman Island to a native camp in the south shore of Minto Inlet. I was taken by the Oblate Fathers of the R.C. Mission, Holman Island to see two sick natives at a camp on Minto Inlet. On this trip 12 Glaucous Gulls, 3 Yellow-billed Loons and 1 Pacific Loon *(Gavia arctica)* were seen.

August 6 — Holman Island. Two Lapland Longspurs were noted in song this day. The song was shorter and more subdued than the typical spring song.

August 7 — Holman Island. A walk of about 2 miles eastward on the rocky plateau behind the post revealed very few birds: 3 American Pipits, 2 Lapland Longspurs, a flock of 10 Horned Larks and the droppings of Willow Ptarmigan *(Lagopus lagopus).*

August 8 — Holman Island. I collected the skull of a female polar bear which with its cub had been shot on the coast near the post on July 25 by one of the natives.

It may be noted that A. E. Porsild (1951) working in parts of Banks and Victoria Islands in part of July and August 1949 used Holman Island as his main base. The following species of birds recorded above at Holman Island were not recorded by him for that area: Golden Plover, Baird's Sandpiper, Pacific Loon, Glaucous Gull, Horned Lark, American Pipit, Raven (though an old nest site was seen). In view of this it is perhaps worth adding that during an approximately 24 hour visit to Holman Island on September 2-3, 1949, I observed numerous American Pipits, several Glaucous Gulls and 2 Ravens near the post.

August 9 — Holman Island to an islet west of Investigator Island on the west side of Prince Albert Sound. We left Holman Island in the evening but because of rough weather anchored by a small island off the north shore of Prince Albert Sound until August 11.

August 11 — Island west of Investigator Island Prince Albert Sound. In an hour's walk over the rocky island to which we were anchored I observed Herring Gulls, 3 Snow Buntings, 1 Lapland Longspur, I American Rough-legged Hawk and one Yellow-billed Loon. A flock of 30 Eiders which were too far away to enable me to be sure whether they were King or Pacific Eiders were also seen. On the vertical cliffs of another island north of the one to which were anchored Herring Gulls were obviously nesting.

August 12 — Prince Albert Sound to House Point (east of Pearce Point on the mainland). During the crossing from Prince Albert Sound to the mainland 1 Long-tailed and 2 Pomarine Jaegers were seen. At House Point there were 4 Pintails *(Anas acuta)* and 1 Herring Gull.

August 13 — House Point to the Booth Islands off Cape Parry. As we left the bay three downy young Duck Hawks *(Falco peregrinus anatum)* were seen on a grassy ledge on the cliff on the west shore of the bay, both parent birds were also present. At the entrance to the harbour Herring Gulls were seen as well as a pair of Glaucous Gulls which appeared to be nesting. Several ringed seals were seen in the course of the day. At the eastern extremity of Cape Parry a fine male Barren Ground caribou *(Rangifer arcticus)* was seen and shot by one of the natives. Four pintails were seen also here. At Cape Parry proper an almost isolated rocky bluff held a colony of about 100 pairs of Thick-billed Murres *(Uria lomvia)*. We went ashore here and from the cliff top I saw one downy young on the highest ledge proving that this is a breeding colony. I have no doubt there were other birds or eggs on some of the other ledges. Clarke (1944) records that he saw several birds of this species at Cape Parry on August 18, 1942, but does not mention any evidence of breeding. His was the first record of the species in the western Arctic while the observation noted above is the first breeding record for the area. Clarke also records that he was told by an Eskimo that this was one of the component species of a large bird colony at Nelson Head, Banks Island. However I was informed by Mr. T. H. Manning (in correspondence) that he saw no murres anywhere along the south coast of Banks Island at the end of July, 1952 or on a visit to Nelson Head in early September 1951. It is fairly certain that the Cape Parry colony is of recent origin since Anderson, (1913) in his report of the natural history collections of the 1908-1913 Canadian Arctic Expedition states that he saw no murres anywhere east of Flaxman Island, Alaska while there is no doubt that he or other members of the expedition passed Cape Parry during the breeding season. The fact that Clarke in 1942 recorded several murres while I saw about 200 in 1953 indicates that the colony has been growing during that period and is also in agreement with the idea of the recent origin. Unfortunately I collected no specimens, so the subspecies to which these birds belong is unknown. There is however no doubt of the species involved as I made a note of seeing the pale area on the bill of these birds at the time.

There were also 6-10 pairs of Glaucous Gulls nesting here, several downy young being seen. Just before reaching the Cape 5 Pacific Loons were seen in two groups.

August 14 — Booth Islands near Cape Parry. We remained anchored in a bay of Big Booth Island for most of the day; during a walk of an hour and half the following birds were identified: 6 Baird's Sandpipers, 3 Semi-Palmated Plovers *(Charadrius hiaticula semipalmatus)*, 7 Sanderlings *(Crocethia alba)*, 1 Semi-palmated Sandpiper *(Ereunetes pusillus)*, 1 Northern Phalarope *(Lobipes lobatus)*, 8 Glaucous Gulls and 2 Herring Gulls, 6 Pintails, 1 Pacific Eider *(Somateria mollissima v nigra)*, 2 Red Breasted Mergansers *(Mergus serrator)*, 1 adult and 3 almost fully fledged young Duck Hawks, one of which I was able to band, 1 Pomarine Jaeger. However there were no passerine birds here at all. The Red-breasted Merganser is apparently a new record for this area as Anderson (1913) records it only for the Mackenzie Delta and the Arctic Coast of Alaska.

August 15 — Baillie Island off Cape Bathurst. En route Booth Islands to Baillie Island the only bird observed was 1 Arctic Tern *(Sterna paradisaea)*. On the sand pit at the southwest end of Baillie Island 1 pair of Glaucous Gulls was seen as well as 10 Arctic Terns including a young bird already able to fly, 3 Old Squaws and about 50 Pacific Eiders many in moult and unable to fly. One ringed seal was also seen here.

August 16 — Baillie Island to Tuktuoyaktuk. Two flocks of Lesser Snow Geese *(Chen hyperborea hyperborea)* were seen flying overhead in a southwesterly direction. Other birds observed on this last leg of the journey were 20 Arctic Terns and 3 Sabines Gulls *(Xema sabini)*.

Addendum: Observations of T. H. Manning in the Amundsen Gulf area 1951, 1952 and 1953. Mr. T. H. Manning has placed at my disposal notes based on observations made by him and A. H. McPherson in 1951 and 1952 and by himself in 1953. Those of his observations made on coastal areas or at sea within the limits of Amundsen Gulf are summarized. The presentation is according to locality, localities being arranged in the general order followed by my journey described above.

Cape Berkeley, Western Victoria Island: Sept. 5-7 inclusive, 1953. Six hours spent ashore here. Observations: Pacific Eider — 15 males, 6 females seen Sept. 8 on leaving the cape by boat. King Eiders — 7 all females (some collected). Duck Hawk — 1; Golden Plover — 1; Ruddy Trunstone — 1; White-rumped Sandpiper — 10; Horned Larks — 6; Ravens —2; Lapland Longspurs — 10; Snow Buntings — 25.

North Shore of Minto Inlet: Sept. 8, 1953. Observed while travelling by canoe. American Rough-legged Hawk — 1; Duck Hawk — 2; Glaucous Gulls — 4.

North Shore of Minto Inlet: Sept. 10, 1953. During two hours walking ashore at about the midpoint of the north shore of the inlet. American Rough-legged Hawks — 2; Arctic Hares — 2.

Baillie Island: Sept. 23-27, 1952. About 300 Rock Ptarmigan *(Lagopus mutus)* concentration apparently due to some sort of a migratory movement perhaps from Banks Island; only a few Willow Ptarmigan.

Cape Dalhousie (mainland coast between Baillie Island and Tuktuoyaktuk). A. H. McPherson saw a grizzly bear *(Ursus horribilis)* about 12 miles south of the cape on September 28, 1952. Sept. 6 to 8th, 1951: A Pintail and a Willow Ptarmigan as well as 6 male Rock Ptarmigan, tentatively assigned to the subspecies *Lagopus mutus rupestris* were collected here, also a Glaucous Gull.

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NOTES ON FUNGI FROM NORTHERN CANADA II BOLETACEAE [1]

J. WALTON GROVES [2] *and* SHEILA C. THOMSON [3]

RECORDS of Boletaceae from the far north in North America appear to be very few. *Boletus scaber* Bull. ex Fr. was reported from Greenland by Rostrup (1888, 1904), from Herschell Island by Dearness (1928), and from Alaska by Cash (1953). No other records of this group of fungi have been encountered by us so far. It is, therefore, of some interest to record the species of boletes collected by members of the biological survey parties operating in the Canadian north under the auspices of the Defence Research Board during the summers of 1948-51.

For the most part, North American authors have recognized only three genera of boletes, *Boletus, Boletinus,* and *Strobilomyces.* It has been clearly evident that the genus *Boletus* contained a heterogeneous assemblage of species, and recently Snell

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2 Principal Mycologist.
3 Assistant Mycologist.

(1941, 1942), Slipp and Snell (1944), and Singer (1945a, 1945b, 1947), have proposed classifications aimed at splitting the old genus *Boletus* into more natural groups and bringing the nomenclature into line with the International Rules.

Although the classification of the boletes cannot be considered to be stabilized as yet, it is believed that these proposals represent a distinct advance in the taxonomy of the group. It is, therefore, proposed to adopt them, and on this basis the boletes collected by the northern biological survey parties, fall into five genera, *Boletinus, Boletus, Leccinum, Suillus* and *Xerocomus.*

The genus *Boletinus* is used in the traditional sense to include species in which the pores are not readily separable from the pileus or from each other, and show a more or less radial arrangement, especially near the stipe, sometimes approaching a lamellate configuration. The spores in *Boletinus* are smooth and narrow-ellipsoid, and usually rather small. The type species is *B. cavipes* (Opat.) Kalchbr.

It is difficult to draw a sharp dividing line between *Boletinus* and *Suillus* which comprises the old section Viscipelles of *Boletus* in the broad sense. The spores are very similar in both *Boletinus* and *Suillus* and often the tubes in *Suillus* species show more or less radial arrangement especially in young stages. The genus is principally characterized by having a viscid pileus and ellipsoid spores. The type species is *S. luteus* (L. ex Fr.) S. F. Gray.

In *Xerocomus* the pileus is dry and may be glabrous to subtomentose, the tubes are never stuffed and do not have red mouths, the stipe is not subbulbous and the spores are subfusiform. The type species is *X. subtomentosus* (L. ex. Fr.) Quél.

Leccinum includes the species formerly placed in the section Versipelles of *Boletus.* The tubes are very long, whitish (or yellow in the section Luteoscabra which is not represented in the northern collections), free, or if adnate when young becoming deeply depressed around the stipe. The stem is relatively slender and furfuraceous-scabrous. The spores are subfusiform and usually relatively large. The type species is *L. aurantiacum* (Bull. ex) S. F. Gray.

Among the northern collections, the only representative of the genus *Boletus* in the more limited sense is *B. edulis* Bull. ex Fr. which is the type of the genus.

The following species have been identified.

Boletinus cavipes (Opat.) Kalchbr. Bot. Zeit., XXV, p. 181, 1867.

Boletus cavipes Opat. Comm. Bolet. p. 11. 1836.

The specimen cited below consists of three fruit bodies 3-5 cm. broad in the dried condition. The colour was described by the collector as "light lemon yellow" when fresh. They are now "Ochraceous Tawny"[4] to "Straw Yellow". The cap is fibrillose-squamulose and the stem is hollow. The spores measure (7-) 8-9.5 (-10) x (2.5-) 3.0-3.5 (-4.0) μ. The species is associated with *Larix* and widely distributed in North America and Europe.

Specimen examined: DAOM *22073,* Yellowknife, N.W.T. Coll. Cody & McCanse (3518), Aug. 17, 1949.

Boletinus glandulosus Peck Bull. N.Y. St. Mus. 131:34. 1909.

Snell and Dick (1941) stated that the only collections of this species known to them were from Nova Scotia and Maine and they reported an additional collection from New Hampshire. It is interesting that this apparently rare species should appear so many times in these northern collections. Evidently its range is predominantly northern and the Fort Smith collections represent a very considerable extension of its range. In addition to the specimens listed below, we have collections in the herbarium from Nova Scotia and from St. Aubert, L'Islet Co., Que.

The dried specimens are 2.5-6 cm. broad, dark reddish brown to dark maroon brown or nearly black, ("Hay's Maroon", "Diamine Brown", "Hessian Brown", "Dark Indian Red"), somewhat shiny. The spores are 8.5-11 x 3-4.5 μ. The distinctive character from which it takes its name is the presence of abundant glandular dots on the tubes and upper part of the stem above the annulus. The presence of these glandular dots and the viscid cap are characters which indicate that this species should be placed in *Suillus* rather than *Boletinus.* However, no combination is available in *Suillus* and it is not considered desirable to make a new combination in this paper.

4 Colour names according to Ridgway, R. 1912. Color Standards and Color Nomenclature. Washington, D.C.

Specimens examined: DAOM *38661,* St. Anthony, Nfld. Coll. D. B. O. Savile & J. Vaillancourt (2827), August 9, 1951; DAOM *28449,* St. Anthony, Nfld. Coll. D. B. O. Savile & J. Vaillancourt (2922), August 16, 1951; DAOM *28453,* St. Anthony, Nfld. Coll. D. B. O. Savile & J. Vaillancourt (2834), August 9, 1951; DAOM *27593,* Fort Smith, N.W.T. Coll. C. C. Loan (L244), August 16, 1950; DAOM *28414,* St. Anthony, Nfld. Coll. D. B. O. Savile & J. Vaillancourt (2791), August 8, 1951; DAOM *27592,* Fort Smith, N.W.T. Coll. C. C. Loan (L256), August 17, 1950; DAOM *27564,* Fort Smith, N.W.T. Coll. C. C. Loan (L278), August 19, 1950.

Boletinus spectabilis (Peck) Murrill N. Amer. Fl. 9:160. 1910.

Boletus spectabilis Peck. Ann. Rep. N.Y. St. Mus. 23:128. 1872.

The red scaly caps of this fungus make it a very showy species. It has generally been considered as rather rare. It is usually, and perhaps exclusively, found with larch, with which it is said to form mycorrhiza.

It is likely to be confused with *B. pictus* Peck. The latter has red scales on a yellow background whereas in *B. spectabilis* the scales are usually grayish on a red background. They can be distinguished with certainty by the spores which are 11-14 x 4.5-6 μ in *B. spectabilis* and (7.5-) 8-10 (-11) x 3.0-4.0 μ in *B. pictus.* Singer (1945b) also points out that in *B. spectabilis* the veil is duplex, the inner veil gelatinizing, and for this reason he places it in a separate section of *Boletinus.*

Only a single collection was received among the northern specimens and *B. pictus* was apparently not collected at all.

Specimen examined: DAOM *21946,* Great Whale River, Que. Coll. J.R. Vockeroth, September 7, 1949.

Boletus edulis Bull. ex Fr. Syst. Mycol. 1:392. 1821.

This well known and widely distributed species appears to be very variable and a large number of forms and varieties have been described. The distinguishing characters of the species are the tubes, which are at first whitish and stuffed, becoming greenish yellow; the bulbous stem which is more or less reticulate; and the rather large spores, 13-18 (-21) x 4.0-6.0 μ. The colour of the cap is variable, usually in shades of yellow to reddish-yellow to reddish-brown often paler on the margin.

The collection referred here consists of two fruiting bodies 6 and 8 cm. diam. in the dried condition. They were described as cream to fawn when fresh and when dried are "Cinnamon Buff" to "Tawny Olive" to "Verona Brown". A striking character of these specimens is that they are deeply rimose to frustose and suggest *Boletus frustulosus* Peck in this character. However Singer (1947) stated that this frustulose character is simply the result of meteorological conditions and he regarded *B. frustulosus* as a synonym of *B. edulis.*

Kallenbach (1926) published a photograph of *B. edulis,* Fig. 14, that almost exactly illustrates the condition found in these fruit bodies. These specimens have spores matching those of typical *B. edulis* and the stem is reticulate on the upper third but not very strongly so.

Specimen examined: DAOM *43638,* Goose Bay, Labrador. Coll. J.M. Gillett & J.S. Barton (5733), August 14, 1950.

Suillus hirtellus (Peck) Kuntze Rev. Gen. Plant. 3^2:535. 1898.

Boletus hirtellus Peck. Bull. N.Y. St. Mus. 8: 94. 1889.

The collection referred to this species was rather difficult to place. It consisted of two fruit bodies 4-6 cm. in diameter when dried. It was obviously a *Suillus* from the spores and viscidity of the cap but lacked an annulus and apparently lacked glandular dots on the stem. Careful search revealed that a few were present near the apex. The scales on the cap are very inconspicuous and appressed-fibrillose, but they are similar to those in specimens from Michigan identified by A. H. Smith. The stems are stout and shorter than in the Michigan specimens and the glandular dots on the stem are less evident, but this seems to be the best disposition of these specimens. The species appears to be rather rare and not very well known. We have no other Canadian record.

Specimen examined: DAOM *34971,* Whitehorse, Y.T. Coll. J. M. Gillett (3417), June 20, 1949.

Suillus piperatus (Bull. ex Fr.) Kuntze Rev. Gen. Plant. 3^2:535. 1898.

Boletus piperatus Bull. ex. Fr. Syst. Myc. 1: 388. 1821.

The specimen cited below consists of three fruit bodies, 2-4 cm. in diameter in the dried condition. The caps are close to "Clay Color" and the pores near "Prout's Brown" to

"Mummy Brown" and are quite large. The stem shows some yellow at the base. The spores are 8-11 x 3-4 μ.

This is a common species in the Ottawa District and one of its most distinctive characters is the very acrid, peppery taste. There were no notes on the taste in this specimen but it matches dried specimens in every respect.

Specimen examined: DAOM *34973,* St. Anthony, Nfld. Coll. D.B.O. Savile & J. Vaillancourt (2833), August 9, 1951.

Xerocomus chrysenteron (Bull. ex Fr.) Quel. Fl. Myc. Fr. 418. 1888.

Boletus chrysenteron Bull. ex Fr. Epicr. Syst. Mycol. 415, 1838.

This is also a widely distributed and fairly well known species. It is rather variable and a number of forms and varieties have been described. Coker and Beers (1943) stated that the spores are truncate at one end but Singer (1945a) claimed that this fungus with truncate spores is not the true *X. chrysenteron.*

In the herbarium at Ottawa there are several specimens identified as *X. chrysenteron* in which the spores are truncate, but there are as well, several specimens, also identified as *X. chrysenteron,* in which the spores are not truncate. In other characters such as the olive-brown, velvety cap, cracking on the margin, the rather large, greenish-yellow tubes, and the striate, partly reddish stem, they seem very similar.

The Newfoundland specimens cited below have spores 11.0-14.5 x 3.0-5.0 μ and they are not truncate. These specimens, therefore, seem best disposed as *X. chrysenteron* if we accept Singer's statement that the form with truncate spores is not the European *X. chrysenteron.*

Specimens examined. DAOM *34954,* St. Anthony Nfld. Coll. D.B.O. Savile & J. Vaillancourt (2921), August 15, 1951; DAOM *34959,* St. Anthony, Nfld. Coll. D.B.O. Savile & J. Vaillancourt (2826), August 9, 1951.

Xerocomus subtomentosus (L. ex Fr.) Quel. Fl. Myc. Fr. 418. 1888.

Boletus subtomentosus L. ex Fr. Syst. Myc. 1: 389. 1821.

This species is similar to *X. chrysenteron* in the colour of the cap and the velvety tomentose character but the cracks in the cuticle of this species show yellow whereas in *X. chrysenteron* they show red. The stem of *X. subtomentosus* is somewhat reticulate at the apex, not striate and not coloured red. The spores in the specimen cited below are 11-14 x 4-5 μ, very close to *X. chrysenteron* in size. *X. subtomentosus* occurs in both North America and Europe.

Specimen examined: DAOM *26285,* Goose Bay, Lab. Coll. J. Gillett and W. Findlay (5428), July 22, 1950.

Leccinum

The genus *Leccinum* includes the species formerly placed in the section Versipelles of the genus *Boletus.* Most of the collections of boletes received from the far north belonged here and they proved much the most difficult to identify.

Snell (1936) recognized and attempted to distinguish eight species in the section Versipelles: *B. albellus* Peck, *B. aurantiacus* Bull. ex. Pers., *B. chromapes* Frost, *B. leucophaeus* Pers., *B. niveus* Fr., *B. scaber* Bull. ex Fr., *B. subpunctipes* Peck, and *B. versipellis* Fr. Singer (1947) concluded from an examination of the type of *B. subpunctipes,* that it was a synonym of *Tylopilus ferrugineus* (Frost) Sing. and did not belong with this group. *B. chromapes* is quite distinct but the remaining six species comprise a difficult group.

Singer (1947) revised this group as section Versipelles of the genus *Leccinum,* and he recognized seven species, *L. albellum* (Peck) Sing., *L. aurantiacum* (Bull. ex) S. F. Gray, *L. chalybaeum* Sing., *L. duriusculum* (Schulz.) Sing., *L. oxydabile* (Sing.) Sing., *L. scabrum* (Bull. ex. Fr.) S. F. Gray, and *L. testaceo-scabrum* (Secr.) Sing. For the purpose of this paper two of these may be disregarded: *L. chalybaeum* known only in Florida, and *L. duriusculum* known only in Europe. Of the remainder, the concepts of *albellum* and *aurantiacum* remain the same whereas *B. versipellis* becomes *L. testaceo-scabrum. B. scaber* is split into two species, *L. oxydabile* and *L. scabrum,* and the latter is further subdivided into two subspecies, *L. scabrum* ssp. *rotundifoliae* (Sing.) Sing. and *L. scabrum* ssp. *niveum* (Fr.) Sing. *B. niveus* is thus reduced to the rank of subspecies but the status of *B. leucophaeus* is still somewhat uncertain. Singer's disposition of this species is not clear and it may possibly be recognizable as a tomentose form in which the flesh blackens.

The principal characters used in distinguishing these five species are the colour of the cap, the colour and colour changes of

the flesh, microscopic structure of the cuticle of the cap, and the spores. In view of the difficulty of separating these species and the confusion that has existed concerning them, the entire collection in the Mycological Herbarium of the Division of Botany and Plant Pathology, comprising about 110 specimens, was worked over independently by both of us with these characters particularly in mind in an attempt to evaluate them as a means of distinguishing species in the light of Singer's (1947) treatment.

The character of the colour changes of the flesh was of no assistance to us because the material consisted entirely of dried specimens and in only a few instances were there any notes on the fresh condition referring to colour changes.

Examination of the cuticle was carried out by moistening with alcohol, removing a very thin shaving with a sharp scalpel, and mounting in KOH. The size range of the spores and the A.M. number were determined.

The concept of the A.M. number was proposed by Snell and Dick (1941). In determining this number the extremes of both the length and width are ignored and the number is constructed by taking the average size of the majority of spores. Thus, if the spores were found to be (12-) 15-17 (-18) x (4-) 5-6 (-8) μ the A.M. number would be 16-5.5. In proposing the use of this number Snell and Dick recognized that it was to some extent a subjective character and that different individuals might not obtain the same numbers. We found this to be true for the number as determined by the senior author almost invariably proved to be slightly larger than that determined by the junior author for the same specimen. A.M. numbers published by one author must be used with caution by others. Nevertheless we are convinced that with experience it is an extremely valuable tool to aid in the identification of boletes, especially dried material.

Of the five species recognized by Singer that might be expected to occur in this region, *L. albellum* (Peck) Sing. is the most distinctive by reason of the cuticle being composed of several layers of sphaerocysts arranged in chains. This character was easily observed in some specimens, but in others it was difficult to demonstrate and several mounts were necessary before sphaerocysts could be found. The spores were (12-) 14-18 (-20) x (4.5-) 5-6 (-6.5) μ with an A.M. number of 16-5.5 or in some specimens slightly smaller to 15-5.5. Most of the specimens referred here had light coloured caps, whitish to pale grey, although a few were evidently fairly dark grey. *L. albellum* was not found among the northern collections.

In *L. oxydabile* (Sing.) Sing. the cuticle is predominantly filamentous but there are a few chains of short, vesiculose cells. The hyphae are up to 15 μ in diameter. The spores are large (15-) 17-22 (-24) x (5.0-) 6-7.5 (-8.0) μ with an A.M. number of 19-7 or 19-6.5. Among the specimens examined, a consistent correlation was found between the presence of large spores and the occurrence of some chains of vesiculose cells in the cuticle and some hyphae up to 15 μ or occasionally more in diameter. The flesh of *L. oxydabile* is said to turn red when cut and the field notes on one specimen recorded this colour change. The cap is greyish, or grey-brown to blackish.

Among the collections examined, sixteen were referred to *L. oxydabile* on this basis. Most of them had originally been identified as *Boletus scaber* Fr. but some had been called *B. leucophaeus* Pers. No specimens from northern Canada were referred to *L. oxydabile.*

L. aurantiacum, L. testaceo-scabrum and *L. scabrum* all have a filamentous cuticle. *L. scabrum* may be various shades of grey-brown from whitish to nearly black, whereas the other two species are more brightly coloured, yellowish to orange or rufous, although *L. aurantiacum* may occasionally be brownish or nearly whitish.

The principal characters in which *L. aurantiacum* and *L. testaceo-scabrum* differ according to Singer may be listed as follows:

1. An orange pigment is present in the hyphae of the cuticle in *L. aurantiacum* but not in *L. testaceo-scabrum.*

2. The context rarely turns blue on injury in *L. aurantiacum* but usually turns blue or occasionally reddish in *L. testaceo-scabrum.*

3. The scabrosity of the stipe is at first whitish to brownish and finally blackish in *L. aurantiacum,* and is black from the beginning in *L. testaceo-scabrum.*

4. The mycelium of *L. aurantiacum* is associated with *Populus, Carpinus, Fagus* or *Quercus,* whereas that of *L. testaceo-scabrum* is associated with *Betula.*

In the material we examined, in most cases we had no information concerning colour changes of the flesh, colour of the sca-

brosity on the stipe when fresh, or the tree-associate. The cuticle was examined microscopically and in every specimen it was possible to demonstrate pigment in the hyphae. We found that it was also possible to demonstrate pigment in the surface hyphae of *L. scabrum* and *L. oxydabile* which often appeared as brightly coloured as those of *L. aurantiacum*. Consequently we are rather inclined to question the value of this character as a basis of species distinction, and, at least, we found nothing in the material we examined that could be referred to *L. testaceo-scabrum* on this basis.

Nearly fifty specimens were, therefore, referred to *L. aurantiacum* (Bull. ex) S. F. Gray. Most of these had been originally identified as *Boletus aurantiacus* Bull, or *Boletus versipellis* Fr. but a few as *B. scaber*. In these specimens the cuticle is filamentous, the hyphae are rather variable in width, usually up to about 15 μ, but in occasional specimens hyphae up to 25 μ in diameter were observed. The hyphae tended to break up rather readily into separate cylindric or curved cells. These separate cells were always at least twice as long as broad, and often proportionately much longer, and they did not resemble the rounded, or short, broad cells found in *L. oxydabile*. Another character that appears to be constant is that the margin is appendiculate in *L. aurantiacum* and is not in *L. oxydabile* or *L. scabrum*.

The spores in *L. aurantiacum* are smaller than in *L. scabrum* and were found to be rather variable in different collections. The A.M. number was usually about 13-4, but often 14-4, and sometimes up to 15-4.5. Snell and Dick (1941) noted that more than one A.M. number could be obtained for this species and Singer (1947) also noted that it was a somewhat variable species. Since we were unable to correlate any other character with this difference in spores, all of these specimens were referred to *L. aurantiacum*. The northern collections are listed below.

The remaining species, *L. scabrum*, has long been regarded as one of our commonest and best known boletes, but it is now evident that it is easily confused with *L. oxydabile* and can only be distinguished microscopically, at least in the dried condition.

The specimens considered to be typical *L. scabrum* all have the cuticle entirely filamentous composed of slender hyphae that very rarely exceed 10 μ in diameter and are mostly 5-7 μ. The spores are smaller than those of *L. oxydabile* but larger and more deeply coloured under the microscope than those of *L. aurantiacum*. The size range is (14-) 15-19 (-22) x (4.5-) 5-7 (-7.5) μ and the A.M. number is 17-6. The cap is coloured various shades of grayish-brown. Five collections from the north were considered to belong to the typical form of *L. scabrum*.

There is some doubt concerning the Baffin Island specimen because of the locality, but the spores are too narrow for ssp. *rotundifoliae* and the cap is considerably larger than any other specimens placed in *rotundifoliae*. It seemed best disposed as *L. scabrum*.

As noted above, Singer (1942) recognized two subspecies of *L. scabrum*, ssp. *niveum* and ssp. *rotundifoliae*. It is not clear why these were regarded as subspecies rather than varieties and, in fact, there does not seem to be any very good reason why they should not be regarded as autonomous species, although admittedly very close to *L. scabrum*. It does seem desirable that they should be accorded some taxonomic status and, in order to avoid creating new combinations at this time, Singer's nomenclature is followed.

L. scabrum ssp. *niveum* proved the more difficult to determine. There were a number of specimens in the herbarium labelled *Boletus niveus* but careful examination revealed the presence of sphaerocysts in the cuticle in most of these and necessitated their re-disposition as *L. albellum*. The sphaerocysts were sometimes difficult to demonstrate and several mounts were necessary before they could be found. This raised the question as to whether ssp. *niveum* might not be simply *L. albellum* in which the sphaerocysts had been overlooked.

Three collections were studied in which we failed to find sphaerocysts, but in which the spores were smaller than in typical *L. scabrum* and very similar to those of *L. albellum*. Two of these specimens were accompanied by field notes. In one it was noted that the cap had green tones in the colouring and that grub channels were pinkish, and in the other a colour change to pinkish in the cut flesh was noted. The occurrence of green tones in the colouring of ssp. *niveus* was noted by Peck (1908) and Singer (1942), and Singer (1947) stated that the flesh of *L. albellum* was strictly unchanging. It was concluded, therefore, that these specimens were properly referred to ssp. *niveum*. It is probable that *L. scabrum*

ssp. *niveum* and *L. albellum* have frequently been confused, but they are distinct entities and can be distinguished by careful examination. One collection from Newfoundland was considered to belong to *L. scabrum* ssp. *niveum*.

L. scabrum ssp. *rotundifoliae* appears to have been distinguished by Singer (1942) principally on the basis of its association with *Betula rotundifolia (B. glandulosa)* and he noted (1947) that it had been found in arctic Canada. It seemed probable that this subspecies would be found among our northern collections. Among the specimens received, only one was definitely noted by the collector as being associated with *Betula glandulosa*. The spores of this specimen are slightly longer and broader than those of typical *scabrum* and gave an A.M. number of 18-7. The cuticle is filamentous but the hyphae are broader than in typical *scabrum*, up to 15 μ in diameter and fairly readily separating into cylindric cells as found in *L. aurantiacum*. Eight other specimens that exhibited the same combination of characters were found among the northern collections. In general, the fruit bodies were also somewhat smaller than those of *L. scabrum*.

In working through the collections of *L. scabrum*, four specimens were found which, on the basis of the characters above, would have to be placed in ssp. *rotundifoliae* but which were collected outside the range of *Betula glandulosa*. Two of these specimens were from Ringwood, N.Y., one from Montreal Island, and one from the Petawawa Forest Experiment Station, Ontario. No information was available on the tree-associates of these specimens, but it is possible that ssp. *rotundifoliae* is not strictly limited to *B. glandulosa* but might be associated with other *Betula* species, possibly *B. pumila*.

Leccinum aurantiacum (Bull. ex) S.F. Gray. Nat. Arr. Brit. Pl. I:646. 1821.

Boletus aurantiacus Bull. ex Pers. Mycologia Europ. 2: 147. 1825.

Specimens examined: DAOM *21916*, Great Whale R., Que. Coll. D.B.O. Savile, July 20, 1949; DAOM *21939*, Rock Creek, Yukon. Coll. J.A. Calder and L.G. Billard (3953) July 26, 1949; DAOM *21948*, West Dawson, Yukon. Coll. J.A. Calder and L.G. Billard (3244), June 22, 1949; DAOM *21953*, MacRae, Yukon. Coll. D.A. Mitchell (210), Aug. 11, 1949; DAOM *21980*, Great Whale R., Que. Coll. D.B.O. Savile and J. R. Vockeroth, Aug. 11, 1949; DAOM *21985*, Great Whale R., Que. Coll. D.B.O. Savile, July 27, 1949; DAOM *21997*, Great Whale R., Que. Coll. J.R. Vockeroth, Sept. 4, 1949; DAOM *26276*, Fort Smith, N.W.T. Coll. C. Loan (259), Aug. 17, 1950; DAOM *26280*, Fort Smith, N.W.T. Coll. C. Loan *(119)*, Aug. 6, 1950; DAOM *26281*, Goose Bay, Labrador. Coll. J.M. Gillett and W.I. Findlay *(5924)*, August, 1950; DAOM *28446*, St. Anthony, Nfld. Coll. D.B.O. Savile and J. Vaillancourt *(2408)*, July 19, 1951; DAOM *28448*, St. Anthony, Nfld. Coll. D.B.O. Savile and J. Vaillancourt *(2551)*, July 28, 1951; DAOM *43637*, King Salmon, Alaska. Coll. W.B. Schofield (265), Aug. 9, 1952.

Leccinum scabrum (Bull. ex Fr.) S.F. Gray. Nat. Arr. Brit. Pl. I:647: 1821.

Boletus scaber Bull. ex Fr. Syst. Mycol. I: 393. 1821.

Specimens examined: DAOM *28426*, St. Anthony, Nfld. Coll. D.B.O. Savile and J. Vaillancourt (2832), Aug. 9, 1951; DAOM *28433*, St. Anthony, Nfld. Coll. D.B.O. Savile and J. Vaillancourt (2831), Aug. 9, 1951; DAOM *28435*, St. Anthony, Nfld. Coll. D.B.O. Savile and J. Vaillancourt (2793), Aug. 8, 1951; DAOM *26270*, Fort Smith, N.W.T. Coll. C.C. Loan (275), Aug. 19, 1950; DAOM *21318*, Hudson Bay Post, Ward Inlet, Frobisher Bay, Baffin Island. Coll. T. N. Freeman, July 19, 1948.

Leccinum scabrum ssp. **niveum** (Fr.) Singer. Ann. Mycol. 40:36. 1942.

Boletus niveus Fr. Obs. I, p. 111, 1815.

Specimen examined: DAOM *28444*, St. Anthony, Nfld. Coll. D.B.O. Savile and J. Vaillancourt *(2407)*, July 19, 1951.

L. scabrum ssp. **rotundifoliae Singer.** Ann. Mycol. 40:36. 1942.

Specimens examined: DAOM *21722*, West Dawson, Yukon. Coll. W.W. Judd, 1949; DAOM *21738*, Yellowknife, N.W.T. Coll. Cody and McCanse *(3517)*, Aug. 17, 1949; DAOM *21937*, Jensen Flats, Yukon. Coll, J. A. Calder and L. G. Billard *(3919)*, 1949; DAOM *25819*, Great Whale R., Que. Coll. D.B.O. Savile, July 13, 1949; DAOM *25829*, Gillam, Man. Coll. W.B. Schofield *(1162)*, July 16, 1950; DAOM *25858*, Chesterfield Inlet, Keew. Coll. D.B.O. Savile and J. Vockeroth *(1353)*, Aug. 9, 1950; DAOM *26288*, Goose Bay, Labrador. Coll. J.M. Gillett and W.I. Findlay *(5393)*, July 20, 1950; DAOM *34972*, St. Anthony, Nfld. Coll. D.B.O. Sa-

vile and J. Vaillancourt *(2855)*, Aug. 12, 1951; DAOM *34976*, St. Anthony, Nfld. Coll. D.B.O. Savile and J. Vaillancourt *(2441)*, July 21, 1951.

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CHRISTMAS BIRD CENSUS — 1954

St. John's, Nfld. — (City limits and two spot checks outside). Dec. 27, 1954; 9.30 a.m. to 4.30 p.m.; temp. 32° to 36°; overcast, no snow; light breeze; 15 observers in five parties and one at feeding station; total party hours, 20½; total party miles, 35. Old-squaw, 15; Common Eider, 24; Gyrfalcon, 1; Glaucous Gull, 26; Iceland Gull, 203; Great Black-backed Gull, 26; Herring Gull, 361; Black Guillemot, 22; Flicker, 14; Downy Woodpecker, 1; Raven, 2; Crow, 39; Black-capped Chickadee, 24; Brown-capped Chickadee, 33; Robin, 310; Golden-crowned Kinglet, 16; Northern Shrike, 1; Starling, 1,545; English Sparrow, 207; Evening Grosbeak, 67; Purple Finch, 138; Pine Grosbeak, 202; Redpoll, 145; Red Crossbill, 10; White-winged Crossbill, 70. Total, 25 species; 3,491 individuals. — Miss C. Furlong, Mrs. A.G. Gosling, R.K. Harper, Geoffrey Hiscock, John Macgillivray, H.D. Macgillivray, Robert McGrath, Rev. A.M. Old, P.B. Rendell, David Rendell, Dr. D. Sergeant, Mrs. D. Sergeant, H.H. Squires, L.M. Tuck, Wayne Tuck, H.H. Winter (Natural History Society of Newfoundland).

Wolfville, N.S. — (From uninhabited woodland through second growth to open farm and orchard land and a muddy tidal shore). Dec. 27, 1954. Overcast, some misty rain in morning, poor visibility, temperature 36 - 40°, light SW wind. Three cars, one party on foot, one bird-table. 65 miles by car; 30 miles on foot. Canada Goose, 152; Black Duck, 235; American Golden-eye, 25; Barrow's Golden-eye, 14; Surf Scoter, 2; American Merganser, 11; Sharp-shinned Hawk, 1; Red-tailed Hawk, 3; Rough-legged Hawk, 3; Bald Eagle, 3; Sparrow Hawk, 2; Ruffed Grouse, 5; European Partridge, 16; Pheasant, 28; Mourning Dove, 5; Black-bellied Plover, 1;

Wilson's Snipe, 1; Great Black-backed Gull, 112; Herring Gull, 560; Pileated Woodpecker, 1; Hairy Woodpecker, 1; Canada Jay, 2; Blue Jay, 50; American Raven, 65; American Crow, 447; Black-capped Chickadee, 100; Brown-capped Chickadee, 11; Whitebreasted Nuthatch, 2; Red-breasted Nuthatch, 1; Robin, 2; Golden-crowned Kinglet, 8; Starling, 1260; English Sparrow, 560; Evening Grosbeak, 44; Pine Grosbeak, 44; Redpoll, 25; American Goldfinch, 9; White-winged Crossbill, 33; Slate-colored Junco, 16; Tree Sparrow, 3; Song Sparrow, 2. Total, 41 species, 3963 individuals. — L. Duncanson, D. Erskine, J. Erskine (compiler), R. Erskine, M. Forbes, M. Gibson, M. Miller, R.W. Tufts.

West Middle Sable, Nova Scotia. — (Matthews Lake and Hemeon Head to Sable River and ½ mi. N., also Port l'Hebert and Jones Harbour to Sable River; all within 7.5 mi. of school in W. Mid. Sable; mixed woods, largely coniferous, 39%; ocean shore, 13%; sheltered brackish water, 29%; sand beach, 9%; scattered rural community, 10%.) — Dec. 31; 7.30 a.m. to 5.45 p.m. Forty per cent cloudy temp. 37° to 48°; wind W to NW, 5-15 m.p.h., calm at sunset; no frost, snow or ice. Two observers in 2 parties, 1 at feeding-station. Total party-hours, 17 (12 on foot, 3 by bicycle, 2 by car); total party-miles, 76 (13 on foot, 45 by car, 18 by bicycle). Common Loon, 1; Horned Grebe, 1; European Cormorant, 69; Canada Goose, 1375 (725 est.); Black Duck, 1068 (1000 est.); Pintail, 4; Greater Scaup, 600 (est.); American Goldeneye, 59; Bufflehead, 29; Old-squaw, 1; Common Eider, 10; American Merganser, 2; Red-tailed Hawk, 1; Bald Eagle, 1; Killdeer, 1 (excellent detailed view at 30 ft.—H.F.L.); Great Black-backed Gull, 71; Herring Gull, 299; Black Guillemot, 2; Canada Jay, 2; Blue Jay, 2; Common Raven, 8; American Crow, 41; Black-capped Chickadee, 5; Golden-crowned Kinglet, 5; Common Starling, 19; House Sparrow, 35; Cowbird, 58; (one flock of both sexes — H.F.L.); Pine Grosbeak, 6; Song Sparrow, 1; Snow Bunting, 1. Total, 30 species; about 3777 individuals. (Seen in area Dec. 28, Ruffed Grouse, 1; Slate-colored Junco, 1; Dec. 29, American Goldfinch, 5; Dec. 30, Gannet, 1; Red-breasted Merganser, 5; Purple Sandpiper, 1; White-throated Sparrow, 1; Jan. 1, Fox Sparrow, 1; Jan. 2, Acadian Chickadee, 6; Evening Grosbeak, 29; Common Redpoll, 40 (est.): — Laura N. Lewis, Harrison F. Lewis, Harold F. Tufts.

Montreal, Que. — (Mount Royal, St. Helen's Island, Nun's Island, St. Lambert, Thorn Hill, Dorval, (Saraguay, Bois Franc, Back River, Montreal North, north shore St. Lawrence River from Mercier Bridge to Victoria Bridge, south shore from Mercier Bridge to Jacques Cartier Bridge) — Dec. 26, 1954; 8:30 a.m. to 4 p.m. Clear; temp. 20°F. to 32°F.; wind NE to S, light; 5-6 inches snow; moderate shore ice and heavy brash ice on river. 25 observers in 7 parties. Total party hours, 40. Total party miles, 120 (29 on foot, 89 by car, 2 by boat). Mallard, 3; Black Duck, 757, Scaup (sp.), 1; Am. Goldeneye, 1249; Bufflehead, 1; Old-squaw, 2; Am. Merganser, 41; Goshawk, 1; Rough-legged Hawk, 5; Sparrow Hawk, 4; Ruffed Grouse, 2; Ring-necked Pheasant, 15; Great Black-backed Gull, 3; Herring Gull, 34; Ring-billed Gull, 2; Screech Owl, 1; Horned Owl, 3; Snowy Owl, 1; Barred Owl, 1; Long-eared Owl, 1; Short-eared Owl, 2; Hairy Woodpecker, 4; Downy Woodpecker, 7; Horned Lark, 7; Am. Crow, 2; Black-capped Chickadee, 31; Whitebreasted Nuthatch, 13; Brown Creeper, 4; Golden-crowned Kinglet, 2; Gray Shrike, 2; Common Starling, 1317; House Sparrow, 661; Red-winged Blackbird, 3; Pine Grosbeak, 25; Common Redpoll, 15; Pine Siskin, 6; Am. Goldfinch, 7; Am. Tree Sparrow, 5; Song Sparrow, 2; Lapland Longspur, 4; Snow Bunting, 418. Total, 41 species; about 4664 individuals. (Seen in area Dec. 29 — Am. Robin, 1) — Miss A. Allin, A. Bain, B. Borden, Miss S. Boyer, J. Brierley, Mrs. H. E. Chalk, J. D. Cleghorn, J. Delafield, P. H. Du Boulay, D. Galvin, Miss G. Hibbard, B. M. Holmes, P. Landry, A. R. Lepingwell, J. Lowther, I. McLaren, G. H. Montgomery, J. Montgomery, Miss I. Rhein-Knudsen, Mrs. P. Roberts, J. W. Robinson, D. Ryan, H. F. Seymour, G. S. Unwin, Mrs. G. S. Unwin (Prov. Que. Soc. for the Protection of Birds).

Hudson Heights, Hudson and Como, Que. — (Same area as in 1953, with addition of estate of Mrs. P. L. Lukis, 8 acres in Choisy two miles westward of westerly boundary of above area, on Lake of Two Mountains). — Jan. 8; 7:00 a.m. to 3:30 p.m. Sunny all day; temp. 1° to 6° to noon, to 17° in afternoon; wind W by N, 6 m.p.h., in morning in wind bitterly cold; 18-in. snow, water frozen except in swift currents. Thirty-three observers in 8 parties. Total party-hours, 120½ (59½ on foot, 51 on skis, 10 by car); total party miles, 154 (48 on foot, 70 on skis, 36 by car).

Ruffed Grouse, 13; Pileated Woodpecker, 1; Hairy Woodpecker, 19: Downy Woodpecker, 16; Blue Jay, 50; Black-capped Chickadee, 241; White-breasted Nuthatch, 39; Red-breasted Nuthatch, 3; Brown Creeper, 1; Winter Wren, 1; Starling, 63; House Sparrow, 20; Bronzed Grackle, 1; Evening Grosbeak, 1; Pine Grosbeak, 79; Common Redpoll, 183; Am. Goldfinch, 6; Slate-coloured Junco, 2; Am. Tree Sparrow, 4; Snow Bunting, 1. Total, 20 species; 744 individuals. (Seen in area Jan. 2, European Partridge.) — Ruth Abbott, Phyllis Abbott, Mrs. T. E. Bibily, Mr. and Mrs. Audry Bryan, Amy Clarke, Marnie Clarke, Mr. and Mrs. E. D. Croll, Mr. and Mrs. R. H. Cundill, Mrs. G. H. Golden, George Guerden, Col. W.G. Hanson, C. Hope, A. Johnson, A.R. Lepingwell, Mrs. P.L. Lukis, Mrs. D.L. Macaulay, Janet Macdonald, Major Robert MacDuff, Harry G. Marpole, G.G. Ommanney (compiler), Mrs. L.J. Papineau, Mrs. R.L. Puxley, Miss May Riley, Mrs. Geo. C. Riley, E.F. Smith, Vera Smith, E.B. Watson, Mrs. C.R. Whitehead, Mrs. R.W. (Jo.) Wright, (convener), Mr. N.M. Yuile.

Ottawa, Ont. (7½ mile radius) — Dec. 26, 1954; 9.00 a.m. to 4.00 p.m. Clear, cool; temp. 10° to 30°; 3-6 inches of snow. Thirty-seven observers in 14 parties. Total party-hours, 68¾ (44¼ on foot, 24½ by car). Total party-miles, 289 (56 on foot, 233 by car). Black Duck, 2; Am. Golden-eye, 246; Am. Merganser, 62; Hooded Merganser, 2; Sparrow Hawk, 5; Sharp-shinned Hawk, 1; Goshawk, 1; Ruffed Grouse, 10; Hungarian Partridge, 61; Ring-necked Pheasant, 15; Screech Owl, 2; Great Horned Owl, 1; Snowy Owl, 1; Pileated Woodpecker, 2; Hairy Woodpecker, 11; Downy Woodpecker, 22; Blue Jay, 23; Crow, 19; Am. Pipit, 1; Black-capped Chickadee, 163; White-breasted Nuthatch, 18; Northern Shrike, 3; Starling, 2508; English Sparrow, 1769; Robin, 1; Red-winged Blackbird, 1; Purple Finch, 5; Goldfinch, 29; Redpoll, 276; Pine Siskin, 2; Evening Grosbeak, 17; Pine Grosbeak, 77; Tree Sparrow, 4; Snow Bunting, 1280. Total, 34 species, about 6,640 individuals. — H. Lloyd, R. Frith, Suzanne Dexter, Mr. & Mrs. A. Ruddell, Mr. & Mrs J. Hanes, B. Hart, D. Friend, J. Smith, M. Millman, B. Millman, Eric Mills, Miss V. Humphreys, Ann Banning, Verna Ross, H. Brown, K. Bowles, Dr. & Mrs. J.W. Groves, Miss M. Flynn, Mr. & Mrs. C. Frankton, Dr. & Mrs. D.B.O. Savile, B.A. Fauvel, V.E.F. Solman, J.S. Tener, R.D. Harris, D.A. Munro, Mr. & Mrs. H. Marshall, M. Spencer, Miss S. Clarke, Mrs. B. Clarke, J. Bird, A.E. Bourguignon (Ottawa Field-Naturalists' Club).

Pakenham, Lanark Co., Ont. — Dec. 30, 1954; 9.00 a.m. to 4.00 p.m.; overcast, no wind, temperature 22° to 33°; 14 inches of snow. Hungarian Partridge, 6; Hairy Woodpecker, 1; Blue Jay, 5; Blackcapped Chickadee, 9; White-breasted Nuthatch, 3; English Sparrow, 43; Evening Grosbeak, 73; Redpoll, 7. Total, 8 species, 147 individuals. (Seen recently in the area, Ruffed Grouse, 3; Pileated Woodpecker, 1; Crow, 2; Snow Bunting (flock). — Edna G. Ross.

Carleton Place, Ont. — (a circle of 7½ miles radius centred on Bridge St., where it crosses the Mississippi River). Jan. 2, 1955; 9.00 a.m. to 4.00 p.m. Light rain in morning; cloudy with some sunny periods during day; clearing in late afternoon; temp. 38 to 30; wind light, north changing to west; depth of snow 18". 17 observers in 4 parties. Total party hours, 21; total party miles, 171½ (6½ on foot, 165 by car). Black Duck, 2; Am. Golden-eye, 16; Greater Scaup, 1; Am. Merganser, 1; Goshawk, 1; Ruffed Grouse, 2; Downy Woodpecker, 1; Blue Jay, 16; Crow, 3; Black-capped Chickadee, 68; White-breasted Nuthatch, 5; Northern Shrike, 2; Starling, 21; English Sparrow, 351; Pine Grosbeak, 4; Tree Sparrow, 2; Common Redpoll, 10, Snow Bunting, 55. Total, 18 species, 561 individuals. (Seen in area Jan. 1. Wood Duck, 1; Evening Grosbeak, 6; Goldfinch, 1.) — Gail Robertson, R.F. Robertson, Jennifer Findlay, G.E. Findlay (compiler), Norah Findlay, D.H. Findlay, D.G. Findlay, Mr. and Mrs. W.F. Findlay, Jeannie Findlay, Peter Findlay, Mr. and Mrs. Lloyd Hughes, Mr. and Mrs. Ross Ferguson, Leonard Elliot, D.D. Findlay.

Brockville, Ont. — (From Brockville to five miles west, along the St. Lawrence River) — December 26, 1954; 8.00 a.m. — 4.30 p.m.; mostly sunny, temperature 30° to 35°; wind southwest 5 - 10 m.p.h.; total miles — 12 (5 by car, 7 on foot); depth of snow — 4 to 6 inches, river open. — Black Duck, 5; Greater Scaup, 43; American Golden-eye, 180; American Merganser, 2; Bald Eagle, 2; Herring Gull, 74; Downy Woodpecker, 1; Blue Jay, 3; Black-capped Chickadee, 8; Starling, 215; House Sparrow, 168. Total species, 11; about 701 individuals. (Seen in same area — December 24 — Goshawk; December 25 — Pigeon hawk; December 31 — Screech Owl.) — D. Hurrie.

Peterborough, Ont. — (7½ mile radius from the City Hall including Jackson Park — Lily Lake, Chemong Park, Otonabee River — Nassau — Heronry, Burnham's Woods — Rifle Range, Lower Otonabee River — Crawford's Grove. Open farmland, 45%; marsh, 9%; water, 4%; mixed woods, 24%; deciduous woods, 8%; coniferous woods, 10%). — December 26, 1954, 8.30 a.m. to 4 p.m. Variable cloudiness with sunny intervals; temperature 28 — 35°; wind SW, 5 — 20 m.p.h.; ground snow covered with 3 - 4 inches of soft snow; lake frozen, river open in most places. 18 observers in 5 groups. Total party-miles 70 (50 by car, 20 on foot). — American Merganser, 14; Goshawk, 1; Pigeon Hawk, 2; Sparrow Hawk, 2; Ruffed Grouse, 3; Herring Gull, 1; Hairy Woodpecker, 3; Downy Woodpecker, 4; Blue Jay, 4; Black-capped Chickadee, 86; White-breasted Nuthatch, 7; Starling, 179; House Sparrow, 215; Meadowlark, 1; Pine Grosbeak, 3; Common Redpoll, 62; American Goldfinch, 119; Tree Sparrow, 47; Snow Bunting, 250. Total, 19 species, 1003 individuals. L.J. McKeever and F.R. Pommett, compilers (Peterborough Nature Club).

Rutherglen, Ont. — (From 18 miles east of North Bay, villages of Bonfield and Rutherglen, areas around Kaipuskong, Amable du Fond, Mattawa, and Ottawa rivers, and Pimisi Bay to town of Mattawa; open farmland 10%, woodlots 10%, mixed second growth forest 50%, marshes and bogs 5%, lakes and rivers 15%, settlements 10%) — Dec. 31; 7:30 a.m. to 4 p.m. (1 hr for lunch). Partly cloudy to cloudy; temp. 14° to 33°; wind W to SW 2 - 5 m.p.h.; ground covered with 12-13 inches soft powder snow; all fresh water except rapids and the Ottawa River frozen. 1 observer. Total hours 7½ (3½ on foot, 4 by car); total miles 48 (6 on foot, 42 by car). — American Goldeneye, 14; Hairy Woodpecker, 7; Downy Woodpecker, 1; Blue Jay, 5; Northern Raven, 3; Black-capped Chickadee, 52; White-breasted Nuthatch, 1; Red-breasted Nuthatch, 1; House Sparrow, 15; Common Redpoll, 7. Total, 10 species; about 106 individuals. (Seen in area Dec. 26 American Robin, 1, seen and heard by 2 observers, L.C. Lawrence and L. de K.L.; Dec. 29 Evening Grosbeak, 6; Jan. 1 Pileated Woodpecker, 1; American Crow, 2; Common Starling, 2; Pine Grosbeak, 3; Snow Bunting, 32). Louise de Kiriline Lawrence.

Huntsville, Ont. — December 19, 1954; 9 a.m. to 4.30 p.m.; temperature, zero to 12 degrees; cloudy, with short intervals of sun; light northwest wind; all small bodies of still water frozen, rivers and larger lakes partly open; 6 - 8 inches snow; all trees and shrubs heavily laden with snow, making observation in the bush difficult; 10 observers in 7 parties — Goshawk, 1; Ruffed Grouse, 13; Herring Gull, 2; Hairy Woodpecker, 14; Downy Woodpecker, 12; Blue Jay, 20; Black-capped Chickadee, 69; White-breasted Nuthatch, 6; Red-breasted Nuthatch, 1; Golden-crowned Kinglet, 3; Starling, 46; English Sparrow, 38; Evening Grosbeak, 1; Pine Grosbeak, 9; Redpoll, 35; Tree Sparrow, 2; Snow Bunting, 66. Total, 17 species; 338 individuals. — Paul Conway, Chick Gryier, Aubrey May, Dorothy Fletcher, Jim Kay, Ken Perrin, Pearl Rogers, Russ. Rutter, Mr. and Mrs. Wilfred Waters (The Huntsville Nature Club).

Toronto, Ont. — Dec. 26, 1954; 7.30 a.m. to 5 p.m.; bright and cool, wind SW 10 m.p.h.; ground mostly bare; creeks and ponds mostly frozen but bay and inside breakwater open; temperature 31° to 46° F.; 108 observers in 26 parties; total party-hours, 143½. — Great Blue Heron, 1; Mallard, 772; Black Duck, 744; Pintail, 2; Green-winged Teal, 1; Greater Scaup, 2,307; Am. Golden-eye, 219; Buffle-head, 113; Old-squaw, 489; Am. Merganser, 36; Red-breasted Merganser, 2; Sharp-shinned Hawk, 4; Red-tailed Hawk, 32; Rough-legged Hawk, 3; Marsh Hawk, 6; Pigeon Hawk, 1; Sparrow Hawk, 62; Ruffed Grouse, 6; Ring-necked Pheasant, 176; Wilson's Snipe, 1; Iceland Gull, 2; Great Black-backed Gull, 30; Herring Gull, 3,427; Ring-billed Gull, 544; Mourning Dove, 25; Horned Owl, 18; Snowy Owl, 6; Barred Owl, 1; Long-eared Owl, 18; Short-eared Owl, 2; Belted Kingfisher, 3; Yellow-shafted Flicker, 2; Pileated Woodpecker, 1; Red-headed Woodpecker, 2; Hairy Woodpecker, 50; Downy Woodpecker, 107; Blue Jay, 136; Crow, 45; Black-capped Chickadee, 593; White-breasted Nuthatch, 84; Red-breasted Nuthatch, 7; Brown Creeper, 8; Brown Thrasher, 1; Robin, 7; Golden-crowned Kinglet, 14; Northern Shrike, 31; Starling, 5,887; House Sparrow, 1,944; Red-winged Blackbird, 2; Cardinal, 73; Evening Grosbeak, 8; Purple Finch, 21; Pine Grosbeak, 1; Common Redpoll, 1; Pine Siskin, 35; Goldfinch, 246; Red Crossbill, 1; Towhee, 4; Slate-coloured Junco, 372; Tree Sparrow, 234; White-throated Sparrow, 4; Swamp Sparrow, 5; Song Sparrow, 20; Lapland Longspur, 35; Snow Bunting, 320. Total, 65 species, 19,354 individuals. Mrs. P. Addison, W. Addison, Robert

Anderson, J.L. Baillie (compiler), H. Bare, H. Barnett, Robert Bateman, Ross Bateman, G.M. Bennett, O.D. Boggs, O.D. Boggs, Jr., D.E. Burton, Robert Campbell, Wishart Campbell, C.H.D. Clarke, J. Clarke, Lee Clarke, W. Clarke, B. Clifford, R. Corlett, F. Crawford, C. Crowley, J. Crowley, C. Davies, I. Davies, A. Dawe, O.E. Devitt, F.H. Emery, A. Falls, J.B. Falls, T. Farley, B. Foster, C.D. Fowle, M. Foy, B. Geale, D. Geale, J. Geale, C. Goodwin, A. Gordon, H.M. Halliday, Paul Harrington, Peter Harrington, R. Hensell, H. Hogg, J. Hogg, R.F. James, F. Keim, R. Knights, G. Lambert, L. Langstaff, C. Leavens, B. LeVay, J. LeVay, N. LeVay, R.V. Lindsay, J. Livingston, J.R. Mackintosh, N. Martin, K. Mayall, R. McCleary, W. McGregor, T.F. McIlwraith, J. McIntyre, I. Metcalfe, W. Milne, A.J. Mitchener, C. Molony, F. Mueller, M. Nourse, R.E. Pannell, J. Parker, D.E. Perks, M. Porter, A. Reid, H. Richards, D. Ripley, R. Riseborough, R.C. Ritchie, T. Russell, J. Satterly, R.M. Saunders, B. Scovell, Dorothy Scovell, Douglas Scovell, R. Scovell, F.B. Sharp, J. Sherrin, T.M. Shortt, F. Smith, W.W. Smith, D.H. Speirs, J.M. Speirs, N.R. Speirs, D. Summer, E.H. Taylor, H. Thorpe, R.W. Trowern, E. Wasserfall, W. Wasserfall, E. Welch, D.A. West, J.D. West, M. West, H. White, H. Whyte, W. Williams, M. Wood and J. Woodford (30th consecutive Brodie Club Christmas Census).

Hamilton, Ont. — (Same area as former years). — Dec. 26; 7.30 a.m. to 5.30 p.m. Mostly clear; temp, 21° to 46°; wind S to SW, 10 - 18 m.p.h.; ground bare; marshes frozen, harbor open. Sixty observers in 27 parties. Total party-hours, 133 (123 on foot, 10 by car); total party-miles, 304 (159 on foot, 145 by car). Horned Grebe, 3; Great Blue Heron, 1; Mallard, 161; Black Duck, 83; Redhead, 1; Canvasback, 14; Greater Scaup, 895; Lesser Scaup, 5; Am. Golden-eye, 350; Buffle-head, 16; Old-squaw, 70; White-winged Scoter, 107; Ruddy Duck, 12; Hooded Merganser, 3; Am. Merganser, 670; Red-breasted Merganser, 285; Cooper's Hawk, 2; Red-tailed Hawk, 14; Bald Eagle, 2; Marsh Hawk, 1; Peregrine Falcon, 1 (seen by 3 parties); Sparrow Hawk, 25; Ruffed Grouse, 5; European Partridge, 5; Ring-necked Pheasant, 41; Am. Coot, 1; Glaucous Gull, 6; Iceland Gull, 2; Great Black-backed Gull, 147; Herring Gull, 12600; Ring-billed Gull, 80; Mourning Dove, 31; Screech Owl, 3; Great Horned Owl, 7; Long-eared Owl, 2; Belted Kingfisher, 3; Yellow-shafted Flicker, 3; Hairy Woodpecker, 31; Downy Woodpecker, 50; Blue Jay, 78; Am. Crow, 2; Black-capped Chickadee, 521; Tufted Titmouse, 1; (at Schneiders' feeding station since Nov. 19); White-breasted Nuthatch, 47; Red-breasted Nuthatch, 8; Brown Creeper, 14; Winter Wren, 4; Mockingbird, 1 (visiting Miss Malcolm's garden since Nov. 12); Am. Robin, 2; Golden-crowned Kinglet, 19; Ruby-crowned Kinglet, 1 (J.C., K.J.C., J.D.); Cedar Waxwing, 7; Gray Shrike, 9; Common Starling, 1700; House Sparrow, 1900; Cardinal, 67; Evening Grosbeak, 12; Purple Finch, 25; Pine Grosbeak, 4; Common Redpoll, 2; Pine Siskin, 6; Am. Goldfinch, 115; White-winged Crossbill, 15; Slate-colored Junco, 226; Am. Tree Sparrow, 223; Swamp Sparrow, 4; Song Sparrow, 13. Total, 67 species; about 20,764 individuals. — Brock Atkinson, W. Edward Benner, Miss Stella Brown, Neil Bourne, Mr. and Mrs. R.D.F. Bourne, Frank W. Buckle, Don Bucknell, Miss Janet Clarkson, James Cole, Kenneth J. Cox, Harold Cunliffe, James A.N. Dowall, Robert O. Elstone, Mrs. Dorothy Falladown, Mrs. J.H. Forbes, Leopold Fucikovsky, Leslie Gray, Ian Halladay, John A. Hencher, Peter F. Henderson, Robert Henry, David Hick, Mr. and Mrs. William R. Holley, Charles Hunter, Angus B. Jackson, Roger Jackson, Herbert E. Kettle, Mr. and Mrs. Leslie Laking, Miss Margaret Lamb, Miss Eleanor Malcolm, Mr. and Mrs. Julius Mannheimer, George O. McMillan, George Meyers, Glen Meyers, Mr. and Mrs. John J. Miller, Mrs. Carl Morden, John W. Moule, Albert B. Nind, George W. North (compiler), Laurel E. North, Miss Jean Plewes, Mr. and Mrs. C.L. Powell, David K. Powell, Robert K. Sargeant, Mrs. Frank Schneider, Edward Stacey, Robert W. Stamp, Miss Laura Stewart, Mr. and Mrs. Gordon Sweatman, Miss Mabel Watson, Mr. and Mrs. M.R. Watters, J. Harvey Williams (Hamilton Nature Club).

Kirkland Lake, Ont. — (7½ mile radius centering on a point on #112 Highway one mile north of Dane; fields 20%; towns 5%; coniferous woods 30%; deciduous woods 35%; slimes 5%; cattail marsh 5%; and 5 feeding stations). December 27, 8.30 a.m. to 4.30 p.m. Clear sky; temperature 0° to 6°; wind north 10 m.p.h.; 12 inches snow on ground; lakes frozen, streams mostly frozen. 11 observers in 8 parties. Total party-hours 41 (8½ on foot, 6½ by car, 26 at stations). Total party-miles 75 (17 on foot, 58 by car). — Hairy Woodpecker, 14; Downy Woodpecker, 4; Gray Jay, 13; Blue Jay, 29; Common Raven, 3; Black-capped Chickadee, 123; Common Starling, 3; House Sparrow, 31; Pine Grosbeak, 32;

Common Redpoll, 2; Slate-colored Junco, 1; Snow Bunting, 12. Total species, 12; 267 individuals. (A Pileated Woodpecker visited one of the feeding stations regularly but was not observed on December 27. The Junco was first seen at a feeding station on December 27 and has been a daily visitor since). J.G. Stephenson (Kirkland Lake Nature Club).

Kitchener, Ont. — (7½ mile radius centering on the extreme South Westerly boundary of the city; cattail marsh 4%, open farm land and pasture 35%, deciduous woods 26%, coniferous 14%, swamp 10%, city suburbs 5%, open water 6%). — Dec. 26; 8.00 a.m. to 4.30 p.m. Mostly clear, some cloudy intervals; temp. 30 to 44; wind SSW, 10-15 m.p.h.; very light snow cover, thawing in p.m., most rivers and creeks open. Eighteen observers in 6 parties. Total party-hours, 42½ (37 on foot, 5½ by car); total party-miles, 194 (40 on foot, 154 by car). Great Blue Heron, 1; Mallard, 3; Black Duck, 13; Am. Golden-eye, 11; Am. Merganser, 4; Redtailed Hawk, 3; Marsh Hawk, 1; Sparrow Hawk, 1; Ruffed Grouse, 8; Ring-necked Pheasant, 11; Herring Gull, 18; Belted Kingfisher, 2; Pileated Woodpecker, 4; Hairy Woodpecker, 9; Downy Woodpecker, 21; Blue Jay, 6; Am. Crow, 3; Black-capped Chickadee, 301; White-breasted Nuthatch, 14; Brown Creeper, 8; Winter Wren, 2; Brown Thrasher, 1; Golden-crowned Kinglet, 25; Loggerhead Shrike, 1; Northern Shrike, 3; Common Starling, 147; House Sparrow, 659; Cardinal, 33; Evening Grosbeak, 1; Purple Finch, 7; Pine Grosbeak, 2; Common Redpoll, 28; Am. Goldfinch, 63; Slate-colored Junco, 53; Am. Tree Sparrow, 53; Snow Bunting, 350. Total, 36 species; 1,870 individuals. — Malcolm Campbell, Eric M. Carter, Horace A. Dahmer (compiler), James Detweiler, Miss Margaret Dickson, Roy Dickson, Brian Drown, Ralph Hendry, Richard C. Hilborn, Miss Margaret Lemon, Robert Pickering, Morley C. Preston, Mrs. Dorothy Russell, Harold Russell, Willard H. Schaefer, Frank Shantz, Russell Hilt, Arthur Woods.

Yorkton, Sask. — (7½-mile radius centering on Yorkton. Mixed farming district, 25% wooded). Dec. 26, 1954; 8.30 a.m. to 5 p.m. Slight overcast; temp. — 7° to 5°; wind NNW, 5 to 15 m.p.h.; ground covered with 2 inches snow. 23 observers in 6 parties. Total party-hours, 23 (8 on foot, 15 by car), total party-miles, 126½ (14½ on foot, 112 by car). — Goshawk, 1; Ruffed Grouse, 5; Sharp-tailed Grouse, 43; European Partridge, 30; Horned Owl, 3; Snowy Owl, 9; Hairy Woodpecker, 3; Downy Woodpecker, 3; Blue Jay, 2; American Magpie, 47; Black-capped Chickadee, 65; Bohemian Waxwing, 287; Common Starling, 4; House Sparrow, 814; Red-winged Blackbird, 1; Brewer's Blackbird, 7; Pine Grosbeak, 51; Common Redpoll, 57; Slate-colored Junco, 4; Snow Bunting, 474. Total, 20 species, about 1,910 individuals. Tyrone Balacko, Paul Barski, Wayne Bjorgan, Jim Bridgewater, Brother Clarence, Lionel and Ronald Coleman, Brother Halward, Dr. and Mrs. Stuart Houston (compilers), John Hutchinson, Preston McDonald, Dave McVey, Allan Nurse, Jack Park, Irving Pearce, Jack Shaver, C.C. Shaw, Mr. and Mrs. Jeff Smith, Frank and Gillean Switzer, Brother Vincent (Yorkton Natural History Society).

Saskatoon, Sask. — (15-mile radius). Jan. 1, 1955. Temp. —2° to —8°; clear with 1-2" fresh snow; light wind; 2 Parties, 4 Observers. Mallards, 7; Am. Golden-eye, 5; Am. Merganser, 1; Hungarian Partridge, 3; Great Horned Owl, 1; Snowy Owl, 3; Short-eared Owl, 9; Magpie, 23; Chickadee, 2; Red-breasted Nuthatch, 1; Bohemian Waxwing, 65; English Sparrow, 855±; Redpoll, 175±; White-winged Crossbill, 8; Snow Bunting, 750±; Total, 15 species, 1918 individuals. (Seen in area recently Downy Woodpecker, 1; Ring-necked Pheasant, 9; Blue Jay, 2; Shrike, 1). — Mr. and Mrs. F.J.H. Fredeen, Mr. and Mrs. J.B. Gollop.

Grande Prairie, Alberta. — (7½-mile radius centered on 100 St. and 100 Ave.; deciduous woods 23%, coniferous woods 41%, swamp 18%, cultivated 15%, town 3%). — Dec. 27; 8:00 a.m. to 5:30 p.m. Overcast, clearing at 11:00 p.m.; temp. 28.8 to 34; wind SW 10 to 20 m.p.h.; ground covered with 2½" snow in open 8" wooded area, no open water; activity concentrated in south and SE section. Two observers in 1 party. Total party-hours, 9½ (6 on foot, 3½ by car); total party-miles, 77 (7 on foot, 70 by car). Goshawk, 1; Rough-legged Hawk, 2; Gyrfalcon, 1; Ruffed Grouse, 2; Snowy Owl, 3; Gray Jay, 9; Am. Magpie, 35; Common Raven, 12; Black-capped Chickadee, 6; Gray Shrike, 2; House Sparrow, 80; Pine Grosbeak, 2; Snow Bunting, 3. Total, 13 species; about 158 individuals. (Seen in area Dec. 30. Common Redpoll, 50; Hairy Woodpecker, 1; Bohemian Waxwing, 9). — Rev. Marvin Fowler (Sexsmith), R. Fraser Smith (Grande Prairie) (compiler).

Vernon, B.C. — Dec. 19, 1954; 9:00 a.m. to 3:30 p.m.; cloudy, wind light except E. in

Coldstream; temp. 22° to 32°; maximum snow depth 1"; Okanagan and Kalamalka Lakes clear of ice; Swan Lake mostly frozen. Thirteen observers in 3 parties; west to Okanagan Landing, north to Buckerfields' Ranch, south to Kalamalka Lake (Rattlesnake Point) and east to Coldstream Ranch. Common Loon, 1; Horned Grebe, 1; Mallard, 280; Pintail, 13; Green-winged Teal, 3; Baldpate, 166; Redhead, 26; Lesser Scaup, 120; Am. Golden-eye, 26; Bufflehead, 13; Am. Merganser, 2; Hooded Merganser, 8; Goshawk, 3; Sharp-shinned Hawk, 1; Golden Eagle, 1; Marsh Hawk, 4; Sparrow Hawk, 1; European Partridge, 26; Ring-necked Pheasant, 56; Am. Coot, 1,426; Killdeer, 2; Wilson's Snipe, 4; Herring Gull, 7; Horned Owl, 1; Pygmy Owl, 2; Short-eared Owl, 8; Belted Kingfisher, 2; Red-shafted Flicker, 36; Pileated Woodpecker, 1; Hairy Woodpecker, 1; Downy Woodpecker, 5; Horned Lark, 30; Steller's Jay, 2; Am. Magpie, 71; Common Raven, 20; Am. Crow, 27; Clark's Nutcracker, 29; Black-capped Chickadee, 33; Mountain Chickadee, 2; White-breasted Nuthatch, 2; Red-breasted Nuthatch, 12; Pygmy Nuthatch, 25; Am. Dipper, 2; Robin, 179; Townsend's Solitaire, 4; Golden-crowned Kinglet, 6; Bohemian Waxwing, 2,389; Northern Shrike, 8; Starling, 8; House Sparrow, 304; Western Meadowlark, 5; Brewer's Blackbird, 60; Evening Grosbeak, 172; Pine Grosbeak, 8; Oregon Junco, 312; Tree Sparrow, 12; White-crowned Sparrow, 21; Song Sparrow, 45. Total, 58 species; about 6,036 individuals. (Seen during period Towhee, 2; Goldfinch, 40; Mourning Dove, 47) — E. Alderman, H. Baerg, Miss K. Bartholomew, J.B. Beddome, J.T. Fowle, J. Grant, A.N. Humphries, C. McClounie, J. Obaba, J. Quirk, D.A. Ross, B.A. Sugden, P. Tassie (The North Okanagan Naturalists' Club).

Crescent Beach, B.C. — (Parts of coast and bush between Crescent Beach and Ocean Park, including Blackie's Spit and Crescent Oyster Company's property). Dec. 30, 1954; 8.30 a.m. to 4.30 p.m.; temp. 38° to 45°; very heavy rain until 3.00 p.m.; visibility poor, three observers, one confined at home watched feeding table all day. Total miles 15 (10 by car, 5 on foot). — Common Loon, 7; Horned Grebe, 12; Eared Grebe, 1; Western Grebe, 7; Double-crested Cormorant, 2; Pelagic Cormorant, 2; Great Blue Heron, 6; Mallard, 1; Green-winged Teal, 2; Canvas-back, 3; Greater Scaup Duck, 80; Am. Golden-eye, 17; Barrow's Golden-eye, 2; Buffle-head, 8; Old-squaw, 5; White-winged Scoter, 150 (plus); Surf Scoter, 130 (plus); Am. Scoter, 20 (plus); Hooded Merganser, 1; Red-breasted Merganser, 3; Sparrow Hawk, 1; Ring-necked Pheasant, 4; Black Turnstone, 10; Sanderling, 1; Glaucous-winged Gull, 60; Short-billed Gull, 25; Belted Kingfisher, 1; Red-shafted Flicker, 7; Northwestern Crow, 6; Black-capped Chickadee, 7; Chestnut-backed Chickadee, 2; Bewick's Wren, 1; Am. Robin, 1; Varied Thrush, 1; Golden-crowned Kinglet, 3; Ruby-crowned Kinglet, 1; English Sparrow, 3; Purple Finch, 12; Pine Siskin, 50; Spotted Towhee, 4; Oregon Junco, 30; Fox Sparrow, 2; Lincoln Sparrow, 1; Song Sparrow, 10; Total, 44 species, 702 individuals. (Owing to heavy rain land birds hard to find. Lincoln Sparrow, exceptional record, seen with fox and song sparrows in thick scrub close to sea near Ocean Park. Immature Bald Eagle feeding on small duck Dec. 28). — H.N. Clarke, M.W. Holdom, E.E. Woodford.

Vancouver, B.C. — (Bridgeman Park, Stanley Park, Spanish Banks and University of British Columbia Gardens, Blenheim Flats, North and West Shores of Lulu Island, Sea Island, north side of North Arm of Fraser River). December 27, 1954. Temperature 40°, overcast, southeast wind 15 m.p.h. — Common Loon, 4; Black-throated Loon, 21; Red-throated Loon, 37; Eared Grebe, 1; Horned Grebe, 36; Western Grebe, 284; Double-crested Cormorant, 132; Baird's Cormorant, 3; Great Blue Heron, 43; Lesser Snow Goose, 1; Mallard Duck, 580; Pintail Duck, 969; Green-winged Teal, 2; Baldpate, 187; Canvas-back, 8; Greater Scaup, 389; American Golden-eye, 61; Barrow Golden-eye, 21; Buffle-head, 9; White-winged Scoter, 21; Surf Scoter, 216; American Scoter, 23; American Merganser, 11; Red-breasted Merganser, 29; Hooded Merganser, 7; Sharp-shinned Hawk, 3; Red-tailed Hawk, 4; Bald Eagle, 5; Marsh Hawk, 7; Sparrow Hawk, 3; Ruffed Grouse, 1; Ring-necked Pheasant, 8; American Coot, 169; Killdeer, 46; Wilson Snipe, 5; Red-backed Sandpiper, 62; Western Sandpiper, 10; Glaucous-winged Gull, 8147±; Herring Gull, 265; Short-billed Gull, 878±; Screech Owl, 3; Short-eared Owl, 13; Belted Kingfisher, 2; Red-shafted Flicker, 57; Pileated Woodpecker, 3; Hairy Woodpecker, 3; Downy Woodpecker, 5; Horned Lark, 11; Steller Jay, 7; Raven, 1; Crow, 189; Black-capped Chickadee, 91; Bush-tit, 3; Dipper, 1; Winter Wren, 5; Bewick Wren, 4; Long-billed Marsh Wren, 2; Robin, 160; Varied Thrush, 5; Golden-crowned Kinglet, 26; Ruby-crowned Kinglet, 74;

Bohemian Waxwing, 71; Cedar Waxwing, 19; Northern Shrike, 6; European Starling, 2,741; Crested Mynah, 21; House Sparrow, 103; Western Meadowlark, 50; Red-winged Blackbird, 77; Brewer Blackbird, 670±; Evening Grosbeak, 74; Purple Finch, 73; House Finch, 191; Pine Siskin, 1321±; American Goldfinch, 1; Oregon Towhee, 31; Slate-colored Junco, 2; Oregon Junco, 364; White-crowned Sparrow, 4; Golden-crowned Sparrow, 7; Fox Sparrow, 23; Song Sparrow, 132. Number of species, 82. Number individuals, 19,354±. Mr. and Mrs. E.N. Copping, R. Copping, Mr. and Mrs. G. Stevens, R. Stevens, L. Stevens, B. Stevens, Mrs. Foote-Waugh, Miss Nola Waugh, L. Norman Precious, Miss Laura C. Giegerich, Miss Gladys Heritage, Miss Heather Leveson-Gower, Mrs. Francis Morgan, Miss E. Lemon, F. Sanford, Miss Joan Ellingham, Miss Beth Henson, Stewart Bradley, Mrs. Dorothy Bradley, Miss Verna Newsom, Miss Sheila Buchanan, Billy Picket, Ian McGregor, Mr. and Mrs. J. Ross MacKay, William Hughes. (Vancouver Natural History Society).

Victoria, B.C. — (Victoria district). Jan. 2. Weather clear; temp. 38°; wind N.E. 5 mph. Common Loon, 11; Red-throated Loon, 1; Holboell's Grebe, 3; Horned Grebe, 106; Eared Grebe, 13; Western Grebe, 89; Pigeon Guillemot, 4; Double-crested Cormorant, 40; Baird Cormorant, 101; Great Blue Heron, 8; Canada Goose, 18; Mallard, 793; Baldpate, 2077; Pintail, 37; Green-winged Teal, 210; Blue-winged Teal, 18; Shoveller, 122; Wood Duck, 4; Canvasback, 50; Greater Scaup, 884; Am. Golden-eye, 52; Bufflehead, 178; Old-squaw, 18; Harlequin, 51; White-winged Scoter, 67; Surf Scoter, 65; Am. Scoter, 8; Ruddy Duck, 40; Hooded Merganser, 7; Am. Merganser, 4; Red-breasted Merganser, 38; Cooper's Hawk, 2; Red-tailed Hawk, 4; Bald Eagle, 1; Pigeon Hawk, 1; Duck Hawk, 2; Sparrow Hawk, 2; Ruffed Grouse, 1; Hungarian Partridge, 10; California Quail, 51; Pheasant, 5; Coot, 196; Black Oyster Catcher, 3; Killdeer, 56; Surf Bird, 15; Black Turnstone, 107; Wilson's Snipe, 6; Hudsonian Curlew, 1; Lesser Yellow-legs, 2; Aleutian Sandpiper, 25; Glaucous-winged Gull, 1084; Herring Gull, 2; Short-billed Gull, 154; California Gull, 12; Bonaparte's Gull, 5; Yellow-shafted Flicker, 56; Pileated Woodpecker, 1; Downy Woodpecker, 2; European Skylark, 12; Raven, 2; Northwest Crow, 912; Chestnut-backed Chickadee, 113; Bush-tit, 25; Red-breasted Nuthatch, 4; Brown Creeper, 4; Winter Wren, 18; Seattle Wren, 20; North-western Robin, 174; Pacific Thrush, 44; Hermit Thrush, 2; Western Bluebird, 5; Golden-crowned Kinglet, 135; Ruby-crowned Kinglet, 21; Cedar Waxwing, 1; European Starling, 392; English Sparrow, 143; Western Meadowlark, 15; Red-winged Blackbird, 50; Brewer's Blackbird, 25; California Purple Finch, 9; House Finch, 50; Pine Siskin, 1270; Oregon Towhee, 38; Oregon Junco, 217; Puget Sound Sparrow, 1; Golden-crowned Sparrow, 14; Fox Sparrow, 14; Song Sparrow, 48. 89 species, 10702 individuals. — J.O. Clay.

William Head, Vancouver Island, B.C. — December 27, 1954. (William Head Quarantine Station, Pedder Bay, Mary Hill, Wier's Beach and south Montreul Hill. This covered approximately 1 square mile of land and 3 miles of rocky sea shore of Juan de Fuca Strait). The cover constituents of the land portion censused are approximately as follows: 25% open rocky moss-covered hillsides with scattered tree growth; 25% dense conifer stand; 25% slash, cut-over forest; 25% meadows with scrub growth, chiefly, broom *(Cytisus)*. The dominant trees in the forested areas are Douglas fir, Garry oak and madrona. Overcast, mild (low 38°, high 41°), stiff east wind decreasing in afternoon. Ground bare, ponds and creeks open. Two observers together; all coverage on foot with a total of 12 man-hours between 9 a.m. and 4.30 p.m. P.S.T. — Common Loon, 6; Arctic Loon, 5; Red-necked Grebe, 7; Horned Grebe, 68; Eared Grebe, 16; Western Grebe, 42; Brandt's Cormorant, 9; Baird's Cormorant, 44; cormorant sp., 8; Great Blue Heron, 3; Baldpate, 2; Greater Scaup, 1; scaup sp., 96; Common Golden-eye, 56; Buffle-head, 71; Old-squaw, 42; Harlequin Duck, 6; White-winged Scoter, 57; Surf Scoter, 59; scoter sp., 58; Ruddy Duck, 1; Red-breasted Merganser, 13; Red-tailed Hawk, 1; California Quail, 20; Black Turnstone, 9; Glaucous-winged Gull, 62; Short-billed Gull, 8; Common Murre, 2; Marbled Murrelet, 1; Ancient Murrelet, 1; Belted Kingfisher, 1; Red-shafted Flicker, 48; Pileated Woodpecker, 1; Downy Woodpecker, 3; Raven, 1; Chestnut-backed Chickadee, 34; Red-breasted Nuthatch, 16; Brown Creeper, 3; Winter Wren, 17; Bewick's Wren, 2; American Robin, 294; Varied Thrush, 28; Golden-crowned Kinglet, 19; Ruby-crowned Kinglet, 9; Townsend's Warbler, 1; Purple Finch, 17;

House Finch, 1; Crossbill (Red ?), 1; Spotted Towhee, 5; Oregon Junco, 68; Fox Sparrow, 2; Song Sparrow, 9. Total, 49 species, 1364 individuals. (*Seen during census period:* Double-crested Cormorant, Bald Eagle, Sharp-shinned Hawk, Sparrow Hawk, Ruffed Grouse, Herring Gull, Pigeon Guillemot, Hairy Woodpecker, Steller's Jay, Northwestern Crow, Hermit Thrush, American Pipit, Pine Siskin). — G.F. van Tets, George Francis, Vancouver, B.C.

Comox, B.C. — (Courtenay along river and shore line to Comox, with side trips, one of 2 m. to village dump and adjoining logged-over areas; except for last mentioned side trip, same as previous years). January 2. 9 a.m. to 4 p.m.; temperature at start 30°, warmer later. Bright morning but clouding over later. Four observers, one (R.F.) part time. Village of Comox, other three at times together, other in two parties. Total mileage approximately 10 m. mainly on foot, car to dump. — Common Loon, 5; Pacific Loon, 4; Red-throated Loon, 2; Red-necked Grebe, 4; Horned Grebe, 7; Western Grebe, 7; Double-crested Cormorant, 3; Pelagic Cormorant, 7; Great Blue Heron, 7; Mallard, 350 +; Baldpate, 200 +; Greater Scaup, 150 +; American Golden-eye, 200 +; Barrow Golden-eye, 4; Buffle-head, 14; Old-squaw, 3; White-winged Scoter, 500 +; Surf Scoter, 500 +. Approximately 2500 unidentified ducks that would be of the foregoing species but mainly the last two. American Merganser, 17; Red-breasted Merganser, 2; Peregrine Falcon, 1; Bald Eagle, 1; California Quail, 3; Ring-necked Pheasant, 3; Coot, 30; Wilson Snipe, 12; Glaucous-winged Gull, 600 +; Thayer Gull, 3; Short-billed Gull, 10; California Murre, 1; Marbled Murrelet, 2; Belted Kingfisher, 3; Red-Shafted Flicker, 8; Pileated Woodpecker, 1; Harris Woodpecker, 2; Raven, 19; Western Crow, 4; Northwestern Crow, 275 +; Chestnut-back Chickadee, 17; Brown Creeper, 1; Bewick Wren, 7; Winter Wren, 11; Golden-crowned Kinglet, 30; Ruby-crowned Kinglet, 1; House Sparrow, 6; Western Meadowlark, 2; Brewer Blackbird, 30; European Starling, 7; Purple Finch, 9; American Crossbill, 2; Oregon Towhee, 6; Oregon Junco, 60; Golden-crowned Sparrow, 2; Fox Sparrow, 7; Song Sparrow, 12. Total 55 species. (Seen in area previous day (R.F.) Canvas-back, 1; Pintail, 27; Killdeer, 1; Goshawk, 1; Red-tailed Hawk, 1; Siskin, 30. — R. Fryer, D. Guthrie, J. Hames, Theed Pearse.

FEEDING HABITS OF JUVENILE RING-NECKED PHEASANTS ON PELEE ISLAND, ONTARIO [1, 2]

A. G. LOUGHREY [3] *and* R. H. STINSON [4]

OVER the past thirty years numerous attempts have been made to introduce the ring-necked pheasant, *Phasianus colchicus*, into south-western Ontario. Nowhere has an introduction met with greater success than on Pelee Island, lying off the southern tip of Point Pelee in the western end of Lake Erie. Here, over an area of 10,000 acres, it was estimated by Stokes (1952) that a high density of more than three birds per acre had been reached in recent years.

Detailed study has been made of this population only during the last ten years. The introduction of the bird and a brief history of the fall shoot have been given by Taylor (1942). Clarke and Braffette (1946) have described the conditions on the island which have apparently encouraged the high population. Clarke (1947) has reviewed the status of the population at that time. A description of breeding behaviour has been given by Ball (1950); and finally Stokes (1952) has presented data on survival studies.

In the course of the latter investigation there arose the question of the carrying capacity of the island, particularly with respect to the young birds, for lack of sufficient

1) Contribution from Department of Zoology, University of Western Ontario.
2) Received for publication July 2, 1954.
3) Canadian Wildlife Service, Ottawa.
4) Department of Zoology, University of Western Ontario.

Table 1. — NUMBER OF JUVENILE PHEASANTS OF DIFFERENT AGES TAKEN ON PELEE ISLAND FROM JUNE 19 to SEPT. 4, 1950.

Week ending	Age in weeks												
	1	2	3	4	5	6	7	8	9	10	11	12	
June 26	12	3	2										
July 3	13	12	7	4									
July 10	11	13	3	6	2	1							
July 17	4	4	9	5	3								
July 24	4	4	6	9	8	1							
July 31			7	9	9	7	6						
Aug. 7		1		2	5	8	9	5					
Aug. 14					4	7	9	6	2				
Aug. 21						4	13	6	6	4	2		
Aug. 28							4	9	7	3	1		
Sept. 4						1	3	3	6	7	1	2	
Total	44	37	34	35	31	29	44	29	21	14	4	2	324

or suitable food might be a factor contributing to mortality occurring between the time of hatching and the autumn hunt. The present study of the feeding habits of juvenile pheasants was conducted during the summer of 1950 in order to determine the kinds and quantities of food materials eaten by different age groups of juvenile birds, and whether the selection of such items was the result of preference or availability.

The largest of the chain of islands in the western end of the lake, Pelee is quite flat, the highest point being only 38 ft. above lake level and much of the interior lying two to three feet below this level. In 1950 approximately 6400 acres of this area were under cultivation, 1,200 acres in pasture and 600 acres in woodlots. Three-quarters of the cultivated area contained soya beans, wheat occupied about one-eighth, and the remainder was sown in corn, oats, barley and other crops. The low-lying sections are drained by a series of canals with dense undergrowth lining the banks. Together with the shrubbery along roadsides and fencerows there is a considerable amount of cover present over the remaining uncultivated land.

METHOD

The food habits of the birds were interpreted from a quantitative analysis of the contents of their crops. From June 19 to September 4, 324 specimens ranging from one to twelve weeks of age were taken from four food-producing habitats which had been classified as pasture, woodlot, cultivated and uncultivated areas (Table 1). The age of a bird was determined by measurements of the primary wing feathers according to the procedure outlined by Trautman (1949), a week being used as the unit of age. The crops were removed, tied off and preserved in 70% alcohol.

Over the winter of 1950-51 the crop contents were analyzed volumetrically. Each crop was opened and the contents placed in a dish of water. Food items were separated and their volumes determined by water displacement. Amounts of less than 0.05 c.c. were recorded as traces.

Table 2. — CONDITION OF CROPS COLLECTED FROM 324 JUVENILE PHEASANTS.

	Age in weeks												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
No. of crops with food	18	21	22	29	26	27	42	28	20	13	4	1	251
No. of empty crops	26	16	12	6	5	2	2	1	1	1	0	1	73
Total	44	37	34	35	31	29	44	29	21	14	4	2	324

RESULTS

It can be seen from Table 2 that almost one-quarter of the crops examined were empty, and that the greatest proportion of these empty crops occurred among the youngest birds. Since Dalke (1935) has stated that pheasant chicks begin feeding before they are 36 hours old, the presence of so many empty crops among the birds of one to three weeks is likely due to the small size of the crop and the fact that food does not remain in it for long, rather than to the possibility that the birds have not yet begun to eat. It was observed particularly with older birds that they did much of their feeding in early morning and late afternoon, hence most collecting was done at these times in order to secure birds with full crops.

In Table 3 is presented the volumetric analysis of 251 full crops. The percentages shown here are based upon the total quantity of each item in all the crops of each age group.

ANIMAL FOOD

It is evident from Table 3 that during the first three weeks the diet was almost wholly of animal origin, with insects making up the larger portion. Other arthropods consisted chiefly of spiders, some phalangids, mites, diplopods, chilopods and isopods. Molluscs included land slugs and field snails. In Table 4 is shown the relative importance of different insect orders in this diet. It is apparent that a wide variety of insects is found in the crops. In fact one two-day old

Table 3. — FOODS EATEN BY DIFFERENT AGE GROUPS OF JUVENILE PHEASANTS GIVEN AS PERCENTAGES BASED ON VOLUMETRIC ANALYSIS OF 251 FULL CROPS.

Foods	Age in weeks									
	1	2	3	4	5	6	7	8	9	10-12
Insects	82.5	82.6	93.1	69.8	35.6	23.5	18.3	15.4	3.8	7.2
Other arthropods	11.1	15.8	1.2	4.2	4.6	1.3	0.6	1.4	0.7	0.9
Molluscs	6.0	1.6	0.0	0.1	1.0	0.2	0.5	1.8	0.2	0.4
Grains	0.0	0.0	5.3	15.6	31.3	58.4	37.2	41.9	40.1	45.6
Wild fruits	0.0	0.0	0.0	8.5	13.6	6.3	24.0	18.7	15.7	16.8
Grass and leaves	0.2	0.0	0.0	1.7	2.2	2.8	7.0	4.0	11.4	6.8
Seeds	0.2	0.0	0.4	0.1	11.7	7.5	12.4	16.8	28.1	22.3
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 4.—INSECT ORDERS EATEN BY DIFFERENT AGE GROUPS OF JUVENILE PHEASANTS GIVEN AS PERCENTAGES BASED ON VOLUMETRIC ANALYSIS OF 251 FULL CROPS.

Insect order	Age in weeks 1	2	3	4	5	6	7	8	9	10-12	Average
Orthoptera	0.0	1.7	0.2	1.3	2.4	3.9	7.0	24.2	11.3	24.7	9.3
Neuroptera	0.2	0.0	0.2	0.1	0.5	0.1	0.0	0.0	0.0	0.0	0.1
Ephemerida	16.0	62.9	50.8	52.9	69.4	82.5	60.0	46.8	14.5	3.6	54.4
Homoptera	6.8	9.7	18.7	7.6	3.4	1.7	2.0	1.2	6.9	1.3	3.7
Hemiptera	15.5	1.4	0.7	0.6	1.3	1.2	0.8	1.5	2.6	5.1	1.7
Coleoptera	1.9	0.7	1.2	0.4	0.9	1.6	1.5	2.5	4.1	5.3	1.8
Trichoptera	0.4	11.9	0.5	8.6	12.1	0.9	13.2	0.5	43.1	54.0	11.8
Lepidoptera	17.3	3.5	24.0	15.7	1.7	3.0	4.3	9.2	10.3	4.6	7.2
Diptera	38.2	8.2	3.7	3.9	7.0	1.7	3.1	4.7	1.0	0.2	4.3
Hymenoptera	3.7	0.0	0.0	8.9	1.3	3.4	8.1	9.4	6.2	1.2	5.7
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

chick had eaten insects representing six orders, and examples of ten orders were found in the crop of a four-week old bird.

Orthoptera formed about nine per cent of the total, occurring most frequently in eight to twelve-week old birds. This is explained of course by the fact that grasshoppers do not become available to any extent until August. Those of the family Acrididae were taken most frequently, though Gryllidae and Rhaphidophoridae were also represented. The order Neuroptera formed a negligible portion and was represented entirely by larval forms, chiefly of the Chrysopidae.

The order of insects represented in greatest numbers was the Ephemerida, for may-flies formed 54 per cent of the total insect matter. The crop of one six-week old bird contained 170 ephemerids. Several species occur on the island, but the one most frequently identified was *Hexagenia occulta* Walker. The large number of may-flies consumed is due to the fact that these insects emerge from the shallow water in the west end of Lake Erie and swarm in countless numbers over the island during the latter part of June and the first weeks of July. They come to rest on the ground, bushes and trees in such numbers that a concentration of 100 may-flies per sq. ft. may occur in some areas after a particularly heavy flight. It should be noted that they do not occur in any quantity in the crops of week-old chicks, possibly because of the relatively large size of the insect at this time.

Bugs of the orders Homoptera and Hemiptera were consumed in the largest numbers during the first three weeks. The families most frequently represented in these orders were Cicadellidae, Aphidae, Lygaeidae and Miridae. The common forms of Coleoptera were adults of the Coccinellidae and Curculionidae.

Larvae and adults of Trichoptera formed some 12 per cent of the total, the majority taken by the older birds. The occurrence of insects of this order in the crops of younger birds was rather irregular. In the case of the adult insects this probably resulted from different dates of emergence of the various species, but the irregular occurrence of the larvae was possibly related to their

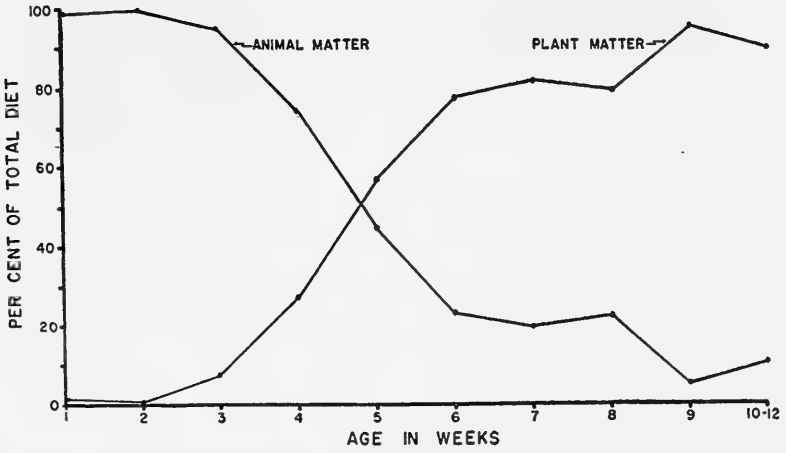

Fig. 1. Amounts of animal and plant matter in the diet of 251 juvenile pheasants.

aquatic habitat. Under normal circumstances the larvae would not be exposed to the young birds, so those taken were probably found at the edges of shallow meadow pools which had begun to dry up.

Lepidoptera and Diptera formed the bulk of the insect diet of the first week. The former consisted mainly of larvae while the latter included adult Chironomidae and larval Syrphidae. Representatives of Hymenoptera occurred chiefly in the older birds, the common forms being pupae and adults of Formicidae; the crop of one seven-week old bird contained 380 ants.

PLANT FOOD

After six weeks of age cultivated grains make up the largest portion of the diet. Of these, wheat formed 86 per cent, soya beans seven per cent and oats and barley seven per cent. The wheat became available to the birds as waste wheat after it was combined. Often up to 500 young pheasants could be seen feeding in a 30-acre stubble field in an evening. Although most of the cultivated area was in soya beans, these beans were not found in any quantity in the crops because the pods were not ripe by the time sampling was terminated on Sept. 4.

Like the grains, wild fruits, grass, leaves and seeds became increasingly important in the diet after the third week. The fruits found to occur most frequently were those of fragrant sumac (*Rhus aromatica* Ait.), snowberry (*Symphoricarpos albus* L.), grapes (*Vitis* spp.), panicled dogwood (*Cornus racemosa* Lam.), hackberry (*Celtis occidentalis* L.), staghorn sumac (*Rhus typhina* L.) and bittersweet (*Solanum Dulcamara* L.). A single fruit of serviceberry (*Amelanchier* sp.) was found in the crop of a four-week old bird. This is of interest since Core (1948) does not record the serviceberry for Pelee Island.

Among the leaves commonly found were those of sweet clover (*Melilotus* sp.), black medick (*Medicago lupulina* L.), common ragweed (*Ambrosia artemisiifolia* L.), dock (*Rumex* sp.) and bittersweet.

Of the seeds the meadow grasses (*Poa* sp.) were the most important items. Other seeds taken by juvenile birds included those of sedges (*Carex* spp.), foxtail grass (*Bromus* sp.), vetch (*Vicia* sp.), sorrel (*Oxalis* sp.), black medick and sweet clover.

Grouping the categories of Table 3 into plant and animal food, Fig. 1 is presented to show the change in these components of the diet over the 12-week period. It is apparent that between four and six weeks of age the young pheasants made a rather sharp change-over from a diet largely animal to one largely of plant material.

PREFERENCE VS. AVAILABILITY

So striking is this change from animal to plant food that an attempt was made to determine whether it might be the result of

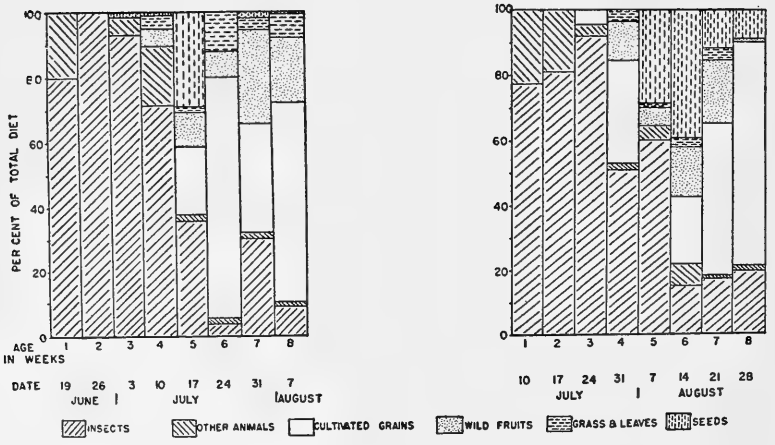

Fig. 2. Left. Foods eaten by 55 juvenile pheasants of Group I, hatched from June 9-19. Right. Foods eaten by juvenile pheasants of Group II, hatched from July 10-24.

a change in nutritional requirement on the part of the bird, or a change in the availability of the food. Whether or not food is available depends of course not only on the season but on the mobility of the bird. Those from one to three weeks of age, and to a lesser degree those of four and five weeks, are dependent upon the food in their immediate surroundings, while birds six weeks and older can travel some distance to a source of supply.

Fig. 2 (a) shows graphically the foods eaten by 55 birds, hatched between June 9 and 19. This figure illustrates in more detail the change from animal to plant food and the date at which this took place. In Fig. 2 (b) appears a similar plot for 48 birds hatching between July 10 and 24. Although Group II has hatched at least three weeks later than I, the picture is somewhat the same. The change from animal to plant food still occurred between the fourth and the sixth week despite the fact that the wheat was combined by July 24 and thus waste wheat became available in quantity to the birds of Group II when they were only three weeks old. It is evident that at this date they were still largely insectivorous, while those of Group I were eating a considerable amount of wheat. It can also be seen that grass and leaves were not taken until the fourth week. Since these are available throughout the summer, this also might indicate a selection determined perhaps by nutritional requirement beginning at four weeks of age.

However, availability of food does play a part in determining what is eaten. For example, at six weeks of age the later-hatched birds ate less grain but considerably more seeds than those of the same age group hatching earlier. This was possibly due to there being less wheat available, but almost certainly because of the increasing supply of ripened seeds in August.

SUMMARY

1. The contents of 251 full crops of juvenile ring-necked pheasants taken on Pelee Island were analysed volumetrically.
2. The young birds were almost wholly insectivorous for the first three weeks; they changed between the fourth and sixth week to a diet consisting mainly of plant food.
3. May-flies of the order Ephemerida formed the bulk of the insect diet, and wheat the bulk of the plant diet.
4. Both preference and availability appear to play a part in the selection of food items.

ACKNOWLEDGMENT

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NOTES AND OBSERVATIONS

The Alaska Fox Sparrow *Passerella iliaca zaboria* Oberholser and Oregon Junco *Junco oreganus oreganus* (Townsend) **in the Caribou Parkland, B.C.** — On May 5, 1954, I collected a female *Junco oreganus oreganus* 10 miles west of Williams Lake, B.C., and on May 14, 1954, a female *Passerella iliaca zaboria* from amongst a large flock of Golden-crowned Sparrows at Williams Lake, B.C.

To my knowledge, no other record of the races mentioned has been published before for this area. — *LEO JOBIN, Kelowna, B.C.*

Interesting records of birds collected in the Peace River Parkland, British Columbia. — Palm Warbler *Dendroica palmarum* (Gmelin).

On May 25, 1954, I collected a mature female of this species while it was feeding on the ground near a small slough at Groundbirch, B.C.

Magnolia Warbler *Dendroica magnolia* (Wilson).

On May 28, 1954, two females were collected near Tupper Creek P.O. and a male was taken eight miles west of Little River P.O. Another pair was observed nesting near a small slough at this same place.

Bay-breasted Warbler *Dendroica castanea* (Wilson).

At Tupper Creek P.O. I noticed a strange birds amongst a large flock of Black-poll Warblers which was feeding in heavy spruce trees. I collected it and identified it as a mature female of the species noted. According to Munro and Cowan, (Review of the Bird Fauna of British Columbia, 1947) one specimen was taken at Charlie Lake in the Peace River Parkland on June 16, 1938.

Black-bellied Plover *Squatarola squatarola* (Linnaeus).

On May 29, 1954, I collected a mature male of this species in full spring plumage near Rolla P.O., and also saw another specimen at the same place. To my knowledge, this would appear to be the first spring record of this species in this part of B.C.

Philadelphia Vireo *Vireo philadelphicus* (Cassin).

On June 5, 1954, I collected two males and one female of this species in a grove of aspen near a small creek eight miles west of Little Prairie P.O. Each bird had a brood patch, and several others of this species were seen or heard in the same locality. To my knowledge, this is the first nesting record of these birds for the Peace River Parkland, as well as the westernmost record for this species.

Black-headed Steller Jay *Cyanocitta stelleri annectens* (Baird).

On June 9, 1954, I collected a male on the bank of the East Pine River, about 40 miles west of Dawson Creek, B.C. Very few birds of this species were observed in the Peace River Parkland, and no record for that area is mentioned in the "Review of the Bird Fauna

of British Columbia" by J. A. Munro and I. McT. Cowan. — *LEO JOBIN, Kelowna, B.C.*

First record of the Dakota Song Sparrow *Melospiza melodia juddi* Bishop **for British Columbia.** — On May 27, 1954, while collecting specimens in the Peace River Parkland, British Columbia, I camped near the south end of Swan Lake, Tupper Creek, Peace River, British Columbia.

In the early morning of May 30, 1954, I heard a bird singing in a patch of tall grass, growing amongst some low bushes, about fifty yards from the lakeshore. This song was unfamiliar to me. After careful watching I saw two very similar birds. I killed both with one shot, but was able to find only one. It proved to be an adult male *Melospiza melodia juddi* Bishop. It would appear that these two birds were mated. The testes of the male collected were fully enlarged. Total length of the bird was 162 millimeters. I have been unable to find any other record for this subspecies in any literature covering the bird fauna of British Columbia. — *LEO JOBIN, Kelowna, B.C.*

Pseudomma affine G. O. Sars: **an addition to the list of the Mysidacea of Eastern Canada.** — A large number of specimens of Mysidacea were collected during July and August, 1952, in the vicinity of the Atlantic Biological Station, St. Andrews, New Brunswick, during a search for parasitic nematodes. Four species were collected, one of which was new to Canada. It was *Pseudomma affine* G. O. Sars. The other species were already recorded by Tattersall (1939).

Five males and one female, from 11 to 12 mm. long, were collected about one mile off Campobello Island, New Brunswick, in 80 to 110 metres of water. The only previous record of this species on this side of the Atlantic Ocean is of a single individual collected at *Fish Hawk* Station 999 (39° 45′ 13″ N.; 71° 30′ W.; i.e. off Martha's Vineyard) in 1881. (Tattersall 1951, page 132). The depth was 484 metres. European records were in depths of 120 to 900 metres. It is not unusual for deep-water forms to be found in lesser depths in the lower Bay of Fundy where tidal mixing brings deep conditions nearer to the surface.

Dr. F. A. Chace, Jr. compared two of our specimens with the one in the United States National Museum and found no significant differences.

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W. L. Klawe,
Atlantic Biological Station, Fisheries Research Board of Canada, St. Andrews, N.B.

Purple Martins. — At our summer cottage near Ottawa we have a 16 compartment martin box which has been used to capacity by Purple Martins, *Progne subis,* for the past several years. As they arrive every year in April we have counted from day to day two pairs coming in first being followed by other pairs until all compartments are occupied. There are apparently a few fights for possession to start with but the colony soon gets settled and breeding starts.

When the young are hatched out, one, two, or three in every compartment, the growing birds cause over-crowding and quite a few of the off-spring seem to be edged out and fall to the ground before they are strong winged. The old birds, their mothers and fathers, sometimes flutter above their fallen chicks but scarcely ever are noticed to ground to give assistance.

Until recently we have endeavoured to save some of these young by placing them on a bush adjacent to the martin box. Their parents were able to service them there better than on the ground.

However, we recently acquired a new idea from one of our visiting guests. A long bamboo pole with a perch fixed to its tip was brought into action. The young bird was placed on the perch to which it clung grimly. The pole was then raised and when the tip was alongside the box the bird flew into the box — BUT — only if its nest was on that side. If it was not on that side the bird would again flutter to the ground and a second raising to the opposite side enabled the bird to find its own home. Many young birds were saved in this fashion.

George C. Gardner,
Ottawa.

The Barred Owl in Alberta. — In the course of our investigations and research on the Great Gray Owl *(Scotiaptex nebulosa nebu-*

losa) in Alberta, further interesting records of the Barred Owl, *Strix varia,* have emerged.

To the best of our knowledge only four previous records for this Barred Owl are known from Alberta. They include a bird collected at Kvass Creek, near Smoky river about 120 miles north of Jasper, on August 9, 1945 by the Twomey-Mellon party. Preble (Auk Vol. 58, pp. 407-408) heard one near Ft. McMurray, May 1934, the basis for Bent's Ft. McMurray record in his volume on the owls of North America. There is a specimen at Cornell University taken at Calgary Feb. 12, 1912. Barnie Hamm of Wembley, in the Peace River country, reports that a neighbor of his shot a Barred Owl in the fall of 1952. Hamm saw the bird and is thoroughly familiar with the owls.

The following records must now be added to the Alberta list.

May 11, 1953

A single feather from the breast of a Barred Owl was found by the senior author in an area of dense muskeg approximately 15 miles north-west of Corbett Creek, which is about 125 miles north-west of Edmonton. Local settlers when interviewed spoke of an owl that frequently emitted weird noises.

December 18, 1953

A dead female Barred Owl was brought to A.F.O. by Indian trapper John S. Jacobs of the Calling Lake area, approximately 140 miles north of Edmonton. The bird had perished in a weasel trap. The mounted specimen is now in my possession.

March 27, 1954

Mr. R. E. Junck of Grosmont, some 100 miles north of Edmonton sent A.F.O. a dead female Barred Owl which was shot by a trapper 20 miles west of the village of Fawcett. The mounted specimen is now in the collection of E. T. Jones of Edmonton.

April 11, 1954

While scanning heavy timber country across the Athabaska river, 30 miles west of the village of Flatbush, approximately 100 miles north of Edmonton, E. T. Jones, William McKay, Dr. E. Höhn and the senior writer observed a Barred Owl in heavy spruce timber along the Akinui Creek. E. T. Jones was able to obtain several feet of colored movie film of this bird.

April 28, 1954

While visiting with Mr. Guy Miller of the Obed Lake area, approximately 155 miles west of Edmonton, the bodies of two dead Barred Owls were seen hanging from the back porch of the cabin. They had been partly skinned in an amateur's attempt at taxidermy. Both skins were secured. The sex of one bird was determined, proving to be a female and is now mounted and in the collection of R. W. Salt of Edmonton. The other bird is now mounted and in possession of Mr. Houle of Edmonton. Both birds were trapped in weasel sets north of Obed Lake.

May 15, 1954

While observing a nest of the Great Gray Owls in an area approximately 45 miles west of Rocky Mountain House, a dead Barred Owl was found not less than 45 feet from the base of the large black poplar tree containing the nest of the Great Gray Owls. The bird was too badly decomposed to determine sex and cause of death was not determined, although circumstances indicate a local trapper.

We continue to receive reports from observant woodsmen, who describe an owl answering to the description of the Barred Owl from many areas throughout northern Alberta. Many have described perfectly the voice of the Barred Owl and we have no reason to doubt, especially on the evidence of what has turned up in the past year, that the Barred Owl enjoys a general distribution throughout the province. We feel that when more competent observers enter the field a nest of this species will unquestionably be discovered for the first time in Alberta. Frequenting heavy timber in remote areas has undoubtedly been the major reason for the fact that the Barred Owl has hitherto almost totally escaped observation and may prove to be a relatively common bird in Alberta.

A. F. Oeming and E. T. Jones,
Edmonton, Alberta.

First records of the American Egret in Alberta. — Two records for the American Egret *(Casmerodius albus egretta)* have emerged for the first time in the province of Alberta during the summer of 1954.

Mr. F. H. Riggall of Claresholm, in southern Alberta, was able to photograph an American Egret first spotted by Mr. Bernard H. B. Smith on May 6, 1954. The bird was wading about a small slough on the edge of the village of Cowley. Mr. Riggall reports that the breeding plumes, so characteristic of this species, were plainly visible. Although the bird had been pestered by

village youths, Mr. Riggall was able to approach within 150 yards of it. A photograph of the bird is now in the possession of the senior author.

On August 23, 1954, an American Egret was seen wading in a side pool of Big Lake (ten miles north of Edmonton) by the senior author. The bird was approached within 130 yards and showed no evidence of breeding plumes, but showed unmistakably all other marks of identification for this species. On August 24, accompanied by Dr. E. O. Hohn, John Matthews and Bud Lucas, the bird was again sighted and corroborated at a distance less than 100 yards. For three succeeding days the bird was sighted by A.F.O. and all attempts to collect the now extremely wary creature were unsuccessful.

On September 1, 1954, Mr. E. T. Jones and A.F.O. flew over Big Lake and Mr. Jones was able to obtain approximately 50 feet of color movie film of this bird.

An extensive re-check of all existing ornithological publications for Alberta, reveals no other records of the American Egret for the province, and so one must assume these two to be Alberta's first authentic records for this species, and an outstanding addition to an ever increasing Alberta check list.

A. F. Oeming and F. H. Riggall,
EDMONTON, Alberta.

REVIEWS

CAP THOMSON'S FISH GAME & NATURE GUIDE TO THE 1,000 ISLANDS *Caribou Press, Bronxville, N.Y. Price 35 cents.*

This attractive information booklet has been rather carefully scrutinized by officers of the Canadian Wildlife Service.

Cap Thomson is "selling" the beauties of the 1,000 Islands, but he is doing it in a pleasing way. The 15 pages of glossy print contain illustrations of the fauna of the region in colour, and in black and white. Line sketches of cones, leaves, etc. of trees indicate the important characteristics of some of the native trees.

A presentation of the geological history of the region should prove most interesting to visitors as well as to local inhabitants. As fishing is an important attraction for many tourists, the two pages of coloured plates of local fish will be most useful. The birds are covered quite concisely. The different species are divided according to their habitat preference thus giving the casual bird-watcher a better idea of what birds he is likely to see in certain locations.

The pertinent reference given at the end of each section should be very helpful. The addition of "Trees of Canada" published by the Dept. of Resources and Development for the section of trees would have been a useful reference.

The booklet is produced for the tourist who enjoys nature, not the scientist, but it has much scientific background. It contains slight inaccuracies which the trained observer will note, but these detract little from its value as a guide to the natural features of this favoured recreational area. Since so many persons visit the 1,000 Islands, the booklet may well be widely circulated and should serve to stimulate interest in "North America Outdoors".

Graham Cooch, *Ottawa.*

Summer Birds of Western Ontario. *By L. L. Snyder. 1953. Transactions of the Royal Canadian Institute, Vol. 30, Part I, pp. 47-95.*

This carefully prepared report summarizes the results of four summer expeditions to parts of western Ontario. Some 170 species of summer birds are listed, three hypothetically, and 95 are shown to breed or to have bred. Annotations are succinct concerning mainly occurrence and distributional details with some comments on voice and behavior.

The author's taxonomic notes are based on the examination of 739 specimens — by far the best collection of birds in existence from that area. Notes on *Parus atricapillus anamesus* Todd and *Setophaga ruticilla tricolora* (Müller) are particularly full. Eastern most distributional cornerposts in Canada for several campestrian forms are demonstrated. The taxonomic comments are *definite* with none of that exasperating vagueness too often encountered as to why specimens are referred to a given race. Many measurements and other data useful to taxonomists also are given. This reviewer noted but one *lapsus:* the Yellow Warbler of the area is referred to the nominate race, *Dendroica petechia petechia.* The author concludes that, "Comparison of specimens collected.... shows that a considerable

number are represented in western Ontario either by races of western distribution or display genetic influence from that direction .... obviously faunal influx or peripheral pressure is from the south and west". This publication well fills a long-felt want. — *W. EARL GODFREY.*

SOCIAL BEHAVIOUR IN ANIMALS WITH SPECIAL REFERENCE TO VERTEBRATES *By N. Tinbergen; xi + 150 pp.; 67 figures and 8 plates; $3.00; Methuen & Co. Ltd. and John Wiley & Sons, Inc., 1953.*

For those who want a readable, non-technical introduction to animal social behaviour, the present volume can be highly recommended. Several excellent books on the subject have appeared within recent years, but for the reader who must limit his purchases to a single volume, Dr. Tinbergen's *Social Behaviour in Animals* appears to be by far the best. It is, in a sense, a general survey of the entire field, despite the fact that the author's main purpose is to treat social behaviour in vertebrates only.

Such a wealth of material is packed in this volume that it is impossible to do justice to the book within the confines of a brief review. In general three main biological problems associated with a study of animal behaviour are discussed: function, causation and evolution. And these are considered from the point of view of mating, fighting, family and group behaviour and the ways in which they are organized in various species, followed by a consideration of the evolutionary aspects of social organization.

The material presented in the book is the result of thousands of observations carried on by a host of competent biologists observing wild animals in their natural environment. In the past behaviour studies were carried on in the laboratory or observations made on captive animals. It is only since scientists have moved from the laboratory into the field that many forms of behaviour have acquired any meaning. Among those who have been engaged in ethological studies are, Dr. N. Tinbergen, author of the present volume, Konrad Lorenz, David Lack, Fraser Darling and F. B. Sumner, to mention only a few.

Were it not for these field studies, it is doubtful that we would understand many of the forms of behaviour which we observe in free-living organisms. Among these might be mentioned the red spot on the lower mandible of the herring gull and its relationship to the feeding of the young, or the vertical posturing of the male stickleback in the presence of a rival male. The elaborate courtship behaviour exhibited by many birds, fishes and insects would appear superfluous if we did not realize that the female requires persuasion and the male's tendency to fight all other individuals must be overcome. We should wonder why the male robin permits other species of birds to enter his territory except those with red in their plumage. Many types of behaviour would appear ridiculous and meaningless, such as the grass-pulling of herring gulls in the presence of a rival, if we are not aware that it is a form of threat behaviour. The vigorous singing of a male bird following a fight with a rival has struck many observers as absurd until the animal sociologists discovered its true significance. As the result of their studies, too, we now know that individual birds recognize members of their own flock as "personalities" not merely as members of the same species. Sex recognition among flickers is based on the presence or absence of the moustache; a female who had been provided with an artificial moustache was treated as a male even by her mate! Numerous examples of this kind are treated in the book.

The last chapter, entitled "Hints for Research in Animal Sociology" is perhaps the most interesting section of all. Here the author suggests how both professional as well as amateur naturalists can make valuable contributions to this fascinating field. He outlines, in a general way, how behaviour studies can be undertaken, what pitfalls to avoid and how to interpret the results. He also suggests literature that might be consulted and periodicals where original papers on the subject are published.

It is to be hoped that Dr. Tinbergen will reward us, in the near future, with another book as delightful and as stimulating as the present volume.

AUSTIN W. CAMERON.

THE DANCING BEES, an account of the life and senses of the honey bee. *By Karl von Frisch. xiv + 183 pp., 61 text figs., + XXX plates. Methuen & Co. Ltd., London. 1954. ($3.75). [English translation by Dr. Dora Ilse of AUS DEM LEBEN DER BIENEN. 5th, revised, edition published by Springer Verlag (Berlin — Göttingen — Heidelberg) in 1953].*

The English translation of this German work by von Frisch, is written in a simple but fascinating style which makes for pleasant reading, and easy understanding of the elaborate experiments made by this long-life observer of bees. His experiments led to remarkable discoveries on the "language" of bees. This peculiar language he explains in a most detailed fashion, with the addition of illustrations, in the longest and most important of the 16 chapters, which constitute the book. In order to understand this universal and "wordless" language, one should know something of the life, senses, mental capacities and behaviour of bees in comparison with other social insects.

In various chapters of the book, reference is made to the manner in which the honey bee originally lived in nature, the size and components of a colony, the division of labour, and the feeding habits of bees. The compound eye of a bee is explained by comparison with the human eye. The smell and taste are demonstrated by experiments, and tests are described which prove that, in vision, the honey bee discriminates only 4 colours: yellow, blue-green, blue and ultra-violet.

As means of communication with their pollen and nectar collecting sister workers, honey bees perform in the hive a "round dance" and a "wagging dance". The round dance consists of a series of whirlings describing semi-circles in right and left hand directions. This dance tells the companion workers the neighbourhood of the food supply. The wagging dance is performed by whirling in a semi-circle, tracing a waving (or wagging) line to the starting point, and whirling in the opposite direction, to make altogether the pattern of 2 semi-circles united by a wagging line. The direction of the wagging line tells the other bees the position of the rich source of food which is expressed as the angle formed between this line and a line to the position of the sun. The distance of the food supply is expressed by the number of waggings in a given time, this number being greater when the distance is reduced, and smaller when the distance is increased. The kind of flower visited is determined by the smell carried by the collector bee. A similar dance is performed by the scouts in the swarm cluster to indicate a suitable location for the new colony.

It is a recognized fact that the honey bee, as well as other bees and many other insects, are important agents in the pollination of flowers and, thus, contribute to the abundance and quality of fruits. Tests have also proved that, towards the end of the season, when the yield of nectar from other crops is greatly reduced, bees may be enticed to "dance" for the collection of pollen and nectar on thistle, in order to increase their winter supply. There is also evidence that bees can be trained to collect from clover, for the increase of the seed production.

Among other insects which live in colonies are listed the bumblebees, other bees, wasps, ants and termites. None of these, however, have reached the degree of perfection of the social life existing in the honey bee. In spite of their dwellings, associations, ability, and powerful defence, honey bees have numerous and dangerous enemies, and these are briefly described in the work at hand.

New information on the habits of the honey bee is constantly coming to hand. Von Frisch tells us that queen bees mate only once in their youth, but very recently, bee experts have demonstrated that the queen may mate several times on her first or subsequent flights prior to egg-laying.

A few errors in printing and editing have been noted, among the most important of which are the interchange of plates XIII and XIV in the text, and the omission of explanation of figures 50 to 61 in the list of the text illustrations.

Everyone interested in raising honey bees for the rich product they supply, the pleasure they bring to the beekeeper, or for the pollination of fruit trees, other trees or various agricultural plants, would be well advised to read this book which explains, in a simple manner, many facts formerly unknown or erroneously interpreted.

Robert Lambert,
Entomology Division,
Department of Agriculture,
Ottawa, Ontario.

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The CANADIAN FIELD-NATURALIST

75th ANNIVERSARY ISSUE

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THE RELATION OF MAN TO NATURE THROUGH THE AGES[1]

T. F. McIlwraith

Professor of Anthropology, University of Toronto

An address delivered at the 75th Anniversary Dinner of the Ottawa Field-Naturalists' Club

AN anniversary is a suitable time to look both backward and forward. I congratulate the Ottawa Field-Naturalists' Club on marking their 75th birthday by this gathering, and I regard it as a very great compliment that I have been asked to be the guest speaker.

I have naturally chosen an anthropological subject, but one which, I hope, is in keeping with the historical thought which pertains to an anniversary, and one which I feel to be of major importance at the present time. We are all apt to forget that our life depends upon the earth, the water, and the living organisms of our world; in this machine age we naturally think of our increasing ability to control our environment, but we must never forget that we are still part of it.

My subject is man's relationship to nature, from before the dawn of history until today. I feel that it can be divided into three main chapters:

Man the Defender
Man the Attacker
Man the Controller

Man the Defender

In the Upper Palaeolithic Age, preceding the last advance of the glacial ice, man lived in southern Europe, western Asia, and parts of Africa. By means of archaeology we are able to reconstruct much of his life. We know that he was a hunter from the broken bones of deer, bison and other mammals that served for food; we know his tools, crude unpolished stone knives and points. We know many of the things which he lacked; he had no metal, no pottery, no weaving, no bow and arrow, no system of writing. Still relying on evidence from archaeology, we may infer that the population was sparse and that the social units were small, probably little more than family groups.

Yet man survived with these miserably poor tools. His world was a hard one, perhaps an increasingly hard one with the advance of the last ice sheet. He lived as a neighbour of the wolf, the bear, the mammoth, the bison, and other mammals, first in a warm climate and later in a cold period. With his tools he could not cut down a single tree—his life was controlled by his environment. He was the hunted rather than the hunter, relying largely upon wild roots and plants and smaller game animals. Life must have been a struggle, in the same sense that it is today for any weak carnivorous mammal that is constantly seeking its own food as it strives to escape becoming the food of predators stronger than itself. I have used the term "defender" in this period to emphasize the weakness of man in relationship to other forms of life.

The important point is that man survived. Perhaps the very perils of his existence stimulated his ingenuity. It was at this period that man became a tool-using creature, wherein he differs from all other animals. Since that time he has increased the number and complexity of his tools, but the initial step, the fabrication of stone or wood to make a tool with which he could supplement his bodily strength, belongs to this period. Two other basic elements of all human culture likewise go back to the Palaeolithic Age, namely, fire and religion. Fire helped man protect himself; religion undoubtedly gave him inward strength. While still a weakling in a strong world, man had developed the elements of greatness.

Man the Attacker

Very slowly man developed new and better tools, and with these he was able to attack his environment. After the retreat of the

1) Received for publication January 19, 1956.

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last ice sheet, when the climate in Europe and western Asia grew rapidly warmer, human civilization in Eurasia changed significantly. Although tools were still of stone, man had learned to polish them, and to make axes with which it was possible to cut down trees, and to make wooden utensils of different kinds. Wood and stone were becoming increasingly effective human servants. The bow and arrow gave him a relatively effective weapon for hunting, and in the manufacture of pottery man brought the inorganic element of clay to his service.

It was at this period, the Neolithic Age, that man first conquered — and I use the term advisedly — various plants. He learned to cultivate barley, rye, and, in Palestine, emmer, a simple form of wheat. No longer was man exclusively a wanderer. His crops provided a reliable source of food, but, more than that, they began to dominate his life. Social co-operation was needed in the clearing of land and the planting and harvesting of cereals. Population increased, and with it social co-operation on a larger scale became possible. Not only were domesticated plants valuable for food, but from flax came materials necessary for weaving; a new era in clothing manufacture had begun.

It may have been slightly before the Neolithic Age that man began to spread around the world. He crossed Bering Strait to America; he reached the farthest islands of the South Pacific; indeed the Antarctic alone remained unpopulated. It must not be thought that this movement took place within a few years. It was a slow spread, similar to the gradual extension of range of a plant or an insect and, likewise, influenced by climatic and geographical factors. And of course there was no uniformity either in the rate of spread, or in the addition of new skills. In Europe, for example, man learnt to master the inorganic elements of tin, lead and even iron several thousand years ago, whereas stone was the basic material in most of North America until the time of Columbus, and in the interior of New Guinea until World War II. If, however, we use stone polishing as the criterion of the Neolithic Age, we owe to the nameless farmers of that period every one of our modern crops. Corn, potatoes, tomatoes, peanuts, and manioc in the New World; rice, yams, taro, and sugarcane in Asia and the South Pacific; dates and figs in the Mediterranean basin; various fruits and vegetables in Persia and in Southeastern Asia — all had been brought to the service of man before records in writing were available. Our modern developments in agriculture have improved existing crops, but have not added a single species to those won from nature by our prehistoric ancestors. Not only did they cultivate these basic food crops, but in tobacco, tea, and coconuts they provided non-essentials which contributed to the pleasures of life.

As man gained mastery over plants, so likewise did his constant attack upon animals bear surprising results. It was in the Neolithic Age that man tamed the dog, the sheep, the pig, the cow and the horse. We will never know how the first domestication took place; perhaps some hunter brought home cubs or kittens as pets for his children, or perhaps it was a dog that attached itself to a hunter. Such incidents must have happened time after time, but in some way animals began to breed in captivity, controlled by man. I have mentioned only the mammals that belonged to the Eurasiatic-North African area; but elsewhere in the Neolithic Age man domesticated the elephant, the camel, the yak, the water buffalo, the donkey, as well as various species of chickens and ducks and the New World turkey. From among the insects, the silkworm and the bee were drawn into human service.

As with plants, the domestication of animals did not occur at one time or in one place. We of today owe to these Neolithic hunters the beginnings of domestication, in fact no animal has been added to the list since the dawn of history. The modern breeder has improved and modified strains, but he has not added a single species to the total of those domesticated before history began.

The process of domestication had far-reaching effects both upon man and the animals themselves. Generations of living under unnatural biological conditions has turned the cow into a creature which can give abnormally large quantities of milk; the hen into an egg-laying machine of amazing productivity, and the horse into varied specialized types suited to the race course or the plough. Still more modified has been the dog. The peculiar conditions of domestication have produced the asthmatic bulldog, the almost hairless chihuahua, and the poodle with excess hair hanging over its eyes. If the ancestors of any of these animals, the wild cow, the jungle fowl, the desert stallion, the wolf or

the fox, could look at the biologically distorted animals of today, one might imagine them saying that their descendents had been contaminated by too long and too close an association with mankind.

As man has modified animals by domestication, so, too, have the domesticated animals affected human culture. Not only has man had a stable food supply, but he has utilized the ox for pulling the plough, the horse and the camel as beasts of burden and for riding, and the sheep and the silkworm as producers of materials for clothing. Truly, man's way of life has been profoundly modified by his domesticated animals. In fact, they have frequently become his masters. The farmer of today may "own" a cow, but this ownership compels him to milk his animal twice daily throughout the year. We may speak of the cow as the servant of man, but we forget that frequently man is the slave of the cow.

If one thinks of the relationship of man to animals in the broadest perspective as a struggle, it may serve to explain some of the attitudes towards animals found widely in many parts of the world. Sometimes there has been absolute veneration, as shown in the animal cults of Egypt, of India, or of Mexico. Although animal deities are relatively rare throughout the world, an attitude of respect is very widely held — the commonest examples being the practice of totemism, and the supernatural strength of animals, shown so commonly in myth and legend. Surely such attitudes owe their beginnings to the varied powers possessed by animals, powers which impressed man as an attacker. But once man had conquered, often-times he displayed his ruthlessness. "Woe to the vanquished" was shown to human prisoners, and likewise man exulted in his triumph over mammals and showed himself callous to their sufferings. The bullfight, the combats of fighting cocks, bear baiting and the kicking of hedgehogs or badgers are practices well known in European history. Perhaps the confinement of parrots, or the zoological gardens of the last century, are relics of the same attitude of control. So too is the cruelty shown by the modern Eskimo to the wounded seal, or the wholesale slaughter of antelopes by some African tribes. Veneration and cruelty are not incompatible if viewed in the perspective of an age-long struggle.

Man has many sides to his character. The ruthlessness of the conqueror gives place to the concepts of charity and of kindness. Tolerance and forbearance were among the precepts of Jesus, and later of St. Francis of Assisi. Today the sentiments of protection and charity are shown in the growth of the Humane Society, the Audubon Society, and in legislation for the protection of animals. Man, as conqueror, has begun to feel ethical responsibilities.

We have come a long way from the Palaeolithic hunter defending himself against stronger animals with the aid of fire and of crude tools; or even of his Neolithic descendants boldly attacking nature with their puny axes and arrows. Today we have subjugated most animals and plants, and even the inorganic world of metallic ores and clays are made by man into tools to further his conquest of the world of which he and they are part.

Man the Controller

We can now look to the future. With modern machinery it is possible to change the course of rivers, to clear forests, to destroy whole species of animals. It goes without saying that we have not used our powers wisely. The clearing of the forests from the mountains of Greece, to build vessels of war, led to erosion and the decline of what was once a rich agricultural area. Such too is the history of Asia Minor, but perhaps we forget the more modern examples of the dust-bowl of Oklahoma, the drying up of parts of southern Saskatchewan and, indeed, the sweeping away of far too much of the fertile topsoil of southern Ontario.

I do not think it is an exaggeration to say that with our increasing capacities for destruction — and we are on the threshold of the use of nuclear power, there is a far greater responsibility upon our generation than upon any that has gone before. We have profited from the attainments of unknown Neolithic hunters and farmers; we have the power to continue and improve upon their work. Have we the wisdom to do so? Time alone will tell, but truly it is an obligation upon all of us, and particularly on those who enjoy the out-of-doors, to realize our responsibility and to plan for the future, so that our children and grandchildren will be enabled to enjoy some of the trees, the plants and wild life which are part of the world in which we have our being. Indeed we must learn to live with other forms of life or perish, victims of our own powers of destruction.

PRESIDENTS OF THE OTTAWA FIELD-NATURALISTS' CLUB

Inaugural, March 19, 1879 Lt. Col. Wm. White
1880-1883 James Fletcher
1883-1885 Dr. H. Beaumont Small
1885-1886 W. H. Harrington
1886-1887 James Macoun
1887-1889 R. B. Whyte
1889-1892 R. W. Ells
1892-1895 Geo. M. Dawson
1895-1897 Dr. F. T. Shutt
1897-1899 Prof. E. E. Prince
1899-1901 Dr. H. M. Ami
1901-1903 Robert Bell
1903-1905 W. T. Macoun
1905-1906 S. B. Sinclair
1906-1908 W. J. Wilson
1908-1910 A. E. Attwood
1910-1911 Andrew Halkett
1911-1912 Alexander McNeill
1912-1914 L. H. Newman
1914-1916 Arthur Gibson
1916-1918 Harlan I. Smith
1918-1919 C. Gordon Hewitt
1919-1920 M. Y. Williams
1920-1922 R. M. Anderson
1922-April, 1925 Hoyes Lloyd
April 1925-December 1925 G. A. Miller
1925-1927 Norman Criddle
1927-1928 Dr. E. M. Kindle
1928-1929 E. F. G. White
1929-1931 Dr. Harrison F. Lewis
1931-1933 C. M. Sternberg
1933-1935 Dr. M. E. Wilson
1935-1937 Herbert Groh
1937-1938 P. A. Taverner
1938-1940 A. E. Porsild
1940-1942 H. G. Crawford
1942-1944 Douglas Leechman
1944-1946 Rev. F. E. Banim
1946-1948 W. H. Lanceley
1948-1950 Dr. Pauline Snure
1950-1952 Dr. J. W. Groves
1952-1954 Rowley Frith
1954- W. K. W. Baldwin

"LET US NOW PRAISE FAMOUS MEN" [1]

HERBERT GROH
Ottawa, Ontario

IN 75 years an institution like the Ottawa Field-Naturalists' Club is bound to have gathered about it some history. Those who were with it from the first have passed on, although it was not until as lately as 1949 that Dr. Small, the last of the founding group, was lost to us. At least three close links with those founders remain in the persons of Dr. Gibson, Mr. White and Mr. Attwood. While two of these are no longer in Ottawa, and are now in impaired health, it would be an inspiration to us of the present if we could have a message from them out of the past.

My own membership began just before the first break by death in the original ranks. James Fletcher who had been a prime moving spirit among those early enthusiasts, was the first to go. This was on November 8, 1908, a few months after he had enticed me to come to his slender staff. He had met me the year before as a Senior at Guelph when I approached him regarding a weed, *Eruca sativa*, which just then was making its appearance widely across Canada. His request that I record my observations in the Ottawa Naturalist was thus my initiation into Club activities.

Through the years Dr. Fletcher had contributed much of the dynamic behind the Club's amazing progress. Although my association with him was so brief I had already learned to appreciate his sterling qualities. His stature as an inspiring leader is preserved to us in a memorial issue of the Naturalist for January, 1909, in which are addresses by representative members delivered at a gathering in his memory. A fountain, the work of his sculptor friend, Tait McKenzie, also stands at the Experimental Farm.

My own tribute may well have reference to his kindly welcome on my arrival, his introductions all around and his concern to get me comfortably settled in a city then disturbingly strange to me. My first meal was with the Fletchers in their home on the Farm still standing alongside the Chemistry Laboratory. My first Saturday afternoon was spent, by invitation, with W. Hague Harrington, a fellow officer of the club, and himself in cruising about Dow's Lake. They were in search of aquatic life, some of it, like wild rice, previously "planted" there by themselves. My presence could have been in no way essential but was purely in the line of their generous thoughtfulness. Mr. Harrington was a senior official in the Post Office Department, a founder and fourth Club President, and had Entomology as his absorbing interest.

Dr. H. Beaumont Small, already named above, reached the advanced age of 94, had been a prominent physician and the third President. As late as 1936 he showed his continuing interest in the Club by appearing at a meeting in the Carnegie Library lecture room at which I was the speaker, and joined in the discussion following. Earlier, on the occasion of the fiftieth anniversary of the Club's founding, when eleven surviving members of that period were invited as dinner guests, he was one of two to be there.

Not by death, but by departure before my time, one member of the original Committee, Joseph Martin, had left a place vacant. He reached eventually a seat for East St. Pancras in the British House of Commons.

The first President for one year before Dr. Fletcher held the post for three years was Lt.-Col. William White. I remember him in advanced years, and his sons George R. and E.F.G. White, both keen observers and collectors of birds, particularly waterfowl. George was a member of Council at the time of his death in 1927, and his brother also until, for health reasons, he removed to the Pacific Coast. When the Club observed its fiftieth birthday the latter was drafted for a year as President in recognition of his father's first incumbency.

Hoyes Lloyd has reported once asking George White how boys so long ago became interested in natural history and was told "We had a good father". Apropos to this, it was at a Council meeting in the White home that I once proposed some provision for the encouragement of such junior naturalists. Years afterwards "Bill" Baldwin, a product of such encouragement elsewhere, made a similar proposal and, what is more, did something about it — witness the Macoun Field Club of today.

1) Received for publication November 15, 1954.

The Macoun Club was named in honour of Prof. John Macoun the fifth President of the senior body who, with his sons, James M. and William T., were another notable trio. James was a botanist along with his father and a former Editor of the Naturalist. William was a Treasurer and then President, 1903 to 1905. While I was yet new in Ottawa and so soon bereft of Dr. Fletcher's guidance in botany I had much occasion to impose on the good nature of Professor and James Macoun in their offices in the old Geological Survey building on Sussex Street. In summer both were away on field survey, but in winter I would find them immersed in work on their specimens. The Professor was giving a set time each day to bringing to near completion a Flora of the Ottawa District, enlarging upon Fletcher's Flora Ottawaensis which had run through early issues of the Club publication. He enlisted my help to provide citations from the collections in our custody at the Farm. This monumental work, alas, is still unpublished.

I came to know all three Macouns in Council meetings and in the old Botanical Branch of the Club which gathered regularly in the homes of members. At the latter, particularly, the Professor contributed zest to the discussions. He was positive in his opinions and in his expression of them. He had a faculty, being Irish I suppose, for finding his way to the contrary side of any issue.

Macoun and Fletcher, I understood, had always been somewhat opposites. They were unlike temperamentally, and may have felt a certain rivalry through their parallel roles in botany within one city. Both were naturalists of the old school and knew full well the forte for which they were equipped. As Macoun expressed it in his eulogy of Fletcher later, "he was a naturalist of the school of Gilbert White of Selborne"; and in his dogmatic fashion he added, "the last we were likely to see as the modern atmosphere was fatal to the growth of this devoted all-round type". Of course we younger workers have our merits too; but if he seemed at times to disparage these he certainly did not hold himself aloof. It seemed a pleasure to him, and others like him, to impart to a disciple the experience and contagious enthusiasms they possessed. I well recall being taken down river some distance to see the type localities of some of the new violets offered to science by the Macouns.

R.B. Whyte, the first Secretary of the new society and its sixth President, continued still as one of its most earnest members and Councillors down to my time. He worked closely with Fletcher in botany and horticulture, which fascinated both. He had large business interests which continue under the firm name of James G. Whyte & Son (he being the son) to the fourth generation now. These cares were not however allowed to monopolize his time. Ottawa and provincial horticultural organizations received his counsel and honoured him with office. One of his later contributions was through a district Boys' Potato Growing Contest. He was the originator of the well-known Herbert raspberry. At one of the Botanical Branch sessions held at his home, in November 1909, we were so absorbed in his experiments with seedling gooseberries that little else was discussed. I am not aware that these repeated for him the success of his famous raspberry.

A colourful figure among the fathers of the Club was Dr. H.M. Ami, President in 1899-1901. He had been on the Geological Survey staff but when I knew him was working independently, having private means. He conducted expeditions to southern France in exploration of cave remains of early man. In his last years he set up an exhibit of his finds in an up-town building to which I was invited to come but had failed to do so at the time of his death.

Several other of the early Presidents became known to me but others I never met. Ells, Bell and Dawson, and probably Sinclair, I must have known only by reputation. Prof. E. E. Prince and W. J. Wilson I remember in Council meetings. Dr. F.T. Shutt, presiding in 1895-1897, was better known to me at the Experimental Farm than through any further part in Club activities. W.D. Le Sueur, W.R. Billings and W.P. Anderson of the original officers were living but I have no recollection of them except that Le Sueur was one of those that I must have heard at the Fletcher memorial gathering. Lt.-Col. White, as first President, was again in the Chair for this meeting.

A long-time member who was on the Council was Dr. Mark G. McElhinney. Older members will recall his familiar advertisement in the Naturalist as, "Dentist to certain of the Cognoscenti", by which was meant, I believe, Vice-Royalty among others. He was a motorboat enthusiast on the Rideau, his last vessel being so fitted out with every convenience

that he lived in it often the year round. One of his delights was to take a party of Field-Naturalists aboard for a trip to Black Rapids. At the age of 71, while occupying his house-boat on Dow's Lake, along with his brother, he was found drowned nearby.

A.G. Kingston, Treasurer about 1890-1896, from the beginning an active leader in Ornithology, was an officer in the Public Works Department with over 60 years' service at retirement. He served on the Council until his death in 1934, and was long one of the auditors. He was esteemed for his constant and unassuming helpfulness.

Not of the original coterie but by some ten years antedating me was Arthur Gibson with whom I was teamed under Dr. Fletcher, and with whom I shared duties until our new Chiefs arrived late in the next year. Until this separation of Entomology and Botany, Fletcher had attended also to anything coming up in the fields of forage crops, fibre, bees and bacteriology, all now under separate heads.

Gibson, while carrying his share of the above load, was Treasurer of the Club for some years until that office was turned over to me to release him for duty as Editor of the Naturalist. He later succeeded Dr. C. Gordon Hewitt as head of Entomology and after retirement still did a good stint of writing. In the Club he served a term as President and until recently remained on the Reserve Fund Committee. Having removed from Ottawa he is not as well known to recent members as he should be.

Fletcher's earlier assistant, J.A. Guignard, had also been active in the Club, for a brief period as Editor of the publication. He was an elderly Swiss gentleman who departed, to my regret, before I could make his acquaintance.

The officers during my first year in Ottawa were already a stage removed from pioneer days but include names which are already becoming memories. As President, A.E. Attwood, Principal of Osgoode St. School, did the honours acceptably. He still lives here, long retired but with an active mind keeping check of what goes on. His Vice-President, Andrew Halkett, stepped up when the time came but for one year only. He was a capable and conscientious student of Ichthyology, but less at ease in the Chair. We have had few more earnest leaders on excursions. I have seen him trailing along when so frail that he had to be assisted.

The Second Vice-President was Rev. G. Eifrig, Lutheran Minister and, in his time, one also of our leading authorities on the Ottawa birds. I well remember an excursion to Beaver Meadows which was then bordered by stately trees where now are dwellings. One of the discoveries of the day was a hawk's nest of special interest to him far aloft in a tree, presumably with eggs. He drew me aside to ask if I would come back with him another day. This I did, climbing the tree for him and securing the coveted clutch of eggs — about the only birdsnesting I ever did before or since. Lutheran colleges in the United States claimed his services, and his death has been reported recently.

The Secretary for 1909 was T. E. Clarke, a teacher who later went to London Normal School. He was succeeded by John J. Carter, also a teacher; and I became Treasurer for one year. Our association, begun here, was continued in other congenial ways more or less through life. He died in 1950 at the age of 76.

At that time the Club boasted a Librarian and something of a library. The office was held by Chas. H. Young, an Entomologist of rare skill in the collecting, rearing and mounting of microlepidoptera. After 1906 he worked closely with Macoun in collecting and preparing zoological and other specimens. Deafness was a handicap to social intercourse but it did not spoil his humour and cheerfulness among friends.

The Committee (not yet known as Council), consisted at the time of J.M. Macoun; Alex McNeil, Chief of the Fruit Division; E.E. Lemieux; L.H. Newman, Secretary, Canadian Seed Growers' Association, later Cereal Husbandman at the Farm and now retired to his own farm; H.H. Pitts and three ladies, the Misses A. Jackson, E.E. Curry and M.B. Williams. Several of these I scarcely knew personally but Newman had been with me in college and McNeil I soon came to hold in high regard. Miss Williams, at that time in the National Parks Branch, was a charming writer and is reported still active in London, Ont.

James Macoun, retiring as Editor about this time, had a distinguished corps of Associate Editors, i.e. Dr. H.M. Ami, Geology; Dr. J.F. Whiteaves, Palaeontology; Dr. James Fletcher, Botany and Nature Study; Hon. F.R. Latchford, Conchology; Mr. W. H. Harrington, Entomology; Rev. G. Eifrig, Ornithology; Prof. E.E. Prince, Zoology; Dr.

Otto Klotz, Meteorology. Since Dr. Klotz, then Dominion Astronomer, there appears to have been but little emphasis on matters astronomical.

A sidelight on the membership of the time is shed by letters received by me as 1910 Treasurer. Included are those of Hon. Sydney A. Fisher, as the Minister of Agriculture my ultimate Chief; Hon. Chas. Fitzpatrick, Cabinet Minister and later Lieutenant-Governor of Quebec; George Harcourt, Deputy Minister of Agriculture, Alberta; Hon. F.R. Latchford, Chief Justice, Ontario Supreme Court; Dr. James W. Robertson, distinguished pioneer in many agricultural, educational and other movements; Dr. E.M. Walker, Toronto naturalist, still active; J.W. Gibson, educationist of Ottawa and Victoria, B.C., and father of the present Dean of Arts in Carleton College; Dr. John Brittain, Prof. of Nature Study, Macdonald College and father of the Principal of that College now; Chas. W. Nash, Biologist of the old Provincial Museum, Toronto; Dr. Lawrence M. Lambe, Geological Survey, Ottawa; Dr. M.O. Malte, then recently from Sweden and after a move or two becoming Botanist of the National Museum; T.N. Willing, a pioneer in the West in my own field of weed investigation; E.P. Venables, a valued correspondent in the West of Dr. Fletcher, as was also F.H. Wolley-Dod; James Murray, Superintendent, Brandon Experimental Farm; Chas. Macnamara, a keen naturalist at Arnprior; Rev. W.A. McIlroy, Minister, Stewarton Church, Ottawa; T.W.E. Sowter, local naturalist; and others including such as have figured already in this account.

One is tempted at times to envy the drawing power of the Club in those days, forgetting that names now accepted as a matter of course may be glamorous too for the members of another generation. There has never been, nor is there now, any lack of good executive and field leadership. Then, as now, some names may have been chiefly window-dressing, but they probably did represent real interest and good will.

I have by no means exhausted my subject, however much I may have wearied my readers. It only remains to be shown yet why I, and not some others, should have assumed to chronicle a period as much theirs as mine. Could it be for this reason: the term of my Presidency, 1936-1937, in one respect at least marked the end of an era?

In the past there had been in the Club a degree of social conformity somewhat slipping now. Many members had been in the staid old Arts and Letters Club, where public meetings were held with officers in formal dress. This was also true here up to my time, and I confess that my immediate predecessor, Dr. Morley Wilson, in that regalia looked the part. When it came my turn thus to appear at an annual meeting I had qualms, but my Mentor in the matter was adamant; it could not be otherwise. So for the first time in his life this "rube" donned the "duds" — and lived through it. The thing that has continued to rankle in my mind is the thought that I was the last President thus to conform. True, under the patronage and presence of Vice-Royalty dress is still imperative. It was my fate to undergo this ordeal too, tails and all when, in my second year, together with the Secretary, Miss Peggy Whitehurst, Lord Tweedsmuir had to be met at the door and engaged in conversation until the lecture commenced. With the help of his kindly understanding it passed off pleasantly enough. My earlier initiation undoubtedly helped too. Nonetheless I could have coveted the distinction which remained to my successor, P.A. Taverner, of being the instrument to end the era of formal finery at annual meetings.

75th ANNIVERSARY
OTTAWA FIELD-NATURALISTS' CLUB

THE SEVENTY-FIFTH ANNIVERSARY of the Ottawa Field-Naturalists' Club was celebrated during 1955 with a number of special events.

The chief event was a banquet held on November 8, 1955 at the Assembly Hall, Lansdowne Park, Ottawa and attended by over 100 members and friends of the Club. A splendid address, "The relation of man to nature through the ages", was delivered by Professor T. F. McIlwraith, Head of the Department of Anthropology of the University of Toronto. This is reproduced elsewhere in this issue of the Canadian Field-Naturalist.

Honorary memberships in the Club were conferred on Dr. Alice Wilson and Mr. Herbert Groh.

Murphy-Gamble's Department store put one of their display windows at the disposal of the Club for the period from November 1st to 6th. There, an excellent display, in the main ornithological, was made. There were also many exhibits on the ground floor of the store.

The Newsletter, organ of the local membership, gave considerable space to the Anniversary. All the newspapers of the Capital area and the Canadian Press were given material concerning the Club and its activities. The newspapers were most generous of space, and the public of Ottawa was given several excellent accounts of the Club and its work.

The arrangements for the celebration of the 75th Anniversary were made by a Special Committee under the Chairmanship of Rev. Father F. E. Banim.

BIBLIOGRAPHIC SURVEY OF JAMES FLETCHER'S FLORA OTTAWAENSIS [1, 2]

B. BOIVIN *and* W. J. CODY
Botany and Plant Pathology Division,
Department of Agriculture, Ottawa, Canada.

THREE ENUMERATIONS of the vascular plants of the Ottawa District have been published in the past, in 1867, 1880, and 1888-93 respectively. The first was presumably prepared by B. Billings and appeared as the liminary paper of the Transactions of the Ottawa Natural History Society, **1**: 1-16. 1867 (?) under the title "List of Plants Collected by Mr. B. Billings in the vicinity of the City of Ottawa, during the summer of 1866". It is a mere listing of plants with dates of collection but without localities or habitats. A few additions made in 1867 are listed at the end. There is some doubt as to the exact date of publication of Billing's list.

The second and third enumerations were published in parts by James Fletcher over a period of 14 years. A detailed bibliography of these papers is given below.

A fourth enumeration was undertaken by John Macoun, but was not published. The manuscript, which is preserved at the National Museum of Canada, is in Macoun's handwriting. It is complete from *Actaea* to *Isoetes*, and lists 1126 taxa for the Ottawa District. The author mentions in each case whether the plant occurs on the Quebec or Ontario side of the river, or both. The manuscript is 45 pages long and is entitled "List of Ottawa Plants".

The manuscript enumeration left by Macoun was the basis for successive revisions by M.O. Malte. The last and most complete of these redrafts is a fat manuscript of about 671 pages, some of which are missing. It is largely typewritten and is entitled "The Ottawa Flora". This last text includes extensive keys, descriptions, synonomy, local distribution and numerous references to individual collections.

James Fletcher [3], the author of the second and third enumerations, was born in 1852 and was one of the founders of the Ottawa Field-Naturalists' Club. Prior to the organization of the Dominion Experimental Farms he acted as Dominion Entomologist to the Department of Agriculture, a title conferred on him in 1884. On July 1, 1887, he was appointed Entomologist and Botanist to the Dominion Experimental Farms and was transferred from the Library of Parliament to the Staff of the Farms, and up to the spring of 1895, he had charge of the Arboretum and Botanic Garden at the Central Experimental Farm.

It is during that period of time that, under the collective title of "Flora Ottawaensis" and its variants, James Fletcher published some 29 articles on the flora of the Ottawa District, comprising two successive enumerations of the vascular plants and Sphagna of the area plus miscellaneous notes and additions.

Unfortunately many of these papers are affected by bibliographic irregularities. The paging of one of these papers was incorrect (see entry number 21) [4], three were reprinted with a change of paging and quite a few

1) Received for publication February 16, 1954.
2) Contribution No. 1374 from the Botany and Plant Pathology Division, Science Service, Department of Agriculture, Ottawa, Ontario, Canada.

3) See James Fletcher Memorial Number, Ott. Nat. 22: 189-234. 1909.

others were issued with a separate paging as a supplement to the Ottawa Naturalist. For convenience we have numbered these papers in sequence as published. No such numbers appear on the originals.

Many of the papers listed below were published without clear indication of authorship. In the absence of any evidence to the contrary, we have assumed that all were prepared by James Fletcher, except entries 10 and 24. The latter two include some mosses and we have assumed that these lists of bryophytes were prepared by John Macoun. Names of presumed authors have been set off in [square brackets] in the following enumeration.

1—Fletcher, James, FLORA OTTWAENSIS, Ott. Field-Nat. Club, Trans. 1 (vol. 1 no. 1); 43-61. 1880. An enumeration of all the vascular plants of the Ottawa District; total 800 entities, a few unnamed. No comments or localities. The names in italics appear to indicate introduced plants. The Candollean order is apparently followed. This is the first edition of the Flora Ottawaensis.

2—[Fletcher, James], FLORA OTTAWAENSIS. ADDITIONS TO LIST OF 1879-1880, Ott. Field-Nat. Club, Trans. 2 (vol. 1, no. 2): 41. 1881. A list of additions to the previous list (entry no. 1) without annotations or localities.

3—[Fletcher, James], ERRATA — FLORA OTTAWAENSIS, Page 41, Ott. Field-Nat. Club, Trans. 2 (vol. 1, no. 2): 41, 1881. This consists of a half-page of corrections pasted in opposite page 41. The errata refer to entry no. 2.

4—[Fletcher, James], APPENDIX. FLORA OTTAWAENSIS; ADDITIONS TO PREVIOUS LISTS, Ott. Field-Nat. Club, Trans. 3 (vol. 1, no. 3): 23. 1882. A half-page list of additions, without localities or annotations. This was published as an appendix to the Report of the Botanical Branch for the Season of 1881, by B. Small and R. B. Whyte.

5—[Fletcher, James], APPENDIX. FLORA OTTAWAENSIS; ADDITION TO PREVIOUSLY PUBLISHED LISTS, Ott. Field-Nat. Club, Trans. 4 (vol. 1, no. 4): 73. 1883. A full page of additions with dates and names of collectors. Published as an appendix to the Report of the Botanical Branch for the Season of 1882, by R. B. Whyte & B. Small.

6—Fletcher, James, NOTES ON THE FLORA OTTAWAENSIS, WITH SPECIAL REFERENCE TO THE INTRODUCED PLANTS, Ott. Field-Nat. Club, Trans. 5 (vol. 2, no. 1): 29-37. 1884. This paper starts with a discussion of the previously published lists and additions of the Flora Ottawaensis. The Ottawa District is defined for the purpose of the Flora Ottawaensis as being an area of 12 miles radius with the city as its centre. Five entities are subtracted from the previous lists and a few others are discussed. The adventive vegetation is reviewed. A list of 194 introduced plants is given; they are in order of aggressiveness and the names in italics indicate entities that are considered to exist in the area both as native and introduced plants.

7—[Fletcher, James], FLORA OTTAWAENSIS. (ADDITIONS MADE IN 1883), Ott. Field-Nat. Club, Trans. 5 (vol. 2, no. 1): 126-7. 1884. Additions with locality, date, and collector. Follows the Report of the Botanical Branch, by J. Macoun, R. B. Whyte and J. Fletcher and preceeds Appendix A of the same report.

8—[Fletcher, James], FLORA OTTAWAENSIS. ADDITIONS, 1885, Ott. Field-Nat. Club, Trans. 7 (vol. 2, no. 3): 363. 1887. Additions with locality, date and collector. Follows the Report of the Botanical Branch, by R. B. Whyte, J. Macoun and B. Small and like previous similar entries no. 4, 5 and 7, appears to be part of the report.

9—[Fletcher, James], ADDITIONS TO THE "FLORA OTTAWAENSIS", Ott. Nat. 1: 77. 1887. A short note giving six additions with locality, date, and collector. Follows the Report of the Botanical Branch, by R.B. Whyte, S. Woods and H.B. Small. Like the preceeding, appears to be part of the report.

10—[Fletcher, J. & J. Macoun] FLORA OTTAWAENSIS. (ADDITIONS MADE IN 1887.), Ott. Nat. 2: 26. 1888. A full page of additions with locality and collector, including eight mosses collected by "Prof. Macoun", which leads us to believe that John Macoun was co-author of the paper. Follows the Report of the Botanical Branch for the Season of 1887.

11—Fletcher, James, FLORA OTTAWAENSIS, Ott. Nat. 2: 28-32. 1888. This is the second edition of the Flora Ottawaensis. It begins with a two page justification of the opus and continues with an enumeration of the flora, starting with *Clematis* through *Actaea*. The order followed is that of J.

4) For other irregularities in paging of the same journal, see W. J. Cody and B. Boivin, The Canadian Field-Naturalist and its Predecessors. Can. Field-Nat. 68 (3): 127-132. 1954.

Macoun, Cat. Can. Pl. 2 vols. in 5 parts, 1883-1890. The numbers used for species are also those of Macoun. Under each taxon is mentioned one or more vernacular or Benthamian names, the habitat and main flowering period (in quarters of a month). The letter (B) indicates entities previously mentioned by [B. Billings], List of Plants Collected by Mr. B. Billings in the vicinity of the City of Ottawa during the Summer of 1866, Trans. Ott. Nat. Hist. Soc. **1**: 1-16. 1867 (?). Frequency of occurrence and localities are given for all species that are not common. Collectors are mentioned when others than J. Fletcher himself. Introduced plants are set off by *italics*. An asterisk (*) designates the first collection for the District. For the purpose of this second edition, the Ottawa District has been redefined as an area of "about 30 miles so as to include Casselman on the one side, and Wakefield on the other; and up the river as far as Chats Rapids and down to Buckingham.

12—[Fletcher, James], (FLORA OTTAWAENSIS. — CONTINUED FROM PAGE 32.), Ott. Nat. **2**: 61-4. 1888. Continuation of the preceding from *Menispermum* through *Cardamine*. See entry 11.

13—[Fletcher, James], (FLORA OTTAWAENSIS. — CONTINUED FROM PAGE 64.), Ott. Nat. **2**: 77-80. 1888. Continuation of the preceding installment from *Cardamine* through *Lychnis*. See entry 12.

14—[Fletcher, James], FLORA OTTAWAENSIS, Ott. Nat. **2**: 104. 1888. A short quarter page note which reads as follows: "It has been decided by Council to reprint the 13 pages of the "Flora Ottawaensis" which have so far appeared, and for the future to keep a separate pagination for that part of the Ottawa Naturalist. This is done to meet the wishes of several of the members who have expressed a desire to have these pages printed in such a manner that they may be separated from the monthly numbers without injuring the rest of the volume". The reprint promised did not appear until fascicle 12 of volume 2. See entry 18. The paging, however, was modified at once and the next installment of the Flora Ottawaensis, entry 15, occurs immediately after page 104, but is paged 14 to 21. The separate paging thus given to the Flora Ottawaensis has resulted in a certain amount of duplication in paging in vols. 2, 3, 4 and 7.

15—[Fletcher, James], Ott. Nat. **2**: 14-21. 1888. No title. Continuation, from *Saponaria* to *Apios*, of previous installment, see entry 14, and of reprinted text, see entry 18. The paging runs from 14 to 21 and is continuous from the text of the reprint published more than six months later, see entry 18. This installment was published somewhat as a supplement to the regular issue but was of one fascicle with the preceding text and was meant to be cut off by those interested, as explained under entry 14. The latter remark also applies to entries 16, 17 and 23.

16—[Fletcher, James], Ott. Nat. **2**: 22-41. 1889. No title. Printed consecutively after page 116. Continuation, from *Amphicarpaea* to *Aster*, of previous installment, see entry 15.

17—[Fletcher, James], Ott. Nat. **2**: 42-45. 1889. No title. Printed consecutively after page 144. Continuation from *Aster* to *Senecio*, of previous installment, see entry 16.

18—[Fletcher, James], FLORA OTTAWAENSIS, Ott. Nat. **2**: 1-13. 1889. With unnumbered title-page. This is a reprint, in a slightly modified form, of entries 11, 12 and 13. The text is substantially identical, but has been reset so that the paging is slightly modified. A title page has been added. Printed as a separate fascicle sewn in at the end of issue no. 12, where it follows page 157 and page ii of the index. See entry 14 for the explanation of this reprint and entry 15 for continuation of the text.

19—[Fletcher, James], Ott. Nat. **3**: 46-49. 1889. No title. Printed on a single sheet of paper, folded to form 4 pages and issued lightly glued in after page 44. Continuation, from *Senecio* to *Andromeda*, of previous installment, see entry 17.

20—[Fletcher, James], Ott. Nat. **3**: 50-61. 1889. No title. Printed as two fascicles inserted loose after page 80. Other installments similarly printed as loose fascicles are 21, 22, 26, 27, 28. Continuation, from *Kalmia* to *Melampyrum*, of previous installment, see entry 19.

21—[Fletcher, James], Ott. Nat. **3**: 62-69. 1889. No title. Incorrectly paged 121-8. Issued as a loose fascicle inserted after page 116. Continuation, from *Epiphagus* to *Polygonum*, of previous installment, see entry 20.

22—[Fletcher, James], Ott. Nat. **3**: 70-73. 1890. No title. Issued as a loose fascicle inserted after p. 160. Continuation from *Polygonum* to *Daphne*, of previous installment, see entry 21.

23—[Fletcher, James], Ott. Nat. **4**: 74-77. 1890. No title. Printed consecutively after page 40 as part of the same fascicle as the rest of issue 2. Continuation, from *Dirca* to *Alnus,* of previous installment, see entry 22.

24—[Fletcher, J. & J. Macoun], FLORA OTTAWAENSIS, Ott. Nat. **5**: 82-84. 1891. This paper is a list of additions published immediately after the Report of the Botanical Branch, 1890, by J. Fletcher, R.B. Whyte and W. Scott. Entry 24 comprises first a three-quarter-page list of additions, with locality, date and collector, presumably prepared by James Fletcher. This is immediately followed by a list of Sphagna under the subtitle "LIST OF THE SPECIES OF THE GENUS SPHAGNUM FOUND AT OTTAWA" and presumably prepared by John Macoun. This and entry 10 are the only two parts of the Flora Ottawaensis which actually list mosses. Otherwise the bryophytes of the Ottawa District were dealt with mainly in two lists published, the first one as a single paper in Trans. **7**: (vol. 2, no. 3), the second one in installments beginning with Ott. Nat. **11**: 129. 1897 & sequ.

25—[Fletcher, James], FLORA OTTAWAENSIS. ADDITIONS MADE SINCE LAST REPORT, Ott. Nat. **5**: 204. 1892. A half-page of additions with locality and collector. Follows the Report of the Botanical Section, 1891, by J. Fletcher, W. Scott and R.H. Cowley.

26—Fletcher, James, FLORA OTTAWAENSIS, Ott. Nat. **7**: 67. 1893. A short note explaining the reasons for the delay in completing the Flora Ottawaensis. Also explains for the new readers how this flora is being published as a supplement to the Ottawa Naturalist.

27—[Fletcher, James], Ott. Nat. **7**: 78-85. 1893. No title. Issued as a loose fascicle inserted after page 68. Continuation, from *Alnus* to *Spiranthes,* of previous installment, see entry 23.

28—[Fletcher, James], Ott. Nat. **7**: 86-93. 1893. No title. Issued as a loose fascicle inserted after page 84. Continuation, from *Spiranthes* to *Sparganium,* of previous installment, see entry 27.

29—[Fletcher, James], Ott. Nat. **7**: 94-101. 1893. No title. Issued as a loose fascicle inserted after page 100. Continuation, from *Arisaema* to *Scirpus,* of previous installment, see entry 28.

Another 25 pages or so and the Flora Ottawaensis would have been completed. But it never was. Fletcher died in 1908 and in the Memorial Number, Ott. Nat. **22**: 206. 1909, we read, concerning the Flora Ottawaensis: "His great regret was that his official duties prevented him from finishing that work".

For a general bibliography of Dr. Fletcher's writings see A. Gibson and H. Groh, The published writings of Dr. Fletcher, Ott. Nat. **22**: 227-234. 1909.

FIRST RECORDS OF EIGHT SPECIES OF FISHES IN SASKATCHEWAN [1]

F. M. ATTON and R. P. JOHNSON
Saskatchewan Fisheries Laboratory, Saskatoon, Sask.

FIELDWORK for projects of the Saskatchewan Fisheries Laboratory has provided many opportunities for the collection of fishes in the province. Several of the collections merit published record because they represent major extensions of known ranges. None of these species are listed by Rawson (1949) in his checklist, while other references to distribution either do not mention Saskatchewan waters or tend to make vague generalizations concerning western distribution. This list adds two families and five genera to the fish fauna of this province and suggests that further ichthyological collecting throughout Saskatchewan would be worth while. Collecting has been done by the authors, and specimens have been contributed by H. S. Swallow and P. H. Edwards. Dr. W. B. Scott has identified all species except the carp, brown bullhead, and sheepshead, and the collections which he has examined have been retained in the Royal Ontario Museum of Zoology at Toronto.

1) Received for publication November 8, 1954.

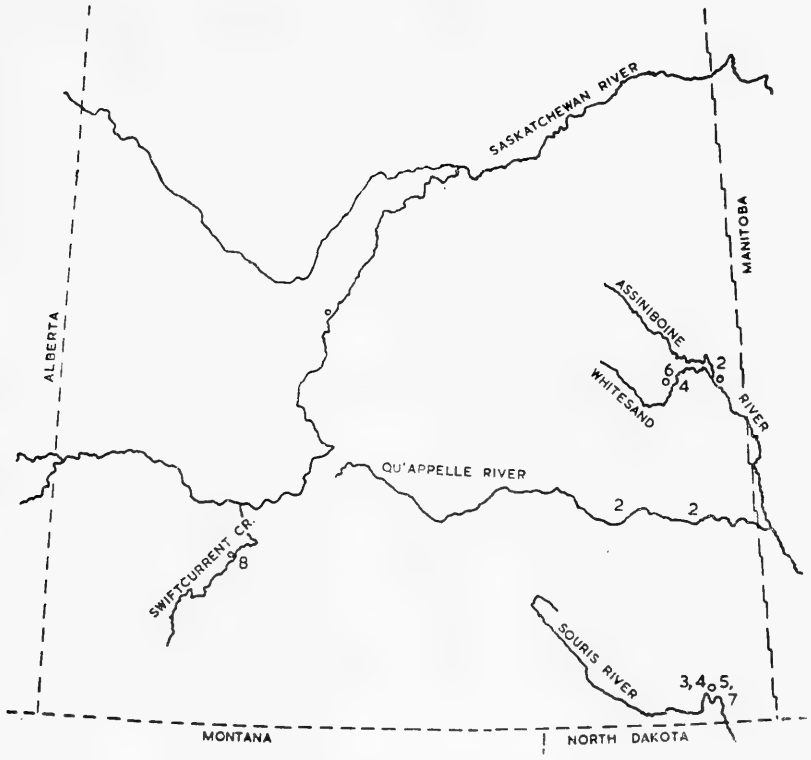

Figure 1. Map of Southern Saskatchewan. The numbers indicate the localities in which the species listed have been collected.

The Hudson Bay drainage system has two natural sections which together comprise the larger part of Saskatchewan. The Churchill River system drains the northern forested zone, much of it Precambrian in character. The prairie zone is drained by the Saskatchewan Rivers and other streams tributary to Lake Winnipeg. Figure 1 is a map of this southern section showing the localities in which the following species have been collected. The new records are all in the eastern and southern parts of this area.

1. *Moxostoma anisurum* (Rafinesque)—Silver redhorse.

This species was collected in the South Saskatchewan River at Saskatoon on October 25, 1952. Previous records by Dymond (1947) and Bajkov (1928) report this species from the Hudson Bay drainage of Manitoba. It is commonly taken by seining along with the quillback sucker *Carpiodes cyprinus* and the northern redhorse *Moxostoma aureolum*.

2. *Cyprinus carpio* Linnaeus — Carp.

Numbers of young-of-the-year specimens were found at Kamsack in November, 1953. These were in pools that had been formed by the spring overflow of the Assiniboine River. Carp were also collected in the Qu'Appelle River in August, 1954. The spread of the carp in North America has been rapid. Brought to the eastern part of this continent about 1877, this species was introduced into the Mississippi River in Minnesota in 1883. In 1938 it appeared in the Red River in Manitoba near the boundary at Lockport. By 1943 the carp had entered Lake Winnipeg and moved north as far as the mouth of the Winnipeg River. In 1953 it had ascended the Assiniboine River to Saskatchewan.

3. *Notemigonus crysoleucas* (Rafinesque) — Golden shiner.

A collection in the Souris River at Oxbow on July 27, 1954 yielded several specimens

of this fish. The distribution previously reported has been from northeastern Lake Winnipeg (Keleher, 1952) southward through Manitoba, North Dakota and Wyoming (Hubbs and Lagler, 1947).

4. *Notropis cornutus* (Mitchill) — Common shiner.

The distribution of this species is given in very general terms in all references available, e.g. "from Saskatchewan to Quebec" (Hubbs and Lagler, 1947). A personal communication from Dr. W. B. Scott, Toronto indicates that there are Manitoba records but none from Saskatchewan in the Royal Ontario Museum of Zoology and Paleontology collections. There are no specimens in the University of Saskatchewan collections. A single large individual was obtained from the Whitesand River at Canora on June 16, 1954 and a number of smaller specimens were collected in the Souris River at Oxbow on July 27, 1954.

5. *Notropis deliciosus* (Girard)—Sand shiner.

This species was collected by seining in the Souris River at Oxbow on May 16, 1953. Hubbs and Lagler (1947) list this fish from Lake of the Woods, and Hinks (1943) states that it is not known from Manitoba. The Saskatchewan record therefore extends its western distribution considerably.

6. *Ameiurus nebulosus* (Le Sueur) — Brown bullhead.

A single live specimen was submitted from the Whitesand River at Canora on October 5, 1954. Keleher (1952) records that this species is common at Victoria Beach, Lake Winnipeg, and Eddy and Surber (1947) note its occurrence in North Dakota but that it is not in the Lake Superior drainage. It seems likely the introduction to Manitoba has been through the Red River system, and thus it is found in its tributary, the Whitesand-Assiniboine drainage in Saskatchewan.

7. *Hadropterus maculatus* (Girard) — Blackside darter.

Specimens were collected by seining in the Souris River at Oxbow on July 21, 1953. Dymond (1947) gives the known western distribution as the Red and Assiniboine Rivers in Manitoba. Hubbs and Lagler (1947) mention its occurrence in North Dakota. Since the Souris River is a tributary of the Red River, it is not surprising that this species has now been collected somewhat further west.

8. *Aplodinotus grunniens* Rafinesque — Fresh-water sheepshead.

Two dead specimens were found on the bank of Swiftcurrent Creek at Swift Current on June 12, 1953. The northern distribution of this species does not seem to be clear, some references stating that it is in part of the Hudson Bay drainage of Manitoba, and others omitting any mention of these waters. Hubbs and Lagler (1947) note that it is found in the Mississippi lowlands in Montana. Rostlund (1952) mentions an early record from the Milk River. Hinks (1943) records its occurrence in the Red and Assiniboine Rivers, Lake Winnipeg and rarely in Lake Manitoba. Reports of the occurrence of this fish in the Qu'Appelle River in Saskatchewan have never been verified. The present record is the more surprising because Swiftcurrent Creek is a tributary of the South Saskatchewan River. The northwestern distribution of this species is thus extended into a drainage only remotely connected with that from which it was previously reported.

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PLANTS OF CUNNINGHAM ISLAND, OTTAWA, ONTARIO[1]

HERBERT GROH
Ottawa, Ontario

THIS SURVEY was prompted by the recovery recently, in files of a quarter century ago, of a list of plants made then on Cunningham Island.

In 1927 the new Champlain Bridge had first made possible easy access to the three islands of the Remic Rapids in the Ottawa River a few miles above the city of Ottawa. The prospect loomed that natural conditions would thus be disturbed, as was soon enough realized on the third, or Bate Island. In order to preserve some record of the existing flora a survey, all too hurried, was made of the second, known as Cunningham Island. No collections were made.

This, like its sister islands, is a low emergence above water, changing in area with the seasonal flow. It may be as little as three acres at floodtime, or as much as five acres in late summer. There are times, indeed, when it is possible to pass dry-shod between it and the adjacent islands. There is only a shallow soil over strata of Ottawa limestone, shown in a map of 1938 as Pamelia. This is exposed around the shore at low water, except at the lower end where alluvial deposits have somewhat extended the area lying above water after late spring.

The island cover may be described as deciduous woodland with an under-storey of shrubbery, the latter most pronounced at the lower end. Away from the denuded shoreline there is almost everywhere more or less of a turf and only a rather limited true woodland flora. In the interstices of rock shelving exposed at low water a surprising number of species maintain themselves. Water vegetation is limited, no doubt by the velocity of the current at flood time.

Excluding Bate Island, which has been converted to picnic use, the islands have not undergone much apparent change. Park management has kept the bottom cleared of debris and has removed trees as they became decadent. There is no evidence of undue public vandalism. Absence of hepatica, dogtooth violet, trillium and the like, is as likely as not ecologically conditioned, since they had not earlier been observed.

1) Received for publication May 25, 1954.

Notwithstanding impressions it was felt that the existence of a 1927 list of close to 150 species, warranted a new survey to check against it. This was undertaken in 1953 with more thoroughness, and with collection of specimens throughout the summer as nearly as possible at flowering or fruiting. The area was visited weekly as a rule by the writer, except during six weeks absence when others filled the breach. Some publicity had been given earlier to the 1927 list in Field-Naturalist and Macoun Field Club circles with resulting interest of members, which is appreciated. Special thanks are due for collecting to Miss Ruth Horner, Dr. C. Frankton and Mr. Leslie Jenkins. In identification later of more critical groups valuable help was given by Dr. W.G. Dore, Mr. J.A. Calder, Dr. J.M. Gillett, Dr. B. Boivin and other members of the Division of Botany staff.

Plants ordinarily were collected in triplicate. One set is deposited in the National Herbarium (Nat.). A partial set, including a few plants not available to complete the first, is in the herbarium of the Division of Botany (DAO), and a third, incomplete, is at Carleton College, Ottawa.

The list, following, is complete of plants found on Cunningham Island by the several collectors. When collected only by others than the writer the collector is indicated; thus Jenkins, or Horner & Frankton (H. & F.). Other collections are all by the writer; often repeated by one or both of the other teams. (With L. Jenkins was sometimes associated W. Ilman, and with H. Groh often D. C. Maddox). Plants in this table not in the 1927 list are preceded by an asterisk. They form quite an imposing array. Nomenclature is according to Gray's Manual, Eighth Ed.

Plants of Cunningham Island, 1953

EQUISETACEAE

EQUISETUM ARVENSE L. Common Horsetail

Sparingly on shores.

***E. PALUSTRE** L. Marsh Horsetail

Jenkins specimen in DAO.

OSMUNDACEAE

***OSMUNDA REGALIS** L. Royal Fern
Under cover of thicket at lower end.

POLYPODIACEAE

ONOCLEA SENSIBILIS L. Sensitive Fern
Shores.

***ANTHYRIUM FILIX-FEMINA** (L.) ROTH Lady Fern
Moist soil under shrubbery. Jenkins specimen in DAO.

PINACEAE

THUJA OCCIDENTALIS L. White Cedar
A few in main area.

ZOSTERACEAE

***POTAMOGETON GRAMINEUS** L. Pondweed
In water at a few locations.

HYDROCHARITACEAE

***ELODEA CANADENSIS** MICHX. Waterweed
Jenkins specimen, DAO.

GRAMINEAE

POA COMPRESSA L. Canada Bluegrass
Frequent in main area.

P. PRATENSIS L. Kentucky Bluegrass
Common, forming turf.

***P. PALUSTRIS** L. Fowl Meadow Grass
Common in the grass cover.

***GLYCERIA GRANDIS** S. WATS. Reed Meadow Grass
From near shore on low ground. Horner & Frankton.

DACTYLIS GLOMERATA L. Orchard Grass
General in shade.

***ERAGROSTIS POAEOIDES** BEAUV. Love Grass
In shade of bridge.

***AGROPYRON REPENS** (L.) BEAUV. Love Grass
Quite common.

***ELYMUS VIRGINICUS** L. Lyme Grass
Common.

***SPHENOPHOLIS INTERMEDIA** RYDB. Wedge Grass
Little noticed.

***CALAMAGROSTIS CANADENSIS** (MICHX.) NUTT. Blue Joint
Abundant along shores.

***AGROSTIS GIGANTEA** ROTH. Black Bent
A few noticed.

***A. ALBA** L. VAR. **PALUSTRIS** (HUDS.) PERS. Creeping Bent Grass
Low shores.

***A. SCABRA** WILLD. Hair Grass
Mostly near shores.

***A. PERENNANS** (WALT.) TUCKERM. Upland Bent Grass
Abundant.

PHLEUM PRATENSE L. Timothy
Common on main area.

***ALOPECURUS AEQUALIS** SOBOL. Foxtail
One collection by Jenkins, DAO.

***MUHLENBERGIA MEXICANA** (L.) TRIN. f. **SETIGLUMIS** (S. WATS.) FERN. Dropseed
Abundant along shores.

***SPARTINA PECTINATA** LINK. Cord Grass
Infrequent, at shores.

***DIGITARIA SANGUINALIS** (L.) SCOP. Crab Grass
Infrequent, at shores.

***PANICUM CAPILLARE** L. Old Witch Grass
Common along shores.

***P. LANUGINOSUM** ELL. Panic Grass
Common. Shores.

***SETARIA GLAUCA** (L.) BEAUV. Yellow Foxtail
Infrequent. Bridge area.

***ANDROPOGON GERARDII** VITMAN. Beard Grass
Occasional at lower end.

CYPERACEAE

***CYPERUS STRIGOSUS** L. Galingale
One collection by Jenkins, DAO. More on Riopelle Island.

***ELEOCHARIS CALVA** TORR. (probably)

***E. SMALLII** BRITT. Spike Rush
Mud at lower end.

***E. COMPRESSA** SULLIV.
Mud at lower end.

***FIMBRISTYLIS AUTUMNALIS** (L.) R. & S.
A colony on mud at lower end. An earlier specimen in DAO from Britannia, Ont., and one in Nat. Herb. from Quyon, Que., just outside the Ottawa District, are the nearest local collections found.

***SCIRPUS ACUTUS** MUHL. Bulrush
Common on muddy lower end.

***S. CYPERINUS** (L.) KUNTH. VAR. **PELIUS** FERN. Wool Grass
Mud at lower end.

***S. ATROTINCTUS** FERN.
One collection by Jenkins, DAO.

*CAREX ROSEA SCHKUHR. Sedge (as also others below).
This and the others generally on main area away from shore.
*C. CEPHALOIDEA DEWEY.
*C. SPARGANIOIDES MUHL.
*C. ALOPECOIDEA TUCKERM.
*C. VULPINOIDEA MICHX. Jenkins, DAO.
*C. TRIBULOIDES WAHLENB.
*C. TENERA DEWEY.
*C. LENTICULARIS MICHX.
*C. PECKII HOWE
*C. LANUGINOSA MICHX.
*C. GRACILLIMA SCHWEIN. Jenkins, DAO.
*C. ARCTATA BOOTT
*C. SPRENGELII DEWEY
*C. BLANDA DEWEY
*C. VIRIDULA MICHX.
*C. RETRORSA SCHKUHR
*C. VESICARIA L.
*C. sp. (Sect. LAXIFLORAE)
*C. sp. (probably Sect. BRACTEATAE)

ARACEAE

ARISAEMA ATRORUBENS (AIT.) BLUME. Jack-in-the-Pulpit
A few in parts of main area.

JUNCACEAE

*JUNCUS NODOSUS L. Rush
Common at muddy lower end.

LILIACEAE

SMILACINA RACEMOSA (L.) DESF. False Spikenard
A few clumps in main area.

POLYGONATUM PUBESCENS (WILLD.) PURSH. Solomon's Seal
Frequent in main area.

SMILAX HERBACEA L. Carrion-flower
Abundant, mostly in shrubbery of main area.

IRIDACEAE

*SISYRINCHIUM MONTANUM GREENE. Blue-eyed Grass
One collection H. & F. 33.

*S. ANGUSTIFOLIUM MILL. Blue-eyed Grass
Common on main area.

IRIS VERSICOLOR L. Blue Flag
Rocky shores. Frequent.

SALICACEAE

*SALIX NIGRA MARSH. Black Willow
*S. SERISSIMA (BAILEY) FERN.
*S. INTERIOR ROWLEE.
*S. DISCOLOR MUHL. Pussy Willow
*S. PETIOLARIS SM.
All willows sparingly along shores.

POPULUS TREMULOIDES MICHX. Aspen Poplar
Occasional on main area.

P. BALSAMIFERA L. Balsam Poplar
A few at lower end.

MYRICACEAE

*MYRICA GALE L. Sweet Gale
Abundant at lower end in mud and into water.

JUGLANDACEAE

CARYA CORDIFORMIS (WANG.) K. KOCH. Bitternut Hickory
Occasional on main area.

CORYLACEAE

OSTRYA VIRGINIANA (MILL.) K. KOCH. Ironwood
Common on main area.

CARPINUS CAROLINIANA WALT. Blue Beech
Mostly at lower end with other trees and shrubs.

*ALNUS RUGOSA (DuROI) SPRENG. Speckled Alder
Rocky shore of lower end.

FAGACEAE

QUERCUS MACROCARPA MICHX. Mossy-cup Oak
Common on main area.

Q. RUBRA L. Red Oak.
Common on main area.

ULMACEAE

*ULMUS RUBRA MUHL. Slippery Elm
Rather common formerly; only hollow stumps now, with sprouts from the live circumference to provide identification.

U. AMERICANA L. American Elm
Common throughout main area.

URTICACEAE

*PILEA PUMILA (L.) GRAY. Clearweed
In shade of bridge.

BOEHMERIA CYLINDRICA (L.) SW. Bog Hemp.
One collection near bridge.

POLYGONACEAE

RUMEX CRISPUS L. Curled Dock
Mostly near shore.

*R. SP. A swamp dock?

POLYGONUM AVICULARE L. Knotweed
In thin sod at base of trees, main area.

*P. **AMPHIBIUM** L. Water Smartweed
Main area and in shade of bridge.

P. **PERSICARIA** L. Lady's Thumb
Main area or near shore.

P. **CONVOLVULUS** L. Wild Buckwheat
One collection near bridge.

CHENOPODIACEAE

*CHENOPODIUM **HYBRIDUM** L. VAR. **GIGANTOSPERMUM** (AELLEN) ROULEAU. Maple-leaved Goosefoot
Main area near bridge.

C. **ALBUM** L. Lamb's Quarters
Near bridge sparingly.

C. **CAPITATUM** (L.) ASCHERS. Strawberry-blite
Young leaf rosettes only, on shore at bridge.

CARYOPHYLLACEAE

ARENARIA LATERIFLORA L. Sandwort
Main area near shore. Frequent.

STELLARIA GRAMINEA L. Common Stitchwort
Occasional near shore.

CERASTIUM VULGATUM L. Common Mouse-ear Chickweed
Seen sparingly on main area.

SILENE CUCUBALUS WIBEL. Bladder Campion
Mostly near bridge.

SILENE NOCTIFLORA L. Night-flowering Catchfly
Occasional on main area.

RANUNCULACEAE

*RANUNCULUS **REPTANS** L. Creeping Spearwort
Alluvial deposits off lower end at low water.

R. **ABORTIVUS** L. Small-flowered Buttercup
Frequent on main area.

R. **ACRIS** L. Tall Buttercup
Common on main area.

THALICTRUM POLYGAMUM MUHL. Tall Meadow-rue
Near shores occasionally.

*ANEMONE **RIPARIA** FERN. Thimbleweed
Frequent on main area.

A. **CANADENSIS** L. Canada Anemone
A few patches on main area.

ACTAEA RUBRA (AIT.) WILLD. Red Baneberry
One colony on main area to west.

CRUCIFERAE

BRASSICA KABER (D.C.) L.C. WHEELER VAR. **PINNATIFIDA** (STOKES) L.C. WHEELER. Wild Mustard
Very little, in shade of bridge.

ERYSIMUM CHEIRANTHOIDES L. Wormseed Mustard
Around trees near bridge.

BARBAREA VULGARIS R.BR. Winter Cress
Occasional on main area.

*CARDAMINE **PENSYLVANICA** MUHL. Bitter Cress
Fairly common, mostly near shores.

SAXIFRAGACEAE

RIBES AMERICANUM MILL. Wild Black Currant
Occasional on main area.

ROSACEAE

*PYRUS SP. Apple? Immature.
Main area in a few locations.

*AMELANCHIER **SANGUINEA** (PURSH) D.C. Juneberry
Sparingly, on main area.

CRATAEGUS SP. Hawthorn. Immature.
Occasional on main area.

FRAGARIA VIRGINIANA DUCHESNE. Wild Strawberry
Common on main area.

F. **VESCA** L. VAR. **AMERICANA** PORTER. Woodland Strawberry
Less common on main area.

*POTENTILLA **ARGENTEA** L. Silvery Cinquefoil
Sparingly at upper end on dry shallow soil.

GEUM CANADENSE JACQ. White Avens
Occasional, in shaded main area.

*G. **ALLEPICUM** JACQ. VAR. **STRICTUM** (AIT.) FERN. Yellow Avens.
Occasional on main area.

*RUBUS **ODORATUS** L. Purple Flowering Raspberry
Sparingly on main area.

R. IDAEUS L. VAR. **STRIGOSUS** (MICHX.) MAXIM. Wild Red Raspberry
Fairly common on main area.

***R. OCCIDENTALIS** L. Black Raspberry
One collection so identified.

R. SP. Immature. Blackberry

***AGRIMONIA GRYPOSEPALA** WALLR. Agrimony
A few near bridge.

***ROSA ACICULARIS** LINDL. Wild Rose
Sparingly near shore.

R. BLANDA AIT. Early Wild Rose
Sparingly near shore.

***PRUNUS PENSYLVANICA** L. f. Bird (Pin) Cherry
Occasional on main area.

P. VIRGINIANA L. Choke Cherry
Occasional on main area.

LEGUMINOSAE

TRIFOLIUM REPENS L. White Clover
Common on main area.

T. HYBRIDUM L. Alsike Clover
Common on main area.

T. AGRARIUM L. Hop Clover
Common on main area.

***MELILOTUS ALBA** DESR. White Sweet Clover
Occasional, especially near bridge.

***MEDICAGO SATIVA** L. Alfalfa
One collection by H. & F.

M. LUPULINA L. Black Medick
Common on main area.

VICIA CRACCA L. Tufted Vetch
Occasional on main area.

***V. AMERICANA** MUHL. American Vetch
One collection. Search of Nat. and DAO Herb. failed to find another Ottawa District specimen.

***LATHYRUS PALUSTRIS** L. Vetchling
One collection on main area.

***APIOS AMERICANA** MEDIC. Groundnut
On shores at a few points.

AMPHICARPA BRACTEATA (L.) FERN. Hog-peanut
On shores at a few points.

OXALIDACEAE

OXALIS EUROPAEA JORD. Wood Sorrel
Frequent on main area.

RUTACEAE

XANTHOXYLUM AMERICANUM MILL. Prickly Ash
Abundant on parts of main area.

EUPHORBIACEAE

***MERCURIALIS ANNUA** L. Three-seeded Mercury
Sparingly on shore.

ANACARDIACEAE

RHUS TYPHINA L. Staghorn Sumac
One location only, on main area.

RHUS RADICANS L. Poison Ivy
Common on various parts of main area.

CELASTRACEAE

CELASTRUS SCANDENS L. Climbing Bittersweet
Common on main area with shrubbery.

ACERACEAE

ACER RUBRUM L. Red Maple
Occasional on main area.

RHAMNACEAE

***RHAMNUS CATHARTICA** L. Common Buckthorn
One specimen near each end of main area.

R. FRANGULA L. Alder Buckthorn
On main area, forming thickets near lower end.

VITACEAE

PARTHENOCISSUS QUINQUEFOLIA (L.) PLANCH. Virginia Creeper
Occasional on main area.

VITIS RIPARIA MICHX. River-bank Grape
On shores with shrubbery.

TILIACEAE

TILIA AMERICANA L. Basswood
Common on main area.

GUTTIFERAE

HYPERICUM PERFORATUM L. Common St. John's-wort
Frequent on main area.

***H. ELLIPTICUM** HOOK. St. John's-wort
Muddy lower end.

***H. MAJUS** (GRAY) BRITT. St. John'swort
Muddy lower end.

VIOLACEAE

***VIOLA NEPHROPHYLLA** GREENE. Stemless Blue Violet
A few colonies on main area.

***V. SEPTENTRIONALIS** GREENE. Stemless Blue Violet
One location on main area, not since found.

*V. **PENSYLVANICA** MICHX. Smooth Yellow Violet
Abundant on main area.

*V. **CONSPERSA** REICHENB. Leafy Blue Violet
Occasional on main area.

ONAGRACEAE

OENOTHERA BIENNIS L. Evening Primrose
Occasional on main area.

CIRCAEA QUADRISULCATA (MAXIM.) FRANCH. & SAV. VAR. **CANADENSIS** (L.) HARA. Enchanter's Nightshade.

HALORAGIDACEAE

***MYRIOPHYLLUM ALTERNIFLORUM** D.C. Water Milfoil
Off-shore water.

UMBELLIFERAE

***SANICULA GREGARIA** BICKN. Black Snakeroot
Occasional on main area.

OSMORHIZA CLAYTONI (MICHX.) C. B. CLARKE. Sweet Cicely
Occasional on main area.

SIUM SUAVE WALT. Water Parsnip
Abundant on shores at low water.

CORNACEAE

CORNUS STOLONIFERA MICHX. Red Osier Dogwood
Common, mostly near shores.

***C. OBLIQUA** RAF. Silky Dogwood
A few colonies on rocky shores.

***C. RACEMOSA** LAM. Racemose Dogwood
On a rocky shore.

PRIMULACEAE

***LYSIMACHIA TERRESTRIS** (L.) B.S.P. Yellow Loosestrife
Abundant on shores.

L. NUMMULARIA L. Moneywort
Common creeper on moister parts of main area.

L. CILIATA L. Fringed Loosestrife
Common on shores.

OLEACEAE

FRAXINUS PENNSYLVANICA MARSH. Red Ash
One of the commoner trees on main area.

F. AMERICANA L.
White Ash.
One seen.

APOCYNACEAE

APOCYNUM SIBIRICUM JACQ. Indian Hemp
Abundant on shores.

ASCLEPIADACEAE

***ASCLEPIAS INCARNATA** L. Swamp Milkweed
One collection near shore by H. & F.

A. SYRIACA L. Common Milkweed.
Occasional on main area

BORAGINACEAE

LITHOSPERMUM OFFICINALE L. Common Gromwell
Common on main area.

LABIATAE

***SCUTELLARIA LATERIFLORA** L. Mad-dog Skullcap
Along shores.

***S. PARVULA** MICHX. Small Skullcap
Near shores.

NEPETA CATARIA L. Catnip
A few clumps in shade of bridge.

***PRUNELLA VULGARIS** L. Selfheal
Occasional on main area.

***LEONURUS CARDIACA** L. Motherwort
A collection near bridge.

***LYCOPUS UNIFLORUS** MICHX. Bugleweed
Along shore.

L. AMERICANUS MUHL. Bugleweed
Common along shores.

MENTHA ARVENSIS L. VAR. **VILLOSA** (BENTH.) S. R. STEWART. Canada Mint
Common along shores.

SOLANACEAE

***SOLANUM AMERICANUM** MILL. Nightshade
A little, in shade of bridge.

SCROPHULARIACEAE

***LINARIA VULGARIS** HILL. Butter and Eggs; Toadflax
Common on main area.

***MIMULUS RINGENS** L. Monkey-flower
Occasional on shores.

***VERONICA SERPYLLIFOLIA** L. Thyme-leaved Speedwell
Sparingly on main area.

***V. SCUTELLATA** L. Marsh Speedwell
Frequent on shore at low water.

PLANTAGINACEAE

PLANTAGO RUGELII DCNE. Rugel's Plantain
Common, especially on shores.

RUBIACEAE

***GALIUM APARINE** L. Cleavers.
Mostly on main area near bridge.

G. TRIFLORUM MICHX. Sweet-scented Bedstraw
Common on main area.

G. PALUSTRE L. Marsh Bedstraw
Moister parts of main area.

***CEPHALANTHUS OCCIDENTALIS** L. Buttonbush
Covering much of lower end of island.

CAPRIFOLIACEAE

***LONICERA TATARICA** L. Tartarian Honeysuckle
Freely scattered over entire main area. In pink and white forms.

***L. DIOICA** L. Honeysuckle
Occasional in main area.

***VIBURNUM LENTAGO** L. Nannyberry
Occasional in main area.

V. RAFINESQUIANUM SCHULTES. Downy Arrow-wood
Occasional in main area.

***V. TRILOBUM** MARSH. Highbush Cranberry
A few shrubs on ledge above west shore — also on Lower Island.

SAMBUCUS PUBENS MICHX. Red-berried Elder.
Occasional in main area.

***LOBELIA CARDINALIS** L. Cardinal-flower
Frequent on shore at low water.

***L. INFLATA** L. Indian Tobacco
Occasional in main area.

COMPOSITAE

EUPATORIUM MACULATUM L. Joe-Pye-weed
Abundant on shores at low water.

***E. PERFOLIATUM** L. Boneset
Occasional on main area.

E. RUGOSUM Houtt. White Snakeroot
Mostly in shade of bridge.

***SOLIDAGO CAESIA** L. Blue-stem Goldenrod
On main area.

***S. SQUARROSA** MUHL. Stout Ragged Goldenrod
Scattered on main area.

***S. CANADENSIS** L. Canada Goldenrod
On main area.

***S. LEPIDA** D.C. Goldenrod
On main area.

S. GRAMINIFOLIA (L.) SALISB. Narrow-leaved Goldenrod
Occasional on main area.

***ASTER CORDIFOLIUS** L. Heart-leaved Aster
On main area.

***A. LATERIFLORUS** (L.) BRITT. Aster
On main area.

***A. ONTARIONIS** WIEG. Ontario Aster
Abundant on main area.

ERIGERON PHILADELPHICUS L. Philadelphia Fleabane
Occasional on main area.

E. ANNUUS (L.) PERS. Daisy Fleabane
Sparingly on main area.

E. CANADENSIS L. Canada Fleabane
Sparingly on main area.

ANTENNARIA PETALOIDEA FERN. Everlasting
One colony at upper end above shoreline. More on Riopelle Island.

***AMBROSIA ARTEMISIIFOLIA** L. Common Ragweed
A few plants only on main area near bridge.

***BIDENS VULGATA** GREENE. Beggar-ticks
A few plants beneath bridge.

***GALINSOGA CILIATA** (RAF.) BLAKE
A few plants beneath bridge.

ACHILLEA MILLEFOLIUM L. Common Yarrow
Common on main area.

CHRYSANTHEMUM LEUCANTHEMUM L. VAR. **PINNATIFIDUM** LECOQ. & LAMOTTE. Ox-eye Daisy
Sparingly, mostly near bridge.

ARTEMISIA VULGARIS L. Common Mugwort
A few plants, mostly near bridge.

ARCTIUM MINUS (HILL) BERNH. Common Burdock
A few plants, mostly near bridge.

CIRSIUM VULGARE (SAVI) TENORE. Bull Thistle
A few in leaf-rosette stage only. On shore at bridge.

C. ARVENSE (L.) SCOP. Canada Thistle
Occasional.

TARAXACUM OFFICINALE WEBER. Common Dandelion
Common on main area.

SONCHUS ASPER (L.) HILL. Spiny Annual Sow Thistle
Sparingly near bridge.

LACTUCA SCARIOLA L. Prickly Lettuce
Only in disturbed bridge area.

***HIERACIUM FLORENTINUM** ALL. King Devil
Common at upper end of main area.

Plants on Adjacent Riopelle and Lower Island (here so named) and not seen on Cunningham Island

EQUISITUM FLUVIATILE L. Pipes
Lower Island.

DRYOPTERIS THELYPTERIS (L.) GRAY VAR. **PUBESCENS** (LAWSON) NAKAI Marsh Fern.
Riopelle Island.

PINUS STROBUS L. White Pine
Riopelle Island.

TYPHA LATIFOLIA L. Cat-tail
Riopelle Island.

POTAMOGETON SPIRILLUS TUCKERM. Pondweed
Riopelle Island.

SAGITTARIA LATIFOLIA WILLD. f. **GRACILIS** (PURSH) ROBINSON
Riopelle Island.

POPULUS DELTOIDES MARSH. Cottonwood
Riopelle Island.

BETULA PAPYRIFERA Marsh. White Birch
Riopelle Island.

LYTHRUM SALICARIA L. Purple Loosestrife
Lower Island.

EPILOBIUM GLANDULOSUM LEHM. VAR. **ADENOCAULON** (HAUSSK.) FERN.
Riopelle Island. In crevice of bridge wall.

CONVOLVULUS SEPIUM L. Wild Morning-glory
Lower Island.

CHELONE GLABRA L. Turtlehead
Riopelle Island.

TRIOSTEUM AURANTIACUM BICKN. Feverwort
Riopelle Island. In 1927 reported on Cunningham Island.

HELENIUM AUTUMNALE L. Sneezeweed
Lower Island.

Plants of Cunningham Island, 1927. Occurrence not substantiatetd in 1953.

BOTRYCHIUM SP. Grape Fern.

TAXUS CANADENSIS MARSH. Ground Hemlock.

BROMUS SP. Brome Grass.

URTICA PROCERA MUHL. Slender Nettle.

RUMEX ACETOSELLA L. Sheep Sorrel.

ATRIPLEX SP. Orach.

STELLARIA MEDIA (L) CYRILL. Common Chickweed.

THALICTRUM DIOICUM L. Early Meadow-rue.

MENISPERMUM CANADENSE L. Canada Moonseed.

CORYDALIS AUREA WILLD. Golden Corydalis.

FUMARIA OFFICINALIS L. Common Fumitory

SISYMBRIUM OFFICINALIS (L.) SCOP. Hedge Mustard.

CAPSELLA BURSA-PASTORIS (L.) MEDIC. Shepherd's Purse.

PENTHORUM SEDOIDES L. Ditch Stonecrop.

POTENTILLA NORVEGICA L. Rough Cinquefoil.

TRIFOLIUM PRATENSE L. Red Clover.

DESMODIUM SP. Tick Trefoil.

IMPATIENS CAPENSIS MEERB. Spotted Touch-me-not.

VIOLA CANADENSIS L. Canada Violet.

EPILOBIUM ANGUSTIFOLIUM L. Fireweed.

LAPPULA SP. Bluebur.

VERBASCUM THAPSUS L. Common Mullein.

PLANTAGO MAJOR L. Common Plantain.

TRIOSTEUM AURANTIACUM BICKN. Feverwort.

SYMPHORICARPUS ALBUS (L.) BLAKE. Snowberry.

ANAPHALIS MARGARITACEA (L.) BENTH. VAR. **INTERCEDENS HARA.** Pearly Everlasting.

SENECIO SP. Ragwort.

TARAXACUM ERYTHROSPERMUM ANDRZ. Red-seeded Dandelion.

PRENANTHES SP. Rattlesnake-root.

The second list, plants seen only on adjacent islands, is reasonably supplementary to the main list since absence from it can be little more than fortuitous. For plants occurring on each, as the majority do, there are differences of incidence but not such as to suggest dissimilar ecology.

The third list is of plants recorded in 1927 but not again found on Cunningham Island. They may be casualties of the interval as, for instance, *Corydalis* and *Fumaria,* which have also failed to be found where they had been known on the mainland nearby. *Triosteum* may have been on both islands formerly. With more careful separation from the species found Common Plantain and Red-seeded Dandelion could perhaps have been shown still present. Misidentifications cannot be ruled out entirely and seem a probability in the case of *Melilotus* which had been listed before, no doubt without benefit of flowers, as the yellow species.

Summary

Plants distinguished (with a few exceptions) to the species — 232, as against 140 in 1927.

Plants seen on the two adjacent islands only would, if included, bring the total to 246.

More critical collection of some genera, i.e. *Salix, Rubus* and among the grasses and sedges, could very well extend the list, and is a challenge to workers in such groups.

Plants in the 1927 list not again accounted for number 30. This, together with the lengthened list of 1953 indicates, undoubtedly, some actual losses and gains of species but it would not be easy to say how much, particularly of gain, in view of unequal closeness of survey at the two dates.

One of the interesting outcomes of the project is its demonstration of how extensive an association of plants is possible on so few acres.

A rough breakdown of the flora to its main habitats is about as follows:

Main dry area of island	55%
Rocky shoreline	23%
Sediment of lower end	11%
Modified environs of bridge	8%
Water off-shore	3%

It appears that trees and shrubs, in similar number of species, form nearly one fifth of the list. Grasses and sedges, also about equally divided, form another fifth. Compositae to the number of 30, are somewhat short of one fifth. Thus these three groups alone comprise more than half of all species.

BIRD OBSERVATIONS FROM SOUTHERN KEEWATIN AND THE INTERIOR OF NORTHERN MANITOBA[1]

FARLEY M. MOWAT *and* ANDREW H. LAWRIE
Toronto, Ont.

DURING the years 1947 to 1949 the authors spent a substantial period in the interior of southern and central Keewatin District and in adjacent areas of northern Manitoba. The bird observations made during these years are presented here as a contribution to the rather meagre knowledge of the avifauna of these regions.

During 1947, observations were made by Mowat in the vicinity of Nueltin Lake; on the Thlewiaza River; and on th canoe routes from Nueltin Lake south to Brochet on Reindeer Lake. During 1948, both authors worked together at Nueltin Lake and in the vicinity of Angikuni Lake, while Lawrie spent some time alone at Nueltin in late autumn, and Mowat spent a similar length of time alone at Brochet. In 1949, Lawrie, accompanied by D. Peterson, made observations at Beverly Lake, Nueltin Lake and Baker Lake. Table 1 gives a chronological chart showing the locations of the observers for specific dates.

1 Received for publication July 24, 1954.

Table 1. LOCATIONS OF OBSERVERS

Year	Observer	Localities	Period
1947	Mowat	Churchill	May 20 — May 31
	"	Nueltin Lake	May 31 — July 8
	"	Nueltin Lake to Brochet	July 8 — Aug. 4
	"	Nueltin Lake	Aug. 4 — Aug. 14
	"	Nueltin Lake to Eskimo Point	Aug. 14 — Sept. 3
1948	Lawrie-Mowat	Churchill	May 20 — May 23
	" "	Nueltin Lake	May 23 — July 20
	" "	Angikuni Lake	July 20 — Aug. 15
	" "	Nueltin Lake	Aug. 15 — Oct. 14
	Mowat	Brochet	Oct. 15 — Jan. 5 (1949)
	Lawrie	Nueltin Lake	Oct. 15 — Dec. 10
1949	Lawrie	Hudson Bay Railway	Jan. 10 — May 16
	"	Baker Lake	May 17 — June 1
	"	Beverly Lake	June 1 — Aug. 2
	"	Nueltin Lake	Aug. 2 — Aug. 27

Previous Work

Relatively little bird work has been done in the area under discussion. Clarke (1940. Nat.Mus.Can.Bull. No. 96) has summarized what was known of the avifauna of the Thelon River system and adjacent areas up until 1938. Clarke's study includes references to the fragmentary information available from A.E. Porsild and from the 5th Thule Expedition records, both from the areas of Yathkyed Lake and the lower Kazan River. T.H. Manning (1948. Can. Field-Nat. Vol. 62, pp. 1-28) published an account of observations made at a number of briefly visited stations running nearly parallel to our main stations, but located roughly one hundred miles eastward. Francis Harper made collections at Nueltin Lake in 1947 and has reported on his work in The American Midland Naturalist, 1953, Vol. 49, pp. 1-116.

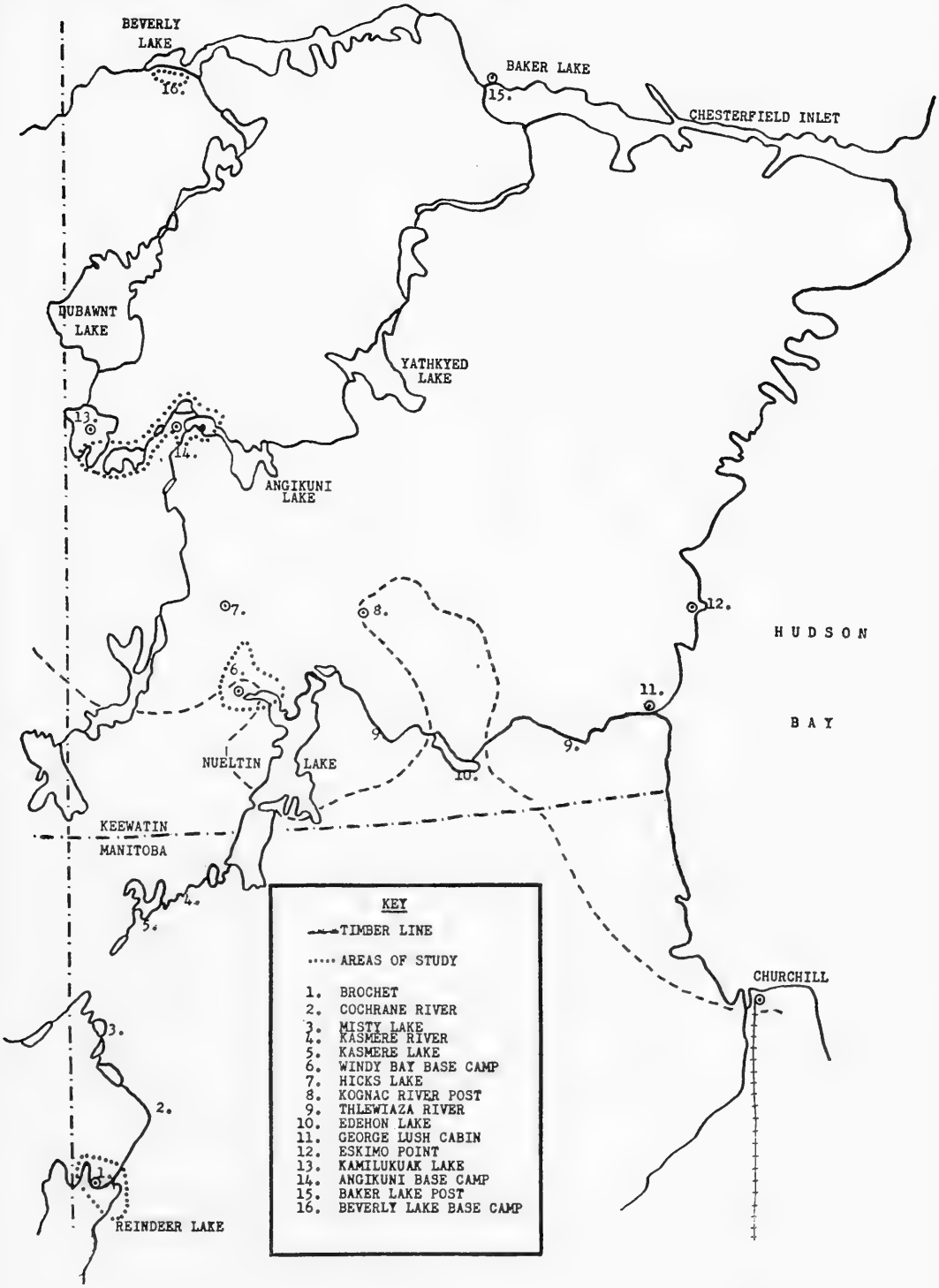
To the south, in the adjacent areas of interior Manitoba there is a similar paucity of published information. The only available reports seem to be those of Angus Buchanan (1920. Wild Life in Canada, Toronto). In the coastal regions about Churchill a great deal of excellent work has been done, notably by Taverner and Sutton, but Churchill and the coastal area is not included in our study area, except incidentally.

Method of Presentation

The following annotated list represents the observations of the authors, with occasional inclusions of reports, previously unpublished, from local sources. No attempt has been made to draw comparisons with information contained in other published works. Since most of our data are based on visual observations, rather than on collections, no attempt has been made to allot subspecific status to most species. Where specimens were taken, brief reference is usually made to this fact. All specimens taken by Mowat are at present in the Royal Ontario Museum of Zoology and Palaeontology at Toronto, Ontario. Species which are included in the list on the basis of local reports only, are shown as hypothetical unless the occurrence of these species has been otherwise confirmed.

Acknowledgments

Our thanks are due to Messrs. C. Schweder of Churchill; G. Lush of Thlewiaza River; C. Russell of Eskimo Point and Sandy Lunan of Baker Lake, for information covering periods of the year when we were not able to make observations at these points. The invaluable co-operation of Mr. W.E. Godfrey of the National Museum of Canada has been of great help in the final preparation of this manuscript.



Map. 1. Southern Keewatin and northern Manitoba.

Due to the absence of Lawrie as this manuscript was being completed, Mowat accepts all responsibility for any errors or omissions which may exist.

Description of Localities

Windy Bay and the Nueltin Lake Area

Windy Bay is the extreme northwestern extremity of Nueltin Lake and lies 280 miles northwest of Churchill and 200 miles inland from Hudson Bay. Our base camp during the three seasons we were in the area, was at the mouth of Windy River but our observations covered most of Nueltin Lake proper, as well as a good deal of the adjoining interior region.

Windy Bay was of particular interest since it lies in the Transition zone between boreal forest and relatively open tundra. Timberline (here defined as the limit of continuous tree cover) crosses Nueltin Lake some thirty miles south of Windy Bay. Trees occur northward in varying sized stands which rapidly diminish in size and number.

There is great variety in the terrain and cover. The western shores of the lake, below Windy Bay contain extensive ranges of hills that are so heavily overlaid with glacial rock fragments that they are nearly impassable. Some low-lying valleys in these ranges are traversed by sandy eskers where 'oases' of much more southerly flora exist.

Windy River, flowing roughly east and west, provides a boundary between the rocky hills and the gently undulating tundra plains to the north, where drumlinoid formations, eskers, and low eroded ridges provide the high ground between areas of bog and innumerable small lakes and ponds.

Plant cover ranges from sparse lichens and mosses on the hill crests, through scanty stands of sedges, bunch grasses, bearberry, arctic cranberry, labrador tea and dwarf birch on the more protected slopes of both the interior hills, and the tundra ridges. In the protected valley bottoms, sedge meadows are often bounded by dwarf willow clumps, and grassy swales are fairly numerous and vigorous in growth. The trees, occupying favourable sites in the hill valleys and along Windy River, or in very protected hollows on the open plains, are largely black spruce. In the best positions, white spruce and tamarack are also found, together with small stands of birch and poplar. Tree size ranges from a single white spruce that measured 20″ in diameter and stood 60′ high in a sheltered hill valley, to wind stunted black spruce on the open tundra that barely attains a height of two feet. In general, the tree cover north of Windy River does not exceed two percent of the land area.

Windy Bay to Brochet, Reindeer Lake

The canoe route from Windy Bay to Brochet was traversed in both directions by Mowat in 1947. Brochet lies 225 air miles south of Windy River and close to the borders of Manitoba and Saskatchewan.

The canoe route begins at the south end of Nueltin and follows the Kasmere and Cochrane Rivers through forested country. From Nueltin to the height of land between the Cochrane and the Kasmere, the land is low, muskegy and the major forest cover is black spruce and tamarack with some poplar and birch. From the height of land south down the Cochrane, the surrounding area is more rolling and dry and the dominant tree is Jack pine. The many lakes and rivers are clean bottomed and although spruce bogs are numerous, there are few swamp or marsh areas in this typical boreal forest region.

Windy Bay to Eskimo Point, Hudson Bay

The route followed by Mowat in 1947 was along the Thlewiaza River. Stretching eastward from north Nueltin Lake for the first 90 air miles, the country is high plateau tundra similar to that found at Windy Bay. At Edehon Lake a loop of timber line crosses the river route but quickly withdraws again. From Edehon eastward to the coast of Hudson Bay the land slopes steeply and is almost devoid of ridges or highlands. It is extremely wet, and sedge meadows or extensive bog areas increase in area steadily toward the coastal plain.

Angikuni Lake Area

In 1948 the authors travelled widely by canoe in this area. Angikuni itself lies 320 miles northwest of Churchill and 100 miles north of Windy Bay. To the north of the lake the land rises in a succession of massive ridges to a high and rolling plateau. Many of the hills are drumlinoid in form, and rock outcrops are common. The plateau tundra is much drier than at Nueltin Lake. There are few ponds in this highland, and sedge meadows are scarce. On the dry ridges bunch grasses grow sparsely among the almost prostrate mats of cranberry, crowberry, Lapland rhododendron, Labrador tea and dwarf birch and these in turn cover the ubiquitous lichens

and mosses. Dwarf willows are found growing luxuriantly to a height of seven or eight feet in the swales along the few streams flowing to the lake. A single grove of black spruce, less than half an acre in extent, composed of gnarled and stunted trees, huddles under the southern face of a ridge.

Westward to Kamilikuak Lake the high plateau gives way to a flat and water saturated plain of nigger-head tundra. About the south end of Kamilikuak the hills rise again in a broken and rugged range reminiscent of the Windy Hills at Nueltin. Here, on the more sheltered slopes there are a few oases of spruce, mostly black, but some white spruce, several acres in extent. The largest single tree was 40 feet high and measured 16 inches in diameter at breast height.

Beverly Lake

Beverly lies 450 miles north of Churchill and about 300 miles west of the mouth of Chesterfield Inlet on the Hudson Bay coast. The area investigated lies on the south shore of the lake, and is rolling tundra with extensive wet sedge meadows lying between ridges of sand and gravel. The vegetation cover much resembles that at Angikuni Lake with extensive thickets of low dwarf birch along the banks of streams. On the drier sites, these shrubs are wholely prostrate. Certain elements of arctic flora, not found at the southern stations, were found here, notably *Cassiope tetragona, Papaver radicatum,* and *Armeria labradorica.* Some of these may have occurred at Angikuni Lake, but could easily have been overlooked by us in the post-flowering season. Spruce was found in a single locality, a deep-sided stream valley cut into the drift. Most of the trees were stunted, but a few reached a height of 20 feet with a diameter at breast level of 8 inches.

Annotated List

1. **Common Loon,** *Gavia immer*

Arrival dates: Windy River — June 7, 1947; June 3, 1948.

N.Manitoba: Common on Reindeer Lake and along the Cochrane, but becoming scarcer on the Kasmere River and not seen on the open parts of Nueltin Lake.

Windy River: From June 7-12, 1947; 7 individuals were seen, but none were recorded after these dates. In 1948 there were 6 records between June 3 and July 5, but none were certainly identified after July 5.

Angikuni Lake: While no Common Loons were definitely identified in this area, it is possible that the species was present. All certain identifications were of the following species, and it was particularly noted that the similarity of certain call notes between the two species made 'voice' identification extremely unreliable.

A common summer resident well inside timberline but becoming much rarer toward the edge of forested country. It is our belief that the species is hardly more than a rare straggler in the open plains of southern and central Keewatin. However a single specimen was collected at Baker Lake in the summer of 1924 by A. Bangstead (see Clarke, loc. cit.) while T.H. Manning records the species just south of Baker Lake in 1945.

2. **Yellow-billed Loon,** *Gavia adamsii*

Arrival dates: Windy River — June 14, 1947. Beverly Lake — June 14, 1949.

Windy River: A male collected by Schweder on June 14 and a pair seen on Aug. 10 constitute the only 1947 records. A single bird, probably of this species was seen on June 19, 1948.

Angikuni Lake: At least four pairs were resident in the area and a pair of adults encountered on Angikuni Lake, Aug. 10, 1948, were accompanied by a young bird still in natal down though nearly two thirds grown.

Beverly Lake: From June 14 to July 1, 1 to 8 birds were seen daily. Few were seen thereafter but this may well be due to nesting dispersal.

Rare to accidental south from Nueltin, but from Windy Bay northward it evidently replaces the foregoing species, being most numerous north of Angikuni. It was not recorded on the Thlewiaza River and there was no positive evidence of its occurrence eastward to the coast.

3. **Pacific Loon,** *Gavia arctica*

Arrival dates: Windy River — June 5, 1947; June 4, 1948. Beverly Lake — June 9, 1949.

N. Manitoba: Evenly distributed and fairly common on Reindeer Lake and on the Cochrane, Kasmere systems, and on Nueltin Lake. One to 5 birds seen daily July 9 to Aug. 4, 1947.

Windy River: Flocks of up to 12 were seen daily from June 6 to June 12, 1947 with single birds and pairs recorded daily after these dates. In 1948 the species appeared

much less abundant and only 5 were seen, the last being on Sept. 13.

Angikuni Lake: Common through the area with 2-16 seen daily. Many were paired and undoubtedly breeding locally.

Thlewiaza River: Becoming increasingly common east from Nueltin toward the coast; running from 2 daily to a maximum of 20-24 a day in the immediate vicinity of Hudson Bay. Flightless young were found on Edehon Lake and adults carrying fish from the sea to muskeg ponds were noted as late as Aug. 24, 1947.

Beverly Lake: 1-4 seen daily from June 9 to July 1, 1949; after which the species was seen infrequently.

The commonest and most evenly distributed loon throughout the area. The mounting abundance eastward toward the coast appears noteworthy in the light of the apparent rarity, or absence, of members of the other three species, on the Thlewiaza River.

4. **Red-throated Loon,** *Gavia stellata*

Arrival dates: Windy River — June 7, 1947; May 26, 1948. Beverly Lake — June 19, 1949.

N. Manitoba: Rarer than the Pacific Loon. There were 8 records on the Kasmere River, but none were seen below the height of land on the Cochrane River nor on Reindeer Lake.

Windy River: Uncommon from June 7 to June 11, 1947 and only 2 records thereafter in 1947. About the same abundance in 1948 until June 20, after which the species was rarely seen. Last seen Sept. 29, 1948.

Angikuni Lake: Uncommon, with 7 records.

Thlewiaza River: Rare in the interior and not recorded within 50 miles of the coast.

Beverly Lake: Considerably rarer than the Pacific Loon, with not more than 2 records daily, most of which were referable to a single breeding pair. The nest was on the edge of a tundra pond within 6 feet of the water. It contained 2 eggs on July 3, 1949. A second nest in a similar location contained 1 egg on July 12, 1949.

Pehaps most common at, and just south of timberline but absent farther south. Widely distributed in small numbers on the tundra to the north.

5. **Horned Grebe,** *Colymbus auritus*

We identified a single bird at Churchill on May 19, 1948. C. Schweder reports having shot one at Windy River in 1946 and having seen an adult with young nearby, later that year.

6: [**Great Blue Heron.** *Ardea herodias*

Charles and Frederick Schweder reported seeing a single bird at the south end of Nueltin Lake in June, 1942.]

7. **American Bittern,** *Botaurus lentiginosus*

The Schweder brothers saw one bird in a marsh area near the south end of Nueltin in 1946. Mowat recorded a single bird on Misty Lake, Cochrane River July 15, 1947.

8. **Whistling Swan,** *Cygnus columbianus*

Arrival dates: Churchill — May 30, 1947; May 21, 1948. Beverly Lake — June 9, 1949.

Windy River: C. Schweder reported 3 on Oct. 15, 1947, and 60 in September of 1944.

Thlewiaza River: George Lush, at the mouth of the river, reported this species rare in spring migration, but not uncommon in the fall, along the coast.

Beverly Lake: 3 seen on June 9, and 5 on June 11, 1949 constituting the only records.

Athough seen by us in 1947 and 1948 in small numbers at Churchill, the species appears rare to accidental in spring migration through the southern interior of Keewatin, and only slightly — if at all — more numerous in fall.

9. **Canada Goose,** *Branta canadensis*

Arrival dates: Churchill — May 30, 1947; May 19, 1948. Ilford, Manitoba — April 28, 1949. Windy River — June 6. 1947; June 5, 1948. Beverly Lake — June 2, 1949.

Windy River: Small flocks were seen until June 13, 1947, after which only pairs and single birds were noted. No subspecific identification was attempted. In 1948 small flocks were recorded until June 23, and no others were observed until Sept. 13 when approximately a hundred birds were seen in one flight. No direct evidence of breeding was discovered but Schweder believed that a pair nested each year on the upper Windy River.

Angikuni Lake: 6 flightless adults were seen Aug. 6, 1948 and a pair of adults with 4 young on Aug. 10, 1948.

Thlewiaza River: From Aug. 21 on the species became rapidly more numerous as the coast of Hudson Bay was neared. More than 300 were seen daily Aug. 26-Aug. 28, 1947.

Beverly Lake: June 2 to June 25, 1949, from 8-150 seen daily. Thereafter average daily records show 6-12 birds. It is probable that much larger numbers were present on the sandy islets far out in the lake, and the cries of many geese could be heard on still evenings from these islets. After June 15, 1949, two races were to be found; the smaller being half to two-thirds the size of the larger subspecies and making up about one third of the population.

A large race was fairly numerous and well distributed throughout the plains, being most numerous as a summer resident in the Beverly Lake area, and as a migrant, in the coastal region. A small race was definitely present as a summer resident at Beverly Lake, and was not recognized south of that point.

10. **American Brant,** *Branta bernicla*

On June 4, 1947, a pair appeared with a flock of Herring Gulls on the ice near camp at Windy River. They were watched through binoculars at a range of 60 yards. One bird was later wounded but escaped. On June 9, 1947, a single bird was seen with pintails and mallards and was observed in flight at 100 feet. The record appears to be accidental.

11. **White-fronted Goose,** *Anser albifrons*

On June 6, 1947 a single bird was seen on Windy River and on June 9, a male was collected by Mowat from a flock of five at this location. In 1948 a pair with 6 flightless young was found on the Kazan River near Angikuni Lake. George Lush reported the species as rare in migration at the mouth of Thlewiaza River.

At Beverly Lake the species arrived June 2, 1949 and thereafter from 6-40 were seen daily until June 26. Occasional birds were heard until July 17 and 3 adults, still flying, were found with 9 downy young on July 23.

The relative abundance of the species at Beverly makes its apparent rarity as a migrant south through Keewatin notable. See distributional notes under Snow Goose.

12. **Snow Goose,** *Chen hyperborea*

Arrival date: Beverly Lake — June 3, 1949.

Windy River: C. Schweder shot one near Windy Bay in late summer of 1941. The specimen was emaciated and may have been diseased.

Thlewiaza River: A flock of 170 at Eskimo Point on Aug. 28, 1947. George Lush reported the species as a common migrant, spring and fall, at the mouth of Thlewiaza River.

Beverly Lake: From June 3, 1949 until June 24 from 4-100 seen daily. Some were observed far out on the lake, on sandy islets, until July 14, but none were seen thereafter. Some individuals were conspicuously larger than the majority seen, but this may have been due to sexual dimorphism.

The breeding concentration of geese at Beverly Lake and northward (Peter Scott, Wild Geese and Eskimos, London, 1951), contrasted with the relative scarcity in migration through the interior of Keewatin, and considered in conjunction with the large number of migrants along the coast of Hudson Bay, seems important. Our data indicate that Canada and Snow Geese may reach the main breeding grounds in the north of Keewatin by a Hudson Bay West Coast flyway; while White-fronted Geese appear to reach this breeding area from the west, via a central flyway.

13. **Blue Goose,** *Chen caerulescens*

On May 20, 1948, a single bird leading a small flock of Canada Geese was seen at Churchill. This appears to be one of the few Churchill records for the species.

At Beverly Lake 5 birds were seen on June 11, 1949; and 3 on June 15.

The species appears accidental on the Hudson Bay West Coast Flyway, and at least very rare in the interior north as far as Beverly Lake.

14. **Common Mallard,** *Anas platyrhynchos*

Arrival dates: Windy River — June 9, 1947; June 2, 1948.

N. Manitoba: Common on the Cochrane River but much less numerous north along the Kasmere River. On July 25, 1947, 2 broods were seen. The young numbered 8 and 6, and were about ten days old.

Windy River: A female on June 9, 1947 and 5 males on June 11. In 1948 a single female was seen on June 2. On Aug. 14, 1947, a female was found on Simon's Lake near Windy Bay, acting as if she had young. C. Schweder reported that the species bred regularly on this lake.

Common in the Reindeer Lake area and becoming scarce to timberline, beyond which the species does not appear to go.

15. **Black Duck,** *Anas rubripes*

On June 30, 1947 a single bird at Windy River and on July 13, 1947, a pair on the south end of Nueltin Lake. On Aug. 31,

1948, Lawrie observed 5 birds at Windy Bay but was not able to establish positive identification. Two other birds on July 24, 1948, at Angikuni Lake were probably of this species.

The absence of this species south of timberline to Brochet perhaps indicates that the birds seen were from the south east. The species is rare, but probably of regular occurrence in the southern part of the Keewatin plains area.

16. **American Pintail,** *Anas acuta*

Arrival dates: Churchill — May 20, 1947. Windy River — June 3, 1947; May 23, 1948. Beverly Lake — June 11, 1949.

N. Manitoba: Rare on the Cochrane and only slightly more numerous north along the Kasmere River with a total of 7 records.

Windy River: Flocks of up to 100 were seen daily in 1947 from June 4 to June 15, after which the species was not much in evidence though possibly breeding locally in small numbers. In the spring of 1948 it was much less numerous in migration and was not seen after June 20. In 1949 occasional birds were seen along Windy River, August 2 to August 15, and a flock of 20 was seen at Simon's Lake, August 20.

Beverly Lake: From June 2, 1949 until the end of that month from 4 to 20 seen daily. It was less in evidence thereafter though breeding locally.

The apparent absence of this species at Angikuni Lake and along the Thlewiaza River may be due to seasonal dispersal. Certainly the species was fairly common in spring migration at timberline, and undoubtedly breeds across the entire area under study.

17. **Green-winged Teal,** *Anas carolinensis*

Arrival dates: Ilford, Man. — May 3, 1949. Windy River — June 7, 1947; June 3, 1948.

Five were seen at Windy Bay in 1947 and two pairs in 1948. A pair on the Cochrane River near Misty Lake on July 23, 1947. Evidently an uncommon but regular summer resident at and below timberline.

18. **Baldpate,** *Mareca americana*

On June 6, 1947, a male was collected from a pair seen at Simon's Lake. A second pair on Windy River July 7, 1947 and a single bird on the Kasmere River, July 29, 1947, constitute the only other records.

19. [**Shoveller,** *Spatula clypeata*

C. Schweder reported having shot a pair at Windy Bay in June, 1945.]

20. **Greater Scaup Duck,** *Aythya marila*

Arrival dates: Churchill — May 21, 1947. Windy River — June 7, 1947; May 24, 1948. Beverly Lake — June 11, 1949.

Windy River: One or two recorded almost daily in 1947 and 1948. Breeding locally.

Angikuni Lake: A flock of 10 males on July 24, 1948.

Thlewiaza River: One bird on Aug. 22, 1947.

Beverly Lake: A pair on June 11, 1949.

Sparsely distributed over the entire area north of timberline. All specimens taken were of the present species, and no field records for *Aythya affinis* were made though a particular search was instituted.

21. **American Golden-eye,** *Bucephala clangula*

Arrival dates: Windy River — June 6, 1947; May 26, 1948.

N. Manitoba: Not much in evidence but probably fairly common through the area.

Windy River: Only occasional birds were seen on Windy Bay, but a small lake surrounded by a heavy stand of spruce and hidden in the hills south of camp had a large population. On July 6, 1947 almost a hundred birds were seen in this area and on June 25, 1948, a flock of 30 males was found there.

Thlewiaza River: rare and only seen where areas of timber approached the river.

The localized abundance at Windy River is probably due to non-breeding, or post-breeding flocks of males from farther south. The species is not normally a summer resident north of timberline.

22. **Buffle-head,** *Bucephalas albeola*

A pair spent two days (June 7-8, 1947) at the mouth of Windy River. Evidently accidental.

23. **Old Squaw,** *Clangula hyemalis*

Arrival dates: Churchill — May 21, 1948. Windy River — June 5, 1947; June 10, 1948. Beverly Lake — June 9, 1949.

Windy River: Ice conditions kept most species of waterfowl in congested areas until June 13, 1947. The present species was seen in numbers averaging 30 a day, until this date. They were scarce afterwards and only occasional birds were seen. A nest on July 1, 1947 contained 6 fresh eggs and was

located on a small, treeless islet. In 1948 occasional pairs were seen until June 20.

Angikuni Lake: Recorded 5 times from July 25 to Aug. 8, 1949. A pair with 3 young, two-third grown, were found on a tundra pond on the later date.

Thlewiaza River: Only 3 records east to Hudson Bay, but common at the coast.

Beverly Lake: The most common duck in the area with from 12 to 35 seen daily.

Sparsely dispersed through the southern interior regions but common at the coast, at least in fall migration, and at Beverly Lake during the breeding season.

24. **King Eider,** *Somateria spectabilis*

Schweder informed the authors that he had shot a male of this species near Windy Bay on September 17, 1947. The specimen is in the possession of F. Harper. Certainly an accidental record at this locality.

25. **White-winged Scoter,** *Melanitta deglandi*

One record for June 30, 1947 at Windy Bay. A female with 7 young near the mouth of the bay on Aug. 15, 1947 and 3 adults at the south end of Nueltin Lake, July 12, 1947.

Timberline appears to mark the northern limit of this species in this area.

26. **Surf Scoter,** *Melanitta perspicillata*

Arrival dates: Churchill — May 22, 1947. Windy River — June 6, 1947; June 3, 1948.

N. Manitoba: 2 seen on Kasmere River near Fort Hall Lake, July 16, 1947.

Windy River: Uncommon in both 1947 and 1948 and not recorded after the spring migration of ducks ended.

Thlewiaza River: Seen only at the coast, but then in flocks of up to 300 birds daily.

Rare in the interior and there were no indications that the species summered north of timberline in the area studied.

27. **American Scoter,** *Oidemia americana*

Arrival dates: Windy River — June 6, 1947; May 30, 1948.

N. Manitoba: Seen south as far as Misty Lake but most numerous on the Kasmere River where flocks of up to 16 were seen daily in late July, 1947.

Windy River: Fairly common in both 1947 and 1948, with 1 to 5 birds seen daily. A nest on a barren islet contained 8 slightly incubated eggs on July 9, 1947. Last seen on Sept. 25, 1948.

Angikuni Lake: A single female on Aug. 5, 1948.

Thlewiaza River: 5 records on the river and several small flocks on Hudson Bay near Eskimo Point, Aug. 27, 1947.

Fairly common along the northern forest limits and probably common southward. Uncommon to rare on the open interior plains, though present in some numbers at the coast.

28. **Hooded Merganser,** *Lophodytes cucullatus*

Five eclipse birds were seen at Misty Lake, July 25, 1947. Schweder reports having taken two from fish nets in the Windy River in the autumn of 1947. Probably not uncommon south of timberline, but accidental northward.

29. **American Merganser,** *Mergus merganser*

Arrival dates: Windy River — June 6, 1947; May 23, 1948.

N. Manitoba: Fairly common and evenly distributed along the Cochrane and Kasmere Rivers. Congregating, in eclipse plumage, with the following species at all rapids.

Windy River: Fairly common in 1947 and slightly more abundant in 1948. Young still unable to fly were seen Sept. 15, 1948, and the species was last seen on Oct. 5, 1948.

Fairly common through timber country and to Windy River, but not certainly identified north or east of here, and definitely not seen at Beverly Lake. It would appear that the distribution of this species is more southerly than for the following species, at least in the area studied.

30. **Red-breasted Merganser,** *Mergus serrator*

Arrival dates: Windy River — June 6, 1947; June 8, 1948. Beverly Lake — June 19, 1949.

N. Manitoba: Common to abundant on the major rivers with from 50 to 300 individuals seen daily. Most birds were in eclipse and were congregated at the foot of rapids. On Aug. 1, 1947 three broods, none of the young being more than a week old, were found on the Kasmere River.

Windy River: Almost, if not quite, as numerous as the preceding species. A nest with 9 fresh eggs was found July 1, 1947. Another nest on July 5, 1947 held 5 fresh eggs, while a nest on July 12 had 8 slightly incubated eggs. All nests were on islets. Oct. 3, 1948, was the latest date for the species.

Angikuni Lake: Slightly more common than at Windy River with from 7 to 8 seen

daily, most of these being in eclipse. Two recently hatched young were found on Aug. 10, 1948.

Thlewiaza River: Fairly common, and becoming commoner down river to a point fifty miles from the coast. None were seen beyond this point. Broods of 13, 6, and 3 young were seen on Aug. 14, 1947, and none appeared more than a week old. From Aug. 17 to Aug. 20, 1947, an average of 100 adults daily, mostly in eclipse and concentrated at rapids.

Brochet: A flight of 30 on Nov. 1, 1948.

Beverly Lake: Uncommon with only 11 individuals recorded.

The commonest duck in the wooded areas below timberline and fairly common north to Angikuni Lake. Sparsely distributed from there north to Beverly Lake.

31. **Goshawk,** *Accipiter gentilis*

Windy River: In the fall of both 1947 and 1948 an influx of birds, mainly juveniles, was recorded. In 1948 there were 21 records between Sept. 10 and Oct. 27. One flock contained 5 juveniles. Only five of the above records were for adults but there was evidence that a pair nested near Windy Bay in 1948.

Brochet: A single juvenile on Nov. 18, 1948.

Probably breeding through the northern forests to timberline and wandering north in fall, perhaps some distance into the open plains.

32. **Broad-winged Hawk,** *Buteo platypterus*

A single record, July 16, 1947, on the portage between the Cochrane and Kasmere Rivers.

33. **American Rough-legged Hawk,** *Buteo lagopus*

Arrival dates: Ilford — April 19, 1949. Churchill — May 19, 1948. Windy River — June 2, 1947; June 2, 1948. Beverly Lake — June 2, 1949.

Windy River: Not common in 1947, though one or two, probably members of the same pair, were seen almost daily. Three nests were examined but none was occupied. In 1948 the species was rare with only 2 records for spring and summer, and 14 for fall — the last on Oct. 29. C. Schweder reports that some years many individuals winter in the plains north of Windy River. Abundance appeared directly related to the local lemming cycle. 1946 was a peak year while almost no lemmings were present in 1947, and very few in 1948. The one-year lag in predator cycles would seem to explain the rarity of this species during 1947 and 1948.

Angikuni Lake: Not uncommon, 1 or 2 being seen daily. A nest with 5 young about 2 weeks old, on a rock in a small tundra pond was found July 21, 1948. Lemmings were fairly numerous here suggesting, together with the larger hawk population, a time differential between small mammal peaks at Angikuni and Windy River.

Thlewiaza River: Uncommon, with 5 records.

Beverly Lake: In 1949 the lemming population here was high. There were 15 records for Rough-legged Hawks with 1 or 2 seen daily. An occupied nest was found on July 11, 1949, but not investigated.

There appears to be considerable local variation in abundance, directly related to local variations in the time of peak lemming cycles. However, the species is well distributed in summer throughout the plains area. In 1947 the relationships of light to dark phase birds in the southern areas was almost exactly 50-50. At Beverly Lake the majority were light phase birds.

34. **Golden Eagle,** *Aquila chrysaëtos*

An immature bird was seen on July 6, 1947 at Windy River and an adult on Aug. 1, 1947 on the Kasmere River.

Rare, north of timberline and uncommon south of it.

35. **Bald Eagle,** *Haliaeetus leucocephalus*

Two adults were seen on the Cochrane River July 21, 23, 1947 and one adult at the south end of Nueltin Lake Aug. 3, 1947. None recorded north of timberline.

36. **Marsh Hawk,** *Circus cyaneus*

An immature female was collected at Windy River Aug. 18, 1948 and six additional immatures were seen between Aug. 16 and Sept. 8, 1948. A single immature on Aug. 21, 1949. The appearance of this species appears to be due to a northward migration of immature birds in late summer and early autumn.

37. **Osprey,** *Pandion haliaetus*

A single record, for La Pensie Lake on the Cochrane River, July 22, 1947.

38. **Gyrfalcon,** *Falco rusticolus*

Windy River: A very dark and probably immature bird was seen on August 15, 1947.

A second bird, unsuccessfully attacking a raven, was observed November 23, 1948.

Brochet: On Dec. 11 and 12, 1949, a very light phase bird hunted ptarmigan in the vicinity of the settlement.

Thlewiaza River: George Lush reported finding a nest of this species on a cliff near Edehon Lake; and that he saw six or seven individuals each year near the mouth of Thlewiaza River.

Angikuni Lake: A brownish individual seen twice on July 23, 1948, and another single bird recorded on July 28.

Beverly Lake: One record; July 7, 1949.

The scarcity of cliff-faces in the interior plains is probably the limiting population factor. It seems certain that, while the species appears rare, it is distributed over the whole Barrens section of the study area as a summer resident.

39. **Duck Hawk,** *Falco peregrinus*

Arrival dates: Windy River — June 4, 1947. Churchill — May 25, 1947. Beverly Lake — June 2, 1949.

Windy River: A pair nested on a cliff near camp in 1947 but after a single egg had been laid, the nest was deserted. The nest was not used in 1948 but two juveniles were seen in late September. A pair was evidently nesting at Big Point on Nueltin Lake in 1947.

Thlewiaza River: One recorded; Aug. 25, 1947, at the coast.

Angikuni Lake: A nest containing 3 well-grown young on a high cliff near Kamilukuak Lake on Aug. 2, 1948. No others were seen except in the vicinity of this nest.

Beverly Lake: Six records between June 2, 1949 and June 29, 1949.

Widely distributed over the plains area and nesting wherever suitable sites are available.

40. **Pigeon Hawk,** *Falco columbarius*

N. Manitoba: 4 adults seen on the Cochrane and Kasmere Rivers in July, 1947. On July 27, a nest was found in a Jack pine, which contained 2 well-grown young, within a few days of leaving the nest.

Windy River: In 1947 a single record, but during June of 1948, 4 adults were seen. Between Sept. 1-6, 1948, 3 juveniles. One juvenile on Aug. 19, 1949. C. Schweder reported finding a nest in a spruce 'oasis' on the Kazan River near Ennadai Lake in July, 1943.

Not uncommon breeding north to timberline, and for some distance into the plains where suitable nesting sites are to be found.

41. **Spruce Grouse,** *Canachites canadensis*

N. Manitoba and Brochet: Several were seen along the Cochrane and Kasmere Rivers in July, 1947. The species was common at Brochet during the winter 1948-49 where the Indians killed large numbers for the pot.

Windy River: A female was collected June 8, 1947. A family including 8 downy young, about a week old, was found in late July, 1947. In 1948, 4 adults, of 8 seen, were shot in various spruce thickets. C. Schweder reported that he had found isolated individuals in spruce stands for fifty miles to the north of Windy River.

Fairly common north as far as satisfactory tree cover is available.

42. **Ruffed Grouse,** *Bonasa umbellus*

Accidentals stray north to Brochet but the north limit of the range seems to reach about half way up Reindeer Lake. This species was almost as numerous as the Spruce Grouse at the south end of Reindeer in 1948.

43. **Willow Ptarmigan,** *Lagopus lagopus*

Windy River: Abundant in spring and fall migration. Heavy spring movement seemed to begin about mid-May and until the end of the month enormous flocks moved through the area. From May 31 to June 2, 1947, as many as 2000 individuals were seen daily. However this was an unusually late season and in 1948 the bulk of the migrants had passed by the time we arrived on May 23. Most birds were paired by June 5, 1948 and residents were in occupation of all suitable territories by that date. On July 8, 1948, newly hatched young were found. Fall migration began about Oct. 10, 1948 and between Oct. 11 and Oct. 12 about 1000 migrants were seen. The migration reached its peak by Oct. 24 after which date an average of 10-25 were seen daily until Dec. 9, probably representing winter resident birds. The summer range extended south to Big Point on Nueltin Lake where at least one pair was breeding in 1947.

Angikuni Lake: It was difficult to assess the relative numbers of this and the following species, but ptarmigan were numerous in the area. Twenty family groups were seen with from 2 to 12 young, and an average of 6 per family. Breeding population

was about twice that at Windy River. By Aug. 11, 1948, flocking had begun and families were grouping into larger units of 20 to 50 individuals.

Thlewiaza River: Ptarmigan were very scarce east from Nueltin to Hudson Bay and only 2 birds, probably of this species, were seen inland from the coast.

Brochet: First migrants arrived Oct. 20, 1948 — about ten days after the major migrant wave began to pass Windy River. The species did not become numerous until Nov. 15. The majority of the flocks moved south of Brochet and appeared to be most abundant as winter residents at the south end of Reindeer Lake. By Dec. 1 the population was fairly well stabilized at Brochet with from 50 to 300 birds seen daily. Northward from a point 130 miles south of Churchill on the H.B. Railway, the species was common during the winter 1948-49.

Beverly Lake: Ptarmigan arrived here on June 3, 1949. From this date 1 to 6 were seen daily and a nest with 7 eggs was found on June 25, 1949. No certain identification of the following species was made and all ptarmigan seen were referred to the present species.

Willow Ptarmigan bred commonly north from timberline but the boundary where this species began to overlap the range of the Rock Ptarmigan was not determined. It is perhaps somewhere near the axis Eskimo Point-Angikuni Lake.

44. **Rock Ptarmigan,** *Lagopus mutus*

Windy River: The only certain records are for two dead birds and a live individual seen at the end of May, 1947. Not found in summer and rare in migration at this point. On Nov. 10, 1948, 2 were seen at Kognac River amongst 50 Willow Ptarmigan. A total of 12 were seen in this general area on Nov. 14.

Angikuni Lake: A small percentage of the ptarmigan seen were probably of this species but there was no confirmation through specimens.

Brochet and N. Manitoba: A single bird, probably the same one, on Dec. 11 and Dec. 14, 1947, in company with a large flock of Willow Ptarmigan.

The rarity of this species in winter when sight identification is easier seems to indicate a small interior population, relative to the preceding species, in the study area. It is our opinion that the species does not occur regularly as a summer resident south of Angikuni Lake.

45. **Sharp-tailed Grouse,** *Pedioecetes phasianellus*

A flock of 7 wintered at Brochet, 1948-49, and other small flocks were reported to the south. There is some possibility it breeds farther south, and moves north for some distance in the winter.

46. **Little Brown Crane,** *Grus canadensis*

Windy Bay: On June 9, 1947, a flock of 6 was seen moving north over camp and on May 15 Fred Schweder reported 3 flocks of 8, 12, and 6, respectively over the south end of Nueltin. Lawrie saw 2 migrating south near camp on Sept. 7, 1948.

George Lush reported a nest with 2 eggs about 60 miles west of the mouth of Thlewiaza River in 1938 and flightless young from the same area in 1940. He also reported heavy spring and fall migration along the coast. Combined with our observations this indicates that the balance of the high arctic birds migrate along the coast in preference to the interior, in the manner we have already suggested for certain of the geese. Lawrie found the species fairly common at Beverly Lake with from 1 to 6 seen daily after the arrival date of June 2, 1949, and the birds were almost certainly breeding locally. In the interior south of Beverly Lake the species was rare both as a migrant, and as a summer resident.

47. [**Whooping Crane,** *Grus americana*

On April 9, 1947, C. Schweder saw two white cranes circling the mouth of Putahow River at the south end of Nueltin Lake. The birds circled for nearly an hour, evidently wishing to land on the only exposed ground in the area — a snow-free sand ridge where the Schweders had their tent. The birds passed over the tent once at an altitude of about 50 feet and there seems no reasonable grounds for doubting the authenticity of the record.]

48. **Semipalmated Plover,** *Charadrius hiaticula*

Arrival dates: Churchill — May 20, 1947. Windy River — June 5, 1947; May 23, 1948. Beverly Lake — June 5, 1949.

N. Manitoba: A pair on July 30, 1947, near Kasmere Lake acting as if they had a nest. A single on Aug. 1, 1947 on Kasmere River.

Windy River: Widely distributed locally. Two nests, July 1 and July 4, 1947, on a high stony ridge held 2 and 4 fresh eggs. After early August in 1947 and 1948, no birds were seen. Aug. 1 was the last date, in any year, when the species was observed in the interior from Nueltin to Beverly Lake.

Angikuni Lake: A single record, July 23, 1948.

Thlewiaza River: None in the interior but from 2 to 5 daily on the coast in late August.

Probabaly summering in the interior from timberline and a short way south of it, north to Beverly Lake where from 1 to 4 were seen daily from June 5 to July 22, 1949. Though fairly numerous at both Windy River and Beverly, the species appeared absent in the intervening area.

49. **Killdeer,** *Charadrius vociferus*

Arrival date: Ilford, Man. — April 29, 1949. Churchill — May 20, 1948.

June 9, 1947, a single bird near Windy River camp. Probably the same bird seen again the following day. Accidental north of timberline.

50. **American Golden Plover,** *Pluvialis dominica*

Arrival date: Beverly Lake — June 2, 1949.

Three were seen July 29, 1948, at Angikuni Lake. At Beverly Lake from June 2 to 14, 1949, 4 to 30 seen daily with an average of 15 per day. None were seen thereafter until July 22 when 4 were observed. There was no evidence of breeding.

Very rare in the area studied north to Beverly Lake and probably only a migrant there.

51. **Black-bellied Plover,** *Squatarola squatarola*

One at Eskimo Point, Aug. 27, 1947. First seen at Beverly Lake June 4, 1949. 5 records during the first two weeks in June, and not seen thereafter.

A rare migrant at Beverly Lake, and accidental in the interior to the south. It appears that this and the preceding species do not normally migrate through the interior of Keewatin.

52. **Ruddy Turnstone,** *Arenaria interpres*

A flock of 29 at Windy River June 5, 1947 and one collected June 15, 1947. On Aug. 27, 1947, 4 were seen at Eskimo Point. First arrival at Beverly Lake was June 13, 1949 and from June 13 to June 19, one or two were seen daily.

A rare migrant in the study area, slightly more numerous about Beverly Lake than elsewhere.

53. **Wilson's Snipe,** *Capella gallinago*

Arrival dates: Ilford, Man.—April 29, 1949. Windy River — June 5, 1947; May 28, 1948.

Fairly common at Windy River and present southward to Brochet. Mating flights began on June 10, 1947 and June 7, 1948. Last record at Windy River July 10, 1947; July 6, 1948.

54. **Hudsonian Curlew,** *Numenius phaeopus*

One on June 6, 1947, at Windy River. A flock of 50 at Eskimo Point on Aug. 28, 1947. The absence of this species at Beverly Lake and elsewhere inland indicates that it is accidental or at least very rare in the interior of the study area, even as a migrant.

55. **Spotted Sandpiper,** *Actitis macularia*

Arrival dates: Churchill — May 29, 1947. Windy River — June 4, 1947; May 31, 1948.

N. Manitoba: Common on the Cochrane and Kasmere Rivers with an average of ten records a day. Week-old young were found near Lac du Brochet on July 17, 1947, and a nest with 4 well incubated eggs on the upper Kasmere River, July 27, 1947.

Windy River: Fairly common in 1947, 1948, and 1949, with 2 to 4 seen daily. The local distribution was limited to the shores of Windy and Little Rivers where there were stands of spruce upon both banks. Last seen Aug. 14, 1947; Aug. 15, 1948; Aug. 16, 1949. Common in the forested sections of the area north to Windy River but not recorded eastward toward Hudson Bay.

56. **Solitary Sandpiper,** *Tringa solitaria*

Two records, July 23, 28, 1947, on the Cochrane River below Lac du Brochet. Accidental northward.

57. **Greater Yellow-legs,** *Totanus melanoleucus*

Arrival dates: Ilford, Man. — April 29, 1949. Windy River — May 29, 1948.

Occasional individuals in company with the next species were seen at Windy River in spring. One record for 1947; and 4 for 1948 between May 29 and June 1. Probably rare to accidental north of timberline.

58. **Lesser Yellow-legs,** *Totanus flavipes*

Arrival dates: Churchill — May 20, 1947. Windy River — June 4, 1947; May 23, 1948.

N. Manitoba: 5 records along Cochrane and Kasmere Rivers in July, 1947. A pair with 2 young, about ten days old, on Cochrane River July 27, 1947.

Windy River: Uncommon summer resident with flocks numbering up to 12 in spring migration. 3 to 5 pairs summering in the wooded areas. Not present after Aug. 10, 1947; Aug. 15, 1948; Aug. 17, 1949.

Angikuni Lake: Fairly numerous but in small flocks of 3 to 8 indicating that these were non-breeding birds. Not seen after Aug. 3, 1948.

Since the species was not recorded at Beverly and there was no breeding evidence at Angikuni, it appears that the breeding range terminated a short distance north of timber-line while the range of non-breeding summer migrants normally does not extend far north of Angikuni Lake.

59. **American Knot,** *Calidris canutus*

Two were seen on Aug. 2, 1948, near Angikuni Lake and a flock of 12 on Aug. 11 in the same area; 4 at Eskimo Point on Aug. 26, 1947. Occurrence in the interior is probably limited to ranging flocks of non-breeding birds during the summer.

60. **Pectoral Sandpiper,** *Erolia melanotos*

Arrival dates: Churchill — May 29, 1947; May 21, 1948. Windy River — June 5, 1947; May 25, 1948. Beverly Lake — June 2, 1949.

Windy River: An uncommon spring migrant in 1947 wth 8 records to June 13. A single record in spring 1948 and 3 fall records, the last being on Sept. 19.

Angikuni Lake: 3 records between July 23 and Aug. 3, 1948.

Thlewiaza River: 2 records on the river proper but large numbers seen along the coast to Eskimo Point with flocks of 25 or more seen frequently.

Beverly Lake: From June 2 to June 21, 1949, 6 to 25 daily. Male courting on June 20. Single birds seen until July 3.

The rarity of most shorebirds in migrations at Windy River, Angikuni Lake, and along the Thlewiaza River suggests that the bulk of the species which breed north of the Thelon River — Chesterfield Inlet axis must migrate either along the Hudson Bay west coast, or up a more western flyway. They then spread west, or east as the case may be, into the breeding areas. It seems certain that very few pass through the south-central Keewatin highlands. This fact supports the hypothesis made earlier in this paper, in regard to certain ducks and geese.

61. **White-rumped Sandpiper,** *Erolia fuscicollis*

On June 7, 1948, one was seen with a flock of Semipalmated Sandpipers at Windy River. At Beverly Lake 7 were seen on June 19, 20, 1949. As with most shorebirds, very rare in the interior of the study area, south of Beverly Lake where it may be an uncommon, but regular migrant.

62. **Baird's Sandpiper,** *Erolia bairdi*

Ten records, including a specimen at Windy River, between June 5 and June 17, 1947 — but none seen at Windy in 1948. Sixteen were seen along the Thlewiaza River, with most of these being recorded near the coast. In 1948, at Angikuni Lake, flocks totalling 12 birds were seen on three occasions. There was only a single record from Beverly Lake, June 5, 1949. Probably the interior birds were summer vagrants.

63. **Least Sandpiper,** *Erolia minutilla*

Arrival dates: Churchill — May 21, 1947. Windy River — June 5, 1947; June 7, 1948.

Windy River: This and the Semipalmated Sandpiper appeared equally common and both species bred locally. A nest of the present species found on June 22, 1947, contained 4 fresh eggs. The last adults seen in fall migration were on Aug. 15, 1947.

Angikuni Lake: 5 individuals in 1948.

Thlewiaza River: 7 records in 1947.

This species was not certainly identified at Beverly Lake. At other points it ranged contemporaneously with the Semipalmated Sandpiper and at Windy River was as numerous, though at all other localities it was greatly inferior in numbers.

64. **Red-backed Sandpiper,** *Erolia alpina*

The only record for the interior south of Beverly Lake is a single bird shot by Eskimos on the middle Kazan River on July 1, 1947. At Beverly Lake the species arrived on June 12, 1949, and six were seen before the species disappeared on June 15. Evidently this species follows the pattern already postulated for the migration of most shore birds in this area. However it seems to be even more of a maritime migrant, following the west shore of Hudson Bay in large numbers in spring at least.

65. **Stilt Sandpiper,** *Micropalama himantopus*

Arrival dates: Churchill — May 21, 1948. Windy River — June 4, 1947. Beverly Lake — June 20, 1949.

Fairly common at Windy River between June 4 and June 14, 1947 (56 records), but completely absent in 1948. The only interior record in 1948 was for 3 seen near Angikuni Lake on July 27, and these were probably mid-season wanderers from other areas. At Beverly Lake in 1949, 13 were seen between June 20 and June 22, but there was no evidence of summer residents thereafter.

The apparent abundance at Windy River in 1947 was probably accidental and due to the unusual weather conditions that year. The species is very rare generally in migration and probably does not breed in the study area.

66. **Semipalmated Sandpiper,** *Ereunetes pusillus*

Arrival dates: Windy River — June 5, 1947; May 24, 1948. Beverly Lake — June 2, 1949.

Fairly common at Windy River. A nest with 3 slightly incubated eggs on June 29, 1947. A second nest with 4 fresh eggs on June 8, 1948. Rare along the Thlewiaza River, but by the time this journey was made, migration would have been well advanced for most shorebirds. It was common in the Angikuni area where flying juveniles were seen on July 28, 1948. It was last seen in the Angikuni area on Aug. 9. At Windy River fall migration was well in progress by Aug. 15, 1948. At Beverly Lake this was the common sandpiper with from 6 to 30 seen daily until June 25, 1949. A nest on July 13, contained 4 eggs and, on the following day, these eggs had hatched.

One of the few shorebirds that was well distributed, and breeding, through the Barrens section of the study area.

67. **Sanderling,** *Crocethia alba*

A single record from Brochet, Oct. 25, 1948, was almost certainly an accidental stray. The only other records are from Beverly Lake where 4 were seen between June 14 and June 20, 1949. This species is not found even as a migrant in the interior of the study area and its occurrence south of Beverly Lake in the interior plains is evidently only accidental.

68. **Red Phalarope,** *Phalaropus fulicarius*

Three were seen with a flock of Northern Phalaropes near Eskimo Point, Aug. 27, 1947. Entirely maritime as far as the study area is concerned.

69. **Northern Phalarope,** *Lobipes lobatus*

Arrival dates: Windy River — June 3, 1948. Beverly Lake — June 10, 1949.

None at Windy River in 1947, but not uncommon from June 3 to June 10 in 1948, after which none were seen. At Angikuni Lake the species was fairly common and young were seen on July 23, 1948. The last record for this area was Aug. 4. Along the coast of Hudson Bay, Aug. 26 to 28, 1947, the species was abundant with flocks of 300 or more individuals frequently seen. At Beverly Lake it was common, probably breeding although the last record was for July 22, 1949.

Probably a scarce migrant through the interior (in comparison with coastal numbers) but well distributed and breeding through the Barrens proper.

70. **Pomarine Jaeger,** *Stercorarius pomarinus*

A single dark phase bird at Beverly Lake, June 21, 1949. Rare to accidental in the interior of the study area.

71. **Parasitic Jaeger,** *Stercorarius parasiticus*

Arrival dates: Churchill — May 25, 1947. Windy River — June 4, 1947; June 7, 1948.

Windy River: The nine records for 1947 probably all concern a single pair which may have nested locally. The pair was seen attacking a wounded Ring-billed Gull on June 24, first driving it from a rock into the river, then repeatedly striking it about the head. The 1948 records for Windy River show a single bird seen on June 7.

Angikuni Lake: Common, breeding in some numbers. On Aug. 5 a pair was found with one well-grown young that could make a fairly sustained flight. The nest was near a small tundra pond. At Angikuni, individuals were several times observed attacking Duck Hawks and evidently coming close enough to strike.

Thlewiaza River: Fairly common along the whole river and at the coast. A flock of 16 was found near Edehon Lake on Aug. 22, 1947.

Beverly Lake: Rare in this area. 5 records, all between July 20 and July 22, and

perhaps attributable to only one or two individuals.

This species appears to range commonly and to breed locally throughout the southern section of the plains area, but to become rare to the north at least near Beverly Lake.

72. **Long-tailed Jaeger,** *Stercorarius longicaudus*

Arrival dates: Windy River — June 5, 1947; June 10, 1948. Beverly Lake — June 7, 1949.

Windy River: One or two pairs summered in the area in both 1947 and 1948.

Angikuni Lake: At least as common as the preceding species and undoubtedly breeding. Many territorial displays were noted.

Thlewiaza River: None were seen on the river proper but two pairs were noted at the coast.

Beverly Lake: Very common with from 1 to 25 seen daily and an average of 12 per day. A nest being built was found June 25, 1949. Another nest, unlined, on a sandy patch of ground contained 2 eggs on July 3. By July 15 there was a newly hatched young bird in this nest. It was noted here that this species when defending territory would attack and actually strike not only hawks and gulls, but even caribou and men as well.

The distribution of this species appears similar to that of the preceding species in the plains area from Angikuni Lake to the south. To the north it appears much more abundant and almost replaces the Parasitic Jaeger in the Beverly Lake region.

73. [**Great Black-backed Gull,** *Larus marinus*

On May 25, 1947, at Churchill, a single bird was seen with a flock of Herring Gulls at a range of 200 yds, with binoculars. It was observed both in flight and at rest. The following day a single bird, no doubt the same one, was seen for several minutes in flight. Accidental in this area.]

74. **Herring Gull,** *Larus argentatus*

N. Manitoba: Common and breeding along the Cochrane and Kasmere Rivers in 1947.

Windy River: Common in flocks of 30 to 100 until the ice left the major lakes and rivers after which the flocks dispersed, though the species remained common. The vulture-role of these gulls appears most important. It was noted that they would gather in large numbers remarkably soon after a shot was fired at caribou. In 1948 they were observed to almost completely strip a fresh caribou carcass in less than 24 hours. The same observation was repeated at Beverly Lake in 1949. As scavengers during the spring, summer and early fall, they probably account for the utilization of a very large percentage of available carrion. In early spring numbers of them are caught in fox traps as they attempt to scavenge the meat baits.

On July 1, 1947, a nest with 3 slightly incubated eggs was found. The following year, on June 6, 3 fresh eggs were found in the same nest. The last adults were seen on Sept. 20, 1948, and the last juveniles on Sept. 27.

Angikuni Lake: Common. Swimming young were found on a tundra pond on July 23, 1948. On Aug. 10, young almost ready to fly were seen.

Thlewiaza River: Fairly common on the river and abundant at the coast. Flightless, but well grown young were seen near Edehon Lake on Aug. 17, 1947.

Beverly Lake: Common, undoubtedly breeding, with about 25 records a day throughout the observation period.

Universally common and well distributed over the entire area, breeding where found in summer.

75. **Ring-billed Gull,** *Larus delawarensis*

A wounded bird being attacked by Jaegers was found at Windy River, June 24, 1947. Three days later the bird was collected. Accidental in this area.

76. **Bonaparte's Gull,** *Larus philadelphia*

Scarce but evenly distributed south along the Cochrane and Kasmere River systems in 1947. The only northern record was for 4 seen at Windy River on June 13, 1947.

77. **Common Tern,** *Sterna hirundo*

Terns were common along the Cochrane and Kasmere Rivers in 1947 but no specimens were taken in the area where this and the following species probably overlap. At Windy River, where specimens were collected, the Arctic Tern appeared to be the dominant species. A colony of about 100 pairs on Kasmere Lake appeared to include both species with the Common Tern the most abundant. 40 nests were examined here on July 31, 1947, and their contents ranged from fresh laid eggs to half-grown young. The present species probably does not extend far into the open plains as a breeding species.

78. **Arctic Tern,** *Sterna paradisaea*

Arrival dates: Windy River — June 11, 1947; June 13, 1948. Beverly Lake — June 21, 1949.

Windy River: Uncommon to fairly common in local areas. No large breeding groups — most appearing to breed in groups of one or two pairs on gravel reefs. A nest on July 8, 1947, contained 2 quarter-incubated eggs. Last seen Aug. 15, 1948 and Aug. 16, 1949.

Angikuni Lake: Common, with many flying juveniles seen from Aug. 10, 1948, onward.

Thlewiaza River: Common on the river and on the coast.

Beverly Lake: Common, seen daily in groups of 10 to 20, and no doubt breeding locally.

Common and well distributed as a breeding species north from Nueltin Lake. South of Nueltin its range fades into that of the preceding species.

79. **Brunnich's Murre,** *Uria lomvia*

An emaciated specimen was collected near Edehon Lake on Aug. 17, 1947. The bird was unable to fly and was evidently in a starving condition. Accidental.

80. **Mourning Dove,** *Zenaidura macroura*

At Brochet, on Nov. 10, 1948, a single individual appeared at the settlement and, in company with some ptarmigan, spent two days on a small strip of sand kept snow-free by the wind. The bird appeared weak and eventually was killed by dogs. Undoubtedly an accidental stray.

81. **Great Horned Owl,** *Bubo virginianus*

During the winter of 1943, C. Schweder reported an invasion of this species near Windy River. Seven were caught in fox traps set out into the Barrens as far as Kazan River. During the same winter George Lush saw three horned owls near the mouth of Thlewiaza River. In December, 1948, Mowat saw two at Brochet.

This species breeds north to timberline and in exceptional years may range far to the north. In 1943 the northward trend was probably in search of ptarmigan, many of which wintered at or near timberline in that year.

82. **Snowy Owl,** *Nyctea nyctea*

Although present in fair numbers at Churchill in May of 1947 and 1948, none was seen alive at Windy River where it is found in winter. Pellets indicated that at times the local winter population near Windy River may be large. Schweder reported large numbers wintering there, but with irregular and marked fluctuations that do not appear to conform to the usual cyclic pattern.

We saw two birds in the Angikuni Lake area but found no evidence of breeding. None were seen at Beverly Lake in 1949, but Lawrie saw a single bird near Kognac River on Nov. 14, 1948.

The lemming population was very low during both 1947 and 1948 but neither white foxes nor Rough-legged Hawks showed a numerical decrease to compare with the virtual absence of Snowy Owls in the entire study area. It is possible this species is only a rare summer resident south of Beverly Lake, even when lemming populations are high.

83. **Hawk Owl,** *Surnia ulula*

On June 4, 1947, 2 were seen in flight at Windy River. On June 10, 1947, C. Schweder shot at a bird feeding on a caribou carcass, and he identified it as this species. On Oct. 17, 1948, Lawrie saw a bird in flight, by moonlight, which was probably of this species.

The species has been recorded from Brochet and probably ranges north to timberline at Windy River, though rarely.

84. **Short-eared Owl,** *Asio flammeus*

Arrival dates: Churchill — May 20, 1948. Windy River — June 4, 1947; May 31, 1948.

In 1947 it was uncommon at Windy River with about 2 pairs resident in the area. It was even less numerous in 1948 and the last date for that year was Sept. 23. At Angikuni Lake it was fairly common and was recorded 13 times. At Beverly Lake it was rare, with a single record on July 3, 1949.

The commonest summer owl in the interior plains south of Angikuni Lake, and distributed north at least to Beverly Lake.

85. **Nighthawk,** *Chordeiles minor*

Fairly common along the Cochrane River in July, 1947, north to Lac du Brochet. Not recorded farther north.

86. **Belted Kingfisher,** *Megaceryle alcyon*

A single record from Fort Hall Lake, Kasmere River, July 28, 1947.

87. **Flicker,** *Colaptes auratus*

Arrival date: Ilford, Man. — April 29, 1949.

N. Manitoba: Fairly common along the Cochrane and Kasmere Rivers to the south end of Nueltin Lake with two to six seen daily in July, 1947. On July 15 a nest was found with 8 eggs and the female was still incubating on July 28.

Windy River: A single record from 1947 — July 1. In 1948 six records between June 27 and Sept. 18. Probably breeding in the spruce thickets south of the river.

Fairly common to timberline and possibly straying farther north into isolated spruce stands.

88. **Hairy Woodpecker,** *Dendrocopos villosus*

C. Schweder reported one wintering at Windy River 1946-47. Mowat recorded one on Kasmere River, July 14, 1947; and a second at Brochet on Nov. 18, 1948. It is unlikely that the species is much more than a rarity north of Reindeer Lake.

89. **American Three-toed Woodpecker,** *Picoides tridactylus*

A single female at Brochet on Nov. 26, 1948. Rare to accidental north of Reindeer Lake.

90. **Horned Lark,** *Eremophila alpestris*

Horned larks were present at Churchill and Windy River before our arrival. However they were first seen at Beverly Lake on June 2, 1949. The migration peak at Churchill was reached by May 25, 1947.

Windy River: Migration peaks here were June 2, 1947 and May 26, 1948. The northern race *E.a.alpestris* reached its peak well ahead of *E.a.hoyti.* These two races were identified from specimens. By July 1, 1947, eggs were well incubated and flying juveniles were observed as of July 20. Horned Larks were amongst the commonest breeding species here, with *E.a.alpestris* greatly outnumbering *E.a.hoyti.*

Angikuni Lake: Common throughout this area. Juveniles were flying from July 23, 1949, onward.

Thlewiaza River: Only three records, probably because fall migration had already cleared this area.

Beverly Lake: Migration peak here was reached on June 14, 1949, and by June 30 only one or two birds were to be seen daily. The species was not nearly so common as at Angikuni and Windy River. A nest found on July 14 contained 2 newly hatched young and 1 egg.

Brochet: Not common in fall migration, and the last record was for two individuals on Oct. 20, 1948.

Horned Larks of two subspecies are probably the commonest and most widely distributed birds in the plains area from Angikuni Lake southward. To the north there appears to be a marked dropping off in numbers as indicated by the scarcity at Beverly Lake.

91. **Tree Swallow,** *Iridoprocne bicolor*

Arrival dates: Churchill — May 26, 1947; May 24, 1948.

The only inland records were for two seen at Windy River, June 15 and July 1, 1947. Timberline appears to mark the extreme northern limits in this area.

92. **Cliff Swallow,** *Petrochelidon pyrrhonota*

A large colony (perhaps 250 pairs) was found nesting on a cliff face at Big Point on Nueltin Lake, July 12, 1947. The only additional records are for two birds seen on the upper Kasmere River in July of that year.

93. **Canada Jay,** *Perisoreus canadensis*

N. Manitoba: Common on the Kasmere and Cochrane Rivers in July 1947, with many juveniles seen in family groups. At Brochet it was common during the winter 1948-49. At Ilford, adults were seen carrying food on April 6, 1949, and flying young were seen on April 28.

Windy River: A single record in 1947, for an adult shot on Aug. 10. During 1948 a family group was seen on July 5. That autumn the species was fairly common with several birds seen daily. However none were recorded north of this point. It is probable that they nest north to Windy River in small numbers but that northern autumnal migration swells the population until early winter, when a reverse southward movement takes place.

94. **Raven,** *Corvus corax*

N. Manitoba: Common in summer along both the Kasmere and Cochrane Rivers. A nest with one young, ready to leave, was found at La Pensie Lake, July 18, 1947. By July 25, 1947, flocking had begun. Fluctuating greatly in winter numbers at Brochet.

Windy River: Slightly less common in summer than in the forests with from one to three seen almost daily in 1947 and 1948.

This population was swelled abruptly in the fall, almost certainly by an influx from the north. The high level was maintained at least until Dec. 10, 1948 but the species was absent from the open plains to the north during both November and December of that year. The earliest flying juveniles observed here were seen July 26, 1947.

Angikuni Lake: Uncommon, with only 7 records. These were all single birds and no juveniles were seen in 1948.

Thlewiaza River: Almost absent with only a single record, from Edehon Lake, in late summer of 1947.

Beverly Lake: Not common. 11 records from June 2 to June 22, 1949, and none thereafter.

The heaviest breeding population was south of timberline with a marked falling-off in summer residents to the north. However the Barrens population, though scanty, appeared fairly evenly distributed.

The late summer, autumnal and winter movements of the Barrens birds appear to be definitely correlated with the movements of the caribou herds. There is a steady southward drift of adults, in small numbers, during August and September to the general vicinity of timberline. However the juveniles, often in very large flocks, appear to move directly with the southward-bound caribou herds. In the late fall of 1948 Lawrie noted a marked increase in the numbers of ravens coincidental with the arrival of the major caribou herds. In the same year, Mowat at Brochet, observed that the Raven population swelled suddenly by several hundred percent with the arrival there of the same caribou herds, on Nov. 10. At that time flocks of up to 30 Ravens appeared and were seen to be moving in the same direction as the herds — not always north-south, but varying from day to day. There may be two distinct populations. A semi-static one inside timberline, and a very migratory one in the plains country which (except of course during the breeding season) closely follows the movements of the deer.

95. **Crow,** *Corvus brachyrhynchos*

Arrival date: Churchill — May 20, 1948.

N. Manitoba: Fairly common on the Cochrane River and less common north on the Kasmere River in 1947.

Windy River: Two were seen in late June, 1947. During October and early December of 1948, Lawrie saw 4 birds probably of this species although distance made identification uncertain.

The species breeds north to timberline and perhaps individuals may wander some distance northward, particularly in autumn.

96. [**American Magpie,** *Pica pica*

C. Schweder took one from a fox trap in December of 1944.]

97. **Hudsonian Chickadee,** *Parus hudsonicus*

C. Schweder reported a few seen some winters, with numbers fluctuating greatly, winter by winter. In January of 1947 he noted a fairly heavy influx at Windy River.

There was only a single record from Brochet, for Nov. 8, 1948. They were regular residents at Ilford during the winter 1948-49 and Lawrie saw two at Big Sand Lake in N. Manitoba on Feb. 13, 1949. George Lush reported occasional 'invasions' to Edehon Lake on Thlewiaza River, but that the species was absent most winters. The main breeding range probably stops short of Reindeer Lake but an erratic northern movement to timberline appears to take place in some years.

98. **Robin,** *Turdus migratorius*

Arrival dates: Ilford, Man. — April 29, 1949. Churchill — May 22, 1947; May 21, 1948. Windy River — June 3, 1947; May 23, 1948.

N. Manitoba: Common along the Kasmere and Cochrane Rivers in 1947.

Windy River: Common in 1947 with from 6 to 7 seen daily, but slightly less common in 1948. A nest on June 22, 1947, contained 3 fresh eggs. Other nests were found on the ground in areas without suitable tree cover and the species seemed to have no particular preference between spruce bush and open country. The last fall date was Oct. 7, 1948.

Angikuni Lake: Not common, but widely distributed.

Thlewiaza River: Only 2 records, but this may have been due to the lateness of the season.

The breeding population evidently extends to some point north of Angikuni Lake, and south of Beverly Lake where the species was not present in 1949. It is most abundant at and below timberline, but the willingness to accept normally unsuitable territory in the very open plains near Angikuni Lake is interesting.

99. **Olive-backed Thrush,** *Hylocichla ustulata*

Six records along the Cochrane River in July, 1947, and a single record for the upper Kasmere River. None were found north of Kasmere Lake.

100. **Gray-cheeked Thrush,** *Hylocichla minima*

Arrival dates: Windy River — June 4, 1947; June 1, 1948.

N. Manitoba: There seemed to be little if any overlap with the range of the preceding species. The only records in 1947 were 2 birds on the Kasmere River, north of Kasmere Lake.

Windy River: Common and slightly more abundant than the Robin but — in this area — more restricted to tree cover and much less common in the dwarf birch stands on the open plains. On June 30, 1947 a nest with 4 fresh eggs and on July 1, 1947, 2 further nests each with 4 fresh eggs. These nests were all located about 4 feet from the ground in spruce thickets. One or two later nests were found on the ground in dwarf birch scrub.

Angikuni Lake: Common though mostly concentrated in willow swales and dwarf birch scrub. Flying juveniles were seen on July 21, 1947.

Thlewiaza River: Only 3 records, but this species is an early migrant and in other parts of the study area had vanished by Aug. 20.

The breeding range seems to begin at timberline and to extend northward past Angikuni Lake, but not as far as Beverly Lake where none were seen in 1949. The heaviest population seems to be in that part of the plains where ground cover is fairly dense.

101. **Mountain Bluebird,** *Sialia currucoides*

A pair with a nest and 2 incubated eggs was found on a portage at Kasmere Lake on July 27, 1947. Since the birds were breeding they cannot be considered accidental despite the fact that there are no other known records for adjacent areas.

102. **American Pipit,** *Anthus spinoletta*

Arrival dates: Churchill — May 21, 1947. Windy River — June 5. 1947; May 23, 1948. Beverly Lake — June 11, 1949.

N. Manitoba: A pair feeding young was found at the south end of Nueltin Lake on Aug. 4, 1947.

Windy River: Not very common, but widely distributed in the broken hill country. On July 2, 1947, a nest under a ledge of rock contained 6 partly incubated eggs. By Sept. 8, 1948, there was a notable increase in numbers, and flocking had begun. The last date was Oct. 10, 1948.

Angikuni Lake: Slightly more numerous than at Windy River with from 5 to 7 seen on most days. Fledglings were observed by July 23, 1949, and small flocks were forming on Aug. 12.

Thlewiaza River: About as common as at Angikuni Lake, as far as the coast and to Eskimo Point.

Beverly Lake: 8 were seen between June 11 and June 21, 1949, but none thereafter and there was no evidence of breeding.

The species breeds north from timberline in increasing numbers to at least Angikuni Lake. Beyond that the population appears to diminish rapidly.

103. **Bohemian Waxwing,** *Bombycilla garrula*

Two pairs and a single bird were seen on the Cochrane River in late July, 1947. Not recorded to the north.

104. **Northern Shrike,** *Lanius excubitor*

One was seen at the south end of Nueltin Lake on Aug. 4, 1947. There were single records for Windy River on Aug. 13, 1947; Sept. 23, 1948 and Aug. 17, 1949. There was some evidence of at least one pair having bred near the mouth of Windy River. In general the species probably ranges sparingly north to timberline.

105. **Myrtle Warbler,** *Dendroica coronata*

Arrival dates: Windy River — June 6, 1947; June 2, 1948.

Only observed at Windy River with 4 records in 1947 and 5 in 1948. None was seen after June 25 in either year. It is probably more numerous in the forested areas to the south.

106. **Black-poll Warbler,** *Dendroica striata*

Arrival dates: Windy River — June 6, 1947; June 1, 1948.

This species appeared to be common along the Cochrane and Kasmere Rivers. Fledglings were seen on July 31, 1947. At Windy River it was also common, but restricted to fairly heavy spruce woods. There was a single record for Angikuni Lake.

Breeding commonly north to timberline and accidental to the north.

107. **Northern Water-thrush,** *Seiurus noveboracensis*

Arrival date: June 2, 1948.

Although it was only twice recorded on the Cochrane River in 1947, it was probably commoner than records indicated. At Windy Bay there were 5 records for 1947 and 6 for 1948. There was also a single record from Angikuni Lake.

Range and distribution appeared similar to that of the preceding species, but the Water-thrush was much less abundant.

108. **Rusty Blackbird,** *Euphagus carolinus*

Arrival dates: Churchill — May 20, 1948. Ilford — April 29, 1949. Windy River — June 4, 1947; May 23, 1948.

N. Manitoba: Fairly common on the Kasmere River but rapidly decreasing in numbers on the Cochrane, and rare in the summer of 1947 at Brochet. On July 25 many flocks of up to 30 individuals, mostly in rusty plumage, on the lower Kasmere River.

Windy River: Fairly common with from 3 to 8 seen daily in both 1947 and 1948. A nest with 4 well incubated eggs was found on June 30, 1947. Flocking had begun by Aug. 30, 1948. The last bird seen was on Oct. 14, 1948, but the bulk of the migrants had left by the third week in September.

Timberline marked a clear-cut range limit and there were no records to the north. The heaviest population appeared to be across a belt, about a hundred miles broad, running south of timberline.

109. **Purple Finch,** *Carpodacus purpureus*

On June 5, 1947, a pair was found accompanying a small flock of redpolls near Windy River. This species is probably accidental this far north.

110. **Pine Grosbeak,** *Pinicola enucleator*

A female on June 7, 1947 and a male and female on Sept. 23, 1948, all in the Windy River area, constitute the only records. It may be slightly more common southward to Brochet.

111. **Hoary Redpoll,** *Acanthis hornemanni*

Rather rare at Windy River with 12 records in 1947 and 6 in 1948. Two were seen at Beverly Lake on June 21, 1949.

112. **Common Redpoll,** *Acanthis flammea*

Arrival dates: Windy River — June 2, 1947. Beverly Lake — June 13, 1949.

N. Manitoba: Fairly common and evenly distributed south from timberline to Brochet in summer.

Windy River: Common in large flocks until June 8, 1947, and until May 31, 1948. After these dates small flocks of up to 10 individuals were noted throughout the breeding season, as well as a small number of individuals and paired birds. After June 25, most of the flocks consisted entirely of males. Last seen on Oct. 31, 1948.

Angikuni Lake: Fairly common, but in small groups — mostly males and showing distinct preference for willow swales and spruce clumps.

Thlewiaza River: Observed regularly, though in small numbers, almost to the coast.

Beverly Lake: From one to six seen on most days in 1949.

The heaviest breeding population was evidently at and below timberline with the population declining — though not sharply — north to Beverly Lake. Roving flocks of males and non-breeding females made it rather difficult to assess local resident populations accurately.

113. **Savannah Sparrow,** *Passerculus sandwichensis*

Arrival dates: Windy River — June 5, 1947; May 24, 1948. Beverly Lake — June 19, 1949.

N. Manitoba: Fairly common in grassy areas along both the Cochrane and Kasmere Rivers south to Brochet, in the summer of 1947.

Windy River: Common. Each small muskeg supported a large population sometimes as high as 6 pairs to the acre. But although preference was shown for wet, grassy areas, individual territories included all types of terrain including high, rocky tundra. A nest just completed was found on June 18, 1947 and by June 25 contained 5 fresh eggs. The last date in 1948 was Sept. 18.

Angikuni Lake: As common and as widely distributed as at Windy River with from 8 to 10 pairs seen daily near camp. Flying juveniles were found on July 23, 1949, and flocking had begun by Aug. 12.

Thlewiaza River: Fairly common, despite the lateness of the season, along the entire route from Nueltin Lake to Eskimo Point.

Beverly Lake: Common and with much the same density and distribution as at other stations in the study area. Migration peak was noted here as being reached on June 21, 1949. A nest with 4 eggs was found on July 3 and the young hatched about July 14.

Common and very evenly distributed throughout the entire area.

114. Slate-coloured Junco, *Junco hyemalis*

Arrival dates: Churchill — May 21, 1947. Ilford — April 6, 1949. Windy River — June 3, 1947; May 27, 1948.

N. Manitoba: Although only 4 were seen in the summer of 1947, the population was probably much larger. Flightless young were found at the south end of Nueltin Lake, on Aug. 3, 1947.

Windy River: Uncommon in spring migration and as a summer resident with perhaps 4 pairs breeding in the immediate vicinity. However during the fall the population rose sharply, particularly in early September. This influx was probably from the south. The last date was Oct. 9, 1948.

There were no records from Angikuni or Beverly Lakes. The small spring migration, coupled with the lack of breeding birds to the north, seems to indicate a northern migration of juveniles in autumn at least to timberline.

115. Eastern Tree Sparrow, *Spizella arborea*

Arrival dates: Ilford — April 28, 1949. Beverly Lake — June 19, 1949.

N. Manitoba: Uncommon to rare along the Cochrane and Kasmere Rivers proceeding south. Most abundant at the south end of Nueltin Lake.

Windy River: The most abundant sparrow and one of the commonest birds. Population density was as high as 10 pairs to the acre in some particularly suitable areas. Spruce woods, dwarf birch draws, and open hill sides were all utilized as breeding territory. Two nests, each with five eggs, found on July 3, 1947, were about half incubated. The last date was Oct. 9, 1948.

Angikuni Lake: Slightly less numerous than at Windy River, but still very common and breeding in all types of habitat. Flying juveniles were seen on July 25, 1949 and flocking had begun by Aug. 10.

Thlewiaza River: Fairly common along the river route and at Eskimo Point.

Beverly Lake: Migration peak was reached by June 22, 1949, and the species remained common thereafter, although not as common as at the southern stations, nor as numerous as the Savannah Sparrow.

The most abundant and best distributed bird in the area from timberline north to Angikuni Lake. Almost absent inside the forests, and less numerous north of Angikuni.

116. Harris's Sparrow, *Zonotrichia querula*

Arrival dates: Windy River — June 4, 1947; May 23, 1948.

N. Manitoba: Fairly numerous south to Brochet. A pair feeding young was seen on Aug. 1, 1947.

Windy River: Common, with from 8 to 12 seen almost daily in the immediate vicinity of camp. The density of breeding birds in the spruce woods was high — sometimes 12 pairs to the square mile. Most nests were located in open areas under dwarf birch scrub and often on ridges or otherwise exposed slopes, with spruce woods on both sides. No nests were found in spruce thickets. A total of nine nests with eggs were examined and the usual clutch was 5, occasionally 4. Early nest dates were June 24, 1947 — 5 fresh eggs, and June 19, 1948, with 4 fresh eggs. Flocking had begun by Aug. 30, 1948. Last seen Sept. 27, 1948.

Angikuni Lake: Not common, with only 17 records in 1949. Flying juveniles were seen on July 26. The local distribution seemed restricted to the immediate vicinity of willow swales.

Thlewiaza River: Only 6 records for the entire route.

Beverly Lake: A single bird was seen on July 5 and probably the same bird on the two succeeding days.

Breeding from well south of timberline north to Angikuni Lake with by far the heaviest population at, or near timberline. Probably accidental at Beverly Lake.

117. White-crowned Sparrow, *Zonotrichia leucophrys*

Arrival dates: Windy River — June 4, 1947; June 1, 1948.

N. Manitoba: Fairly common and more numerous than the preceding species, south to Brochet. A nest with 5 well incubated eggs was found at Misty Lake on July 25, 1947.

Windy River: Up to 20 were seen daily until June 5, 1947, but after this date the species became scarce and only 9 other records were obtained. The following year it was much more abundant with several seen daily during the breeding season and a breeding density of about 6 pairs to the square mile in the spruce woods. Last seen on Sept. 23, 1948.

Fairly common in the forested areas and at timberline, but not found to the north.

118. **White-throated Sparrow,** *Zonotrichia albicollis*

A male was collected at Churchill on May 29, 1947. Probably accidental in the entire study area.

119. **Fox Sparrow** *Passerella iliaca*

Arrival dates: Ilford — April 28, 1949. Windy River — June 3, 1947; May 28, 1948.

Fairly common in the forested areas south to Brochet and flying juveniles were seen on the Kasmere River, Aug. 1, 1947.

At Windy River it was rather rare and found only in the spruce woods. It was last seen Sept. 19, 1948.

Timberline marks the northern range limit in this area.

120. **Lincoln's Sparrow,** *Melospiza lincolnii*

Three records along the Cochrane and Kasmere Rivers in 1947, and two for Windy River in early June, 1947. Probably an uncommon summer resident about Reindeer Lake, and rare to accidental north of there.

121. **Song Sparrow,** *Melospiza melodia*

A pair was found at Brochet in late July, 1947. They appeared to be nesting in a grass swale near the settlement. The species is probably rare to accidental this far north.

122. **Lapland Longspur,** *Calcarius lapponicus*

Windy River: Very common during late May and the first two weeks in June after which it was not so much in evidence and almost no males were seen. Breeding areas were restricted to open country and included high, rocky ridges and low peat bogs. A nest in construction was found June 13, 1947. Fledglings were first seen on July 21, 1948. Small groups of juveniles were still present in October and the last date for the species was Oct. 16, 1948.

Angikuni Lake: Abundant in this area with flocks, composed largely of juveniles, already forming by July 23, 1949.

Thlewiaza River: Common, with flocks of up to 200 seen from Aug. 20, 1947, until Aug. 29. A marked rise in population was noted as the coastal plains were approached.

Brochet: Common in fall migration 1948. Last seen Oct. 21.

Beverly Lake: The most abundant small bird in this area. First recorded June 2, 1949. On July 7 two nests were found, one with 5 eggs and one with 4. On July 13, a nest contained 3 young. By July 22, young birds had left some of the nests and flocks of juveniles appeared by the end of the month.

This species appears to be one of the commonest breeding birds on the plains, but its abundance increases with the distance north from timberline, reaching a peak about Beverly Lake.

123. **Smith's Longspur,** *Calcarius pictus*

In 1947, 8 pairs were located on open plains country near Windy River, and several specimens were collected. However in 1948 only a single male was seen in this area, and there were no records from Angikuni Lake in 1948, or from Beverly Lake in the succeeding year. At least in 1947 the species was not uncommon at timberline but subsequently it disappeared and was not found anywhere in the open Barrens. The writers can offer no explanation of this phenomenon.

124. **Snow Bunting,** *Plectrophenax nivalis*

Arrival dates: Ilford — April 19, 1949. Churchill — April 25, 1949. Beverly Lake — June 3, 1949.

The movement of this species through Churchill exhibited an interesting example of 'horde' phenomena. In 1947 the first birds evidently arrived at Churchill in early May but the species was not yet numerous by May 21. Then the population suddenly increased to horde proportions with the peak being reached on May 25 when flocks of up to a thousand individuals were common, and the daily total was in the tens of thousands. But by May 30 this vast movement had dwindled until only a few small flocks were to be seen. In 1948 this same pattern was repeated at Churchill but about a week earlier. It was obvious that the vast majority of the migrants passed through Churchill in a two or three day period.

At Windy Bay we were too late to catch this peak wave in spring, and only stragglers were present in 1947 while none were seen in the spring of 1948. There is a distinct possibility that there is no heavy spring migration in the interior area, but that most of the migrants follow the coast.

Fall migration at Windy River began on Sept. 30, 1948 and within three days had reached a peak with plus 3000 birds recorded daily. The peak dropped off abruptly and by Oct. 6 we were only recording 50-60 birds a day.

At Brochet the peak wave arrived on Oct. 8, 1948 and the numbers seen approximated those observed at Windy River. The last individual records were: Windy River — Oct. 31, 1948; Brochet— Nov. 8, 1948.

The only summer record from Angikuni Lake was a single bird moving with a flock of Lapland Longspurs on July 29, 1948.

At Beverly Lake the horde phenomenon was not in evidence. From June 2 until June 10, 1949 the species was present in moderate numbers. From June 19 until July 14, there was a steady decrease and none was seen after the later date.

The species does not breed in the study area but is common to very common in migration — at least in fall. There is a possibility that it may be much less common in the interior during spring migration.

BOTANICAL INVESTIGATIONS ON COASTAL SOUTHERN CORNWALLIS ISLAND, FRANKLIN DISTRICT, N.W.T. [1, 2]

W. B. SCHOFIELD [3] *and* W. J. CODY [4]

IN 1949 the senior author made a botanical survey of Resolute Bay and the adjoining Allen and Assistance Bays, on the south shore of Cornwallis Island. This survey was sponsored jointly by the Canada Department of Agriculture and the Defence Research Board of the Canada Department of National Defence.

A considerable quantity of plant material resulted from this survey. Of this, the mosses have already been treated by W.C. Steere (1951). The purpose of the present paper is to bring together the knowledge of the phanerogamic flora of Cornwallis Island, and in particular to describe the plant communities of the areas adjacent to Assistance, Resolute and Allen Bays.

Cornwallis Island is located in the Canadian Arctic Archipelago in the midst of the larger islands of Devon on the north and east, Bathurst on the west, and Somerset and Prince of Wales on the south.

A preliminary paper on the geology of Cornwallis Island has been prepared by Thorsteinsson and Fortier (1954); also, a journal of the 1950 geological expedition to Cornwallis Island has been published by Harwood (1951). The island is composed almost entirely of Paleozoic sedimentary formations, with the exception of the Intrepid Bay Formation which is Cretaceous or Tertiary (?) in age. Assistance Bay lies wholly within the Read Bay Formation which is of Ordovician and Silurian age: this formation is comprised of limestones, shales, sandstones, and siltstones. The west side of Resolute Bay and Cape Martyr also belong to this formation. The strata in the vicinity of Allen Bay and along the east side of Resolute Bay are composed of Ordovician (?) and Silurian dolomites and limestones of the Allen Bay Formation.

Polunin (1940) reviewed the history of exploration in the Canadian Eastern Arctic, and Thorsteinsson and Fortier (1954), that of Cornwallis Island in particular.

The largest and most important early plant collection was that of Dr. Peter C. Sutherland (1852). His specimens were collected in 1851 at Assistance Bay, the place where the ships *Lady Franklin* and *Sophia* overwintered.

Also in 1851, a small collection was made by Charles Ede, assistant surgeon on *H.M.S. Assistance*, but the exact localities where his specimens were taken are unknown. Assistance Bay was named after the ship, *H.M.S Assistance* and it is possible that Ede's specimens came from that locality. They could, however, have come from almost any locality along the south coast of Cornwallis Island, for the ships under Captain Austin, of which the *Assistance* was one, wintered off Griffith Island, and numerous excursions were made between them and those wintering at Assistance Bay, in addition to the investigations made along the coast in search of traces of the Franklin expedition.

A single specimen, *Arenaria rossii*, was collected by Admiral Sir Leopold McClin-

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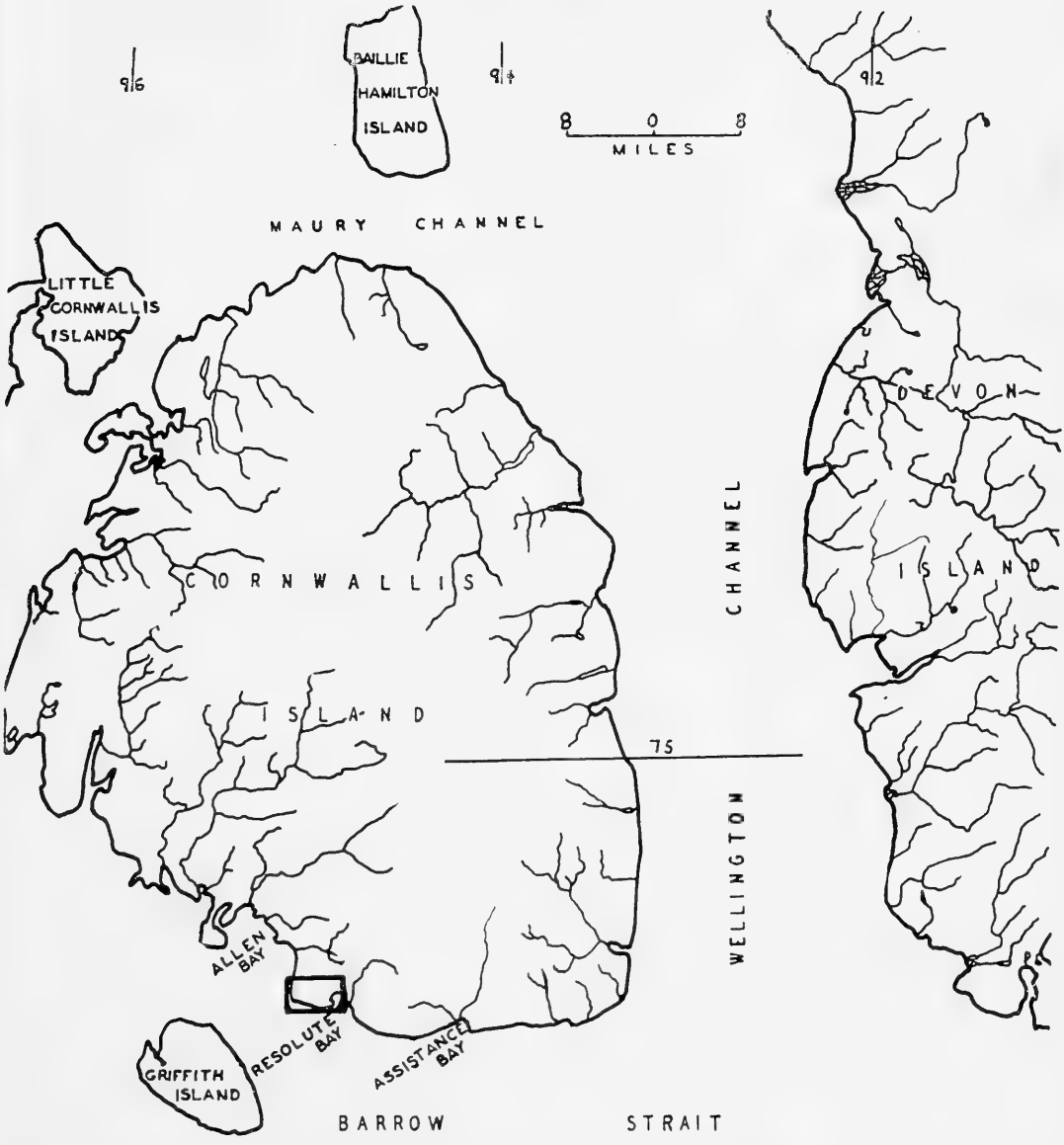
2) Contribution No. 1411, from the Botany and Plant Pathology Division, Science Service, Canada Department of Agriculture, Ottawa, Ontario.
3) Survey Assistant.
4) Assistant Botanist.



Map. 1. Cornwallis Island showing locations of Allen, Resolute and Assistance Bays; the area indicated by the rectangle is shown in Map 2.

tock on Cornwallis Island (McClintock ex Markham 1909, p. 245). This was recorded by Polunin (1940), as "opposite Browne Island".

The Ede specimens and some of the Sutherland specimens are preserved in a "Botanical Scrapbook" assembled by Mr. Adam White (Polunin 1936) and now preserved in the Herbarium of the University of Toronto. As a frontispiece to this volume, there is a coloured plate entitled "Part of the view represents Assistance Harbour, with three cairns". Below this legend is a list of the species depicted in the foreground. *Oxyria reniformis, Saxifraga nivalis, Draba alpina, Dryas integrifolia, Parrya arctica, Saxifraga flagellaris, Saxifraga oppositifolia, Polygonum viviparum, Alopecurus alpinus, Papaver nudicaule, Cerastium alpinum, Cochlearia fenestralis* and *Ranunculus frigidus* are shown in brilliant colour (although

not very accurately); the water and surrounding hills of Assistance Bay form the background. This plate is extracted from opposite page 137 of Volume II of Sutherland's Journal (1852). A list of the "Plants collected during voyage and named by Sir W.J. Hooker, K.H., D.C.L., F.R.A., and L.S." is included as an appendix to Sutherland's Journal. All of the species depicted on the plate but not all the species in the "Botanical Scrapbook" are listed in the appendix, and there is no indication, as pointed out by Polunin (1936), that Hooker saw these plants at any time.

Since the recent construction of the airstrip at Resolute Bay a number of collections have been made in that area. The junior author has studied several of these collections, but that made by the senior author is the most complete. Other workers who have made small collections are W.C. Wonders (specimens at Department of Agriculture, Ottawa), Major Hugh Miller (specimens at Defence Research Northern Laboratory, Ft. Churchill), D. MacClement (specimens at McMaster University), Jean Michea and S.M. Pady (specimens at Montreal Botanical Garden), H.B. Collins Jr. (specimens at National Museum of Canada and Smithsonian Institution, Washington, D.C.), H.H. Aime (specimens at National Museum of Canada) and N.C. Polunin. Not all of these collections have been seen, but no additions to the senior author's list have been found in those examined.

ALLEN BAY, the westernmost of the three bays studied, is separated from Resolute Bay by Cape Martyr, a 600 foot hill which rises slowly out of the undulating fjaeldmark.

The beach lines of the bay are not well defined and maintain a relatively small flora when contrasted with that of Resolute Bay described below. Beyond the slope leading down to the bay, the land is quite barren. Its flora is limited to an occasional small plot of *Parrya arctica, Saxifraga oppositifolia, Draba alpina,* moss or lichen. Ponds in this area, if they are even semi-permanent, usually have well vegetated margins; *Alopecurus alpinus* and *Salix arctica* together form the bulk of this vegetation.

Beyond the coastal slope the land flattens out somewhat, then breaks into low undulating hills. Here are scattered ponds and streamlets. These streamlets, which seem to rise from nowhere and disappear just as abruptly are evidently neither permanent nor recurrent, for their margins are usually devoid of vegetation.

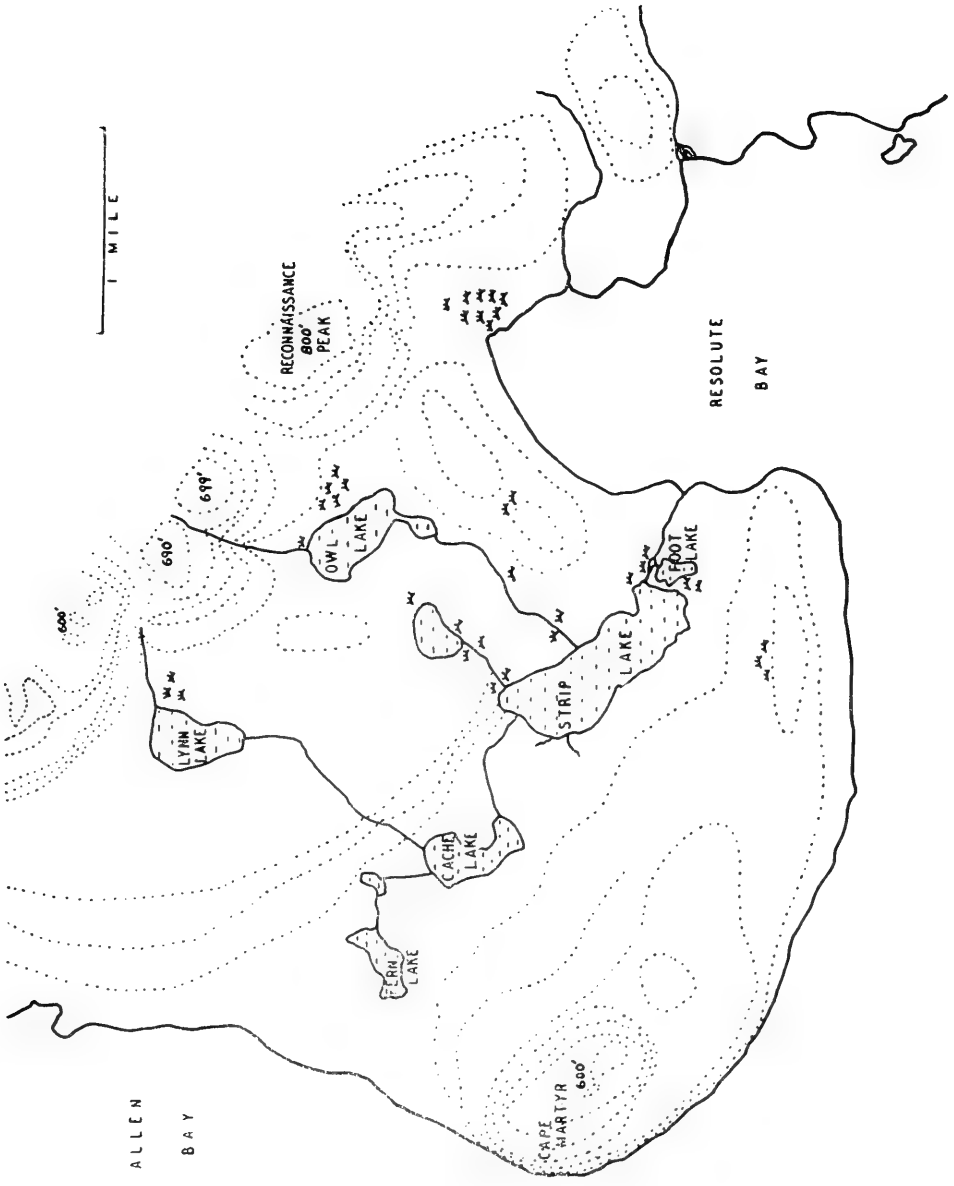
At Allen Bay, however, besides a few deep-valleyed temporary streams, there are two large streams with perpendicular-walled gorges through which water rushes to the sea in mid-July. Flowing into these gorges are occasional snow-melt tributaries, and here, along their margins and near their snow-bank sources are small meadows. The major elements of these meadows are: *Alopecurus alpinus, Eriophorum angustifolium, E. scheuchzeri, Draba fladnizensis, D. alpina, Ranunculus sulphureus,* and numerous rich yellow-green mosses. *Saxifraga oppositifolia, S. hirculus* and *Eutrema edwardsii* also occur occasionally.

Near the coast, beyond a large fresh-water lake, are a number of large damp meadows that yield not only an abundance of *Salix arctica* and *Eriophorum angustifolium,* but also *Polygonum viviparum* and *Dryas integrifolia.* Muskoxen had found good grazing here and had cropped the vegetation closely, leaving for example, only a small fragment of a culm of *Alopecurus,* a grass which was in great abundance.

A lowland barren dominated by *Saxifraga oppositifolia* was observed to the west of the second gorge. Here also was seen the largest of Allen Bay's lakes, its water apparently draining directly into the bay by a short stream. Unfortunately this area could not be reached.

CAPE MARTYR rises by a number of obscure beach lines from the strait dividing Cornwallis from Griffith Island. Its sides are sterile and of inhospitable jagged rocks. On top of the cape there is little vegetation. *Saxifraga oppositifolia* and the ever-present *Draba alpina* are here, but there is little else other than lichens and a few sterile mosses.

Below Cape Martyr are a number of long-abandoned Eskimo houses, built of stone, sod and whale-bone. In and around these houses, and bordering the adjacent small transient streamlets, is found a vegetation far advanced in its development beyond that of the surrounding areas. Here were found the earliest flowering representatives of a number of species, among them *Draba alpina, Saxifraga flagellaris, Polygonum vivipa-*



Map 2. Resolute Bay area, Cornwallis Island

rum, Oxyria digyna, and *Alopecurus alpinus.* Two factors had no doubt aided in advancing the stage of growth: the shelter of Cape Martyr, and presence of nitrogenous wastes around the ruins.

The shore of RESOLUTE BAY rises gradually by eight distinct beach-lines, behind each of which, particularly those toward Cape Martyr, are a number of permanent or temporary oval ponds.

Beyond the beach lines is a broad, undulating fjaeldmark dotted with small ponds and lakes and an occasional lichen-encrusted igneous erratic. Beyond this fjaeldmark rise high hills which continue as far inland as one can see. Snow clings to the bases of these hills until the middle of August.

The large lakes of Resolute Bay have little vegetation on their margins. This barren condition is, at least in part, the result of slow-melting ice being pushed up on the shores by the wind, thus denuding them of vegetation.

The largest river is just east of camp, beyond Reconnaissance Peak. This river, like the others, has its water supply governed by snow-melt. It is completely devoid of phanerogamic water plants. The water is alternately clear then somewhat milky, dependent upon the temperature of the day and the amount of snow remaining in the hills.

The shores of the bay are completely barren, and are subjected to constant abrasion by ice. Some marine algae are washed in after the break-up; a number of specimens of *Agarum, Fucus, Laminaria* and several Rhodophyceae were collected here.

Since the vegetation is confined to relatively specialized habitats it is perhaps advisable to define these habitats and to describe their phanerogamic vegetation.

A. FJAELDMARK

The fjaeldmark is that dry, nearly desert, area composed of broken limestone rock, with small areas of caked limestone dust, or "soil". For the most part it is hilly and exposed. It supports the following phanerogamic plants:

1. Completely exposed rocky area: *Saxifraga oppositifolia* (d) [5], *Papaver radicatum* (a), *Draba alpina* (c), *Arenaria rubella* (d), *Cerastium alpinum* (o).

2. Depressions with disintegrated limestone, a powdery "soil" when broken: *Salix arctica* (d), *Saxifraga caespitosa* (c). These plants appear to take root among mosses that have previously established themselves, and in time they crowd them out.

3. Bases or south sides of hills, or somewhat sheltered areas: *Dryas integrifolia* (a).

B. ISLETS OF SOIL

In the fjaeldmark, isolated vegetated plots surrounding vacated lemming dens are occasionally found. These islets, which rarely occupy more than a few square feet, maintain a rich moss flora and, usually, a good phanerogamic flora. The phanerogamic vegetation of three islets is given below:

ISLET 1. *Alopecurus alpinus* (d), *Papaver radicatum* (o), *Draba alpina* (f), *Cardamine bellidifolia* (o), *Saxifraga nivalis* (f), *S. cernua* (f), *Salix arctica* (r), *Cerastium regelii* (r), *Stellaria monantha* (o), and *Draba subcapitata* (r).

ISLET 2. *Parrya arctica* (f), *Draba alpina* (o), *Papaver radicatum* (d), *Cardamine bellidifolia* (r), *Cerastium alpinum* (r), *C. regelii* (f), *Alopecurus alpinus* (a), *Saxifraga cernua* (r), *Stellaria monantha* (a), and *Juncus biglumis* (r).

ISLET 3. *Draba alpina* (f), *Ranunculus sulphureus* (f), *Papaver radicatum* (a), *Saxifraga cernua* (f), *S. caespitosa* (o), *S. oppositifolia* (o), *S. nivalis* (o), *Juncus biglumis* (f), *Draba subcapitata* (o), *Luzula nivalis* (d), *Alopecurus alpinus* (f), *Stellaria monantha* (o), *Cerastium regelii* (o), *Poa abbreviata* (o), and *Arenaria rubella* (r).

From an examination of the composition of these three islets, it can be seen that there is no apparent succession in species; the dominance or rarity of any one species depends more on which was established first.

C. DAMP BORDERS OF PONDS

As the snow melts, it forms numerous ponds, temporary or permanent, around which vegetation is often found. The plants most often found in such habitats are: *Saxifraga oppositifolia* (o), *S. flagellaris* (f), *S. caespitosa* (o), *S. nivalis* (o-r), *Braya purpurascens* (r), *Papaver radicatum* (a), *Ranunculus sulphureus* (f), *Polygonum vivi-*

5) Key to abbreviations. d=dominant, a=abundant, c=common, f=frequent, o=occasional, r=rare.

parum (o), *Lychnis apetala* (o), *Arenaria rossii* (o), *Cerastium regelii* (f), *Luzula nivalis* (a), *Juncus biglumis* (a), *Pleuropogon sabinei* (f), *Alopecurus alpinus* (d), and *Braya purpurascens* (o-a).

D. SNOW-MELT MEADOWS

These meadows are formed by the seepage of snow-melt water from the bases of the hills where snow persists late in the season. They are dominated by *Alopecurus alpinus* with the following plants in comparative abundance: *Equisetum variegatum* (o), *Phippsia* prope *concinna* (o), *Arctagrostis latifolia* (o), *Pleuropogon sabinei* (o), *Dupontia fisheri* (o), *Eriophorum scheuchzeri* (o), *E. angustifolium* (f), *Carex aquatilis* (a), *Luzula nivalis* (c), *Juncus biglumis* (c), *Salix arctica* (c), *Polygonum viviparum* (c), *Lychnis apetala* (c), *Cerastium alpinum* (o), *Arenaria rossii* (r), *Ranunculus sulphureus* (a), *R. hyperboreus* (o), *Papaver radicatum* (r), *Cochlearia officinalis* (o), *Eutrema edwardsii* (r), *Cardamine bellidifolia* (o), *Draba alpina* (r), *D. fladnizensis* (c), *Parrya arctica* (o), *Saxifraga caespitosa* (r), *S. stellaris* (o), *S. nivalis* (o), *S. hirculus* (f), *S. oppositifolia* (r), and *Dryas integrifolia* (o). It can easily be seen from this list, that the snow-melt meadow is one of the most verdant habitats in the area.

E. BEACH LINE HOLLOWS

The luxuriance of the vegetation in this habitat is largely the result of two factors that have helped build up a substrate: refuse left by the Eskimo some four hundred or more years ago, and the decay of marine algae that have been washed up on the shore. These beach lines may be divided into two classes (1) damp beach lines, in which mosses play a very important part in the vegetation, and (2) drier, more exposed, rocky beach lines. The main phanerogamic plants are:

1. *DAMP HOLLOWS OF BEACH LINES* — *Alopecurus alpinus* (a-d), *Luzula nivalis* (r), *Cerastium alpinum* (f), *C. regelii* (f), *Stellaria monantha* (o), *Arenaria rubella* (o), *Ranunculus sulphureus* (c), *Papaver radicatum* (r), *Cochlearia officinalis* (o), *Cardamine bellidifolia* (o-r), *Draba alpina* (a), *Parrya arctica* (o), *Saxifraga caespitosa* (o), *S. nivalis* (o-r), *S. flagellaris* (o-r), and *S. oppositifolia* (o).

2. *DRIER, EXPOSED, ROCKY BEACH LINES* — *Poa abbreviata* (a), *Salix arctica* (o), *Oxyria digyna* (o), *Cerastium alpinum* (f), *C. regelii* (f), *Stellaria laeta* (o), *Arenaria rubella* (f), *Papaver radicatum* (f), *Draba alpina* (f), *Parrya arctica* (f), *Saxifraga cernua* (o), *S. caespitosa* (c), *S. oppositifolia* (d), and *Dryas integrifolia* (o).

F. MARSHY MEADOWS

Meadows near lakes and ponds show much the same vegetation as do the snow-melt deltas. The conditions in these two habitats are much the same, except that the former are somewhat wetter. *Phippsia* prope *concinna* (o) and *Cardamine pratensis* (r) were found here in addition to the species listed in D. Their presence is probably related to the greater amount of water.

G. ESKIMO HOUSES

The houses of stone, sods, and bone, contain the richest soil found in the entire area. This soil is the result of rubbish and nitrogenous waste left by the Eskimo who formerly occupied them.

These houses are often situated on damp shores of lakes, and consequently have the same flora as habitats D and F with the addition of *Chrysosplenium tetrandrum* (o), and strangely the exclusion of *Lychnis apetala, Polygonum viviparum* and *Eutrema edwardsii.* In spite of the favourability for its growth *Cardamine pratensis* in this habitat is very rare. *Alopecurus alpinus, Luzula nivalis, Poa abbreviata,* and *Juncus biglumis* usually are dominant on the sods of the house itself with scattered plants of *Puccinellia angustata, Arenaria rubella, Papaver radicatum, Saxifraga oppositifolia, S. flagellaris, S. nivalis, S. cernua* and *Cerastium alpinum.*

The houses on the dry exposed beach lines bear the same vegetation as E 2, but the plants are possibly in greater abundance on the ruins than on the adjacent beach.

H. BRACKISH PONDS

Behind the present beach are ponds with a remarkably small flora, for only *Cochlearia officinalis* and sterile *Puccinellia phryganodes* occur in any abundance on their margins. The ponds have a green scum of brackish-water algae, and the *Puccinellia* often grows into the water; otherwise, they are barren.

The country inland from Resolute Bay is not remarkably different from the sea-beach coast. No glacial erratics were seen, but a few outcrops were observed. The terrain is made up mostly of broken rock of the same type as that of the coastal fjaeldmark. In the hollows the moss vegetation was, for the most part, abundant, but few species were represented. On the whole, except for the mosses, the vegetation was disappointing. *Alopecurus alpinus* was abundant in the snow-melt meadows and the ever present *Saxifraga oppositifolia* was found on the hills. Also noted were *Draba alpina, Arctagrostis latifolia, Saxifraga hirculus, Luzula nivalis, Phippsia* prope *concinna, Parrya arctica*, and rarely, *Dryas integrifolia.*

ASSISTANCE BAY was but briefly observed. On the whole, the bay seems well sheltered by high, fairly abrupt hills. Its rivers, which cut through steep gorges, appear to flow the year round. There was considerably more limestone mud here than at Resolute Bay.

The lowland barrens supported a comparatively flourishing vegetation, including *Dryas integrifolia* (d), *Saxifraga oppositifolia* (f), *Draba alpina* (f), *Parrya arctica* (f), *Salix arctica* (o), *Papaver radicatum* (a). In the damp meadows surrounding temporary or permanent ponds, a luxuriant vegetation was found, including *Salix arctica* (o), *Draba fladnizensis* (c), *Cochlearia officinalis* (c), *Cardamine bellidifolia* (o), *Lychnis apetala* (o), *Arctagrostis latifolia* (o), *Dupontia fisheri* (o), *Alopecurus alpinus* (d), *Eriophorum angustifolium* (a), *Juncus biglumis* (o), *Saxifraga cernua* (o), *S. oppositifolia* (o), *Papaver radicatum* (o), *Luzula nivalis* (f), *Carex aquatilis* (f), *Cerastium regelii* (o), and *Ranunculus sulphureus* (o).

CATALOGUE OF SPECIES

Polunin (1940) records 111 species plus 5 species of doubtful occurrence for his District 2 in the Canadian Eastern Arctic (Devon, Cornwallis and Somerset Islands). Of this number twenty are definitely recorded for Cornwallis Island, three are queried for some reason, and thirteen are recorded as "c. everywhere — numerous collections from almost all localities", but no citations for the Island are given. Of this latter thirteen, seven species are to be found in the Herbarium of the Universty of Toronto, the remaining six may possibly be found at either Kew or British Museum. Also of these thirteen only three, *Poa arctica, Saxifraga tricuspidata* and *Cassiope tetragona* were not found by the senior author. Of the three that were queried, only one, *Vaccinium uliginosum* was not found.

The present paper records 47, plus 4 doubtful species for Cornwallis Island; 19 are new or apparently new to the known flora of Cornwallis Island; 3 are new to District 2 as defined by Polunin (1940).

The known flora of the island is thus very small, much smaller than that of Devon island to the east, and Ellesmere Island to the north. No Gamopetalae were collected, and only two species, *Cassiope tetragona* and *Vaccinium uliginosum,* are doubtfully recorded in the list.

In the following list the numbers in *italics* are the senior author's collection numbers; specimens are preserved in the Herbarium of the Botany and Plant Pathology Division, Science Service, Department of Agriculture, Ottawa (DAO).

EQUISETACEAE

EQUISETUM VARIEGATUM Schleich. — sterile; abundant in snow-melt meadows among the mosses or in meadows of brooks that drained snow-melt lakes; inconspicuous, rarely exceeding 5 cm. in height; RESOLUTE BAY: *279.* New to the flora of Cornwallis Island and District 2 of Polunin.

GRAMINEAE

ALOPECURUS ALPINUS Sm. — certainly the most abundant grass in Southern Cornwallis Island; it is most luxuriant in snow-melt and pond-margin meadows, but reaches its greatest height (about 6 inches) on the Eskimo house ruins; RESOLUTE BAY: *272.* ASSISTANCE BAY: Polunin (1940, p. 46) records this species in District 2 as "c. almost everywhere — fourteen records from thirteen localities", but does not cite a Cornwallis Island specimen. There is a Sutherland specimen in the Herbarium of the University of Toronto labelled "Assistance Bay, Lat. 74°40'N, Long. 94°16'W, July 24th 1851, from a small patch of vegetation at the foot of an accumulation of loose rock top of Prospect Hill, Elevation 400 feet".

ARCTAGROSTIS LATIFOLIA (R.Br.) Griseb. — occasional in snow-melt and lakeside meadows; RESOLUTE BAY: *614.* New to the flora of Cornwallis Island.

PHIPPSIA prope *CONCINNA* (Fries) Lindeb. — occasional in marshy snow-melt and lakeside meadows; RESOLUTE BAY: *436* and *507;* ASSISTANCE BAY: Polunin (1940, p. 63), records a specimen under *Catabrosa algida* as: "Sutherland (K)[6] as *Phippsia monandra* veg. only". The specimens at hand differ from *Phippsia algida* in usually having only one stamen, anthers larger (0.6 to 0.8 mm. when wet), seed slightly broader below the middle, and lemmas pubescent on the back and measuring up to 2 mm. in length, hence appearing to be close to *P. concinna.* No typical material of *P. concinna* from Spitzbergen has been seen however, so our specimens are but tentatively referred here. The Assistance Bay specimen cited by Polunin is sterile and could not be placed with either *P. algida* or the series discussed here with any degree of surety.

PLEUROPOGON SABINEI R.Br. — occasional around damp borders of ponds and in marshy snow-melt meadows; RESOLUTE BAY: *430.* New to the flora of Cornwallis Island.

POA ABBREVIATA R.Br. — in sandy spots and on dry islets of soil on the fjaeldmark; RESOLUTE BAY: *278, 306, 327,* and *369;* ASSISTANCE BAY: Polunin (1940, p. 65) records this species as: "Sutherland 1851 (T) as *"P. brevifolia?"* and (K) as *"P. cenisia"* ". The Sutherland specimen in the Herbarium of the University of Toronto is labelled "Assistance Bay, Lat.: 74°40'N, Long.: 94°16'W, July 24th 1851. From around the Bay at various elevations — 30 to 300 feet, in grassy tufts where the dung of foxes, ptarmigan and the owl accumulates and where spiders and other insects abound".

POA ARCTICA R.Br. — Polunin (1940, p. 72) records this species for District 2 as "c. everywhere — numerous records from almost all localities", but does not cite a Cornwallis Island specimen. Apparently absent, there are neither Ede or Sutherland specimens of this species in the Herbarium of the University of Toronto, nor is it recorded by Sutherland (1852).

DUPONTIA FISHERI R.Br. — occasional around borders of ponds and in damp snow-melt meadows; RESOLUTE BAY: *311.* New to the flora of Cornwallis Island.

PUCCINELLIA PHRYGANODES (Trin.) Scribn. & Merrill — sterile; on margins of brackish pool behind tidal ridge; RESOLUTE BAY. *432.* New to the flora of Cornwallis Island.

PUCCINELLIA ANGUSTATA R.Br. — in clumps in bog and around Eskimo house ruins; RESOLUTE BAY: *444* and *581A.* New to the flora of Cornwallis Island.

FESTUCA BAFFINENSIS Polunin — dry islets of soil surrounding limestone boulder in fjaeldmark; rare; RESOLUTE BAY: *339.* New to the flora of Cornwallis Island and District 2 of Polunin.

CYPERACEAE

ERIOPHORUM SCHEUCHZERI Hoppe — occasional in snow-melt meadows and around boggy margins of pools; RESOLUTE BAY: *503.* New to the flora of Cornwallis Island.

ERIOPHORUM ANGUSTIFOLIUM Honckeney var. *TRISTE* Th. Fries — occasional in moist meadows; RESOLUTE BAY: *486.* Polunin (1940), p. 104) records *E. angustifolium* in District 2 as "c. everywhere — numerous records from almost all localities" but does not cite a Cornwallis Island specimen. There are no Ede or Sutherland collections of this species from Cornwallis Island in the Herbarium of the University of Toronto. The record of *E. polystachum* (Sutherland 1852. *2:* clxxxix) probably belongs here, so that *E. angustifolium* cannot be recorded as new to the flora of Cornwallis Island.

CAREX MISANDRA R.Br. — occasional on damp margins of bog near the brook east of Ptarmigan River; RESOLUTE BAY: *505.* New to the flora of Cornwallis Island.

CAREX AQUATILIS Wahl. — frequent in damp meadows; RESOLUTE BAY: *612.* New to the flora of Cornwallis Island.

JUNCACEAE

LUZULA NIVALIS (Laest) Beurl. — abundant on hummocks in wet muskeg and

6) Abbreviations of herbaria cited by Polunin: T—Toronto University, Toronto, Ont.; K—Kew, Royal Botanic Gardens; B—British Museum of Natural History, London.

occasional on damp islets of soil on the fjaeldmark; sometimes dominant on the sods of ancient Eskimo houses; RESOLUTE BAY: *273, 312,* and *372.* New to the flora of Cornwallis Island.

JUNCUS BIGLUMIS L. — rare to frequent on islets of soil in the fjaeldmark; in wet snow-melt meadows it is quite common while it is sometimes dominant on the sods of ancient Eskimo houses; RESOLUTE BAY: *304, 310, 371,* and *530;* ASSISTANCE BAY: *268;* recorded by Polunin (1940, p. 146), as "Sutherland 1851 (T, K) as *"J. triglumis"* ". Sutherland's collection in the Herbarium of the University of Toronto has the following data: "Assistance Bay, Lat. 74° 40'N, Long. 94°16'W. August 7th 1851. From a soft and moist grassy plot. Elevation 30 feet".

SALICACEAE

SALIX ARCTICA Pall. — margins of lakes and ponds, in hummocky meadows, exposed rocky areas and rarely on islets of soil in the fjaeldmark; RESOLUTE BAY: *274* and *438;* ASSISTANCE BAY: recorded by Polunin (1940, p. 158) as "Sutherland 1851 (K) as *"S. cordifolia"* ". There is a Sutherland specimen in the Herbarium of the University of Toronto labelled: "Assistance Bay, Lat. 74°40'N, Long. 94°16'W. July 24th 1851. From the side of Prospect Hill. Southern exposure".

POLYGONACEAE

OXYRIA DIGYNA (L.) Hill — locally abundant in damp sandy soil of beach line and with *Alopecurus* on humus among Eskimo house ruins; RESOLUTE BAY: *84* and *276.* Polunin (1940, p. 176) records this species in District 2 as "c. everywhere — numerous records from almost all localities" but does not cite a Cornwallis Island specimen. There are no Ede or Sutherland collections from Cornwallis Island in the Herbarium of the University of Toronto. Recorded by Sutherland (1852. *2:* clxxxix) as *O. reniformis;* specimens are probably at either Kew or British Museum.

POLYGONUM VIVIPARUM L. — common in snow-melt meadows, and around damp borders of ponds; RESOLUTE BAY: *175* and *301;* ASSISTANCE BAY: recorded by Polunin (1940, p. 178) as "Sutherland 1851 (T, K)". Three Sutherland specimens in the Herbarium of the University of Toronto are labelled "Assistance Bay, Lat. 74°40'N, Long. 94°16'W. From an elevation of at least 350 to 400 feet. W.N.W. of Kate Austin's Lake, over a chain of lakes. July 24th, 1851 [2] and July 26th, 1851".

CARYOPHYLLACEAE

LYCHNIS APETALA L. var. *ARCTICA* (Th. Fries) Cody (*L. apetala* var. *nutans* Boivin, *L. apetala* sensu Polunin (1940)) — common in snow-melt meadows, and around damp borders of ponds; RESOLUTE BAY: *303;* ASSISTANCE BAY: recorded by Polunin (1940, p. 185) as *L. apetala* "Sutherland 1851 (K)".

CERASTIUM ALPINUM L. — occasional on exposed rocky areas and on dry islets of soil in the fjaeldmark; frequent on the drier exposed rocky beach lines with scattered plants being found on the sods of the ancient Eskimo dwellings; RESOLUTE BAY: *106, 205, 224, 299, 366, 409;* ALLEN BAY: *200;* ASSISTANCE BAY: recorded by Polunin (1940, p. 187) as "c. everywhere — numerous records from almost all localities incl. *"Cornwallis Island,* Assistance Bay, (Sutherland 1852, II p. clxxxix, sub nom. var. *'glabatum')"* ". There are two collections from Assistance Bay identified by Hooker (Sutherland 1852), one as *C. alpinum,* and the other as *C. alpinum* var. *glabatum.* The record of var. *glabatum* is probably referable to the *C. regelii,* for Polunin (1940, p. 190) records both the University of Toronto and Kew specimens labelled as *"C. alpinum* var. *glabratum",* under that species. The *glabatum* used by Sutherland is obviously a mis-spelling of *glabratum.*

CERASTIUM REGELII Ostenfeld — frequent on islets of soil on the fjaeldmark, damp borders of ponds and in beach line hollows; RESOLUTE BAY: *437, 490, 509, 529, 546,* and *592;* all of these collections are non-flowering but some have vegetative buds in the axils of a few of the leaves; ASSISTANCE BAY: recorded by Polunin (1940, p. 190) as "? Assistance Bay, Sutherland 1851 (T, K) as *"C. alpinum* var. *glabratum"* ". The specimen in the Herbarium of the University of Toronto and *Schofield 529* from Resolute Bay are atypical, approaching some forms of *C. alpinum.*

STELLARIA LAETA Richardson *(S. longipes* sensu Polunin pro parte) — abundant locally on ruins of an old Eskimo habitation; RESOLUTE BAY: *576.* ASSISTANCE

BAY ?: the specimen collected by Ede preserved in the Herbarium of the University of Toronto is a scrap without flowers, but leaf shape and pubescence of the upper internodes refer it here, rather than to the following species; it is recorded by Polunin (1940, p. 193) under *S. longipes* as "Cornwallis Island, Ede 1851 (T) f. *humilis*".

STELLARIA MONANTHA Hultén var. *MONANTHA (S. longipes* sensu Polunin pro parte) — occasional in moist islets of soil of limestone fjaeldmark; RESOLUTE BAY: *333.* New to the flora of Cornwallis Island and District 2 of Polunin.

ARENARIA RUBELLA (Wahl.) Sm. — exposed rocky areas and islets of soil on the fjaeldmark and occasional in both damp and drier hollows of beach lines: RESOLUTE BAY: *108, 275, 439, 545, 549,* and *577;* Allen Bay: *172;* ASSISTANCE BAY: recorded by Polunin (1940, p. 200) as "Sutherland 1851 (K)".

ARENARIA ROSSII R.Br. — in drier spots of boggy area surrounding Eskimo house ruins near Foot Lake; RESOLUTE BAY: *446;* ASSISTANCE BAY: recorded by Polunin (1940, p. 202), as "Assistance Bay, Sutherland 1851 (K)" and also " 'Opposite Browne Island' (McClintock ex Markham 1909, p. 245)". The petals of No. *446* are definitely longer than the calyx and would seem to be referable to what Polunin has described as var. *daethiana* (1940, p. 201). Bruggemann and Calder (1953) have, however, shown that this is the typical phase of *A. rossii* and that var. *daethiana* should be included in the synonomy of that species.

RANUNCULACEAE

RANUNCULUS HYPERBOREUS Rottb. — in water of lake by the Eskimo house ruins on the 8th beach line; sterile; RESOLUTE BAY. *575.* New to the flora of Cornwallis Island.

RANUNCULUS SULPHUREUS Soland. — common in the beach-line hollows and in snow-melt meadows; frequent around the damp borders of ponds and on islets of soil on the fjaeldmark; RESOLUTE BAY *85, 86, 215* and *611;* ALLEN BAY. *201;* ASSISTANCE BAY: Polunin (1940, p. 217) records this species from Assistance Bay as "Sutherland 1851 (T) as *"R. glacialis"* and *"R. frigidus"*". There are two specimens collected by Sutherland preserved in the Herbarium of the University of Toronto, with essentially the same label data "Assistance Bay, Lat. 74°40'N, Long. 94°16'W. Elevation twenty to thirty feet. From moist localities, taking root in a deposit of peat or humus among the loose shingle. July 30th 1851".

PAPAVERACEAE

PAPAVER RADICATUM Rottb. — abundant on islets of soil in the fjaeldmark and around the damp borders of ponds; scattered along the beach lines and on the ancient Eskimo houses; rare in wetter localities such as the snow-melt meadows; RESOLUTE BAY: *90, 216, 222, 281, 295, 326, 355* and *410.* ASSISTANCE BAY: Polunin (1940, p. 224) records this species in District 2 as "c. everywhere — numerous records from almost all localities" but does not cite a Cornwallis Island specimen. There is a Sutherland specimen in the Herbarium of the University of Toronto labelled "Assistance Bay, Lat. 74°40'N, Long. 94°16'W, July 23rd 1851. Penny's Voyage" as well as an Ede collection labelled "Cornwallis Island". Recorded as *P. nudicale* in Sutherland (1852. *2:* clxxxix).

CRUCIFERAE

COCHLEARIA OFFICINALIS L. var. *GROENLANDICA* (L.) Gelert — damp meadows in the lowland fjaeldmark, damp hollows of beach lines and around the brackish ponds behind the present beach; RESOLUTE BAY: *87* and *445;* ASSISTANCE BAY: *262;* recorded by Polunin (1940, p. 227) under *C. officinalis* as "Sutherland 1851 (T) as *"C. fenestrata"*". The Sutherland specimen in the Herbarium of the University of Toronto is labelled "Assistance Bay, Lat. 74°40'N, Long. 94°16'W, July 24th 1851. Southern exposure, elevation 400 feet. N.W. side of Bay".

EUTREMA EDWARDSII R.Br. — occasional in snow-melt meadows and similar habitats; RESOLUTE BAY *506;* ALLEN BAY: *176.* New to the flora of Cornwallis Island.

CARDAMINE BELLIDIFOLIA L. — occasional in snow-melt meadows and less frequently in the damp hollows of beach lines and in islets of soil on the fjaeldmark; RESOLUTE BAY, *89, 286, 359* and *443;* ASSISTANCE BAY: recorded by Polunin (1940, p. 229) "Sutherland 1851 (T, K) incl. f. *laxa*". The Sutherland specimen in the

Herbarium of the University of Toronto is labelled "Assistance Bay, Lat. 74°40'N, Long. 94°16'W, July 23rd, 1851. Finely divided soil".

CARDAMINE PRATENSIS L. — rare in wet boggy area at margin of pond east of Reconnaissance Peak and in similar habitats elsewhere; plants non-flowering; RESOLUTE BAY: *434.* New to the flora of Cornwallis Island.

DRABA ALPINA L. — found in a variety of habitats: islets of soil on barren hillsides; dry gravelly southern slopes; dry sandy soil of lowlands; drier hummocks of shingly beaches; damp mossy tussocks near lake; wet boggy edge of small lake; and damp peaty soil near riverbank. 15 collections of this very variable species were made: 11 from RESOLUTE BAY, 2 from ALLEN BAY, and 2 from ASSISTANCE BAY. Polunin (1940, p. 235) records this species from Assistance Bay as "(Sutherland 1852 II p. 189, sub nom. *D. glacialis)*". There is a Sutherland specimen in the Herbarium of the University of Toronto labelled "Assistance Bay, Lat. 74°40'N, Long. 94°16'W, July 21st 1851. Dry localities".

DRABA SUBCAPITATA Simmons — islets of soil on the limestone fjaeldmark and on the beach lines and ancient Eskimo dwellings; RESOLUTE BAY: *74, 107* and *204.* New to the flora of Cornwallis Island.

DRABA FLADNIZENSIS Wulfen — scattered on hummocks in snow-melt meadows and in similar habitats; RESOLUTE BAY: *433;* ALLEN BAY: *173;* ASSISTANCE BAY: recorded by Polunin (1940, p. 237) as "Sutherland 1851 (T, K) as *"D. glacialis* var." and *"D. rupestris"* ". There are two Sutherland specimens from Assistance Bay, Lat. 74°40'N, Long. 94°16'W in the Herbarium of the University of Toronto: (1) August 7, 1851. Elevation 30 feet above the level of the sea, dry soil; and (2) July 23, 1851, S.E. side of Bay, Southern and Southwestern exposure.

BRAYA PURPURASCENS (R.Br.) Bunge var. *DUBIA* (R.Br.) O.E. Schultz—abundant in more or less muddy depressions in fjaeldmark, and borders of small lakes; RESOLUTE BAY. *340* and *613;* ASSISTANCE BAY: recorded by Polunin (1940, p. 250) as "Cornwallis Island, Ede 1851 (T) as *"B. glabella";* Assistance Bay, Sutherland 1851 (K, B) var. *dubia* as *"B. glabella"* ". The Ede collection bears no further information than that given by Polunin.

PARRYA ARCTICA R.Br. — this species grows luxuriantly as rounded deep-rooted clusters by rivers and snow-melt areas in moist soil otherwise bare of vegetation; it is however found in every habitat, including the highest of the hills (800 feet). The rich purple flowers somewhat replace those of *Saxifraga oppositifolia* which almost finishes blooming by the time it begins. Scanty fruit was set in 1949: a raceme of 6-8 flowers usually produced only one or at most, two silicles. RESOLUTE BAY: *82, 293, 370, 501,* and *582;* ASSISTANCE BAY: *264;* recorded by Polunin (1940, p. 251) as "Assistance Bay, Sutherland 1851 (T, B, K) as *Platypetalum purpurascens".* There are three Sutherland specimens in the Herbarium of the University of Toronto from Assistance Bay, Lat. 74°40'N, Long. 94°16'W.: (1) and (2) from finely divided soil; elevation 30 feet, S.E. side of the bay (no date), and (3) July 19th 1851; northwest side of the bay; moist soil.

PARRYA ARCTICA R.Br. f. *ALBIFLORA* Boivin — occasional, occurring with the typical form; RESOLUTE BAY: *88.* New to the flora of Cornwallis Island.

SAXIFRAGACEAE

SAXIFRAGA CERNUA L. — occasional in wet mossy meadow areas bordering some of the ponds and their drainage brooks, on islets of soil on the fjaeldmark, on drier beach lines and ancient Eskimo dwellings; RESOLUTE BAY: *271;* ASSISTANCE BAY: Polunin (1940, p. 255) records this species in District 2 as "c. everywhere — numerous records from almost all localities" but does not cite a Cornwallis Island specimen. There are two specimens in the Herbarium of the University of Toronto: one is labelled "Cornwallis Island. 1851. C. Ede RN"; the other, a Sutherland collection, is labelled "Assistance Bay, Lat. 74°40'N, Long. 94°16'W. July 12th 1851. Wet localities. In deposits of peat (humus)".

SAXIFRAGA CAESPITOSA L. — common to occasional along the beach lines and the associated ancient Eskimo dwellings, in damp snow-melt and lakeside meadows, and on islets of soil in the fjaeldmark; RESOLUTE BAY: *324;* ASSISTANCE BAY: Polunin (1940, p. 257) records this species as

"c. everywhere — numerous records from almost all localities", but does not cite a Cornwallis Island specimen. There is a Sutherland specimen in the Herbarium of the University of Toronto labelled "Assistance Bay, Lat. 74°40'N, Long. 94°16'W, July 23rd 1851. Dry localities."

SAXIFRAGA STELLARIS L. var. *COMOSA* Retz. — occasional at the base of tussocks with *Alopecurus alpinus* and *Eriophorum angustifolium* in wet snow-melt and pond-margin meadows. With one exception, all plants seen in the field belonged to forma *asexualis* Engler and Irmischer, the one exception being a plant with a single white bud that had not yet burst by August 6; RESOLUTE BAY: *405.* New to the flora of Cornwallis Island.

SAXIFRAGA NIVALIS L. — occasional to rare on dry islets of soil on the barren hills, in frost polygon cracks with *Alopecurus alpinus, Eriophorum angustifolium* and *Saxifraga hirculus,* on damp borders of ponds, snow-melt meadows, and damp beach lines and their associated ancient Eskimo dwellings; RESOLUTE BAY: *203, 289, 325* and *583.* ASSISTANCE BAY: Polunin (1940, p. 261), records this species in District 2 as "c. everywhere — numerous records from almost all localities" but does not cite a specimen from Cornwallis Island. There are two specimens in the Herbarium of the University of Toronto: one is labelled "Cornwallis Island. 1851. C. Ede RN"; the other is a Sutherland specimen labelled "Assistance Bay, Lat. 74°40'N, Long. 94°16'W. Aug. 7th 1851. Moist locations. Elevation 30 feet."

SAXIFRAGA TRICUSPIDATA Rottb. — Polunin (1940, p. 264) records this species for District 2 as "c. everywhere — numerous records from almost all localities". Apparently absent, there is no Sutherland or Ede collection of this species in the Herbarium of the University of Toronto, nor is this species represented in any of the other collections studied.

SAXIFRAGA FLAGELLARIS Willd. — occasional to rare around moist borders of permanent or temporary ponds, and in the damp hollows of the beach lines and on their associated ancient Eskimo dwellings growing among mosses or grasses, or often, on the damp muddy limestone soil; RESOLUTE BAY: *168* and *202;* ASSISTANCE BAY: recorded by Polunin (1940, p. 265) as "Sutherland 1851 (T, K)". There are three Sutherland specimens in the Herbarium of the University of Toronto, the one with the most complete data is labelled "Assistance Bay, Lat. 74°40'N, Long. 94°16'W. July 24, 1851. Occurring at various heights, from 30 to 300 and 400 feet, in flower earliest at the lowest height. Localities moist early in the season, but dry generally towards the end of July and the beginning of August."

SAXIFRAGA HIRCULUS L. — frequent in snow-melt and lakeside meadows; RESOLUTE BAY. *270.* Polunin (1940, p. 266) records this species as "c. everywhere — numerous records from almost all localities", but does not cite a Cornwallis Island specimen. There are no Sutherland or Ede collections of this species in the Herbarium of the University of Toronto. Apparently new to the flora of Cornwallis Island.

SAXIFRAGA OPPOSITIFOLIA L. — this species is found in almost all the habitats of southern Cornwallis Island from completely rocky exposed areas to hummocks in the wet snow-melt and lakeside meadows. It is one of the most conspicuous flowers in the region; RESOLUTE BAY: *69, 71, 73, 79, 80* and *81;* ASSISTANCE BAY: *263;* Polunin (1940, p. 269) records this species in District 2 as "c. everywhere — numerous records from almost all localities", but does not cite a Cornwallis Island specimen. There are two specimens from Cornwallis Island in the Herbarium of the University of Toronto: one is labelled "C. Ede RN 1851. Cornwallis Island", the other is a Sutherland collection labelled "Assistance Bay, Lat. 74°40'N, Long. 94°16'W, July 15th 1851. Flowering. In fruit in the season, but always varying in this respect according to the elevation and exposure as well as the [location ?]".

The material in the senior author's collection is extremely variable: No. *80* is a double-flowered form; No. *73* is a narrow-petaled form with petals measuring only 3-4 mm. in width, as compared to other specimens from the area which measure 5-8 mm. in width, thus approaching an entity described by Hayek from the Alps as subvar. *stenopetala;* No. *79* has the petals light mauve, rather than the typical purple, and is thus intermediate to the white or cream-coloured flowers of Nos. *71* and *91* which have been described as forma *albiflora*

(Lange) Fern. This white-flowered form has apparently been recorded from the Canadian Eastern Arctic from only Southampton Island (Cody 1951).

CHRYSOSPLENIUM TETRANDRUM (Lund) Th. Fries (*C. alternifolium* L. var. *tetrandrum* Lund)—wet depressions of the swampy area surrounding the Eskimo house ruins at Foot Lake: RESOLUTE BAY: *435.* New to the flora of Cornwallis Island.

ROSACEAE

DRYAS INTEGRIFOLIA M. Vahl—abundant at the bases or south sides of hills, and in somewhat sheltered areas on the fjaeldmark and occasional in snow-melt meadows and drier exposed rocky beach lines; RESOLUTE BAY: *174* and *302;* ASSISTANCE BAY: Polunin (1940, p. 287) records this species in District 2 as "c. everywhere — numerous records from almost all localities" but does not cite a Cornwallis Island specimen. There is a Sutherland collection in the Herbarium of the University of Toronto labelled "Assistance Bay, Lat. 74°40'N, Long. 94°16'W. July 19th 1851. Dry soil".

ERICACEAE

CASSIOPE TETRAGONA (L.) D. Don — Polunin (1940, p. 311) records this species in District 2 as "c. everywhere — numerous records from almost all localities", but does not cite a Cornwallis Island specimen. Apparently absent, there are no Ede or Sutherland specimens of this species from Cornwallis Island in the Herbarium of the University of Toronto. It is not recorded from Assistance Bay by Sutherland (1852).

VACCINIUM ULIGINOSUM L. — Polunin (1940, p. 316) records this species as "? Cornwallis Island, Assistance Bay, Sutherland (K)". Apparently absent, there are no Ede of Sutherland specimens of this species from Cornwallis Island in the Herbarium of the University of Toronto. It is not recorded from Assistance Bay by Sutherland (1852).

Acknowledgements

The junior author would like to thank the following for their kindness in making collections available for study: Dr. J. H. Soper, University of Toronto for the "Botanical Scrapbook" compiled by Mr. Adam White; Dr. N.W. Radforth, McMaster University for the collections of Dr. W.D. MacClement, and Miss D. Brown, Defence Research Northern Laboratory, Fort Churchill, Man., for the collections of Major Hugh Miller. The senior author would also like to thank the following for their interest and encouragement during the survey: E.H.N. Smith and W. Butler, Entomology Division, Science Service, Canada Department of Agriculture, Dr. H.B. Collins Jr. of the Smithsonian Institute, Washington, D.C., Jean Michea of the National Museum of Canada and R.C.M.P. Constable H.H. Aime. The assistance of the Canada Defence Research Board, RCAF, USAF, and Canada Department of Transport, without which this work could not have been accomplished, is also gratefully acknowledged.

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ADDITIONS TO THE FLORA OF YARMOUTH COUNTY, NOVA SCOTIA[1]

W. L. KLAWE
Atlantic Biological Station, St. Andrews, New Brunswick.

DURING the summer of 1953 a small collection of vascular plants was made in Yarmouth County, Nova Scotia. Most of the collecting was carried out at Wedgeport and its immediate vicinity. The collection has been placed at the Herbarium of Vascular Plants, University of Toronto. A few of the findings appear worthy of record. Listed plants are first findings for the County unless otherwise indicated.

I am indebted to Mr. D. S. Erskine for his examination of the collection and his continuing advice.

Dennstaedtia punctilobula (Michx.) Moore. Dense mixed woods, Wedgeport, July 5, 1953, *1111*[2]. Dry situation in coniferous woods, Wedgeport, July 31, 1953, *1287*.

Sagittaria cuneata Sheldon. Damp shore of Tusket River, Tusket, July 12, 1953, *1179*.

Corallorhiza maculata Raf. Dense coniferous woods, Wedgeport, July 29, 1953, *1258*.

Spiranthes romanzoffiana Cham. Exposed barrens, Upper Wedgeport, July 26, 1953, *1235*. Roadside in coniferous woods, sandy soil, Wedgeport, July 29, 1953, *1255*.

Rumex orbiculatus Gray. Damp shore of a small creek, Wedgeport, July 18, 1953, *1155*.

Salsola kali L. Gravelly sea-shore, Wedgeport, June 14, 1953, *936*.

Cerastium biebersteinii DC. Waste place, dry situation, Wedgeport, June 16, 1953, *942*. This plant is commonly planted and occasional escapes were observed.

Sarracenia purpurea L. forma **plena**. D. S. Erskine forma nov. *Planta staminibus carpellisque in petalibus totius transformatis*. Sphagnum bog, Wedgeport, July 1, 1953, *1049*. One individual with petal-like structures arranged to form a rosulate flower; stamens and pistils not developed.

Oenothera biennis L. var. *hirsutissima* Gray. Open roadside, dry situation, Tusket, July 12, 1953, *1190*. This plant was previously reported from Kings County and Guysborough County. See D. S. Erskine, Rhodora 53: 264-270, 1951.

Monotropa hypopithys L. Dense coniferous woods, Upper Wedgeport, July 26, 1953, *1232*.

Gerardia maritima Raf. forma **alba**. D. S. Erskine forma nov. *Planta epurpurata corollis albis*. Salt-marsh, Wedgeport, July 30, 1953, *1276*. This white flowering form is not uncommon and grows with the purple flowering form.

Plantago oliganthos R. & S. Salt-marsh, Wedgeport, July 4, 1953, *1082*.

Lobelia spicata Lam. Dry pasture, Wedgeport, August 3, 1953, *1300*. Only previous record for the province from the top of Cape Blomidon in Kings County.

Galium aparine L. Rocky sea-shore, Wedgeport, September 7, 1953, *1329*.

Eupatorium perfoliatum L. Wet shore of Tusket River, Tusket, July 12, 1953, sighted only.

Aster ericoides L. Dry meadow, Wedgeport, July 30, 1953, *1272*. There is no published record of this species for the province but it has been previously collected in Hants County by J. S. Erskine.

Hypochoeris radicata L. Dry pasture, Wedgeport, July 5, 1953, *1104*. This collection indicates that the plant is spreading from Yarmouth, its station of introduction.

1) Received for publication November 22, 1954.
2) Collector's number.

NOTES AND OBSERVATIONS

Ring-necked Duck *(Aythya collaris)*, **breeding in Saguenay County, Quebec.** — During the period July 5 to September 20, 1950, the writer operated a banding station at Baie Johan Beetz, Saguenay County, Quebec. The station was first set up by the Northeastern Wildlife Station in 1947, and since 1950 has been operated by the Canadian Wildlife Service. Trapping is undertaken at Lac Salé, three miles inland from Baie Johan Beetz. Lac Salé is one of a chain of small water bodies which are found at the base of an escarpment running from Havre St. Pierre to Natashquan (70 miles). Black duck *(Anas rubripes)*, Pintail *(Anas acuta)*, and Green-winged Teal *(Anas carolinensis)* concentrate on those lakes each fall, the feeding areas serving as an effective check to migration.

On August 30, 1950, the writer trapped two downy young Ring-necks, a male and a female, on the Piashti River, six miles inland from Baie Johan Beetz. The birds were approximately two-thirds grown and were part of a brood of four. The male was shot on October 20, 1950, at Little Otter Creek, Addison County, Vermont. As far as the writer knows, these birds constitute the first breeding record from the north shore of the Gulf of St. Lawrence in the Anticosti Island region.

Wright (1948, Trans. 13th N.A. Wildlife Conf., 356-365) reported that a survey made by him had failed to note any breeding Ring-necked Ducks north of the Maritime Provinces. In 1949, Charles Bartlett, of the Northeastern Wildlife Station, Fredericton, New Brunswick, made the first captures of Ring-necked Duck *(Aythya collaris)* at the banding site. The fact that he banded as many as 88 of these birds was one of several evidences that in recent years the species has greatly expanded its range in the northeast. Springer (Auk. 66:200, 1949) reported an adult male banded at Orland Refuge, Illinois on March 23, 1945, and shot on October 27, 1945, at Mingan, 80 miles west of Baie Johan Beetz. Tuck (Can. Field-Nat.,64 (5): 200-201, 1950) reported the first breeding records from Newfoundland, and since that time an increasing number has been noted in the Gander area. Hewitt (Can. Field-Nat. 64 (1):52-53, 1950) reported the birds breeding at Lochaber Bay, Labelle County, Quebec. — *GRAHAM COOCH, Canadian Wildlife Service, Ottawa, Ontario.*

A dark specimen of the giant slug, *Limax maximus* **L., collected at London, Ontario.** — On June 27, 1953, Mr. H. J. Wheaton was engaged in sorting out an accumulation of old lumber, which had been undisturbed for several years, beneath the verandah of a house in London, Ontario. In the course of this activity he found a large slug on a piece of the lumber and turned it over to the writer for examination. The slug was kept in a jar and died after a few days. While alive and in active movement the slug extended to a length of about five inches and when dead and preserved in fluid was three and five-sixteenth inches long. The whole of the upper surface and the sides of the body were uniformly dark gray, verging on black, except for a few small dots of white on the anterior end of the mantle. The foot of the animal was dull white. Dr. J. Oughton, Ontario Agricultural College, Guelph, Ontario, examined the specimen, including the features of its alimentary tract and reproductive system, and identified it as a dark example of the giant slug, *Limax maximus* L. The dissected specimen, preserved in fluid, is deposited in the collection of the Department of Zoology, University of Western Ontario.

Limax maximus L., introduced from Europe, has been reported in Ontario by Larocque (1938, 1948, 1953) and Oughton (1948) from Ottawa and Toronto where it occurs mainly in the vicinity of human habitations and in greenhouses. In its typical form (Pilsbry, 1948) this slug is light in colour with the mantle spotted with black and the back streaked with black bands usually broken into spots. Pilsbry reports further that "rarely it is uniform pale, without markings, or sometimes suffused with blackish throughout". The specimen collected by Mr. Wheaton at London was in this latter category for the dark gray colour of the whole upper portion of the body masked any pattern of black spots or bands on its surface.

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W. W. JUDD,
Department of Zoology,
University of Western Ontario,
London, Ontario.

Torilis japonica **in the Ottawa District.** — An extensive colony of a white-flowered Umbellifer beside Route 11 at Ironside, three miles north of Hull, P.Q., attracted my attention on August 14, 1954, on my return from a cycling trip in the Gatineau. The fragment taken was sufficient to identify it as *Torilis japonica* (Houtt.) DC., a Eurasiatic species introduced in North America at widely scattered points. As this material was inadequate for a herbarium voucher and duplicates, material for the Department of Agriculture Herbarium was taken on the 19th by I. J. Bassett and G. A. Mulligan of the Weeds Section as their number 3212. The following data were recorded: Four to five acre infestation along roadside bank and in old pasture field particularly in the shade of sugar maples, in clay loam soil. Although quite near a farmhouse, there was no evidence of intentional introduction, and the station seemed old.

No other Canadian specimens were then in the Departmental herbarium, but one arrived on exchange from Ontario Agricultural College. Professor F. H. Montgomery, of the Department of Botany, had the following records, which he most kindly permits me to publish: ONTARIO. Wentworth Co.: Glanford Township, Mount Hope, growing along a hedge, located here for years but not spreading; not apparently planted, Aug. 16, 1954, *D. R. Sands 1426*, (OAC, DAO); Kent Co.: Chatham, Sept. 1, 1946, *Donald Young* (OAC). — *DAVID ERSKINE.*[1]

1 Dept. of Geography, University of Toronto, and Survey assistant (1954) with Botany and Plant Pathology Division, Canada Department of Agriculture, Science Service, Ottawa.

Notes on the Black Swift and Vaux Swift at their Nesting Sites in Central British Columbia. — The black Swift, *Cypseloides niger borealis* (Kennerly), and the Vaux Swift, *Chaetura vauxi vauxi* (Townsend) are the only two species of swift to be found in the central interior of British Columbia. These birds are not numerous in this part of British Columbia and very little is known regarding their habits in general. No nesting site of the Black Swift has been found in Canada heretofore.

In July, 1934, I located my first nesting colony of Black Swifts at the end of North Arm of Quesnel Lake, B.C. The birds were nesting on a very high cliff surrounded by several miles of swampy terrain. The cliff was inaccessible. I noticed the swifts in general were flying low to gather insects from the swamp during cloudy days; during clear days they would fly fairly high until late in the afternoon. In general, from 10 a.m. until 2 p.m. very few birds were to be seen. The nesting site of Black Swifts is a very busy and noisy place, otherwise I never heard any sound from them.

On June 28, 1954, I collected one male Black Swift from a flock of sixteen. This bird was in good condition, total length 170 mm., testes 12 mm., brood patch. Between July 6, 1954 and July 11, 1954, I located the nesting site on a high cliff, just below the snow line, in the vicinity of a small unnamed lake. This lake is surrounded with many acres of shallow water. Approximate location of the nesting site was six miles northwest of Kleena Kleene Post Office, B.C. About fifty birds were going to and from the swamp and above the jack pine forest gathering insects. Specimens were taken above the swamp and the forest. Only one female was secured and one juvenal bird of the year. It would appear that the females stay on the nest more than the males. Measurements of some specimens taken at this location are as follows: Male, length 175 mm., testes 10 mm., wing spread 427 mm. Female, length 160 mm., one ovary 3 mm. Juvenal, length 150 mm. The contents of each stomach examined were about the same — aquatic insects, green beetles, blue beetles, small flying black ants. Each adult bird collected had a pronounced brood patch. The spring migration of the Black Swift in this part of British Columbia appears to be from the last week in May to the first week in

June; the fall migration from the last week in August to the first week in September.

On July 21, 1954, at the north end of Antoine Lake, Horsefly Post Office, B.C., I collected my first Vaux Swift. This was an adult female, with a total length of 114 mm., a wing spread of 278 mm., and with brood patch. This bird had a large lump under the bill and part of the throat about the size of a medium marble. This little pouch was packed with insects and the stomach contents were aquatic insects, little brown beetles, and little black flying ants. Some males and one juvenal were also taken. The males had no brood patch. Flying among the Vaux Swifts were 8 Black Swifts. They were feeding above a very shallow part of the lake. The Vaux Swifts were flying to and from a small grove of large dead cottonwoods about 300 yards west of the lakeshore where they were feeding the young.

The Black Swifts were flying to and from a northern direction to the vicinity of Quesnel Lake. It would appear that both species are getting along very well. One adult female Black Swift was collected (total length 160 mm.) with under parts marked with white feather tips. The stomach contents of this bird were the same as the Vaux Swifts. I believe that this is the first colony of Vaux Swifts recorded from this part of British Columbia. — *LEO JOBIN, Kelowna, B.C.*

The Columnar Form of the Western Red Cedar — an Environmental Modification [1]. — A columnar form of the western red cedar, *Thuja plicata* D. Don was reported to occur at Kilgard, B.C., by R. Glendenning in *The Canadian Field-Naturalist* 62: 39-40. 1948.

During my visit to British Columbia in 1954 my attention was drawn to this variation by Mr. W. Winson of Huntingdon and Mr. Milton Jack of Hatzic. Both of these men had transplanted small specimens of this form to their gardens only to find that the plants reverted to the common form within a few years. Later Mr. J. H. Eddie, manager of the nursery firm of H. M. Eddie and Sons, informed me by correspondence that when young trees of the form were propagated in the nursery the dwarf, compact habit was lost, and that his experience had been much the same as that of Mr. Glendenning and Mr. Winson. The form was pointed out to Mr. Glendenning by Mr. Eddie's brother, now deceased.

On investigating the site where the columnar trees were located I found that their occurrence is restricted to an open area within a few hundred yards of the Kilgard brick works. With one exception all the younger trees of the species within the area are modified to the columnar form. The exceptional tree is a specimen 40 to 50 feet high with a diameter at breast height of about 12 inches. The only explanation I can give for its occurrence with the other trees is that this tree must be genetically an extremely vigorous plant. Mature trees up to several hundred years of age showed no suppression of the main branches, but the young branchlets were more irregular and tufted than usual. No other species of plant in the area showed any distinct sign of a dwarfing effect. There was a deposit of clay dust on the vegetation in the area, especially in the immediate vicinity of the brick works.

After considering various possible explanations of the phenomenon, I decided that clay dust in the atmosphere is probably responsible for the columnar effect. I could find no evidence to suggest that the form had existed before the arrival of white men, and the brick works appeared to be almost certainly associated with the cause of deformity in these young trees. Possibly the clay dust, by irritating the naked growing points of the branches, causes the apical meristem to divide more frequently than is normal in the growth of this species. More probably the cause is related to inhibition of growth, either by the introduction of a toxic substance to the meristematic cells, or by interference with CO_2 intake through the stomata.

The spire-like appearance of the leaders of the younger of the affected trees, similar to that of subalpine and boreal conifers, puzzled me for some time, and after a second visit to the area, its cause was explained to me by Mr. C. Brayshaw, one of three botanists who accompanied me. The spire-like form in subalpine and boreal conifers is considered to be essentially the result of a suppression of growth brought about by adverse conditions. If in trees growing at high altitudes or in northerly regions dwarfing on the side branches is relatively greater than on the leader, the ratio of height to spread is increased. Apparently such a correlation of growth occurs in some species under adverse conditions. This explanation suggests that the modific-

1 Contribution No. 1448 from the Botany and Plant Pathology Division, Science Service, Dept. of Agriculture, Ottawa.

ation observed in the cedars near Kilgard is due to an environmental factor that causes the plants to be dwarfed. — *H. L. J. RHODES, Botany and Plant Pathology Laboratory, Canada Department of Agriculture, Ottawa, Ontario.*

REVIEWS

Mark Trail's Book of North American Mammals. *By Ed. Dodd, McClelland and Stewart Ltd., Toronto. 242 pp. 1955. $2.35.*

The author-artist of a well-known daily newspaper strip has produced a delightful little book profusely illustrating nearly all the larger and a few small mammals of North America. It is in no sense a complete field guide, but it will certainly serve to introduce the uninitiated to most of our more conspicuous mammals. There is a brief text for each treated species, filling the spaces between the sketches. Each species is drawn in many poses and the tracks are illustrated. The beaver and porcupine are the only rodents dealt with, and all lagomorphs, bats and shrews are omitted.

In general the information is factual and interesting. The purist might quibble over some statements, but very few can be considered seriously misleading. The statement that "the mountain goat is closely related to the pronghorn, for he is an antelope and not a goat" is unfortunate; for he is properly neither a goat nor one of the great old-world assemblage loosely termed antelopes, although in the same family as both. The unique pronghorn is in a family of its own.

The most surprising statement in the book is that in British Columbia the black bear is snowy white. I shudder to think of countless hunters streaming into British Columbia to collect snowy white hearth rugs without all the difficulties attendant on shooting a polar bear, unaware that the nearly white phase is restricted to Gribbell Island. In British Columbia at large the black phase is predominant, although cinnamons occur in some areas.

Despite these few faults and its incomplete coverage this book is excellent value and will appeal widely to hunters and all interested in wildlife. The text is simple enough to be readily understood by a youngster. — *D. B. O. SAVILE.*

Mitteilungen. Institut für Auslandsbeziehungen. *(Proceedings. Institute for Foreign Relations. Stuttgart, West German Republic).*

We have received for review the March-April, 1955 number of the Proceedings of the Institute for Foreign Relations, Stuttgart, Germany. This is a special number devoted to the listing and the review of the cultural periodicals of the world. Approximately 900 periodicals of 72 countries are included. For almost all publications are given the name of the publisher and a brief description of the field of learning covered. The question of deciding which publications are to be classed as "cultural" is understandably troublesome. A wide variety of journals is listed here — those dealing with national literature, history, archeology, philosophy, current affairs and politics, art, music, the theatre, modern language and science reviews, natural history and even "Punch" and "The New Yorker".

It will readily be appreciated that a listing of all the cultural publications of the world would be an enormous task, and — as the editors point out — this listing is by no means complete. Information about the literature of certain countries was not available and the listing for countries included is not necessarily complete. Unfortunately, French language literature of Canada is not covered. The goal of the editors has been to make this number "like a burning glass in which are collected spiritual beams from all corners of the earth in order to kindle a flame in the innermost soul of the nations". This number contains a collection of information probably unique of its kind. Even a glance over the publications listed for a country does indeed furnish an impression of the cultural interests of the people.

The Institute for Foreign Relations was founded in 1917 and is devoted to the "furthering of spiritual exchanges between nations". An extensive library and archives containing

foreign books, periodicals, newspapers, reports and manuscripts is maintained. Three periodicals are published in co-operation with other educational institutes. The Institute appears to be a well-established and influential cultural organization. Its goal is most praiseworthy, for surely an understanding of the daily interests and outlook of our international neighbours is basic to the sorely-needed dissolution of national jealousies and suspicions.

R. J. MOORE.

Field Book of American Wild Flowers. *F. Schuyler Mathews, revised and edited by Norman Taylor. Published by G. P. Putnam's Sons, New York, and concurrently in Canada by Thomas Allen, Ltd., Toronto, June 1955. XXIX plus 601 pages, 305 plates of line drawings and 30 in colour, size 17.5 x 11 x 3.5 cm., weight 17 oz., cloth. $5.00.*

Fully revised and brought into line with current botanical nomenclature, this new edition of Mathews' Field Book should now regain much of its former popularity. Indeed, it can now be recommended without hesitation to the acute naturalist seeking the correct names and general details for most wild flowers he is likely to encounter in Eastern Canada. About 850 species are given separate attention; approximately two-thirds of them occurring within the area from southern Ontario to the Maritimes, — a rather satisfactory proportion for a manual covering all of eastern and central North America. The book is not suitable for use in Western Canada or in the North.

The species are treated in a sequence following the conventional "natural order" from cat-tails to composites, rather than alphabetically or according to flower color — an advance over other hand-guides. There is, however, no detailed key for identification. It is intended that the user will simply flip the pages to locate the picture of the specimen at hand and then check its parts with the description opposite. The right-hand page has been reserved for the drawings and, with familiarity, it should be possible to make field identifications quite quickly and accurately by this method. All species having distinctive form are illustrated in good line-drawings and others closely related to them are mentioned in the text. The colour plates grouped together at the end will probably prove of little use; their quality is of minor artistic merit.

In "wild flowers" are included, besides the showy native species, such garden flowers as Day Lily, Celandine and Purple Loosetrife gone wild, and most of the brighter weeds of foreign origin. No trees, grasses, sedges, or species with inconspicuous flowers are included, and it is mainly in this way that the total number of some 4 or 5 thousand species has been effectively reduced to a workable size. — W. G. DORE.

An introduction to Ornithology. *By George J. Wallace. 1955. The Macmillan Company, New York and Toronto. Pp. I-XII, 1-443 ($8.00 in Canada).*

This book is aimed at meeting the critical need for an introductory text in ornithology. Doubtless it will be highly successful in filling that need. The essential principles of most aspects of ornithology are brought together and are explained simply yet academically. Although it is designed primarily for students in colleges and schools, it is written in such non-technical language that anyone desirous of improving his general knowledge of birds can read it easily or use it for reference.

The history and current status of bird study are taken up in the first of the 16 chapters that make up the text. Succeeding chapters explain the origin of birds; their external features and adaptations; their internal features and functions; the sense organs and behavior; their annual cycle (4 chapters). Then follow treatments of migration, distribution, food habits, economic relations, conservation, classification, and nomenclature. The fossil record of birds is interestingly developed in another chapter and then follows a good elementary account of ornithological methods.

A feature of the book is the wealth of well-selected references to literature for use by those wishing to pursue any aspect of bird study in greater detail. These are placed at the end of each chapter and also there is a good bibliography at the end of the book. The large amount of material in the text is logically arranged and well indexed for easy reference. It is well illustrated by many half-tones and line drawings. — W. EARL GODFREY.

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ON THE SPRING FLIGHT OF BLUE AND SNOW GEESE ACROSS NORTHERN ONTARIO [1]

JAMES L. BAILLIE
Royal Ontario Museum, Toronto

SOPER (1942) has stated with reference to the Blue Goose, *Chen caerulescens,* (Linnaeus) that 'The detailed character and exact route of the great flight of these geese from Manitoba to James Bay, remains one of the outstanding unsolved questions of their life-history. Practically nothing is known about it.' They leave their southern Manitoba gathering places west of Winnipeg on the average about May 6th and migrate up both coasts of Hudson Bay.

Bremner (1949) has provided some inkling of the route taken by these and Snow Geese, *Chen hyperborea* (Pallas), on spring migration across northern Ontario. He watched a flock of 200 (15% Blues) passing in a northeasterly direction over Casummit Lake (mark 1 on map) on May 15, 1947 and was told that 'white wavies' had been seen by local residents for about a week or ten days prior to that date.

A keen observer of birds with whom I have had an interesting interview, Mr. Clarence Watson, told me that he had notes on this subject gathered while he was stationed for five years (1938-43) at Rat Rapids (mark 2 on map) in the Lake St. Joseph area of Ontario as Superintendent in the employ of the Hydro-Electric Power Commission of Ontario. He promised to produce these notes for publication, and the significant parts of his communication follow:

"Some time prior to the Spring of 1937, the writer had heard or read, that the exact spring route of the Blue and Lesser Snow Geese from their resting place in southern Manitoba to James Bay was unknown, but was supposed to be along the English River, Lake St. Joseph, and Albany River to James Bay...

"So it was with some eagerness, on the writer's arrival at Rat Rapids... on Lake St. Joseph in June of 1937, that enquiries were made about the abundance of these geese at that place during the spring flight. The results were a bit disappointing. Yes, a few flocks of 'wavies' were seen usually each spring, but only a few, and it seemed that these few seen had passed over in a direction and location not corresponding to the general direction of the Albany River whose beginning is in Lake St. Joseph.

"The writer's stay in Rat Rapids in 1937 was from June to October. He arrived too late to observe any spring flight, and no Blues or Snows were seen that fall.

"In June of 1938 the writer returned to Rat Rapids but this time he remained there for five years, until June of 1943. [It might be recalled that on June 16, 1938, Mr. Watson collected the first eggs of the Bonaparte's Gull to be found in Ontario at Rat Rapids (Dear, 1939)].

"In view of later observations made at Rat Rapids, the geographical location of the place should be understood. Lake St. Joseph is about 65 miles long and averages about two miles wide, with large and deep bays along its north shore. The lake lies approximately east and west, and is in the form of a long boot with the boot at the eastern end and the toe pointing towards the north. The eastern end of the lake is formed by an island six miles long from north to south. The water outflows from the lake at the north end of this island at Rat Rapids, and at the southern end of the island by Cedars Channel. The H.E.P.C. of Ontario have a generating station at Rat Rapids, and the controlling dam for the lake at Cedars Channel. The beginning of the Albany River is at Rat Rapids and

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Cedars Channel. It is important to keep in mind that Rat Rapids is six miles north of Cedars Channel.

"During the six autumns, 1937-42, no Blues or Snows were seen in flight by the writer at Rat Rapids. But it was obvious that some of these geese passed through that locality each fall, since the Indians would regularly bring in about three to six geese along with each fall's bag of ducks. These geese were always plucked when seen by the writer so could not be identified as to Blues or Snows but their size would indicate one or the other. It should also be noted that, from enquiries, these geese were always taken, while resting or feeding, east of Lake St. Joseph on the Albany River. In contrast to this, only very occasionally have the Indians reported 'wavies' in the immediate vicinity of the Upper Albany River in the spring.

"*Each spring the Blues and Snows passed over Rat Rapids, usually rather low, in flocks of from 40 to 150 birds.* Always, as memory serves, there were both Snows and Blues in each flock, *about 10 to 25 per cent being Snows. The direction was always approximately the same, northeast by east* (notes were kept on all flocks seen but these Rat Rapids notes were lost in a fire).

"From two to four flocks each day for a week would be seen passing over, and about an equal number appeared to pass over at night. That week would be at the height of the flight, *usually commencing about the end of April, right at the time of the break-up. The flight seemed to come full force all at once but straggling flocks would be seen during the second week.* It is unfortunate that the notes were lost since a check might have been made on the possible bearing that weather conditions might have had on these flights from Manitoba. However, it appeared that the geese preferred travelling in clear and calm weather.

"It was noted by the writer from the first spring that more flocks were seen to the north than to the south of Rat Rapids, although no significance was given the fact at the time. Also it seemed odd that the flocks came from the southwest by west, across country north of the main body of Lake St. Joseph and on across country to the northeast by east without deviating to follow the Albany River and its accompanying string of lakes which lies in a southeasterly direction for about twenty miles below Rat Rapids. From enquiries of the Indians and scow crews it did not appear that geese were any more numerous at the west end of Lake St. Joseph than at Rat Rapids.

"Such were the observations made at Rat Rapids; let us see what was happening at Cedars Channel, only six miles to the south of Rat Rapids.

"The first spring, 1939, that the writer was at Rat Rapids, precise instructions were given the two watchmen at Cedars Channel as to the observations to be made on passing Blue and Snow Geese. Writing material was provided for notes. High hopes were entertained for a lot of interesting reading since Cedars Channel would be directly in the line of flight of geese following the length of Lake St. Joseph and down the Albany River.

"The result of those observations were altogether different to that expected. That first spring one small flock of seven was seen, and these [geese] were found early one morning swimming around in the quiet water above the dam. In only one other spring can it be recalled that the watchmen saw geese, and that one was a comparatively small flock going northeast. The percentage of Blues and Snows in the two flocks was not noted.

"The above were the results of observations taken at Rat Rapids and Cedars Channel until the spring of 1942.

"On May 1, 1942, the writer, as one of a small party of prospectors, left Rat Rapids by canoe for the Forester Lake gold country on the Williams River... 85 air miles straight north of Rat Rapids, or 65 miles straight north of Pickle Lake [mark 3 on map]. Pickle Lake is the airplane landing for the Central Patricia and Pickle Crow Gold Mines.... Word had been received from the Indians that the lakes in the north were clear of ice and most of the snow gone from the ground.

"The weather for the day or two previous to May 1 was threatening. On the morning of May 1 it started to rain with an east wind. By evening it had started to snow with wind and lowering temperature. All night and next day it blew almost a blizzard, real winter weather. The party remained at Central Patricia the evening of

Direction followed by Blue and Snow Goose in spring migration across northwestern Ontario. Localities are identified in the text.

May 1 and [all of] May 2. On the morning of May 3, the snow had stopped falling, the wind had abated, and the temperature was already above freezing. Clouds remained heavy and low all day and into the night.

"A start was made on the evening of May 3 down the Crow River and camp was made about a mile below Central Patricia. The morning of May 4 was clear and frosty, and proved to be the first day of a stretch of three weeks of fine weather with warm days and frosty nights with only occasional short lapses of cloud and light snow flurries.

"Kicker trouble prevented much progress on May 4 and camp was made that night in the heavy spruce swamp on the shore of the Crow River about three miles north of the Pickle Crow Gold Mines.

"The first geese seen or heard was a flock of about 120 that passed directly over-

head and high at about 6.15 p.m. travelling NE by E. About ten per cent of this flock were Snows. A few minutes after this flock another passed out of sight to the south. (The tall spruce trees all around this camp made it far from ideal as an observation post). Then commenced a fairly continuous clamour of passing geese for the rest of the evening and all through the night until about three hours after daylight on the morning of May 5. Those geese that passed in view were high and travelling a little north of east. The geese passed apparently in equal numbers both to the north and south of the camp. Their noise prevented much sleep.

"At about three hours after daylight the number of flocks seemed to taper off, although this was probably due in large to the restricted range of view between the trees on the banks of the stream and the noise of the kicker preventing hearing them until they were close overhead. This view would seem to be substantiated by the fact that the presence of the geese was more in evidence on the portages...

"As soon as the party entered the sizeable Mud Lake, at about 2.30 p.m. (May 5), with its less restricted view, at once flocks of geese were seen and continued to be seen at short intervals sometimes more than one flock in view at the same time. This condition held throughout the four hours spent in traversing Mud Lake and the broad mouth of the Spruce River. The flocks were all of the familiar pattern. They contained from 75 to 200 birds. All appeared to be travelling NE or NE by E. Those close enough were observed to consist of from 10 to 20 per cent of Snows and the rest Blues.

"Although Mud Lake would appear to be an ideal resting and feeding place, being extensive and consistently shallow and with plenty of plant life both in the water and on the low marshy shores, no geese were seen at rest. All seen were passing straight over and high.

"It was on Mud Lake, on this afternoon of May 5, that the largest and most numerous flocks were seen. It seems worth mentioning here the circumstances under which the largest flock, by far, was seen over this lake. As the writer's party approached the mouth of the Spruce River in the late afternoon, with the lake calm and the sun warm, a group of tents was seen on a point. This called for a short visit. It proved to be Chief James Meskias' camp and accompanying families who were making their leisurely way from their winter trapping in the north to Osnaburgh House on Lake St. Joseph for the Treaty that was to be held at that post on about July 1.

"Concerning this camp, the writer's notes state: 'Chief James Meskias' camp at mouth of Spruce River; ten tents, mostly new and white, and three wigwams; all tall, fine-looking men; squaws and babies well-dressed and fat; many rabbit-skin blankets hanging on the trees, airing; lots of ducks and fish hanging up; many guns stacked against the tree trunks; good canoes, some very large freighters; several kickers.' Some of the men were painting and repairing canoes. Others were whittling out paddles with that strange all-important tool of the north bush, the canoe knife. The rest of the men lolled down to the shore to look over the visitors' outfit and to listen to the conversation. The women nursed their babies, poked about the supper fires, or just sat in the warm sun and watched. It was a scene of wilderness, prosperity and carefreeness.

"In this pleasing setting suddenly all eyes turned upwards and there were awed exclamations of 'weewik' (from which the universal northern name of 'wavie' is derived. Indians of Lake St. Joseph refer to both Blues and Snows as 'wavies'). There, almost overhead, and coming straight for us, was the forefront of a flock or system of flocks of geese that seemed to extend back for a great distance. They had approached unheard but when nearly overhead broke out in a tremendous clamour. Even the Indians appeared awed by the sight.

"The writer does not think he exaggerates when he says that he was literally spellbound. All duties as an observer were forgotten until a decided cramp in the neck, from gazing straight overhead, brought him to his senses. Even then it required a force of will to take his mind off the feast to the eyes and to concentrate on estimating the numbers of the geese. But by then the head of the flock had passed so far from overhead that individuals were lost in undulating lines of beating wings. Straggling flocks, though part of the main body, fol-

lowing after the main body, were still passing as we pulled away in our canoes.

"Concerning this flock the notes say: 'At 4.00 p.m. one flock, estimated 2,000 geese, 8 or 10 per cent Snows, going north of east, very high'. It might be noted here that in all cases of estimations of numbers in flocks a conservative policy was followed.

"About an hour after the passing of the large flock, two other flocks of considerable size were seen. To quote the notes: 'At 5.10 p.m. at mouth of the Spruce River, two flocks estimated at 500 each, travelling high and close together, north of east, about 10 per cent Snows and rest Blues'.

"Other small flocks were seen while passing up the broad mouth of the Spruce River until the stream narrowed and view was restricted. These flocks averaged about 100 individuals, about 10 per cent Snows, flying high and NE by E.

"Camp was made that night at the Falls that is the first portage on the Spruce about a mile and a half from the mouth. The weather continued clear, calm, and frosty. All that night the cries of passing geese were heard above the noise of the falls and again the writer had sleep only in spots.

"Next morning, May 6, for about two miles above the camp, several flocks of about a hundred each, all following the usual pattern as to species and direction, were seen. Then suddenly the absence of geese was noted.

"At 11.45 a.m. a flock of 250 was seen, going in the usual direction and consisting of about 15 per cent Snows. This flock might be considered the last of the main flight. No more geese were seen on... May 6, nor were any heard on any night after that.

"It should be understood that the Crow River, from Central Patricia to the mouth of the Spruce River flows in a direction practically paralleling the observed flight of the geese. From the mouth of the Spruce River to Spruce Lake, a distance of about 40 miles, the Spruce River flows almost straight south, so that in passing up the Spruce River we were cutting the line of flight almost at right angles.

"The few flocks noted after May 6 may be quoted from the notes: 'May 7, at 6.00 a.m., on Upper Spruce River, one flock of about 75, all Blues, at medium height, passed overhead going north of east; May 7, at 7.00 p.m., one flock of 100, almost overhead, all Blues, going north of east; May 14, at sundown, in camp of George Porter's claims on Obuskantaga Lake on Williams River [mark 4 on map], one flock of about 75, all Snows, low and close by, going northeast; May 16, at 6.45 a.m., same place, one flock of about 75 geese going northeast, could not identify in mist if Blues or Snows'.

"The entry of May 16 was of the last geese seen. Throughout the trip no resting geese were seen. All flocks observed along the main fly-way were at least of considerable height, by far the most of them could be called high. The consistency of the direction followed by all observed seemed remarkable. Most flocks were mixed, only two batches were entirely Blues and one entirely Snows."

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NEW OUTLINES ON COMPARATIVE ODONTOLOGY [1]

L. BERNER
Marseilles, France

1

EVOLUTIONISTS commonly suppose, though, erroneously, that the complex forms of dentition among mammals are derived from "simpler" ones still in existence.

If the canine of an adult man is compared with the open conical tooth of a full grown specimen of *Pagrus vulgaris* C.V., for instance, there are so many differences in structure, attachment, function, etc. that one is inclined to attribute them to evolution from the "primitive" forms seen in recent fishes which are the "lowest" classes of vertebrates and to suppose that the human tooth has resulted from a process of evolution extending from the fishes right up to the highly specialized dentition of man.

However if the primary canine of an infant of ten months is used for the comparison rather than the tooth of an adult, many analogies appear and it would seem that the teeth of present-day bony fishes are merely *arrested* in development, whilst those of the human baby have *continued* to develop according to the general constitution of "higher" vertebrates. For example all bones in the piscine skull and especially the dentaries jaws remain separate, whilst they become ankylosed in mammals. In this case there are similar differences in both attachment and function of teeth carried thereon. Thus we become aware that there is no "evolution" but only an arresting of development in teeth we mention.

In all vertebrates the size of a tooth corresponds with the general growth of the animal and the respective class to which it belongs. There is a distinct similarity in the dental development of all vertebrates whilst their dentine also corresponds, but the morphology and the enamel (where it exists) differ according to the species concerned. A similar difference exists in the respective circulation, respiration and digestive systems, the degree of development varying in conformity with the respective type of constitution though without evolution in the living forms themselves. In fact in recent dentitions degrees of complexity correspond with the type concerned.

The plan of dentition is the same whether seen in mammals or the bony fishes. Although more complex in the "higher" vertebrates, even the sperm whale *(Physeter catodon* L.) has but one kind of conical tooth whilst some living fishes such as *Hybodus* possess complex tubercular teeth and *Cochliodus contortus* folded teeth. In *Diodon, Triodon* and *Tetrodon* there are compound teeth, built up of lamellae of dentine and osteodentine. In short we may see single teeth both in mammals and fishes, as well as complex ones.

2

There is no strict relationship between tooth structure and feeding habits but there is such a relationship between the teeth and the general constitution or the diet and the digestive system. The otter *(Lutra lutra* L.) and the seal *(Phoca vitulina* L.) live both principally on fish, but their teeth are dissimilar, one being an Arctoide and the other a Pinniped, though both belong to the Carnivora.

The flying fox *(Pteropus edulis* E. Geof.) is frugivorous but has some carnassial type of teeth. Therefore they must be related rather to the specific constitution of that animal than to the diet. Besides such a feature is seen even more clearly in Ungulata. For instance oxen (*Bos taurus* L.) or sheep (*Ovis aries* L.) have no maxillary incisors and their lips are believed to be specially suited to replace them, even though horses *(Equus caballus* L.) have such similar lips but are provided with incisors in the maxilla and both oxen, sheep and horses have cheek teeth in accordance with their herbivorous diet. Nevertheless their digestive systems differ as do other parts of their bodies, the former animals being Artiodactyles and Ruminants whilst horses are Perissodactyles and belong to a distinct Phylum. Thus teeth vary with the species rather than with the diet.

In order to ascertain an animal's diet one must examine the stomach contents rather than the teeth, as well as their function. In spite of their sectorial teeth, sharks swallow their food whole. They do not cut up their food into portions, but if they seize some

1) Received for publication August 30, 1954.

complex object, they pull it off rapidly or turn the object quickly about until it is free. Evidently when seizing brutally, their teeth cut off portions, but sharks never act in a manner as do animals slashing a prey. Besides there is no purpose for it as their powerful digestive system rapidly dissolves whole food swallowed without any dental activity.

A single use for an organ may help in the development, even as disuse may lead to atrophy but it does not suffice to explain its presence. Furthermore variation in diet never produces a change in dentition which invariably corresponds with that being common to a species.

So the brown bear (*Ursus arctos* L.) has teeth suited to its mixed diet, for it is mostly herbivorous in early life and largely carnivorous in later life. In return the polar bear (*Thalarctos maritimus* Phipps) is entirely carnivorous but its cheek teeth retain their broad top character throughout life as do those of the brown bear.

The fox (*Vulpes vulpes* L.) is omnivorous but not so much so as the hedgehog (*Erinaceus europaeus* L.). In this case, there is no relationship between dentition and diet, but the teeth are of the carnivorous type like *Canidae* on the one hand and *Insectivorae* on the other — two distinct groups of living mammals.

Whatever the diet, the dentition agrees with the general structure of an animal's body and a creature must either feed itself on what food is available and / or suitable to its digestive system or pass out of existence. That is why animals with varied dentitions often choose the same diet whilst others with similar teeth eat quite different food.

3

As a general rule throughout the vertebrates a tooth arises in a specific manner from the enamel organ and dentin germ, the activity of them depending on the general growth of the animal. According to WILLIAMS, human dental morphology conforms to the type of skeleton and shape of cranium; for instance, the oval incisors correspond with the oval face, etc. These are individual rather than specific varieties.

Sexual differences are never prominent in primary teeth. There is a relationship between size and shape of teeth and sex and maturity irrespective of diet, but feeding habits will correspond with the development. Likewise a young eel (*Anguilla vulgaris* Turt.) has few cilliform teeth in its *Leptocephalus* stage of development, whilst after its metamorphosis it has numerous little sharp teeth and its diet changes with its age and size. As rays approach maturity most of them reveal sexual characteristics in their teeth. The bony fish: *Aphya pellucida* Nardo has a primary and an adult dentition whilst the spawning male has a dentition distinct from that of the female. The male of another fish *Cristallogobius linearis* Düb. & Kor. possesses teeth, but the female is edentulous. The male of narwhal (*Monodon monoceros* L.) is edentulous in the mandible but has two incisors in the maxilla. In his female both these teeth are unerupted. In the male the right tooth is usually like those of the female in shape whilst the left one extends in a spiral form from the jaw by persistent growth, once it has reached maturity. Of course all those dental differences have no influence on the diet; male and female feed in perfectly the same manner.

There is a difference between the dentition of a stallion and a mare; the latter has no canines and none develop when a colt has been castrated in youth.

Thus glandular secretion controls the development of teeth mentioned, as it influences tooth replacement where the replacing teeth are always proportionally greater than those which are replaced, the volume of a replacing tooth being complete before the bone to which it will become attached has reached its full size for such attachment to take place. On further development each of them remains stationary. An erupted tooth does not increase in size unless there is a persistent pulp.[2]

In short: glandular and growth's stimulus to the whole body also affects the tooth germs. Remind: baby's first dentition is already formed in foetal stage; the infant's second one—in full size conformable to ultimate growth—will arise just before reaching maturity, i.e. before the skeleton is completely formed. In consequence there must

2) I.e. in such teeth there is a secondary ascending growth; nevertheless they do not differ anymore in shape, but are stimulated by internal glands to progress. Thus the canines of the wild boar (Sus scrofa L.) are of persistent growth only during sexual period, and arrested in an old male of no more sexual function.

be a gradual axillar internal stimulus for proportional regulation of what it will become subsequently for future equilibrium.

4

All teeth are "deciduous" and it is incorrect to speak of a *deciduous* or a *permanent* dentition. The duration of a tooth's function depends on its variable activity and specific constitution but its use may vary in course of time. Various sets of teeth may sometimes function at the same time though teeth with persistent pulp differ.

As a rule teeth erupt, replace others or are buried in accordance with the development of the body or the growth in equilibrium with the whole organism. Their shape rather conforms to the species however and due consideration must be paid to the physiology. Many animals grow rapidly but their life-span varies. Thus two years is as good an age for a mouse, as fifteen is for a dog, etc. but those two years on the one side equal these fifteen ones on the other side, only the vital intensity varies conformably to life-time, as all phenomena accord with it. That is to say: the physiological development as regards foetal life, youth, maturity and natural death are similar even though periods vary.

Growth in many bony fishes is unlimited before death and their teeth are always replaced when shed, for fishes are polyphyodont. In reptiles — except in crocodiles — succession of the teeth often stops at maturity, while growth is limited and their teeth are replaced in quite an irregular manner. In mammals growth is limited but corresponds with function throughout life. Here dentitions are limited too; they appear, succeed or are suppressed in accordance with the species' constitution. Thus edentulous mammals possess tooth germs at first but either they do not develop into teeth or the teeth are not calcified or even may remain unerupted. The disappearance of teeth or the reduction in number is an ontogenic process. This means that when a character develops the more and more later, it finally will be lost, unless being rudimentary, whereas a character which develops the more and more earlier, becomes subsequently preeminent. Thus if disappearance of teeth occurs by elimination, such as seen in Cetacea, no further succession takes place.

In another type of tooth of persistent growth, for instance the prismatic incisor of rodents, the root is eliminated, whereas the hypsodont tooth of the horse becomes rooted after its long use. In this case the relation between teeth and the animal's growth is obvious, because only in youth i.e. during growth the horse's tooth increases and afterwards the whole (skeleton, body and teeth) is arrested. In other species erupted teeth do not increase; they are shed off for not being more in equilibrium with the organism and replaced or not.

As the internal glands influence the growth or the development of teeth, so they influence their replacement; therefore "primary" and "secondary" dentitions should be spoken of rather than "deciduous" and "permanent", although primary and secondary dentitions sometimes overlap — of course being faced only two sets of mammalian dentitions, possibly there are more.

In Ungulata, Carnivora, Insectivora vera and Primates the two dentitions alternate. Cheiroptera and Soricidae are losing the primary dentition, whilst rodents have nearly lost it entirely. In marsupials the primary dentition possibly functions through life and the secondary does not erupt any more than the secondary cheek teeth in Proboscidea. In the mature Castor brewer (*Castor fiber* L.) all the teeth except the premolars belong to the primary set. Thus so called "deciduous" teeth become "permanent". Likewise the expression "milk" teeth in bony fishes is inequitable, although they possess both primary and secondary dentitions. Here the teeth are never permanent for fishes are polyphyodont. In old men often teeth are worn off by age, as well as sometimes a "milk" tooth becomes permanent; we are even told that occasionally in very old age a man had a third dentition. Any way it is more logical to give up "deciduous", "permanent" and "milk" teeth.

5

It is generally believed that hairs and teeth correspond but neither their origin nor development are alike. Both come from ectodermal cells like still other formations but the morphology and growth differ even if there is convergence in design.

Hairs are always attached obliquely and formed in situ by papillae, becoming rooted in the course of growth though the ex-

tremity is immediately free. There is an ascending growth and, after eruption, the hairs continue growing and sometimes curl. When stabilized they attain to full size; then, when lost, they are replaced by another one which arises from the follical directly.

On the contrary teeth always arise from dental germs. The crown is moulded first and calcified; the enamel organ's activity is moulding the top into shape. Then the tooth grows towards the root by dentine germ's activity and thus descending growth results in it attaining full size. It may afterwards erupt for use being previously socketed or otherwise attached. The pulp cavity may contract in due course, but the shape of the tooth never alters.[3] The teeth last so throughout life unless lost, being always proportionate with the whole body.

This process occurs everywhere in all vertebrates, but true hairs are found only among mammals. For such reason a tooth is an *unique* organ in the body.

6

First of all a tooth is a typical character of species or genus. But often a tooth is besides an organic device for easy use too when required; when it functions there is naturally an "instinct" to account for it, although its use may not always be evident as the non-poisonous fangs of the false viper, the stunted cheek teeth of the vampire bat (*Desmodus rufus* Wied) lapping blood from victims with its tongue only, etc. The utility of teeth in a fish which swallows its food whole, or of the rudimentary teeth of the humpback whale (*Megaptera boops* L.) with its balloon plates retaining food, is clearly less evident than the tusks in elephants by porterage. In *Babirussa babirussa* L. and allied animals canines become sexual weapons, but they are real hypertelical organs, causing restraints.

In fact, the formation of teeth is an integral part of general development. In such a way there is no end into their coming to use and their special purpose may not always be evident whilst disuse does not ever cause their disappearance. Canines and caniniform incisors as well as premolars in the camel (*Camelus dromadarius* L.) are organs of importance without obvious use under present conditions. We may especially mention the *Manidae* having no functional teeth at all, though being termite-eaters, whereas bats *(Microchiropterae)* feeding exclusively on insects have sharp pointed teeth. The salamanders have teeth on each jaw; the frog only on upper jaw, while the toads are generally edentulous, but all are feeding nearly in the same manner, swallowing whole small food they obtain. Thus we cannot see directly any relationship between their teeth and diet, but we are perfectly aware that there is one between them and their constitution, each phylum having a particular dental system, for instance the unerupted teeth of the python, or much better the rudimentary teeth in rachiodon (*Dasypeltis scabra* L.) a snake which feeds on eggs swallowed whole, but broken by an enamelled prolongation of the thoracic vertebra bone, without any dental function. What may be the use of the sole two teeth only apparent in *Hyperoodon's* lower jaw, whereas all the others are buried into its gum? But those teeth remain nevertheless into the general dental system of Cetacea.

7

Teeth have often but one function although they show a complexity in infinity whereas their fundamental structure is the same throughout all vertebrates, only details varying with the species, used or not.

Any modification in a tooth is reflected in the specific constitution. It is an integral part of the whole animal. Teeth arise in the course of growth in a species and may finally disappear but they have no evolution in themselves. Nor do they possess an adaptive modification unless the species varies too. So they have the same degree of complexity as the whole body.

So as species become more complicated their teeth similarly assume a more complex form, without fundamental change in their structure. With increased development, such as seen in tusks, or suppression due to internal secretion there is no known reason to account for either. But always growth of the whole body is reflected in the teeth's development and their replacement. Unlimited growth corresponds to unlimited replacement of teeth, while limited growth is met in limited dental succession.

3(However there is an ascending growth too in teeth with persistent pulp as told before, after formation by descending growth.

In crocodiles the number of teeth never varies throughout life; however the size of individual teeth is always proportional to the extent of the animal's body. As an erupted tooth with closed pulp never increases, it is shed off for not more fitted with the jaws' growing, then being directly replaced by another one more voluminous. In due course each set succeeds from birth to death in order to maintain an equilibrium between the body and teeth. Thus the growth of the crocodile involves dental renewal, just as the teeth of bony fishes are always replaced, whether injured or not, if their body increases. Therefore a tooth from a sixty cm. crocodile might well be measured and compared with that of a three meter one, as it never changes in shape, only the volumne remains proportional to the whole body, although some of the teeth in activity may not be equal among themselves in the same animal. In rodents the incisors get longer, but without changing the shape, their size being continually changed by wear.

8

We conclude that teeth are rather a fact of development than a result for a purpose, as they have no general meanings, though they can get a use, but never a role in all vertebrates. In reality they constitute a specific character similar to any others in the animal kingdom.

Teeth are used on account of their disposition, but they are not always disposed in such a manner that they may be used, if there is a reason for it.

FOOD HABITS OF MARTEN *(Martes americana)* IN NORTHERN BRITISH COLUMBIA [1]

HORACE F. QUICK
University of Maine

MARTEN food habits have not been adequately described although several studies have presented information pertaining to seasonal food habits in specific localities (Cowan, 1950), (Marshall, 1946). Only a few food habits have included appraisals of food availability which are essential if the effects of predation on population variations are to be properly interpreted.

An analysis of marten food habits was made to evaluate the relationship of this mammal to the carrying capacity of its food base. This study was part of a fur resource survey conducted in northern British Columbia which also included an appraisal of small mammal populations (Quick, 1954). These collections and studies were made during the trapping seasons of 1947-48 and 1948-49 in the region of Fort Nelson, B.C.

A description of the food items selected by marten was obtained by an examination of the alimentary tracts of specimens collected from trappers. Winter food habits were determined by the analysis of 250 specimens and 68 scats. This adds to the information obtained in southern British Columbia by Cowan (1950) from three stomachs and 112 scats collected during several summer periods.

Most animals are trapped because of hunger. The stomachs of such animals are therefore usually empty and provide no data about food habits but sometimes useful information can be obtained from other parts of the alimentary tracts. Evidence of food-item selection was classified according to the quality of the information which could be obtained from the specimens. Specimens fell into six groups as shown in Table 1.

In the separate collections representing two different winter periods the same proportion (59%) of the specimens were found to have empty alimentary tracts (Table 1). This indicates the degree of difficulty of obtaining information on food habits from trapped specimens. Data obtained from Class 1 specimens were most productive and that from Class 2 next. A comparison of these two classes combined shows a notable similarity for each of the two years indicated. In 1947, for example, about 14% of the marten had food in their stomachs from a recent meal at the time they were trapped and the same proportion had empty stomachs but food in the intestines or recta representing food ingested a day or two prior to being

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Table 1. EVALUATION OF FOOD HABITS MATERIALS

		1947-48	1948-49
Class 1:	stomach and rectum yielding data	14.2%	9.7%
Class 2:	rectum only yielding data	14.2%	17.2%
Class 3:	stomach only yielding data	11.0%	10.5%
Class 4:	scats adhering to carcass-fur	0	1.7%
Class 5:	bait in stomach	1.6%	1.7%
Class 6:	alimentary tract empty or containing only debris	59.0%	59.3%
	No. of specimens	127	123

trapped. In the following year these two classes of data, combined, were equivalent to that of the previous year but separately Class 1 data (animals with food in stomachs) had fallen about 5%. This might have been caused by the somewhat colder weather in the latter year which would make hunting difficult and delay feeding thus increasing the proportion of specimens trapped with empty stomachs. The collections for the two years are comparable in number and about 40% of the specimens from each collection yielded some kind of usable information. Although these specimens probably were hungry when trapped the contents of their alimentary tracts represent the natural food habits of this species.

Food items selected by marten during winter are listed in Table 2 for each of two winters. Some distinct differences in dietary selection are shown but the frequency of red-backed voles, *Clethrionomys gapperi,* in both groups of material was about equal. Despite an increase of about 300% in small rodent populations during 1948 voles appeared to be as important in 1947 as in 1948 having occurred with a frequency of about 40% in both groups of specimens. The balance of the food items in 1947 appeared to consist mostly of birds while in 1948 it was made up of small rodents other than voles such as deer mice, *Peromyscus maniculatus,* red squirrels, *Sciurus hudsonicus,* snowshoe rabbits, *Lepus americanus,* and shrews, *Sorex* sp.

The greater diversity of food material (eight species) which appeared in the dietary of 1948 was probably caused by the colder weather. Small mammals usually are not as active during extreme cold periods and are therefore more difficult to find. Larger predators must travel farther in order to find prey. The chances are increased in this way of encountering a greater variety of prey, depending of course, on relative population levels.

Investigations by Craighead (1950) have illustrated the function of prey population in diet item selection by raptorial birds. The present analysis of marten food habits partly demonstrates this function of predator-prey population relationships although posi-

Table 2. MARTEN FOOD HABITS BY EXAMINATION OF CARCASSES.

Food Item	Frequency of occurrence in per cent	
	1947	1948
	127 specimens	123 specimens
red backed vole	39.0	40.0
deer mouse	0	16.4
shrew	7.5	5.5
red squirrel	0	12.7
snowshoe rabbit	0	10.9
bird (spp. unknown)	46.0	7.3
grouse	7.5	5.5
porcupine	0.7	0.8
grass	0.8	0
bait	1.6	1.6
unidentified material	1.1	0
snail	0	1.6

tive correlations are not clear. Grouse and hares for example were more numerous in 1948 than in 1947 yet an increase in the use of only hares was noted while predation on grouse actually was reduced. This can be interpreted in terms of prey vulnerability which also is a factor governing food item selection. Grouse, for example, are capable of eluding terrestrial predators more easily than are hares. More squirrels appeared in the 1948 diet than in that of 1947 because of the colder winter which induced the squirrels to remain in their sub-snow cone caches where marten could find them. Increased predation on squirrels occurred despite the greater abundance of mice. The colder weather caused mice to remain below snow surface where they were proportionally less vulnerable than either squirrels or hares.

Food-item selection appears to be governed by a number of variable factors. The most obvious of these are prey-predator population ratios, prey habits (vulnerability) and weather influences. These factors have the effect of shifting the pressure of predation from one species or group of species to another. A predator population, such as the marten is not entirely dependent of any one food-item but in an unexploited population probably is limited by the availability and vulnerability of all forms of prey.

Analysis of scats

Cowan found that mice were more important in marten diets when hares were scarce in southern British Columbia. He shows that marten were devoting their foraging efforts to the hunting of mice rather than hares. An examination of 61 scats found at a den in the Fort Nelson region revealed at least the local importance of hares in the marten diet. The scats were definitely related to a period of time by the position in which they were found in the snow. These specimens could be dated as having been deposited after the first snow fall. They provide a good record of food-item selection for a period of a month between November 15 and December 15 when they were collected.

Local conditions in this case were somewhat different than those found by Cowan. All small mammals were becoming increasingly abundant in the Fort Nelson region. Hares were numerous in the immediate home range of the marten represented by the scats considered here. Tracks of this animal were observed within a half mile radius of this den for a period of one month immediately following the first snow of November 15. Tracks of rabbits also were numerous in the alder-willow-spruce thickets surrounding the den. This marten was eventually trapped near the den in late December. The scat collection yielded an average of two per day. As very few scats are found on marten trails in winter this probably represents nearly 100% of the food material which was consumed by this animal.

All of the scats contained a large quantity of hair. Bone, teeth and claws occurred in 75% of them. Only 19% contained vegetable matter most of which was likely ingested as the stomach contents of prey animals. Most scats contained but one species of prey item but combinations of red squirrel-vole, hare-vole and hare-mouse occurred in 7% of the scats. The remains of hares occurred in 86.5% of the scats collected at the den. Despite an increase of red backed voles in the fall of 1948 they occurred in only 11.5% of this particular collection of scats. When compared to the all-winter stomach analysis of 123 specimens for this same year which shows a 40% frequency of these voles, it appears that the individual marten represented by this scat collection was, for the time period represented, exploiting a local hare population. Moose hair found in one scat was no doubt obtained by robbing trap baits which eventually led to the marten's death.

This analysis of scats shows that marten are quite capable of killing hares. It indicates that individual animals will concentrate on a particular prey species even when other species are more abundant and appear in larger collections to be more frequently taken by a predator population in general.

Trail scats

Very few scats were found on trails in the Fort Nelson studies but these contribute a little to the knowledge of marten food habits. Seven scats revealed a similar selection of prey items as found in the stomach and den-scat analyses. Two additional items, however, which did not appear in the other materials were found. A single scat was composed entirely of the remains of a chipmunk, *Eutamias* sp. This scat was obtained in early fall, and most

likely represents food item selection at a period when the chipmunk was not in hibernation. This rodent is seasonally more important in the marten dietary than is shown in the analysis of material collected in winter. Cowan found chipmunk in 3.5% of the specimens he examined.

Several scats contained fruits of *Viburnum cassinoides* and some plant material which appeared to be debris accidentally ingested. Fruits are a class of food in the marten diet which are not adequately represented in a winter collection of specimens. Cowan shows that berries constitute about 5% of all food eaten by marten during the summer period.

Results of the analysis of scats found along trails agreed favorably with an analysis of material from other sources as well as with Cowan's findings. Rabbits appeared to be somewhat more important at the time of study in the northern British Columbia material (during winter) than in Cowan's samples from southern British Columbia (during summer).

Scats representing summer food habits added two items to the marten dietary list which did not appear in winter collections of materials. Both of these are obviously only seasonally available but perhaps important in season. Cowan found red and flying squirrels in both summer and winter diets but the ground squirrels and chipmunks occurred only in materials found in summer. He also noted berries to be used in summer but not in winter. His work gives a good description of the summer food habits of marten, whereas the present study provides an appraisal of winter food habits. These food habits studies agree that small mammals are an important food base for martens during all seasons of the year.

Summary

Marten are sufficiently versatile in their hunting habits to glean a living despite extreme changes in prey population levels. Although mouse populations changed as much as 300% in one year no difference in the frequency of occurrence of these animals was noted in collections of comparable size from one year to another. The predator-prey population information derived in this study makes it appear that food availability was not limiting marten populations at the time of the study.

Cowan has noted a lack of correlation between marten populations and cyclic hare and grouse populations which reportedly fluctuate with a ten year periodicity. From the present study it appears that small rodents are not a factor controlling marten populations either. In fact, the proportion of marten specimens containing vole remains was the same during low vole populations as during high vole populations. This food habits study reveals the ability of the marten to adapt to drastic changes in prey population levels by shifting to more available or more vulnerable species.

The important food base complex during the most critical period of the year consists of red backed voles, deer mice, red squirrels and snowshoe hares. These animals vary in abundance but low levels did not appear to limit marten populations in northern British Columbia during 1947-1949.

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OBSERVATIONS ON A SECOND COLONY OF THE LAND SNAIL *CEPAEA NEMORALIS* (L.) AT LONDON, ONTARIO WITH A CONSIDERATION OF THE BANDING PATTERNS IN THE TWO COLONIES [1]

W. W. JUDD

University of Western Ontario, London, Ontario.

THE WRITER (Judd, 1953) reported upon a colony of the snail, *Cepaea nemoralis*, found on the outskirts of London in Westminster Twp. in April, 1952. In the fall of the same year a second well-established colony was found within the city limits of London, three miles to the north-east of the first colony, in the "Morgan Gardens", 986 Wellington Street, London. These gardens, set in a residential section of London, comprise an area of about one-half a city block. They are open to the public during the growing season and display a considerable variety of trees, hedges and herbaceous plants. Throughout the warm months of the year live *Cepaea nemoralis* are commonly seen on the soil of the flower beds, resting on the leaves of plants and climbing over the trunks and foliage of the trees; and the old, empty shells are frequently turned up with the soil. Mr. A. J. Morgan, proprietor of the gardens, reports that the snails have been present in the gardens since at least as early as 1920. In the course of stocking the gardens plants had been imported from England, Holland, Belgium and other European countries, and the likelihood is that *C. nemoralis* was imported with these plants.

On September 5, 1952 one thousand living snails were collected in the gardens. The weather was cool and at first only a few snails could be found in the open. It was then discovered that they were concentrated particularly about plants of the day lily, *Hemerocallis* sp., the leaves of which were still green but drooping against the ground. A few snails were clinging to the under sides of the leaves but the majority were in a quiescent state, clustered between the bases of the leaves at ground level. In each snail the mouth of the shell was closed by a membranous epiphragm. The clustered snails were invisible if the plant was examined casually, even though two or three dozen snails might be present at the base of the plant, and it was necessary to part the leaves close to the ground in order to extricate the closely crowded specimens. A few live snails were found on plants of peony, iris and phlox.

The banding patterns of the one thousand snails were studied and the frequencies of the variations in pattern were recorded. The same band formula as used by Judd (1953) was used as the frequencies were recorded. The five bands on the shell are numbered from the top down: 1, 2, 3, 4, 5, and a pattern of five separate bands is represented by the formula 12345. Where a band is missing it is replaced by "0", e.g. where bands 1 and 2 are missing the formula is 00345. If a band is indistinct it is represented by a small figure below the line, e.g. where band 4 is indistinct the formula is $123_{4}5$. Where bands are fused the criterion for fusion is that proposed by Cain and Sheppard (1950) who recorded fusion as occurring when bands are "fused at and after a line drawn across the body-whorl from the umbilicus at right angles to the lower lip of the mouth". Where complete fusion occurs the bands involved are enclosed in round brackets, e.g. where bands 3 and 4 are completely fused the formula is 123(45). Where incomplete fusion occurs the bands are enclosed in square brackets, e.g. 123[45]. The frequencies of the different patterns occurring on the shells of the snails from the Morgan Gardens (colony B) are presented in Table 1 together with those found in the colony from Westminster Twp. (colony A) as previously reported by Judd (1953).

The bandless pattern: 00000 did not occur in the sample from either of the two colonies. Stelfox (1918) showed that this pattern is dominant over the banded condition. It has not turned up in the colonies at London but would probably soon become prevalent when once established. In both colonies the predominant patterns are those in which all bands are present, whether all separate, 12345, or fused in various combinations, e.g. 123(45), (12)3(45), (123)(45). Lack of bands 1 and 2, e.g. in patterns 003(45) and

1) Received for publication December 6, 1954.

Table 1 — FREQUENCIES OF BANDING PATTERNS OCCURRING IN 1000 SHELLS FROM COLONY A AND COLONY B.

Pattern	Frequency		Pattern	Frequency	
	Colony A	Colony B		Colony A	Colony B
12345	353	104	$123_{4}5$	1	0
123[45]	429	20	10345	1	4
123(45)	102	183	10045	0	1
1(23)(45)	1	3	12045	7	0
1(23)[45]	1	0	(12)0(45)	0	4
1[23]45	2	0	[12]045	2	0
1(23)45	0	2	120[45]	4	0
1[2345]	1	0	$_{1}2045$	1	0
12(345)	1	4	$_{1}20[45]$	2	0
(12)345	0	10	12305	1	0
(12)3[45]	1	0	$1_{2}045$	0	1
(12)3(45)	0	266	02345	8	0
[12]3(45)	19	31	0(23)45	1	0
[12](345)	0	2	023[45]	2	0
[12]345	0	4	0(23)(45)	0	1
[12]3[45]	0	10	023(45)	5	0
[123][45]	1	2	02(345)	0	3
[123](45)	0	24	020[45]	2	0
(123)(45)	0	59	020(45)	1	0
[12345]	15	2	003[45]	1	10
(12345)	0	1	003(45)	0	139
$_{1}2345$	13	0	00345	0	50
$_{1}23[45]$	19	0	$00_{3}(45)$	0	1
$_{1}23(45)$	3	0	00300	0	49
$1_{2}345$	0	5	000(45)	0	2
$1_{2}3(45)$	0	3	TOTALS	1000	1000

003[45] is more prevalent in colony B than in colony A, and the single-banded pattern 00300 occurs only in colony B. Cain and Sheppard (1950) show that the more uniform the background on which the snails live the higher the number of unbanded shells. They found the greatest concentration of unbanded shells, almost 100 percent, in beech forests where the ground was uniformly covered with brown leaves, and the greatest concentration of banded shells where the greatest diversity of vegetation was present, as about hedgerows. In terrain of an intermediate nature with an overgrowth of trees and green herbage below, the banded and unbanded conditions were both well represented. The two colonies at London are in terrain of a diversified nature with trees and shrubs growing above lawns and flower beds, and the banded patterns predominate. The unbanded condition, 00000, has however, not appeared and its likely proportion in the colonies, if it occurred, cannot be assessed.

The ground-colour of the shells also varies in *Cepaea nemoralis*. The colour varieties have been given names (Pilsbry, 1939): e.g. yellow - *libellula*, pink - *rubella* and pale brown or fawn - *petiveria*. Cain and Sheppard (1950) studied the relation of ground-colour of shells to the nature of the background and concluded that the proportion of yellow shells increases as the amount of green vegetation at ground level increases. In the colonies at London the snails lived on grassy lawns and green herbage and all shells studied were of the yellow variety.

The problem of the occurrence of variations in populations of *Cepaea nemoralis* has been discussed by various authors. Diver (1940) considers that selective forces and adaptive values have played little direct part

in production of variations in colonies, the most probable general cause of variation being random differentiation in small, isolated populations, as by "genetic drift" suggested by Wright (1940). Cain and Sheppard (1950) and Sheppard (1951, 1952), however, demonstrate that the different ground-colours have definite selective values, related to the environment, and that the ratio of genotypes in a breeding population is determined by two kinds of selection, one physiological and the other due to selective elimination by predators. An important snail predator in Europe is the song thrush, *Turdus ericetorum*. Its effect as an agent of natural selection has been studied by Sheppard (1951). This bird gathers the snails and cracks them open on stones, known as "thrush anvils", and devours the contents of the shells. The percentage of yellow snails killed decreases from the middle of April to the middle of May while the colour of the vegetation becomes greener during this period. Thus the selective value of the yellow phenotype varies with changes in the background colour, being at a disadvantage in the middle of April when the background is relatively brown, becoming neutral later in April and early May and advantageous by the middle of May when the background is green. In this way predation by the thrush affects the number of yellow shells in the breeding population. Cain and Sheppard (1950) list also rats, grey squirrels, small field rodents and rabbits as predators of the snails. These various animals occur in the vicinity of London and could act as selective agents of the colonies of *Cepaea nemoralis*. Sheppard (1952) does not, however, preclude the possibility that small inbreeding communities might diverge to some extent as a result of isolation by distance. He studied two colonies, one mile apart, which showed differences in shell colour. In the two colonies at London, separated by three miles, there was no difference in the ground-colour of the shells, which were all yellow, but the proportion of shells lacking one or more bands was considerably greater in colony B than in colony A.

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TWO RED ALGAE NEW TO NOVA SCOTIA [1]

DAVID ERSKINE

University of Toronto, Toronto.

THE BASIS of our knowledge of the marine algae of the Maritimes, as appears from Taylor's bibliography (1937), is the survey of Bell and Macfarlane (1933). All large forms of red algae known in Nova Scotia are recorded, but, as its economic bias made inevitable, the survey is incomplete for small, easily overlooked filamentous forms determinable only by microscopic examination. For instance, there are present several species of the unreported *Acrochaetium*, a genus of minute epiphytes often restricted to a single host.

1) Received for publication January 5, 1955.

The following are definitely determined:

Acrochaetium Alariae (Jónsson) Bornet *(Kylinia Alariae* (Jónsson) Kylin), an epiphyte restricted to the kelp *Alaria,* of cold seas, was found on old blades of *Alaria esculenta* growing on the lower, wave-beaten boulders at Herring Cove, Halifax County, in August 1949 (UC 1,019,879, Erskine). The ragged distal parts of the blade were quite pink with a "fur" of *Acrochaetium.* Originally described from Iceland, this species was known from Massachusetts to Maine in North America.

In possessing a star-shaped chromatophore in each cell, it falls within the genus *Kylinia* Rosenv. as circumscribed by Papenfuss (1947), and, in its single large basal attachment cell, belongs to *Kylinia* as circumscribed by Kylin (1944). However, as the two circumscriptions by no means coincide, it seems wiser at present to retain the genus *Acrochaetium* in a broad sense.

Trailliella intricata (J. Agardh) Batters forms dense tufts about an inch high, and is characterized by the small refractive gland-cell associated wth each cell of the filament. It was found floating in wash at Bayfield beach, Antigonish County, in July 1948, (UC 1,019,880, Erskine) amid plentiful *Ceramium* cf. *diaphanum.* At the time it appeared to be a range-extension from Massachusetts; however, Stephenson and Stephenson (1954) have reported it as an abundant and characteristic epiphyte of *Chondrus* (Irish moss) at Souris, P.E.I., in 1948. These two stations for the Maritimes were both, expectably enough, in the warmer waters of the Gulf of St. Lawrence. In view of the temporary disappearance of this species from the waters of Buzzards Bay, it would be interesting to know whether it shows the same behavior in the Gulf.

In North America this species is a recent arrival, first recorded from Massachusetts in 1928. Its migration northwards on this coast matches that made in Europe, where it reached Britain in 1890. Long a genus of uncertain position, it has been placed by Feldmann and Feldmann (1942) as the sporophyte of *Bonnemaisonia hamifera* Hariot *(Asparagopsis hamifera* (Hariot) Okamura), which has been extending its range simultaneously in a strikingly parallel fashion, arriving, for instance, in the English Channel about 1890 (reported, 1893) and in Masssachusetts in 1927! However, it is still known on this coast only from the Cape Cod region.

The specimens upon which these reports are based are preserved in liquid at the Department of Botany, University of California, Berkeley, U.S.A.

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THE REARING OF A GREY SEAL IN CAPTIVITY [1]

BETTY JUNE MYERS

Institute of Parasitology, McGill University, Macdonald College, P.Q.

IN FEBRUARY, 1954, Mr. Paul L. J. Montreuil, Director of the Marine Biological Station, Grindstone, Magdalen Islands, P.Q. (in the Gulf of the St. Lawrence), captured two grey seal pups *(Halichoerus grypus* (Fabric.)). These pups were shipped by air to the Institute of Parasitology, Macdonald College, Ste. Anne de Bellevue, and were received during the last week of February.

1) Received for publication February 6, 1955.

One died shortly after their arrival but the other is thriving. So far as the author is aware this is the first time that a seal of this species has been reared in captivity in North America. Until recently, the grey seal was considered a rare animal along our coasts although common in European waters. Recent investigations by Dr. H. D. Fisher, Atlantic Biological Station, St. Andrews, N.B., however, indicate that the North American population of this seal is now equal to if not greater than that in Europe.

Both pups were in birth pelage upon their arrival at the Institute and were estimated to be about two months old. They were housed in a basement room where the temperature was approximately the same as that outside (average 32°F.). Snow was shovelled into the pen daily to give the animals protection from the concrete floor. A shallow porcelain-lined sink was filled daily with fresh tap-water and was kept in the wire-enclosed pen.

As the seals were not weaned upon arrival several methods of feeding them were tried. The least ineffective was to pour evaporated milk, undiluted, and fortified with cod-liver oil, on the back of each seal, and then to induce them to suck the milk from the coat. Although some milk was taken by each seal in this manner it was insufficient to provide adequate nourishment. In addition, as the seals were almost ready to moult there was a danger of their swallowing fur. The usual bottle techniques were unsuccessful as was pan-feeding — the latter because the seal does not have a lapping tongue. After a period of two weeks the smaller and weaker of the two seals died.

The remaining seal was introduced to a diet of small smelt by inducing it to bite the fish. Once a taste for the fish had been acquired the feeding problem was solved. The amount of smelt fed and the number of feedings in a day depended upon the seal's appetite. A cod-liver oil supplement was added to the smelt diet. During this period the seal was a very pampered animal and the smelt were handed to it individually. After a short time, however, it was able to feed itself from a pan.

Early in April the seal began to shed its coat profusely and also suffered from loss of appetite. Sores began to appear on the flippers, about the mouth, and the mucosal linings of the nose and mouth. The eyes became pale and there was a discharge of matter from them. At first this condition was thought to be related to the spring rise in temperature and the poor ventilation in the room. Accordingly, the seal was removed to the outdoors where it was given a spacious enclosure with a concrete "swimming pool" (the latter was about five feet wide by twenty-five feet long by a depth varying from about three to five feet). A continuous flow of fresh water was maintained in the pool and during the spring the water in the pool was changed completely twice a week. With the approach of summer and higher temperatures the water was changed more often — almost daily in any heat wave. A runway was constructed from the pool to the ground surrounding it so that the seal had liberty of movement.

Despite its new surroundings, the condition of the seal continued to deteriorate. It was then thought that the loss of appetite and condition might be associated with a vitamin deficiency — something akin to Chastek paralysis in foxes due to a diet of whole fish. Accordingly large doses of thiamine [2] and "Beminal" [3] tablets were given to the seal. After two periods of dosing, the seal's appetite improved and it has continued to eat all that it is given. The vitamin supplements have been continued from the time of their initiation.

The fur lost posterior to the shoulders has not returned and while, anterior to the shoulders, its pelt is normal, posteriorly the animal appears to have only the short undergrowth.

Herring were gradually added in increasing numbers to the seal's diet and these fish have been the sole diet since the beginning of July. It takes about ten pounds of herring at its single daily meal.

When the seal arrived at the Institute it weighed about 25 lbs. and was about 3 ft. long. Today it weighs nearly 150 lbs. and is nearly 5 ft. long.

The seal is fairly tame and liked the constant stream of visitors — particularly children — which it had all summer and fall. When first placed out-of-doors it seemed to spend more time out of its pool than in it;

2) 4 5-mg. tablets daily Thiamine hydrochloride.
3) Four tablets daily "Beminal with C Fortis" (Ayerst McKenna and Harrison). Each tablet contains: Thiamine 2.5 mg., Riboflavin 12.5 mg., Niacinamide 100 mg., Calcium d-panthothenate 10 mg., ascorbic acid 100 mg.

the reverse was the case during the summer months and it has continued to prefer to be in the water. It will, however, climb out of the pool when it sees its meal arriving and will also "stand up" against the fence at the edge of its enclosure when visitors start to leave. If called by its name — Buster — it will sometimes cross the enclosure to where a person is standing.

The animal has almost outgrown its present accommodation and even although it might be possible to keep it out-of-doors during the winter months, by spring it would be too large to either retain or ship elsewhere. (A fully grown grey seal may weigh a 1,000 pounds.) Accordingly, arrangements are being made to ship it to a zoological garden where it can be adequately cared for. [4]

4) Since this manuscript was prepared the seal has been shipped to the Bronx Zoo, New York Zoological Society, New York.

PLANT COLLECTIONS FROM MATTHEWS AND MUSKOX LAKES, MACKENZIE DISTRICT, N.W.T. [1, 2]

W. J. CODY [3] *and* J. G. CHILLCOTT [4]

DURING the summer of 1953, the junior author, while taking part in the Northern Insect Survey, a co-operative project of the Entomology Division of the Canada Department of Agriculture, and the Canada Defence Research Board, visited Matthews and Muskox lakes in southeastern Mackenzie District. He collected a representative set of the plants of each area in addition to the insect fauna.

Since little is known of the flora of southeastern Mackenzie District, the present paper has been prepared. The descriptions of the areas and the habitat notes are those of the junior author; the determinations of the specimens, notes on distribution of the various species, and the history of previous collecting in the region are the work of the senior author.

Matthews Lake

Matthews Lake is located at 64°05'N, 111° 15'W, between Courageous and MacKay lakes, about one hundred and fifty miles northeast of Yellowknife, N.W.T. The small mining settlement where camp was set up from June 11 to July 8 was on the east shore.

The geology of the area is of particular interest. A geologic fault runs the length of Matthews Lake. Basic volcanic granite is found on the west side of the lake, and slaty sedimentary rock with some intrusions of granite and acid volcanic rock is prevalent on the east. Vertical shear lines in the slate run almost due north and south.

The striking geologic difference between the two sides of the lake is reflected in the vegetation. Several species such as *Juniperus communis, Anemone parviflora, Rubus acaulis, Cassiope tetragona* and *Dryas integrifolia* were found only on the western side. Their restricted occurrence may be explained in part by the extra shelter provided by the high hills which rise up to eighty feet above lake level, and by the heavier spruce cover. *Dryas* and *Cassiope* are, however, typical exposed tundra plants, and their presence here cannot be explained by the shelter provided by hills and trees.

Matthews Lake is at the northeastern limit of trees in this area. No spruce trees were seen or are reported from farther north. On the west side of the lake, black spruce is fairly common in sheltered valleys, and sometimes attains a height of twenty feet. However, most of the trees in rocky exposed areas are severely twisted and stunted, and have well-developed branches only on the lower two feet of the trunk. Even in wet valleys, there is considerable dwarfing. Here the trees are well spaced, and numerous dead stumps, some of them much larger than the living trees, are scattered throughout the stands.

On the east side of Matthews Lake, the spruce trees are little more than shrubs, rarely over two feet high, growing in compact clumps along the edges of lakes and ponds. These are apparently mature trees,

1) Received for publication June 10, 1955.
2) Contribution No. 1465 from the Botany and Plant Pathology Division and No. 3329 from the Entomology Division, Science Service, Canada Department of Agriculture, Ottawa, Ontario.
3) Assistant Botanist.
4) Assistant Entomologist.

with dead spruce of similar size among them. Some of these dwarfed spruce had a few cones on the branches.

Heavy willow and birch thickets, with the occasional alder tree among them are present along drainage areas. These grow as high as ten feet on the west shore, but rarely over six feet on the east shore. In these thickets, *Ledum, Lycopodium* and *Polygonum viviparum* form a thick undergrowth.

Another outstanding feature of the area is the occurrence of gravel eskers, rising to thirty feet above ground level and generally running northwest to southeast. One long esker, about five miles to the east, had been levelled off to form a landing strip for the mining camp, but several portions of it still remain undisturbed. Here *Arctostaphylos* forms large mats, with large open areas sparsely populated with *Oxytropis viscida* var. *hudsonica* and *Potentilla.* On the slopes, *Betula glandulosa* grows in open thickets.

The region is fairly free of glacially transported rock. There are only scattered boulders and no moraine fields. The soil is gravelly and permafrost is on the average at about 6 inches depth. The marshland is hummocky, with niggerheads about a foot apart. There is little sorting of particles on the well-drained uplands, but in a few partially drained areas, frost action has opened crevices about two feet deep, blocking off large irregular polygons of heath tundra. Frequently the small hummocks are formed in a large ring ten to fifteen feet across with a flat gravelly centre. In some of the drier marshy areas frost action has brought the finer particles together to form little pockets of fine rich black soil about eight inches in diameter extending down to permafrost level.

When work was begun in early June, snowdrifts were present only in sheltered areas. The ice on the lake was still solid and six feet thick in places, but it had already lifted, and wide crevices were found along the shore.

Arctostaphylos was already in bloom on June 11. The larger bushes of *Salix richardsonii* and S. *planifolia,* and *Oxytropis viscida* var. *hudsonica, Loiseleuria procumbens* and *Rhododendron lapponicum* were found in bloom within the week.

A brief visit was made in mid-August. The area was very dry. Even in localities that were marshy in the spring the water level was several inches below the surface. *Rubus chamaemorus* and most of the sedges and grasses were already in full fruit; foliage was yellowed, or bright red in *Arctostaphylos.*

Muskox Lake

Muskox Lake is a large lake situated at approximately 64°38'N, 108°15'W, some 100 miles northeast of Matthews Lake. It is drained by Back River. The area in which most of the collecting was done is about four miles north of the east end of the lake and about four miles northwest of the junction of Back and Contwoyto rivers, on the shores of a small unnamed lake (64° 45'N, 108°10'W). A camp established a number of years ago by a white trapper, M. Murphy, was the base of operations from July 9 to August 14.

This area is about 75 miles beyond the tree-line, and there is no sign of even isolated spruce in the vicinity. In the valleys, however, birch and willows grow six feet high in dense thickets along the streams, and there is sufficient brush in three valleys near the camp to supply Mr. Murphy with fuel the year round, without the need of seriously depleting the stands. Permafrost during the midsummer period was, on the average, 6 to 8 inches below the surface.

Unlike Matthews Lake, the geology of the region is more typical of the eastern Arctic. Large transported boulders overlying a gravelly soil occur over the entire area, and boulder fields with very little vegetation are found on the far side of Back River. Around the camp, the upland areas are strewn with many rocks, but in the lowland or marshy areas the rocks are scarcer and well scattered over the landscape.

There are few outcrops of the underlying rock. To the east about five miles runs a long line of hills of sedimentary rock. Here the valleys are heavily rock-strewn. A mile to the west and extending about a mile beyond is a small outcrop of similar type. In the same region are several outcrops of rock of high iron content and mounds of rust-cemented soil.

The striking localization of certain plants observed at Matthews Lake is not seen in the Muskox Lake region. The species are generally distributed throughout the area and, with the one exception of *Viola palustris,* may be found in almost any spot where the habitat is suitable for their growth.

The effect of the long-established camp on the immediate area is striking. The fertilizing effect of the dogyards has resulted in especially lush vegetation, where grasses and *Epilobium angustifolium* grow waist high.

There was little sign of frost action at Muskox Lake. None of the polygons and few of the muck-pockets so common at Matthews Lake were present. The niggerheads were also less striking, and rarely arranged so as to form rings with the flat centre such as those observed at the tree-line camp.

On arrival on July 8th, it was noticed that the vegetation was less than a week behind that at Matthews Lake, although in early June the break-up had been at least two weeks behind that at Matthews Lake.

Previous Collecting in the Area

The area under consideration is of particular phytogeographic and floristic interest since a number of southern species find their northeastern limit, and some northern species find their southern limit in eastern Mackenzie District here. Few specimens have previously been collected here, and of these many bear no exact locality data. The following are among the most important earlier collections.

There is an appendix to Back's Narrative (1836) which lists plants collected by Richard King during the expedition and determined by Hooker. Localities are given from Ft. William, Ontario, to the Arctic coast, but few, if any, of the collections came from our area.

In 1900, J.W. Tyrrell (1902) was in charge of a party that traversed the country from Great Slave Lake eastward through Artillery Lake, Sifton Lake and Thelon River to Chesterfield Inlet. A list of plants collected during the expedition was prepared by John Macoun and published as appendix No. 5 to the separate of Tyrrell's report. This list has not been seen.

In 1924-25, a party under John Hornby crossed the territory between Ft. Reliance, at the east end of Great Slave Lake, and Chesterfield, by way of the Thelon River. A list of plants collected between Sifton Lake and Aberdeen Lake is given by Critchell-Bullock (1930-31), but no localities are cited.

East of the Matthews and Muskox lakes region, in the Thelon Game Sanctuary and in central Keewatin District, C.H.D. Clarke (1940), J.B. Tyrrell (1896), J.W. Tyrrell (1897), and particularly A.E. Porsild have made collections of plants. Porsild has made extensive collections around Great Bear Lake. H.M. Raup (1936) has studied the vegetation of the Athabaska-Great Slave Lake area, and has brought together the work on that region. More recently, W.J. Cody has also made some collections in this latter area, as well as at Indin Lake (64° 17'N, 115°12'W), to the west.

Floristic Relationships

The present collections are of interest since they were made at, and just beyond, the northern limit of trees. A total of 84 species of phanerogamic plants are recorded from the two localities: 51 from Matthews Lake, and 62 from Muskox Lake.

A study of the known ranges of these species shows that nearly half are apparently at or near their limit of distribution, either northward or southward, and that this distribution is apparently limited by factors governing tree-line.

Only one species, *Lychnis ostenfeldii*, is endemic to the area. *Potentilla hookeriana* is a western species that is at its eastern limit range here. *Artemisia tilesii* is also a western species that finds its eastern limit of distribution at James Bay.

The following nineteen species apparently find their northeastern limit of range in eastern Mackenzie District in this region: *Equisetum sylvaticum, E. fluviatile, Picea mariana, Juniperus communis* var. *depressa, Festuca saximontana, Calamagrostis canadensis, Scirpus caespitosus* var. *callosus, Salix planifolia, S. arbusculoides, Parnassia kotzebuei, Rubus acaulis, Epilobium angustifolium, Kalmia polifolia, Arctostaphylos uva-ursi, Vaccinium microcarpum, Pinguicula villosa, Galium trifidum* and *Petasites sagittatus*. Also included here is *Viola palustris*, an isolated record of a species otherwise unknown from north of Lake Athabaska.

Eighteen species apparently find their southern limit in eastern Mackenzie District in this region. These are *Poa arctica, Hierochloë alpina, Carex bigelowii, C. rotundata, C. membranacea, Luzula wahlenbergii, L. confusa, Salix richardsonii, Draba ? nivalis, Oxytropis viscida* var. *hudsonica, O. maydelliana, O. arctica, Cassiope tetragona, pedicularis lapponica, P. flammea, Antennaria angustata, A. isolepis* and *A. pygmaea*.

The remainder of the flora consists of species of wide range such as *Equisetum arven-*

se, Poa glauca and *Polygonum viviparum,* northern species such as *Lycopodium selago, Dryas integrifolia, Epilobium latifolium* and *Rhododendron lapponicum* that range through the area at least as far south as Great Slave Lake, and southern species such as *Anemone parviflora* and *Pedicularis labradorica* that extend northward some distance beyond it.

Lists of Plants Collected

The numbers throughout the list are the collection numbers of the junior author. The specimens have been preserved in the Herbarium of the Botany and Plant Pathology Division, Canada Department of Agriculture, Ottawa, Ont. (DAO).

HEPATICAE

MARCHANTIA POLYMORPHA L. — *MUSKOX LAKE:* moist slope below dogyard, *181;* just a small patch; only place seen.

POLYPODIACEAE

DRYOPTERIS FRAGRANS (L.) Schott — *MATTHEWS LAKE:* crevices of rock outcrop ½ mile north of camp, *52. MUSKOX LAKE:* in cracks of rock cliff, 1½ miles southwest of camp, *133;* of rare occurrence.

EQUISETACEAE

EQUISETUM ARVENSE L. — *MATTHEWS LAKE:* wet marsh between hummocks, *64B. EQUISETUM SYLVATICUM* L. — *MUSKOX LAKE:* wet willow-birch thickets along stream, 1 mile south of camp, *129;* very common among willows. This collection helps to complete the picture of the northeastern range of the species between Great Bear Lake and the eastern end of Great Slave Lake.

EQUISETUM FLUVIATILE L. — *MUSKOX LAKE:* in deep water in slow moving stream ½ mile east of camp, *128;* only place seen. This collection helps to complete the picture of the northeastern limit of the species, between Great Bear Lake and the eastern end of Great Slave Lake. The species has apparently not previously been reported from beyond the limit of trees.

LYCOPODIACEAE

LYCOPODIUM SELAGO L. — *MATTHEWS LAKE:* among high willows in valley due west of camp, *1. MUSKOX LAKE:* scattered on south-facing slope at base of rock cliff 1½ miles southwest of camp, *139;* very rare in this area.

LYCOPODIUM ANNOTINUM L. — *MATTHEWS LAKE:* among willows and birches on wet soil near pool, *7;* common in *Salix* and *Betula* thickets. *MUSKOX LAKE:* in wet willow-birch thickets 1 mile south of camp, *127;* wet soil on slope in rocky valley, *136;* uncommon except in willow thickets. These collections help complete the known distribution of the species between Great Bear Lake and the eastern end of Great Slave Lake.

PINACEAE

PICEA MARIANA (Mill.) BSP. — *MATTHEWS LAKE:* granite slopes on west side of the lake growing to 10 ft. in height; on the east side of the lake never attaining more than 3 ft., and then only along streambanks or shores of small lakes. These latter trees were of great age, one butt measuring 4 ft. in circumference.

JUNIPERUS COMMUNIS L. var. *DEPRESSA* Pursh — *MATTHEWS LAKE:* poor soil on south side of igneous rock hill 1 mile west of camp, *18;* common on south side of hill and among willows in valley; found only on the west side of the lake. Apparently the most northeasterly collection in eastern Mackenzie District, it is a range extension of some 100 miles from the nearest known sites to the south at the eastern end of Great Slave Lake.

GRAMINEAE

FESTUCA SAXIMONTANA Rydb. — *MUSKOX LAKE:* hummocks on upland slope, *162.* This collection is from near the northern limit of range of the species in eastern Mackenzie District. The nearest site known to the authors is Ft. Reliance at the eastern end of Great Slave Lake (Raup 1936).

POA PRATENSIS L. — *MUSKOX LAKE:* quite common on rich uplands around camp, *145B.*

POA ARCTICA R. Br. — *MUSKOX LAKE:* dry gravelly patches on uplands, *175A.*

POA GLAUCA Vahl — *MUSKOX LAKE:* in hollow of boulder on top of hill, *157;* dry gravelly patches on uplands, *175B.*

TRISETUM SPICATUM (L.) Richt.—*MUSKOX LAKE:* dry gravelly patches in uplands, *160.* The specimens are much smaller than the others seen from southern Mackenzie District or even the Canadian Eastern Arctic, the culms at most only 9 cm in height, the spikes but 15mm in length and 3 to 5 mm in diameter.

CALAMAGROSTIS CANADENSIS (Michx.) Nutt. — *MATTHEWS LAKE:* dry heath slopes and meadows, *67, 68. MUSKOX LAKE:* quite common on rich uplands around camp, *145A, 147.*

HIEROCHLOE ALPINA (Sw.) Roem. & Schult. — *MUSKOX LAKE:* gravelly patches on dry uplands, *161.* This collection helps complete our knowledge of the southern limit in eastern Mackenzie District between the Thelon Game Sanctuary and Great Bear Lake.

CYPERACEAE

ERIOPHORUM VAGINATUM L. — *MATTHEWS LAKE:* wet hummocky marsh, 3 miles southeast of camp, *9. MUSKOX LAKE:* fairly common on hummocks in upland meadow marsh, *159.*

ERIOPHORUM ANGUSTIFOLIUM Honckeney — *MATTHEWS LAKE:* between hummocks in low marsh areas, *60.*

SCIRPUS CAESPITOSUS L. var. *CALLOSUS* Bigel. — *MATTHEWS LAKE:* as solid clumps on dryish hummocks, *66A.* This species was noted in Flora Boreali-Americana as occurring "Throughout Canada to near the shores of the Arctic Sea", but Raup (1947) reported that he had seen no specimens from north of Great Slave Lake. This collection, then, is an extension of range of some 100 miles north from Raup's collection sites at the east end of Great Slave Lake. The specimen was heavily infected with the smut *Cintractia scirpi.*

CAREX SCIRPOIDEA Michx.—*MATTHEWS LAKE:* on lichen hummocks in marsh land, *65.*

CAREX GLACIALIS Mack. — *MUSKOX LAKE:* fairly common on dry upland, *156.*

CAREX BIGELOWII Torr. — *MATTHEWS LAKE:* moist marshy soil, *59. MUSKOX LAKE:* wet hollows in hummocky marsh, *148, 169.* These collections are from near the southwestern limit of range of the species in eastern Mackenzie District.

CAREX ROTUNDATA Wahl.—*MATTHEWS LAKE:* moist soil between hummocks in marsh, *58. MUSKOX LAKE:* fairly common in thickets along streams, wet hollows in hummocky marshes, and hummocky upland meadows, *149, 150, 158, 165, 179.* This species has apparently not been reported for Mackenzie District, although recorded for both Keewatin District and Alaska; possibly some specimens recorded under *C. membranacea* may be referred here.

CAREX MEMBRANACEA Hook. — *MATTHEWS LAKE:* wet marsh land, *63, 64A.*

JUNCACEAE

JUNCUS CASTANEUS J.E. Sm. — *MUSKOX LAKE:* hollows in hummocky marsh, *151A.*

LUZULA WAHLENBERGII Rupr.—*MUSKOX LAKE:* hollows in hummocky marsh, *151B.* This species has apparently not previously been recorded between central Keewatin District and the Mackenzie Mountains.

LUZULA CONFUSA Lindb. — *MUSKOX LAKE:* hollows in hummocky marsh, *152.* Artillery Lake, to the east of Great Slave Lake, appears to be the southernmost limit of distribution of the species in this region. It has apparently not previously been recorded in the area between there and Great Bear Lake.

LILIACEAE

TOFIELDIA PUSILLA (Michx.) Pers. — *MATTHEWS LAKE:* in rock crevice on east side of granitic hill, 1 mile west of camp, rare, *29;* moist marsh, *56. MUSKOX LAKE:* fairly common among willows on moist slope, *112.*

SALICACEAE

SALIX ARCTOPHILA Cock. — *MATTHEWS LAKE:* low prostrate plant on dryish uplands, 1 mile east of camp, *34;* marshy areas near shore of lake, 1 mile west of camp, *31. MUSKOX LAKE:* in wet moss hummocks, *176.*

SALIX GLAUCA L. — *MATTHEWS LAKE:* dry uplands, 1 mile east of camp, *32. MUSKOX LAKE:* a common willow in the area both on dry rocky slopes and in moist ground along streams, *134, 166, 167, 168, 170, 171, 174, 177, 178.* These collections are apparently from near the northern limit of range of the species in eastern Mackenzie District.

SALIX RICHARDSONII Hook. — *MATTHEWS LAKE:* hummocky marshland, *10, 11;* in valleys on south and east sides of granitic hill, 1 mile west of camp, *19.* These collections are from near the southern limit of the species in eastern Mackenzie District.

SALIX PLANIFOLIA Pursh — *MATTHEWS LAKE:* wet marshy tundra, *4, 14;* dry uplands in slate country, *35, 36, 37, 38, 39. MUSKOX LAKE:* wet land along stream, *169.* The map given by Raup (1947) shows stations in the Thelon Game Sanctuary, at Great Slave Lake and at Great Bear Lake. These collections help complete the northern limit of range in eastern Mackenzie District.

SALIX ARBUSCULOIDES Anders. — *MATTHEWS LAKE:* dry gravelly upland patches on tundra slope, *12.* The map of the distribution in Raup (1947) shows stations in the Thelon Game Sanctuary, and south of a line between the eastern end of Great Slave Lake and Keith Arm, Great Bear Lake. This

collection helps complete the northern limit of range in eastern Mackenzie District.

BETULACEAE

BETULA GLANDULOSA Michx. — *MUSKOX LAKE:* along stream, *172;* generally common; 2 to 4 feet in height in wet places, prostrate on uplands.

ALNUS CRISPA (Ait.) Pursh—*MATTHEWS LAKE:* shrubs 4 to 6 feet high on moist hill slopes on granitic soil, *41;* confined to west side of bay, but fairly common there. This station is between previously known sites at the east end of Great Slave Lake and Bathurst Inlet (Cody 1954).

POLYGONACEAE

POLYGONUM VIVIPARUM L. — *MUSKOX LAKE:* fairly common along bank of stream and among willows, *130.*

CARYOPHYLLACEAE

STELLARIA LAETA Rich. — *MATTHEWS LAKE:* as undergrowth in willow swamp areas, *28;* occasional only. The type of this species was collected on the barren grounds northeast of Great Bear Lake by Richardson.

STELLARIA MONANTHA Hulten — *MUSKOX LAKE:* common and widespread in dry sandy soil, 1 mile south of camp, *111;* generally common in moist soil in deep grass around camp, *182.*

ARENARIA RUBELLA (Wahl.) J. E. Sm. — *MUSKOX LAKE:* on high dry hillock, 1 mile east of camp, *122;* very inconspicuous, only 8 small plants seen.

LYCHNIS OSTENFELDII (A.E. Porsild) Boivin — *MUSKOX LAKE:* at mouth of ground squirrel burrow on high sandy hillock, 1 mile north of camp, *126;* previously known only from pre-Cambrian rocks of the east shores of Great Bear Lake.

RANUNCULACEAE

ANEMONE PARVIFLORA Michx. — *MATTHEWS LAKE:* fairly common on slopes of willow valleys around hill 1 mile west of camp, *22;* apparently not previously recorded between the east end of Great Slave Lake, and Great Bear Lake and the Arctic coast to the north.

ANEMONE RICHARDSONII Hook. — *MATTHEWS LAKE:* wet soil and marsh on slopes of granitic hill, 1 mile west of camp, *27;* common in willow — birch marsh and rarer on hill slopes. *MUSKOX LAKE:* common on wet land at edge of stream among willows, *117,* July 17, 1953; base of south-facing rock cleft on edge of moist valley, *137,* July 31, 1953, late flowering, and not usually seen outside of willow thickets. The nearest previously known sites are some 250 miles to the north along the shore of Coronation Gulf, and northwest around Great Bear Lake; south and east of this area known from Lake Athabaska, Churchill, York Factory and several stations in Ungava District, Quebec.

RANUNCULUS LAPPONICUS L. — *MUSKOX LAKE:* infrequent among willows in wet ground at edge of stream, *115.*

CRUCIFERAE

DRABA ? NIVALIS Liljebl. — *MATTHEWS* LAKE: seen only in clumps of *Silene acaulis* on top of esker, *8.* The plants collected on June 18 and hence quite immature, are tentatively assigned to *D. nivalis.* If correct, this collection extends the range some 150 miles south from sites at Bathurst Inlet.

SAXIFRAGACEAE

SAXIFRAGA TRICUSPIDATA Rottb. — *MATTHEWS LAKE:* dry sandy mound on edge of lake, 1 mile west of camp, *79;* common in dry areas. *MUSKOX LAKE:* dry sandy hill 1 mile south of camp, *110;* uncommon but widely distributed.

PARNASSIA KOTZEBUEI Cham. & Schl.— *MUSKOX LAKE:* infrequent in wet soil among willows along stream, *118.* The record helps complete the known eastern limit of range in Mackenzie District between Coronation Gulf and the east end of Great Slave Lake.

ROSACEAE

RUBUS CHAMAEMORUS L. — *MATTHEWS LAKE:* hummocks in willow marsh at stream source, 1 mile west of camp, *46;* heath hummocks in wet marsh in valley, ½ mile east of camp, *15;* fairly common throughout the country. *MUSKOX LAKE:* very common in moist soil, *107.* These collections help fill out the northern range in eastern Mackenzie District between Great Slave Lake, Great Bear Lake and Coppermine.

RUBUS ACAULIS Michx. — *MATTHEWS LAKE:* fairly common in moist willow thickets, 1 mile west of camp, *45. MUSKOX LAKE:* common among willows in wet land near stream, *116.* These collections fill out the northern range in eastern Mackenzie District between Thelon Game Sanctuary and Great Bear Lake.

POTENTILLA HOOKERIANA Lehm. — *MATTHEWS LAKE:* top of high esker, 2 miles north of settlement, *3;* well-drained soil on rock ledge on slopes of granitic hill, 1 mile west of camp, *25, 26;* apparently confined to such habitats. *MUSKOX LAKE:* beside ground squirrel burrow on top of

sandy hill, 1 mile south of camp, *125;* only place seen. These collections are from near the eastern limit of distribution as shown by Hultén (1945). The Muskox Lake specimens are considerably taller than those collected at Matthews Lake. This increased height may be due to fertilization by ground squirrels and the fact that they were collected at a later date.

POTENTILLA PALUSTRIS (L.) Scop. — *MUSKOX LAKE:* among willows along stream edge, *144;* common generally. This collection helps fill in the northern range between the east end of Great Slave Lake and Bathurst Inlet (Cody, 1954).

DRYAS INTEGRIFOLIA Vahl — *MATTHEWS LAKE:* well-drained soil and rock crevices on slopes of hill on west shore of lake, opposite camp, *24;* common on high areas, on west side of lake only. In Mackenzie District this species extends as far south as Great Slave Lake.

LEGUMINOSAE

ASTRAGALUS ALPINUS L. — *MUSKOX LAKE:* common on gravelly mounds in moist hummocky land, *103.*

OXYTROPIS VISCIDA Nutt. var. *HUDSONICA* (Greene) Barneby — *MATTHEWS LAKE:* top of big esker, *2,* occasional plants on high hills, not common on esker or in area. *MUSKOX LAKE:* common on dry hummocks in moist soil, *104.* These collections are perhaps the southernmost sites for this species in eastern Mackenzie District.

OXYTROPIS MAYDELLIANA Trautv. — *MUSKOX LAKE:* common on hummocks in dryish upland marsh, *102.* The map in Raup (1947) shows stations in the Thelon Game Sanctuary, at Bathurst Inlet, along Coronation Gulf, and at Great Bear Lake. This collection helps fill in southern limit of distribution in eastern Mackenzie District.

OXYTROPIS ARCTICA R. Br. — *MATTHEWS LAKE:* well-drained gravelly soil near top of granitic hill, 1 mile west of camp, *30;* fairly common at this elevation. Barneby (1952) records this species as follows: "Arctic shores, inland in Alaska only, from the south shore of Rae Isthmus at about 87°W., westward through coastal Mackenzie and the islands of the Polar Sea to the upper Yukon and Seward Peninsula, Alaska". The fact that this species has not been recorded from inland in the Northwest Territories probably lies in the paucity of collections from the area. Other inland collections in the Divisional Herbarium are *J. Woodruff 67,* southwest of head of Bathurst Inlet, 66°04'N, 108°28'W and *J. Woodruff 163,* moraine east of Kigyik Lake, 67°03'N, 112°44'W.

EMPETRACEAE

EMPETRUM NIGRUM L. — *MATTHEWS LAKE:* dry heath tundra along edge of lake, *16. MUSKOX LAKE:* common on moist uplands, 1 mile east of camp, *121;* generally distributed.

VIOLACEAE

VIOLA PALUSTRIS L. — *MUSKOX LAKE:* common among willows in wet soil along stream, *118;* previously unreported for Mackenzie District and the Northwest Territories. Raup (1936) has the following discussion: 'A specimen in Herb. G. is labelled "Arctic Am. Back ? Syn. Fl. N. Am." and "Capt. Back Coll."; but it is difficult to correlate it with any records in Back's list.' There is but one species of the violets collected by Richard King, which are listed in Appendix II of Back's Narrative (1836), with which this Gray Herbarium sheet could possibly have been confused, and that is *V. blanda;* the other three species, *V. pubescens, V. canadensis* and *V. muhlenbergiana,* are all caulescent. The specimen of *V. blanda* was collected at Ft. William, Ont. It is possible that the Gray Herbarium specimen did come from Mackenzie District but was not seen by Hooker when he was compiling the list of King's collections.

ONAGRACEAE

EPILOBIUM ANGUSTIFOLIUM L. — *MATTHEWS LAKE:* scattered colonies in dry disturbed soil about settlement, *62; MUSKOX LAKE:* disturbed soil near buildings, *143;* very common in this area only, growing up to 4 feet tall. The map in Raup (1947) shows stations in the Thelon Game Sanctuary, at Great Slave Lake, and at Great Bear Lake. These collections help complete the northern limit of range in eastern Mackenzie District.

EPILOBIUM LATIFOLIUM L. — *MUSKOX LAKE:* low damp riverbank, *140;* only one small colony found.

EPILOBIUM PALUSTRE L. — *MUSKOX LAKE:* fairly common in wet marsh, *192.*

PYROLACEAE

PYROLA GRANDIFLORA Radius — *MATTHEWS LAKE:* in moist willow thickets on west side of lake, 1 mile west of camp, *42;* fairly common on west shore of lake.

ERICACEAE

LEDUM PALUSTRE L. var. *DECUMBENS* Ait.—*MATTHEWS LAKE:* quite common on dry uplands, *40, 54. MUSKOX LAKE:* very common on dry uplands, *101;* wet ground in shelter of rock ledge overhang, *135.* This latter collection, which is without flowers or fruit, has some leaves, particularly those remote from the growing tips of the branches, flattened (measuring up to 0.5 mm in width) and glabrate; some of these larger leaves are infected with the rust *Chrysomyxa ledi.* The infection and the abnormal leaf shape are probably related to the moist protected habitat in which the plant was found.

RHODODENDRON LAPPONICUM (L.) Wahl. — *MATTHEWS LAKE:* fairly common, but usually dwarfed, on dry gravelly patches in upland tundra, ¼ mile east of camp, *13;* fairly common as bushes averaging 1 ft. high in valleys and on slopes on west shore of bay, 1 mile west of camp, *20. MUSKOX LAKE:* scattered on high dry uplands, 1 mile east of camp, *119;* all plants small. This is a northern species that in eastern Mackenzie District is found as far south as Great Slave Lake and Artillery Lake.

LOISELEURIA PROCUMBENS (L.) Desv. *MATTHEWS LAKE:* high barren gravelly hill slopes, 1 mile east of camp, *5;* generally common on upland areas. *MUSKOX LAKE:* fairly common on moist and dry meadowland and hill slopes, 1 mile east of camp, *123;* at base of rock cliff in wet ground, *138.* In eastern Mackenzie District the southern limit of range of this species appears to be Artillery Lake.

KALMIA POLIFOLIA Wang.—*MATTHEWS LAKE:* moist soil on edge of lake, *44;* only occasional on both sides of lake. Specimens have been seen from the Thelon Game Sanctuary, Gordon Lake and Great Bear Lake (CAN). The present collection helps complete the northern limit of distribution in eastern Mackenzie District.

CASSIOPE TETRAGONA (L.) D. Don. — *MATTHEWS LAKE:* dampish to wet soil on lower slopes of granitic hill, 1 mile west of camp, *21;* fairly common here, but restricted to the granitic west shore of the lake. *MUSKOX LAKE:* fairly common at foot of slope, 1 mile south of camp, *124.* These collections are from near the southern limit in eastern Mackenzie District.

ANDROMEDA POLIFOLIA L. — *MATTHEWS LAKE:* quite common on wet marshy hummocks, *33. MUSKOX LAKE:* common on moist hummocks in marsh, *106.*

ARCTOSTAPHYLOS UVA-URSI (L.) Spreng. *MATTHEWS LAKE:* rooted in rock crevices on south side of hill of igneous rock, 1 mile west of camp, *17.* This collection helps to complete the northeastern limit of range in Mackenzie District. It is known from around Great Slave Lake and western Great Bear Lake, and the map in Raup (1947) also shows a collection from the Mackenzie River Delta.

ARCTOSTAPHYLOS ALPINA (L.) Spreng. — *MATTHEWS LAKE:* gravelly uplands, 1 mile east of camp, *6:* common throughout the area. *MUSKOX LAKE:* common on high dry uplands, *120.* These collections are apparently from near the southern limit of range in eastern Mackenzie District.

ARCTOSTAPHYLOS RUBRA (Rehder & Wilson) Fern. — *MUSKOX LAKE:* a color photograph taken on August 15, shows both this species and *A. alpina* growing in close proximity. Unfortunately, no specimens of either species were obtained with mature fruit.

VACCINIUM ULIGINOSUM L. — *MATTHEWS LAKE:* hummocky marsh, *51. MUSKOX LAKE:* common, generally in moist locations, *108.*

VACCINIUM VITIS-IDAEA L. var. *MINUS* Lodd. — *MATTHEWS LAKE:* marshy hummocks in camp area, *53;* very widespread. *MUSKOX LAKE:* common on slopes of moraine near camp, *109.*

VACCINIUM MICROCARPUM (Turcz.) Hook. f. — *MATTHEWS LAKE:* found as an admixture in a collection of *Scirpus caespitosus, 66B.* This collection helps complete the northern limit of range in eastern Mackenzie District between Great Slave Lake and Great Bear Lake.

SCROPHULARIACEAE

PEDICULARIS LAPPONICA L. — *MATTHEWS LAKE:* wet marsh land, 1 mile west of camp, *47;* quite common on west shore of lake. Porsild (1943) cites specimens of this species from the Mackenzie River Delta, Great Bear Lake and in central Keewatin District. This collection helps complete the picture of the southern extent in eastern Mackenzie District.

PEDICULARIS LABRADORICA Wirsing — *MATTHEWS LAKE:* moist hillocks in marsh land, 1 mile west of camp, *93;* not common, apparently restricted to west shore of lake. *MUSKOX LAKE:* common on moist hummocks in marshy land, *105.*

PEDICULARIS FLAMMEA L. — *MATTHEWS LAKE:* wet marsh, 1 mile west of camp, *48;* restricted to volcanic rock areas; previously known in Mackenzie District from around Great Bear Lake.

LENTIBULARIACEAE

PINGUICULA VILLOSA L. — *MATTHEWS LAKE:* wet marsh hummocks, *50.* This collection helps fill in the northeastern limit of distribution in eastern Mackenzie District between the eastern end of Great Slave Lake and Great Bear Lake.

RUBIACEAE

GALIUM TRIFIDUM L. — *MUSKOX LAKE:* fairly common in wet stream bank among willows and long grass, *141:* This is a range extension of some 330 miles northeast from Fort Smith. It is also known in Mackenzie District as far north along the Mackenzie River as the Mackenzie River Delta, and at Great Bear Lake.

COMPOSITAE

ANTENNARIA ANGUSTATA Greene — *MATTHEWS LAKE:* common among willows and alder on south slope of granitic hill on west shore of lake opposite camp, *23.* This collection helps complete the known distribution of the species in eastern Mackenzie District. Distribution maps of this and the following species are given by Porsild (1950).

ANTENNARIA ISOLEPIS Greene — *MUSKOX LAKE:* common in moist willow thickets along stream, 1 mile south of camp, *153;* found at this locality only.

ANTENNARIA PYGMAEA Fern.—*MUSKOX LAKE:* moist slope near stream, *113;* infrequent. This collection helps fill in a gap in the known distribution between central Keewatin District and the west side of Great Bear Lake.

ARTEMISIA TILESII Ledeb. — *MUSKOX LAKE:* moist willow thickets along stream, 1 mile south of camp, *159;* common, but this locale only. This collection is from near the eastern limit of distribution in Mackenzie District. To the southeast, it is known from Churchill and southern James Bay.

PETASITES SAGITTATUS (Pursh) Gray — *MUSKOX LAKE:* in wet areas along stream, *173;* generally common. This collection helps complete the northern limit of distribution between the Thelon River and Great Bear Lake collections cited by Porsild (1943).

ARNICA ATTENUATA Greene — *MUSKOX LAKE:* common on moist slope near stream, *114;* at base of south-facing rock wall, 1½ miles southwest of camp, *132.*

TARAXACUM ? HYPERBOREUM Dahlst.— *MATTHEWS LAKE:* in rock crevice, 1½ miles north of camp, *53. MUSKOX LAKE:* on rock ledge on south-facing slope of valley, *131.* These specimens, which are all immature, are only tentatively referred here.

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NATURAL HISTORY SURVEY OF COPPERMINE, NORTHWEST TERRITORIES, 1951 [1, 2]

S. D. HICKS [3]

Insect Systematics and Biological Control Unit, Entomology Division, Ottawa.

THE NORTHERN INSECT SURVEY, in which a number of Arctic and subarctic localities have been investigated each year since 1947, is a project sponsored jointly by Science Service of the Canada Department of Agriculture and the Defence Research Board, Canada Department of National Defence. The author, aided by Mr. Wallace Findlay, a summer assistant, conducted an investigation of the Coppermine area in 1951. Most of the survey work was concentrated within one mile of the settlement. The author collected entomological specimens for the Canadian National Collection of Insects and kept a diary on the zoology of the region. Mr. Findlay collected botanical specimens for the Botany and Plant Pathology Division, Science Service, Ottawa.

Features of the Coppermine Area

Coppermine is slightly to the west of the mouth of the Coppermine River in Coronation Gulf. The site is probably the most suitable for settlement, and the buildings the best, along the western Arctic coast. Most of the buildings are in a line along the sandy shore of the Gulf for about half a mile. The terrain back of the buildings is low-lying and marshy. A few drainage ditches carry off the surface water present most of the season on account of permafrost.

The settlement is built on the northern border of the Canadian Shield. According to geologists (Chipman and Cox, 1924), the coast on either side of Coppermine is composed of Coppermine River series rock for several miles. It is predominantly amygdaloids with some conglomerate in the lower part, passing upwards into a great series of interbedded shales and sandstones. The Coppermine River reaches the coast through two mouths, which surround a large, low, grass-covered island, with two diabase hills on the northern end. Not far above the mouth, the river narrows considerably and has steeply sloping, alluvial cut banks.

The volume of Coppermine River water pouring into the Gulf creates a large body of fresh water for miles in front of the settlement. Tremendous quantities of ice from spring break-ups erode the soil banks and the resultant silt forms many sand bars in the river, at the mouth and in the Gulf east and west of the settlement. The sand bars make travel by boat hazardous and one needs knowledge of the negotiable channels for safe travel by boat.

Outcroppings of basalt become evident as the land rises gradually from the coast toward the south. A broad valley directly back of the settlement fans out into smaller valleys between high cliffs, where it meets the tundra country. The main valley has predominantly grasses and sedges, among which there are many pools that remain until the dry summer season. Three basaltic cliffs stand in bold relief a mile to the south of the settlement. The highest of the cliffs is near the Coppermine River. It has an abrupt drop of approximately 150 feet, a characteristic of all the cliffs in this region. The most interesting collections of plants and insects were made at the base of this cliff.

Weather Conditions

Throughout the three months stay, weather conditions were extremely variable; many days were unpleasantly wet, cold, and dull. During most of the time a cold wind blew from the east, and only occasionally was there a warm southwest wind. On good authority we were informed that the winds are reversed in the winter time. With such conditions, little time was suitable for field collecting. However, on August 3 the tem-

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2) Received for publication January 5, 1956.
3) Technician.

perature was 77°F. Coppermine has been recorded as having the highest temperature, 86°F., of all of the western Arctic settlements.

On June 17 the Coppermine River ice broke up and moved into the Gulf. The spring break-up is important to the residents of the settlement in many ways. There is no landing strip at Coppermine and the local population depends on firm sea ice or open water in front of the settlement for aeroplane landings. The action of the river ice breaks up the heavy sea ice, preventing further travel by dog team for hunting or other purposes to the islands and distant points. Once the Gulf is open for boat travel, nets are set for Arctic char, upon which the residents depend for food for both themselves and their dogs. Stored ice blocks from the Coppermine River are used for drinking water during the summer.

Vegetation

An annotated list of the plants collected by Mr. Findlay was published by Cody in 1954. However, the following supplementary notes on general botanical conditions are given as a more detailed indication of the flora. The northern limit of trees is approximately 20 miles south of the settlement. Willows form the highest vegetation everywhere, often occurring in extensive, dense patches. The tundra is comparatively flat and composed of caribou moss, grasses, sedges, and scattered, showy-flowering plants. The low-lying area in the settlement is marshy and produces many species of perennials. *Carex* meadows are noticeable as one moves up the valleys toward the three rock cliffs on the south. There are mats of *Ledum, Rhododendron, Vaccinium,* and occasional patches of dwarf *Betula* in many places on rock or soil. The most ideal plant situations were observed to be at the bases of the basalt cliffs. Protected from the predominant cold east wind, plants probably attain their maximum height here, where the highest local temperature is maintained.

Spring Observations

As the party arrived at so early a date, little collecting could be done on account of winter conditions. Daily temperatures ranged between 20° and 40° F. for some days, and ice and snow covered the ground to a depth of two feet. At this time the willows, knee-high and higher, were showing well-developed catkins. The following notes are daily records of the natural history of the region as the season advanced. These observations establish the date of appearance after the winter season for some of the first zoological specimens.

May 18. Rock ptarmigan were common and two shot by an Eskimo were examined for external parasites. Flies were beginning to appear around the windows and on the white walls of the government school; several species were collected from these places and on snow. A few bluebottle flies, *Protophormia terrae-novae* (Robineau-Desvoidy), were collected on the south side of sunny, cliff rock about a mile from the settlement.

May 19. Two more ptarmigan shot by an Eskimo were examined and a few lice collected. Flocks of snow buntings were common, and ravens were observed flying near the school.

May 20. The first geese were observed flying south of the settlement.

May 21. The first horned larks appeared.

May 22. Birds were beginning to arrive in numbers, geese and ravens were more common, and the first white-crowned sparrows were seen.

May 23. Herring gulls were noticed for the first time. This was the only species of gull observed in the region.

May 26. The gulls were more numerous, the first gyrfalcon was observed circling the school, and the first spider was collected.

May 27. A red-backed mouse was trapped and examined for fleas.

May 29. The first mosquito larvae were noticed in a rock pool slightly to the southeast of the school. Snow still covered the ground; large patches in some places were from one to two feet deep. Some pools had a thin coating of ice. The temperature of the air was 37°F. and that of the surface water in the pools was 42°F. Larvae were not abundant in any of the pools in the area; it took 20 minutes to secure 25 for rearing.

May 31. Mosquito larvae were observed to be active even in pools covered by a coat of ice. Several spiders and the first Collembola were collected on snow. Six small ground beetles were also collected on snow. These were the only beetles observed on snow at any time, although a diligent search for additional specimens was continued.

June 1. The first water beetles were observed moving around in pools. A number of mosquito larvae were collected from a

grassy meadow pool on the west side of the settlement. These were lighter-coloured than those in the rock pools and probably of another species.

June 2. The first bumble bee was noticed. A number of a new species of fly were taken on old grass stems along the beach west of the settlement. Local residents stated that plants of purple mountain saxifrage, *Saxifraga oppositifolia* L., were commencing to show their striking flowers. According to them, this is the first colourful plant to flower in the area.

June 3. Many more purple mountain saxifrage were showing bloom, especially on peculiar, slightly raised mounds of wet clay. The first arctiid caterpillar, *Parasemia lapponica gibsoni* B.-H., collected as it crawled across the snow, was put into a glass-topped tin and was later reared to maturity; this caterpillar was very rare. Several spiders were collected.

June 4. The maximum temperature was 52°F. Mosquito larvae were developing and another series was collected. Mr. Findlay collected another arctiid caterpillar of the same species; it was also reared to the moth. Some water beetles were collected from pools, as well as several of the first caddisfly larvae. A bumble bee was collected for the first time.

June 5. The first overwintered adult mosquito, *Culiseta alaskaensis* (Ludl.), was noticed and collected at the south side of the rock cliffs. Tree sparrows were common. Many species of low, colourful plants were beginning to show flower buds, and the willows were producing pollen.

June 8. Since the weather was unsuitable for collecting, time was spent preserving different stages of mosquito larvae; emerged adults were pinned, and about 20 larvae were collected from rock pools. There was no sign of any mosquito pupae in the pools yet.

June 12. This was the first good collecting day. There was a warm southwest wind, which made the insects active. A good series of bees was collected, several species of flies, some small Hymenoptera, three small weevils, and the first and only coccinellid. The first cranefly was noticed. The birds were becoming more abundant. American pipits, redpolls, and longspurs were observed in numbers. Residents reported mosquito bites for the first time. From this date the weather became more suitable for general collecting, and a more detailed report is given of species under "Biting Flies" and "Other Insects".

Biting Flies

No species of Tabanidae or Simuliidae were found in the area. Mosquitos were abundant from mid-June until the end of July. There was only little more than a month, therefore, when they might require control measures. At the peak of their season, an "S" sweep with a net would collect about 65 specimens. Frequent applications of fly repellent made collecting conditions bearable. The first and only adult specimen of *Culiseta alaskaensis* (Ludl.) was taken in the field on June 5. All other species of mosquitoes were first abundant on June 23, when the temperature reached a high of 64°F. The following species were identified: *Aedes impiger* (Walk.), reared from larvae, and a few wild-caught females; *Aedes nigripes* (Zett.), almost all wild-caught females; and *Aedes hexodontus* Dyar' a few wild-caught females. Further examination of the material may reveal additional species.

Other Insects

Approximtely 1500 specimens other than biting flies were brought back for study. These represented mainly the orders Lepidoptera, Coleoptera, Diptera, Hymenoptera, and Arachnida. To date, the following species have been determined.

In the Lepidoptera, the following species are represented: *Anarta richardsoni* Curt., *Parasemia lapponica gibsoni* B.-H., *Oeneis melissa* Fabr., *O. taygete* Gey., *Lycaena phlaeas feildeni* McLach., *Colias hecla* Lef., *C. nastes* Bdv., *Boloria polaris* Bdv., *B. freija* Thun., *B. chariclea* Schneid., *B. improba* Butl., *B. pales* D. & S., *Erebia rossii* Curt., *E. fasciata* Butl., *E. disa subarctica* McD., *Androloma maccullochi* Kirby, and *Aspilates orciferarius* Wlk. Two specimens of *Coenonympha* sp., probably southern intrusions, were collected.

The total collection of Coleoptera represents 13 families and 33 genera. In the Carabidae, 20 specimens of a strikingly beautiful ground beetle, *Carabus vietinghoffii* Adams, were taken. The only other species of *Carabus* taken was *C. chamissonis* Fisch., a good series being obtained. Other carabids were *Blethisa catenaria* Br. (two males), known previously only from the

type, a female; *Stereocerus haemotopus* (Dej.); and species of *Nebria, Cryobius, Bembidion, Curtonotus, Elaphrus,* and *Pelophila.* Two genera of Elateridae were represented, *Hypolithus* with two species and *Negastrius* with one species. The family Dytiscidae was represented by the genera *Ilybius, Hydroporus* (three or more species), *Agabus* (four or more species, and *Hygrotus,* and *Colymbetes.* There were two genera, *Helophorus* and *Cercyon,* in the Hydrophilidae. One specimen of a rather rare coccinellid, *Ceratomegilla ulkei* Cr., was collected. *Podabrus* was the only genus represented in the Cantharidae; *Morychus* and *Byrrhus* in the Byrridae; *Silpha lapponica* Hbst. in the Silphidae; *Haliphus* in the Haliplidae; *Tachinus* (or near) and *Olophrum* (or near) in the Staphylinidae; *Melanophila acuminata* (Deg.) (one specimen) in the Buprestidae; and four species, *Acmaeops proteus* (Kby.), *A pratensis* (Laich.), *Asemum atrum* Esch., and *Arhopalus agrestis* (Kby.), in the Cerambycidae. By the end of the third month no additional species were found. Therefore, this is probably a fairly representative list of the beetles in the Coppermine area.

About 125 specimens of bees were collected. The following were identified: *Bombus sylvicola* Kby., *B. balteatus* Dahlb., *B. strenuus* Cress., *B. neoboreus* Slad., *B. sylvicola* var. *johanseni* Slad., and two specimens of *Osmia* sp. The following genera of parasitic Hymenoptera were represented: *Amblyteles, Apanteles, Atractodes, Campoplex, Cteniscus, Ctenochira, Endasys, Erromenus, Ichneumon, Ichneutes, Mesoleius, Phygadeuon, Polyblastus, Syndipnus,* and several genera in the subfamilies Plectiscinae and Alysiinae.

The Arachnida were represented by the following:*Gnaphosa brumalis* Thorell (one ♀), *G.* sp. (immature ♂), *Pardosa gertschi* C. & I. (one ♂), *P. modica brunnea* Com. (one ♀ & ♂), *P. glacialis* (Thorell) (one ♀), *P. umanchi* (one ♂), *P. prosaica* C. & I. (one ♂), *P. tristoides* C. & I. (one ♀), *P.* sp. (immature ♀), *Xysticus labradorensis* Keys (♂♂ & ♀♀), *Tarentula* sp. *(pictilis* Emert. ?) (immature ♀ and ♂, and adults), *Callilepsis* sp., and *Haplodrossus hiemalis* (Emert.) (one ♀).

Many species of Diptera and a few of Trichoptera were collected but almost all of those have not been identified.

The Diptera were examined by Dr. J. R. Vockeroth, the Lepidoptera by Dr. T. N. Freeman and Mr. D. Hardwick, the Coleoptera by Mr. W. J. Brown, and the Hymenoptera by Drs. W. R. M. Mason and R. Lambert, all of the Entomology Division, Ottawa. The Arachnida were identified by Mr. D. Gray, formerly of the Entomology Division.

Effects of Weather on Insects

Two phenomena were noticed concerning the effect of weather on insects. Sudden drops in temperature occurred frequently throughout the summer. When this happened, several species of Diptera were easily collected from the white walls of the government school and other resting places because of their torpid condition. A more interesting observation concerned the butterflies. On a normal sunny day which was ideal for collecting, dozens of the few species of butterflies common to this area dotted the landscape. Several times the writer noticed that as soon as a cloud obscured the sun all the butterflies disappeared. When the sun emerged, the butterflies would gradually re-appear and resume their flight over the tundra.

Nearby Localities of Interest

On July 7 an attempt was made to reach the Richardson River and travel up it for some distance to make collections. Unfortunately, the wide bay at the mouth was still choked by sea ice and further progress was impossible. A landing was made on the east side of the bay, where some of the country was investigated. It was very similar to the Coppermine area, except that the influence of the salt water of the Arctic Ocean was more noticeable. In some spots along the shore line there were heavy deposits of old sea-urchin shells, and both salt and fresh water shells.

On the way back, stops were made at three of the group of islands to the northwest of the settlement. Collections of plants and insects, and general observations, suggested that the islands were similar to the mainland. The rock, according to investigations by geologists (Chipman and Cox, 1924), is of the Coppermine series, capped by diabase or basalt, with the usual mixture of shales and sandstones.

On July 26, a trip was made to the mouth of the Nipartoktuak River, about 12 miles east of Coppermine. The river is wide and shallow at its mouth, and gradually narrows inland between moderately high clay banks. In about an hour's collecting, many speci-

mens of plants and insects were obtained. These appeared to be very similar to those taken near the settlement.

Two trips were made on July 17 and 26 to Bloody Falls, the most interesting locality close to Coppermine. Situated about 12 miles up the Coppermine River, Bloody Falls is actually a gorge about a mile long, with deep, rapid water and steep banks rising to 200 feet. Owing to the heavy current, it is possible to reach the start of the rough water only by boat. It is necessary to get out and travel overland almost half a mile before reaching the gorge. On both occasions, the insects and plants collected appeared to be similar to those taken close to the settlement.

The area around Coppermine is of great historical interest since many early explorers passed through this country. At Bloody Falls, one event is of special interest. Preble (1908) states, "At Bloody Falls, named from the circumstances, the Indians, small parties of whom had joined the company from time to time, fell upon a large party of Eskimos, then their bitter enemies, and, much to Hearne's horror and disgust, massacred the entire company." Preble also records on the same page that Samuel Hearne was the first European traveller to penetrate the Great Slave region and therefore most likely the first to reach the Arctic coast by land. He writes that this event happened during Hearne's attempt in 1771 to discover the source of copper reported by Indians to have come from near the banks of a large river far to the northwest and at the same time to throw light on the supposed existence of a feasible passage by sea to the westward for the Hudson's Bay Company.

Eskimos and Eskimo Names

About 30 Eskimos were living at Coppermine in the spring of 1951. This number increased to approximately 70 in late summer, when other Copper Eskimos from outlying districts arrived to help unload the supply boat from Aklavik. Among those resident at Coppermine, two were worthy of mention. One, Ikey Bolt, had assisted Stefansson in collecting insects for the Canadian Arctic Expedition, 1913-1918. He acted as an interpreter and was helpful in many ways during our stay. The other, Jim Koiyakoak, known as a mighty hunter, was the oldest member of the Copper Eskimo tribe that settled at Coppermine.

There are Eskimo names for many place names in the Coronation Gulf region, and these and their meanings follow for a few of the names mentioned in this article. Coppermine River is "Kogluktok", which means "big river". Richardson River is "Kugnahirk", meaning "a mere river". The first small river east of the Coppermine is Nipartoktuak, which means "it has spruce trees". Bloody Falls is "Hagavaktok", meaning "cascade, tide-rip, current". The translation and etymology of Eskimo names follow the interpretation of Jenness (*in* Chipman and Cox, 1924), ethnologist of the 1913-1918 Canadian Arctic Expedition.

Acknowledgements

The author is indebted to Mr. A. C. Jones, Defence Research Board, and Dr. T. N. Freeman, Co-ordinator of the Northern Insect Survey, for their co-operation. Transportation was supplied largely by aircraft of the R.C.A.F. Transport Command. Many thanks were due to Mr. D. B. Lord, teacher and social welfare worker for the Coppermine settlement, Canon Webster, Anglican missionary, Mr. G. S. F. Jackson, Department of Transport operator, and Mr. L. Manning, Hudson Bay manager, for generous aid in providing local transportation, information, and accommodation. In general, all residents assisted wth many kindnesses, which made our stay an enjoyable and profitable experience.

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NOTES AND OBSERVATIONS

Notes on the Four-toed Salamander in the Province of Quebec. — On October 10, 1953, a four-toed salamander *(Hemidactylium scutatum)* was taken by the writer at Gleneagle, 7 miles north of Hull, Quebec. (Reported by S. Bleakney in Canadian Field-Naturalist 68(4).) This appears to be the first record for the province. The specimen was found in a partly rotted white pine log. The log was located under a large pine tree, about fifty yards from a small permanent brook and about one-quarter of a mile from the main highway. In this area the majority of the trees are deciduous, with a few scattered softwoods, and considerable ledge showing on the higher ground.

On April 25, 1954, six four-toed salamanders were collected at a spot one-quarter of a mile distant from the location where the first specimen was taken. Here the habitat was much different as the six specimens were found in an old log which jutted into a small woodland "frog pond". The salamanders were very inactive and had probably hibernated in the log during the winter. No doubt there would be no water near the log during the winter months as the pond is much larger in spring due to the melted snow.

On April 27, 1954, at the same spot two more four-toed salamanders were taken by Mr. Bleakney (Herpetologist, National Museum of Canada), Mr. Francis Cook, and myself.

On June 6, 1954, one of the female specimens taken on April 25 laid eggs while in captivity.

On July 24, 1954, a four-toed salamander was taken under moss on an old log about one-eighth of a mile distant from the second collecting spot, and in a much drier habitat.

On July 27, 1954, Mr. Bleakney and Mr. Cook collected a female four-toed salamander in a small sphagnum moss bog in Gatineau Park at Kingsmere. This is about 4 miles west of Gleneagle.

Of the eleven specimens captured, two escaped and the rest were preserved, there being two specimens in the writer's private collection, one at the New Brunswick Museum, St. John, N.B., and 6 at the National Museum of Canada, Ottawa.

I wish to thank Mr. S. Bleakney for his co-operation in regard to my publishing these notes. — STANLEY W. GORHAM, *National Museum of Canada, Ottawa.*

Observations on the Habitat and Food of the Queen Snake, *Natrix septemvittata*, at London, Ontario. — During July, 1955 it was discovered that specimens of the Queen Snake, *Natrix septemvittata* Say, could be found along the one-half mile stretch of Medway Creek ending at its confluence with the Thames River in London, Middlesex County, Ontario. Logier (1939, Royal Ont. Mus. Zool., Handbook No. 4) records that this snake has been found in Middlesex County and that it is "not common" in Ontario. During the summer, such as that of 1955, the water in Medway Creek is low and is flanked by clay flats which are several yards in width and which have rounded boulders and flattened water-washed stones plentifully scattered over them. The snakes were found either swimming in the water or coiled beneath stones within one yard of the water's edge. Five specimens were collected during afternoons in July between 2 and 4 P.M. (E.D.S.T.).

1. This snake, found on July 11 beneath a stone 1 yd. from the water, was kept in a jar with stones and water till Aug. 9 and was offered small crayfish as food but did not eat any. On Aug. 9 its measurements were: total body length — 30.3 cm.; tail length — 7.3 cm.

2. This snake, collected on July 18, was swimming in the creek close to shore and its measurements were: total body length — 28.3 cm.; tail length — 6.6 cm.

3. A second snake was found on July 18 beneath a rock. No measurements were taken.

4. A snake collected on July 31 from beneath a rock 1 yd. from the water's edge was put in a collecting jar and one-half hour later it ejected about 1 cc. of brown fecal material. When examined under the binocular microscope this material was found to contain two intact antennal (excretory) glands of a crayfish as well as portions of other broken antennal glands, thus indicating that the snake had recently digested at least two crayfish. The snake was dissected and no contents were found in the stomach, midgut or hindgut. The measurements of the snake were: total body length — 30.1 cm.; tail length — 7.4 cm.

5. A second snake, collected on July 31 from beneath a rock 1 yard. from shore, was put in a collecting jar and 10 mins. later disgorged two crayfish both with a body length of about 4 cm. and with their complement of appendages complete. The snake was measured (total length — 37.3 cm.; tail length — 9.6 cm.) and its stomach, midgut and hindgut were dissected out separately. In the stomach was a legless body of a crayfish, about 4 cm. long, with the anterior end considerably digested and in the midgut were two pereiopods and two antennal glands, probably parts of the crayfish found in the stomach. The hindgut was empty. It is thus evident that this snake was in the process of digesting three crayfish when captured.

The presence of crayfish in the diet of the queen snakes caught at London is in accord with the conclusions of several authors e.g. Pope, C.H. (1944, Amphibians and Reptiles of the Chicago Area, Chicago Nat. Hist. Mus., p. 193), Schmidt, K.P. and D.D. Davis (1941, Field Book of Snakes of the United States and Canada, G.P. Putnam's Sons, New York, p. 213) and Logier, E.B.S. (*op. cit.*, p. 28) who attest that crayfish form the bulk of the diet of this snake.

The five snakes showed the typical color pattern of the species with the black median dorsal line and the two lines on the fifth row of scales distinct and the two dusky bands on the mid-ventral region present and separate. — W.W. JUDD, *Department of Zoology, University of Western Ontario, London, Ontario.*

Ruff and White Pelican at Fort Severn. — While on a visit to Fort Severn on June 12, 1955, the writer was given a specimen of a ruff, *Philomachus pugnax* (Linne), by Mr. R. Still, manager of the Hudson's Bay Company Post. The bird had been shot by an Indian a few days earlier on the shore of the Severn River, just below the village. He killed it because he did not know what it was, never having seen one before. The bird was a male in full breeding plumage having a ruff, chesnut in colour, with black bars. The testes were enlarged. The skin is now in the Royal Ontario Museum of Zoology and Palaeontology.

Two other specimens have been collected in Ontario. J.A. Morden and W.E. Saunders (Canadian Sportsman and Naturalist, Vol. 3, No. 6. June 1883) recorded a male killed on the bay at Toronto in the spring of 1882. This specimen was in the possession of a Mr. Young of Toronto, but is now lost. The other specimen, also a male, was shot by a Mr. Wightman in 1887 at the Scarborough Bluffs near Toronto. This specimen is preserved in the Royal Ontario Museum of Zoology and Palaeontology.

The chief of the Severn Indian band, Eseas Thomas, gave the writer the mummified head and cleaned radius and ulna of a White Pelican, *Pelecanus erythrorynchos* Gmelin. He had found the decomposing carcass of the bird on June 8, 1955, on the bank of the Severn River a short way upstream from the Post. The Severn Indians said they had never seen a pelican before.

The head of this bird and pictures were shown to the Indians at some of the posts in the central and western part of the Patricia portion of Ontario. While none of them were able to give the Cree name for a pelican (cha'chukew of the Plains Cree) some did say that they had occasionally seen or shot this bird. Johnny Yesno of Fort Hope said that two were shot there about 1924. He added that he had dropped two large suckers down the dead bird's throat to see how big a fish it could handle. David Baxter from Ogoki said he had seen two killed at English River many years ago.

Manning (Birds of the west James Bay and southern Hudson Bay coasts. Nat. Mus. Canada, Bull. 125, 1952) records four specimens from the vicinity of Hudson Bay.

These were all taken prior to 1859 and two were used by Gmelin in his description of the species in 1789. Manning suggests that these specimens may have been taken inland.

Baillie (Canadian Field-Naturalist, Vol. 53, No. 9, pp. 130-131, 1939) records the breeding of pelicans on Dream Island near Massacre Island in the Ontario portion of the Lake of the Woods. There have been some scattered sight records from northern Ontario in recent years which seem to indicate that the bird wander frequently into the Province. — H. G. LUMSDEN, *Ontario Dept. of Lands and Forests, Maple, Ont.*

The Laysan Albatross off the British Columbia Coast. — The Laysan Albatross *(Diomedea immutabilis)* is not mentioned in the authoritative "Review of the Bird Fauna of

British Columbia" by Munro and Cowan (1947).

In September 1954 while the U.S.C.G.C. *Northwind* was crossing the northeast Pacific from Unimak Pass (Aleutian Islands) to Victoria, B.C., the ship was accompanied by this species over much of the distance. Specifically, Laysan Albatrosses were observed during daylight hours on September 24, 25 and 26 from approximately lat. 54°N, long. 157°W to lat. 51°45'N, long. 137°30'W. The latter position is 200 sea miles from the west coast of the Queen Charlotte Islands and is definitely closer to British Columbia than to any other land. The number of individuals in sight at any one time varied from one to six or more. Birds were photographed at close range on several occasions. They were accompanied by much larger numbers of Black-footed Albatrosses *(D.nigripes)*. The latter species maintained its attendance to within 50 or 60 miles of the Vancouver Island coast. — FERRIS NEAVE, *Biological Station, Nanaimo, B.C.*

REVIEWS

Animal Camouflage. *By E.M. Stephenson and Charles Stewart (London, Charles and Adam Black). Distributed by the MacMillan Company of Canada $3.00, Second Edition 1955; 1-179, Glossary 180-187, Bibliography 188-189, Appendices 190-195; 15 plates, 9 figures.*

This interesting book, first published in the Pelican series in 1946, has been brought up to date and more extensively illustrated in the present cloth-bound edition.

The book covers a wider field of information than the title suggests. In addition to the general chapters on camouflage, with their many well-chosen examples, there are philosophical discussions of "Camouflage and its Contribution to Survival" and "What is the Real Significance of Camouflage". These chapters review the selective action of camouflage and its possible mode of action in regard to survival. Also discussed are the complicated types of camouflage that seem almost impossible to explain by mutation and natural selection only.

Supplementing the general discussions of camouflage and its values there are several chapters devoted to colour changes and the hormonal and nervous control under which they take place in the different phyla of animals.

A chapter on mimicry deals with both form and behaviour and discusses the reasons why mimicry may be useful under varied conditions. Two chapters deal with colours and patterns, the bases for many types of camouflage. Of these "Nature's Pigments and Colour Effects" deals with colour produced by pigments and by surface structure. "Control of Colour Change in Vertebrate Animals" goes into detail on nervous and hormonal control of chromatophore and melanophore cells in vertebrates from dogfish to snakes. Nervous control of these cells (in contrast to hormonal) becomes more common as one reaches higher orders.

The final chapter on "Sight in the Animal World" brings together much useful information on what the different animal groups can and cannot "see" in relation to the structure and location of their eyes.

This compact book will be welcomed by both biologists and general readers. The complexities of camouflage are discussed, some are explained, and the need for additional research is made apparent. The data are presented and conclusions are drawn with commendable freedom from bias and preconception.

The type is easy to read, the format pleasing and the illustrations well chosen. Typographical irregularities are pleasantly few. — V.E.F. SOLMAN.

Check-List of Amphibians and Reptiles of Canada and Alaska. *By E. B. S. Logier, and G. C. Toner (Contributions of the Royal Ontario Museum of Zoology and Palaeontology No. 41, August 31, 1955).*

Two major groups of common Canadian vertebrates are the amphibians and reptiles which occur from coast to coast and northwards to the tree line. As a source of food they form an indispensible item in the diet of many other animals. The astronomical numbers of insects and the vast numbers of rodents that they annually consume are testimony of their economic value to Canada. Yet this segment of our fauna has had so little attention that until August of 1955 there was only one comprehensive check list of Canadian amphibians and reptiles

(R.C. Mills, 1948) and it contained no maps and cited no records. The few obsolete local lists that are in existence constitute a situation sharply in contrast with that occurring in the United States where there is a separate handbook each for frogs, salamanders, turtles, lizards and snakes of the country, where nearly every state has its own herpetofaunal handbook, and where distribution maps are frequently published showing new *county* records. It is, therefore, with gratitude that we greet the Check-List of Amphibians and Reptiles of Canada and Alaska by E. B. S. Logier, and G. C. Toner (Contributions of the Royal Ontario Museum of Zoology and Palaeontology No. 41, August 31, 1955) which contains the first Canadian herpetofaunal distribution maps ever to be published.

This eighty-eight page volume represents the work of over a decade of accumulating scattered records and reports from various Canadian and American sources, and a glance at the acknowledgements section impresses one with the number of contributors involved. The order, families, genera, species, subspecies and common names are conveniently listed phylogenetically in the table of contents. There follows a four page introduction, a list of abbreviations, acknowledgements, and pages 7 to 75 are devoted to maps and text. The remainder of the book consists of a list of 187 references.

The 44 amphibian and 54 reptile species are treated each in three paragraphs: scientific and common name; brief description of range in Canada; and a list of Canadian locality records arranged alphabetically by province. As the authors point out their check list is not an inventory of records but an outline of distribution, and consequently they have cited only one or two of the available records for any given area. Each of these records is represented by a spot on the distribution map for that species. These maps are conveniently located adjacent to their respective species in the text. In addition to this treatment of the text material, there is a special discussion on the taxonomic status of *Bufo americanus copei* in eastern Canada and on *Thamnophis sirtalis* ssp. in British Columbia. The taxonomist and student of animal populations will find these two discussions most informative and should be struck by the fact that the taxonomy and distribution of even our common toad and garter snake have as yet been insufficiently studied.

In the opinion of the reviewer, the value of this book is greatly enhanced by the introduction. In this section, Mr. Logier and Mr. Toner deplore our paucity of knowledge in respect to Canada's herpetofauna and present a few of the challenging problems which confront the would-be investigator. Foremost of these is the concept of the species and subspecies and the justification in describing new forms. The two writers are of the opinion that a form should be thoroughly studied and then named (if it proves to be unique) rather than first naming and then studying (the latter usually resulting in another synonym for the literature). The authors poignantly state "To note differences and resemblances where they may be observed by any means whatever is a legitimate function of the study of zoology, but to attach trinomials or quadrinomials to any vagary of variation that appears in a population is something else again... In the same train of thought, we should remark with considerable emphasis that the application of racial names to geographic gradients of variation is a highly dubious procedure, but the variations and factors relating to them are worthy of careful study". The reviewer hopes that their introduction and distributional maps both will serve as guides to future Canadian herpetologists.

As is inevitable in a work of this nature, there are a few errors. On page 9 under *Ambystoma jeffersonianum,* the Nova Scotia reference of Bleakney 1953 should read 1952. In *Rana sylvatica* the Quebec locality records have been repeated under Labrador where the records of Backus 1954 were meant to have been quoted. The Atlantic ridley turtle is designated as *Leptochelys* instead of *Lepidochelys.* On the erratum slip on page 49 the painted turtle from Laval County, Quebec, should certainly be referred to *Chrysemys picta marginata* and not *C. p. picta.* One Canadian snake species, *Contia tenuis* of British Columbia, was omitted from this check list. Perhaps the greatest criticism that can be levelled against this volume is the poor quality glue used in attaching the paper cover. It is an admirable thing to reduce the selling price of a volume through such a cover, but it is deplorable that such a significant work as

this Check-List of Amphibians and Reptiles of Canada and Alaska did not receive one of a more tenacious nature. — SHERMAN BLEAKNEY, *National Museum of Canada, Ottawa.*

The Mammal Guide. *By Ralph S. Palmer. Doubleday and Company Inc., Garden City, New York, 384 pp, 40 colored plates, 37 line drawings, 145 maps, 1954. Price $5.50.*

Although numerous field guides and handbooks dealing with birds, reptiles, amphibians, insects and marine invertebrates have appeared within the last decade or so, similar works dealing with mammals have been conspicuous by their absence. Without up-to-date references amateur naturalists have tended to neglect mammalogy, to the disadvantage of the science as a whole, since non-professional persons have, in the past, made most worthwhile contributions. They are responsible for many of the specimens in our museums and their studies and observations of the animals in the wild have added greatly to our knowledge of species whose life history would otherwise remain unknown.

But if the amateur mammalogists were obliged to wait for suitable reference, they did not wait in vain. In 1952 "A Field Guide to the Mammals" by Dr. William H. Burt and illustrated by Richard P. Grossenheider appeared, followed in 1954 by "The Mammal Guide" by Dr. Ralph S. Palmer. Both books are guides to identification of North American mammals, but Dr. Palmer's book, in addition has brief accounts of the biology of each species, with a paragraph devoted each to habitat, reproduction, habits and economic status. There is a short but adequate description of each species and either a line drawing or a colored plate as a further aid to identification. There are 250 figures in color depicting 182 species. The range of each species is delineated on a small map accompanying the text. In those cases where a number of species are closely related and have similar habits, they are treated as a group. Most of these are the smaller species for which very little definite information is available, in any case.

It is obvious that the author has devoted a great deal of time and effort in the preparation of this work, including the examination of a tremendous mass of literature. It is therefore not surprising that there is little to criticize.

However, there could be some improvement in the reproduction of the colored plates. It is doubtful whether the amateur could distinguish between the varying and brown lemmings, using the colored figures as guides. And even the professional mammalogist would have difficulty identifying the meadow vole, the pine mice or the red-backed mouse without the aid of the captions. However, since the identification of many small mammals is dependent upon the examination of minute characters not obvious in a small figure, this criticism is not as serious as it might at first appear. In a few cases the range maps may be misleading, as in some cases the distribution as shown is that of the range of the species at the time when the white man arrived on the continent (pronghorn), while others delineate the range as it is today (bison, gray wolf).

Some of the vernacular names used may cause confusion. It is obvious that mammalogists should come to some agreement regarding the English names to be applied to species of the genus *Peromyscus,* and that either Phenacomys should be retained as the vernacular for the rodents of that genus, or, "spruce mouse", as used by Dr. Palmer, should be adopted.

For those who want a single volume, of the field guide type, which at the same time provides a certain amount of information on the biology of the species treated, this book can be highly recommended. Both the author and the publishers are to be complimented on the excellence of this publication. — AUSTIN W. CAMERON.

A Study of Variations in the Maskinonge from Three Regions in Canada. *By A. S. Hourston, 1955. Contrib. Roy. Ont. Mus. Zool. and Palaeo. No. 40, 13 pp., 4 tables, 16 pls.*

This interesting and carefully conducted study indicates that there is considerably more geographical variation in the maskinonge than had probably been realized. The author discusses the names and taxonomic history of the two sub-species of maskinonge and examines the nature and extent of the subspecific differences between maskinonge from different parts of their range.

To this end, fish were collected, by means of angler co-operation, from three distinct areas in Ontario and Quebec where the spe-

cies is reported to be abundant. A test of the reliability of body markings for taxonomic classification was made by classifying the various types of markings found and examining all fish accordingly. These markings are shown to be useful in subspecific distinction. An analysis of measurements of body proportions and other features indicated significant differences among the three groups of fish. Unfortunately, the data are not presented in a way that is easily understood, verified or compared. It is felt that a graphic presentation of the data would have enhanced the readability of the paper.

The author supports recent taxonomic opinions that differences exist between maskinonge from the St. Lawrence River and Lake of the Woods region. He further indicates differences of lesser magnitude between populations from the St. Lawrence River and the Kawartha Lakes.

The paper, which includes pertinent photographs concerning body markings, is a distinct step forward in the difficult taxonomic problem of recognizing sub-species within the maskinonge group. — F. H. SCHULTZ.

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