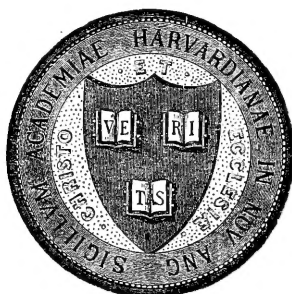


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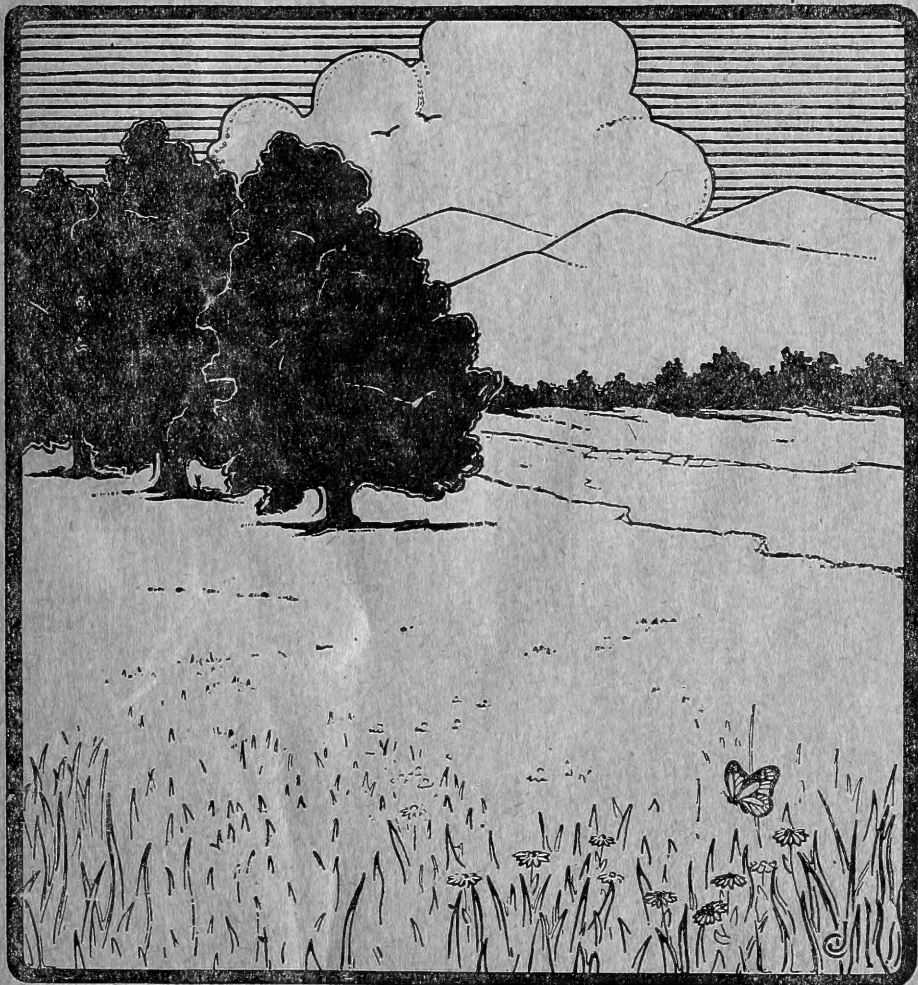
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OTTAWA, CANADA

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CONTENTS

	PAGE
A List of the Breeding Birds of the Athabasca District, Alberta. By T. E. Randall.....	1
A Study of the Home Life of the Northern Yellow-Throat, (<i>Geothlypis trichas brachidactyla</i>) By Henry Mousley.....	9
Some New Plant Records for Canada. By H. Groh.....	10
A New Species of Merychippus from the Miocene of Saskatchewan. By Lorin S. Russell.....	11
A Rare Find. J. H. C. Dempsey.....	12
The Genotype of Belemnites; with a Synopsis of North American Species of Belemnoida. By C. H. Crickmay.....	12
54th Annual Meeting, Ottawa Field-Naturalists' Club.....	15
Statement of Financial Standing, Ottawa Field-Naturalists' Club, at the close of the Year 1931- 1932.....	16
Book Reviews:—	
The Cowbirds. Robert D. Lockwood.....	17
Notes and Observations:—	
Announcements.....	22

The official publications of THE OTTAWA FIELD-NATURALISTS' CLUB have been issued since 1879. The first were *The Transactions of the Ottawa Field-Naturalists' Club*, 1879-1886, two volumes; the next, *The Ottawa Naturalist*, 1886-1919, thirty-two volumes; and these have been continued by *The Canadian Field-Naturalist* to date. *The Canadian Field-Naturalist* is issued monthly, except for the months of June, July and August. Its scope is the publication of the results of original research in all departments of Natural History.

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No. 1

A LIST OF THE BREEDING BIRDS OF THE ATHABASCA DISTRICT, ALBERTA

By T. E. RANDALL

HAVING now completed my fourth year in this district, during which time a considerable amount of oological and ornithological work has been accomplished, I think, perhaps the time has come when the results obtained should be passed on to other bird students in the hope that they will find therein something of value and interest. While I recognize the fact that four years is too short a time in which to make a complete list of the birds of a district, yet I believe that the following is sufficiently comprehensive to form a reliable guide to any ornithologist who may visit the Athabasca district in the future.

The district covered by this article comprises the country lying east and west of the Canadian National Railway between the towns of Athabasca (Athabasca Landing, 80 miles north of Edmonton, on the older maps), at the north and Rochester at the south, within fifteen miles of the railway. This country is very diversified in character, which accounts for the large number of species of birds to be found there. Muskeg areas are very extensive in the southern part of the district and heavy stands of black spruce and tamarack occur. Lakes are numerous and usually bordered by considerable areas of grassy bog. The numerous ridges are for the most part sandy and more or less thickly clothed with stands of jack pine, white spruce, aspen poplars, white birch and willow. In the northern half of the district the areas of muskeg are smaller, large patches of alder occur and on the west side the country is intersected by numerous deep coulees which at intervals widen out into small lakes. Throughout the entire district agricultural clearings are found and in some places are of large size. Owing to the fires that annually sweep large areas of bush land, large timber is found only in small isolated patches while much of the original timberland is now covered with low brush interspersed with numerous bare, blackened tree-trunks. These burned-over areas attract a large bird population

and are favourite breeding places for Lesser Yellow-legs, Nighthawks, Alder Flycatchers, White-throated Sparrows as well as those species which make use of old woodpecker holes for nesting purposes.

In some instances the concentration of birds in such areas is extraordinary. Thus in 1931, on 320 acres I found the following nests containing eggs or young:—Cedar Waxwing, 19; Alder Flycatcher, 18; Robin, 16; Clay-colored Sparrow, 15; Least Flycatcher, 8; Redstart, 10; White-throated Sparrow, 1; Brewer's Blackbird, 5; Meadow Lark, 1; Hermit Thrust, 2; Flicker, 4; Kingbird, 5; Vesper Sparrow, 2; Red-eyed Vireo, 5; Philadelphia Vireo, 3; Yellow Warbler, 6; Maryland Yellow-throat, 4; Catbird, 1; Goldfinch, 5—a total of 130 nests which were all found after June 15th. As at that time many broods of young had left the nest and many nests escaped my notice it is quite easy to realize how dense was the bird population of these two quarter sections.

During the four years spent in the district, I have personally recorded the occurrence of 206 species of birds, of which number 142 species nest within the boundaries of the district. Further work will undoubtedly result in the addition of a number of species to this list, especially if that part of the district lying north of the Athabasca River is included. So far I have not touched this area at all.

Unless otherwise stated or inferred, occupied nests or very juvenile young have been found in all the following species. The nomenclature is that of the A.O.U. Check-list of North American Birds, Fourth edition, 1931. As series of specimens are not available for comparison and few definite racial identifications from the locality have been made, the subspecies has been disregarded and only the specific binomial given. For geographic probabilities, the only other means of identification, the reader is referred to the above Check-list or other distributional publications.

Gavia immer, COMMON LOON.—Every muskeg lake has its pair of LOONS.

Colymbus grisegena, HOLBÖELL'S GREBE.—Breeds in considerable numbers on all our lakes.

Colymbus auritus, HORNED GREBE.—Common on small muskeg ponds and larger lakes alike, but nests in isolated pairs.

Colymbus nigricollis, EARED GREBE.—Small colonies are found on most of the larger lakes.

Aechmophorus occidentalis, WESTERN GREBE.—A few pairs nest on Baptiste Lake. Most of our lakes lack the reed beds that form the favourite nesting grounds of this bird.

Podilymbus podiceps, PIED-BILLED GREBE.—Not common. A few pairs nest in the rush-covered margins of our lakes.

Ardea herodias, GREAT BLUE HERON.—Three pairs nest at one place in the district.

Botaurus lentiginosus, AMERICAN BITTERN.—Fairly common throughout the whole district.

Branta canadensis, CANADA GOOSE.—A few pairs still nest near some of our more isolated lakes, also on the gravel bars of the Athabasca River.

Anas platyrhynchos, MALLARD.—Common everywhere in the district.

Chaulelasmus streperus, GADWALL.—This duck, plentiful a few years ago, is now quite rare. During the shooting season of 1931, the writer saw but two birds of this species.

Mareca americana, BALDPATE.—Fairly numerous on the larger and deeper lakes. As the nest is always under cover of bushes, they are not rifed by crows as often as are the nests of Mallard, Pintail and other species that nest in the open grass lands.

Dafila acuta, AMERICAN PINTAIL.—Fairly common throughout the district.

Nettion carolinense, GREEN-WINGED TEAL.—Another once plentiful duck that is disappearing at an alarming rate. In 1931 the writer failed to discover a single nest or bird.

Querquedula discors, BLUE-WINGED TEAL.—Unlike the last-named, the Blue-wing appears to be increasing in numbers. Certainly in 1931 they were more numerous than in any previous year in my experience.

Spatula clypeata, SHOVELLER.—Another duck that was unusually numerous in 1931. Breeds in fair numbers on all the lake marshes.

Nyroca americana, REDHEAD.—Breeds in considerable numbers in the marshy area at the south end of Flat Lake. A few pairs are found on the other lakes of the district.

Nyroca collaris, RING-NECKED DUCK.—A duck of the muskeg ponds. The nest is invariably

placed in a clump of grass overhanging water.

Nyroca valisineria, CANVAS-BACK.—Every fair-sized lake has one or more pairs of Canvas-backs. They nest early and have all gone south by the beginning of September.

Nyroca affinis, LESSER SCAUP.—Abundant wherever lakes are bordered by rough grass-land.

Glaucionetta clangula, AMERICAN GOLDENEYE.—Common throughout the district, nesting in hollow stumps or old woodpecker holes, often a mile from water. A nest found by me contained 23 eggs.

Charitonetta albeola, BUFFLEHEAD.—Quite common. The nest in a hollow tree is never very far from water.

Melanitta deglandi, WHITE-WINGED SCOTER.—Common. The eggs are laid about the end of June. The nest is often at a considerable distance from water.

Erisimatura jamaicensis, RUDDY DUCK.—Common on all lakes that are bordered by a thick growth of tules or reeds. Another late breeder.

Astur atricapillus, AMERICAN GOSHAWK.—Fairly common. The only hawk that spends the entire year with us.

Accipter velox, SHARP-SHINNED HAWK.—Not plentiful but evenly distributed over the district.

Buteo borealis, RED-TAILED HAWK.—Common in all parts of the district.

Buteo platypterus, BROAD-WINGED HAWK.—Only a few pairs of Broad-wings use our woods for nesting. We lack the groves of large aspen poplar that form their favorite nesting grounds.

Circus hudsonius, MARSH HAWK.—Fairly common. Although the adults do little harm, the immature birds prey largely upon the young of ducks and Black Tern late in the summer.

Pandion haliaëtus, OSPREY.—Occasionally seen during the spring and summer. A pair used to nest at Baptiste Lake and it is likely that one or two pairs nest near the more isolated lakes in the western part of the district.

Falco peregrinus, PEREGRINE FALCON.—One or two pairs nest on the steep banks along the Athabasca River.

Falco sparverius, AMERICAN SPARROW HAWK.—Common throughout the district, nesting in old woodpecker holes.

Canachites canadensis, SPRUCE GROUSE.—Fairly common in the muskeg areas.

Bonasa umbellus, RUFFED GROUSE.—At the time of writing (April, 1932), our three grouse are probably at their peak of abundance. The present species is plentiful everywhere and one may encounter from eighty to one hundred birds

in a day's walk through the woods.

Pedioecetes phasianellus, SHARP-TAILED GROUSE.—Abundant throughout the district.

Perdix perdix, EUROPEAN PARTRIDGE.—This imported species has spread rapidly throughout the district and is a very welcome addition to the ranks of our game birds.

Grus canadensis, SANDHILL CRANE.—I have discovered the nesting place of only one pair of Cranes in this district. It is in the midst of a very large muskeg area.

Porzana carolina, SORA RAIL.—Abundant and breeding on any small or large marshy area.

Coturnicops noveboracensis, YELLOW RAIL.—I have flushed the Yellow Rail from tough patches of grassy muskeg on two occasions. As this was in the first half of June it is practically certain that they were nesting.

Fulica americana, AMERICANA COOT.—Abundant on all the larger lakes.

Oxyechus vociferus, KILLDEER PLOVER.—Abundant everywhere. Scarcely a farm in the district that does not provide a nesting place for at least one pair.

Capella delicata, WILSON'S SNIBE.—Plentiful on all the muskegs and lake marshes.

Bartramia longicauda, UPLAND PLOVER.—Probably not more than half a dozen pair nest in the whole district.

Actitis macularia, SPOTTED SANDPIPER.—Plentiful on lake and river alike. In 1930 I flushed a bird of this species from a Bronzed Grackle's nest eighteen feet from the ground in the top of a poplar stump. The nest contained four eggs.

Tringa solitaria, SOLITARY SANDPIPER.—This interesting Sandpiper is by no means common in this district. However a few pairs are always to be found in the muskegs, always nesting near the edge of a small pond.

Totanus melanoleucus, GREATER YELLOW-LEGS.—Not common but nests on all the larger areas of muskeg in the district. All nests found by me have been on a hummock of moss in the muskeg, whereas the next species nests almost invariably upon the dry ridges.

Totanus flavipes, LESSER YELLOW-LEGS.—Common throughout the district. Like the preceding species it often lays eggs during the last few days of April.

Limnodromus griseus, DOWITCHER.—I know of several places in the district where the species nests. Two or three nests will often be found within an area of a few square yards.

Steganopus tricolor, WILSON'S PHALAROPE.—Common and breeding in small colonies wherever lake marshes occur.

Larus philadelphia, BONAPARTE'S GULL.—One or two pairs of this gull are to be found on almost every muskeg pond and lake. The nest of lichens is placed on a branch of a spruce or tamarack usually within a few yards of water but sometimes as much as a mile from the lake. Although Herring, Ring-billed and Franklin's Gulls and Common Tern are present during the whole spring and summer, I have not yet discovered a breeding place of either species. I think however that there are lakes a few miles north where they nest.

Chlidonias nigra, BLACK TERN.—Abundant everywhere and breeding wherever found.

Coccyzus erythrophthalmus, BLACK-BILLED CUCKOO.—In July, 1931, the writer observed a bird of this species flying through the town of Athabasca and, after a short search, discovered the nest containing young birds in some bushes on the outskirts. Thus the known breeding range of the species in Alberta has been extended northwest about 250 miles.

Bubo virginianus, GREAT HORNED OWL.—Our commonest owl, breeding in all parts of the district.

Surnia ulula, AMERICAN HAWK OWL.—Not plentiful. A few pairs breed in suitable places.

Scotiaptex nebulosa, GREAT GRAY OWL.—Scarce, but a few breed here.

Asio wilsonianus, LONG-EARED OWL.—Quite rare, but a few pairs nest in the southern part of the district.

Asio flammeus, SHORT-EARED OWL.—Much more common than the preceding species.

Cryptoglaux funerea, RICHARDSON'S OWL.—Another rare owl that nests in the district.

Cryptoglaux acadica, SAW-WHET OWL.—Rather more plentiful than the two preceding species but not common.

Chordeiles minor, NIGHTHAWK.—Common, nesting in numbers in the burned-over areas.

Archilochus colubris, RUBY-THROATED HUMMINGBIRD.—Each year I encounter a number of Hummingbirds, sometimes deep in the poplar bush, more often in the flower gardens of farmers. I have not so far discovered a nest but there is no doubt about their nesting here.

Megaceryle alcyon, BELTED KINGFISHER.—Not numerous, but found nesting along the rivers and creeks.

Colaptes auratus, YELLOW-SHAFTED FLICKER.—Common and nesting everywhere throughout the district.

Ceophloeus pileatus, PILEATED WOODPECKER.—This large woodpecker is still fairly common in this district but frequent fires and advancing settlement are rapidly depriving it of suitable

nesting trees.

Sphyrapicus varius, YELLOW-BELLIED SAP-SUCKER.—Common and breeding throughout the district.

Dryobates villosus, HAIRY WOODPECKER.—Common everywhere and resident throughout the year.

Dryobates pubescens, DOWNY WOODPECKER.—Not as plentiful as the preceding species and is partially migratory, since it is less plentiful in winter than in the breeding season.

Picoides arcticus, ARCTIC THREE-TOED WOODPECKER.—Fairly common in the muskegs and coniferous woods.

Picoides tridactylus, AMERICAN THREE-TOED WOODPECKER.—Rather more plentiful than the last named.

Tyrannus tyrannus, EASTERN KINGBIRD.—Common. In this district the nest is almost invariably placed on a stump, usually about five feet from the ground.

Sayornis phoebe, EASTERN PHOEBE.—Common and nesting in suitable places throughout the district.

Sayornis saya, SAY'S PHOEBE.—A few pairs remain with us to nest. An old, isolated building is the usual nesting place.

Empidonax flaviventris, YELLOW-BELLIED FLY-CATCHER.—Our rarest flycatcher. Breeding pairs are few and far between.

Empidonax trailli, TRAILL'S FLYCATCHER.—Plentiful wherever areas of short willow brush are found. Does not nest until July.

Empidonax minimus, LEAEST FLYCATCHER.—Very common.

Myiochanes richardsoni, WESTERN WOOD PEWEE.—Common and breeding wherever found.

Nuttallornis mesoleucus, OLIVE-SIDED FLY-CATCHER.—Common. Wherever a clump of large spruce grows, there will a pair of Olive-sided Flycatchers be found.

Otocoris alpestris, HORNED LARK.—So far no Horned Larks have been found nesting but the species is a common migrant.

Iridoprocne bicolor, TREE SWALLOW.—Common and usually associated with the Purple Martin but usually occupying lower holes in the dead stubs.

Riparia riparia, BANK SWALLOW.—One or two small colonies of Sand Martins nest in the district.

Petrochelidon albifrons, CLIFF SWALLOW.—A few small colonies are located within the district, the nests in each case being built under the eaves of farm buildings.

Progne subis, PURPLE MARTIN.—Fairly common in the burned-over areas, where the bare poles

afford them nesting sites. The nest is always high up.

Perisoreus canadensis, CANADA JAY.—Common, especially in the muskeg regions.

Cyanocitta cristata, BLUE JAY.—Fairly numerous in the vicinity of small towns but not often seen in the remoter parts of the district.

Pica pica, AMERICAN MAGPIE.—A bird that comes to us from the south to spend the winter. Only one or two pairs remain here to breed.

Corvus brachyrhynchos, AMERICAN CROW.—Only too common everywhere.

Penthestes atricapillus, BLACK-CAPPED CHICKADEE.—Abundant in many places. The nest is almost invariably in a hole in a dead birch tree.

Penthestes hudsonicus, BROWN-HEADED CHICKADEE.—Quite common on the muskegs and spruce woods. The nest is almost invariably in a hollow spruce stump.

Sitta canadensis, RED-BREASTED NUTHATCH.—Fairly common. A nest found in 1931 was forty-five feet from the ground in a live poplar.

Troglodytes aedon, HOUSE WREN.—Quite common. Usually nesting in hollow stumps in the woods, sometimes in farm buildings.

Nannus hiemalis, WINTER WREN.—On May 12th, 1932, I found a Winter Wren in a grove of spruce on the edge of a large muskeg. This bird was seen and heard at various times throughout the summer. Another bird was found on the edge of a muskeg about three miles from the first. Although in each case I failed to discover a female or nest, it is most probable that the birds were nesting.

Telmatodytes palustris, LONG-BILLED MARSH WREN.—Not common. A few pairs nest in the tules around the edges of the larger lakes.

Dumetella carolinensis, CATBIRD.—In 1931, I found a nest containing young in the northern part of the district.

Turdus migratorius, AMERICAN ROBIN.—Abundant everywhere.

Hylocichla guttata, HERMIT THRUSH.—Rather more plentiful than the Olive-backed. A bird of the high, dry woods.

Hylocichla ustulata, OLIVE-BACKED THRUSH.—A fairly common species in the muskeg areas.

Sialia corrucoides, MOUNTAIN BLUEBIRD.—Found in fair numbers throughout the district in both muskeg and dry woods.

Corthylio calendula, RUBY-CROWNED KINGLET.—Common in the muskegs. Its beautifully constructed nest is not easy to find as it is usually well hidden amid the lichen-coated spruce boughs.

Anthus spraguei, SPRAGUE'S PIPIT.—A few pairs nest on open, grassy areas of muskeg in the northern part of the district.

Bombycilla garrula, BOHEMIAN WAXWING.—This elusive bird nests in the district every year but always in a different spot. Usually several pairs nest in the same small patch of muskeg.

Bombycilla cedrorum, CEDAR WAXWING.—One of our commonest birds. Nesting in July, they often colonize to such an extent that from twelve to twenty nests may be found on a quarter section.

Vireo solitarius, SOLITARY VIREO.—Like the Warbling Vireo this species is quite rare in this district.

Vireo olivaceus, RED-EYED VIREO.—Common in the birch woods throughout the district.

Vireo philadelphicus, PHILADELPHIA VIREO.—Fairly numerous. All the nests discovered by me have been in fairly tall alder trees, about eighteen feet from the ground.

Vireo gilvus, WARBLING VIREO.—A few pairs nest in the southern part of the district.

Mniotilta varia, BLACK AND WHITE WARBLER.—Fairly common in the wetter parts of the bush.

Vermivora peregrina, TENNESSEE WARBLER.—Quite common throughout the district, except in the muskegs.

Vermivora celata, ORANGE-CROWNED WARBLER.—Like the Black and White Warbler, this bird prefers the damp places.

Dendroica aestiva, YELLOW WARBLER.—Common everywhere.

Dendroica coronata, MYRTLE WARBLER.—Common. A warbler of the muskeg areas.

Dendroica striata, BLACK-POLL WARBLER.—Several pairs of this species were observed throughout the breeding season of 1932 and a male was collected on June 25th. I failed to find a nest but on July 15th young birds were seen still taking food from the parents.

Dendroica pinus, PINE WARBLER.—In 1928, I found several pairs of this warbler near the eastern part of the district. They were found in isolated clumps of large spruce and were undoubtedly nesting. Dr. Oberholser, who was staying with me for a few days, confirmed my identification of the birds.

Dendroica palmarum, PALM WARBLER.—Not common, but nesting pairs may be encountered at widely separated points in the muskegs.

Seiurus aurocapillus, OVENBIRD.—A few pairs nest in the poplar woods in the southern part of the district.

Seiurus noveboracensis, NORTHERN WATER-THRUSH.—In May, a large number of Water-thrushes migrate through the district, and a few remain to nest.

Oporornis agilis, CONNECTICUT WARBLER.—I know of half a dozen places in the district where this rare warbler may be found in the nesting season.

Oporornis philadelphia, MOURNING WARBLER.—Fairly common in poplar woods where the undergrowth and wind-falls are densest.

Geothlypis trichas, YELLOW-THROAT.—Quite common throughout the district.

Setophaga ruticilla, AMERICAN REDSTART.—Common, nesting in the willow thickets throughout the district.

Passer domesticus, ENGLISH SPARROW.—Common in town and country alike.

Sturnella neglecta, WESTERN MEADOWLARK.—A bird that is extending its range as the land comes under cultivation. Fairly common.

Xanthocephalus xanthocephalus, YELLOW-HEADED BLACKBIRD.—A few pairs nest on the lakes having beds of reeds.

Agelaius phoeniceus, RED-WINGED BLACKBIRD.—Common on almost every lake and tule-fringed pond.

Icterus galbula, BALTIMORE ORIOLE.—Athabasca must be near the northern limit of range of this species. A few pairs are found scattered throughout the district.

Euphagus carolinus, RUSTY BLACKBIRD.—Common, breeding in colonies on the muskeg.

Euphagus cyanocephalus, BREWER'S BLACKBIRD.—Common, nesting almost invariably on the ground.

Quiscalus quiscula, BRONZED GRACKLE.—Not as common as the two preceding species. Usually found nesting in the tules in company with Red-wings whose nests it systematically robs of eggs.

Molothrus ater, COWBIRD.—Common everywhere.

Piranga ludoviciana, WESTERN TANAGER.—Quite common. Usually found associated with the Olive-sided Flycatcher.

Hedymeles ludovicianus, ROSE-BREASTED GROSBEAK.—Fairly common. A bird of the birch woods.

Hesperiphona vespertina, EVENING GROSBEAK.—Fairly common in winter and a few pairs remain with us in spring, undoubtedly to breed.

Carpodacus purpureus, PURPLE FINCH.—Common. Nest usually placed in extreme tip of spruce tree.

Acanthis linaria, COMMON REDPOLL.—A few pairs of Redpolls undoubtedly nest in the district. In 1931 a farmer, living near Baptiste Lake, accurately described a pair that had a nest in a willow bush on his farm.

Spinus tristis, AMERICAN GOLDFINCH.—Common.

Nests in July, invariably placing its nest in the fork of an alder stem.

Passerculus sandwichensis, SAVANNA SPARROW.—Not plentiful, but present on all fairly large expanses of grass-land.

Passerherbulus caudacutus, LECONTE'S SPARROW.—Plentiful alike in muskeg and lake marsh.

Poocetes gramineus, VESPER SPARROW.—Common. Prefers the road-sides for nesting.

Junco hyemalis, SLATE-COLORED JUNCO.—Very common. Nests in the muskegs or on the higher land alike.

Spizella passerina, CHIPPING SPARROW.—Common in all muskeg areas.

Spizella pallida, CLAY-COLORED SPARROW.—Plentiful throughout the district.

Zonotrichia albicollis, WHITE-THROATED SPAR-

ROW.—Very common. Nests in all parts of the district.

Passerella iliaca, FOX SPARROW.—A few pairs nest in suitable spots throughout the district. I have found young birds on two occasions.

Melospiza lincolni, LINCOLN'S SPARROW.—Plentiful in the muskeg areas.

Melospiza georgiana, SWAMP SPARROW.—A sparrow of the swampy, grassy coulees. The nest is always raised from the ground, sometimes as much as two feet.

Melospiza melodia, SONG SPARROW.—Very common. While the nest is usually placed on the ground, another favourite site is the branches of a fallen spruce.

* This list was written in April, 1932 since when two species, Winter Wren and Black-poll Warbler have been added.

A STUDY OF THE HOME LIFE OF THE NORTHERN YELLOW-THROAT (*Geothlypis trichas brachidactyla*)¹

By HENRY MOUSLEY



IN THIS, my eighteenth intensive study of the home life of birds—principally Warblers—I feel somewhat like the man accused of murder in the second degree, for I could very easily have prevented the happenings—presently to be related—had I been so minded, instead of allowing nature to take its own course, perhaps, after all, the wisest thing to do, as a rule, instead of meddling in affairs, the ultimate results of which in most cases we can neither foresee, nor correctly estimate.

Some insight to the foregoing remarks may be gathered from Volume II, page 422, of the *Birds of Massachusetts*, by the late E. H. Forbush, wherein he says, "The saddest part of the life history of the Cowbird is that the introduction of its egg or eggs into the nests of smaller birds usually dooms the eggs or young of their foster-parents", as was the case in the present study, for the nest of the Northern Yellow-throat—a very common host—contained a Cowbird's egg, which I, knowing full well the probable consequences, yet allowed to hatch out, in the hope of obtaining a series of pictures representing the daily development of a young Cowbird (*Molothrus ater ater*) which I was most anxious to secure—to augment those already figured in Friedman's splendid *Monograph of the Cowbird*,² as well as to make a study of the home life of the host, the Northern Yellow-throat (*Geothlypis trichas brachidactyla*) to compare with

that made by Miss Shaver at Lake Okobogi, Iowa, in 1917.³

The present nest was found near Snowden, a suburb of Montreal, on June 11th of the past year (1931), and at that date contained two eggs of the owner and one of the Cowbird, apparently about 3 or 4 days incubated, the flushing of the sitting female leading to its discovery. It was situated at the foot of two small willow bushes near the outskirts of a large cat-tail bed, being well concealed amongst the rank herbage, the foundation being composed of dried leaves, coarse shreds of cat-tail and grass stems, while the lining consisted of fine grasses only. The dimensions were as follows, viz.: Outside diameter 3¼", inside 1¾", outside depth 3¼", inside 1½". It was not until early on the 19th that the Cowbird's egg hatched out, together with one of the owner's, the other later on proving to be infertile. Pictures of very young birds are usually disappointing and not very pleasant to look at, but I took a few on this date, not repeating the procedure again until the 22nd, after which they were taken regularly each day until the 28th, the date upon which the young Cowbird left the nest, it being then nine days old.

On arrival at the site at 9 a.m. on the 19th, the female was brooding, but slipped off mouse-like from the nest when preparations were commenced for photographing the young, both of which were blind and nearly naked, except for a tuft of mouse-

¹ Read before the Province of Quebec Society for the Protection of Birds, Montreal, October 19, 1931 (illustrated.)

² Friedman, Herbert, 1929. The Cowbirds, a Study in the Biology of Social Parasitism.

³ Shaver, Nelle E. A Nest Study of the Maryland Yellow-throat, University of Iowa Studies, 1st series No. 23, Dec. 1918.

coloured down (neossoptiles) on each side of the head, and some on the wings, which can be seen in one of the pictures of the young Cowbird lying on its belly—the skin of which was very thin and transparent—with the head resting on the floor of the nest, this attitude being said by Friedman to be characteristic of early infancy. The egg tooth of the Cowbird was also plainly visible, not in this, but in another picture. Even at this early stage, it was easy to see which of the two young birds was getting the most food, for whenever I imitated the call of the old birds—useless of course in the case of the young parasite, since it would be unfamiliar with any notes of its foster-parents—or touched either of them, it was always the warbler who responded with wide open mouth, begging for food, never once the Cowbird, although the latter kept up a nervous twitching of its body whenever anything touched it, suggestive of its desire to eject the offending obstacle, and reminding me of the same evicting instinct in the European Cuckoo (*Cuculus canorus*).

On the 22nd, or third day, when I arrived, the female was again brooding, but slipped away as before on my near approach to the nest. The eyes of the young, although smaller, were still covered over, but the sheaths of all the primaries, secondaries, and tertiaries, had pierced the skin, and were now plainly visible, with a very narrow ridge of feather sheaths also extending down the entire length of the back. Except for this, the rest of the back, sides, head, and underparts, were entirely bare, with the exception of the patches of down (neossoptiles) on the head and wings, mentioned on the 19th, which were still there. The young Cowbird had now assumed a sitting posture, with its head off the floor, and resting against the rim of the nest, the inside of the mouth being of a bright red colour, while the gape of the bill—somewhat swollen at the angle—was white, this latter in the Warbler being of a yellow colour, and the inside of the mouth a much paler red than that of the Cowbird. In both cases the mouth cavity contained a few white spots, or pads, but these did not appear to be arranged as systematically as in the case of a young Cuckoo (*Coccyzus erythrophthalmus*) for instance, although judging from some of the photographs of the young Cowbird, two spots can generally be seen at the base of the tongue, one at the tip and one on each side of the palate near the angle of the gape. No reference, if I remember rightly, is made by either Friedman or Shaver to these spots or pads, although a few can be detected in one of Friedman's plates, No. XXII I think, but more especially in the frontispiece.

The young Cowbird was even more sluggish

than on the 19th, a clear proof that it had been well fed before my arrival, while my slightest movement produced a feverish excitement on the part of the young Warbler, which literally pleaded for food with gaping mouth and upstretched neck, which, to say the least of it, was somewhat disconcerting.

Arriving at 9 a.m. the day following, the 23rd, found the female brooding as usual. The eyes of the young Cowbird were now partly open, as were those of the Warbler, this being the fourth day and the same period of time as that upon which Miss Shaver's Cowbird obtained its sight, and which Friedman states is the time when the eyes usually begin to open. The narrow ridge of feather shafts down the back was becoming more pronounced, as were all the wing sheaths, while the colour of the mouth and gape, in each case, seemed brighter—if anything. Having secured the day's "progress" pictures of the young Cowbird, I decided to take some of the parents feeding the young. A narrow lane was therefore made through the cat-tails, some 25 feet in length, at the end of which I sat in full-view of the nest, with the shutter release close at hand attached to the stem of a tall cat-tail. During the two and one-half hours I remained with the birds, the young were fed nineteen times, nine by the male and ten by the female, both birds giving notice of their approach to the nest by a little chirp which later on they seemed to discontinue, at least I did not notice if after the death of the young Warbler. It was more than evident, however, on this and the following day, which youngster was again getting the bulk of the feedings, for out of twenty-three pictures obtained, only one actually shows the young Warbler being fed, and this by the female, all the others depicting it with wide open mouth, receiving no attention whatever, all the food going down the capacious maw of the young Cowbird, who now about filled the nest.

On two occasions both parents arrived at the nest together, feeding at one and the same time, it being my good fortune to secure pictures of both events, for at no subsequent sitting was the procedure repeated. Pictures of the parents removing the faecal sac were also obtained, not only on this, but on other occasions, as well.

If, on previous visits—as already mentioned—the sight of the helpless young Warbler was disconcerting, it was now becoming positively distasteful, for each time a picture was taken of the parents at the nest, and it became necessary to reset the shutter, the same scene always presented itself, that of a lazy, well-fed and fast-growing young Cowbird, now occupying more than two-thirds of the nest, whilst the rightful occupant

was being crowded out and starved to death, at least until I chose to intervene, which I had almost a mind to do. However, having gone so far, and for the reasons already given, I decided to carry on to the bitter end, and so refrained from strangling that young Cowbird on the spot.

On arrival at the nest the next morning, the 24th, or fifth day, the female was not brooding, nor did I catch her in the act again during subsequent visits in the daytime, although she may have brooded at night, which was the case with Miss Shaver's bird. The sheaths of the retrices of the Cowbird's tail were now beginning to show, and, although very small, the egg tooth also—as well as that of the Warbler—was still visible, but had entirely disappeared by the following, or sixth, day. The young interloper was again drowsy, apparently having recently been fed, while the young Warbler was evidently starving, thrusting up its head and opening its mouth at the least sound. During the two and one-half hours I was at the nest, the young were fed thirteen times, six by the male and seven by the female, the greater bulk of the food, not only on this but on previous and subsequent visits, as well, consisting of soft green caterpillars, interspersed with various kinds of moths, flies, beetles, and plant lice, etc., which the birds invariably obtained in an easterly direction within a hundred yards or so of the nest—which, as already stated, was situated in a bed of cat-tails (*Typha latifolia*), amongst which was a great profusion of Bindweed or Wild Morning Glory (*Convolvulus sepium*), Lance-leaved Goldenrod (*Solidago graminifolia*), Rough Bedstraw (*Galium asprellum*), and Cow Vetch (*Vicia Cracca*), interspersed with a number of willow bushes, and it was from this environment that the parents gathered their food supply.

What with the heat and the very insufficient food supply of the past few days, it became painfully evident—before I left—that the young Warbler was not going to hold out much longer. Greatly to my relief this proved to be the case, for on arrival the next morning, the 25th, no trace of it could be found anywhere and I could only surmise—since we have no definite knowledge at present on this subject—that it had been ousted from the nest by the young Cowbird—one photograph in particular suggesting this—and later carried away by some outside agent—if not by the parents themselves—one more example of inexorable fate, for I consider the survival of Miss Shaver's two Warblers to be exceptional indeed, especially as the Cowbird's egg hatched out a day before the Yellow-throat's, thus giving the young parasite a considerable advantage, to say nothing of its being larger to begin with.

Up to the present time the male had fed the young almost as often as his partner, but on this occasion his efforts in this direction fell off considerably, not much more than halving those of the female, who fed four times in succession before he made an effort to do so. He accompanied her, however, in her foraging expeditions, keeping up an incessant chipping and occasionally singing, but this latter, always at some distance from the nest. On one occasion, when quite close to me, he tried to take the food away from his partner. It might here be mentioned that neither bird from the commencement showed any great fear of the camera, in fact often using the legs of the tripod to perch on when going to or coming from the nest. My presence also did not seem to cause them much uneasiness, except that the male on my arrival each day would often do some scolding, at times making use of a peculiar—and I find seldom described—long drawn-out snarl, to vent his displeasure at my intrusion.

It was usually not long, however, before he and his partner were gathering food all around me, on many occasions not more than two feet away. They certainly are captivating little birds, with their wren-like ways, so uncommon in a Warbler, the male on account of his more attractive plumage, probably being the greater favourite of the two as well as the more often seen. From the data obtained to-day, and on other occasions, it would seem as if the young Cowbird muted only after every third feeding. The sheaths of the wing feathers were now seen to be opening a little, but the egg tooth—as already mentioned—was no longer visible.

The day following, the 26th, or seventh day, was very hot and sunny, and it soon became necessary to adopt other methods than the usual one for obtaining pictures, one of which was to put a cloth over the exposed nest while the parents were away gathering food, and then removing it when I heard or caught sight of them returning. The other method was as follows, *i.e.*, up to this time, and, in fact, to the very last, both birds always approached the nest from the rear, usually perching on the stems of the two small willows, and then letting themselves down to the nest which lay at their base. Now it struck me that if instead of temporarily covering over the nest with the cloth, I were to do it permanently with the natural surrounding herbage—the same as I did every day when leaving—some very pleasing pictures might be obtained of the parents approaching the nest. To secure these it became necessary of course to move the camera somewhat further back, making the willow stems the focussing point instead of the nest. Both of these methods

worked very well, the latter especially giving me a series of seven pictures from a different view point, which included not only the birds—of course on a smaller scale—but much also of the nest surroundings. As on the previous day, it was the female which commenced feeding operations, doing so three times in succession before the male participated, when he also fed the same number of times in succession, during the hour I was at the nest. Both birds kept up an almost incessant chipping, ceasing, however, when approaching the nest—as already mentioned. Not only was there a marked increase in the opening of the wing sheaths, but most of the other tract sheaths also showed signs of this, with the exception of those on the forehead. On arrival the next day, the 27th, it was again very hot, and on my commencing to open up the nest for photographing purposes, the young Cowbird muted, a pretty sure sign that the instinct of fear was now rising. The behaviour of both parents was similar to that of the day previous, except that the male in the present instance left all the feeding to his partner, who fed five times in succession during the hour I was with them. The addled egg I noticed was still in the nest and in full view of both parents, but neither on this or any previous occasion, when it happened to become exposed, had either of them attempted to remove it. With regard to this matter, Miss Shaver relates that her male bird removed the addled egg, but proceeds to quote other instances in which the addled egg remained in the nest throughout the brooding period—as in my case. Continuing, she says the question arises then, as to what is the common practice of birds towards a foreign or addled egg? Friedman says (p. 195) that the great majority of birds do not seem to mind the Cowbird's eggs if they have some of their own at the time, whilst Leverkühn, who has tabulated all the experiments made up to his time on the behaviour of birds towards foreign eggs, placed in their nests, found that these intrusive objects were received and brooded about as frequently as they were destroyed, or abandoned together with their own proper eggs. His tables embrace 222 species and include 406 cases where definite results were noted.

As regards addled eggs, I can find little or no literature on the subject, but am inclined to think that very often—unless accidentally broken—they remain in the nest to the end, my reasons for this assumption being the finding in recent years of quite a number, not only in the Summer, but in the Fall, and early Spring as well, in nests which at the time were, or from their condition later had

evidently been, the home of a brood of young birds. However, much further intensive work will be necessary before anything definite can be said regarding the actual fate of these eggs, which at present, I believe, the parents are generally supposed to remove, but did not do so in my case—as already mentioned.

From its behaviour to-day I was quite prepared for what took place on the morrow, the 28th, for on my arrival at the site, the young Cowbird again muted, but this time immediately left the nest, it being now nine days old, the time at which, or perhaps a day later, they almost invariably leave their home. After its replacement in the nest, I succeeded in securing only three more pictures, one showing the general opening of all the sheaths, also how very short and small the tail is at this stage, another the two tufts of down (neossophtiles) still present on the head, whilst the third and last—after the bird had again left the nest—depicts it perched on a willow twig, the streaks of the juvenal plumage on the underparts, together with the down at the distal ends of some of the head feathers being plainly visible, as well as the general bareness of the space around the eyes and chin. It could only fly a little and was easily caught again.

Altogether I had spent twenty hours at the nest, nine of which had been devoted to intensive watching, during which period the young—to all intents and purposes the Cowbird—had been fed fifty-four times, 22 by the male and 32 by the female, or at the rate of once in every ten minutes, as against once in every seven and one-half minutes for Miss Shaver's Cowbird, over a period nearly eleven times that of mine.

The nest was kept very clean as in Miss Shaver's case, who records that the female would pick into it vigorously—this only at an early period—sometimes nearly standing on her head in her efforts, the observer wondering if this behaviour could be for the purpose of securing ventilation. If my experience is anything to go by, I would suggest that the bird was not endeavouring to secure ventilation, but possibly trying to rid the nest of grubs that had hatched out in the materials forming its base, as was the case with a Chestnut-sided Warbler (*Dendroica pensylvanica*) which I was studying at Hatley in 1921, the bird in that case, also, nearly standing on her head in her efforts to get rid of some grubs which I found were hatching out in the stem of a raspberry cane passing through the base of the nest. In conclusion the appended table—as in previous studies—summarises the principal happenings at the nest.

TABLE OF SUMMARIES

SPECIES	Period of Observation	Hours	Number of Times Fed by		Times Faeces Removed by		Times Faeces Eaten by	
			Male	Female	Male	Female	Male	Female
Northern Yellow-throat.	June 19-22							
	23	2½	9	10	1	0	0	1
	24	2½	6	7	1	0		
	25	2	4	7	0	3		
	26	1	3	3	1	1		
	27	1	0	5	0	1		
	28		0	0	0	0		
Totals		9	22	32	3	5	0	1

Average rate of feeding once in every ten minutes.
Total time spent at the nest = 20 hours.

SOME NEW PLANT RECORDS FOR CANADA

By H. GROH

RANGE IN CANADA OF OENOTHERA CRUCIATA

PRIOR TO 1921 *Oenothera cruciata* Nutt. had been collected on Sable Island by J. Macoun and H. St. John. In July, 1928, a specimen was received from Blythe Hurst, Sr., Brackley Beach, P.E.I., with a note indicating that it was present in field and lawn. It was next collected in the course of field work of the Division of Botany on July 16, 1930, at Moncton, N.B., where it was growing on a roadside. Finally, it was observed in some numbers along railway sidings at Bromptonville, Que., on August 29, 1932. Specimens from the latter three stations are in the Herbarium of the Division of Botany, Central Experimental Farm, Ottawa. Thus the United States range is pretty well paralleled on this side of the border by records from each of the four eastern provinces.

LOPSEED AT ITS WESTERN LIMITS

WHILE visiting the farm of Mr. Alexander Murray, Graysville, Man., in company with Messrs. Wright, Foulds and Burke, of the Dominion Seed Branch, on July 18, 1932, young plants, believed to be lopseed (*Phryma leptostachya* L.) were found scattered all through a fine piece of woodland on the property. Flowering and fruiting specimens sent to the Central Experimental Farm by Mrs. Murray served to confirm this tentative determination. The only previous western Canadian records are those of J. Macoun, 1896, and H. Groh, 1921,

both from Morden, which is about twenty miles south and short of this newly located frontier for an interesting native plant.

PLANTAGO RAMOSA IN CANADA

THROUGH the kindness of Dr. M. O. Malte, National Museum, Ottawa, in making available for the Canadian Weed Survey the information that he had received and identified a specimen of *Plantago ramosa* (Gilib.) Aschers. from Toronto, Ontario, where it was found in considerable amount by Mr. H. H. Brown, the true identity of two other specimens of the same weed collected this summer has been revealed. One of these was obtained by the writer from sandy reclaimed waterfront at Pointe aux Trembles, adjoining Montreal, Que., on August 30, 1932, and the other by Mr. W. G. Dore, from a dump on Bayswater Ave., Ottawa, Ont., on September 12, 1932.

It has been previously reported from Dayton, Ohio, Lancaster County, Pa., Ithaca, N.Y., and doubtless elsewhere by now, since two of these records had secured a place for it already in Britton and Brown's Illustrated Flora, 1913 edition. Its native home is in Central Europe, and its habitat is the sandier type of land, entitling it to the popular name of sand plantain. The plants are readily distinguishable from any other plantains occurring in America, by their branching rather than scapose habit, and the cauline, narrow, whorled leaves. It is an annual, propagated by the seeds, which are believed to have come in clover seed from Europe.

A NEW SPECIES OF MERYCHIPPUS FROM THE MIOCENE OF SASKATCHEWAN¹

By LORIS S. RUSSELL

THE DISCOVERY of a Miocene mammalian fauna in southern Saskatchewan is the work of Mr. C. M. Sternberg², of the Geological Survey of Canada. Sternberg proposed the name Wood Mountain gravels for the formation containing these fossils. The specimens were identified by Dr. G. G. Simpson, of the American Museum of Natural History.

In 1930 and 1931, field parties of the Geological Survey of Canada, under Dr. F. H. McLearn, obtained additional specimens of the Wood Mountain fauna. Several teeth among this new material apparently represent an undescribed species of *Merychippus*, and these form the subject of the present paper.

Order PERISSODACTYLA
Family EQUIDAE

Genus *Merychippus* Leidy
Merychippus præcocidens, sp. nov.

Figs. 1-3

Type. National Museum of Canada, No. 8624; right M³, from Wood Mountain gravel in section 13, township 4, range 3, west of 3rd meridian, near Wood Mountain, Saskatchewan, Canada; F. H. McLearn, 1931.

Specific characters. Upper molars of about the size and degree of hypsodonty of *M. severus* (Cope). Protocone separate in upper half of crown, narrowly ovoid in section, without anterior spur toward protocone. Hypocone smaller than protocone, connected with metaconule. Protoloph and metaloph with pronounced plications. Length of M³, 17.0 mm.; width, 17.8 mm.

Remarks. In size and height of crown the upper teeth of this species are relatively primitive, but the shape of protocone and the plication of the crests suggest some species of *Hipparion*.

A fragment of an upper crown, from section 4, township 5, range 27, west of 2nd meridian, near Bonneau Lake, about 20 miles east of the type locality, probably also represents the present species,

although in this specimen the protocone is somewhat crescentic.

Two lower molars, probably M₁ and M₂ of the same individual, were also obtained at the type locality of the present species. As it is likely that they pertain to *M. præcocidens* they are represented in figures 4 and 5.

An upper molar, probably M¹, identified as *M. isonesus?*, from section 11, township 3, range 30, west of 2nd meridian, near Rockglen, is figured for comparison.

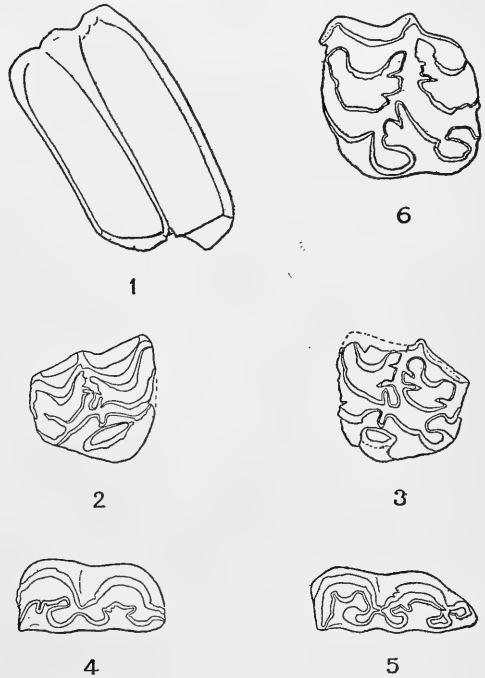


FIG. 1—*Merychippus præcocidens*, n.sp., 3rd right upper molar, holotype, external view.

FIG. 2—The same, crown view.

FIG. 3—*M. præcocidens*, 2nd left upper molar, paratype, crown view.

FIG. 4—*M. præcocidens?*, 2nd right lower molar, crown view.

FIG. 5—*M. præcocidens?*, 3rd right lower molar, crown view.

FIG. 6—*M. isonesus?*, 1st? left upper molar, crown view.

All figures natural size.

¹ Published with the permission of the Director, Geological Survey of Canada, Department of Mines, Ottawa.

² Roy. Soc. Canada, Trans., ser. 3, vol. 24, sec. 4, pp. 29, 30, 1930.

A RARE FIND

By J. H. C. DEMPSEY



AT THE beginning of July, 1931 Sergeant Gordon MacNair of the Hamilton, Ont., Police Department, an ardent florist and botanist, brought me a strange plant for identification. It was in bud and I could not identify it at the time. When, about a month later, I saw it in bloom, I found that it was *Epipactis Helleborine* (L.) Cr.

This rare and beautiful orchid—the upper petals white, the lower ones yellowish green and spotted or blotched with deep purple—grew to a height of one-half to one foot. It was found in a ravine about 100 yards wide and equally deep, growing in red clay.

In Canada, it has previously been found at Toronto, Ont., and vicinity, Peterborough, Ont., Montreal, Que., and in several places in the Montreal district.

Epipactis Helleborine (L.) Cr. FOUND AT OTTAWA

By M. O. MALTE

This species was collected last summer by Mr. Clyde Patch at Rockcliffe, Ottawa, Ont., where it grew on the property of Mr. Hoyes Lloyd. According to Mr. Lloyd, it has been growing there for at least three years. When examined *in situ* by the writer the plants were found to belong to the var. *viridiflora* (Hoffm.) Irmish, characterized by having the flowers greenish, particularly on the inside, and more or less tinged with pink. The observation was further made that in plants taken home and kept in an ice-box over the weekend the flowers lost much of their greenish appearance and developed a rich rose-colour.

THE GENOTYPE OF BELEMNITES; WITH A SYNOPSIS OF NORTH AMERICAN SPECIES OF BELEMNIOIDEA

By C. H. CRICKMAY
University of Illinois

INTRODUCTION



COMPREHENSIVE programme of research necessitates much spade-work the object of which is to clear the foundation, as it were, in preparation for an edifice of new results. My study of the Jurassic System in North America has been no exception to this rule. One such piece of spade-work has delved into the matter of the correct generic designations of the American species of belemnites, some of them already named, but a great many more, yet to be described. The results of this study, a by-product of my principal researches on the Jurassic, form the theme of this article.

THE GENOTYPE OF BELEMNITES

In reviewing the genera of belemnites, or Belemnioidea, one is astonished by the strange circumstance that no attempt has been made by the modern systematists to recognize *Belemnites* as a genus. All insist on using the name as a sort of collective or categorical term for all unidentifiable specimens; as Naef puts it, "als Sammelname für alle Belemnitidae, von denen ohnehin oft die Zugehörigkeit zu einer bestimmten Gattung fraglich ist".¹ This view is hardly tenable, for

Belemnites, though an ancient and much abused term, has had a place in binomial nomenclature. There is neither excuse nor justification for neglecting it. The proper course is rather to trace the history of the name, and to determine, if possible, either the intention of its binomial founder, or a valid limitation of the scope of the genus.

The name *Belemnites* dates from the sixteenth century, and was widely used by pre-Linnean naturalists. Linnaeus did not use the term. Neither did Bruguiere: the first mention of *Belemnites* in the *Encyclopédie Méthodique* being in 1816. A few early post-Linnean authors employed the name, but rather in a categorical than a generic sense.² Lamarck seems to have been the first binomial naturalist to use the name in a generic sense.³ He thus describes *Belemnites*, without species, illustrations, or reference: "Coq. droite, en cone allongée, pointue, pleine au sommet, et munie d'une gouttière latérale; une seule loge apparente et conique, les anciennes ayant été successivement effacées par la contiguité et l'empilement des cloisons". Thus, *Belemnites*

¹ A. Naef: Die Fossilen Tintenfische. Jena, 1922. This is the most modern and authoritative systematic work on the group. However, it is neither an iconography nor a monograph.

² For instance, Johann Samuel Schröter: Lithologisches Real- und Verballexikon, 1779; and Vollständige Einleitung in die Kenntnis und Geschichte der Steine und Versteinerungen, 1784.

³ J. B. Lamarck: Prodrome d'une nouvelle classification des coquilles. Mem. Soc. Hist. Nat., Paris, 1799.

became a part of binomial nomenclature, a genus without species.

In 1801, Lamarck repeated his 1799 description, and named a single species, *Belemnites paxillosa*,⁴ referring for illustration to "Breyn. Dissert de Polythalam, p. 41, t. 1, No. 1-14", and "Klein, de tubulis marinis, t. 8, f. 2-13". The species *paxillosa* thereby became the monotype of the genus, and the plates of Breyn and Klein became genosyntypes.

The first of these works to which Lamarck referred is properly called *Dissertatio physica de Polythalamiis, nova testaceorum classe*, etc. by J. P. Breyn, Gedani,⁵ 1732, an 18th century conchological treatise. The reference to t. 1, No. 1-14, meaning tabula (= plate) No. 1, figures 1 to 14, is in error in one respect, because the only plate in the whole work with as many as 14 figures is not No. 1, but "Tabula belemnitarum". Undoubtedly, this is the plate to which Lamarck referred. However, the illustrations show only that Lamarck conceived the genus and species as widely as the family: several sorts of belemnites are shown.

The other work to which Lamarck referred is *Descriptiones Tubulorum Marinorum*; etc., by J. T. Klein, Gedani, 1731. Tabula VIII, figures 2 to 13, are of several sorts of belemnites, even more various than those depicted by Breyn. Neither of these references helps to limit the genus.

In 1808, De Montfort gave an illustration of a belemnite which though not actually labelled was coupled with a description of *Belemnites paxillosus* which was rightly taken as the type of the genus.⁶ Unluckily, de Montfort's illustration is not like any actual form of belemnite, and is quite different from any of the figures of Klein or Breyn. It shows a very short rostrum and an unnaturally large alveolar slit. It can not be claimed as an illustration of *B. paxillosus*, for that would remove that species from the realm of actuality.

Belemnites paxillosus is very commonly ascribed to Schlotheim who in 1813 mentioned that species and five others.⁷ He did not describe the forms but at least limited some of them very definitely, for instance, his *B. mucronatus* is limited to Breyn's Tab. bel. F. 1. a 2, b.,⁸ and *lancoelatus*

⁴ J. B. Lamarck: *Système des Animaux sans Vertébrés* etc. Paris, 1801.

⁵ Gedani=Danzig.

⁶ Denys de Montfort: *Conchyliologie Systematique*, tome 1. Paris, 1808.

⁷ J. F. Schlotheim: *Beitrag zur Naturgeschichte der Versteinerungen in Geognostischen Hinsicht*. Leonhard Taschenbuch für gesammelten Mineralogie. 7 Jahrgang. Frankfurt, 1813.

⁸ This is important because *mucronatus* later became the type of *Belemnitella d'Orbigny*. D'Orbigny with rather surprising ignorance of the work of Lamarck, cited as illustrations of *Belemnitella* the same figures as had served half a century previous as the types of *Belemnites*. But this neglect is of no consequence since Schlotheim definitely indicated the illustrations of his species, *mucronatus*.

to F. 7. a of the same plate. He failed to limit *paxillosus*, however.

In 1820 Schlotheim named several other species and in the same work limited *paxillosus* to "Breyn Comment de Belemn. T.V. f. 3. 4." and "Knorr P. II, T. I. f. 3. 4."⁹ The latter reference was not mentioned by Lamarck, and hence can not serve as a type. The former is a reference to the part of Breyn's *Dissertatio* dealing with belemnites, but the illustrations cited are not of a belemnite at all. They depict an Endoceratid cephalopod allied to *Vaginoceras*. Hence Schlotheim's attempt at limiting the species is a futile one. However, it is possible that T.V. is an error for *Tabula belemnitarum*, and, if it is, figure 3 is merely an almost perfectly circular cross-section, and figure 4 is a phragmacone with steep but hollow sides. Neither is distinctive, and consequently the species is left in doubt.

In 1827, de Blainville monographed the belemnites.¹⁰ However, he merely mentioned Schlotheim's species, and did not figure them.

Finally in 1830, Voltz described, and illustrated clearly, a form which he called *Belemnites paxillosus* Schlotheim.¹¹ This is the earliest picture of the species that is sufficiently distinctive to be recognizable. The form figured by Voltz is an upper Lias belemnite to which later authorities have continued to restrict the name *paxillosus*.¹² Of course, Voltz' figures are not types, but nevertheless they embody the earliest successful attempt to put the characters of this hitherto uncertain species on paper. It would seem permissible, therefore, to regard them as restricting the interpretation of the species to a certain definite group of characters.

If this is done, *Belemnites paxillosus* Lamarck as restricted by Voltz must be taken, in want of anything better, as indicating the characters of the genus. The species may be described as follows: Rostrum, elongate, smooth, cylindrical, convexo-conical at the summit which bears 2 short latero-dorsal furrows, 1 or more medio-dorsal, and 1 medio-ventral impressed stria;

⁹ J. F. Schlotheim: *Die Petrefactenkunde auf ihrem jetzigen Standpunkte*. Gotha, 1820.

¹⁰ H. D. de Blainville: *Memoire sur les Belemnites*. Paris, 1827.

¹¹ M. Voltz: *Observations sur les Belemnites*. Mem. Soc. d'Hist. Nat. de Strasbourg, tome 1, 1830. *B. paxillosus* is illustrated in Plate VI, fig. 2.

¹² J. Phillips: *British Belemnitidae*. *Palaontographical Society*, 1865-1870.



FIGURE I—Type of *Belemnites paxillosus*.

phragmacone nearly right conical, with striate conotheca, and numerous short chambers; ventral radius slightly less than half the diameter at the apex, axis about 4 times as great as the diameter. In the restricted sense, therefore, *Belemnites* is equivalent to the group of the Liassic "paxillosi". *Holcoteuthis* Stolley and *Passaloteuthis* Lissajous are both synonyms of it, and are therefore to be discarded. None of the American species, thus far known, belongs to *Belemnites* in the restricted sense. The only North American species closely allied to it is *Brachybelus themis* Crickmay.

Though we follow Voltz' interpretation of *B. paxillosus*, we can not speak of his figures as types, and it seems desirable to place on record a valid designation of a type illustration of *B. paxillosus* which will be, of course, the genoholotype as well. It is desired to make this designation in such a way as to leave the long accepted interpretation undisturbed. Accordingly the specimen illustrated in J. T. Klein's *Descriptions tubulorum marinorum*, Tab. VIII, fig. 7, is now selected as holotype of *B. paxillosus*. Though the figure is not good, it agrees, as far as it goes, with Voltz' illustrations; and even if its selection serves no more useful purpose, it will at least forestall any less wise attempt at dealing with *Belemnites*. Klein's figure is reproduced herewith: it may save those who are interested the labour of hunting for copies of Klein's work which is very rare.

SYNOPSIS OF NORTH AMERICAN SPECIES OF BELEMNOIDEA

PHYLUM MOLLUSCA

CLASS CEPHALOPODA

ORDER BELEMNOIDEA

FAMILY AULACOCERATIDAE

Genus *AULACOCERAS* Hauer

- A. carlottense* Whiteaves
Upper Triassic, Queen Charlotte Islands.

Genus *DICTYOCONITES* Mojsisovics

- D. americanus* Smith
Upper Triassic, California

Genus *CALLICONITES* Gemmelaro

Genus *ATTRACTITES* Gümbel

- A. burckhardti* Smith
Middle Triassic, Nevada
A. clavatus Smith
Middle Triassic, Nevada
A. drakei Smith
Upper Triassic, California
A. elegans Smith
Middle Triassic, Nevada
A. böckhi, Smith
Middle Triassic, Nevada
A. nevadaensis Meek
Middle Triassic, Nevada
A. philippii Hyatt and Smith
Upper Triassic, California

- A. solidus* Smith
Middle Triassic, Nevada

FAMILY BELEMNITIDAE

Genus *HASTITES* Mayer-Eymar

Genus *RHABDOBELUS* Naef

Genus *COELOTEUTHIS* Lissajous

Genus *NANNOBELUS* Pavlov

- Genus *BELEMNITES* Lamarck
= *Holcoteuthis* Stolley
= *Passaloteuthis* Lissajous

Genus *PSEUDOHASTITES* Naef

Genus *GASTROBELUS* Naef

Genus *PLEUROBELUS* Naef

Genus *SALPINGOTEUTHIS* Lissajous

Genus *DACTYLOTEUTHIS* Bayle

Genus *ODONTOBELUS* Naef

Genus *BRACHYBELUS* Naef

- B. themis* Crickmay
Early Middle Jurassic, southwestern
British Columbia

Genus *HOMALOTEUTHIS* Stolley

Genus *CYLINDROTEUTHIS* Bayle

- C. skidegatensis* Whiteaves
Early Upper Jurassic, Queen Charlotte
Islands

- C. inaequilateralis* Eichwald
Early Upper Jurassic, Chisik Island,
Cook Inlet, Alaska.

- (?) *C. pacificus* Gabb
Jurassic; Sierra Nevada, California

Genus *PACHYTEUTHIS* Bayle

- P. densus* Meek
Mid Upper Jurassic,
P. assimilis Whiteaves
Early Upper Jurassic, Queen Charlotte
Islands

- (*P. curtus* Logan), not a valid name.
Homonym of "*Belemnites*" *curtus* D'Orb.

Genus *ACROTEUTHIS* Stolley

- A. eocretacicus* Crickmay
Early Cretaceous, southwestern British
Columbia.

Genus *OXYTEUTHIS* Stolley

- O. tehamaensis* Stanton
Late Lower Cretaceous, California
O. baculus Crickmay
Early Cretaceous, southwestern British
Columbia.
O. macritatis White
Early Cretaceous, Port Moller, Alaska.

Genus *AULACOTEUTHIS* Stolley

- A. impressus* Gabb
Late Lower Cretaceous, California

- (?) *A. sicarius* Eichwald
Upper Jurassic, Alaska Peninsula

Genus *RAPHIBELUS* Naef

Genus *BELEMNOPSIS* Bayle

Genus *HIBOLITES* Montfort

- H. pistilliformis*, Eichwald, non Blainville
Upper Jurassic; Chisik Island, Cook
Inlet, Alaska.

Genus *PARAHIBOLITES* Stolley

Genus *MESOHIBOLITES* Stolley

Genus *NEOHIBOLITES* Stolley

- Genus *BELEMNITELLA* d'Orbigny
B. americana Morton
 Upper Cretaceous, New Jersey
B. baculus Logan
 Upper Cretaceous, Kansas
B. bulbosa Meek and Hayden
 Upper Cretaceous, Nebraska
B. compressa Emmons
 Upper Cretaceous, North Carolina
B. manitobensis Whiteaves
 Upper Cretaceous, Manitoba.
- Genus *ACTINOCAMAX* Miller
 Genus *DICOELITES* Böhm
 Genus *DUVALIA* Bayle
 Genus *PSEUDOBELUS* Blainville
 Genus *CONOBELUS* Stolley
 Genus *BAYANOTEUTHIS* Munier-Chalmas
 Genus *STYRACOTEUTHIS* Crick.

FAMILY BELEMNOTEUTHIDAE, ETC.

Four or five other families, unimportant among fossils, and unknown in North America.

INCERTAE SEDIS

- "*Belemnites*" *ambiguus* Morton
 Upper Cretaceous, New Jersey
 "*Belemnites*" *obtusus* Whitfield
 Upper Jurassic; Black Hills, South Dakota
 "*Belemnites*" *conformis* Eichwald
 Upper Jurassic; Chisik Island, Cook Inlet, Alaska.
 "*Belemnites*" aff. *puzosi*, Castillo and Aguilera
 Upper Jurassic; Sierra de Catorce, San Luis Potosi, Mexico.
 "*Belemnites*" aff. *obeliscus*, Castillo and Aguilera
 Upper Jurassic; Sierra de Catorce, San Luis Potosi, Mexico.

54th ANNUAL MEETING, OTTAWA FIELD-NATURALISTS' CLUB REPORT OF COUNCIL

1. MEETINGS.—During the year four Council meetings have been held at the homes of the following members: Mr. C. M. Sternberg, President, Dr. R. E. DeLury, Miss M. E. Cowan, Mr. Hoyes Lloyd. The attendance averaged 15.

2. LECTURES.—No lectures were given during the year.

3. BIRD CENSUS.—An important part of the Club's work is the annual bird census which is carried out in connection with other societies in the United States and Canada. The local bird census was taken on December 26th, 1931, 21 members going out in 10 distinct parties. 2567 individual birds were counted and 21 species identified.

4. EXCURSIONS.—The excursions of the Club were unusually successful this year. On the four spring excursions held in May attendance averaged well over 100; on the four summer ones in June about 12; and on the four autumn ones in September, 14. The excursions went to the following districts and covered the fields as indicated; McKay's Lake: Geology and Ornithology, led by Dr. Kindle and Mr. Lloyd; Britannia-on-the-Bay: Botany, led by Miss Cowan and Mr. Groh; Fairy Lake: Ornithology and Zoology, led by Dr. DeLury and Mr. C. E. Johnson; Val Tetreau: Geology, Botany and Ornithology, led by Dr. Alcock, Mr. Miller and Mr. Groh. On the first two Saturdays of June, instead of going out to the country, the Club was invited to (a) the National Museum of Canada, by the Director,

Dr. W. H. Collins, and (b) the Dominion Experimental Farm, by the Director, Dr. E. S. Archibald. The other June excursions were in: (a) Rockcliffe Annex, Botany, Ornithology, Zoology, led by Mr. Fauvel and Mr. Lloyd; and (b) Billings Bridge to Hog's Back, Ornithology, Zoology, led by Mr. Lanceley and Mr. Halkett. The autumn excursions were: (a) along the Rideau River to Hog's Back, Geology, led by Mr. Sternberg; (b) Ironsides, Botany and Ornithology, led by Mr. Fauvel; (c) Chelsea Dam, Biology, led by Mr. Fraser; (d) Wakefield, Botany, led by Mr. LaRocque.

5. COUNCIL REPRESENTATIVE TO ROYAL SOCIETY MEETINGS.—Dr. M. E. Wilson was appointed to represent the Club at the Royal Society of Canada meetings held at the National Research building in May.

6. INTERNATIONAL ASSOCIATION FOR BIRD PROTECTION.—Mr. Lloyd and Dr. Lewis have again been the Canadian representatives of the International Association for Bird Protection during the past year.

7. PUBLICATIONS.—The report of Mr. Lloyd, Chairman of the Publications Committee, is as follows: "This Committee, which is in charge of the publications of the Club, has had an active and successful year."

"Pursuant to the policy laid down by Council the "Naturalist" has been maintained without reduction in size, or change in style. The cost of publication was reduced (beginning with the September issue) about twelve per cent."

8. FINANCE.—Owing to the prevailing economic conditions there has been no demand for back issues of the Canadian Field-Naturalist. For the same reason there has been a decrease in membership in the Club and a deficit in the current account, necessitating the use of a portion of the Reserve Fund.

9. INFORMATION SERVICE.—A new departure for the Club is the Information Service which was founded this year. As announced in the May issue of the Canadian Field-Naturalist, the Service is open to all subscribers. Questions will be answered by correspondence, or, if of general interest, through the journal itself.

10. MACOUN MEMORIAL COMMITTEE, AND MACOUN BIOGRAPHY COMMITTEE.—The Macoun Biography Committee, which undertook to publish the Biography of the late Prof. John Macoun, and the Macoun Memorial Committee which undertook to place Prof. Macoun's portrait in the National Museum, reported in April that

their undertakings had been completed, and were both honourably dismissed.

11. SPECIAL COMMITTEE.—In September the Special Committee which was appointed to raise funds for the Club agreed to call upon men of means who might be interested to contribute towards an Endowment Fund. Mr. Hoyes Lloyd was appointed Chairman of this Committee.

12. COUNCIL.—We feel that our organization has stood up as well as others in the stormy time, and we are, as a Club, now looking forward and ready to face brighter days as they dawn upon us. Your Council, in retiring from Office, wishes to express its feeling that the year has been a successful one, despite any financial stresses which have been felt.

To the incoming Council and Executive we express our hopes that the 55th year of the Club's history will be one of prospering enterprise.

GRACE S. LEWIS, *Secretary.*

STATEMENT OF FINANCIAL STANDING, OTTAWA FIELD-NATURALISTS' CLUB, AT THE CLOSE OF THE YEAR, 1931-1932

ASSETS		LIABILITIES	
Balance in Bank, Nov. 26, 1932.....	\$.88	Reserve Fund.....	\$196.32
Bills receivable.....	38.17	Publication Fund.....	41.25
	<u>Total</u> 39.05		<u>237.57</u>
Debit balance.....	198.52		
	<u>237.57</u>		
RECEIPTS		DISBURSEMENTS	
Balance, November 28, 1931.....	\$110.65	Printing and Mailing "Naturalist"....	1,239.95
Membership—Current.....	963.55	Editor.....	90.00
Advance.....	52.00	Postage and Stationery.....	65.32
Advertisements.....	32.00	Bank discount.....	19.85
Single Numbers.....	26.25	Separates and Illustrations.....	62.30
Separates.....	41.57	Miscellaneous.....	23.27
Miscellaneous.....	37.98	Balance in Bank November 26, 1932..	.88
Reserve Fund.....	196.32		<u>\$1,501.57</u>
Temporary Advance.....	41.25		
Publication Fund.....			
Temporary Advance.....			
	<u>\$1,501.57</u>		

Audited and found correct:
December 2, 1932.

HARRISON F. LEWIS,
P. KINGSTON,

Auditors.

WILMOT LLOYD, Treasurer.

STATEMENT—RESERVE FUND

ASSETS	
Government Bonds.....	\$1,200.00
Balance in Bank.....	5.89
Temporary Advance to Current Account	196.32
	<hr/>
	\$1,402.21

RECEIPTS	
Balance in Bank, November 28, 1931.	\$132.72
Bank Interest.....	3.49
Bond Interest.....	66.00
	<hr/>
	\$202.21

WILMOT LLOYD, Treasurer.
W. T. MACOUN, Chairman.

LIABILITIES	
NIL	
Balance.....	\$1,402.21
	<hr/>
	\$1,402.21

EXPENDITURE	
Advance to Current Account.....	\$196.32
Balance in Bank.....	5.89
	<hr/>
	\$202.21

Audited and found correct:
December 5, 1932.
P. KINGSTON,
HARRISON F. LEWIS,
Auditors.

STATEMENT—PUBLICATION FUND

ASSETS	
Government Bond.....	\$500.00
Temporary advance to Current Account	41.25
	<hr/>
	\$541.25

RECEIPTS	
Bond Interest.....	\$41.25
	<hr/>
	\$41.25

WILMOT LLOYD, Treasurer.

LIABILITIES	
NIL	
Balance.....	\$541.25

EXPENDITURE	
Advance to Current Account.....	\$41.25
	<hr/>
	\$41.25

Audited and found correct:
December 5, 1932.
P. KINGSTON,
HARRISON F. LEWIS,
Auditors.

BOOK REVIEWS

THE COWBIRDS—*A Study in the Biology of Social Parasitism. Made by Herbert Friedman of Amherst College. Published by Charles C. Thomas in 1929. Price \$6.00 net.*

As a result of Dr. Friedman's field and research work on the subject of Parasitism in Birds, we now have in *The Cowbirds* a most valuable mass of information on the subject. This well illustrated work of some 400 pages is a complete report on all the Cowbirds, and is based on five years of uninterrupted work. In carrying on this research work, Friedman studied the Eastern Cowbird for three years at Ithaca, New York; and also devoted a breeding season each to the Cowbirds found in Argentina and on the Texas-Mexican border. Besides this field work, Dr. Friedman's evident deep study of all literature pertinent to this subject, adds weight and interest to his book.

The seven species of Cowbirds are arranged in the three genera—*Agelaioides*, *Molothrus* and *Tan-gavius*—and the first and greater part of the book is devoted to a discussion of their range, migration, courtship and mating, songs and call notes, sexual and territorial relations, nest and nest building, eggs and egg laying, young, food, plumage and molts, enemies and common names. Before passing on to the latter part of the work—that dealing with the evolution of parasitism—I should like to make a synopsis of this other information which has to do with our Eastern Cowbird of North America—*Molothrus ater ater*—a species of the most highly parasitic and most recent genus *Molothrus*.

In dealing with our Eastern Cowbird, Dr. Friedman first describes its breeding range. In this connection he has prepared a map which charts

the ranges as determined by actual records besides giving the probable boundaries.

The spring migrations are carefully summarized, several pages being devoted to migration records from various localities during the past 100 years. From these and many of his own records he has made a Spring Migration Chart showing the progress of migration as corresponding to dates.

Working from observations made at Ithaca, New York, Friedman divides the migration into the following six phases:

(1) *Vagrants*.—Those individuals coming a week or two before the true migration. They are birds which have wintered on the northern limit of the winter range and their movements may be more of the nature of a wandering after food than a true northern migration.

(2) *Migrant Males*.—The first true migrants to arrive. These birds usually mix with flocks of Redwings and do not form any solid flocks of their own kind. They are rather silent and come to the marsh to spend the night with the Redwing and Rusty Blackbirds, but during the day scatter over the fields and hills. When these birds arrive the vegetation in general is hardly started and they feed almost entirely on seeds. These migrant males continue to arrive and depart for over a month.

(3) *Resident Males*.—Of the two years devoted to studying the exact time of arrival of the resident males, Dr. Friedman states that the first year was spent in studying the breeding areas of Cowbirds and particularly the singing trees of the males; then the next spring was occupied in watching for the return of the male to his post. These males, he finds, on arrival, at once establish themselves on their posts and remain in their territories for a few hours early every day, spending the greater part of the time in hunting for food in stubble fields and, a little later on, in ploughed areas. The interval between the arrival of the first migrant and first resident males is much shorter than in the Redwing, being only three days in the case of the Cowbird as against twelve in that of the Redwing. These resident males do not mix with the migrating males, either when feeding or when sleeping. The resident males sleep in their territories and the migrants in the marsh.

(4) *Migrant Females*.—Close on the heels of the migrant males and at about the same time as the resident males, come the first few migrant females mingling with the Redwings; later, soon after the bulk of the migrant males has gone, these females appear in flocks of 45 or more. The males, Dr. Friedman has found, pay comparatively little attention to them, occasionally

displaying, but displaying just as often when no female is in sight. The ovaries of the migrant females are only slightly enlarged and the food is chiefly vegetable, although insects are eaten when found.

(5) *Resident Females*.—The author detected their arrival most readily by watching the actions of the resident males. Until about the 3rd of April (Ithaca, N.Y.) they take but little interest in any of the females, but at that time other females arrive to which the males react in an entirely different manner. The arrival of these females acts as a spark to set off the pent-up energies and passions of the males and arouses them to a terrible frenzy. The persistence with which the males pursue these females makes one wonder if either ever rests. The females evidently recognize the limits of the territories of their pursuers, as they fly in circles closely followed by one or more males, but they do not leave the general vicinity of these territories. The ovaries of these females are considerably larger than those of the migrant birds of the same date.

(6) *Immature Males and Females*.—These arrive after all the other migrations have passed on.

Dr. Friedman then describes the courting display which he divides into three types depending on whether the bird is on the ground, in the air, or in a tree. These he terms the terrestrial, the aerial, and the arboreal displays respectively.

Terrestrial Type.—The male runs alongside the female and turns to face her diagonally. He then ruffles up his neck feathers and gives his shrill note. The wings and tail are not used in this type.

Aerial Type.—There is hardly any aerial display, but it consists of ruffling up the feathers in flight, arching the wings and giving the squeaky song.

Arboreal Type.—This is the common and most typical of the three types and the author has arranged a set of photographs to show the different stages in the display. The display is begun by the bird ruffling out its feathers, at the same time giving low guttural notes which are not audible for more than 50 feet, and sometimes rising and falling gently on its legs straight up and down. After this little preliminary movement the bird begins the display proper by arching its neck and spreading its tail, then, raising its wings, it bends slowly forward—all this time the feathers of the neck and underparts are fluffed out—the wings are then brought out to full expanse; suddenly the tail is thrown up and the bird pivots and swings over. The display ends when the wings are brought back to the body and the bird then rights itself and is ready to repeat the whole per-

formance. When it is spreading and arching its wings, it starts to give a high, shrill and squeaky *tsee* which is kept up until the forward fall is completed. The whole display takes about 3 or 4 seconds.

Many pages are devoted to the descriptions of the eggs and egg-laying habits of the North American Cowbird. Friedman believes that the eggs and egg-laying are one phase in the history of the Cowbird which is surrounded with the greatest ignorance. He is of the opinion that, since the egg-laying habits are what tend to make the bird parasitic, they form the centre of the whole problem and are, therefore, of prime importance. Before the book was started, the number of eggs laid by a single bird in one season, and the intervals between them were absolutely unknown; but data on approximately nine thousand victimized nests of 195 species of birds were assembled for it, and it was found that in over two-thirds of the cases only one parasitic egg was found in a nest. In the other third it was proved that many nests contained eggs of different Cowbirds. This would indicate clearly that the ordinary and normal thing is for a Cowbird to deposit one egg in a nest. The observations of these egg-laying habits are summarized under thirteen points:

1. The Cowbird in the majority of cases lays one egg in a nest.
2. The Cowbird sometimes lays more than one egg in a nest.
3. More than one Cowbird sometimes lays in the same nest.
4. The Cowbird sometimes lays in a nest before any of the rightful eggs are laid.
5. The Cowbird usually lays in a nest already containing eggs.
6. The Cowbird lays its egg in a nest while the owner is away.
7. The Cowbird rarely lays an egg in a nest containing already partly incubated eggs, but has been known to lay in a nest containing young.
8. The Cowbird lays directly into the nest.
9. The Cowbird lays at intervals of one day.
10. Two Cowbirds laid five eggs each, and one laid four.
11. The Cowbird is not normally specific in its parasitism, but this tendency seems to crop out at times.
12. The Cowbird's egg is usually larger than the egg with which it is found.
13. The incubation period of the Cowbird is ten days.

There are 72 pages enumerating the victims of the North American Cowbird. The list of victims includes birds of 8 orders, 25 families, 103 genera, 158 species, and 195 species and subspe-

cies. Of these 195 forms in the present list the greater part are uncommon, rare, or even accidental victims, while the species most commonly affected number not more than 80.

Friedman also deals with the young Cowbird, the different moults, and the Cowbird's enemies, but I shall pass over these, significant as they are, in order to allow space for the more important material in the book—for instance the association with cattle. As the name of the bird suggests, it is frequently found around cattle, but what is the cause of this association? What benefit do the birds derive from the presence of cattle?

The supposition that intestinal worms discharged by the animals might be the source of attraction has been found to be erroneous. Wasps, ants, and flies form no great part of the food of the Cowbird, so the presence of these insects around cattle (or around the buffalo herds with which the Cowbird was also found) could not have been the force which first attracted the birds. Yet the food attraction must have been of an animal nature, for vegetable food would naturally be scarcer where great herds of herbivorous animals had been grazing for some time, than it would be elsewhere. If, then, the food supply is not increased by the presence of cattle, or of buffalo herds, then it must be that the animals render it more available. In grazing the animals flush the hosts of grass-inhabiting insects with every bite and, in this way, render the food supply far more available to the birds and also save them the trouble of hunting out each individual insect.

This would seem to be a logical reason, as it is chiefly in the summer and autumn that Cowbirds gather round cattle and buffalo, and it is in these seasons that grass-inhabiting insects are most abundant.

In dealing at considerable length with the matter of the food of the Cowbird, the conclusion reached by Dr. Friedman seems to be that the Cowbird feeds upon whatever is most available and that, in the majority of cases, its food habits are such as would tend to raise its economic status. Friedman points out, however, that though the food habits may be beneficial, the economic status is complicated by the fact that each Cowbird raised to maturity represents anywhere from one to six birds of some other species. So, even though the food habits of the Cowbird in destroying insects and weed-seeds make it valuable, one must remember that the victims sacrificed by its parasitism are, as a rule, birds whose food habits are quite as valuable. Thus, the economic benefit of the rearing of these parasites is open to question. The author, however, thinks

that the Cowbird should be regarded as an important member of Nature's systems of checks and balances.

Let us now glance at Friedman's account of the Bay-winged Blackbird of central South America, a species of the genus *Agelaioides*, which is recognized to be the most primitive of the three genera of Cowbirds. The features of its life history most in contrast with those of the North American Cowbird are its nesting habits and its manner of courtship. The difference in the mating is that there is no courtship display, the birds merely leaving the flocks in pairs.

The other feature of this Cowbird is that it is not parasitic, bringing up its own young. True, it uses the old nests of other birds in which to do so, but it cares for its own eggs, and so shatters that idea "Cowbird? Oh yes; the bird that has other birds bring up its young."

While these two points are the only two of special importance to the average naturalist, the thirty pages devoted by Dr. Friedman to a discussion of this genus are very interesting.

The species of Cowbird representing the midway stage between the primitive and the most recent forms is another member of the genus *Molothrus*—the Shiny Cowbird, which ranges over three-quarters of the South American continent. It differs from the Bay-wing in that it has a courtship display and is parasitic in its nesting habits.

It differs from the North American Cowbird also, because, although it has a courtship display, the usual type employed is the terrestrial, while our Cowbird uses the arboreal type most frequently. Nor is the parasitism in the Shiny Cowbird so highly developed as in our North American Cowbird, as it wastes many of its eggs. It lays them on the ground, in abandoned nests, or even in nests containing a large number of Cowbird eggs. There are records of nests containing as many as 37 Cowbird eggs. Of course the original owner would desert it long before the number of parasitic eggs reached any such volume, and so the eggs are wasted. This bird has even been known to build a nest of its own, although there is no record of its ever laying eggs in its own nest. These facts would seem to indicate that the Shiny Cowbird is a step about half way between the primitive and most recent Cowbirds, and, when we study the evolution of the present Cowbird, that is where we find that Dr. Friedman has placed it.

In his discussion of the evolution of the Cowbird, Dr. Friedman has dealt with it in a most concise manner, the whole account covering only three pages. By tracing it in the light of evi-

dence afforded first by geographical distribution; second by habits; and third by colouration, he presents this evolution in a most interesting and conclusive way. These three individual sets of records practically coincide in result to prove the original and most primitive form to be the Bay Wing of Central South America, the next step the Screaming Cowbird, then the Shiny Cowbird and ending with our own Eastern North American species—the most recent of the whole family of Cowbirds.

In the last chapter of his book, Dr. Friedman sums up the origin and evolution of the parasitic habit. He cites theories dating from the time of Aristotle and comments upon the fact that, up to the last century, the only bird known to be parasitic was the European Cuckoo, with which bird all hypotheses had to do. He, however, inclines to what seems to be the generally accepted opinion, that the one explanation would serve both for Cuckoos and Cowbirds.

He passes over the explanations given by the ancients as interesting only from an historical point of view.

The first serious suggestion then quoted is that of Herrisant (1757), who thought that in the case of the European Cuckoo the bird was prevented from incubating because of faulty anatomy, believing that the stomach was too big and heavy, and protruded so far ventrically that if the bird sat upon eggs she would smash them. This theory was disproved by Gilbert White when he dissected several cuckoos and compared them with other birds.

Friedman then quotes Pycraft and Fulton and many other writers as exponents of the theory that "the source of parasitism might be sought in the condition of polyandry supposed to exist in all parasitic birds." He, however, remarks that while it may be that Cuckoos are polyandrous, Cowbirds are more or less monogamous, and such polyandry as occurs in this group is a possible result but not cause of its parasitism.

After discussing briefly the question of whether polyandry causes parasitism or parasitism causes polyandry, he cites a curious theory brought out by Widman who thought that the Cowbirds, following the Buffalo too far from their nests, could not get back in time to use their own nests, and so used, in emergency, the nests of others. Friedman dismisses this theory as more interesting than suggestive.

He quotes as the best theory yet advanced and one which his own studies support in part, that of Prof. F. H. Herrick, who, studying the cyclical instincts of birds, found that the parasitic habit may have originated from a lack of attune-

ment of the egg-laying and the nest-building instincts, which resulted in the eggs being ready for deposition before a nest was ready for them—thus the origin of the parasitic habit.

A possible evolution of this habit suggested is that if a bird got into the habit of breeding in old nests of other birds it would not discriminate between a newly completed nest and one recently abandoned. It is likely, too, that the greater abundance of new than of deserted nests would favour the frequency of such mistakes until the parasitic habit would have become established. This suggestion seems well founded, but the actual origin of the parasitic habit is not explained.

Friedman points out that in any discussion of the parasitic habit we must start with one of two assumptions. Either the Cowbirds originally built their own nests and cared for their young in normal fashion, or they have been parasitic from the start. Only one of these assumptions can be true but there is much difference of opinion as to which is the true one. Friedman assumes that the Cowbirds were originally normal nest building birds, and gives the following reasons:

1. The instincts of nest building and incubation are so universally present in all groups of birds that it seems likely that this is the primitive condition of Cowbirds.

2. All the Cowbirds' close relatives are nest builders; in fact, its family, American Starlings or Hang Nests, is known as a family in which the nest-building instinct is very highly perfected.

3. Within the genera *Agelaioides* and *Molothrus* he has found several stages in the evolution of parasitism exhibited by several species as follows:

The Bay-winged Cowbird uses other birds' nests and lays its eggs in them but incubates and raises its own young. Sometimes it makes its own nest.

The Shiny Cowbird is parasitic but has the habit very poorly developed, as it wastes a number of its eggs. Rarely it attempts to build a nest but in this it is seldom successful. This would indicate that originally it built a nest but no longer knows how.

The North American Cowbird is entirely parasitic but is not wasteful of its eggs.

The Screaming Cowbird carries the evolution of this habit in a different direction in that it tends more towards specificity in hosts.

The parasitic Cowbirds have definite breeding territories and are more or less monogamous. It is shown earlier in the book that the territory precedes the nest in the evolution of the instincts of guarding associated with reproduction. If the Cowbirds were parasitic from the start, it would

be very hard to explain their territorial instincts. Monogamy would be of no use to parasitic birds; indeed promiscuity would better serve their purpose. The fact that Cowbirds are fairly monogamous indicates, therefore, that they originally were so, and, like all other monogamous birds, probably nested in normal fashion.

5. As was shown in his discussion of the evolution of the present Cowbird, the Bay-winged Cowbird is the most primitive of the existing species and should, therefore, represent the original condition of the Cowbird stock. Suppose we consider this to be so, then the original condition of the Cowbird would be monogamous, non-parasitic and of normal breeding habits.

From the above Friedman deems it safe to assume that parasitism is not the original condition in the history of the Cowbirds. The problem that now confronts us then, is not whether the Cowbirds were parasitic but rather how they lost their original habits and became parasitic.

As the book points out, all Cowbirds establish breeding territories but these are most definitely marked out in the most primitive, non-parasitic Bay-wing and least definite in cases of the Shiny Cowbird and of our own Eastern Cowbird of North America.

This distinctness of territory depends on the protective instincts of the male. In birds of normal breeding habits the male establishes a breeding territory and protects it from the inroads of all other males of his own species. Sometimes the female also helps to guard this territory.

As all naturalists doubtless know, in the case of normal breeding birds, the male usually establishes his territory and then the female chooses a nesting site somewhere within it. But this is not true of the Bay-winged Cowbirds, for they reverse the process. They leave the winter flocks in pairs and then, instead of looking for a territory, they search for an old or even new nest in which to breed, and will, when one is located even fight for it if necessary. When once in possession of a nest they then extend the territory radically around it, thus making the "territory" of only secondary importance. With this reduction in the significance of the territory, naturally the instinct to defend it would lessen correspondingly. Thus the protective instinct of the male would slowly decrease until, in the more recent, parasitic species where these instincts are further reduced, the territory of any one male would be very likely invaded by other males of the same species.

Furthermore, writes Friedman, in the Bay-winged Cowbird we have seen that the female has lost most of her protecting instincts, and seems to use up most of what she has before laying her

eggs, after which the nest and eggs are largely dependent on the male for protection. The female, although bold and fearless when away from the nest, is very shy and nervous when incubating. Evidently she has the instinct to conceal her eggs in a nest, usually not of her own building, but she has very little desire to protect them when once laid. If it were not for the protection of the male, she would probably not be able to care for the eggs, and the result would be an instinct to conceal her eggs in nests but not to care for them. Should the male lose this protecting instinct, it would open an easy path to parasitism, and, on examining the habits and instincts of the other Cowbirds, Friedman found that this is exactly what has happened.

The males have lost their protecting instincts and he claims this loss to be more complete in the two parasitic species, the North American Cowbird and the Shiny Cowbird, than in the non-parasitic form—the Bay-winged Cowbird. The very fact that in these three Cowbirds Friedman has found these somewhat obscure stages in the loss of the protecting instincts only serves to empha-

size the downward path these instincts have taken.

So then, it may be said that the immediate cause of the origin of the parasitic habit in Cowbirds was the loss of the protective instincts of the male. The fact that the female, sometime earlier in the history of the group, lost most of her protective instincts cannot be called a cause, for as long as the male retained his instinct of defence, as in the Bay-winged Cowbird of to-day, the birds were not parasitic. What caused the almost complete loss of these instincts in the male cannot be definitely determined, but Friedman maintains that the factor which started their weakening, and which finally brought their destruction, was the reversal in the territorial and nesting habits.

Dr. Friedman thinks there is no doubt but that the parasitic habit developed separately in each of the groups employing this means of raising their young—Cowbirds, Cuckoos, Weavers, Honey-guides and Ducks—but he reserves his information on these other groups for a further work which will deal with the parasitic birds of the world.—*Reviewed by* ROBERT D. LOCKWOOD.

NOTES AND OBSERVATIONS

ANNOUNCEMENT.

At the 54th Annual Meeting, December 6th, 1932, the Constitution was amended to provide for the following additional classes of membership:—

- | | |
|----------------------------------|-------------|
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The notice of motion which was adopted, and which became an amendment to the Constitution is that proposed by A. La Rocque, which notice may be found on page 189 of the November, 1932, "Naturalist."

All dues for these new classes of membership are to be paid into a separate publications fund, the income from which will be used for the publication of the "Naturalist."

It is hoped that those members who are able to do so will take action under these new clauses in the Constitution and thus help the Club

maintain the continuity of its important work in publishing natural history.

It will be of interest to all workers in Biology to learn that the Council of the Biological Society of Washington, at its last meeting, has voted the granting of a special price reduction on the following of its publications: "Natural History of the District of Columbia," by W. L. McAtee, 142 pages, inset map, octavo, paper, 1918. \$1.00, postpaid \$1.15; "The International Rules of Zoological Nomenclature," 28 pp. octavo, paper, 1926, 50c; "Birds of the Washington, D.C., Region," by May Thatcher Cooke. 79 pp. octavo, paper, 1929, 50c. These can be obtained, postpaid, from the Society's corresponding secretary, J. S. Wade, U.S. Bureau of Entomology, Washington, D.C., at the prices indicated. Requests should be sent promptly as only a very limited number of copies remain.

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CONTENTS

	PAGE
Biological Notes, covering parts of the Peace, Liard, Mackenzie and Great Bear River Basins. By M. Y. Williams.....	23
Geographic Variation in the Big Brown Bat (<i>Eptesicus fuscus</i>). By Glover M. Allen.....	31
William Markwick's "Florula Canadensis". By John Ardagh.....	32
The "Blue Limestone" of Hastings County, Ontario. By M. E. Wilson.....	33
Some Notes on the Henslow Sparrow. By J. Murray Speirs.....	35
Notes and Observations:—	
Bird Notes from Cochrane, Alberta. By Alvin Gissing.....	36
An Occurrence of the Clay-coloured Sparrow, <i>Spizella pallida</i> , in Renfrew Country, Ontario. By Hoyes Lloyd.....	36
Pygmy Nuthatch on Vancouver Island. By Hamilton M. Laing.....	36
Yellow-headed Blackbird in B.C. By Hamilton M. Laing.....	36
Carolina Wren (<i>Thryothorus l. ludovicianus</i>) at Toronto. By Clifford E. Hope.....	36
Crested Flycatcher and Cast Snake-skins. By A. G. Haultain.....	36
Letter from Andrew Barclay.....	37
Book Reviews:—	
The Hawks and Owls of Ontario. By P.A.T.....	37

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No. 2

BIOLOGICAL NOTES, COVERING PARTS OF THE PEACE, LIARD, MACKENZIE AND GREAT BEAR RIVER BASINS

By M. Y. WILLIAMS

DURING the summers of 1921 and 1922 the author was engaged in geological investigation for the Geological Survey of Canada in the Mackenzie River Basin, and incidentally made some biological observations. The trip of 1921 from Peace River town down the Peace and Slave rivers, through Great Slave Lake, and down the Mackenzie River to the oil well 50 miles below Fort Norman, covering some 1,400 miles by scow and canoe, has been described geologically in the Summary Report of the Geological Survey, 1921, Part B, pp. 56-66, and a summary of the biological notes is to be found in *The Canadian Field-Naturalist*, 36: 61-66, Apr., 1922.

In 1922, the author's party in company with Dr. G. S. Hume's party, left Peace River town on May 10th by the gas boat Ingenika and scow, and travelled up the Peace River to Taylor's Flats, 16 miles below the Hudson Bay Post of Fort St. John. From here the combined party started with pack train on May 16th over the 150 mile trail to Sikanni Chief River, which was reached on May 31st. From here the two parties travelled separately by canoe. The author thus travelled down the Sikanni Chief River, the Fort Nelson River, the Liard River and the Mackenzie River to Fort Norman, and 40 miles up the Great Bear River to the rapids at Mt. Charles. Numerous side trips were made on foot into the country adjoining the rivers traversed, and a special investigation was made of the northern extension of the Franklin Mountains which, with the exception of Mt. Charles, had never been studied previously by geologist or biologist. In fact there is no record of Mount Clarke ever having been previously visited. The length of river travelled by canoe is estimated at about 900 miles. The return journey was made by gas boat and steamer along the familiar transportation route, up Mackenzie River, through Great Slave Lake and up Slave and Athabasca Rivers to the railway near McMurray. The author's geological report

on this region is to be found in the Summary report of the Geological Survey of Canada, 1922, Pt. B, pp. 65-87.

FAUNAL ZONES, CLIMATE AND TOPOGRAPHY.

The whole area explored belongs to the Boreal Region. With the exception of the valley of the Great Bear River, the river valleys traversed belong to the Canadian Zone, marked so well by the summer residence of the Canada Jay, the Hawk Owl, and the White-throated Sparrow. The Hudsonian zone includes the Great Bear River valley and the slopes of the Mackenzie and Franklin Mountains. The crests of the mountain ranges, and especially the tops of Mountains Cap and Clarke, belong to the Arctic zone.

The climate of the valleys explored varies with altitude and latitude, but as the altitude decreases with increase in latitude, there is less difference between the climates of the southern and northern areas than might be expected. The altitude of the Peace River at Fort St. John is 1,350 feet and that of the plateau to the north at the present townsite 2,250 feet, the latitude being about 56°15'. Some 30 miles farther north the land surface has an elevation of 2,750 feet and the divide between the Peace and Sikanni Chief drainage basins has an approximate elevation of 3,600 feet. The Sikanni Chief River flows in a narrow valley about 700 feet deep and empties into the Fort Nelson River, which is a tributary of the Liard. The water level at the mouth of the Fort Nelson River has an elevation of about 1,000 feet according to Major Hart's measurements. From here northward there is a steady decline in elevation, although few accurate levels are available.

The country north of Fort St. John is park land, or semi-prairie with swampy lowlands and spruce and jack pine ridges. More than 35 miles of the region traversed have recently been homesteaded. Toward the divide, the land is only suitable for pasture. The valley of the Sikanni

Chief River is about one mile wide and is bordered by steep banks of Cretaceous sandstone and shale, 600 or 700 feet in height. Our party dropped down from frosty nights and leafless trees at the divide, to bright green spring foliage at river level, with a temperature of 110° in the sun. The Fort Nelson valley is wider, but it and the Liard have also cut their channels deeply into the Cretaceous upland. To the north, the southern end of the Mackenzie Mountains borders the Liard River, and Nahanni Butte occupies the downstream angle between the Liard and its northern tributary the South Nahanni River. The upland level decreases downstream and having passed the Devonian rock outcrops at the picturesque 10-mile rapids, the Liard widens out into almost lake-like proportions before joining the Mackenzie River at Fort Simpson. Down to the north, the mighty Mackenzie sweeps, with an average width of about a mile and three-quarters. The valley is broad and the flat bordering lands are covered with shallow lakes, ponds and muskeg. Some sand ridges break the monotony, and 10 or 15 miles back plateau remnants of flat-lying Cretaceous sediments occur between stream valleys.

Some 75 miles below Simpson, the Mackenzie River impinges against the Mackenzie Mountains and is diverted from its northwest-by-west course to a direction about north-by-west. Fifty-five miles lower down, the Franklin Mountains rise gently from the plain east of the river, and from here north, the Mackenzie flows through a broad plain between mountain ranges.

Great Bear River enters Mackenzie River just below Norman. Its water has the blue colour of glacial waters, is very cold and has a most striking fishy smell, which strangely enough is not unpleasant. Its valley is narrow and steep sided, and harbours banks of ice, especially at the rapids, well into July. Mt. Charles and rapids mark the crossing of the Franklin range which descends rapidly to the north. The Great Bear River, with its icy water, appropriately marks the edge of the Hudsonian zone.

FLORA.

The river valley bottoms are normally forested with fine black poplar and white spruce with alder and willow margining the water. The timber is especially heavy along the Fort Nelson and its tributaries, where many log jams occur. One drift spruce tree measured 7.9 feet in circumference at the butt and 130 feet in length. In fact most of the driftwood of the Mackenzie River comes from

British Columbia via the Liard River system. The islands and river flats of the Mackenzie have excellent stands of spruce and black poplar, but the timber belt as a rule is limited in width. Back from the river, white spruce is found on suitable uplands, but is of relatively small size. The muskeg areas are dotted with black spruce, the largest of which are 5 or 6 inches in diameter and about 250 years old. Willows, alder, white poplar and white birch occupy suitable ground, and occasional sandy ridges of jack pine occur. The muskeg areas are those typical of northern Canada, with their sphagnum moss, labrador tea, mountain laurel, etc. The frost is never far below the plant roots, and commonly extends down 30 or 40 feet. The summer flowers are very lovely, as already described in the account of 1921.

OBSERVATIONS.

From the appended notes the following conclusions may be drawn:

The divide between the Peace River and Liard River drainage basins, situated about 115 miles north-by-west of Fort St. John, appears to form the northern limit of distribution of such birds as Say's Phoebe, the Goldfinch, the Purple Finch, the Mountain Bluebird and the Crow.

The northern trend of the tributaries of the Mackenzie, combined with the relatively warm climate enjoyed by its valley, have lured many eastern and southern birds far west and north of their regular habitats.

Barrow's Golden Eye, taken on Fort Nelson River, appears to be the common species in the Mackenzie valley. Its autumn migration route to the Pacific coast, and especially to the Strait of Georgia, where many pass the winter, is unknown. The limited number of species of water-fowl, and their relatively small numbers, found breeding in northern waters, is demonstrated clearly by the author's observations.

The problem of race and distribution of the dark phase of the Red-tailed Hawk, so common in the Mackenzie valley in summer, has yet to be solved.

The small dark phase of the Sharp-tailed Grouse, common in the Franklin Mountains and at Fort Norman, has proved of much interest to ornithologists. Unfortunately the two specimens taken by the writer were birds of the year.

The occurrence of Rock and Willow Ptarmigan in the Franklin Mountains is not unexpected but is interesting.

The problem of the autumn migration of birds seems self-explanatory when one is caught with

them in a sleet storm late in August. With saturated feathers, the sparrows flutter and run from one bush to another, but always towards the brighter sky—the south. Tragedy stalks the birds however, as seen when a pigeon hawk struck down a tree swallow as it winged its southern way past Norman, heading up Mackenzie River.

BIRD OBSERVATIONS.

The following list of birds follows the 1931 A.O.U. check list in order and nomenclature. Except as indicated, these are sight records and the sub-specific determinations are hence based upon accepted distribution. Where much uncertainty exists, it is so indicated. The specimens taken have been identified by Mr. P. A. Taverner who has also kindly criticized this paper.

COMMON LOON. *Gavia immer* (Brünnich).—Peace River above the Crossing, May 9, sp.? Two seen in Wrigley Harbour, Great Slave Lake, Sept. 11th.

PACIFIC LOON. *Gavia arctica pacifica* (Lawrence).—1 River-between-two-Mountains, June 30th; 1 Old Wrigley, July 1st; 1 Black Water River, August 3rd; 1 Saline River, August 16th; heard on Bear River, August 20th and 21st; and 3 seen at Norman, August 24th.

HOLBOELL'S GREBE. *Colymbus grisegena holboelli* (Reinhardt).—One evidently of this species, on Peace River at Alberta-British Columbia boundary, May 12th.

WHITE PELICAN. *Pelecanus erythrorhynchos* Gmelin.—Reported nesting on rocky islets in Smith rapids, Slave River.

CANADA GOOSE. *Branta canadensis* sub. sp.?—Peace River at British Columbia boundary, 2 pair May 12th. Two at Nig Creek, and 2 at Beaton River, May 26th and 27th. Heard, Fort Nelson River, June 10th. Five on Mackenzie at Brackett River, August 19th. Several at Dahadinni River, September 4th. Forty at Providence and 8 at Wrigley Harbour, September 10th and 11th. A flock at Resolution, September 13th and flocks at McMurray, September 23rd. Mr. Whitacker found the Geese nesting on the Horn and Trout Rivers, and the above observations lead to the conclusion that their main nesting grounds are south of Simpson.

LESSER SNOW GOOSE. *Chen hyperborea hyperborea* (Pallas).—A flock of about 100 near Providence, September 10th. Thirty on Athabaska River, September 22nd.

COMMON MALLARD. *Anas platyrhynchos platyrhynchos* Linnaeus.—One, Peace River above Crossing, May 9th, and 15 near British Columbia boundary, May 12th. Six? big bend Liard River,

May 20th. Females on Mackenzie near Old Wrigley, June 30th and July 1st. A pair and 8 young near Wrigley, July 20th. Two males, Blackwater River, July 30th. A flock? at Norman, August 21st. Occasional flocks along Mackenzie from North Nahanni River south, September 7th-13th, and from Chippewyan along the Athabaska to McMurray, September 21st to 23rd.

BALDPATE. *Mareca americana* (Gmelin).—A flock of 12, perhaps the same birds, seen June 28th, 30th and July 1st, from 40 miles below Simpson to site of Old Fort Wrigley. 3 seen on June 29th. 4 taken at Simpson, September 8th. Several seen at Trout River, September 9th.

AMERICAN PINTAIL. *Dafla acuta tzitzihoua* (Vieillot).—Six on Fort Nelson River, June 15th. Three big bend Liard River, 4 mouth south Nahanni River, June 20th and 21st. One, Simpson, June 28th. Several, River-between-two-Mountains, June 30th. 3, Old Wrigley, July 1st. One taken Wrigley Harbour, September 12th.

GREEN-WINGED TEAL. *Nettion carolinense* (Gmelin).—Two on Peace River on Alberta-British Columbia boundary, May 12th. Twenty, 10 miles north of Fort St. John, May 17th. Three on Fort Nelson River, June 12th. Doubtful identifications big bend Liard River, June 20th, North Nahanni River and northward, June 29th and 30th, and on Bear River, August 21st.

CANVAS-BACK. *Nyroca valisineria* (Wilson).—Doubtful identifications, 30 miles north of Fort St. John, May 20th and Wrigley, July 21st.

LESSER SCAUP DUCK. *Nyroca affinis* (Eyton).—2? Peace River near British Columbia boundary, May 12th. One female, Wrigley, July 5th. Female and 6 young, sp.? Wrigley, July 20th. 2 Old Wrigley, September 5th and 6th.

BARROW'S GOLDEN-EYE. *Glaucionetta islandica* (Gmelin).—Pair 30 miles north Fort St. John, May 19th. Two Nig Creek, May 26th. Female Sikanni Chief River, June 8th. Two males (1 taken) and 4 females, Fort Nelson River, June 11th. Several on Fort Nelson River, June 13th and 14th, and female with young on 16th. On Fort Nelson, Liard and Mackenzie Rivers to Wrigley as follows:—2 on June 16th, 1 on 17th, 2 on 20th, 4 females with young on 21st, a female on 28th, 3 males on 30th and 1 female on July 1st, 3 females on July 21st. Some *G. c. americana* may be included above.

BUFFLE-HEAD. *Charitonetta albeola* (Linnaeus).—Pair British Columbia boundary on Peace River, May 12th. Female and 5 eggs, about 18 feet up in hole in dead spruce stump, May 21st, on Blueberry River. A pair on Nig Creek, May

24th, three on Beaton River, May 27th. 2 males, Fort Nelson River, June 15th. Two, Liard River near mouth of South Nahanni River, June 21st. Nine males, Liard River rapids, June 24th. Female at River-between-Two-Mountains, June 30th. Two females, Wrigley, July 20th.

WHITE-WINGED SCOTER. *Melanitta deglandi* (Bonaparte).—One seen 40 miles below Simpson, June 28th and 6, June 29th, near North Nahanni River. Several at Old Wrigley, July 1st.

SURF SCOTER. *Melanitta perspicillata* (Linnaeus).—Common from 40 miles below Simpson to Old Wrigley, over 50 noted and two males taken.

EASTERN GOSHAWK. *Astur atricapillus atricapillus* (Wilson).—One dead bird seen at Fort St. John. A doubtful observation, Sikanni Chief River, June 7th.

SHARP-SHINNED HAWK. *Accipiter velox velox* (Wilson).—One, Blueberry River, May 21st; one, June 10th and one, June 12th, Sikanni Chief River; one, Mt. Clarke, August 14th; one, Mt. Charles, August 23rd.

COOPER'S HAWK. *Accipiter cooperi* (Bonaparte).—Doubtfully recognized, Peace River, British Columbia line, May 12th. Fort St. John, May 16th.

RED-TAILED HAWK. *Buteo borealis calurus* Cassin.—Peace River, near British Columbia line, June 12th. Three, Fort St. John, June 17th; three, 30 miles to north, June 19th. Two Nig Creek, June 24th. A pair, nest and 3 eggs (half incubated), near Beaton River, June 20th. A young rabbit lay on the nest, which was built of twigs and lined with strips of bark and was placed about 20 feet up in a dead spruce. Common along Sikanni Chief, Fort Nelson and Liard Rivers to mouth of South Nahanni River, June 9th to 21st. Took a brown male on Sikanni Chief, June 10th, upon which Mr. Taverner made the above classification. He states "it is the first Red-tail I have seen from east of the mountains with this peculiar reddish breast." One at Wrigley, July 17th, 1 dark bird at Ochre River, July 24th. Several seen most days from August 2nd to August 10th at the mouths of tributary streams, from the Blackwater River to Norman, most of these birds being dark brown. The writer saw a large dark brown bird strike down a small light plumaged male of the year at the mouth of Saline River (near Mt. Clarke), on August 9th. The small bird was flying with a gale of wind; the big bird flying up wind at greater elevation, struck the small bird in the back, its talons piercing the lungs on both sides of the shoulder. Having lowered its prey to a gravel bar, the big bird flew on its course leaving its prey in a paralyzed condition. Mr. Taverner notes the small size of the bird killed and states

"as far as subspecific characters go I could duplicate it with many eastern birds." Several seen at Mt. Charles, August 21st. Fairly common from Norman to Trout River, several in light phase, September 5th to 9th. Fairly common, Athabaska Lake to Waterways, August 22nd to 25th.

FERRUGINOUS ROUGH-LEG. *Buteo regalis* (Gray).—Seen at Fort St. John on 13th and 15th of May. One at Fort Norman, August 17th.

GOLDEN EAGLE. *Aquila chrysaetos canadensis* (Linnaeus).—Two on Liard River above rapids, June 23rd; one at Saline River, August 9th; one at Mt. Clark, August 11th; one at Mt. Charles, August 23rd.

NORTHERN BALD EAGLE. *Haliaeetus leucocephalus alascanus* Townsend.—One at Providence, September 10th.

MARSH HAWK. *Circus hudsonius* (Linnaeus).—Eleven, including three grey males, along Peace River, at Fort St. John and north to Nig Creek, May 13th to 24th; two, Gravel River to Norman, August 16th and 17th; two at Norman, August 23rd and 24th; three, Simson to Trout River, September 8th to 10th; one at Resolution, September 13th.

OSPREY. *Pandion haliaëtus carolinensis* (Gmelin).—One at mouth of North Nahanni River, June 29th.

DUCK HAWK. *Falco peregrinus anatum* Bonaparte.—A pair and 3 downy young in nest at top of bank beneath sod, on island at head of rapids, Liard River, June 24th. Male and female at Wrigley, July 17th and 19th; two at Old Wrigley, September 5th.

WESTERN PIGEON HAWK. *Falco columbarius bendirei* Swann.—One in mountains near Blackwater River, July 28th. Five seen up Saline River and on Mt. Clarke, August 9th to 14th. Several on Bear River, August 19th. One, Providence, September 10th.

EASTERN SPARROW HAWK. *Falco sparverius sparverius* Linnaeus.—Rather common. Taylor's Flats and Fort St. John, May 14th to 16th. One, Nig Creek, May 26th. A male, Fort Nelson River, June 15th. Two, Liard River above Fort Liard, June 18th. One, Cap Mountain, June 7th. Three at Wrigley, June 17th to 20th. Several Johnson River, July 31st. Eight observed on Saline River and Mt. Clarke, August 8th to 14th. Common on Bear River, August 19th.

HUDSONIAN SPRUCE GROUSE. *Canachites canadensis canadensis* (Linnaeus).—Three taken at Nig Creek, May 24th. Nest and 4 eggs, Beaton River, May 27th. A female, Fort Nelson River, June 12th. Fairly common in spruce woods bor-

dering Mackenzie from Wrigley to Blackwater, July 5th to August 4th—over sixty seen; two females and one male taken. One male taken, September 11th, at Wrigley Harbour.

GRAY RUFFED GROUSE. *Bonasa umbellus umbelloides* (Douglas).—Common at Fort St. John, May 13th. Nine from Blueberry River north to Summit; a brown male taken, May 20th, 3 taken, May 24th, a nest with 10 eggs, May 27th. A male taken, Sikanni Chief River, June 3rd. Female and young, Fort Nelson River, June 16th; heard drumming, June 17th, and again on Liard on 20th. Female and young at Nahanni Butte, June 22nd. Female and 4 young near Wrigley, July 14th. One on Blackwater River, July 28th.

WILLOW PTARMIGAN. *Lagopus lagopus albus* (Gmelin).—Twenty-six seen on Mt. Clarke and six taken, August 12th to 14th.

ROCK PTARMIGAN. *Lagopus rupestris rupestris* (Gmelin).—One Nahanni Butte, Liard River, June 22nd. Common about Cap Mountain; 37 adults (2 specimens taken) and 26 half-grown young seen, July 7th to 13th. Rock-by-Riverside, Wrigley, 2 females and several young, July 18th. Two adults and 4 young in mountains up Blackwater River, August 3rd. Forty-two seen on Mt. Clarke, one taken, August 12th to 14th. One sp. ? Mt. Charles, August 23rd.

NORTHERN SHARP-TAILED GROUSE. *Pedioecetes phasianellus phasianellus* (Linnaeus).—Fairly common in the northern Franklin Mountains and at Fort Norman where they eat the kitchen refuse. Eight near Mt. Clarke, two taken, August 11th. Two at Norman, August 18th and 24th. Thirty-nine at Mt. Charles, August 21st to 23rd, three taken. Of an adult female taken at Mt. Clarke, August 12th, and a juvenile taken at Mt. Charles, August 23rd, Mr. Taverner says: "Most extraordinary birds. Remarkably small and very dark. . . . They show the postulated characters of the type form described from Hudson Bay in an exaggerated degree."

PRAIRIE SHARP-TAILED GROUSE. *Pedioecetes phasianellus campestris* Ridgway.—Common from Fort St. John to Nig Creek, May 13th to 26th. Four taken. Mr. Taverner says of a male sent him: "Cannot see that this specimen differs from the Prairie Sharp-tail of Southern Alberta." The birds reported as being common at Fitzgerald are probably of this species.

WILSON'S SNIFE. *Capella delicata* (Ord).—Heard in "love song" high in air, Fort St. John, May 12th. Four south of Blueberry, May 23rd.

SPOTTED SANDPIPER. *Actitis macularia* (Linnaeus).—Two at Nig Creek, May 24th and 26th.

One to three each day, June 5th to 9th, along Sikanni Chief River and common after that along Fort Nelson, Liard and Mackenzie to Norman, August 23rd. One at Norman, August 28th. Several above and below Wrigley, September 4th, 5th, 6th.

WESTERN SOLITARY SANDPIPER. *Tringa solitaria cinnamomea* (Brewster).—One Fort St. John, May 16th.

GREATER YELLOW-LEGS. *Totanus melanoleucus* (Gmelin).—Five, Blackwater River, August 1st. Five, Slave River above Fitzgerald, September 20th.

SANDERLING. *Crocethia alba* (Pallas).—A male taken near Providence, September 10th. Flock sp. ? at Resolution, September 13th.

HERRING GULL. *Larus argentatus smithsonianus* Coues.—Sp. ? Peace River, British Columbia boundary and Taylor's Flats, May 9th and 14th. A faded male of previous year taken on the Fort Nelson River, June 12th. Several along lower Liard River. A male taken below Simpson June 28th of which Taverner says: "A good adult. On cursory examination think it shows affinities with the eastern and interior bird rather than with the coast ones." Eight seen between North Nahanni and River-between-Two-Mountains, June 29th to 30th. Common between Blackwater and Saline Rivers, July 30th to August 16th. A few large gulls at Trout River, September 9th and Chipewyan, September 21st.

DUSKY HORNED OWL. *Bubo virginianus saturatus* Ridgway.—A dead bird seen at Fort St. John. One seen north of Blueberry, May 22nd. A juvenile male and an adult female taken near Fort Nelson, June 13th and 14th. Of these Mr. Taverner says: "I should regard them as very light *saturatus*." Three seen on Liard near Fishing Creek. One seen on Mackenzie below Simpson, June 28th.

SNOWY OWL. *Nyctea nyctea* (Linnaeus).—Remains of dead bird at Fort St. John.

AMERICAN HAWK OWL. *Surnia ulula caparoch* (Müller).—A pair taken near Nig Creek, June 26th. A female taken north of Summit, June 29th. One seen on Mt. Clarke, August 13th, one at Providence, September 10th.

SHORT-EARED OWL. *Asio flammeus flammeus* (Pontoppidan).—One at Fort St. John, May 15th. One at Fort Simpson, June 25th. One at Providence, September 10th.

EASTERN NIGHTHAWK. *Chordeiles minor minor* (Forster).—Common, Beaton River, May 27th and 28th. Common along Sikanni Chief, Fort Nelson and Liard Rivers to Nahanni Butte, June

5th to 22nd. Heard below Simpson, June 28th. One seen at Wrigley, July 23rd.

EASTERN BELTED KINGFISHER. *Megaceryle alcyon alcyon* (Linnaeus).—Heard at Sikanni Chief River, June 1st and 2nd. Occasional along rivers from Fort Nelson to site of Old Wrigley, 10 being seen from June 15th to July 1st. One at Ochre River, July 25th; one at Johnson River, July 31st; one at Blackwater, August 6th; one at Saline River, August 14th; one at Wrigley Harbour, and one at Hay River, September 11th and 12th.

NORTHERN FLICKER. *Colaptes auratus luteus* Bangs.—Several at Rolla Landing and St. John, May 12th and 14th; common north for 30 miles; common also near Nig Creek, May 25th and 26th. Four seen on Fort Nelson from Post to mouth, June 13th to 16th. One at Fort Simpson, June 25th. One at North Nahanni River, June 29th. Fairly common at Wrigley, July 2nd to 20th. One at Saline River, August 9th.

NORTHERN PILEATED WOODPECKER. *Ceophloeus pileatus abieticola* Bangs.—Evidently fairly common along Sikanni Chief, Fort Nelson and Liard Rivers to Fort Liard. Three seen and several heard, June 10th to 19th.

YELLOW-BELLIED SAPSUCKER. *Sphyrapicus varius varius* (Linnaeus).—Common ten miles north of Fort St. John, May 17th. Two seen at Blueberry River, May 20th; a female taken at Nig Creek, May 24th. Several at Summit, May 30th. Heard near Fort Nelson.

NORTHERN HAIRY WOODPECKER. *Dryobates villosus septentrionalis* (Nuttall).—One on Blackwater River, July 28th and a female there on August 7th.

ARCTIC THREE-TOED WOODPECKER. *Picoides arcticus* (Swainson).—One female seen at Summit, May 29th, with a nest in a dead Jack Pine about 7 feet from ground.

AMERICAN THREE-TOED WOODPECKER. *Picoides tridactylus bocatus* Bangs.—One at Blueberry River, May 20th.

EASTERN PHOEBE. *Sayornis phoebe* (Latham).—Common at Rolla and Fort St. John, May 12th and 13th. Common along Sikanni Chief, June 7th, and along whole route to the mouth of the North Nahanni River, June 29th. Heard at Wrigley, July 20th.

SAY'S PHOEBE. *Sayornis saya saya* (Bonaparte).—Two at Fort St. John, May 13th. Four, one taken, 30 miles north, May 20th. One at Nig Creek, May 25th.

LEAST FLYCATCHER. *Empidonax minimus* (Baird and Baird).—Common at Nig Creek, May 27th.

Heard commonly along the Sikanni Chief River and occasionally along Liard and Mackenzie Rivers to Simpson, June 6th to 27th.

OLIVE-SIDED FLYCATCHER. *Nuttallornis mesoleucus* (Lichtenstein).—Heard commonly on Sikanni Chief River to big bend of Liard River, June 6th to 20th.

HORNED LARK. *Otocoris alpestris* prob. *hoysi* Bishop.—One Nig Creek, May 24th.

TREE SWALLOW. *Iridoprocne bicolor* (Vieillot).—Common, Fort Nelson to big bend Liard, June 17th to 20th, and along Mackenzie from North Nahanni to River-between-Two Mountains, June 28th to 30th.

BANK SWALLOW. *Riparia riparia riparia* (Linnaeus).—Several at Blueberry River, May 20th. Twelve pairs nesting Conroy Creek, June 8th. Common and generally nesting along route travelled to North Nahanni River, June 10th to 28th. Several at mouth of Johnson River, July 31st and at Blackwater River, August 6th.

CLIFF SWALLOW. *Petrochelidon albifrons albifrons* (Rafinesque).—One bird at old nests Blueberry River, May 21st; two dead young birds of last year in an old nest. One bird at Klewie Creek, June 13th. About 200 nesting near mouth of Fort Nelson River, June 16th.

CANADA JAY. *Perisoreus canadensis canadensis* (Linnaeus).—Generally distributed along whole route, but not seen for days at a time as over the Divide north of Fort St. John from Nig Creek to the Sikanni Chief valley, and from Fort Liard to Wrigley, June 20th to July 2nd. Below Wrigley seen only on the Blackwater River and neighbouring mountains and at Norman. A male taken at Hay River, September 12th and two birds seen at McMurray, September 24th. Immature birds seen on Sikanni Chief River, June 5th and 11th.

NORTHERN RAVEN. *Corvus corax principalis* Ridgway.—One seen at Taylor Flats, May 14th. Occasional along whole route from Conroy Creek, June 10th, to Old Wrigley, July 1st, about 30 being seen and one taken on North Nahanni River, June 29th. One seen at Wrigley, July 19th, one at Johnson River, July 31st. A male taken at Blackwater River, August 7th, and six seen here and at Saline River, August 7th to 9th. Several from Gravel to Bear River, August 17th to 19th. Two at Norman, August 28th and 29th. Occasional, Wrigley to Resolution, September 6th to 12th, about 15 seen. Several along Upper Slave, September 20th.

WESTERN CROW. *Corvus brachyrhynchos hesperis* Ridgway.—Fairly common at Fort St. John,

May 15th and 16th. Heard at Nig Creek, May 24th.

LONG-TAILED CHICKADEE. *Penthestes atricapillus septentrionalis* (Harris).—One at Nig Creek, May 25th. Two on Sikanni Chief River. June 5th and 12th.

HUDSONIAN CHICKADEE. *Penthestes hudsonicus hudsonicus* (Forster).—Several on Beaton River, May 27th. One at Nahanni Butte, June 22nd. Fairly common in Franklin Mountains and vicinity, from east of Wrigley, July 9th to Mt. Charles, August 23rd.

RED-BREASTED NUTHATCH. *Sitta canadensis* Linnaeus.—Birds probably of this species heard on Fort Nelson River, June 12th.

EASTERN ROBIN. *Turdus migratorius migratorius*. Linnaeus.—Common and in song Taylor's Flats, May 14th. Common to Nig Creek, May 26th, not seen on summit but common along Sikanni Chief River and along route to Wrigley, June 8th to July 2nd, and in Franklin Mountains to east until July 14th. Three eggs in nest on ground and young birds flying at Simpson, June 28th. Not recorded after July 14th at Wrigley until July 31st at Johnson Creek. Heard rarely to Blackwater River, August 7th. One seen at Mt. Charles, August 21st. Common at Norman, September 2nd. Occasional along Mackenzie from Norman to Trout River, September 3rd to 9th.

NORTHERN VARIED THRUSH. *Ixoreus naevius meruloides* (Swainson).—Common along Sikanni Chief and Fort Nelson Rivers, June 2nd to June 14th. Common at Fort Liard and Nahanni Butte, June 19th to 21st. Common at mouth of North Nahanni River, June 29th. Two reliably reported at Norman, September 2nd and 3rd.

EASTERN HERMIT THRUSH. *Hylocichla guttata faxoni* Bangs and Penard.—Common apparently from Fort St. John along whole route and in the Franklin Mountains. In song from May 20th on Blueberry River to July 20th on Cap Mountain. A nest with three blue eggs at Summit north of Fort St. John, May 29th.

OLIVE-BACKED THRUSH. *Hylocichla ustulata swainsoni* (Tschudi).

GREY-CHEEKED THRUSH. *Hylocichla minima aliciae* (Baird).—Birds of one or the other of these species at Fort St. John, May 13th, at the Summit, May 29th; heard commonly along Sikanni Chief River and route to north and in Franklin Mountains, June 5th to July 10th. A nest under a root with 4 young, Fort Nelson River, June 10th. A female taken at Norman, September 3rd, proves to be *H. ustulata swainsoni*.

MOUNTAIN BLUEBIRD. *Sialia currocoides* (Bechstein).—Fairly common from Fort St. John to

Nig Creek, May 15th to 24th. One specimen taken.

TOWNSEND SOLITAIRE. *Myadestes townsendi* (Audubon).—Two at Mt. Charles, August 23rd.

EASTERN RUBY-CROWNED KINGLET. *Corthylio calendula calendula* (Linnaeus).—Common in song Nig Creek to Summit, May 24th to 30th, and along Sikanni Chief and Fort Nelson Rivers to Fort Nelson, June 9th to 13th.

AMERICAN PIPIT. *Anthus spinoletta rubescens* (Tunstall).—Several on Cap Mountain, July 11th and 12th. Two on Mt. Clarke, August 12th. A flock at Norman, August 29th and common there and along river to Simpson, September 8th. Common at Fitzgerald, September 19th.

CEDAR WAXWING. *Bombycilla cedrorum* Vieillot.—Several at Beaton River, May 28th. Several at Johnson River, July 31st, and at Blackwater River, August 1st. Some may have been *B. garula pallidiceps*.

RED-EYED VIREO. *Vireo olivaceus* (Linnaeus).—One seen at Beaton River, May 28th. Heard commonly along Sikanni Chief, Fort Nelson and Liard Rivers to Nahanni Butte, June 7th to 22nd; again at Wrigley, July 17th to 20th. Two seen in Franklin Mountains, July 26th, and two near Blackwater River, August 1st.

EASTERN YELLOW WARBLER. *Dendroica aestiva aestiva* (Gmelin).—Doubtful recognition near Nig Creek, May 25th. One at mouth of Fort Nelson River, June 17th. Common and in song 50 miles below Simpson, June 28th. Heard at Wrigley, July 20th.

MAGNOLIA WARBLER. *Dendroica magnolia* (Wilson).—A male seen at Old Wrigley, July 1st.

MYRTLE WARBLER. *Dendroica coronata* (Linnaeus).—Several near Nig Creek, May 23rd and 24th. Two reported on Sikanni Chief River, June 7th. A female seen at Wrigley, July 21st.

BAY-BREASTED WARBLER. *Dendroica castanea* (Wilson).—Several seen near Wrigley, July 3rd.

BLACK-POLL WARBLER. *Dendroica striata* (Forsater).—One taken August 5th, on Blackwater River.

OVEN-BIRD. *Seiurus aurocapillus* (Linnaeus).—Heard at the Summit north of Fort St. John, May 30th. Heard commonly along Sikanni Chief, Fort Nelson and Liard Rivers to Nahanni Butte, June 5th to 22nd.

GRINNELL'S WATER-THRUSH. *Seiurus noveboracensis* (Ridgway).—One seen at Blueberry River, May 20th.

AMERICAN REDSTART. *Setophaga ruticilla* (Linnaeus).—Probably common along rivers traversed.

Reliably reported from Liard, June 20th and Mackenzie below Simpson, June 28th.

ENGLISH SPARROW. *Passer domesticus* (Linnaeus).—Common Peace River town, May 8th. Not noted up river. (In 1930 this species was common at Taylor's Flats and Fort St. John.)

GIANT RED-WING. *Agelaius phoeniceus arctolegus* Oberholser.—Common Rolla Landing, Fort St. John and north to Nig Creek, May 12th to 26th. A specimen taken at Fort St. John, June 13th, was recognized as *A. p. arctolegus* Oberholser, by Taverner. A male near its nest in a typical black-bird marsh near Klewie Creek, June 12th, appeared to be at the northern limit of its range.

RUSTY BLACKBIRD. *Euphagus carolinus* (Müller).—One probably of this species near Blueberry River, May 19th. A female taken at Trout River, September 9th. Several from there to Wrigley Harbour, September 11th. Common about Fort MacKay, September 23rd.

NEVADA COWBIRD. *Molothrus ater artemisiae* Grinnell.—Males common Rolla Landing, May 12th. Common Fort St. John to Nig Creek, May 13th to 25th.

ROSE-BREADED GROSBEAK. *Hedymeles ludovicianus* (Linnaeus).—Heard commonly along Sikanni Chief, Fort Nelson and Liard Rivers, June 5th to 25th.

PURPLE FINCH. *Carpodacus purpureus purpureus* (Gmelin).—Common at Rolla Landing and Fort St. John, May 12th and 13th; and from Nig Creek to Summit, May 24th to 29th.

GREY-CROWNED ROSY FINCH. *Leucosticte tephrocotis tephrocotis* (Swainson).—A bird probably of this species seen on Cap Mountain, July 12th.

COMMON REDPOLL. *Acanthis linaria* sub. sp.?—One seen on Liard River, June 20th.

NORTHERN PINE SISKIN. *Spinus pinus pinus* (Wilson).—Common from Blackwater River to Norman, August 6th to 29th.

EASTERN GOLDFINCH. *Spinis tristis* prob. *tristis* (Linnaeus).—Common in song Peace River town, May 8th. One in song, Nig Creek, May 27th.

WHITE-WINGED CROSSBILL. *Loxia leucoptera* Gmelin.—Common Fort Liard to South Nahanni River. Heard doubtfully as far north as Blackwater River, July 29th.

WESTERN SAVANNAH SPARROW. *Passerculus sandwichensis alaudinus* Bonaparte.—Common, Taylor Flats, May 14th, and south of Summit, May 28th, sub. sp.? Common at Wrigley Harbour, September 11th. A male taken here is placed doubtfully in *alaudinus* by Taverner.

WESTERN VESPER SPARROW. *Poocetes gramineus*

confinis Baird.—Common, Fort St. John to Blueberry River, May 13th to 19th. One south of Nig Creek, May 23rd. Two nesting below Norman, June 28th.

SLATE-COLORED JUNCO. *Junco hyemalis hyemalis* (Linnaeus).—Common everywhere throughout trip. Seen least commonly from Blackwater River to Norman, August 4th to 27th. Two nests with 4 eggs each on Sikanni Chief River, June 1st and 2nd.

TREE SPARROW. *Spizella arborea arborea* (Wilson).—One seen at Norman, September 3rd; one at Old Wrigley, September 4th. A male taken at Providence, September 10th, which Taverner doubtfully referred to *S. a. ochracea* Brewster on distribution. The new check list makes its identity with the eastern bird probable.

WESTERN CHIPPING SPARROW. *Spizella passerina arizonae* Coues.—Several at Peace River town, May 8th. Common at Fort St. John, May 16th. One at Fort Liard, June 18th; one at Simpson, June 26th and 27th. Common at Wrigley, July 3rd. Several at McMurray, September 25th.

GAMBEL'S SPARROW. *Zonotrichia leucophrys gambeli* (Nuttall).—Several at Peace River town, May 8th. Three seen, the last in song, Fort Simpson to River-between-Two-Mountains, June 26th to 30th. Common and in song in Franklin Mountains east of Wrigley, July 7th to 12th. Several at Wrigley, July 20th. Two at Blackwater, July 28th. Several at Mt. Clarke, August 13th and 14th. Common at Norman, September 1st to 4th, in song on last date.

WHITE-THROATED SPARROW. *Zonotrichia albicollis* (Gmelin).—Common in song, Peace River town, May 8th. Fairly common from Fort St. John to Sikanni Chief River, and in song along whole route to River-between-Two-Mountains, June 6th to 30th. Not recorded afterwards.

EASTERN FOX SPARROW. *Passerella iliaca iliaca* (Merrem).—Common at Norman, August 29th to September 4th. A female taken August 29th was sent to Taverner.

SWAMP SPARROW. *Melospiza georgiana* (Latham).—Common at Norman, August 29th to September 4th. A specimen was submitted to Taverner.

ALASKA LONGSPUR. *Calcarius lapponicus alascensis* (Ridgway).—Flocks at Fort St. John, May 10th. One bird seen at Conroy Creek, June 9th.

MAMMALS.

BLACK BEAR. *Euarctos americanus*.—Common along Sikanni Chief River, four seen, May 31st to June 9th. Signs near Cap Mountain, July 10th. One seen on Blackwater River, August 7th.

MARTEN. *Martes americana*.—One of the commonest and most profitable furbearers of the Mackenzie valley. One was seen chasing a red squirrel about 10 o'clock at night, June 30th, about 50 miles below Simpson.

WEASEL. *Mustela* (cf. to Dr. Anderson).—Probably common. A specimen, taken from a trap at La Butte, near Fitzgerald, was sent to Dr. Anderson.

RED FOX. *Vulpes* sp. ?—One seen on Mt. Clarke, August 13th.

LYNX. *Lynx canadensis*.—A common furbearer in most of the region. One heard in Franklin Mountains, August 2nd.

CANADA WOODCHUCK. *Marmota monax canadensis* (Erxleben).—Sub-species assumed from distribution. One seen at Nig Creek, May 26th. Two seen along Fort Nelson River, June 10th and 16th; they were smaller and with redder and more bushy tail than eastern animals. One at Liard Rapids, June 24th. Two skins seen at Fort Simpson, where they are called "Winisks"; like small eastern ground hogs, one of about the eastern colour, and one dead black.

NORTHERN CHIPMUNK. *Eutamias minimus borealis* (Allen).—Common at Rolla Landing, May 12th, also at Barker Creek, May 28th. One at Waterways, September 25th.

RED SQUIRREL. *Sciurus hudsonicus*.—Well distributed in the coniferous forests everywhere. Very common along Sikanni Chief River, one seen on bare top of Nahanni Butte, 3,900 feet above the river, June 24th. Reasonably common in Franklin Mountains, common at Norman, and on Mt. Charles.

MEADOW MOUSE. *Microtus* (sp. see Dr. Anderson).—A specimen taken at Fort St. John, May 17th, was sent to Dr. R. M. Anderson. Near Blueberry River, writer saw a small "vole" swim across a small creek under water.

VARYING HARE. *Lepus americanus*. sub. sp.?—Very common at St. John and Taylor's Flats. Occurring sparingly along the whole route.

MUSKRAT. *Ondatra zibethica*.—Common in suitable localities. One seen at Trout River, September 7th.

MOOSE. *Alces americana*.—This is the most dependable large game of the Liard and Mackenzie valleys, and yet is rarely seen and may be scarce over some areas. Two seen on Sikanni Chief River. Tracks along Fort Nelson River, in Franklin Mountains and along tributaries of Mackenzie below Simpson. A cow and calf swam Liard River near mouth, June 25th.

BARREN GROUND CARIBOU. *Rangifer arcticus* sp.?—Two cast antlers, one large, on Cap Mountain; antlers were also found on Mt. Clarke.

REPTILES AND BATRACHIANS.

GARTER SNAKE.—A light grey snake, 28 inches long, seen at Fort St. John, May 13th.

FROGS.—Probably northern spotted, in full song from Taylor's Flats to Blueberry River, May 14th to 18th. Several seen near mouth of Fort Nelson River, June 16th and 17th. "Pipers" in Franklin Mountains east of Wrigley, July 6th. Several frogs and tadpoles at Wrigley, July 19th and 20th. Frogs common at Johnson River, July 29th to 31st. Several along Saline River, August 9th.

GEOGRAPHIC VARIATION IN THE BIG BROWN BAT (*Eptesicus fuscus*)

By GLOVER M. ALLEN



THROUGH the courtesy of Dr. R. M. Anderson, I have lately had the opportunity of studying the series of Big Brown Bats (*Eptesicus fuscus*) in the collection of the National Museum of Canada (Ottawa), taken at various places in eastern Canada, Alberta and British Columbia. On laying out this series according to localities, it was evident at once that notwithstanding the generally uniform type of colouring and the slight amount of individual variation, three distinct geographic forms were represented, (1) the olive-brown eastern bat, (2) a much paler, almost white-bellied one from the semi-arid regions of Alberta, and (3) a richly

coloured form from the saturate regions of the Pacific coast of British Columbia. A further comparison of the specimens in the Museum of Comparative Zoology, together with a series of eight lent by the Academy of Natural Sciences at Philadelphia, representing topotypes of the subspecies described as *bernardinus* and *melanopterus*, has resulted in making clearer the distribution of the races found in the continent of North America.

The colour differences correspond fairly well with areas of contrasted humidity. Thus the eastern race, *Eptesicus fuscus fuscus* (Beauvois), type locality, Philadelphia, Pennsylvania, is

tawny olive and glossy above, slightly paler and dull below, with a small amount of individual variation. This race extends from Nova Scotia, to western Ontario and south to northern Florida, east of the Plains.

In southern Florida there is an obvious increase in the richness and intensity of the colouring, which though slight, is sufficient to characterize the race *Eptesicus fuscus osceola* Rhoads, type locality, Tarpon Springs, Hillsboro County, Florida. It closely resembles in colour the Pacific Coast race.

Westward of the Mississippi River region, in correlation with the greater aridity, there is a decided paling out of the colouration, characterizing a well-marked race of the west-central United States and Canada, to which the appropriate name *pallidus* was given by Young in 1908, type locality, Boulder, Boulder County, Colorado. In this dry-country subspecies, the lower surface is sometimes nearly pure white at the tips of the hairs, although their bases are dark, while the dorsal surface is, in extreme examples, "pinkish buff" of Ridgway (1912), as is the case in some of the Alberta specimens (Lac La Nonne). Others from Las Cruces, New Mexico, are nearly as pale though a trifle more soiled whitish below. The range of this form, *Eptesicus fuscus pallidus* Young, is then from Colorado and New Mexico north to Dakota and Alberta.

Westward again, the colouring deepens in intensity as the Pacific coast is reached, resulting in a much brighter brown, nearly cinnamon above, and a duller tint below. This colouring is most extreme in the series from the coast of British Columbia where the atmospheric moisture is greatest but specimens from California, including

Yosemite, Mt. Tallac, San Bernardino, and Mt. Whitney, are distinctly this rather than the whitish-bellied race of the interior. To these Pacific Coast specimens, therefore, the name *Eptesicus fuscus bernardinus* Rhoads will apply, type locality, near San Bernardino, San Bernardino County, California. A synonym is *E. f. melanopterus* Rehn, based on the Mt. Tallac series, some of which I have studied in this connection. A single specimen from Pacheco, Chihuahua, is perhaps as near this as to typical *fuscus*, from which it is hardly distinguishable. Complete intergradation between all these subspecies is obvious, so that frequently it is hard to place individual specimens, but when series are compared the average differences come to view.

From southern Mexico (Mirador, Vera Cruz) has been described a yet darker form, *Eptesicus fuscus miradorensis*, of which a specimen in the Museum of Comparative Zoology from Boquete, eastern Panama, adds a slight extension to the range as given in Miller's check-list (1924). It is nearly "cinnamon brown" above and slightly paler, nearly "buckthorn brown" below.

Finally, from the arid tip of the Lower California peninsula Thomas has named as a distinct race, *Eptesicus fuscus peninsulae*, type locality, Sierra Laguna, Lower California, Mexico. Of this I have seen no specimens.

These notes are offered in an attempt to make the status of the various described subspecies a little clearer and to define their general ranges, since there has been hitherto more or less uncertainty as to the validity of the western races and their general distribution. In Central America a distinct and smaller species, *E. propinquus* (Peters) occurs side by side with the larger.

WILLIAM MARKWICK'S "FLORULA CANADENSIS"

By JOHN ARDAGH



HIS INTERESTING manuscript is in the collection of the Linnean Society of London, and as it is apparently unknown to Canadian botanists, my friend Mr. John Adams, of the Central Experimental Farm, Ottawa, suggested the compilation of this note.

The "Florula" consists of 219 drawings, in Indian ink outline and wash, with a few in water-colour, accompanied by short descriptions on the opposite pages, and is now bound in three folio volumes, with this title-page:—

"Florula Canadensis, or Figures and Descriptions of North American Plants found in Canada

and at Gaspee [sic] Bay in Nova Scotia. Drawn from dried specimens in the possession of Mrs. Prescott by William Markwick F.L.S."

On the back of the title-page is this inscription: To the President, Vice Presidents and Fellows of the Linnean Society these Drawings of Canadian Plants are most respectfully presented by their most obedient humble servant Wm. Markwick.

The volumes are not dated, but many of the sheets are watermarked "1795" and "1801"; some of the plants were sent from Upper Canada by Mr. White, Attorney-General.

William Markwick, afterwards Eversfield (1739-1813), lived at Catsfield in Sussex and was much interested in the natural history of that country. He became an Associate of the Linnean Society in 1788 and a Fellow in 1792. He corresponded with Gilbert White and most editions of "The Natural History and Antiquities of Selborne" contain Markwick's "Naturalist's Calendar."

Many of his manuscripts are in the possession of the Linnean Society; in addition to the

"Florula Canadensis" there are (1) "Plantae Sussexienses" communicated to the Society on 16 November and 21 December, 1802, but not printed, (2) "British Zoology, containing descriptions and figures of several species of Fish and Mollusca found on the coast of Sussex," (3) "Remarks on British Birds," and (4) "Descriptions and Figures of Grasses." There are some interesting notes on these manuscripts by J. E. F. Harting in the "Zoologist," 1890, p. 335.

THE "BLUE LIMESTONE" OF HASTINGS COUNTY, ONTARIO *

By M. E. WILSON

NEAR THE southern border of the Canadian Pre-Cambrian Shield, in the central part of Hastings county, southeastern Ontario, there are widespread areas of a most unusual-looking rock that has long been known as the "blue limestone." This limestone, called "blue" because of the deep colour of its weathered surface, is everywhere finely bedded and in many places contains interstratified beds of slate or argillite. (Figure 1). In a few localities, also, but only in its lowermost part, it includes beds of buff-weathering dolomite.

In every outcrop of rock there is recorded some information regarding the story of our earth in the region where the outcrop occurs. Thus in the two outcrops of the "blue limestone" seen in Figures 1 and 2, we learn from the presence of uniform bedding that the rock was deposited in a standing body of water and, from the composition of the rock, and its known wide extent and thickness, that it was almost certainly laid down in the sea. Furthermore, the occurrence in the "blue limestone" of beds of slate or argillite (Figure 1), material carried from the land in suspension by rivers and deposited as mud from time to time on the sea bottom, indicates that

* Published with the permission of the Director, Geological Survey of Canada, Department of Mines, Ottawa.



FIGURE 1—"Blue limestone" and argillite of Hastings Series, lot 2, concession 7, Marmora township, Hastings county, Ontario



FIGURE 2—"Blue limestone" and dolomite of Hastings Series, lot 12, concession 6, Madoc township, Hastings county, Ontario

the rock was laid down in proximity to land and probably in relatively shallow water. Another characteristic of the "blue limestone" conveying information regarding the history of the earth in Hastings county is the fact that everywhere the beds, which were originally horizontal are now highly tilted or, as in Figures 1 and 2, stand nearly vertical, and in many places are much crumpled or broken. It may also be observed that the beds of dolomite (in Figure 2), which is harder and more competent than the limestone, have been broken, the limestone filling the inter-spaces between the fragments. All of these features show that the "blue limestone" and its associated rocks have been intensely deformed, a transformation that is only effected throughout wide areas in the earth by mountain building. Geologists conclude, therefore, that the "blue limestone" of Hastings county was at one time

deeply enfolded in the heart of a great (Pre-Cambrian) chain of mountains, which have since been worn down so that their interiors are now exposed at the earth's surface.

The "blue limestone" of Hastings county forms part of a group of rocks known to geologists as the Hastings Series. It can be seen in many places in fields and pastures along the Hastings county road between Madoc and Bancroft and along the Sarnia-Ottawa provincial highway between Marmora and Madoc. The outcrop shown in Figure 1 lies in the east end of lot 2, concession 7, Marmora township, and about 1 mile west of the Sarnia-Ottawa Highway; that in Figure 2, in the southeast corner of the north half of lot 12, concession 6, Madoc township, and about three-quarters of a mile east of the Wallbridge iron mine on the Hastings road.

SOME NOTES ON THE HENSLOW SPARROW

By J. MURRAY SPEIRS

MY FIRST acquaintance with the Henslow Sparrow was on June 1st, 1931, about two miles north of Lowbanks, Ontario. (Lowbanks is a small village on the north shore of Lake Erie about due south of Grimsby.) Mr. F. H. Emery had been telling me about his experience with this bird near London, Ontario. It was his description of the 'song' of the bird which enable me to identify this sparrow, which I should probably have overlooked otherwise.

As I walked through a wet pasture a new note began to sink into my consciousness. *Tzz-dick*. What was the source of the note? Where was the source? Again *Tzz-dick*, and again, and again. You have heard the Kingbird as it flutters above some poor misguided crow *Tzz-dick-kle-dickle-dickle-dickle-dick-dick*. When the Kingbird has routed the enemy and returned to his fence post he dreams and mutters to himself *Tzz-dick*—*Tzz-dick*. The Henslow Sparrow says, *Tzz-dick*, but when you look for him is he on a fence post dreaming of victories won and to win? No! I looked. There was not a fence nor anything higher than a dogwood bush for two hundred yards. In one of these little bushes a little sparrow sat with his back to me, just the sort of back a Swamp Sparrow should present, I thought. He turned and snapped *Tzz-dick* over his left shoulder. My thoughts went back to Toronto; again I heard Mr. Emery telling me of his trips to Western Ontario, of the bird that says, *Tzz-dick*. I looked again. *Tzz-dick*. My, what a big white beak you have; what nice pink feet you have; and such a lovely little necklace! About this time my bird became self-conscious and left for parts unknown displaying a very ragged tail. I jumped one of the many dogwood-bordered shallow streams that wander through the pasture and located four singing males. From this I gathered that quite a little colony of these birds was probably hidden in the long grass and longer weeds. Further investigations were rudely interrupted by a black bull which made its appearance twisting its tail and saying such things as only a bull can when it finds you in its harem.

Further observations of this colony were made on June 4th, 1931, and a few days later by Mr.

Emery. I visited the colony again this spring (1932) on May 15th. I noticed six birds and discovered that when one of them did not wish to be observed he disappeared with the ease and completeness of the Rails and other marsh gentry. Meanwhile his five brethren would chuckle *Tzz-dick* from five different and most indefinite directions. I watched one enter a sweet clover patch, approached without taking my eyes off the patch, and disturbed great numbers of noisy Bobolinks but no Henslow Sparrow. I finally gave up such fruitless searches and was escorted to the fence by a score of ecstatic Bobolinks.

The foregoing took place at Lowbanks on the north shore of Lake Erie which is the acknowledged territory of the Henslow Sparrow. Mr. Emery saw a Henslow Sparrow at Toronto Island this spring, farther north than the usual range. On July 3rd, 1932, Hubert Richardson, Basil Penlington, and I visited Erindale to observe Field Sparrows and look for a Green Heron. Having observed both we were returning to the car when we heard *tzz-tsic* in a field to the south of us. Hubert spotted him in a patch of vetch, singing over his left shoulder as usual. We approached slowly, stopping to observe him from time to time. Finally he flew ahead and vanished in the long grass. I stayed behind to find out, if possible, why they vanish so successfully. Hubert and Basil spread out and had reached the place where he had disappeared when he flew out some distance behind them and proceeded to a thorn bush. In the thorn bush he allowed us to inspect him at remarkably close range. He did not sing now, but peered at us through the leaves, head down and tail up, then turned and peered at us with his other eye, still head down and tail up. Mr. Emery noticed this same peculiar pose in his Western Ontario birds. Basil approached to within ten feet but the bird never stirred a foot but moved about like a nervous canary in a cage. Another bird was heard at Erindale, but not seen.

I have written this article in the hope that no reader will collect these birds but will give them every opportunity to become established so close to Toronto.

NOTES AND OBSERVATIONS

BIRD NOTES FROM COCHRANE, ALBERTA.—There is a scarcity of Red Polls this winter (1931-32). Since the first flight in late October I have seen only two small flocks.

Large numbers of Snow Buntings everywhere between here and Calgary (35 miles).

A band of Bohemian Waxwings has been about for the past two months.

I have seen a flock of White-winged Crossbills in the spruce woods, four miles north of here. Last year I saw hundreds, nay, thousands.

In Cochrane, a week ago, I came upon a small flock of Evening Grosbeaks feeding on sunflower seeds in the station agent's garden. A passer-by remarked "What pretty birds! They are not the ordinary snow-birds, are they?" I enlightened him on the subject. All small winter birds are "snow-birds" out here.—A. GISSING.

AN OCCURRENCE OF THE CLAY-COLOURED SPARROW, *Spizella pallida*, IN RENFREW COUNTY, ONTARIO.—On July 10, 1930, I was driving by car through a rough section of country near Golden Lake, Ontario. At the bottom of a steep hill I stopped for a rest, and almost immediately a Clay-coloured Sparrow sang its well-known *buzz buzz* song from the top branch of a small tree almost over my head. It sang in full sight of me for a few minutes and then disappeared. At this place the sandy dirt road, bordered by thickets and rail-fences passed between a barren, partly wooded, hilly pasture on one side, and a field crop on the other. The specimen was secured on July 11th, and the locality determined as five miles southeast of Golden Lake Station, Renfrew County, Ontario, almost the exact centre of the county. This is believed to be the first record of the species in the Ottawa valley.—HOYES LLOYD.

PYGMY NUTHATCH ON VANCOUVER ISLAND.—On October 11th, 1931, while deer hunting with Ian McT. Cowan in the vicinity of Williams Beach—about twelve miles north-west of Comox—I heard the unmistakable notes of Pygmy Nuthatches in the tops of the tall Douglas firs in a rather open and parklike bit of country. The cheeping notes of this species are so different from those of its relatives that I was quite certain of the bird and my comrade backed the identification. On the 13th I returned here with my wife and we spent the day scouring the woods of the vicinity, and about sun-down were rewarded by a sudden outburst of the pygmy "cheeping" right overhead in the upper branches of tall firs. Red-breasts and Pygmies were in company and

they were very high but a second load of dust shot proved conclusively that *Sitta pygmaea pygmaea* is at least occasionally a visitor to Vancouver Island. On October 25th Pygmies were again heard and seen in the trees at my home on the beach at Comox.

In the B.C. list of Brooks and Swarth, the Pygmy Nuthatch on Vancouver Island is dismissed with: "The statement by Lord (1866, vol. 2, pp. 133, 296) of its occurrence on Vancouver Island, repeated by Brown (1868, p. 421) and by Ridgeway (1904, p. 456), is an obvious error." The above record then, which plainly was not a mere straggler but one of a small migration, at least establishes the species on Vancouver Island.

It is of interest also to recall here that to date the only record of the Slender-billed Nuthatch (*Sitta carolinensis aculeata*) for the island is a bird that I secured at Comox on September 9, 1922.—HAMILTON M. LAING.

YELLOW-HEADED BLACKBIRD IN B.C.—It is of interest to record another eastern or mid-western bird turning up on the coastal waters of Vancouver Island. On May 19th, 1932, at Denman Island Spit, close to Comox, I secured a specimen of a juvenile male Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*). As in the Brooks & Swarth British Columbia list the inclusion of the species by Selater in a list of Vancouver Island birds is given doubtful recognition, it is well to record this capture.—HAMILTON M. LAING.

CAROLINA WREN (*Thryothorus l. ludovicianus*) AT TORONTO.—While studying birds in a ravine at North Toronto, Ontario, on February 9, 1931, the writer observed a large wren-like bird on the side of a hill, where the sun had melted the snow.

When collected the bird proved to be a female Carolina Wren which makes the fourth Toronto record for this species.* The measurements of the specimen, which is now in my collection, are as follows,—length, 141 mm., wing, 59mm., wing-expanse, 185 mm.—CLIFFORD E. HOPE.

*The previous Toronto records are recorded by:
J. H. Fleming and Hoyes Lloyd, *Auk*, 37:438, 1920.
L. L. Snyder, *Can. Field-Nat.*, 37:159, 1923.
R. V. Lindsay, *Can. Field-Nat.*, 45:205, 1931.

CRESTED FLYCATCHER AND CAST SNAKE-SKINS.—In the spring of 1931 a pair of Crested Flycatchers nested in my Martin house: which by the way has been waiting six years for its proper tenants.

Having read that the Fly-catcher used snake skins as nesting material, I collected a few skins during the summer, hoping that the birds would return this spring.

I waited in vain all spring, and was just about to give up all hope when, on June 24th, a pair started looking over the house and on the 26th began making a nest.

In the afternoon of the 27th I put the snake skins on the ground near the house and sat down about 30 feet away. In about five minutes one of the birds appeared from across the road carrying a large piece of grass root in its mouth. Its line of flight took it straight over one of the snake skins. As it passed over the skin (at a height of, I should say, twenty feet) the bird suddenly arrested its forward movement, and remained fluttering in suspension for quite a few seconds.

It then darted into the nearest hole in the house, deposited the grass root, swooped down on to the snake skin and bore it triumphantly into the house.

The remaining skins were quickly spied and made use of.

At dusk that evening I put out another skin and with it some pieces of cotton, some string and some pieces of old chamois leather. In the morning the skin and the chamois had been

taken but neither the cotton nor the string had been touched.

The sad sequel to this story is that after working hard at the nest for four days the birds disappeared. One turned up again two or three times during the next two weeks but my Martin house remained unoccupied for its sixth summer.—A. G. HAULTAIN.

Dear Sir:—

I am very anxious to get in touch with two or three Canadian naturalists who would be willing to correspond with me on the subject of natural history.

I am not an authority on any branch of natural history, nor am I a teacher or a professor in any of these branches. I am merely one who makes natural history a hobby. My main interest is in entomology, but I am also well acquainted with the botany and zoology of my district.

What I should like would be to exchange nature notes which refer particularly to my own district with similar notes referring to the locality in which my correspondent lives, something after the manner of the celebrated Gilbert White. Besides notes I would exchange photographs and specimens, and I firmly believe that if some Canadian naturalist would correspond with me that it would be to our mutual advantage and interest.—ANDREW BARCLAY, 28 Mount Terrace, Ecclehill, Bradford, Yorkshire.

BOOK REVIEWS

THE HAWKS AND OWLS OF ONTARIO by L. L. Snyder. *Royal Ontario Museum of Zoology (Toronto). Handbook No. 2. 1932. pp. 48. Numerous pen and ink illustrations and diagrams. Paper covers. Price, 35 cents.*

This little brochure is designed as an introduction to the study of the hawks and owls of Ontario. The opening chapter treats of the biology of birds of prey, their role in nature, their competition for food and their diet variations. The next deals with the physical and taxonomic characteristics of hawks and owls and gives a list of the Ontario species and subspecies. The bulk of the publication is composed of an analytical study of each of the nineteen species, their outstanding specific characters, general habits and food resources based upon the contents of four hundred and sixty-six stomachs examined by the Royal Ontario Museum.

Raptorial bird stomachs have been reported upon time after time. The results are quite con-

sistently the same, yet it seems most difficult to drive home to the general public the plain evidence of the facts. One must pile Ossa on Pelion before certain elements will accept the obvious. To answer the criticism that Ontario raptores are different from the same species elsewhere, or that Ontario has interests peculiar to itself, this particular geographically limited study was produced. Its findings are just what would be expected from former experience.

On seven species of rare or only casual occurrence in the Province no material was available. On three species less than six stomachs were examined. These were regarded as too few to base generalized conclusions upon and are not reported. On the nine remaining species that are numerous enough to exert perceptible economic influence the evidence is convincingly presented by easily grasped graphs supported by the detailed enumeration of specimens and data.

The three species of Accipiters are shown to eat

considerable numbers of poultry and protected birds and a minimum amount of rodent and insect pests. Of course, the big Goshawk leads the rest. It has eaten poultry and protected birds at the rate of 58% of the total, and unprotected birds (mostly pigeons) 16.7%. The diminutive Sharp-shin shows no poultry in its record but 45.3% of protected birds. Cooper's Hawk, as would be expected from its intermediate size, comes about half way between the two. It is evident that this is the group that has aroused the just wrath of the husbandman, sportsman and bird-lover and has given the whole family its evil repute.

Of the five Buteos, one species shows the worst that can be said of the genus. 11.4% of its food consisted of poultry and game and 4.5% protected birds. On the other hand, and in extenuation, 49.8% consists of injurious mammals,—mice, hares and squirrels. When one considers that the whole 11% may be one chicken (often offal) or one grouse and the 4.9% may be 100 mice we can well conclude that the species may pay roundly for its keep. The Red-shouldered Hawk presents nearly a clear slate in evidence. Amphibians and reptiles constitute 49.5%, mice and shrews 19%, insects 12.5% and unprotected birds (Crows in this case) 9%. The most rabid anti-hawkist can find nothing to object to in this. The little Broad-wing takes 37.4% insects, mice 27.9% and has only one unfavorable item against it,—a Goldfinch. The big Rough-leg that is so conscientiously slaughtered on the fall marshes comes through with a remarkable record of 89.5% mice and not a single objectionable item.

The Marsh Hawk, as would be expected, stands in a position as to which there can be an honest difference of opinion depending largely on whose ox is gored. Protected birds and poultry bulk 41.1% of the total with mice and rabbits 39%. It is around this species that the greatest furore of the hawk controversy revolves. Why the opposing forces cannot agree to disagree in this one case without prejudice to the others where the evidence is clear is one of the anomalies of human nature.

The Osprey eats nothing but fish. While all of these have potential human food value, suckers constitute 67% and none are of practical, commercial or sporting interest.

The Pigeon Hawk presents a rather unfavorable record, small birds seem to constitute 89.2% of its food. Owing to the small size of both predator and prey its effect is more a sentimental

shock to us than an economic one. It is not very common and the small songsters it kills will never be missed unless it takes its toll close to our homes where every bird is numbered.

The Sparrow Hawk is a regular little major in its helpful activities to man. Insects constitute 67.3% and meadow mice 25.8% of its food.

Among the Owls the Great Horned is the only one that presents a distinctly unfavorable record. Poultry and game make up 31.3% of its food, and mammals, including mice, rats, squirrels, skunk and muskrat, 62.5%. On the whole *Bubo* is not a species to be encouraged in settled communities. The big Snowy Owl with its great potentiality for harm, while with us in the winter, eats rats and mice to the extent of 91.7% and we can tell him with enthusiasm to "go to it." Screech Owl, the little fellow that remains comparatively common as long as there are a few hollow trees in orchard or wood-lot, consumes insects 26.1% and mice 59%. The few protected small birds it takes, in this instance 4.3%, are a bagatelle. The Barred Owl, the next most common Owl, presents a clear record of insects, frogs and rodents a full 100%. The Long-eared Owl has nearly as good a score, mice 93.1% and small protected birds 6.9%. The Short-eared is not quite as satisfactory, mice 49.6% and small protected birds 36.1%. While this is theoretically questionable, practically it is nothing to declare war against. Undoubtedly neither the Long nor the Short-eared Owls will conscientiously discriminate much between small birds and small game or poultry but the fact that they rarely do take the latter should quiet alarm. The midget Saw-whet Owl lives on mice 83.7% and native sparrows 16.3%.

All of which again demonstrates that, with the exception of a very few offenders, the Ontario Hawks and Owls do immensely more good to human interests than harm. It may be advisable to control, or under certain particular circumstances substantially reduce, the numbers of these few, but, if shooters cannot or will not learn to distinguish between friend and foe, public policy demands that they withhold their hands and refrain from involving our many good friends in the destruction of a few possible enemies.

An interesting feature of the booklet is the series of small pen and ink drawings of each species. These are the work of Mr. T. M. Shortt, a young bird artist who is improving in bird knowledge and technic and shows great promise for the future.—P.A.T.

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CONTENTS

	PAGE
William Spreadborough—Collector, 1856-1931. By P. A. Taverner.....	39
Notes on the Mammals of the Interior of Western Nova Scotia. By A. L. Rand.....	41
Christmas Bird Census, 1932.....	50
The British Columbia Woodchuck <i>Marmota monax petrensis</i> Howell. By I. McTaggart-Cowan.....	57
Further Notes on the Henslow's Sparrow at Toronto. By Hubert Richardson.....	58
Notes and Observations:—	
The Blue-winged Warbler at Strathroy, Ontario. By A. A. Wood.....	58
The Pomarine Jaeger (<i>Siercorarius pomarinus</i>) at Hamilton, Ontario. By George W. North.....	59
White Pelicans on Vancouver Island. By Theed Pearse.....	59
<i>Polygyra dentifera</i> in Ottawa District. By A. La Rocque.....	59
<i>Lilium umbellatum</i> near Ottawa. H. Groh.....	59
Investigation on European Starling. By M. S. Ferguson.....	60
Book Reviews:—	
Bird-Watching in the West. By P. A. T.....	60
In Bermuda During the Ice Age. By T. H. Clark.....	60
An Introduction to Bird-Study in British Columbia. By P. A. T.....	61
March Excursion.....	62

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WILLIAM SPREADBOROUGH
1856-1931

The Canadian Field-Naturalist

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No. 3

WILLIAM SPREADBOROUGH—COLLECTOR 1856-1931

By P. A. TAVERNER

NO ONE who has followed Canadian ornithology can fail to be impressed with the importance of the work done by William Spreadborough. If the foundation of Canadian ornithology was not laid by him, at least the framework of the superstructure was made possible largely by his efforts. Not that he was a scientific naturalist or ever wrote a line for print under his own name, but the collections and observations he made, while associated with John and James M. Macoun, were largely the foundation of the *Catalogue of Canadian Birds*, the real beginnings of our national systematic collections and the basis of many scientific papers by specialists. He did not confine his attention to birds; mammals were only slightly secondary in his interest; reptiles, fish and marine invertebrates were also industriously collected for what is now known as the National Museum of Canada and his practical assistance to the Macouns in their botanical researches was beyond measure. Withal, he was practically unknown to all but a few intimates, the Macouns and such officers of survey parties as he accompanied in the field. It is not proper that such a man should pass from the scene without some record being made of his life and character in the annals of the science he advanced so materially. So much did he live away from the current of scientific events that it was only lately that we, who handle his specimens daily and realize the value of his work, heard of his death at his home in Victoria, British Columbia. Though all who were intimately associated with Spreadborough's natural history work have passed away, the outlines of his connection with the National Museum are here, in the files; but it has taken some effort to uncover the earlier and later events of his life, before and after his association with the institution. Notes of early history have been supplied by his niece, Miss Ellen Spreadborough, of Bracebridge, Ontario; and, through the friendly offices of Mr. W. A. Newcombe, of Victoria, British Columbia, the later scenes of his life have been obtained.

William Spreadborough was born at Farnham, England, November 12th, 1856, the oldest son of William and Ellen Lovell Spreadborough who were married in St. George's Church, Hanover Square, London. Shortly after William's birth his father emigrated to Canada and located on land near Bracebridge, Ontario, a mile below the south falls on the south branch of the Muskoka River. In 1861, the mother and her two sons, William, aged five, and Walter, aged three, joined the father and all lived in the little back-woods log cabin where there were eventually five children. The boys attended school in Bracebridge first and later in a little log school at South Falls, going in to the village of Bracebridge to the Anglican Church and Sunday School.

His early life was probably very similar to that of the usual boy of the pioneer families in the eastern woodlands. Farming a little between the stumps of rough clearings, breaking new fields from the stubborn forest, lumbering and teaming for the big camps, peeling tan-bark or splitting rails for self or on contract. The whole family probably worked together, each to the limit of physical ability, as soon as old enough to wield an axe or guide an ox team. We know the conditions of the country at the time and can imagine the picture. Even at this date it seems that William had the urgings of a naturalist within him, and we are informed that in the interim of pioneering his attention was constantly directed towards birds and beasts and that he always had an interest, other than that of the trapper and hunter, in where animals fed or laid up, where the fish spawned or how the birds sang. Not that it can be supposed that he knew their formal names either in official vernacular or scientific nomenclature, but his later life proved that, while young and impressionable, he had absorbed much lore that stood him in good stead in after life. Not only did he know the common wild life about him, but his experience with cant-hook and paddle had taught him the tricks of fast and still water; he knew how to lay his axe edge where

it would cut the cleanest, and developed self-reliance and resourcefulness in the bush. In time he married Jessie Allen from a nearby settlement but his wife did not live long and, with her child, died at childbirth. Evidently William, after reaching man's estate, like most young bushmen, wandered far from home, with lumber camp and survey parties.

The first record we have of William Spreadborough in connection with the Museum is in the autobiography of John Macoun. James Macoun in 1888 accompanying, as Naturalist, a Dominion Land Survey party under Thomas Fawcett from Lesser Slave Lake to Lake Winnipeg via the historic Methye Portage and the Churchill River, reports that the cook of the party showed a great interest in birds and would be a valuable man in future botanical and natural history surveys. James has told of the incident that first directed his attention to Spreadborough. In casual camp discussion, Spreadborough mentioned that he had heard a Scarlet Tanager about camp. He probably called it a "Firebird" or some such popular name. Incredulous, James lent him his gun to verify his statement. Much to Spreadborough's chagrin, but to Macoun's surprise, the bird proved to be a Western Tanager, not the scarlet bird he had expected. This specimen, from Lesser Slave Lake, is still in the Museum and is the first of the very many specimens that Spreadborough afterwards collected. However, such nature knowledge in a camp cook was not to be disregarded and, as he proved to be a willing and apt pupil, Macoun soon taught him how to skin and prepare bird skins, an accomplishment in which he soon out-distanced his teacher. Henceforth, in all his subsequent association with the Macouns, while they botanized it was Spreadborough's part to collect and prepare birds, mammals and other such material that came his way.

From then on, Spreadborough was always a member of the Macoun expeditions or under their direction either alone or with other parties and so he collected assiduously season after season all along the international boundary from Vancouver Island to the Manitoba line. Several times Spreadborough was attached to other parties of the Geological Survey, here, there or elsewhere, collecting and observing and always he acquitted himself well. In 1896 he accompanied A. P. Low to Hudson Bay and across Ungava Peninsula from Richmond Gulf to Fort Chimo. In 1898 he was with J. McEvoy from Edmonton, through the Yellowhead Pass to the Fraser River; and in 1904 with Owen O'Sullivan up the east

coast of James Bay to Cape Henrietta Maria. In 1910 he collected on the Queen Charlotte Islands. The practical results of all these travels and investigations will be found accredited to him in the *Catalogue of Canadian Birds, 1900-1904*, and in the second edition, 1909, as well as in his collections, which are still a reservoir of information on Canadian zoology.

Up to 1901 Spreadborough seems to have made Bracebridge his headquarters and home but in this year he writes, from Victoria, that he was not going back to Bracebridge this year but would stay in Victoria for the winter. Thereafter all his correspondence is dated from that place and he seems to have taken it for his permanent home from that date. On March 4th, 1914, he there married Jessie Dumbreck who still survives him.

In 1912, Prof. John Macoun was forced by failing health to retire from active field work and from then on Spreadborough was closely associated with James Macoun working along the old Grand Trunk Pacific Railway from Prince Rupert to Jasper Park. It was in the latter area that the writer of these notes made his only actual contact with William in the field, where he showed to supreme advantage. For several weeks he was in camp with him at the foot of the little glacial lake below the peak of Mount Edith Cavell. Sprinklings of snow fell and the nights were chilly but if ever a man knew how to make camp comfortable it was Spreadborough. The tents were pitched in a spot sheltered from the strong cold draught that fell from the adjoining glacier, with the finest of water immediately available. The softest of evergreen boughs made our beds. A workable table and comfortable seats were constructed with his axe, and his fires always burned to the best advantage and were plentifully supplied with wood just dry enough for the passing purpose. His bannocks and baked beans were things long to be remembered and the slices off the carcass of a newly described caribou that hung near, and which the Whiskey Jacks were endeavouring to despoil us of, were delicious after William's inspired cookery. By day he was afield investigating the most hidden recesses of the mountains or skinning specimens, distributing the by-products of his operations to the Whiskey Jacks momentarily lured from the caribou. In the dark of the evenings it was pleasant to sit with back against a shielding rock or sheltering trunk, feet extending towards the grateful camp fire, listening to William "reminiscing" from his inexhaustible store of memories of travel and ex-

ploration by field and stream. He could go on and on and, being a natural story teller with a photographic memory that forgot no detail, interest was always sustained. His energy was inexhaustible and no mountain was too steep or way too rough for him to face if a desirable specimen were the objective. His memory, not only for events but for scientific names and specific details, was remarkable. Though he never had an opportunity of studying his specimens after they were shipped from the field to the Museum, once a specimen had passed through his hands and its characters were noted, it remained with him and was his thereafter. A number of times we have found it advisable to consult with him over some specimen he had collected long before, and he always had the answer ready, the details of its taking and all about it. James Macoun tells of asking him to stop over a train to or from the field at some little station where he had once collected, obtain a specimen from a certain tree that stood on a particular hillside. Though it had been ten years since the original specimen was collected, the material was produced in the most matter-of-fact way. He was always on the alert to obtain valuable specimens. At one camp in the mountains, James had gone to the post office for mail and supplies, returning through the bush late at night. Next morning William remarked to him, "You had a companion on your way back last night." James asked, "What do you mean?" "Nothing, but a cougar followed you most of the way." "How do you know?" "Oh, I was following the cougar."

Through years of association in the closest and most trying manner that men can associate,—in camp, through good weather and bad, William and the Macouns, especially James in the later days, grew very close together. Whatever he was doing at the time, when the proposal of field

work came, he was always ready to drop higher wages or other inducements to accompany his old friends to new fields and fresh discoveries. But age began to tell and though he was always ready to accompany James, he felt that the days of strenuous endeavour were waning. When "Jim" died, his heart for field work failed him and he refused to continue his life-long work under new auspices with new associates. His last field work and that of his friend James Macoun, was in the summer of 1919. After that he retired to his home at Esquimalt near Victoria and worked permanently for the municipality in various outside capacities, for William was never a man to be confined between walls. He had a little garden that he cultivated assiduously and was never idle. Not to be busy from daylight to dark made him unhappy. A Victoria neighbour confirms our experience of him in the field, that he lived to eat, sleep and work, but the greatest of these was work.

Though he withdrew from all association with other naturalists, he was never a recluse and was always ready to lend a neighbour or friend a hand either by advice or making or mending a tool or device. One of the last acts of his life was to pass a repaired pruning hook through the fence where a neighbour would find it. But when he had reached the age of retirement and was permanently laid off the municipal staff, his heart was taken out of him and undoubtedly the feeling that he was no longer useful to the day's work preyed heavily upon his mind and materially hastened his end. He passed away March 30th, 1931, in the little workshop at his home and was buried in Royal Oak Burial Park, Saanich, nearby. He leaves a widow in Victoria, and a memory that will long remain green in the annals of Canadian ornithology.

NOTES ON THE MAMMALS OF THE INTERIOR OF WESTERN NOVA SCOTIA

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THE FOLLOWING notes were made during July and August, 1928, and from August 28 to September 10, 1931, about the headwaters of the Liverpool chain of lakes whose waters flow down through the big game and trout regions of Lakes Kejimikujik and Rossignol. Most of the collecting was done about Fisher's Lake, some sixteen miles south of Ann-

apolis Royal. In 1928, while I was with the Annapolis Royal Camp for Boys, Mr. G. A. Boggs, the director, greatly facilitated my work and also generously allowed me the use of the camp in 1931. Mr. Walter Hubley, a local resident and guide at the camp, also gave me assistance.

The country is in a granite area, probably of paleozoic age, and has been heavily glaciated. It

is a boldly undulating to hilly country, where boulders are scattered about in careless profusion, and bed rock, never far down, is exposed in places for hundreds of feet. As one may expect in such a glaciated country, many of the hollows are without possible drainage, and small island-studded lakes and narrow stillwaters form a network of waterways. Sphagnum bogs abound.

It is a country of dry ridges and alternating swamps; the ridges clothed with stands of timber, birch, beech, hemlock, or spruce, or in various stages of reforestation; the swamps form a succession from open water encroached upon by sphagnum, to wooded swamps.

Clearing for agriculture and settling has played but little part, the very nature of the country forbidding it. Lumbering used to be an important industry, but most of the valuable timber has gone. A few roads cross the province at widely separated intervals with their narrow fringes of clearings, but, once away from the roads, the rest is wilderness. Every ridge looks alike, the one ahead and the one that has just been passed. The only trails are the canoe carries between the lakes; the well-trodden game trails that begin out of nothingness, become distinct around a lake or bog, then disappear into nothingness again; and the old "tote" roads, or logging trails of lumbermen, which usually lead directly to the nearest water, whence the logs were rafted to the saw mills.

At one time continuous forest probably extended over the country. Much of the original forest was pine, but pine is now unimportant. Fire, even before the time of the white man, had sadly reduced the forests, and now, both fire and axe have continued their work of destruction until the greater part of the country has been burned over, and stands of "old growth" are restricted to comparatively small areas. Where once a heavily forested region with a forest floor of rich leaf mould and moss-covered rocks was to be seen, now a devastated area is to be found, either in actual slashing or in the aftermath of burned country. The forest is gone and the leaf mould burned. Tangled masses of burnt fallen trees lie everywhere. The bare trunks of former forest monarchs, still upright, make a grim desolate sky line, their bleached or charred skeletons a mute testimony to the richness of the former forest, and to man's heedlessness in destroying it. These "stubs" are crashing down every year, and in time, their unburied skeletons will rot and give new life to the forest that is growing there.

The effect of small local burns which quickly

grow up to brush, and, as such, provide more varied conditions and an increase in certain foods, may be considered beneficial and may tend to increase the numbers of certain species. This is particularly noticeable with birds and is applicable to mammals to some extent. Moose find better browse on the saplings, porcupines find food there during the summer, rabbits frequent the areas, and the jumping mouse has extended its range to include them. This does not apply, however, to widespread areas swept by forest fires where nothing is left for miles but blackened wastes. Here vegetation is slow in gaining a foothold again.

The vegetation in much of the country is in various stages of reforestation, from burned lands to stands of fair sized trees, the so-called green country. It is currently held, and seems to be true, that when hardwood is burned, softwood springs up, and the reverse. The vegetation that follows the fire has an abundance of shrubs, which, with the granite boulders and the grey weathered "stubs," form the typical "barrens." The shrubs predominate; laurel (*Kalmia*), rhododendron (*Rhododendron*), blueberries (*Vaccinium*), and other shrubs form extensive areas of brush. Bunch berries (*Cornus canadensis*) and wintergreen (*Gaultheria*) are common. Bracken is everywhere and lichens clothe the rocks. Sometimes extensive beds of reindeer moss (*Cladonia rangifer*) occur, which probably furnished food for the caribou that used to range here. Here and there areas of alders (*Alnus incana*) grow up on bits of low damp ground. Soon scattered forest trees come in, clumps of birch (*Betula pendula* and *Betula lutea*) and beech (*Fagus grandifolia*) giving hardwood "barrens," or scattered spruce (*Picea*) and hemlock (*Tsuga canadensis*), giving spruce "barrens."

Sometimes enough grey birch (*Betula populi-folia*) and poplar (*Populus*) is present to dominate the area. These trees grow to a certain height, become static, then die out to give way to a sapling stand. The sapling stand, often a direct continuation of the hardwood "barrens," is a rather dense stand of young forest trees, birch, beech and maple (*Acer saccharum*). Many of the shrubs have disappeared and in the new shade one finds sassafras (*Sassafras variifolium*), clintonia (*Clintonia borealis*), and *Trillium*. Many ferns are common and mosses have come in. This continues up to the hardwood forest or, as is more often the case, as an admixture of softwoods, spruce, hemlock, and fir (*Abies balsamea*), in almost any proportion. The hardwood forest is of

beech and birch. Sometimes oak (*Quercus*) and maple come in. The forest floor is leaf-covered and Indian pipes (*Monotropa uniflora*) and beech drops (*Epifagus virginianus*) grow there. The outcropping rocks alone are covered with mosses, and ferns are not common.

The spruce and fir "barrens" may give a second growth of spruce, fir and hemlock, with a mixture of hardwood in almost any proportion. The shrubs disappear, the ground becomes heavily carpeted with mosses. In the glades still linger bracken and shrubs; lady's slipper (*Cypripedium hirsutum*), bunchberries (*Cornus*) are found, and twin flowers (*Linnaea borealis*) form mats almost hiding the moss beneath. The timber that rises from this second growth may be either hemlock or spruce and hemlock, the fir dying out, but is more often a mixture of the two. The hemlock-spruce stands are the most beautiful. No undergrowth occurs and clear vistas open in all directions. A few plants, wild sarsaparilla (*Aralia nudicaulis*), Indian cucumber (*Medeola virginiana*), twister stalk (*Streptopus*), trillium, and Jack-in-the-pulpit (*Arisaema triphyllum*) occur. In some places moss carpets the ground and in others the needles form brown mats. Where much hardwood occurs, the fallen leaves cover the ground.

The swamp succession is rather clearly defined. The humidity here has saved many of them from the fires and their succession comes from the encroachment of the sphagnum on the open water, giving a foothold for other plants.

Lakes form the greater part of the waterways. Small streams run into them from the low rocky ridges, but the runs between the lakes are usually short broken stretches of water. The stillwaters, long narrow reaches of water without apparent current are very characteristic. They often represent the last stages of a lake or bay being encroached upon by the sphagnum. It is in them that some of the finest trout are to be found. The lakes are small, rocky, and island-studded. In the shallow bays the vegetation is continually encroaching. Yellow and white waterlilies occur (*Nymphaea advena* and *Castalia*) as well as chara (*Chara*), bladderwort (*Utricularia*) and pickerel weed (*Pontederia cordata*). Sphagnum encroaches on the water giving it first nearly a pure culture, sometimes with much pickerel weed, but it soon changes to a sphagnum-sedge "meadow," a level area, solid enough to walk over, with a thick growth of sedge. From these areas the sedge is sometimes cut for hay, though it is poor fodder for cattle. Shrubs, rhododendron,

laurel, sweet gale (*Myrica Gale*), meadow-sweet (*Spiraea*), and others often come to occupy completely such an area, locally called a "bog." From a distance it looks like a smooth level area but at close hand it is a tangled mass of shrubbery. The sphagnum grows up between the shrubs and the whole is saturated with water. One sinks ankle deep, or waist deep, and progress is practically impossible. A modification of this area occurs along the lake shore where the land rises abruptly. Here is a narrow line of brush often with much royal fern (*Osmunda regalis*) between the water and the timbered land. Sometimes scattered spruce or tamarack (*Larix laricina*) occur in these "bogs," and give them a characteristic appearance. Sometimes "meadows" occur where blue-joint grass grows, and clumps of alders, meadow-sweet, sweet gale and other shrubs occur, and soft maple (*Acer rubrum*) comes in. The final stage of the habitat is spruce-fir or maple-alder swamps, or swamps where all of these occur. The shade has discouraged the shrubs, the sphagnum is deep and spongy, sedge may be quite common and *Osmunda* (*Osmunda cinnamomea*) may occupy extensive areas.

The clearings, roadsides and waste lands are of little extent and are unimportant. Soil is mostly poor and rocky, and potatoes, carrots, turnips, beans, corn and oats are raised. Areas are cleared of brush so that cattle may find browse amongst the stones, or the hay may be harvested, but these areas are restricted to the vicinity of the few dwellings.

DISCUSSION.

Mammals play an important role in the lives of the settlers in the region. Fur is an important source of income, and moose and deer are used for food. Their depredations are few. Bears sometimes kill sheep, and mink and fox raid chicken yards. Woodchucks, porcupines, rabbits and deer appear in the gardens, but when all this is balanced against the value of the fur catch, the mammalian fauna well repays its debt from an economic standpoint.

Certain mammals of the region are gone; the wolf before the memory of most of the younger men; the caribou, recently. Fisher and martin are extirpated or nearly so, and lynx are sadly reduced in numbers.

Some mammals are moving in. Skunks and raccoons are probably recent additions to the fauna (Gilpin, 1868). Deer have been introduced and are thriving. Grey squirrels (probably escaped cage animals) have been recorded. The introduced house mouse (*Mus musculus*) and the

Norway rat (*Rattus norvegicus*) have not yet reached this area though they are common in the settlements nearer the more settled region of the Annapolis Valley.

There were marked differences in the abundance of certain types of mammals in the seasons of 1928 and 1931. In 1928, long-tailed shrews (*Sorex fumeus*) and (*Sorex cinereus*) were common and numbers were taken in many habitats. *Microtus* was very scarce, though old runs were to be seen everywhere in suitable habitats. In 1931, long-tailed shrews were very scarce in the same areas. Only one, a specimen of *Sorex cinereus*, was secured. *Microtus* was fairly common and many old nests were seen in the meadows and signs of recent work were common. *Synaptomys* was found and from signs had been common but a short time before. Again, in 1928, red-backed mice (*Clethrionomys gapperi*) were only fairly common and were restricted to the damp coniferous habitats. In 1931, they were very common and found in almost all habitats.

Condylura cristata (Linnaeus). STAR-NOSED MOLE.—This creature is rather common in low wet land and pastures and in some alder swamps, where there is soft earth to burrow in. Though common in the fertile Annapolis Valley to the north, its distribution in this region will always be limited by the scarcity of suitable soil. I did not find it, however, in many of the alder swamps where the black muck seemed very suitable.

These moles moved about indiscriminately day or night, specimens being taken at various times during the day.

Average measurements of six adults: total length, 196.3 mm.; tail, 80.4 mm.; hind foot, 28.9 mm.

Sorex cinereus cinereus Kerr. CINEROUS SHREW.—In 1928, this shrew was one of the commoner small mammals. It was fairly common in the hemlock-spruce forest as was the smoky shrew. In the second growth of spruce-fir it was much more common than the smoky shrew and I found its minute tunnels in the moss as well as the runs under rotten logs and stumps. It occurred in the maple-spruce-sphagnum, sphagnum-heath, and sphagnum-sedge habitats, while in the sphagnum swamps on the edge of the lakes and stillwaters, where I found its tiny burrows and trapped it, it appeared to be the only small mammal. Often a set would take two on consecutive nights, but no more, although the trap was left set for some time. It was rare in the dryer habitats of deciduous trees and scanty moss.

In 1931 I was able to secure but a single individual though I trapped in the same areas where it had been common in 1928.

Measurements of three adults, averaged: total length, 108.6 mm.; tail, 45.0 mm.; hind foot, 12.8 mm.

Sorex fumeus umbrosus Jackson. SMOKY SHREW.—This shrew was fairly common in 1928 especially in the stands of large spruce and hemlock with mossy floor where it was perhaps the most common small mammal. It was found commonly in damp pasture land and was often taken in the runs of the mole (*Condylura cristata*). It was also found less commonly in dryer sapling stands and in hardwood.

In 1931 not a single specimen of this species was secured though I trapped intensively in areas where it had been common in 1928.

Measurements of seven adults averaged: total length, 125.5 mm.; tail, 51.4 mm.; hind foot 13.7 mm.

Sorex arcticus arcticus Kerr. SADDLE-BACKED SHREW.—This shrew has been taken in Nova Scotia near Truro (one and three-quarters miles east-south-east) (Jackson, 1928) and may perhaps be found in other parts of the province.

Sorex palustris gloveralleni Jackson. WATER SHREW.—Although I have trapped for this species in all likely habitats, but four specimens have been secured, three of them by pools of open water in mossy spruce-fir habitat, and one in the narrow fringe of shrubs between a second growth spruce area and the lake.

Gilpin (1868) speaks of a hunter cutting a hole in the ice and stooping to drink and having a shrew appear in the opening. It may have been this species.

Average measurements of three adults: total length, 152.3 mm.; tail, 74 mm.; hind foot, 19.1 mm.

Microsorex hoyi thompsoni (Baird). PIGMY SHREW.—This little shrew has been taken in the western part of Nova Scotia at Digby and Little River, Digby Neck (Jackson, 1928). It may occur in this area though none were taken.

Blarina brevicauda talpoides (Gapper). SHORT-TAILED SHREW.—This is one of the commonest small mammals in the dryer habitats of deciduous trees. Its tunnels criss-cross under the dead leaves on the sapling stands and the hardwood hills and spruce, but they are not nearly so common in the clear stands of spruce and hemlock. It is not uncommon in the deciduous "barrens" where there are enough fallen leaves to make ground cover, but seems absent from the spruce "barrens." It occurs only occasionally in the spruce-fir though I captured one amid moss-covered boulders where a small stream trickled along almost underground in a place that would seem ideal for the water shrew (*Sorex palustris*). I took one short-tailed

shrew in the sphagnum habitat. They were common in the alder swamp habitats, following the runs of meadow mice and moles or making their own runways. It was abundant in some habitats and was taken in a single trap night after night. At one such station where a star-nosed mole (*Condylura cristata*) run crossed the trail at the surface, I took more than fifteen short-tailed shrews beside *Sorex*, meadow mice, and the star-nosed mole, in a month and a half. Sawdust piles seem to have a particular attraction for them and they can always be found and taken there. They move indiscriminately day or night, and specimens were taken between eleven and one o'clock on bright days. Many of the specimens had white hairs in the tips of their tails and one had the terminal portion half white.

Average measurements of eight adults: total length, 116.9 mm.; tail, 25.5 mm.; hind foot, 14.4 mm.

Myotis lucifugus lucifugus (LeConte). LITTLE BROWN BAT.—Small bats which may have been of this form, or the next, were often seen over the lake or about the clearing around the camp. The two specimens secured were ones that flew into a lighted cabin.

Myotis keeni septentrionalis (Trouessart). TROUËSSART'S LITTLE BROWN BAT.—The only example of this species secured flew into the lighted cabin.

Euarctos americanus americanus (Pallas). BLACK BEAR.—The black bear is quite common here but is very shy and none were seen. When travelling over the "barrens" during the summer it was a common sight to see dead logs that they had ripped apart for ants, and logs and rocks that they had over-turned in their search for food.

Walter Hubley told me that during the hottest weather in summer they spend the day in the cool sphagnum-maple-spruce habitat. He showed me several wallows in such places, open spring holes with black silty bottoms into which the cool water seeps. At one of these he had trapped a bear in August, 1926. In August, 1928, we kept a trap set at this place but the weather was hardly warm enough for the bears to come to the spring holes.

When the blue-berries are ripe, they form the staple food of the bears. One can see where the animals have been feeding and their droppings are coloured with this food.

On June 28, 1928, on my way to camp I saw a bear cub tethered in a farmer's yard at Aylsford. I was told that the mother had been found in hibernation in January and killed and the cub, which weighed but eleven ounces, had been taken

home and brought up on a bottle. It was quite playful and would romp with the children but it was getting too strong and was becoming a dangerous playmate for it sometimes resented being disturbed.

Procyon lotor lotor (Linnaeus). RACCOON.—The raccoon is said to be rather common here. It is taken only occasionally. In the Annapolis Valley to the north where transition conditions are present, it is fairly common. Gilpin (1868) says that the raccoon is a recent addition to the fauna, entering the province and spreading along the north side of the Annapolis Valley within the last twenty years. It was, he says, previously unknown to the Indians. Lescarbot (1606) says that raccoons occur but this seems doubtful.

Martes americana americana (Turton). MARTEN.—There is a permanent closed season on marten and any data were difficult to secure but I heard of one that had been trapped and smuggled out of the country some years before, bringing some forty dollars when finally sold.

Gilpin (1868) says that marten occurs and, also that one may look for its extinction.

Tyrrell (1888) gives it as occurring in Canada from the Pacific to the Atlantic.

Martes pennanti pennanti (Erxleben). FISHER.—I have no records for the fisher but Gilpin (1868) mentions its occurrence in Nova Scotia, although he says that we may look for its extinction.

Tyrrell (1888) also says that it occurs in Nova Scotia.

Mustela cuginanii cuginanii Bonaparte. WEASEL.—The weasel is said to be tolerably common and to follow the waterways and the low bushy areas. I saw one skull from a carcass left by a trapper and on August 18, 1928, saw a live one. It was in a small thicket of spruce that had grown up in a clearing cut for a camping spot in a magnificent stand of hemlock. We were sitting on our blankets before turning in and two jumping mice leaped through the glow of the campfire. Turning to see the reason for their precipitate haste, I heard the leaves rustle and flashing the light from a torch, could see a weasel running about not at all disconcerted by the light. It had apparently been feeding on the scraps of trout that had been thrown out there and it retired in a few minutes. By a gentle squeaking it was enticed back and came within a few feet of us.

Mustela vison vison. Schreber. MINK.—The mink is fairly common in the low wet habitats. I saw one on a small rocky island some distance from shore in mid-afternoon. Several others were seen about the lake shores during the summer of 1928.

Walter Hubley told me of one he saw on an open spruce-heath bog. As he approached it, it started toward him as though attacking rather than retreating, chattering shrilly. It had a freshly killed rabbit and was apparently defending its prey.

Lutra canadensis canadensis (Schreber). OTTER.—The otter is one of the inhabitants of the waterways and some are taken here each winter. Almost every lake or waterway may be visited by these creatures. They range over wide areas or beats and cannot be called common. In a country such as this where mud slides down banks are not possible, the animals come ashore and roll in the moss along the streams. In the spruce-sphagnum swamps I have seen areas several yards in extent that have been scratched up by these animals. Many of the trappers say that the otters travel in pairs and are sometimes seen swimming and playing along the lakes in the early morning or in the evening. In winter they fish in the runs where there is open water and are sometimes secured at such places by hunters lying in wait to shoot them.

Mephitis mephitis (Schreber). SKUNK.—Skunks have been taken occasionally by trappers near here and during the first of the camp season in 1928 their characteristic odour gave unmistakable evidence that one had been in the cellar of the main lodge. This creature, like the raccoon, is rather rare here, preferring the edge of the more settled districts of the Annapolis Valley. Gilpin (1868) speaks of its comparative recent intrusion into the province.

Vulpes fulva rubricosa (Bangs). RED FOX.—The fox is fairly common and I occasionally saw its signs on the "barrens." It has a propensity for travelling along wood roads and following trails and this habit has been taken advantage of in the practice of snaring it, though it is often hunted with dogs as well.

Cross foxes are sometimes taken. One fur dealer estimated that one cross fox to twelve red ones occurs in the province.

Canis lycaon Schreber. WOLF.—The wolf has been gone so long that there are not even traditions current regarding its presence. At the time Gilpin writes (1868) the wolf was making its last stand. He says that they are trying in vain to reinhabit the province and that for the last sixty to seventy years, they have constantly appeared singly or in pairs, then have disappeared to be unheard of for years. Tyrrell (1888) mentions the wolf as rare in Nova Scotia so that it may still have existed at that time.

Lynx gigas Bangs. LYNX.—The lynx is rather rare but seems to be quite universally known un-

der the name of "Lucifee" which is probably a corruption of the word "Loupcervier," and designates a larger, stronger and more shadowy creature than the wild cat.

Gilpin (1864) writes that it was common at that time, one man taking twenty in a winter and that two hundred and fifty skins a year were being exported from Nova Scotia while five hundred and fifty wild cat skins were exported, but even then it was becoming rare. This decrease has continued and in 1927 there were thirty-five lynx skins exported from the province against 1142 wildcat skins. (Report of the Department of Lands and Forests, 1927, Province of Nova Scotia, 1928.)

Lynx rufus rufus (Schreber). WILDCAT.—The wildcat is fairly common and numbers are taken every winter but I saw neither tracks nor signs. The granite boulders are often heaped together on the ridges and form caves and crevices in which they are said to den, and some such places are called "cat ledges."

Gilpin (1864) speaking of the wildcat in Nova Scotia, said that these cats love the sterile granite hills and that where it abounds no Loupcerviers (*Lynx*) are found.

Marmota monax canadensis (Erxleben). WOODCHUCK.—The woodchuck is rather common in parts of the Annapolis Valley but in this area I have seen but a single individual, August, 1928, which unadvisedly took up its abode in Walter Hubley's garden and attempted to live off the produce. Walter Hubley says that one or two appear each year and are promptly shot. Though usually found in the clearings, Hubley saw one a number of years ago in the "barrens" near Frog Lake some distance from any settlement.

Tamias striatus lysteri (Richardson). CHIPMUNK.—The chipmunk is fairly common on hardwood hills, on the "barrens" and about clearings. The rock piles left by the glacier furnish ideal shelter for them and the stone fences about the clearings are a favourite resort. They are rather shy and the first intimation of their presence is usually their shrill cry as they dart to shelter at the first approach of the intruder. They did not become tame even when food was put out at the camp, although they occasionally came within the cabin.

The fruit of the raspberry, when ripe, and the seeds of the sweet fern are their favourite foods at this season, at least about the clearings, and at this time there is a slight concentration of the species in the areas where these foods are abundant. Blueberries on the "barrens" are undoubtedly their most important food in the fall. Young ones taken July 22 and July 25, 1928, were prac-

tically full grown.

Sciurus hudsonicus gymnicus Bangs. RED SQUIRREL.—The red squirrel is one of the most common mammals in this region. Its distribution is largely confined to the habitats where conifers occur though in the fall they undoubtedly forage out on the hardwood ridges for beechnuts.

Their trill is one of the most characteristic sounds of the region and continues all summer. It is most common in the morning but may be heard at any time during the day and it greets the sun after a storm as does the song of the robin in more settled districts.

They are not molested by man and pay little attention to him except to keep him at a distance. They rarely scold at him and usually continue on their way unmindful of his presence.

Several times I saw them come to the water's edge apparently to drink. While canoeing we overtook one that was swimming from the mainland to an island. It readily accepted the offer of a paddle as I drifted across its course and came up and perched on my shoulder not at all exhausted. After a minute it leaped to the man in the next canoe and thence to the gunwale and, running to the end of the canoe, sprang into the water. It then swam to the nearest island about one hundred yards away. It swam with its head held quite high and so rapidly that I was unable to turn the canoe about and overtake it before it reached the shore. It pulled itself up amid the "Hardhack" and scampered away. On many of the islands there are squirrels or squirrel signs and the ground is littered with cone scales. Many may reach these islands by the ice in the winter but I think that many of them swim to them. At Trout Lake, some forty miles to the northeast, I camped on an island for two weeks in June, 1927. About the middle of our stay there an old male squirrel in ragged pelage appeared. It had most certainly swam to the island that morning for we should have heard it or the cries of the birds nesting on the island if it had been there before.

The seeds of the conifers furnish one of the most important foods and the floor of the forest is usually littered with cone scales in such an area. About the middle of July before the cones are ripe they start to eat them and their faces and chest may be quite sticky with the balsam from them. In August a red-capped fungus, common in the woods, forms an important article of diet. The squirrels often take these up into the trees and wedge them into a safe place. Whether they use them later I am not sure as I have seen many that have been in the tree for a long time.

On August 13, 1928, I picked up a young squirrel which was crawling across the path. It was perhaps two-thirds grown and had its hind quarters paralyzed. It squealed and bit savagely when I picked it up. I took it to camp and it died during the night. Skinning it I found that the backbone was broken but there was no scar on the skin nor was the flesh torn. Possibly the young one not yet able to judge its strength, had tried too long a jump and had failed to make it. A few days afterward another was picked up in the same condition, but as I was away at the time I did not see it.

Sciurus carolinensis Gmelin. GREY SQUIRREL.—Grey squirrels are occasionally reported from various parts of the province. Walter Hubley told me of one that had been seen near this locality during the summer of 1930. It seems probable that these are escaped cage animals, brought to the province by tourists.

Glaucomys sabrinus macrotis. (Mearns). FLYING SQUIRREL.—I have not found the flying squirrel common anywhere in the province. When it was found it was in hemlock-spruce or in mixed forest. In this area the only record I have is of one that a cat belonging to Walter Hubley brought in to her kittens.

Castor canadensis canadensis Kuhl. BEAVER.—The beaver was fairly common in Fisher's Lake in 1928. There were two occupied houses near camp where it was possible to see them any evening. In 1931 but a single beaver was heard during the time spent there and no inhabited beaver house was seen on the lake. The taking of beaver at any time is illegal but the value of the skin makes the risk worth while and skins are taken to supply the demand.

Peromyscus maniculatus abietorum (Bangs). WHITE-FOOTED MOUSE.—This mouse was fairly common, usually on hardwood habitats, on "barrens" and in brush where the berries were ripening. From signs in the cabins it had been abundant there during the winter and there was a desiccated specimen in an old milk-can from which it had been unable to escape. Some time ago, at another camp, I found one stuck in the bottom of a molasses jug from which the cork had been removed. Hubley trapped nine of them in one of the cabins early in the spring but except for one that the cook killed during the summer I was unable to secure any in the cabins and though food was readily accessible to them it was not disturbed. They evidently congregate in the buildings during the winter and spread out into the country in the spring, irrespective of the food supply.

A few were taken along a stone fence on the edge of the pasture where the cook threw out potato peelings and such debris. Several were taken at the junction of the narrow sand beach along the lake, and on the "barrens," and a few in the fringe of shrubs between the lake and the spruce-fir habitat. On the hardwood hills they were feeding on the catkins of the birch and little mounds of the scales were found beneath convenient shelters.

Average measurements of five adults: total length, 187.8 mm.; tail, 95.8 mm.; hind foot, 21.7 mm.

Synaptomys cooperi Baird. LEMMING MOUSE.—This mouse apparently becomes very common at times and then suddenly disappears from its haunts. In 1928 no specimens were taken though old runs which may have been made by this species were found in certain spruce-maple-sphagnum swamps.

In 1931 indistinct runs, probably of this species, were very common in little sedge-grown clearings in the *Osmunda* of the spruce-maple-sphagnum swamps. Many of them appeared fresh or not more than a few weeks old but persistent trapping for ten days yielded but three specimens of the species and a nest containing four young was found.

An adult male and female were taken during the night of August 23, 1931, in their indistinct runs in the sedge on the sphagnum within a few feet of one another. The female was nursing and a search revealed the nest containing four recently born, naked young, several yards away from where the female was trapped. The nest was on a thickly sedge-grown hummock at the base of a low bush and was a ball of dry sedge and a little moss, placed in a depression in the sphagnum amongst the sedge roots so that the short sedge completely concealed it from above. The entrance was by way of a short tunnel but the runs over the sphagnum were for the most part faintly marked in the scanty sedge and the droppings were much more conspicuous signs of their recent abundance.

On August 25, 1931, a two-thirds grown young was taken in a runway to the entrance to the nest. The three stomachs contained finely ground up material consisting of both sedge and moss.

Clethrionomys gapperi (Vigors). RED-BACKED MOUSE.—In 1928 this mouse was only fairly common and was found only in the damper coniferous habitats often along the little moss grown streams and pools. In 1931 it was common and spread through the hardwood habitats and the

"barrens" as well as the coniferous habitats.

Their burrows often open directly to the surface of moss and they evidently spend much time wandering about above ground. Their burrows are shared with the short-tailed shrew and the two species were often taken on consecutive nights on the same trap set at the mouth of a burrow.

Average measurements of five adults: total length, 145.4 mm.; tail, 44.4 mm.; hind foot, 18.5 mm.

Microtus pennsylvanicus acadicus Bangs. MEADOW MOUSE.—The meadow mouse must be very common in certain years. In damp pastures, in sphagnum-sedge bogs, and bluejoint-maple-alder associations, old runs and droppings and grass stalks cut into short lengths were very common but a line of several dozen traps would bring in perhaps one or two individuals. In examining the runs for places to set the traps, fresh signs were rarely found. This decrease in the number of meadow mice must have an important effect on the carnivores that prey upon them and must undoubtedly influence their abundance. In one grassy swamp in a pasture they were fairly common if not abundant. This seemed to be an isolated group that had not been affected by the general conditions affecting the species.

In 1931 these mice were fairly common along the edges of the bogs but few were found in the grassy swamps where they had been common in 1928.

In examining their stomachs I found the food usually too finely ground for identification but in several instances their stomachs contained strawberries and the contents were dyed red from the juice.

Measurements of five adults averaged: total length, 161.4 mm.; tail, 48.4 mm.; hind foot, 21.2 mm.

Ondatra zibethica zibethica (Linnaeus).—MUSKRAT.—This animal was fairly common along all the waterways which have aquatic vegetation along their edge. Their signs were noted on nearly every log and rock that projected along the stillwaters. Here they do not build houses but live in burrows in the bank. There is a belief held here that one muskrat lives in every beaver house.

They were sometimes seen during the day feeding some distance out in the lake.

Zapus hudsonius hudsonius (Zimmermann).—JUMPING MOUSE.—This mouse was not found common but Walter Hubley assured me that they were common in some years on the wild mea-

dows and were conspicuous during haying time through their habit of taking long jumps. I secured two and saw others in that sort of habitat and also found them on the open "barrens," a habitat in which I have taken them elsewhere in the province. Two were also secured in an area which had grown up to spruce and fir. Evidently the mice had inhabited it when it had been a "barren" and had stayed there when it grew up. The species was tolerably common in the sedge-sphagnum bogs both in 1928 and in 1931.

One specimen measured: total length, 225.0 mm.; tail, 135.0 mm.; hind foot, 31.5 mm.

Napeozapus insignis insignis (Miller). WOODLAND JUMPING MOUSE.—I was able to secure but two specimens of this species although traps were kept set for it in places that seemed suitable. One of the specimens was secured in a set under an overhanging bank of a little pool in a spruce-fir habitat; the other, by a stream in a moss-grown hemlock forest.

Average measurements of two adults: total length, 228.5 mm.; tail, 150.5 mm.; hind foot, 31.0 mm.

Erethizon dorsatum dorsatum (Linnaeus). PORCUPINE.—This was a common animal. During the summer it was found not only in the forest but out on the "barrens" and in the cultivated fields. It was often encountered on the ground when it would go into a den if one were near by, or it might climb a tree, leisurely ascending to the very top if it were a small one, or, under apparently the same conditions, would start off at a gallop, a pace faster than a man walks, seeking shelter under windfalls and in thickets, or failing that, it might go down some crevice in the rocks.

The rock piles left by the glacier make ideal dens for it. In the caverns thus formed the floor is often deeply covered with their droppings which have a characteristic odour noticeable at some distance, and contain so much cellulose that they prove very resistant to weathering.

Their food seems to be largely herbaceous at this season, clover and garden truck when available, and leaves. Birch seemed to be a favourite. A large percentage of the young birches examined showed claw marks on the delicate white bark and I observed several animals in such trees. The bark of these birches was not removed although in the winter the food must be largely bark.

The porcupine destroys much valuable timber by gnawing large areas of bark from the trees, often killing them in this way. Its mutilation of

spruce makes the sawing of lumber more difficult since it necessitates the making of adjustments on the carriage.

In this area porcupines are little addicted to coming about camp and disturbing things. A few years ago a porcupine gnawed the thwart of one of the canoes, but these canoes had been out of doors all summer for four years and that was the only bit of damage done to them. The animals never came about our camping places or cabins making themselves obnoxious.

I have never seen one swim but Dr. Breck, who was staying at South Milford, some two miles away, had a young one for a while that he attempted to maroon on a little island off shore, and it promptly swam back to shore.

Their flesh is dark, strong and tough. Even at that it often makes a welcome addition to stew. The liver is not at all bad when fried.

Lepus americanus struthopus Bangs. (VARYING HARE) "RABBIT."—The year 1928 was a poor year for rabbits in this area. Old signs were to be seen in swamps, pastures and brush areas, but the animals were uncommon. I saw very few and the general report bore out my observations. I do not think that this condition necessarily extended over the whole province as I found them abundant elsewhere especially in certain restricted alder swamps although they were apparently absent from the surrounding region.

In 1931, rabbits were quite common and were seen almost daily in every type of second growth country.

Odocoileus virginianus borealis (Miller). DEER.—The deer, now a fairly common animal, is not native but was introduced from New Brunswick although some perhaps found their own way across the isthmus. In any event, it has become firmly established.

During the summer they are often found in the cool spruce-Osmunda-sphagnum swamps and out on the sedge-sphagnum, especially at evening, but they are also seen in almost every type of habitat.

Alces americana americana (Clinton). MOOSE.—Throughout the region the moose is fairly common and it is said to be more common now than it was forty years ago.

During the summer a favourite resting place in the day time is in the spruce-maple-sphagnum swamps where it "beds down" on the cool, wet moss, though sometimes it will lie out on the sphagnum-sedge. The guides say that it feeds on the sedge, and the sphagnum-sedge is usually tracked by it. The food at this time is certainly

herbaceous for their droppings are only semi-solid instead of solid and woody as they are at other seasons when they are feeding on sprouts. Where moose feed on lily pads there is much debris left which may drift ashore and mark their feeding place. One cow moose that I watched feeding in the water waded in until only the top of her head was visible but during the hour that she fed there she did not put her head under the water, feeding only on the surface lily pads.

Remains of winter "yards," mutilated saplings and droppings were found on the "barrens" and also in the "spot-lumbered" hemlock-beech habitat.

Rangifer caribou caribou (Gmelin). CARIBOU.—The caribou was formerly not uncommon in this region and all of the older inhabitants remember having seen it. Most of the inhabitants are of the opinion that it has been extirpated through possibly it may have occurred near this region no longer than twelve years ago.

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CHRISTMAS BIRD CENSUS, 1932

MONTREAL, P.Q., DECEMBER 25, 1932, 8.30 A.M. TO 4 P.M.—Weather clear and exceptionally mild. Temp. 40° at 8 a.m., 50° at 4 p.m. Strong S.W. wind, very little snow in woods, open country bare, streams mostly open and almost at flood level. Observers in two parties. American Golden-eye, 3; American Merganser, 20; Sharp-shinned Hawk, 1; Brünnich's Murre, 15; Northern Blue Jay, 1; Eastern Crow, 3; Black-capped Chickadee, 45; White-breasted Nuthatch, 1; Brown Creeper, 3; Eastern Robin, 2; Eastern Golden-crowned Kinglet, 5; Cedar Waxwing, 3; Starling, 450+; Eastern Red-wing, 2; English Sparrow, not estimated; Common Redpoll, 10; Eastern Goldfinch, 1. Total, 17 species, 565 individuals (not counting English Sparrows.)

Also seen during the past week: Canada Ruffed Grouse, Glaucous Gull (Wynne-Edwards), Herring Gull, Northern Downy Woodpecker.

With the exception of Starlings and Chickadees, birds are scarce at present. This applies especially to Woodpeckers. Very few finches appear to have come in from the north, notwithstanding an abundance of wild fruits and seeds locally. The presence of Brünnich's Murres is most noteworthy. These were first reported here on the 10th of December (1 bird—Low). Another was knocked down by a motor-car on the highway west of Montreal on December 18th. The stomach of this bird was quite empty, but others still to be seen in the open water between Montreal and

Longueil appear to be obtaining a sufficient supply of small fish.—V. C. WYNNE-EDWARDS, HY. MOUSLEY, NAPIER SMITH, ALEX JOHNSON, H. A. C. JACKSON, L. McI. TERRILL (*Members of the Province of Quebec Society for the Protection of Birds.*)

OTTAWA, ONTARIO, DECEMBER 26, 1932.—This Christmas Bird Census was taken by sixteen observers, organized in nine separate parties. The day began with poor weather, the sky being heavily overcast, while light showers of rain fell at times. About 9.00 a.m. the showers gave place to light snow flurries, which ceased about 10.00 a.m., when the clouds broke and the weather began to clear, with falling temperature. The percentage of cloudiness decreased from that time on throughout the day, until at sunset the sky was absolutely cloudless. There was a strong west wind almost all day, falling to a calm at sunset. The temperature was 38° at 8.15 a.m. and 30° at 3.15 p.m. It was estimated that 75% of the ground in open fields and 5% of it in the woods was bare of snow and ice. The maximum depth of snow in the woods was about six inches.

One of the most striking facts about this census is that it contains no Crossbills, Redpolls, Canadian Pine Grosbeaks, Eastern Evening Grosbeaks, Bohemian Waxwings, or Northern Shrikes. These are all northern forms, commonly found in the vicinity of Ottawa at Christmas time. It is also

CHRISTMAS BIRD CENSUS, OTTAWA, ONT., DEC. 26, 1932.

SPECIES OF BIRDS	Route Nos. as in text.									Total
	1	2	3	4	5	6	7	8	9	
American Golden-eye		26				5	12	9		52
American Merganser						1				1
Sharp-shinned Hawk				1		1				2
Canada Ruffed Grouse		1			7	1		3		12
Ring-necked Pheasant			1							1
Herring Gull						1				1
Rock Dove		6								6
Eastern Hairy Woodpecker		1								1
Northern Downy Woodpecker		1			4	1		2	2	10
Arctic Three-toed Woodpecker					1					1
Northern Blue Jay									3	3
Eastern Crow	1	4		2	122	2	4	2	6	143
Black-capped Chickadee	4	5	14		18			102	36	179
White-breasted Nuthatch		3	3			1			2	9
Red-breasted Nuthatch								7	2	9
Brown Creeper						3			2	5
Eastern Robin								4		4
Eastern Golden-crowned Kinglet								2		2
Cedar Waxwing						5				5
Starling	25			135	30	3	12	6		211
English Sparrow	153	36		75	280	90	50	128	117	929
Eastern Purple Finch		26	7		1		1	2	3	40
Northern Pine Siskin			2		55		5	8	6	76
Eastern Goldfinch		20			200			27	18	265
Slate-colored Junco				5	1			5		11
Eastern Snow Bunting									130	130
Total individuals	183	129	27	218	719	114	84	307	327	2108
Total species	4	11	5	5	11	12	6	14	12	26

to be observed that more southern types such as the Eastern Goldfinch, Eastern Purple Finch, Northern Pine Siskin, and Cedar Waxwing, occupy prominent places in this census. There is in the Ottawa region this winter a very heavy crop of seeds of all coniferous trees and also an abundance of fruits on the rowans. It seems probable that the abundant food supply thus provided induced the Goldfinches, Purple Finches, Pine Siskins, and Cedar Waxwings to remain in this region in some numbers, and that, if similar conditions prevail farther north, they likewise held the more northern finches and grosbeaks there. These, in turn, would form a food supply for the Northern Shrikes, which might influence many of them to tarry north of the Ottawa district.

Less easy to explain is the fact that, while the Slate-colored Junco appears in the Ottawa Christmas Bird Census for the first time in 1932, other ground-feeding sparrows such as the Eastern Tree Sparrow, Eastern Song Sparrow, and White-throated Sparrow, which have been includ-

ed in the census in some past years, are wholly lacking this time.

In spite of the absence from the census in 1932 of so many kinds of birds commonly included in it, the total number of species in this report is 26, the largest total of species yet attained in any Christmas Bird Census at Ottawa.

Two other points worthy of mention are that the number of American Golden-eyes in the present census (52) is the largest yet recorded in any Christmas Bird Census here, the next largest number recorded being 50 in 1927, and that the number of Eastern Hairy Woodpeckers included in the census, which was 12 in 1926 and 8 in 1929, has been only 1 in each of the censuses for 1931 and 1932.

The parties participating in the taking of the 1932 census and the routes followed, in North, East, South, West order were: (1) W. H. Lanceley and F. H. Ostrom, 9.00 a.m. to 3.00 p.m., north bank of Ottawa River, Hull to Buckingham, Quebec, and return, 42 miles by auto, 1 on

foot; (2) Hoyes Lloyd, H. A. Lloyd, and D. K. Edwards, 8.30 a.m. to 4.00 p.m., south bank of Ottawa River, eastward from Rideau Gate to Ottawa airport, including Village of Rockcliffe Park and property of Federal District Commission, 10 miles on foot; (3) C. L. Patch, 8.00 a.m. to 2.00 p.m., Lindenlea, Beechwood Cemetery, and Skead's Road, 8 miles on foot; (4) R. M. Anderson and G. S. Postlethwaite, 10.00 a.m. to 12.30 p.m., Ottawa East, including refuse-dump, and north bank of Rideau River to Billings' Bridge, 4 miles on foot; (5) C. E. Johnson and C. M. Sternberg, 9.00 a.m. to 3.20 p.m., Bronson Avenue, south to White's Bridge, along C.P.R. track 5 miles to Metcalfe Road and return on it, 10 miles on foot, 4 by auto; (6) R. E. DeLury, 8.15 a.m. to 3.15 p.m., Experimental Farm, Rideau Canal and River to Hog's Back, and on to Black Rapids and return, 16 miles on foot; (7) B. A. Fauvel, 10.00 a.m. to 1.30 p.m., south bank of Ottawa River, from Ottawa West to Britannia, 10 miles on foot; (8) R. Lockwood and Harlow Wright, 9.05 a.m. to 4.30 p.m., north bank of Ottawa River, Deschenes, Aylmer, Queen's Park, and slightly beyond, 10 miles on foot, two observers separated most of the time; (9) T. G. Hammond and Harrison F. Lewis, 8.40 a.m. to 5.00 p.m., Hull, Wrightville, Fairy Lake, Ironside, Farmer's Rapids and region N.E. for 3 miles, Chelsea, Old Chelsea, and Kingsmere, 24 miles by auto, 11 on foot.—HARRISON F. LEWIS, *Chairman of Bird Census Committee*.

ARNPRIOR, ONTARIO, DECEMBER 24, 1932, 8.30 a.m. to 5.30 p.m.—Cloudy, rain from 3.30 p.m., 5 inches snow on ground, trees heavily coated; wind east, moderate; temp. 29° at start, 30° at return. Twenty miles on foot, observers separate. Scaup (sp. ?), 1; American Merganser, 1; Eastern Goshawk, 1; Canada Ruffed Grouse, 11; Northern Pileated Woodpecker, 1; Eastern Hairy Woodpecker, 2; Arctic Three-toed Woodpecker, 1; Northern Blue Jay, 4; Eastern Crow, 5; Black-capped Chickadee, 38; White-breasted Nuthatch, 7; Red-breasted Nuthatch, 5; Brown Creeper, Eastern Robin, 1; Eastern Golden-crowned Kinglet, 5; Starling, 21; Eastern Purple Finch, 10; White-winged Crossbill, 54; Eastern Snow Bunting, 65. Total, 19 species, 237 individuals. Seen recently, Dec. 18, Eastern Winter Wren. Noteworthy this year is the absence of Eastern Evening Grosbeaks and Northern Downy Woodpecker, while the recent presence of an Eastern Winter Wren and the authentic record of an Eastern Robin are very unusual here.—LIGUORI GORMLEY AND CHARLES MACNAMARA.

ATHENS, ONTARIO, DECEMBER 26, 1932.—Wind West, strong; temp. 46° at start, 31° at return; ground bare. Territory covered: large cedar swamp, interspersed with highlands bearing pines and balsam first, also another wood about $\frac{3}{4}$ mile north of this swamp. About 9 miles on foot; observers together. Canada Ruffed Grouse, 27; Eastern Goshawk, 1; Great Horned Owl, 2; Northern Blue Jay, 2; Eastern Crow, 1; Black-capped Chickadee, 12; Northern Pine Siskin, 8; Eastern Tree Sparrow, 1. Total, 8 species, 54 individuals.—MURRAY W. CURTIS, C. H. CURTIS.

PAKENHAM, ONTARIO, DECEMBER 24, 1932, 8.30 a.m. to 4 p.m.—Mild, leaden sky, light rain after 3 p.m.; no wind. 6 in. loose snow which fell during the previous night, much open water. Temp. 34° at start, 36° at finish. Visibility very poor. Two observers in each group—walked 10 miles. Canada Ruffed Grouse, 34; Great Horned Owl, 1; Eastern Hairy Woodpecker, 1; Arctic Three-toed Woodpecker, 1; Northern Blue Jay, 4; Black-capped Chickadee, 10; White-breasted Nuthatch, 6; Eastern Golden-crowned Kinglet, 2; Starling, 15; Common Redpoll, 36; Eastern Snow Bunting, 125. Total, 11 species, 235 individuals. Species present but not seen on census day: Northern Downy Woodpecker, Red-breasted Nuthatch, White-winged Crossbill.—EDNA G. ROSS, VERNA M. ROSS, WILMER ROSS, ALLAN F. ROSS.

TORONTO, ONTARIO, DECEMBER 25, 1932.—The weather was mostly fair with a southwest wind varying in velocity from 16 to 22 miles and temperature ranged from a maximum of 57 to a minimum of 45 degrees above zero. Similar spring-like conditions had prevailed for a week before Christmas so that the snow which had covered the ground during the second week of December had entirely disappeared.

It may be presumed that this unseasonable weather did not have a pronounced effect upon the bird population, except as to distribution, since quite severe winter weather with considerable snow visited this region in mid-November and remained for about two weeks, giving no encouragement to any summer birds which might have been inclined to linger here for the winter. The list, however, shows about the usual number of stragglers from the summer with extreme northern species rather conspicuously absent. The record of three Towhees is noteworthy since the first winter record of this species was established only about six years ago. The Great Black-backed Gull, Herring Gull and Song Sparrow were found

in larger numbers than ever before. Four species appear for the first time, namely, Pied-billed Grebe, Great Blue Heron, American Coot and Bronzed Grackle, these seeming to reflect the influence of an unusual amount of open water.

Twenty men contributed to the list, covering the established routes with the exception of numbers one and seven which were unavoidably omitted. Those taking part and their distribution were: No. 2.—J. L. Baillie, G. S. Bell, R. J. Rutter, L. Owens, R. E. Bennett, H. M. Halliday, R. G. Dingman, F. S. Dingman; No. 3.—C. E. Hope; No. 4.—T. M. Shortt, H. Stovell, A. Twin-

ing; No. 5.—L. J. Milne, M. Speirs, O. Devitt; No. 6.—S. L. Thompson; No. 8.—F. H. Emery, H. H. Brown, H. G. Macklin, A. F. Coventry. Time: 8 a.m. to 3 p.m.

Other birds which were not seen on census day but which have been noted in the Toronto region during December, 1932, include: American Pintail, Glaucous Gull, Wilson's Snipe, Killdeer, Eastern Belted Kingfisher, Bohemian Waxwing, Cedar Waxwing, Northern Flicker, Eastern Redwing and Snow Bunting.—THE BRODIE CLUB, per R. J. RUTTER, *Secretary*.

8TH CHRISTMAS CENSUS OF THE BRODIE CLUB, TORONTO, DECEMBER 25, 1932.

SPECIES	Parties: 1	2	3	4	5	6	7	8	Totals	
Pied-billed Grebe					1				1	
Great Blue Heron	1								1	
Greater Scaup Duck					250				250	
American Golden-eye				41	90	7			138	
Old-squaw				8	140	150			298	
American Merganser				2	1				3	
Eastern Red-tailed Hawk	1		1		1				3	
Eastern Sparrow Hawk				1					1	
Canada Ruffed Grouse					1			13	14	
Ring-necked Pheasant	9			2	6				17	
American Coot				1					1	
Great Black-backed Gull				3	18				21	
Herring Gull	17	7	229	2300	50				2603	
Ring-billed Gull				4	60	50			114	
Eastern Screech Owl			2						2	
Eastern Hairy Woodpecker	1				1				2	
Northern Downy Woodpecker	5	5	11	2				1	24	
Northern Blue Jay	8		5	2				6	21	
Eastern Crow	5							1	6	
Black-capped Chickadee	27	7	8	10				2	54	
White-breasted Nuthatch	6	4	2	2				1	15	
Red-breasted Nuthatch			1						1	
Brown Creeper	4	6	2	1					13	
Eastern Winter Wren	2	1							3	
Eastern Robin					1				1	
Eastern Golden-crowned Kinglet	5	1	1	3		1			11	
Starling	30	25	29	15				16	115	
English Sparrow	(Seen by all parties—not counted.)									
Eastern Meadowlark			1						1	
Bronzed Grackle				4					4	
Eastern Cardinal			3	1					4	
Eastern Purple Finch				1					1	
Eastern Goldfinch			4		7			30	41	
Red-eyed Towhee	1		2						3	
Slate-colored Junco	24	45	24						93	
Eastern Tree Sparrow	6	16	16			10		2	50	
White-throated Sparrow	1	1							2	
Swamp Sparrow				1					1	
Eastern Song Sparrow	1	8	13	1					23	
Totals		154	140	409	2913	268		72	3956	
Total number of species										39

OMEMEE, ONTARIO, DECEMBER 22, 1932. 7.10 a.m. to 12.10 p.m. and 12.50 p.m. to 4.55 p.m.—Cloudy in morning, clear at mid-day and in afternoon, wind westerly, moderate, temp. 31° to 35°. Ground in open chiefly bare, about 4 inches snow in woods. About 25 miles on foot. Canada Ruffed Grouse, 9 (tracks very numerous); Ring-necked Pheasant, 1 female; Great Horned Owl, 4 (heard); Northern Pileated Woodpecker, 1 (at roosting tree); Eastern Hairy Woodpecker, 3; Northern Blue Jay, 5; Black-capped Chickadee, about 55; White-breasted Nuthatch, 1 (scarce); Eastern Winter Wren, 1; Eastern Golden-crowned Kinglet, 4+; Starling, 3; Northern Pine Siskin, about 30; Eastern Goldfinch, about 35; White-winged Crossbill, 2+; Eastern Tree Sparrow, 4; White-throated Sparrow, 1 (at spring); Eastern Snow Bunting, 15+. Total, 17 species, about 174 individuals, plus English Sparrows. Other species seen recently: Herring Gull (20th), Eastern Screech Owl (13th), Northern Downy Woodpecker (20th), Eastern Purple Finch (20th), Song Sparrow (subsp. ?) (14th).—E. W. CALVERT.

HAMILTON, ONTARIO, DECEMBER 27, 1932.—Mild, clear day. Temperature well above freezing all day. Ground bare. Light S.W. wind.

There were 12 observers out on our census day. The Hamilton territory abounds in wooded ravines. Only a small part of the territory was inspected, Lake Medad, Hendrie's Ravine, the Dundas Marsh, La Salle Park, and the shores of Burlington Bay and Hamilton Beach were covered. G. W. North and his trusty telescope accounted for 9 species of ducks not recorded by any other observer. Almost any winter day it is possible to see 3 or more species of ducks off the Lake and Bay shores in the vicinity of Hamilton. The combined list of all observers is as follows:

Horned Grebe, 2; Common Mallard, 5; Red-legged Black Duck, 452; Baldpate, 2; American Pintail, 1; Redhead, 4; Greater Scaup Duck, 158; American Golden-eye, 99; Buffle-head, 1; Oldsquaw, 70; White-winged Scoter, 57; American Scoter, 1; American Merganser, 480; Red-breasted Merganser, 17; Cooper's Hawk, 1; Eastern Red-tailed Hawk, 1; Eastern Sparrow Hawk, 1; Eastern Ruffed Grouse, 2; Ring-necked Pheasant, 22; Glaucous Gull, 1; Great Black-backed Gull, 11; Herring Gull, 1950; Ring-billed Gull, 50; Bonaparte's Gull, 50; Eastern Screech Owl, 1; Northern Flicker, 1; Eastern Hairy Woodpecker, 4; Northern Downy Woodpecker, 29; Horned Lark (subsp.), 3; Northern Blue Jay, 52; Eastern Crow, 3; Black-capped Chickadee, 153; White-breasted

Nuthatch, 22; Brown Creeper, 3; Eastern Golden-crowned Kinglet, 5; Starling, 500; English Sparrow, abundant; Eastern Red-wing, 14; Eastern Cardinal, 2; Eastern Goldfinch, 7; Slate-colored Junco, 137; Eastern Tree Sparrow, 150; Eastern Song Sparrow, 10; Eastern Snow Bunting, 25. Total, 44 species, 4558 individuals.

Within the last week the following birds were seen but were not recorded on the day of the census:—Eastern Winter Wren, 4; Eastern Robin, 1; Cedar Waxwing, 46; Eastern Meadowlark, 1; Eastern Purple Finch, 2; White-throated Sparrow, 1. For several winters a flock of Cedar Waxwings have stayed at Bull's Lane, on top of the Niagara Escarpment.—MISS BAUER, R. HAIST, MRS. MAC-LOUGHLIN, DR. G. O. McMILLAN, MRS. McMILLAN, C. McQUESTON, MISS MILLS, H. CARL NUNN, ROGER NUNN, G. W. NORTH, MISS SMITH, J. H. WILLIAMS.

VINELAND, ONTARIO, DECEMBER 24, 1932, 9.10 a.m. to 1.15 p.m.—Overcast, becoming misty toward noon. Temp., 35° to 37°. A drizzling rain commenced to fall in the middle of the morning and continued. Ground bare, muddy at surface, frozen an inch or two below the surface.

About an hour and a half was spent on the Experimental Farm grounds and the lake shore near at hand. It is beside the creek on the Experimental Farm that the Carolina Wren has been seen on several occasions. The party then went to several wooded areas and two areas of swampland in the vicinity. About 12 miles were covered on foot and by motor. Unidentified ducks, 8; Ring-necked Pheasant, 8; Herring (?) Gull, 250 to 300; Eastern Mourning Dove, 3; Northern Downy Woodpecker, 5; Northern Blue Jay, 1; Eastern Crow, 5; Black-capped Chickadee, 5; White-breasted Nuthatch, 3; Eastern Winter Wren, 2; Carolina Wren, 1; Eastern Golden-crowned Kinglet, 16; Starling, 2; English Sparrow, numerous; Eastern Cardinal, 1 (female); Eastern Goldfinch (?), 2 or 3 heard; Slate-colored Junco, 50; Eastern Tree Sparrow, 8; Eastern Song Sparrow, 5. Total, 19 species, 385 individuals plus English Sparrows.—G. H. DICKSON, W. E. HURLBURT, DOUGLAS ROSS, FRANK STRONG.

LONDON, ONTARIO, DECEMBER 24, 1932.—Combined list of sixteen individuals in eleven parties, six working in the a.m. and five in the p.m., from daylight until after dark. Weather very cold and wintry for about two weeks, turning milder on the 22nd, followed by two days of rain. Census taken on the second day of rain. Temp. 36° at 8

a.m. rising to 50° at 7 p.m. Sky overcast and a misty rain falling nearly all day. Thames River much swollen and for the greater part of the time full of floating ice. Wind fresh, south-east. Ground bare. List very good considering the adverse weather conditions.

Great Blue Heron, 1; Common Mallard, 3; Common Black Duck, 12; American Golden-eye, 26; Hooded Merganser, 1 (first winter record); American Merganser, 47; Eastern Red-tailed Hawk, 4; Eastern Ruffed Grouse, 1; Ring-necked Pheasant, 19; Herring Gull, 32; Eastern Mourning Dove, 5 (in one flock); Eastern Screech Owl, 1; Eastern Belted Kingfisher, 3; Northern Flicker, 1; Eastern Hairy Woodpecker, 1; Northern Downy Woodpecker, 21; Northern Blue Jay, 29; Eastern Crow, 262; Black-capped Chickadee, 95; White-breasted Nuthatch, 30; Brown Creeper, 6; Eastern Robin, 1; Eastern Golden-crowned Kinglet, 42; Cedar Waxwing, 1; Starling, 9 (very scarce this winter); English Sparrow (numbers not counted); Eastern Cardinal, 34; Eastern Goldfinch, 1; White-winged Crossbill, 1; Slate-colored Junco, 54; Eastern Tree Sparrow, 37; Eastern Song Sparrow, 6; Eastern Snow Bunting, 4 (flying over).

Total, 33 species, 790 individuals (plus English Sparrows).

Also seen recently, Eastern Sparrow Hawk, Eastern Bob-white, Red-breasted Nuthatch.—E. M. S. DALE, *Chairman Census Committee*.

MITCHELL, PERTH COUNTY, ONTARIO, DECEMBER 28, 1932.—Weather mild, with slight haze, ground bare, wind light, S.E.; temp. 38° at noon, 33° at 6.00 p.m. From easterly limit of Mitchell along the Thames River to No. 8 highway, then north 2½ miles, then west across country to Mitchell, entering Mitchell from No. 23 highway. 12.30 p.m. to dark. Eastern Goshawk (?), 1; Sharp-shinned Hawk, 1; Canada Ruffed Grouse, 3; Eastern Screech Owl, 2; Great Horned Owl, 1; Red-headed Woodpecker, 1; Eastern Hairy Woodpecker, 1; Northern Downy Woodpecker, 4; Northern Blue Jay, 9; Black-capped Chickadee, 43; White-breasted Nuthatch, 8; Brown Creeper, 1; Eastern Golden-crowned Kinglet, 7; Northern Shrike, 1; Starling, 106; Eastern Goldfinch, 21; Red Crossbill, 9; Slate-colored Junco, 12. Total, 18 species, 231 individuals, plus English Sparrows. The Red-headed Woodpecker was in a beech grove about ½ mile east of Mitchell, where it has been throughout the fall and winter to date.—W. G. NEFF.

EASTEND, SASKATCHEWAN, DECEMBER 22, 1932.—Valley of the Frenchman River and surrounding hills. Ten miles on foot. Fine, sunny day; wind west (chinook); temp. 20° at 9 a.m., 25° at 4 p.m. Slight covering of snow. Prairie Sharp-tailed Grouse, 42; European Partridge, 12; Horned Owl (subsp. ?), 3; Horned Lark (subsp. ?), 50; American Magpie, 17; Long-tailed Chickadee, 1; Bohemian Waxwing, 22; Pine Grosbeak (subsp. ?), 5; Common Redpoll, 12; Eastern Snow Bunting, 100. Total, 10 species, 264 individuals.—L. B. POTTER.

CAMROSE, ALBERTA, DECEMBER 24, 1932. 10.30 a.m. to 4.30 p.m.—Clear, no wind, 8 inches snow, temp. 15°. To Battle River by auto, then a six-mile walk through woods along river returning home by auto. 20 miles in all. Eastern Goshawk, 1; Gray Ruffed Grouse, 2; Prairie Sharp-tailed Grouse, 8; European Partridge, 60; Great Horned Owl (subsp. ?), 1; Snowy Owl, 1; Northern Blue Jay, 1; American Magpie, 16; Long-tailed Chickadee, 25; Hudsonian Chickadee, 3; Brown Creeper, 2; Evening Grosbeak (subsp. ?), 7; Pine Grosbeak (subsp. ?), 2; Common Redpoll, 10; Eastern Snow Bunting, 500. Total, 15 species, about 640 individuals. On the 27th of December a Northern Pileated Woodpecker was seen at a distance of 100 feet in the same woods, also Downy and Hairy Woodpeckers which were not observed on the 24th.—FRANK L. FARLEY, ARTHUR TWOMEY, ARTHUR CRAIG AND FRANK ARMSTRONG.

GOVERNMENT HAY CAMP, WOOD BUFFALO PARK, ALBERTA, DECEMBER 27, 1932. 10.00 a.m. to 11.45 a.m.—Calm, partially clouded, temp. 16°. Approximately one foot of snow in forested areas. Walked on snowshoes from Hay Camp northward on Fort Fitzgerald trail for 3 miles and return. 1.10 p.m. to 3.00 p.m., Clouded, light N.W. wind, temp. 12°. Hay Camp southward afoot on the Pine Lake trail for 2½ miles and return. Total distance covered on census, 11 miles. Arctic Three-toed Woodpecker, 1; Canada Jay, 2; Hudsonian Chickadee, 4.

Within a week of Christmas the following additional species were observed in Wood Buffalo Park: Hudsonian Spruce Grouse, Gray Ruffed Grouse, Willow Ptarmigan, Northern Sharp-tailed Grouse, Arctic Horned Owl, Northern Hairy Woodpecker, Nelson's Downy Woodpecker, Alaska Three-toed Woodpecker, Northern Raven, Long-tailed Chickadee, Pine Grosbeak (subsp. ?), White-winged Crossbill.—MR. AND MRS. J. DEWEY SOPER.

SUMMERLAND, OKANAGAN LAKE, B.C., DECEMBER 23, 1932. 8 a.m. to 4 p.m.—Weather fair, brisk south wind. Average temperature 32°. Twelve inches snow in hills, dwindling to ice on lake front, caused by sleet storm of previous day. By car from Penticton to Trout Creek Point (7 miles of lake front), thence on foot along 4 miles of lake front, adjoining fruit benches, and back to pine-clad hills. Observers, E. M. Tait, S. A. Liddell, H. M. Simpson, T. Young, Jr., and Aubrey Beggs, in three parties. Horned Grebe, 5; Pied-billed Grebe, 1; American Golden-eye, 6; Buffle-head, 9; Goshawk (subsp. ?), 2; Northern Bald Eagle, 1; Pigeon Hawk (subsp. ?), 1; California Quail, 680; Ring-necked Pheasant, 107; American Coot, 800; Killdeer, 1; Herring Gull, 4; Rocky Mountain Pygmy Owl, 1; Northwestern Flicker, 39; Western Pileated Woodpecker, 1; Hairy Woodpecker (subsp. ?), 5; Batchelder's Woodpecker, 2; Black-headed Jay, 9; American Magpie, 36; Clark's Nutcracker, 1; Long-tailed Chickadee, 72; Mountain Chickadee, 12; Slender-billed Nuthatch, 2; Red-breasted Nuthatch, 22; Dipper, 1; Western Marsh Wren, 2; Western Robin, 1; Bohemian Waxwing, 520; Northwestern Shrike, 2; English Sparrow, 70; Western Meadowlark, 11; Red-wing (subsp. ?), 20; Pine Grosbeak (subsp. ?), 45; Redpoll (subsp. ?), 90; Pale Goldfinch, 87; Slate-colored Junco, 1; Shufeldt's Junco, 265; Western Tree Sparrow, 26; Rusty Song Sparrow, 125. Total, 39 species, 3,084 individuals.—ERIC M. TAIT.

NANAIMO, B.C., DECEMBER 26, 1932.—Weather clear, cool, moderate N.W. wind, offshore. Nanaimo harbour to Pacific Biological Station, Departure Bay, by car; thence on foot to Stevenson's Point and the lagoon, following the seashore, returning by road. Total distance, 12 miles. One observer, 9.30 a.m. to 1.00 p.m. Common Loon, 3; Horned Grebe, 8; Cormorant (sp.), 12; Northwestern Coast Heron, 1; Canvas-back, 12; Scaup Duck (sp.), 6; American Golden-eye, 15; Buffle-head, 20; White-winged Scoter, 13; Surf Scoter, 18; American Scoter, 15; Red-breasted Merganser, 5; Sharp-shinned Hawk, 1; Northern Bald Eagle, 1; Glaucous-winged Gull, 20; Herring Gull, 10; unidentified gulls, 100 (est.); Western

Belted Kingfisher, 1; Northwestern Flicker, 4; Northwestern Crow, 30 (est.); Oregon Chickadee, 4; Western Winter Wren, 2; Seattle Wren, 1; Northwestern Robin, 50 (est.); Pacific Varied Thrush, 35 (est.); Western Golden-crowned Kinglet, 6; Sitka Kinglet, 1; Northern Pine Siskin, 30 (est.); Oregon Towhee, 1; Oregon Junco, 16; Song Sparrow (subsp. ?), 2. Total, 30 species, 331 individuals identified.—WILLIAM E. RICKER.

COMOX, VANCOUVER ISLAND, B.C., DECEMBER 26, 1932. 9.30 a.m. to 4.30 p.m.—Courtenay to head of Comox Harbour (mainly along river and shore line). Observers together. Distance covered, approximately 8 miles. Weather frosty and dull, later sunny and spring-like. Temp. about 45°. Weather previously mild with severe wind storm previous week. Hutton's Vireo seen within few yards. In Comox Bay at least 1,000 unidentified ducks. Common Loon, 10; Pacific Loon, 2; Red-throated Loon, 4; Holboell's Grebe, 9; Horned Grebe, 10; Western Grebe, 33; Pelagic Cormorant, 2; Heron (sp. ?—Ed.), 3; Common Mallard, 350*; Baldpate, 150*; Green-winged Teal, 1; Canvas-back, 7; Greater and Lesser Scaup Ducks, 250*; American Golden-eye, 300*; Buffle-head, 66; Oldsquaw, 2; White-winged Scoter, 1,000*; Surf Scoter, 150*; American Scoter, 13; Hooded Merganser, 1; American Merganser, 14; Red-breasted Merganser, 1; Sharp-shinned Hawk, 1; Ring-necked Pheasant, 1; American Coot, 18; Killdeer, 16; Glaucous-winged Gull, 500*; Thayer's Gull, 2; Short-billed Gull, 60*; California Murre, 1; Marbled Murrelet, 1; Belted Kingfisher (subsp. ?), 7; Northwestern Flicker, 6; Western Pileated Woodpecker, 3; Harris's Woodpecker, 2; Gairdner's Woodpecker, 1; Black-headed Jay, 4; Northern Raven, 13; Northwestern Crow, 125*; Oregon Chickadee, 35*; Western Winter Wren, 16; Seattle Wren, 12; Northwestern Robin, 2; Pacific Varied Thrush, 1; Western Golden-crowned Kinglet, 15*; Hutton's Vireo, 1; English Sparrow, 10; California Purple Finch, 4; Northern Pine Siskin, 30; Oregon Towhee, 28; Oregon Junco, 185; Rusty Song Sparrow, 26. Total, 53 species (2 introduced), at least 3,504 identified individuals. The sign (*) indicates conservative estimate.—THEED PEARSE, DAVID GUTHRIE.

THE BRITISH COLUMBIA WOODCHUCK *Marmota monax petrensis* HowellBy **I. McTAGGART-COWAN**

WHILE on a collecting trip to the Cariboo District of British Columbia in the spring of 1932 special effort was made to obtain specimens of the little known marmot *Marmota monax petrensis*.

The species was first encountered on May 10th at Four Mile Creek about four miles north and east of Quesnel, B.C. On this date a single specimen, an immature male, No. 428 in the writer's collection, was secured. During the succeeding weeks five more marmot burrows were located and two more specimens taken; these were an adult female and an adult male, No. 429 and No. 430 respectively in the writer's collection. The accompanying notes are presented as a slight addition to our knowledge concerning the habits of this rarest of British Columbia marmots.

Though a wide area was covered in our search for this species, all the animals seen were along the narrow, steep-sided gully through which flows Four Mile Creek.

The vegetation in this gully was quite typical of the district. Along the stream bank Black Poplar (*Populus trichocarpa*), Aspen (*Populus tremuloides*), Birch (*Betula fontinalis*), and Alder (*Alnus sitchensis*) predominated while briars and wild gooseberry made up the bulk of the underbrush. Along the rims of the gully Englemann Spruce (*Picea engelmanni*) and Douglas Fir (*Pseudotsuga taxifolia*) were in evidence.

With a single exception the burrows examined were well up on the west side of the gorge and therefore exposed to the early morning sun. The burrows were generally in full view in some little clearing on the hillside, and invariably situated at the base of a fir tree. After an initial steep decline of some two or three feet the tunnel passed almost horizontally into the bank under the roots of the tree. In no case was there more than a single entrance to a burrow. No observations were made as to the length of the burrow or the structure of the nest chamber, for though excavation was attempted, it proved to be a Herculean task due to this habit of digging horizontally into the face of a steep bank.

From the burrow entrance two or more well worn paths led to favourite sunning logs and to the nearest food supply.

The marmots were feeding almost exclusively on the leaves of grass, clover and dandelion and on account of the dry nature of the country this

vegetation was only to be had in sufficient amounts along the stream banks, the animals therefore had often to cover quite long distances in going to and from the feeding grounds; it was quite common to find them a hundred yards or more from the protection of their dens.

A point of particular interest was the cleanliness of the surroundings, the immediate vicinity of the burrow entrance being entirely free from the large deposits of disused bedding and fecal matter that are usually in evidence about the doorsteps of any of the genus *Marmota*. This may be accounted for in part by the fact that the animals had not been long out of hibernation, and in part by the distances to the feeding areas.

M. m. petrensis is probably without exception the quietest and most unobtrusive member of the genus in British Columbia. Not a sound was heard from them throughout the month that we lived in sight of their burrows; even when thoroughly alarmed no warning cry was given to inform others of the presence of danger; possibly this is explained by the solitary habits of the species, for only one pair, an adult male and female, lived in burrows about fifty yards apart and none of the other individuals seen were within half a mile of their nearest neighbours.

The adult female secured on May 12th was nursing young and examination showed that she had but recently given birth, so that in this district the young are probably born in the first two weeks of May.

The specimens taken were of the characteristic reddish-brown phase, nor were any melanistic specimens seen or heard of. At this date they were still in full winter pelage and, as evinced by the absence of fat, had probably not been long out of hibernation.

Specimens examined were remarkably free from all external parasites. Dissection revealed them as being devoid of internal parasites in all tissues studied; viz. body cavity, digestive tract, liver, lungs and heart.

It is my opinion that these marmots will prove to be more abundant than has formerly been supposed. Their solitary and retiring habits, admirable protective colouration, and the nature of their habitat having so far enabled them to evade detection.

FURTHER NOTES ON THE HENSLOW'S SPARROW AT TORONTO

By HUBERT RICHARDSON



TWO DAYS after our discovery of the Henslow's Sparrow in the Toronto Region in summer, it was my pleasure to accompany Mr. and Mrs. Stuart Thompson to show them the place where we had seen it.

When Stuart stopped the car, we listened for about three seconds and then heard from the fields the clear *ts-slick*. We sat still and just listened for several minutes and then stepped out of the car to look for him.

He was perched near where we had seen him two days before. His actions were the same as we had observed previously. He allowed approach only to about twenty yards when perched on the grass in the field, but when he had flown into a bush (it was even the identical bush he had perched in two days before, although there was a row of them) he went through his nervous antics, assuming the head down and tail up pose, and again, allowed a very close approach, this time to about six feet from him.

A few minutes later, a second bird, was seen, which only uttered Savannah-Sparrow-like chips, and was presumed to be a female.

Mr. Thompson and I wandered farther afield to see if there were any other Henslow's Sparrows. However, we found no others close by.

Mrs. Thompson had remained behind to look for the nest, and after half an hour of searching the adjoining fields, I decided to return and help her, but she had already found it. When we left, she had sat down and watched the female, and had seen it fly down into the grass. So she searched this spot, flushing the bird, but without success in finding the nest. At this point, Mr. Thompson had returned and suggested that they both sit down again and renew the watch. This time they approached more carefully when they saw the female fly into the grass, and watched for a movement of a few grass blades where the rest were still, for there was no breeze. After some fifteen minutes of search, Mrs. Thompson again flushed the bird, and upon examining the clump of vetch from which it had flown, dis-

covered the nest, a neat structure of dead grass, about six inches from the ground, containing four eggs. The eggs were about .6 of an inch in length, elliptical ovate in shape, and of a pale grey-green ground colour with cinnamon brown spots, sparsely distributed over most of the surface, but thickly concentrated at the larger end. Mr. Thompson said they looked fairly well incubated.

While we were examining the nest, the female bird sat up and chipped excitedly near by, but the male sang unconcernedly.

On the following Saturday afternoon (July 9), I again went to the nest, being with Murray Speirs and F. H. Emery. This time, as we were walking along the road by another field several hundred yards distant from the first, we heard a second male singing, and saw him, but did not see a second female.

On the following day, another visit showed the eggs still unhatched, and the second male singing away, far from the first one.

The next day, the nest was again visited by a party consisting of Clifford Hope, R. J. Rutter, J. L. Baillie, Jack McBean and the writer. We were pleased to find the eggs hatched, four buffy youngsters (naked, but for a few sparse patches of grey fuzz) stretching up their necks and opening their mouths wide as we turned back the vetch to peer in.

Where, on previous visits we had walked to, and around the nest, our path was plainly visible, for the long grass was flattened into a noticeable track. Mr. Baillie was afraid that it would open the way for predators, and sadly enough this appears to have happened, for Mr. Emery, on visiting the nest the following Saturday (July 16) found it empty. So, since the birds would not use that nest a second time, under the circumstances, he brought it back with him, and it is now in the Royal Ontario Museum of Zoology.

This constitutes the first nesting record of the Henslow's Sparrow in the Toronto Region, and Mr. Baillie of the Museum, tells me that this is the most northerly record of the bird in Ontario.

NOTES AND OBSERVATIONS

THE BLUE-WINGED WARBLER AT STRATHROY, ONTARIO.—On the morning of May 16th, 1932, while checking up on the spring migration near Strathroy, Ontario, a new warbler note was heard. This is a rare pleasure in the locality as the

warblers have been studied quite thoroughly. The song in tone and volume resembled that of the Golden-winged Warbler, but the notes were different. Nearly an hour was spent in locating the singer which proved to be a very beautiful male

Blue-winged Warbler. The specimen is No. 4093 in my collection.

The location was just a few hundred yards from where the Kentucky Warbler was collected in 1931, but down on the low ground in the valley of the Sydenham River. The swamp was densely wooded with cedar, tamarack, black birch, aspen and many small shrubs.—A. A. WOOD.

THE POMARINE JAEGER (*Stercorarius pomarinus*) AT HAMILTON, ONTARIO.—At 11.30 a.m., on October 23, 1932, while walking along the shore of Lake Ontario near the Hamilton Waterworks Pumping Station in the company of Mr. J. H. Williams, the writer observed a large, dark-coloured bird lying on the beach ahead of us, a few yards up from the reach of the waves. When the bird was picked up the plumage was quite dry, and we were delighted to find that it was a jaeger in an excellent state of preservation, having been dead obviously for but a few hours. That the bird had not been lying there for any length of time is also attested to by the fact that I had walked past the same spot at 8.15 o'clock that morning, looking for shore-birds, without noticing this bird on the beach.

This jaeger is now in the collection of the Royal Ontario Museum of Zoology in Toronto, where Mr. L. L. Snyder has carefully examined the specimen and declared it to be a Pomarine Jaeger (*Stercorarius pomarinus*), a female in the plumage of an immature. The bird was in an emaciated condition and had likely starved to death, the stomach having contained only a few unidentified feather remains.

This appears to be the second specimen of the Pomarine Jaeger taken in Ontario. The capture of the first specimen is recorded in the old *Oologist* (of Norwich, Conn.) 4:24, 1879. This bird was an adult female shot by R. Saulier on May 30, 1879, near Fighting Island in the Detroit River, the specimen being now found in the Museum of Comparative Zoology at Cambridge, Mass.—GEORGE W. NORTH.

WHITE PELICANS ON VANCOUVER ISLAND.—On the afternoon of 19th of June, 1932, seven White Pelicans passed over Courtenay, B.C.

I saw these birds approaching from the northwest but they veered to an easterly direction as they passed over (probably seeing the open water of Comox Bay.)

It was a grand sight as they flew nearly over the garden, low enough to see plainly the protuberance on the upper mandible. The flight was

notable, a slow flap and a sail, repeated; the birds were flying in a rather widened V formation; the heads tucked into the necks. As the sun caught the backs of the birds it gave the appearance of burnished silver with the black wing tips showing very plainly.

It is rather remarkable that Pelicans should be seen here in two consecutive years and at such unexpected dates. Deep Bay and Courtenay are not twenty miles apart.—THEED PEARSE, Courtenay, Vancouver Island, B.C.

Polygyra dentifera IN THE OTTAWA DISTRICT.—*Polygyra dentifera* has long been known to occur at Casselman, just beyond the limits of the Ottawa District as defined by the Council of the Ottawa Field-Naturalists' Club. Casselman is outside the thirty-mile limit and so this shell could not strictly be included in a list of Ottawa Mollusca, but it was almost certain that it would, sooner or later, be found nearer Ottawa. It was included in the 1890 list apparently on the strength of the Casselman record.

Two years ago, it was my good fortune to find a specimen of this species at Alcouve, Que. At the time I labelled the specimen *Polygyra albolabris* var. *dentata*, but comparison with authentic specimens of *Polygyra dentifera* showed that my specimen was indeed of that species.

Alcouve being only about twenty-two miles from Ottawa, this record definitely establishes the presence of the species within the district, and extends its range some forty-eight miles north-westward.

For other Canadian records of *Polygyra dentifera*, see Latchford, F. R., *Ottawa Naturalist*, 6:118, November, 1892.—A. LA ROCQUE.

Lilium umbellatum NEAR OTTAWA.—A specimen of lily collected by the writer on June 17, 1930, at Constance Bay, about 25 miles up the river from Ottawa, was assumed at the time to be *Lilium philadelphicum* L., which is not uncommon in the district; but recent examination proves it to be the handsome western *L. umbellatum* Pursh. (in Gray's *Manual* variety *andinum* (Nutt.) Ker. of the first named species). The leaves are quite narrow, and except for one upper whorl of seven, are alternately arranged on the slender stem.

This adds another to a growing list of plants known in the Ottawa district chiefly or solely from the dunes of this fruitful collecting ground. I am not aware of another record within several hundred miles. It is recorded from the sandy shores of Lakes St. Clair and Huron.—H. GROH.

INVESTIGATION ON THE EUROPEAN STARLING.—I believe that the members of your Club would be interested in the investigation on the European Starling being carried on at the University of Western Ontario, London. In this work I will require a great number of specimens for stomach examinations and also reliable information as to the prevalence, migration and general habits of

this bird as well as its relations to other species of birds.

I am certain that information supplied by experienced naturalists will be the most valuable that I can obtain and, along with any comments or advice regarding this investigation, will be very much appreciated.—M. S. FERGUSON, University of Western Ontario, London, Ont.

BOOK REVIEWS

BIRD-WATCHING IN THE WEST by Francis Staver Twining. Metropolitan Press, Portland, Oregon. pp. 171. Many pen and ink drawings, full page and in text.

This consists of a series of essays and pen-pictures of birds and their ways throughout the year, beginning with autumn and swinging through the seasons of winter and spring to summer. It is the work of a nature lover rather than that of a scientist and presents the beauty and aesthetic interest of bird life rather than its systematics or economics. It is charmingly written with much keen appreciation, good observation and, what is more unusual in works of this character, good ornithology and absence of weak sentimentality. A feature of the little book is the illustration. These are pen-and-inks by Florenz Clark. While here and there the ornithological art critic may find attitudes and outlines of which he disapproves, there are more good drawings than poor; many of them are quite charming and some of the tail pieces and bits scattered through the text are captivating little conceits. It seems that modern cheap half-tone processes with their necessity of highly glazed, impermanent paper and their easy use of indifferent photographs have largely ruined book illustration. It is a relief to see, between covers, firm, well-drawn lines and velvet blacks on soft interesting looking paper. The make-up of the volume is decidedly attractive, the paper and type good, and the proof-reading seems well done.—P.A.T.

carried on there by Dr. Beebe. Few, however, are as well acquainted with the geological possibilities. Because there are no sedimentary rocks with "bona fide" fossils, no igneous rocks, and few of the geological phenomena we are used to on the mainland, Bermuda has been considered to be practically barren of geological interest. Nothing could be further from the truth. Although only certain phases of geological activity can be seen at Bermuda, that these are of intense importance is shown by the contents of the paper under review.

The author, who is well known for his work on Permian glaciation states very frankly in the first two pages of this report the many perplexing difficulties and questions which arose upon first seeing the widespread wind blown shell-sand dunes with marine fossils, and their contained buried soils with fossil land snails. These difficulties Sayles has wrestled with in the short periods that business has allowed him for scientific research during the last seven years. Neither suggestion made by others nor observation made by himself is hastily recorded, all have been subjected to long time critical reflection. There have been published one or two short abstracts of progress made from time to time, promising a fuller report which has long been awaited, and students of the geological effect of wind, on oceanic islands like Bermuda, and of changes of level of land and sea during the Glacial Period now have the abundantly illustrated result of Sayles work before them.

IN BERMUDA DURING THE ICE AGE by SAYLES, R. W. *Proc. Amer. Acad. Arts and Sci.*, Vol. 66, No. 11, pp. 381-466, with thirteen plates and eighteen text figures. November, 1931.

During recent years Bermuda has become increasingly well known as a paradise for scientists because of the reorganization of the local station for biological research and also because of the startling explorations of the depths of the sea

The main part of the report is taken up with the subjects of Igneous Rocks, Sedimentary Rocks, Fossil Soils, Paleontology, Petrology and Chemistry, Physiography of Bermuda, and the Evolution of Bermuda. If we understand that Bermuda has a basement of igneous rock, the eroded and submerged remnant of an old volcanic island, upon which there has grown a super-structure of "coral" reefs, the wind blown debris

from which has accumulated on land as sand dunes, and has at several times been weathered to form soils, we see the significance of the chapter headings. Sayles' first suspicion that, because the present soil is post-glacial, earlier and buried soils might be interglacial, was his guiding star and it has been well substantiated by his later field work and proved beyond a doubt as the eighty pages devoted to the summation of the evidence shows.

It was the present writer's privilege to be associated with Sayles in Bermuda searching for gastropod fossils, remains of land snails which abound in many of the interglacial soils. It was our hope that sufficient differences could be found in the fossils of the typical soils to warrant making some species "guide fossils." This hope, however turned out to be groundless, at least as far as the limited work we were able to do was concerned. Sayles was therefore deprived of the most useful and time saving means of identifying his different interglacial soils here and there over Bermuda, and had to rely upon purely geological and climatological data. Although this correlation was extremely difficult, there seems to be no reason to question his results. The summary of the geological history of Bermuda cannot be stated any better than in Sayles' own words:

"The Bermuda volcanoes were erupted during the Tertiary, or earlier. By the end of the Tertiary they had been reduced to submarine platforms. The most northeasterly and largest of these was elliptical in plan, essentially flat, and several hundred feet below sea-level. With the coming of the Pleistocene great quantities of water were subtracted from the oceans to form the continental ice-sheets. When the ice was at its maximum extent the strand-line fell as much as 260 feet below modern sea-level. While the ice-cap grew, large parts of the Bermuda banks, covered by mollusc shells and unprotected by vegetation, were exposed to the sweep of the winds and the dried sands were piled up in great dunes. The higher winds in the vicinity of the Bermuda of the Ice Age and the inevitable changes in flora were important factors favourable for the construction of dunes. When the sea rose at the close of each glacial stage, the source of supply for the dunes was buried beneath the ocean waves, the winds became less violent, and a permanent flora anchored the dunes. A long period of slow decay began, during which red and brown soils accumulated. Such conditions lasted for tens of thousands of years. But with the advent of a new glacial stage, conditions were once more favour-

able to the formation of dunes. Thus dune- and soil-forming conditions alternated during the Pleistocene."

We should remember that several million square miles of land surface in Greenland and the Antarctic are still under glacial ice. This ice, melting, will raise the level of the ocean a hundred feet or more. If we are really in *postglacial* time these ice caps should completely disappear, and the resulting rise in sea-level will reduce the area of Bermuda to a small fraction of its present exposure. This will probably take several tens of thousands of years to accomplish, so Bermuda will continue to be North America's playground and rest cure for centuries to come.—T. H. CLARK, Redpath Museum, McGill University, Montreal.

AN INTRODUCTION TO BIRD-STUDY IN BRITISH COLUMBIA by J. A. Munro. Published by the Department of Education, Victoria, B.C. pp. 99; 26 coloured plates, numerous half-tones and a number of line cuts in the text. The plates and text figures are republished from the *Birds of Western Canada*. The half-tones are new, from photographs by the author.

We are told in the Foreword that this book has been prepared primarily as an aid to teachers in the schools of British Columbia. It consists of two parts; the first, discussions of birds in general and those of British Columbia in particular; the second, a presentation of fifty characteristic birds of the Province individually treated. The various chapter headings and sub-headings indicate the scope of the first part. Under "The Value of Birds to Man" various groups of birds are broadly treated,—"Insectivorous Birds," "Birds as Weed-destroyers," "Gulls," "Game Birds," and "Rodent Pests and the Birds that Control Them." There is a chapter on "The Enemies of Birds" and another on the "Distribution of Birds in British Columbia" with lists of species representative of the principal regional units of the Province. A chapter treats on "How to Study Birds" and one on "Bird Conservation" are included. In the bird list proper the individual species are treated at some length. The descriptions are brief and untechnical but the salient characters are well brought out and are sufficient for general recognition. Greater stress is laid on the bird's general habits and its relation, either economic or aesthetic, to man. There are final

chapters on "Books on Ornithology" and "Birds in Canadian Poetry," under which last a number of well chosen examples are given.

The whole seems admirably adapted to education in the schools and also presents pleasant and profitable reading without them. It is text-book

enough for elementary instruction but is freely and interestingly written, contains much good writing and good observation, and informs not only painlessly but pleasurably. Withal there are many bits tucked away in its lines that even an experienced ornithologist can profit by.—P.A.T.

MARCH EXCURSION

On March 25, by invitation of the Director, Dr. E. S. Archibald, the Ottawa Field-Naturalists' Club will visit the Division of Animal Husbandry at the Dominion Experimental Farm, Ottawa. Meet at the Dairy in Farm Grounds at 3 p.m. Leader—Mr. Geo. W. Muir.

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CONTENTS

	PAGE
The Canadian Snowshoe Rabbit Enquiry, 1931-32.....	63
Notes on a Short Trip to Nova Scotia and New Brunswick. By Allen Brooks.....	70
Wild Geese Killed by Lightning. By D. W. Cartwright.....	72
Some Field Notes on the Abundance of Small Mammals. By C. H. Douglas Clarke.....	73
Some Notes on the Hibernation of <i>Lasionycteris noctivagans</i> (LeConte). By Ian McT. Cowan.....	74
Notes and Observations:—	
Mourning Doves. By Paul F. Bruggeman.....	75
Do Bullfrogs Eat Fish? By Harry Bernard.....	75
Varied Thrush (<i>Ixoreus naevius</i>) in Central Alberta. By Frank L. Farley.....	76
Glaucous-winged Gull on Vancouver Island. By G. D. Sprot.....	76
Chipmunk vs. Snake. By J. M. McArthur.....	76
Book Reviews:—	
A Faunal Investigation of Long Point and Vicinity, Norfolk County, Ontario. By P.A.T.....	77
The Biology of the Amphibia. By C.L.P.....	77
Excursions of the Ottawa Field-Naturalists' Club, 1933.....	78

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THE CANADIAN SNOWSHOE RABBIT ENQUIRY, 1931-32

(Edited for the National Parks Branch, Department of the Interior, Ottawa, by CHARLES ELTON, Bureau of Animal Population, Department of Zoology and Comparative Anatomy, Oxford University, England.)



IN THE years 1924 and 1925 Mr. Hoyes Lloyd carried out from the National Parks Branch an enquiry into fluctuations in numbers of the snowshoe rabbit or varying hare (*Lepus americanus*), with special reference to disease and other factors causing decrease in numbers just about that time. The enquiry covered Canada, but was specially concentrated upon British Columbia, working through the agency of the police and game departments. Cycles in numbers of the snowshoe rabbit are recognised to have an important controlling influence upon the numbers of furbearing animals and birds of prey which depend on rabbits for food. The ten-year cycle in lynx is the best-known example of this phenomenon, which has been described by Seton* (1920), Hewitt † (1921), and also by many earlier observers. They made clear the regularity of these fluctuations, which have been in progress for over a hundred years and have a great amplitude which produces important economic reverberations on the fur trade, and also upon conservation policies throughout Canada.

The curves showing fluctuations in the lynx are the most regular of all, and have been extensively quoted by biologists. Those already published refer to the sales of the Hudson's Bay Company, and therefore cover the whole of Canada—in the case of the lynx mainly the northern forests. The curve in Figure 1 shows some hitherto unpublished statistics for the lynx numbers in the Mackenzie River district for 105 years, between 1822 and 1927. These are published by kind permission of the Hudson's Bay Company: some were collected by Mr. Charles French, late Fur Trade Commissioner of the Company in Winnipeg from the account books of the fur posts. The earlier figures 1822-1839 were obtained by myself from the same sources in the Company's archives in London, in course of an investigation which I am carrying out, financed by the New York

Zoological Society. In obtaining these I have to thank the Society for its support, and Mr. Leveson Gower, the Company's librarian, for his constant help and advice. The curve represents the cycle in lynx from one large district, and the years refer to the actual biological years of production not to the years in which the returns are made or the skins sold in London. The Mackenzie River District as here used covers the following fur-posts: Forts McPherson, Good Hope, Norman, Liard, Nelson, Simpson, Providence, Rae, Resolution; the last three not included in the earliest figures. The cycle is seen to be remarkably violent and also very regular in its periodicity, (about 9.6 years being the mean), though not in its amplitude which varies from 1:9 to 1:62. Such cycles in numbers of furbearers offer a serious problem to the fur trade on the one hand, and a challenge to ecologists on the other.

Since 1924 I have been collecting data with the idea of mapping more accurately the geographical distribution and behaviour of these cycles in numbers. Later the enquiry was expanded onto a larger scale in co-operation with the Hudson's Bay Company, who made available a great deal of unpublished material and also organized questionnaire enquiries at their posts with the object of following changes in numbers of wild animals from year to year. The preliminary co-ordination of this large mass of material has taken some years, and will shortly be published in a book on "Animal Population". Mr. Hoyes Lloyd, with the consent of the Commissioner of National Parks, Mr. J. B. Harkin, generously placed at my disposal the results of the 1924-25 enquiry, which filled in important gaps in the picture of rabbit cycles which was being built up. The regularity, wide geographical extent and importance of these cycles became more and more clear. The Hudson's Bay Company questionnaire system operating for seven years proved the general efficiency of the questionnaire system for following violent cycles such as those of the snowshoe rabbit. In 1931, partly as a result of the interest aroused by the Matamek (Canadian) Conference on Biological cycles organised by Mr. Copley Amory and backed by various government and scientific bodies, the National Parks Branch decided to

*SETON, E. T. (1920). *The Arctic Prairies*, London.

†HEWITT, C. G. (1921). *The Conservation of the Wild Life of Canada*. New York.

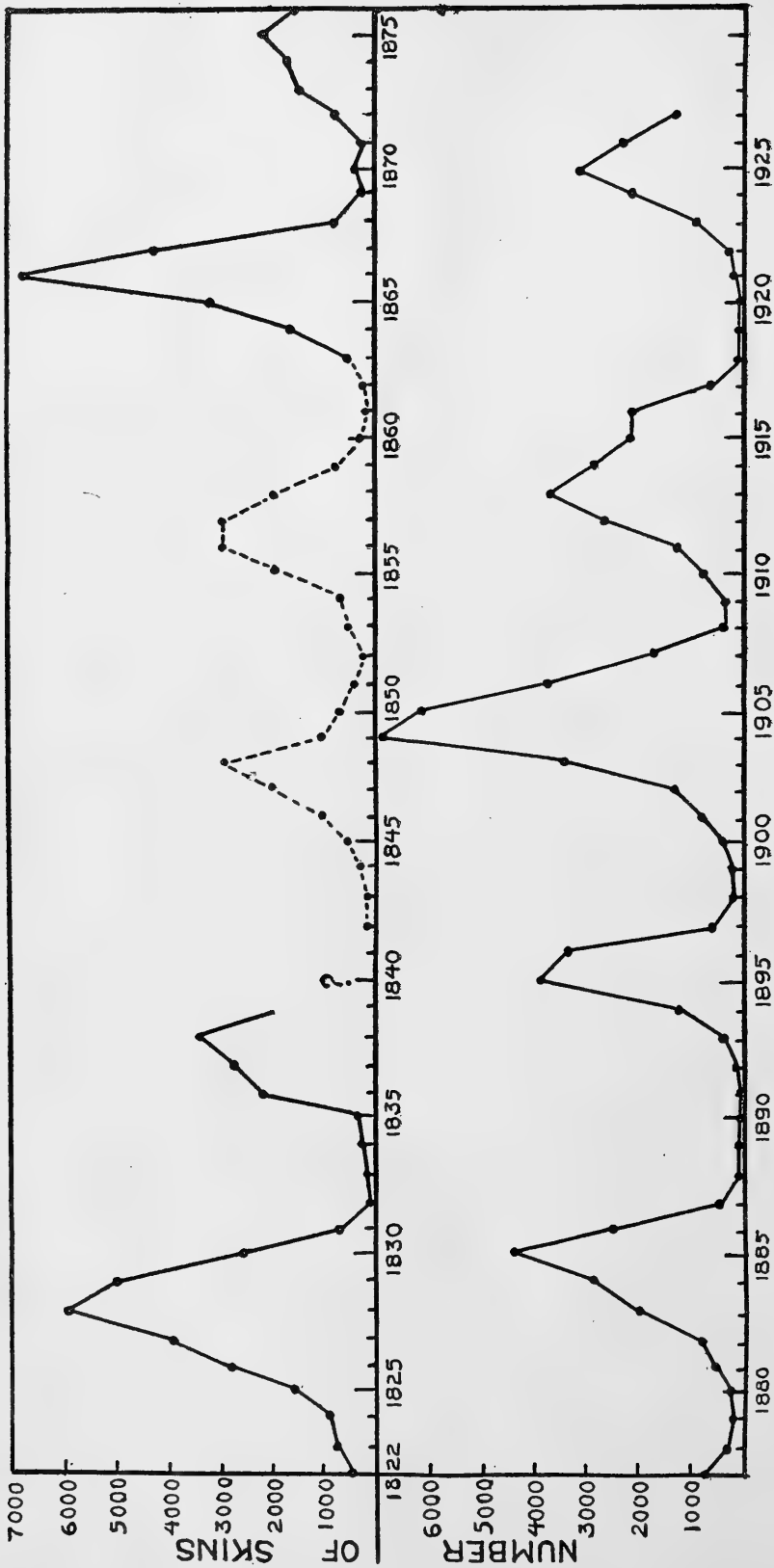


FIGURE 1.—Cycles in numbers of Lynx in Mackenzie River District of Canada, 1822-1927. Statistics of the Hudson's Bay Company, published by permission. 1822-39 obtained from account books of posts in Company's library in London. 1842-62 from an old chart in the Company's possession (round numbers only, hundreds up to a thousand, and after that in thousands); these were checked by overlap of twenty years with succeeding figures. 1863-1927 supplied by the Company from post account books, through the agency of Mr. Charles French, late Fur Trade Commissioner of the Company. Figures for 1840 and 1841 missing. Dates refer to old "outfit" years i.e. the years of biological production and not to the year of office return or sale.

send out annual questionnaires which would enable the snowshoe rabbit cycle to be studied from year to year. This scheme has a particular interest since the rabbits are expected to reach their next peak of abundance between the years 1932-35. In some parts of the North-West, it appears that rabbits have already reached a maximum in places, and are beginning to decrease—in some instances at least, through disease. The present paper records the comparative state of abundance in different parts of Canada covered by the observers of the National Parks Branch in the twelve months ending May 31st, 1932, i.e. the fur season 1930-32, together with the previous summer breeding season. This biological year is useful since it does not cut across the fur statistics, and can be fitted to any data collected by the Hudson's Bay Company which works by "outfits" ending May 31st each year.

In connection with this questionnaire I should like to express my appreciation of the services rendered by the following: the late Mr. C. E. Nagle, National Parks of Canada, who did such effective work in getting the enquiry started, Mr. W. D. Taylor who carried on the work after Mr. Nagle's death, the Royal Canadian Mounted Police, the Game Officers of the Provinces of Canada, Honorary Game Officers under the Migratory Birds Convention Act, Holders of Scientific Permits under the Migratory Birds Convention Act, Taxidermists, Superintendents and Wardens of the National Parks of Canada and other observers throughout Canada. My wife, Rose Elton, has given very valuable assistance during the work on this material.

A large amount of information was received in the answers and only a certain part of this can be published here. The rest is kept until it accumulates to a point at which co-ordinated publication seems desirable. Copies of the questionnaire replies, of all the original large scale map tracings and of the map reproduced here are deposited at the National Parks Branch in Ottawa and also in the Bureau of Animal Population in Oxford, and can be consulted for details.

The questionnaire issued ran as follows:

The snowshoe rabbit or varying hare (known in some localities as bush rabbit) has cycles of abundance and scarcity which are an important feature of wild life, owing to the dependence of many fur-bearing animals and also of birds of prey upon rabbits for food. It is therefore important for scientific purposes to obtain the following information about numbers of rabbits. In the following answers the snowshoe rabbit should be clearly distinguished from the jack rabbit, cotton tail, and European hare. Information about these other species will however be welcomed.

Answers to the following questions and the return

of your questionnaire during May or June next with your observations would be appreciated. This report is for the *twelve months ending May 31st, 1932.*

1. What *region* do your answers refer to?
2. In what *types of country* have you seen snowshoe rabbits during these twelve months?
3. Were snowshoe rabbits *more* abundant or *less* abundant this year than last year?
4. Have you observed any sudden decrease through epidemic disease during these twelve months?
5. If so in what *month*, and what were the *symptoms*?
6. Have you noticed epidemics in previous years? If so what were the *dates* and the *symptoms*?
7. When were the last periods of (a) great *abundance* and (b) great *scarcity* of snowshoe rabbits in your district?

N.B.—In these answers it is greatly to be desired that the exact dates of events should be given wherever possible. Please state when the date is not certain,

339 replies were received, of which the majority gave relevant information, and a large number supplied data of great importance about past cycles. It should be mentioned that a similar enquiry has also been initiated by the Royal Ontario Museum of Zoology at Toronto, under the direction of Mr. J. R. Dymond. As any conflict or overlapping in such enquiries is greatly to be avoided, it is satisfactory to record that the Museum announce their intention of co-operating fully with the National Parks Branch enquiry. The most important point on which agreement has to be kept is the actual form of questionnaire used, since it frequently happens that abundance can be recorded in several ways which do not permit of later amalgamation. The value of national networks of enquiry about wild life cycles is enormously increased by having a large staff of competent observers. If these enquiries are carried out on a common plan, any minor overlapping is comparatively unimportant.

In future years replies to questionnaires sent out by the Hudson's Bay Company will once more become available, while co-operation is also promised from the National Museum of Canada in Ottawa through the kindness of Dr. R. M. Anderson, and from Dr. A. G. Huntsman, working through the fishery organization along the coast of the Maritime Provinces. The total effectiveness of the enquiry will therefore increase as these additional data can be incorporated.

The special feature of the questionnaire given above is the comparison of abundance in one year with that of the year before (a biological year, as explained, being chosen in preference to the calendar year). Observers' estimates and impressions of absolute abundance vary enormously,

and very often the word "usual" has very little meaning at all. It covers the vague subjective impressions of abundance in former years, the impressions getting vaguer as memory recedes. But most people who are living out of doors and among wild animals retain a definite and probably accurate idea of last year's abundance, even if it has no quantitative basis. For this reason comparisons from year to year enable a running record of any conspicuous cycle to be kept, although the actual vertical scale of change is not known. Comparisons at times of great scarcity are however not very easy, since chance patchiness of the population plays an important part in causing errors. The usefulness of this method must be judged by its results, which appear consistent with the statistical material that can be obtained for fur-bearers and with what we already expect from previous cycles. Estimates do have a certain value when comparing the maximum years of abundance or minimum years of scarcity, since there is in these instances a double comparison with years before and after. Here memory often introduces errors in respect to exact dates, and double checking by different observers is desirable, unless notes have actually been kept at the time.

It appears from data already in my possession

that snowshoe rabbits reached their maximum abundance in most parts of northern and central Canada (in the conifer forest belt) about 1923-25, although some places in the far north-west were a year or so sooner. By 1927 there were very few places in Canada where rabbits abounded, and in most they were becoming extremely scarce. The population is now on the increase. The results of the 1931-32 enquiry are very clear-cut and prove that about 85-92% of the area covered by the network of observers had snowshoe rabbits on the increase, though not necessarily very abundant yet in all places. This result is shown on the maps (Figs. 2, 3), which require some explanation. I have attempted to evolve a method of transferring the questionnaire replies to a map of Canada, without introducing any errors due to my own opinions. That is to say, the replies depend on impressions, on subjective opinions, and are therefore liable to errors and cannot be checked by any method at present known. But what the observers say is transferred according to a scientific method which is objective and can be checked, although this does not necessarily prove that the method is accurate. It was felt that if such a method could be adopted, the results of large-scale enquiries in the future could be mapped as simply and easily by routine-workers as are the

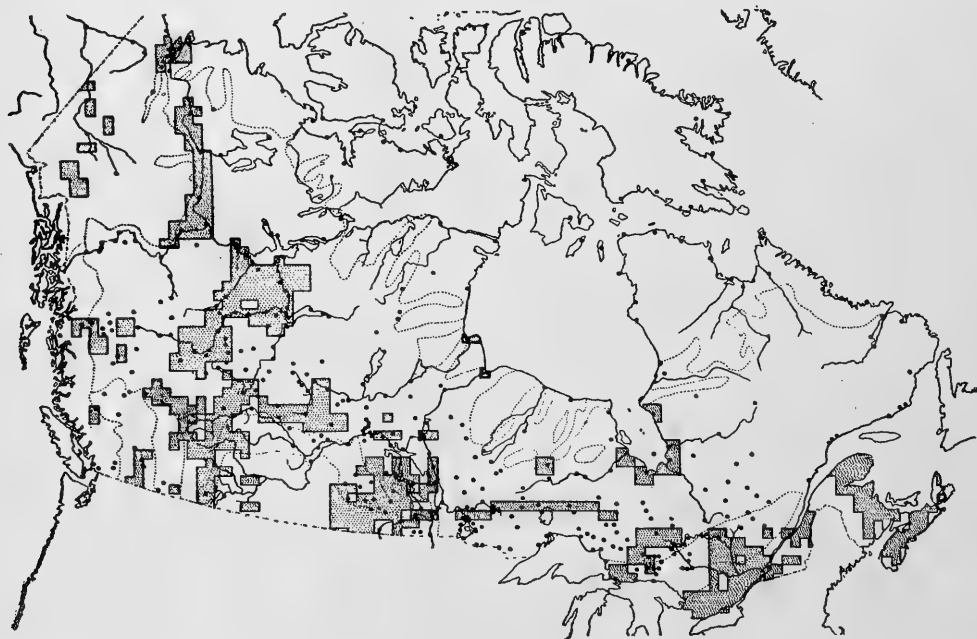


FIGURE 2.—Numbers of the snowshoe rabbit in Canada in 1931-32. Dotted areas are groups of squares overlapped by areas of observers reporting relative increase in 1931-32 over 1930-31. Blank parts of grid of squares omitted. Larger black dots are Hudson's Bay Company posts, etc. Broken lines show main vegetation zones.



FIGURE 3.—Numbers of the snowshoe rabbit in Canada in 1931-32. Vertically hatched areas show groups of squares overlapped by observers reporting relative decrease in 1931-32 over 1930-31. Horizontally hatched areas, no change. Blank parts of grid of squares omitted. Larger black dots are Hudson's Bay Company posts, etc. Broken lines show main vegetation zones.

meteorological data upon synoptic charts. This part of the enquiry requires a reliable rather than a skilled hand.

I believe that the following method is free from most objections. Each province is treated as a unit, since maps are often on different scales for different provinces. Tracing paper is laid over a large scale map of the province (e.g. Alberta at 12.5 inches to the mile). After marking certain fixed points of reference, the boundaries of the actual area covered by each observer are marked in Indian ink. Most of these can be plotted directly from Question 1, especially where the figures of townships of the radius round towns are given. Where the observer gives no details but simply mentions the name of a place, a convention is adopted of drawing a circle of 10 miles radius (i.e. 20 miles across) round the place. In most instances this twenty-mile circle is found to be smaller than the average areas of other observers, and therefore an under-estimate on the safe side. The results are noted in four categories: *more*, *no change*, *less*, *none* (i.e. none at any time). "Extremely scarce at any time" is included with "none" in order not to distort the results.

Most of the areas recording "none" were prairie or other settled areas (e.g. southern Ontario)

where the habitats are either naturally unsuitable for snowshoe rabbits or have been made so by man.

The next step is the creation of a grid composed of squares, thirty miles each way i.e. of 900 square miles, ruled on a blank map of Canada. The map adopted for this purpose is one made on the same scale and projection (120 miles to an inch) as that of the Hudson's Bay Company which shows their fur posts and districts. Although its details are not very accurate, it is a convenient size. It is hoped to improve this map in future years. The main vegetation zones as shown on the official vegetation map of Canada have been transferred to this outline map, which contains only the main geographical features, selected in a somewhat arbitrary manner. It should be remembered that the accurate data are to be found on the original maps of provinces, and that the Canadian map is only intended to give a general idea of the results. It is a simple matter to draw grids on tracing paper to match the large-scale maps of the provinces. By adjusting these to fixed points to correspond with the main grid, it is possible to transfer the province data to the main map, which then shows the thirty mile squares for which *more*, *no change*, *less*, or *none*, are recorded.

The essence of this method is that it eliminates personal bias in interpreting questionnaire results, while giving due weight to the different areas covered by different observers. There are several obvious objections to the method. First, the areas are not sufficiently numerous to overlap to any large extent to form a "chain-mail" pattern. They are therefore counted as covering a square even if they just overlap a part of it. This makes the total area in squares shown on the map of Canada a good deal larger than that actually covered by the observers. But so long as this convention is recognised clearly, it does not greatly matter, since we are dealing with a phenomenon which is acting often simultaneously over huge areas of country. The method is standard from year to year, and thus enables relative increase and decrease to be followed. A second source of error is in transferring from one grid to another. This is largely a matter of accurate technique and draughtmanship: but as the general map reproduced on a small scale can only show very general trends, such errors probably do not amount to anything serious, and the original data can always be consulted.

In interpreting the map several technical points arise. Where the different categories of abundance are recorded for the same square, this means that either there is a real difference of opinion among observers, or else that the summarising of the data into squares simply does not show the original local differences, e.g. one corner might be prairie with no rabbits, while the rest might be poplar country with local rabbit patches as to whose abundance opinions differed. But by far the biggest source of error is contained in the original observations. It is not so much that they are likely to be inaccurate in the mass, but that we have only personal means of ascertaining the accuracy of any given observer, and further more that the observations are based on a series of experiences throughout two years and these are not strictly amenable to scientific record. Here we see the importance of maintaining a balance between the policy of seeking as many observers as possible (to cover a large area and to counter-check observations) and of concentrating on a smaller body of picked people of known ability and accuracy. It seems to me probable that the clear-cut results obtained in the present enquiry are due to the National Parks Branch observers being such a picked body and also in large enough numbers to achieve good results. But it must be repeated that although this map is probably a reliable picture of the rabbit situation in 1931-32, it is a summary of opinions and not of measured scientific census data, and should be considered

only as one method of following cycles in abundance. Experience with other fluctuations studies in England has convinced me of the importance of following up these general enquiries by actual census methods which can give objective facts about the snowshoe rabbit population. In the study of British vole (meadow-mouse) cycles several different methods are being used concurrently; questionnaires to selected observers, comparative trapping data, sample quadrats of mouse traces which also give comparative data from year to year, and finally the trapping out of sample plots annually in order to get an absolute measure of abundance. Such ecological methods have to be backed by investigations upon reproduction, food, parasites, and pathology—questions which have only just begun to be systematically studied for the snowshoe rabbit.

We now have to analyse in more detail the results of mapping the answers to these questionnaires. For the sake of clearness the areas showing increase have been put on one map (Figure 2) and those showing no change and decrease onto another (Figure 3). This is necessary owing to the overlapping that takes place here and there, as already explained. It has not been thought necessary to include the areas recording "none", since these are mainly confined to the places we should expect, such as the mountains and prairie of the west, and southern settled Ontario. Such squares have simply been left out of consideration, unless there is another observation giving information about local numbers within it. It is obvious at a glance that there is an almost unanimous vote in favour of an increase of the snowshoe rabbit in Canada in 1931-32. First of all it is of interest to tabulate the results by provinces, and so find out the constitution of the gross figures of 92% of squares showing increase

The total figure given for the number of observers—240—is less than the actual number of questionnaires received, since some came from areas where few or no snowshoe rabbits exist, while some did not give relevant information or had no observations to record. The average number of squares per observer varies between 1.4 and 2.7, except in Yukon, North West Territories, and Quebec, which show higher figures. The total number of squares filled in on these maps is 617, which represents an area of about 555,000 square miles. Although this (as explained already) is really somewhat more than the area covered by observers, it is clear that it represents a pretty good random sample of Canada, and the maps and figures show that it is scattered also in a representative manner. The chief areas for which there are no observations are large parts

	No. of Observers	Total squares covered by replies	No. of squares reporting increase	% squares reporting increase	No. of increase squares overlapping others	% increase squares overlapping others	No. of squares reporting decrease	% squares reporting decrease	No. of decrease squares overlapping others	No. of squares reporting no change	% squares reporting no change	No. of no change overlapping others
Yukon Territory.....	6	19	19	100	0	0	0	0	0	0	0	0
North West Territories.....	16	91	91	100	0	0	0	0	0	0	0	0
British Columbia.....	26	44	36	82	4	9	5	11	3	7	16	1
Alberta.....	59	143	138	97	3	2	1	1	1	7	5	2
Saskatchewan.....	22	59	53	90	2	3	2	3	0	6	10	2
Manitoba.....	23	48	48	100	0	0	0	0	0	0	0	0
Ontario.....	35	84	74	88	23	27	5	6	5	28	33	18
Quebec.....	21	76	69	91	3	4	10	13	2	0	0	0
New Brunswick.....	9	21	18	86	6	29	2	10	2	7	30	4
Nova Scotia.....	19	26	21	81	11	24	12	46	7	4	15	4
Prince Edward Island.....	4	6	1	17	0	0	5	83	0	0	0	0
Total.....	240	617	586	92	41	7	42	7	20	59	10	33

of the northern conifer forest region e.g. in Ontario and Saskatchewan. It is hoped that next year this area will be covered more completely with the aid of the Hudson's Bay Company's questionnaires which will supplement the others.

An examination of the two maps shows clearly enough that snowshoe rabbits had in the season of 1931-32 increased in all parts of Canada over the previous year, and that this increase is more especially marked in the northern regions, away from civilization. If we take the area which remains after omitting the prairie and grove belts of the Middle West, southern British Columbia, and the settled belt (taken here conventionally as the "cleared hardwood forest area") in Ontario and Quebec, together with the whole of New Brunswick, Nova Scotia, and Prince Edward Island, the total percentage of squares recording increase is 97%.

The percent ges given so far are subject to an error in the case of overlapping squares. The amount of overlap is given in the table, and is the maximum error due to this cause. As already pointed out, overlap may mean a difference of opinion, or local differences in numbers, or smaller local differences in numbers within a real overlap of observers. The lowest percentage figure for increase squares therefore is 92 minus 7 i.e. 85%,

while with the figure for northern Canada there is only a maximum error of 2% which brings it down to 95%.

In the first part of this paper the technique of using the questionnaire method for the rabbit cycle has been described at some length, since it does not appear to the writer that any attempt has hitherto been made to ensure that the data collected will be mapped on a recognised plan which can be criticised and amended in the same way as experimental methods in the laboratory. The results of this mapping show conclusively that rabbits were on the increase in 1931-32 over large sections of Canada. The method will enable future trends to be mapped clearly from year to year. The next step is to show that this increase forms part of a general cycle in numbers, since the figures as they stand show nothing more than an increase in one year. We can safely say however, that such general increase can hardly be due to chance agreement alone, and must be partly influenced by some general factor such as climate. In the second part of this paper, some of the data concerning previous periods of abundance will be co-ordinated and discussed, to form background to the yearly changes in abundance that are in progress, and which it is greatly hoped will be followed by systematic enquiry for many years hence.

(To be concluded)

NOTES ON A SHORT TRIP TO NOVA SCOTIA AND NEW BRUNSWICK

By ALLEN BROOKS



VISIT to Nova Scotia and New Brunswick in August, September and October of 1930 resulted in a few noteworthy records. Leaving my home in British Columbia on August 2nd, I arrived at Halifax on the 9th and was taken by Mr. Robie Tufts to Crescent Beach, Lunenburg County, where I remained until the close of the month as the guest of Dr. S. F. and Mrs. Patten of Boston. Dr. Patten's summer home is delightfully situated on a rocky outcrop at the south end of the famous beach, on which, and the lagoon it encloses, the doctor, who is an enthusiastic ornithologist, has made many notable records. My hosts were more than kind and did everything to ensure the success of my visit.

Shore birds were in great numbers, more so than I have ever seen them on the Pacific coast; nearly all were adults and it was not until the close of the month (August) that a noticeable infusion of juveniles was observed. The exceptions to this were the Piping Plovers and Eastern Willets seen, all of which were juveniles. Semipalmated Sandpipers and Semipalmated Plovers were the dominant species in numbers; 95 per cent. of the former were adults in worn summer plumage and it was not until the 23rd of the month that the first young of the latter were seen. This is just about a month later than the average dates the young arrive on the Pacific Slope of Southern British Columbia. Young of the Ruddy Turnstone, Knot, Dowitcher and Sanderling were all first seen on the 23rd and 24th. No young of the Black-bellied Plover or White-rumped Sandpiper had arrived by the end of August when I left Crescent Beach for Wolfville on the Minas Basin. Here for a few days I enjoyed the company of Mr. Tufts and met that interesting little skulker the Acadian Sparrow, a common summer resident on the salt marshes there.

Leaving Wolfville on September 6th I arrived at the Island of Grand Manan four days later.

Others have written of the extraordinary stragglers that have occurred on this island in the Bay of Fundy which may well be called the Heli-goland of North America. I had hoped to be able to see something of the swarms of birds around the lighthouses of the region but although there were a number of foggy nights only one produced any birds, the night of September 21st, a clear calm night with a sudden interval of fog for forty minutes at midnight. At the Swallow-tail Light near my quarters at North Head only

seven birds were picked up, 5 Maryland Yellowthroats (the northern form), 1 Blackpoll Warbler and one Swamp Sparrow, but at the Light on Gannet Rock 25 miles to the south over one hundred were killed and thrown into the sea by the keeper. It is apparent that only a sudden change will result in many birds striking.

Mr. Allen L. Moses, whose collection of mounted birds has already been discussed by visiting ornithologists, notably Dr. C. H. Townsend, accompanied me on many of my trips, on one of which we had the great pleasure of the company of Dr. Alfred O. Gross when we visited an island sanctuary where many Eiders, Leach's Petrels, Herring and Greater Black-backed Gulls breed under the guardianship of Mr. Moses.

Throughout my stay in the Maritime Provinces I was impressed with the abundance of Ravens; it was a surprise to me to see these birds common on the Atlantic Coast. Hawks also were numerous especially Ospreys, Sharp-Shinned, Marsh and Pigeon Hawks, the latter far commoner than I ever saw them in the west.

The following are the most noteworthy records:

LITTLE BLUE HERON. *Florida caerulea*.—Mr. Moses considers this a fairly regular visitant to Grand Manan and two young birds were seen by the writer there.

YELLOW RAIL. *Coturnicops noveboracensis*.—One was winged and lost at a marsh at Whale Cove, October 7th.

FLORIDA GALLINULE. *Gallinula chloropus cachinmans*.—A young bird taken at the same marsh where the Yellow Rail was seen, August 10th.

ROSEATE TERN. *Sterna dougalli*.—This was one of my special quests, as Canadian records were required. On August 20th Dr. Patten and I chartered a fishing boat to take us to Indian Island, seven miles out to sea from Crescent Beach, Lunenburg County, Nova Scotia. On the extreme south end of the island a colony of several hundred Terns were nesting; as all authorities in American works had given the all black bill of this tern as its diagnostic feature when in breeding plumage I had relied on this character when looking over all the terns seen previously. Lying on my back I studied the milling crowd above my head but no black-billed birds were to be seen; one seemed to have a bill that showed more black than the Common Tern should have. On collecting this individual it proved to be a Roseate Tern, other birds with similar extra long tails

were then collected and all were of the same species although the bills showed about half red, much as in the Common Tern. In all, seven adults and two young of the Roseate and one adult and two young of the Arctic Tern were taken. The proportions of this colony would be in the neighbourhood of the following estimates—Common Tern 300 pairs, Roseate Tern 125 pairs, Arctic Tern 50 pairs. Very few young had been reared, the obvious cause being a nest of Marsh Hawks on the edge of the colony; tern's wings and carcasses were scattered everywhere; in the long grass where the Roseate Terns were nesting bills of the downy young were found lying beside the nests and two young hawks were killed so gorged with terns that they could hardly fly. This will probably result in the abandonment of this nesting place by the terns. Nothing but tern remains were seen around the nest from which the young Marsh Hawks had just flown.

BLACK TERN. *Chlidonias nigra surinamensis*.—A young bird taken by Dr. Patten at Crescent Beach on August 23rd.

MARSH WREN. *Telmatodytes palustris* subsp.—Two Marsh Wrens taken at a marsh on the shore near Castalia, Grand Manan, by Moses and me on October 8th are unlike anything I have seen of this species. They are very black and white birds most nearly resembling the form recently named *waynei* from North Carolina by Sprunt and Dingle. They are even darker than this form of which I have two September birds taken by A. T. Wayne. Compared with them my Grand Manan bird has a black crown with no lighter coronal stripe, a blacker dorsal area and a snow white lower surface and supercilium. Female in fresh post-juvinal plumage, wing 45, tail 38, tarsus 18, exposed culmen 13.5. These two birds were migrant, frequenting marsh grass and not cat-tails and were the only ones of their kind seen. In a cat-tail swamp not far away a Long-billed Marsh Wren of the ordinary brown type as in Ontario birds was seen but not secured. Mr. Moses had never seen Marsh Wrens on Grand Manan previously and certainly none breed there.

The distribution and arrangement of the subspecies in the 1931 Check List is difficult to understand; certainly the specimens I have seen from different parts of Ontario are very distinct from the ones from Winnipeg and vicinity. On looking up the original description of *dissaëptus* Bangs a small dark form is found, very different from the large rufous form that we have known as *iliaeus*, in fact *dissaëptus* is specially diagnosed by its author as distinct from the large brown birds found in the interior. How then can *dissaëptus* become the type of the Prairie Marsh Wren?

CONNECTICUT WARBLER. *Oporornis agilis*.—I called up a young bird of this species in the woods near North Head; it remained within ten feet of me for some time, too close to collect; the complete white eye-ring and brownish breast sharply defined against the yellow lower surface were clearly seen.

EASTERN GRASSHOPPER SPARROW. *Ammodramus savannarum australis*.—On October 1st I took a young male Grasshopper Sparrow at North Head.

WESTERN LARK SPARROW. *Chondestes grammacus strigatus*.—A Lark Sparrow taken by myself at North Head on October 3rd appears to be the western form. Dr. Oberholser who examined the specimen, a young female with traces of juvenal plumage, agrees with this identification and considers the western form to be the logical probability as a straggler on account of its more northern breeding range.

Notes on the collection of Allen L. Moses at North Head, Grand Manan, New Brunswick.

The notable local collection of mounted birds made by Mr. Allen Moses in the vicinity of Grand Manan has been examined by visiting naturalists and most of the extralimitals have been recorded; a full list of these together with some other notable records is given herewith from notes made by the writer in 1930.

AMERICAN EGRET. *Casmerodius albus egretta*.—One specimen taken 12 April, 1930.

EASTERN GREEN HERON. *Butoroides virescens virescens*.—1 June, 1926. Mr. Moses thinks that a pair bred at Kent Island off the S. E. coast of Grand Manan.

LESSER SNOW GOOSE. *Chen hyperborea hyperborea*.—One specimen labeled "*nivalis*," 6 October, 1912.

NORTHERN EIDER. *Somateria mollissima borealis*.—A fine male, 7 May, 1927, taken at "The Wolves".

LAPWING. *Vanellus vanellus*.—Female, 6 January, 1928, Hay Island.

FRANKLIN'S GULL. *Larus pipixcan*.—Female, 6 December, 1925.

BLACK TERN. *Chlidonias nigra surinamensis*.—Female adult, 29 May, 1911.

BLACK SKIMMER. *Rynchops nigra nigra*.—Female, 20 October, 1924. White Head.

RED-HEADED WOODPECKER. *Melanerpes erythrocephalus*.—One June, 1918, another no data.

SCISSOR-TAILED FLYCATCHER. *Muscivora forficata*.—26 October, 1924, Eel Brook.

GREAT-CRESTED FLYCATCHER. *Myiarchus crinitus*.—Female, 7 December, 1928, North Head.

MOCKINGBIRD. *Mimus polyglottos polyglottos*.—Three specimens Male, 15 October, 1911; Male, 19 January, 1928; Male juv., 2 November, 1926. "Of frequent occurrence."

BOHEMIAN WAXWING. *Bombycilla garrula palidiceps*.—Male, 5 December, 1908.

EASTERN EVENING GROSBEAK. *Hesperiphona vespertina vespertina*.—Male, 26 February, 1913.

HOLBOELL'S REDPOLL. *Acanthis linaria holboellii*.—Two red-breasted males, 24 December, 1908. One of these Mr. Moses generously donated to me, a fine example, as was the other, of this irregularly distributed, island-frequenting form. Wing 76, culmen from frontal feathers 11.

CHESTNUT-COLLARED LONGSPUR. *Calcarius ornatus*.—Male, 2 June, 1914. Nantucket Island.

LARK BUNTING. *Calamospiza melanocorys*.—Male juv., 15 August, 1910. Nantucket Island.

LARK SPARROW. *Chondestes grammacus* subsp. —Female and young bird partially spotted on breast; North Head, 24 August, 1925. These are apparently the western form *strigata* and as such are no more extraordinary than the occurrence of

the two preceding species.

IPSWICH SPARROW. *Passerculus princeps*.—Two specimens, one in spring plumage and the other in fall, the former presented to me. Mr. Moses considers the Ipswich Sparrow to be a regular migrant arriving early in April.

GAMBEL'S SPARROW. *Zonotrichia gambeli*.—Male adult, 5 October, 1911. North Head. The lores show a slight trace of black indicating a trace of *leucophrys* blood as these two species hybridize freely where their extraordinary and involved breeding ranges overlap.

RED-EYED TOWHEE. *Pipilo erythrophthalmus erythrophthalmus*.—Male, no date. Gannet Rock Light House.

STARLING. *Sturnus vulgaris vulgaris*.—29 March, 1926.

PURPLE GALLINULE. *Ionornis martinica*.—Mr. John R. Moses picked up a specimen of the Purple Gallinule below Swallow Tail Lighthouse "about 1885", the specimen (mounted) has since been destroyed.

WILD GEESE KILLED BY LIGHTNING

By B. W. CARTWRIGHT



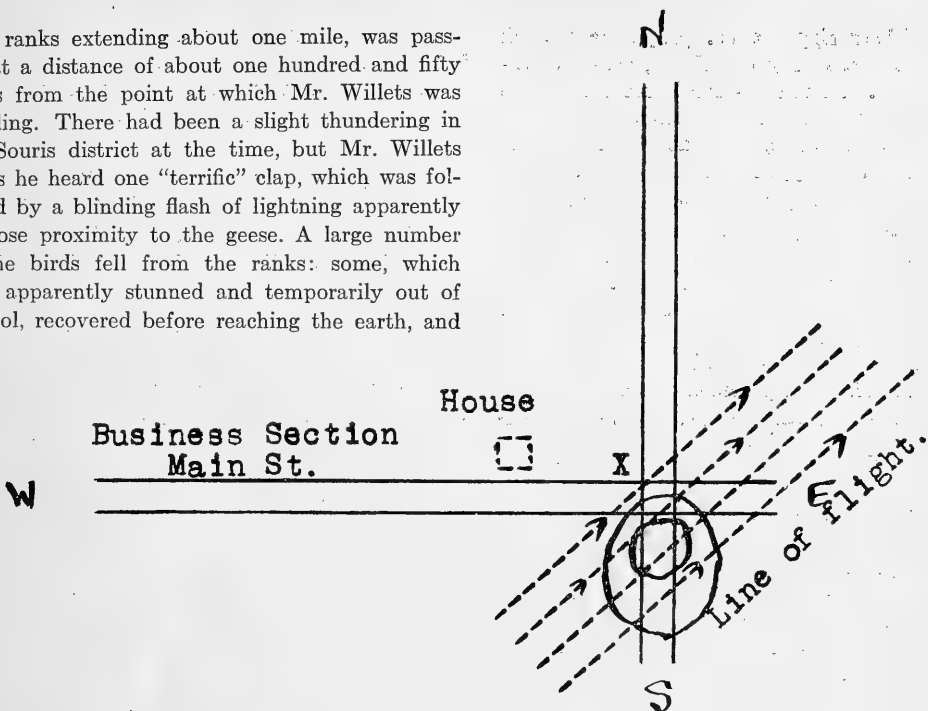
ON APRIL 22, 1932, at 11.20 a.m., 52 Lesser Snow Geese (*Chen hyperborea hyperborea*) and Blue Geese (*Chen caerulescens*) were instantly killed in an electrical storm at Elgin, Manitoba. Mr. C. E. Willets and his two sons were eye witnesses of this extraordinary occurrence and I am indebted to him for the following account:—"I was closest to the happening which occurred about two to three hundred yards south-east of my house which is just inside the limits of the town (Elgin, Man.) I was watching the flock which was about three-quarters of a mile long and roughly three hundred yards wide. I was about 150 yards from where they fell and was dazed by the flash and the terrible roar of thunder. Immediately, a portion of the flock fell to the ground while the outside portion came within a few yards of earth, gained consciousness and soared off. Only one bird which struck ground lived and flew in a few seconds. Another ran off but died afterwards. All of the remainder of the fifty-two were stone dead from the concussion. About three burst open and others were broken inside and some not. The flock was travelling from the south-west to the north-east and was about sixty yards high. They

fell in about fifty yards square." The accompanying diagram was kindly prepared by Mr. Willets. He stood in the rain at the place marked with an X. Inside the small circle were the dead birds. The outer circle represents the relative area in which the birds were almost brought to earth.

The unusual occurrence will be of interest to meteorologists as well as ornithologists and I am indebted to Mr. H. Campbell of the Dominion Meteorological Office in Winnipeg for the following data. On April 21, the day prior to the disaster to the geese, the unseasonably high temperature of 71.08 degrees was recorded. On April 22 low strato-cumulus clouds merging to nimbus were recorded and local electrical disturbances occurred throughout the west.

A flock of geese was destroyed by lightning at Elgin, Manitoba, on April 22nd, 1932. Mr. Creighton E. Willets of Elgin, reported the incident to the officer in charge of the Royal Canadian Mounted Police Detachment at Souris. About 11.30 of the morning of April 22, Mr. Willets was, he states, about one hundred and fifty yards from his home watching a flight of wild geese proceeding northward. The flock, which was a large one,

with ranks extending about one mile, was passing at a distance of about one hundred and fifty yards from the point at which Mr. Willets was standing. There had been a slight thundering in the Souris district at the time, but Mr. Willets states he heard one "terrific" clap, which was followed by a blinding flash of lightning apparently in close proximity to the geese. A large number of the birds fell from the ranks: some, which were apparently stunned and temporarily out of control, recovered before reaching the earth, and



were able to rejoin the large flock, while others tumbled to earth as though shot. Fifty-one were found dead, about two-thirds of them lying on their backs with feet to the sky. One bird was alive, and although apparently its wing was broken, it succeeded in running away. One of the geese picked up was badly mutilated; it was burst across the back and was generally "pulped." The others were fit for human consumption.

There was no sign of burning on any of the geese.

Mr. Willets' two sons, Shirley, age 14, and Creighton, age 12, witnessed the incident from their home.

By authority of the constable in charge of the Royal Canadian Mounted Police Detachment at Souris, the dead geese, except one, were distributed amongst the poor.—HOYES LLOYD.

SOME FIELD NOTES ON THE ABUNDANCE OF SMALL MAMMALS

By C. H. DOUGLAS CLARKE

DURING the past summer the writer was in the field during late May and all of June at Frank's Bay, Lake Nipissing; two weeks in July at Buckshot Lake, Addington County; all of August at Long Lake, Algonquin Park, and in September in the vicinity of London, all in Ontario. A great disparity in the relative abundance of various common small mammals was observed, and in view of the attention now being paid to the question of fluctuations in numbers, it seems well to put these observations on record.

CINEREOUS SHREW. *Sorex cinereus cinereus* Kerr.—One specimen only was taken by me at Frank's Bay, whereas in Algonquin Park these animals

were several times observed, and trapped regularly in a small line of ten traps kept going during the month behind the Long Lake cabin. None were taken at the other places mentioned.

SHORT-TAILED SHREW. *Blarina brevicauda brevicauda* (Say).—The most noteworthy feature of the small mammal life of Frank's Bay was the abundance of *Blarina*, which was found in all sites, and formed the largest element by far in the catch, over 50% of the total. At Long Lake in the park *Blarina* was as scarce as he was abundant at Frank's Bay, only two specimens having been taken. At Buckshot Lake the leaf litter in poplar-maple woods was riddled with his tunnels and in order to test abundance five traps were set around a dead log

which had been ripped open. Exposure of fresh humus or litter, in my experience, seems to attract *Blarina*. In twenty-four hours three were taken in five traps. This species was noted as very abundant in June, 1931, at Goderich, Ontario, and in February, 1932, near London.

NORTHERN CHIPMUNK. *Eutamias minimus borealis* (Allen).—Seen by me only at Long Lake and Tea Lake, Algonquin Park; only three individuals were observed of which one was taken. I missed it at Frank's Bay though one was reported later. This animal appears to have been common the previous summer and such rarity is not in accord with my experience in previous years.

EASTERN CHIPMUNK. *Tamias striatus lysteri* (Richardson).—Found abundant in all places visited.

RED SQUIRREL. *Sciurus hudsonicus gymnicus* Bangs.—Found abundant in all places except Frank's Bay. The greater activity of this species during the cone season must be taken into account and spring is probably the poorest time of all to observe red squirrels. Hence the scarcity at Frank's Bay as compared with Long Lake in particular may be more apparent than real, but squirrels were particularly noticeable at the latter place.

WHITE-FOOTED MOUSE. *Peromyscus maniculatus gracilis* (Le Conte).—This mouse was scarce at Frank's Bay (one specimen) and enormously abundant at Long Lake, where they were observed easily at night by the use of a flashlight. It was possible to have as many as three under observation at once and any spot in the woods would do as a post, it being only necessary to wait a few minutes before one was heard.

NORWAY RAT. *Rattus norvegicus* (Erxleben).—The common rat appeared during August and September in the grain fields around London for

the first time in many years. It has been unusual in the past to find them in shocked corn, but to run across them in wheat and hay fields, and in the stubble during fall ploughing is most unusual. My informant, a farmer at Kilworth, has never observed this before. The number of rats at the London city dump near Carfrae St. was so great that the city health department had to take a hand and two men were hired to "exterminate" the rats. It is not surprising that weasels are reported in the Kilworth area this year as being commoner than usual.

SUMMARY.—The contrast between Frank's Bay and Long Lake, which are only about forty miles distant in a direct line, is very noticeable. In the former *Blarina* is abundant, *Sorex c. cinereus* and *Peromyscus* scarce; in the latter locality the reverse is true. Habitat differences may have something to do with it in the case of *Sorex cinereus*, but in *Blarina* and *Peromyscus* they do not help, the Frank's Bay area being a mixture of different ages of brûlé; while Long Lake is surrounded by mature pine and hemlock.

As for evidence of parasites and diseases, external parasites were found on most individuals examined, and internal parasites in a few cases. This material, still in the possession of the writer, was collected only casually and nothing like an autopsy was made on any specimen. The writer's main efforts were devoted to the study of the Ruffed Grouse, hence only the most obvious small mammal observations are recorded. Trapping figures are not given as trap lines were not set for the purpose of getting definite data on the numbers of small mammals. This would require full time, and special studies of this sort would well repay anyone who undertook them. The species mentioned above are only the most obvious cases, and the number of species in a more detailed study would be considerably increased.

SOME NOTES ON THE HIBERNATION OF *LASIONYCTERIS NOCTIVAGANS*

By IAN McT. COWAN

British Columbia Bird and Mammal Society



WHILE at the University of British Columbia from 1927 to 1931 I came across two instances that would point to the fact that the Silver-haired Bat, *Lasionycteris noctivagans* is a resident at Vancouver, British Columbia, rather than a summer visitant as has been formerly supposed.

On February 27th, 1929, I was presented with a living specimen of *Lasionycteris noctivagans* that

had been taken the same day at Point Gray, Vancouver, British Columbia. This specimen had been found, about twelve feet from the ground under the loose bark at the base of a Giant Cedar, *Thuja plicata*, by an enthusiastic entomologist in search of hibernating beetles. At the time the weather was severe with several inches of snow on the ground. When first examined the animal was still in a state of semi-torpor but in the course

of a few hours it became quite active. After being systematically deloused for the benefit of the University's collection of animal parasites it was skinned and preserved.

Again, on December 21st, 1931, another specimen of this bat was taken under exactly the same circumstances and in the same locality. This one was also hibernating under the loose bark at the base of a Giant Cedar.

Both specimens were adult females, very fat and in good condition and without any sign of an injury that would have prevented them from making the southward migration with the rest of their kind. Both are in the writer's collection.

Coupled with these two occurrences are observations made by P. McT. Cowan and myself on Black Mountain, North Vancouver, British Columbia, in October, 1931. Here at an altitude of 3500 feet after the first fall of snow two individuals of this species were seen flying about our camp on three consecutive nights.

The data here presented would point to the conclusion that *Lasionycteris noctivagans* is a very hardy species, hibernatory or at least semi-hibernatory, and, in some instances at least, a resident throughout the year at Vancouver, British Columbia.

NOTES AND OBSERVATIONS

MOURNING DOVES—About the middle of June, 1930, while on a motor trip to Wainwright, Alberta, I saw my first Mourning Dove. The bird was perched on the railing of a bridge across the Battle River and did not fly off until the car was alongside of it. Locality: township 45, range 3, west 4th mer., latitude 52° 55' n. Alberta.

During August, 1930, while staying with a friend of mine, my friend told me about a bird he had never seen before coming around the yard early in the morning. But it failed to show up every time I was about. I did not recognise it from his description, and was quite puzzled, until one afternoon I noticed a juvenile Mourning Dove feeding among the poultry in front of the barn. It was quite confiding and let me approach within a few yards, and ventured even quite far into the barn.

A few days later I found three Mourning Doves feeding among the chickens on a farm 2½ miles south of my friend's place, situated on the south bank of the Blackfoot Coulee. Locality: township 47, range 1, west 4th mer. latitude 53° 5' n. Alberta.

On July 3rd, 1931, while motoring from Onion Lake, Saskatchewan, to Lloydminster, I saw a Mourning Dove on the trail from Harlan P.O. to Hewitt's Landing ferry about 1½ miles north of the North Saskatchewan River. The bird was sitting on a rail fence and did not fly away until after I had stopped and had identified it beyond doubt. Locality: township 53, range 27, west 3rd meridian, Latitude 53° 35' n. Saskatchewan.

Later during the summer I noticed a number of the birds on several occasions again around the Blackfoot Coulee in the same locality as in 1930. They were apparently nesting in the coulee, but lack of time unfortunately made it impossible to find a nest.—PAUL F. BRUGGEMAN.

DO BULLFROGS EAT FISH?—In the May, 1932, number of the *National Geographic Magazine*, Miss Doris M. Cochran, of the Smithsonian Institute, Washington, published a most interesting article on toads and frogs. Amongst other things, she stated that frogs feed on living creatures only: flies, insects of various families, angleworms, crawfish, etc. While on a fishing trip, last summer I happened to capture a bull-frog of ordinary size which had something protruding from its mouth. After examination, I discovered that it was the tail of a dead minnow and on pulling it out I discovered that the minnow was not less than five inches long. Whence the question: do frogs eat fish, and are they quick enough to catch them alive? The minnow, when taken from the frog's mouth, was in a state of decomposition, but not at all disfigured as to shape. It was an ordinary shiner, of the variety used by anglers to bait their hooks.

I communicated what I called my discovery to Miss Cochran, who answered that my observation "was of real scientific interest". I now quote her letter: "I had already received a letter from a gentleman in Chicago pointing out the fact that Innes, the aquarist, states that frogs are a menace to young goldfish in breeding pools, (Cf. *Goldfish Varieties and Tropical Aquarium Fishes*). I knew, of course, that frogs closed their eyes when swimming under water, and hence could not possibly catch an active fish. I telephoned to the Bureau of Biological Survey in this city, (Washington), and of 142 bullfrog stomachs of which they had record, not one of them contained fish. I talked with a veteran collector, Dr. Bailey, of the Survey, and he told me of a single instance that he knew of where a frog's stomach contained a fish, and I believe there is one other published record somewhere, but the occurrence is cer-

tainly rare enough to be *news* when it does happen."

So much was said, and I thanked Miss Cochran for her kind letter. Later on in the summer, I caught some twenty-five frogs one evening. As I wanted to know what was what, I simply opened up the frogs, to find out what were the contents of their stomachs. In most of them, the usual fare of flies, beetles, angleworms, and even small frogs, but in two of them were fish again. One stomach contained a small shiner and the other a brook stickleback. These observations were made in the presence of witnesses, whose names can be furnished on request. Here are at least three instances where frogs have been known to feed on fish, but there still arises a question: were the minnows captured while swimming, or were they picked up dead on the shore? As Miss Cochran says in her article, the frog's eyesight is very poor and the amphibian is not apt to see its prey at a standstill. Must we then conclude that the minnows eaten by frogs were seized in the act of swimming? We should be inclined to think so, though we possess no certainty as to such prowess. At all events, this would give a fair idea of the swiftness and ability of frogs in seizing their prey.—HARRY BERNARD, *St-Hyacinthe, Que.*

VARIED THRUSH (*Ixoreus naevius*) IN CENTRAL ALBERTA.—On October 10th, 1932, when hunting ducks in company with Mr. Arthur Twomey, about twenty miles south of Camrose and four miles west of Edberg, a Varied Thrush (*Ixoreus naevius*) was collected by Mr. Twomey. It was feeding along the roadside with a mixed flock of migrating sparrows, and appeared to be the only one of the species, as a careful search for others was fruitless. This is apparently the first recorded appearance of the bird in this part of the province, although it has been noted a hundred or more miles to the south-east.—FRANK L. FARLEY.

GLAUCCOUS-WINGED GULL ON VANCOUVER ISLAND.—During the winter of 1931-32, a Glaucous-winged Gull banded as a juvenile by me on Bare Island, Haro Straits in August, 1931, took up its quarters on board a small ketch lying in Esquimalt Harbour, Vancouver Island. Early in May, 1932, by placing food near the galley porthole it was enticed close enough to allow its band number to read; this was A683795.

Later in May the ketch pulled out on a summer cruise and did not return to Esquimalt until October, 1932. As it picked up its moorings, the same bird came aboard, and is still with the ketch, at anchor. (December 20th).

It will not allow any other Gull to land upon the boat.—G. D. SPROT, *Cobble Hill, Vancouver Island, British Columbia.*

CHIPMUNK VS. SNAKE.—One of the most interesting experiences I have ever had in my many years of nature observations was one that occurred last June (1932). While watching the antics of an ichneumon fly I heard a slight flurry in the leaves near some piled up wood and saw a common garter snake foraging around. Suddenly from the woodpile a chipmunk leaped downwards narrowly missing the snake which darted beneath a log. Now I never suspected the chipmunk of ever jumping at the snake, knowing how timid they usually are, but when it again climbed up on the pile of wood and crouched there I was interested. So I watched and waited. Presently the snake came slowly out from its hiding place and crawled onto a bare piece of rock. Like a flash the chipmunk sprang, landing asprawl of the wriggling snake, and one of the strangest little dramas of the woods was enacted before my eyes. To say that the fight was one-sided would be unfair, for that snake put up a fight. Its twining folds wrapping round the chipmunk made the latter loosen its hold and several times both participants rolled over and over among the old leaves scattering them about. But I did notice that the chipmunk never allowed the snake to get loose and face it. It kept asprawl of the snake, clawing and biting at it and at last managed to get a grip behind the snakes' head and the excitement was over.

I now intervened and looked the snake over, and found that it had been bitten quite a number of times along the back, and the back of its head was crushed slightly. The snake measured close to seventeen inches in length. Leaving it on the moss I was going to move on, when the chipmunk jumped on the still moving snake and dragged it up on the log pile, and commenced to eat it. Starting at the nose it ate all the head and about an inch behind it, then turned the snake over, and above the vent gnawed through the belly and pulled out the inner organs and consumed them. It then ate the flesh along each side. It did not touch the tail part.

I have never seen such actions before on the part of a chipmunk with a snake, as I always thought they were too timid and afraid of such reptiles. This fight lasted probably three of four minutes, and the whole episode was finished in about twenty minutes, and the chipmunk left practically only a skeleton to mark this little drama of a day in June.—J. M. MCARTHUR.

BOOK REVIEWS

A FAUNAL INVESTIGATION OF LONG POINT AND VICINITY, NORFOLK COUNTY, ONTARIO, BY L. L. SNYDER. *Contribution No. 4, Royal Ontario Museum of Zoology. Reprinted from Trans. Royal Can. Inst. XVIII, 1931, Part I, pp. 117-236. Pl. 3, one Map.*

The main basis of this paper is two trips made to the locality by members of the staff of the Royal Ontario Museum of Zoology, Toronto, May 25 to July 26, 1927, when attention was principally directed to Mammals and May 1 to June 1, 1928, when more general zoological collecting and study was followed. Notes from occasional observers and other available sources are included.

The report is divided into four parts:—I, General Introduction, giving description of area, Previous Work, Faunal Divisions, Acknowledgements and Bibliography; II, Mammals; III, Birds; and IV, Amphibians and Reptiles. The last by E. B. S. Logier.

Long Point, a little east of midway of the Ontario shore of Lake Erie is, faunally, a most interesting locality. A long, low point isolated from agricultural developments, with sand dunes, beaches, marsh, timber of various types and meadow, has great faunal possibilities. This report well rounds out the important series of intensive work that has been done about the shores of this great inland lake. In this way it is a completion of the investigations of Todd at Erie, Pa.; Jones at Cedar Point and the Lake Erie islands, Ohio; and Swales, Taverner, *et al*, at Point Pelee, Ontario.

Each of the formal faunal lists is extensively annotated as to details of occurrence and habits. That of the Mammals consists of twenty-five species still surviving on the point though documentary evidence is given of several other species that have occurred within the historical past. It is suggested that these latter might just as well have been entered in their systematic order in the main list, instead of being parenthetically discussed in an introduction where they can be so easily overlooked. The amphibians number six and the reptiles twelve.

It is interesting to observe that the same melanistic tendency so notable in the Garter snakes of Point Pelee appears again in the same species at Long Point. The question is whether the ranges are continuous or discontinuous, whether we can postulate a common or independent origins for the two abnormal strains.

A bird man naturally turns to the bird list consisting of some 133 species plus 22 hypothetical,

for evaluation and review. Here the reviewer would like to state as a personal opinion that the making of supplementary lists, hypothetical, introduced, extinct, or what-not is not the best possible make-up for a work that is largely for reference. In looking up data on any particular species the investigator is very likely, on not finding it in its logical place in the main list, to conclude that it is not dealt with and fail to search for a possible appendix in the back pages. The more readily an intermittent inquirer can extract isolated facts from such a list the better that list fulfills an important mission. Varying status of species can easily be indicated by style of type or some other similar convention and if deemed necessary can also be grouped in a few lines of names at the back.

In detail, the birds of Long Point are very similar to those of Point Pelee. The same southern or Carolinian Fauna influence is evident though perhaps not in so marked a degree. Not so many southern forms have made more or less permanent settlement and not so many southern erratics have been noted. Perhaps when as much work in as many different seasons has been done here as at Pelee, the latter statement will have to be altered. The position of Long Point is not quite so favourable as Point Pelee for intrusives from the south. Though it faces directly opposite, across the lake, a similar jumping-off point, Presque Isle, Pa., as Point Pelee faces Cedar Point and Marblehead, Ohio, it has not the convenient stepping-stone islands leading across the broad waters to entice wandering birds onward to its shores. In fact the only Canadian occurrence of the Long-tailed Shrew on Long Point suggests that it may get its southern life in roundabout via the Niagara Peninsula rather than across the lake itself. Long Point, in spite of the small amount of intensive work done there, has at least three birds to its credit that have not been detected at Pelee: Western Sandpiper, Acadian Flycatcher and Louisiana Water-thrush. It is interesting to note that the only two Canadian records for Bachman's Sparrow have been made respectively at Long Point and Point Pelee. On the whole, the paper is a decided addition to our knowledge of the fauna of southern Ontario and a credit to its authors and to the museum that sponsored it.—P.A.T.

THE BIOLOGY OF THE AMPHIBIA. *By G. Kingsley Noble, Curator of Herpetology and Experimental Biology, The American Museum of Natural History. McGraw-Hill Book Co., Inc.*

1931. 577 pages, frontispiece and 174 figures.

This book gives a comprehensive account of both the biology and the natural history of the Amphibia as a class of vertebrate animals. All the genera of Amphibia are diagnosed and the more familiar species of American salamanders figured. Although written primarily to introduce the student to the biology of frogs, toads and salamanders, the book avoids technicalities wherever possible and includes much which will interest the traveler and the field-naturalist.

Part I, dealing with structure and functions, covers pages 1 to 458, pages 459 to 543 are devoted to Part II, relationships and classification, and the remaining thirty-three pages contain an exhaustive index.

Part I is divided into nineteen chapters discussing on the origin of the Amphibia, development and heredity, mode of life history, speciation and adaptation, sex, the integument, respiratory

system, urogenital system, endocrine glands, sense organs, nervous system, instinct and intelligence, the ways of Amphibia, relation of Amphibia to their environment, and geographic distribution and economic value. Each chapter is followed by a list of references cited. The chapter of most popular interest is that entitled "The Ways of Amphibia" as it discusses migration, homing, voice, recognition of sex, parental instinct, feeding habits, responses to temperature changes, defense and leaping.

In Part II of this book the author deals with the relationships and classification of the some 1900 species of frogs, toads and salamanders and of the fossil remains of their ancestors.

Printed on strong paper securely bound, *The Biology of the Amphibia*, is worthy of a prominent place on the bookshelf of the naturalist and in the library of every institution pursuing the study of any phase of biology.—C.L.P.

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CONTENTS

PAGE

A New Ornithomimus with Complete Abdominal Cuirass. By C. M. Sternberg.....	79
The Canadian Snowshoe Rabbit Enquiry, 1931-32.....	84
An Ancient Lava Field in the Canadian Shield. By M. E. Wilson.....	87
A Study of Kumlien's Gull (<i>Larus kumlieni</i> Brewster). By P. A. Taverner.....	88
Observations on a Nest of Sprague's Pipit (<i>Anthus spraguei</i>). By R. D. Harris.....	91
Notes and Observations:—	
Rocky Mountain Goat on Vancouver Island, British Columbia. By J. A. Munro.....	95
Strange Behaviour of Lewis' Woodpecker. By John Ronayne.....	96
A Shell New to the Canadian List. By A. La Rocque.....	96
Book Reviews:—	
The Birds of Minnesota. By P. A. T.....	96
Members of the Ottawa Field-Naturalist's Club and Subscribers to the Canadian Field-Naturalist, May, 1933.....	98

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No. 5

A NEW ORNITHOMIMUS WITH COMPLETE ABDOMINAL CUIRASS¹

By C. M. STERNBERG

INTRODUCTION



Fossilized remains of the Ornithomimidae are common in the Belly River and Edmonton formations of Alberta and the Lance formation of the western States but complete or nearly complete skeletons are very rare. Part of a skeleton of *Ornithomimus*, naturally articulated and splendidly preserved, was collected by G. F. Sternberg, in 1916, from the Edmonton formation of Alberta. This specimen is of special interest as it shows, for the first time, the complete set of abdominal ribs and their relationship to the thoracic ribs and the pectoral and pelvic arches. It also seems to show that there was a cartilaginous sternum.

The fine skeleton of *Struthiomimus altus* (Lambe) described by Professor H. F. Osborn,² gave a fair idea of the abdominal cuirass but did not prove the exact number of ribs or their relation to the coracoids and in Osborn's restoration the pectoral arch seems to have been brought too far back, thus abnormally shortening the body.

RELATIONSHIP

Ornithomimus velox, the genotype, was founded on the distal end of a tibia, astragalus, calcaneum, three metatarsals and digit II, from the Denver formation (probably of Lance age), near Denver, Colorado. Osborn proposed the new generic or subgeneric name for the reception of Lambe's *O. altus* from the Belly River formation of Alberta.³ His main reason for assigning the Belly River species to a distinct genus is its greater age and the presence of a vestigial fifth metatarsal. Gilmore observes that Osborn has not shown sufficient generic distinction and refers all the Ornithomimidae to the one genus, even those from the Arundel formation of Maryland.⁴ (The recently established genus and species *Macrophalangia cana-*

*densis*⁵ is, of course, very different from *Ornithomimus*.)

Parks has recently described a new species from the Edmonton formation as *Struthiomimus breviterminus*⁶. He assigned his new species to *Struthiomimus* because of the presence of a vestigial fifth metatarsal.

The fact that no vestigial fifth metatarsal was found with the genotype does not seem to be proof that none was present in life. The specimen was evidently more or less disarticulated and the small metatarsal could easily become lost. In the specimen about to be described there is no sign of a scar on metatarsal IV or anything to suggest the presence of metatarsal V, but there is a fragment of bone with the specimen, which is very suggestive of part of a fifth metatarsal.

It is quite likely that when more is known of the Lance *Ornithomimus* it will show generic distinction between *Ornithomimus velox* and *Struthiomimus altus* but up to now sufficient distinctions have not been pointed out and the present specimen is referred to *Ornithomimus*. Osborn's generic name, however, will be retained for the present.

Ornithomimus edmontonicus sp. nov

Figures 1, 2 and 3.

Type: Cat. No. 8632 Geological Survey, Canada, consists of parts of three vertebrae; the greater portion of all the left thoracic ribs and the distal portions of those from the right side; the complete set of abdominal ribs; distal portions of both scapulae; complete coracoids; most of both pubes; complete right fore limb; left humerus; right tibia, fibula and pes; most of left femur, tibia and fibula and part of left pes.

Horizon and Locality: Edmonton formation near the middle of the beds on the west side of, and 100 feet above the level of, Red Deer River, 9 miles south-west of Morrin, Alberta.

Specific Characters: Medium sized; relatively

¹ Published with the permission of the Director of the Geological Survey of Canada, Department of Mines, Ottawa.

² Amer. Mus. of Nat. Hist. Bull. 35 Art 43, pp. 738-761, pl. 26, 1916.

³ Loc. cit. p. 743.

⁴ Gilmore C. W., U. S. Nat. Mus., Bull. 110 pp. 129-144, 920.

⁵ Sternberg C. M. *Can. Field-Nat.* 46: 99-102, May 1932.

⁶ Parks W. A. *Trans. Roy. Soc. Can. Sec. IV* pp. 65-70 1926. The original spelling *S. breveterminus* is evidently a topographical error.

slender; scapulæ and coracoids not coalesced; coracoids elongate; fore and aft expansion of pubes long and narrow, coalesced distally; abdominal ribs well developed but not fused, each half composed of moderately heavy ventral rib and one slender proximal splint; manus elongate;

Mtc. I longest and Mtc. III shortest, pollex, relatively long and slender; Mts. relatively slender; Mt. III complete proximally; phalanges of pes relatively elongate.

When compared with the genotype, *O. velox* Marsh, *O. edmontonicus* is larger, much more slender and the ascending astragalus process is longer and narrower. The three metatarsals of Marsh's type are but two-thirds as long as in our specimen though the breadth of each of the bones or of the three, articulated, is fully as great. The same is true of the tibia. It would thus seem that *O. velox* represented a much sturdier animal than *O. edmontonicus*.

Our new species differs from *S. brevitertius* Parks (*loc. cit.*) in the development of metatarsal III proximally; the more nearly uniform length of the metatarsals, the more elongate pes and the longer and narrower foot-like expansion of the pubis. As previously stated the presence of Mt. V is in doubt. Very little detailed information can be got from Parks' illustration so one must rely largely on the measurements as given.

Our femur is not complete but after comparison with the femur of *S. altus* I have estimated the complete length to be 380 mm. On this basis the femoro-tibial ratio is .835 while that of *S. brevitertius* is scarcely .81. The metatarso-tibial ratios are respectively .692 and .62 and that of the foot to the tibia 1.21 and 1.02. Reference to the comparative table of measurements shows that with one exception all of the phalanges of *O. edmontonicus* are longer than those of *S. brevitertius*.

When compared with *S. altus* our new species shows a more advanced stage of development of the abdominal ribs, a more slender and differently proportioned manus and more elongate phalanges of the pes.

DESCRIPTION

The three vertebræ which remain are in such a poor state of preservation that no information can be gained from them. The rest of the column with the skull and most of the pelvic arch was eroded away before discovery.

Ribs: Twelve thoracic ribs are represented and preserved in the rock (Figure 1) in what is regarded as their normal position. Each rib is represented by the distal half or more. This is probably the complete series as Osborn's restoration shows this number and Mr. Barnum Brown informs me (recent communication) that he regards the number of dorsals as twelve. If this is the complete dorsal series No. 2 was somewhat longer than in *S. altus* for it extends well below the blade of the scapula and No. 1 almost reaches it. Otherwise they rather closely resemble the thoracic ribs of Osborn's specimen and their position with relation



FIGURE 1

to each other and to the pectoral arch shows that the scapulæ and coracoids occupy their normal position thus leaving a considerable gap between the posterior edge of the coracoids and the anterior end of the abdominal ribs. Osborn's specimen shows a similar gap between these elements but in his restoration the coracoids are brought back to meet the abdominal ribs thus abnormally shortening the body. Probably the second and third thoracic ribs were attached to the sternum while the posterior ones were united with the abdominal ribs.

Sternum: There is no sign of an ossified sternum but the wide gap between the coracoids and the abdominal ribs suggests that the animal had a cartilaginous sternum. This gap is 120 mm. in length. In *Sphenodon* a semi-calcified sternum occupies a somewhat similar position and unites with some of the anterior ribs. Examination of the sternum of *Gorgosaurus libratus*⁷ suggests that it was poorly calcified and it is possible that in young animals it was cartilaginous.

Abdominal ribs: (Figure 1) The complete series of abdominal ribs is present, splendidly preserved and naturally articulated. There is some lateral compression of the posterior portion of this cuirass but otherwise the elements all seem to be in their normal position. There are fourteen ribs on the left side and fifteen on the right. Each rib is composed of two parts *i.e.* a long slender proximal and a stouter distal part. The abdominal ribs of *Struthiomimus altus* are composed of three segments. Gilmore regards the reduction of the number of segments as a progressive development (*loc. cit.* p. 146.) The proximal splint lies on the anterior face of the main bone and pinches out to thread-like proportions as it overlaps its thicker part. The proximal extremities of some of these are lost but they all seem to be shorter than the distal or main part of the rib. The distal piece is longer and much stouter. They are almost half as broad as the thoracic ribs except the proximal portion which ends in a long drawn out sliver where it overlaps the proximal piece and finally disappears. The ribs are more or less uniform except the last pair which are much less developed and lack the proximal splints. Of this last pair the right one is very short and poorly developed and its mate is bent forward to avoid the distal end of the pubis. There is a slight increase in size and a lessening of the space between the ribs from the front backward.

The ribs meet in the form of a V and no co-ossified or single median segment was present. They extended backward and outward somewhat as in *Sphenodon* thus giving a less rounded abdomen

⁷ See Lambe L. M. Mem. 100, Geol. Surv. Can. Figures 29-30, 1917.



FIGURE 2

than that shown by Lambe for *Gorgosaurus* (*loc. cit.* Figure 27). They do not overlap and though the ends are slightly enlarged there is no rugose attachment area as in *Gorgosaurus*. At the ends of the series the tips of the ribs meet but in the fourth pair the right one extends in advance of its mate and from here to the sixth pair from the back the unions are irregular and there is an extra rib on the right side. Ribs five, six and seven of this side are more slender than the others.

MEASUREMENTS OF ABDOMINAL CUIRASS

Length of complete series of abdominal ribs (midline).....	470 mm.
Breadth, approximately.....	120 "
Posterior edge of coracoids to anterior abdominal rib.....	120 "
Posterior edge of coracoid to foot of pubis.....	600 "
Anterior edge of coracoid to posterior edge of foot of pubis.....	890 "

Scapula and Coracoid: (Figure 2.) The lower halves of the scapulæ and the complete coracoids are preserved. They are naturally articulated except that lateral crushing has caused an overlapping of the coracoids anteriorly and a slight shifting of the right coraco-scapular union (Figure 1, c.). They are not co-ossified.

The scapula was probably not unlike that of *S. altus*. Below the shaft, it expands abruptly forward then forms a broad sweeping curve to its union with the coracoid. This curve is continued by the broad anterior edge of the coracoid. This portion of the bone is very thin as is the anterior portion of the coracoid with which it unites. Posteriorly the scapula is slightly expanded and

thickened to form more than half of the glenoid cavity. This lower portion curves inward to its union with the coracoid thus suggesting a broad chest.

The coracoid is unlike that of most dinosaurs and at first glance somewhat suggests an ilium. It is twice as long as broad and the long posterior expansion is much narrower than the anterior portion. The posterior half decreases in breadth only slightly as it proceeds backward and terminates in a gently rounded extremity. It is quite thin throughout except where it is enlarged to form part of the glenoid cavity and the external border of the posterior extension. This external border is buttressed by a flange which extends from the postero-internal angle of the glenoid cavity, on the inner side of the bone to its posterior end. This is quite similar to the buttress on the lower postero-internal face of the ilium of *Gorgosaurus*. The external border of this posterior half runs to a thickened portion of the bone internal to the posterior edge of the glenoid cavity and near the center of the lower face of the coracoid. This flanging gives the postero-external portion of the bone the appearance of being deeply grooved longitudinally and sets it off from the glenoid cavity thickening by a sharp constriction. The internal border (at the midline of the body), is flatly convex, when viewed from below, and of uniform thinness throughout. The coracoid foramen is in advance of the glenoid cavity and not far removed from the coraco-scapular union.

MEASUREMENTS OF SCAPULA AND CORACOID

Scapula, breadth of shaft near midlength.....	26 mm.
" fore and aft length of distal expansion.....	63 "
" breadth of distal expansion.....	50 "
" thickness of distal expansion.....	2 "
Estimated breadth of chest.....	125 "
Coracoid, length (fore and aft).....	108 "
" breadth through anterior portion.....	43 "
" breadth through glenoid cavity.....	50 "
" breadth posterior extension.....	31 "
" average thickness inner portion.....	2½ "
" thickness through glenoid cavity.....	20 "
" thickness through buttresses, just behind glenoid cavity.....	17 "

Pubis: The foot-like distal expansion of the pubis meets its fellow in a symphysis but they are not co-ossified except for a short distance posteriorly. It is proportionately longer and more slender than in other described species. The total length of this foot-like expansion is 170mm. of which the anterior portion measures 40 mm. and the posterior portion 70 mm.

FORE LIMB

The humerus, radius and ulna are more slender than, but otherwise do not appear to differ greatly from, those of *S. altus* but the manus which is also more slender shows considerable variation. The ulna, radius and metacarpals are hollow and the crushed condition of the humerus suggests that it was also. (See Figure 3.)

Metacarpals I to III are very slender and firmly fitted to one another. There is no sign of a vestigial Mtc. IV as in *S. altus*. Mtc. I is much stouter and somewhat longer than the others and relatively longer than in *S. altus*. It is only slightly divergent distally. The distal ends of the metacarpals are broader than the proximal portions. The breadth of the three united metacarpals is proximally 30 mm., distally 45 mm. and at midlength 23 mm.



FIGURE 3

Whereas in *S. altus* digit II is longest and I is shortest, in *O. edmontonicus* they all reach an almost equal length. The penultimate and ungular phalanges seem most highly specialized in this species for in all three digits these are relatively longer and more slender than in *S. altus*. The penultimate phalanges are hollow and the bone wall is quite thin. Phalanges 1 of II and 1 and 2 of III have suffered postmortem crushing but no doubt were also hollow.

The extreme tips of the unguals were injured in collecting but their lengths can be determined with reasonable certainty. They are of sub-equal length, laterally compressed, slender, and almost straight except that of digit I, which is slightly decurved.

HIND LIMB

The hind limb does not differ greatly from that of *S. altus* except for the more elongate and relatively more slender pes and the more uniform length of Mts. II and IV. These characters are shown in the comparative measurements which follow.

Metatarsals III and IV were slightly misplaced and the proximal end of Metatarsal III is not preserved but the articulation surface on the inner and posterior sides of the other metatarsals and their postero-internal excavation shows that III was developed proximally.

The phalanges are relatively much longer than in *S. altus* and the ginglymoid facets are more strongly developed. The pes shows a highly developed cursorial type and would undoubtedly have been of little use as a grasping organ. The unguals are too badly crushed to show details.

EXPLANATION OF FIGURES

FIGURE 1. *Ornithomimus edmontonicus*. Type. Cat. No. 8632 Geological Survey of Canada. View to show abdominal cuirass and its relation to the rest of the skeleton. C, coracoid; 1-2-3-12, thoracic ribs; dotted line shows portion of tibia removed to show abdominal ribs. — Nat. size.

FIGURE 2. Coracoid and scapula of type No. 8632. Drawn by A. Miles. —Nat. size.

FIGURE 3. Fore limb of type No. 8632. Nat. size.

COMPARATIVE MEASUREMENTS

	<i>Ornithomimus edmontonicus</i>	Osborn's specimens of <i>Struthiomimus altus</i>	<i>Struthiomimus brevitertius</i>
	mm.	mm.	mm.
Rib: 1st. costal, length..	140+		
" 5th " " " ..	200e		
" 11th " " " ..	150+		
Humerus " " ..	280	310	
Ulna " " ..	215	230	
" proximal width... ..	20		
" distal " " ..	22		
Radius length	195		
Manus " " ..	264	315e	
Metacarpal I " " ..	90	85	
" II " " ..	84	100	
" III " " ..	83	95	
Digit I less Mtc. " " ..	167		
" II " " " ..	175		
" III " " " ..	175		
Digit I phalanx 1.....	107	110	
" I " 2.....	65e	65	
" II " 1.....	32	40	
" II " 2.....	90	90	
" II " 3.....	65	85	
" III " 1.....	23	25	
" III " 2.....	26	35	
" III " 3.....	75	75	
" III " 4.....	65	80	
Hind limb total length to tip of digit III.....	1350+ (1440e)	1530	1360
Femur length	310+	480	390
Tibia " "	455	540	483
Metatarsal I " "	300		252
" III " "	315e	370	293-203
" IV " "	310		273
Digit II (articulated) length	150	150	145
" III " " "	235	210	195
" IV " " "	155	150	140
" II phalanx 1 " "	83		73
" II " 2 " "	41		34
" III " 1 " "	76		70
" III " 2 " "	63		58
" III " 3 " "	48		40
" IV " 1 " "	44		47
" IV " 2 " "	38		30
" IV " 3 " "	33		27
" IV " 4 " "	30		21

THE CANADIAN SNOWSHOE RABBIT ENQUIRY, 1931-32

PART II

Edited by CHARLES ELTON

(Concluded from April issue, page 69)

THE MAIN purpose of the enquiry was to follow year to year changes in numbers, in order gradually to build up a reliable picture of the trends of the snowshoe rabbit cycle in different parts of Canada. The maps already discussed show that this can be done successfully. In this second part we have to consider other aspects of the problem which have been studied through the questionnaire, since they throw some light on the nature and causes of the cycle. As regards habitats, dealt with in Question 2, the data have not yet been put together, and could be best studied by someone familiar with the country. It was thought that they would form a useful record of the snowshoe rabbit's habitat during a period of increase: it is quite possible that during the periods of maximum abundance the rabbits overflow their normal habitats and invade others. Any changes of this nature are of importance from the standpoint of forest regeneration, since it is well known that the snowshoe rabbit is capable of forming a serious plague by the destruction of shrubs and young trees, especially during the winter months.

Another very important aspect of the problem is the relation of parasites and epidemic diseases to the decrease of the species after periods of abundance. Here again, the questionnaire replies have supplied a large mass of interesting facts concerning disease in wild snowshoe rabbits, and also in cotton-tails, and other species. These will not be reviewed here, since—as with the habitat data—the significance of the facts will probably be better seen when observations have been collected over several years. It may be said however, that an enormous majority of observers reported past epidemics, and often described the symptoms. Even if we omit the many cases which may have been caused by a conspicuous, though not necessarily fatal, infestation with larval cysts of tape-worms, no doubt can remain as to the commonness of disease during times of rabbit abundance. The orthodox theory about the snowshoe rabbit cycle is that overcrowding causes epidemics at times of abundance and that these are the main factor responsible for periodic decrease. At the same time, evidence is accumulating which suggests

that although widespread increase in disease occurs at times of abundance, this is a result rather than a cause of the snowshoe rabbit cycle. Evidence in support of this idea is found in the occurrence of epidemics on a small or large scale not only at times of great density of numbers, but also at other points in the cycle of abundance. Furthermore the disease theory by itself does not explain the tendency for synchronisation, or at any rate of parallel rise and fall, of the cycle in different parts of Canada, separated by thousands of miles, nor does it explain the existence of the same ten-year cycle in other species (such as the musquash and the fisher and the prairie chicken), which are not directly connected ecologically with the rabbit. In fact, it would appear that the phenomena of disease in snowshoe rabbits are not to be comprised in the simple formula of a ten-year cycle dependent purely on changes in density. For this reason it does not appear to be safe to determine the maximum rabbit abundance from the record of an epidemic alone, unless this is on a very large scale and causes undoubted decimation of the population. It is partly for this reason, and partly because pathologists now realize that the description of symptoms does not elucidate the problem very much unless experimental work can also be carried out, that we shall leave this part of the subject, at the same time drawing attention to its great interest and importance, the widespread evidence of disease at certain times in wild snowshoe rabbits in Canada, and the urgent need for adequate pathological studies during the next four years, when disease will certainly be common and material abundant.

The key to explaining the wide geographical scope and the comparative regularity of this cycle probably lies in an intensive study of the reproduction of the snowshoe rabbit—an aspect of the problem obviously outside the scope of this questionnaire enquiry. We require accurate determinations from large samples taken over a period of twenty years, of the number and size of embryos from parents of known weight. Preliminary work of this character was started through the co-operation of the Hudson's Bay Company, but had to be dropped after one year. The single year's results showed that determination of these three points on a large number of rabbits would enable us to say whether the reproductive rate varies from one year to another, as is widely believed by Indians, and has often been stated by scientists. At present, although there is some reliable evidence of low reproductive rates during

or after periods of maximum abundance, we know nothing certain about conditions during increase. It is this period which is probably critical.

It is highly probable that such reproductive studies would at once throw light on the mechanism of the rabbit cycle, and would at the same time clear the way for discovering what climatic factors are at work in keeping this cycle so regular both in time and space. Recent investigations of old Hudson's Bay Company records, carried out by me on behalf of the New York Zoological Society have proved that the ten-year cycle in lynx has been in progress at any rate since 1745, that is, for nearly 190 years. Such regularity over so long a period has an almost astronomical exactness which can hardly be reproduced by any purely biological rhythm.

Finally, we come to the evidence concerning previous years of abundance of the snowshoe rabbit. The evidence from fur cycles, from observations already made and either published or in the writer's possession, shows that there was a series of years centering around 1923-26, when

snowshoe rabbits reached their maximum abundance in various parts of Canada. The results from Question 7 confirm this conclusion. It is from this maximum and subsequent decrease that the rabbits are at present recovering in so many parts of Canada. It has to be realised that if notes on the abundance of a year ago are subject to errors of memory, those about abundance six or seven years before are still more likely to contain mistakes. The experience gained in such enquiries as these is that mistakes in memory are comparatively frequent, and that only notes actually recorded at the time are fully reliable. At the same time, with a large number of observers it might be expected that the errors would have a random distribution except in so far as they become progressively more frequent as we go back in years. The following method of treating the results of Question 7 was therefore adopted. A large area (*e.g.* the three prairie provinces of Central Canada: Alberta, Saskatchewan, and Manitoba) is taken as a unit. Each observer is given a vote on the subject of the last years of

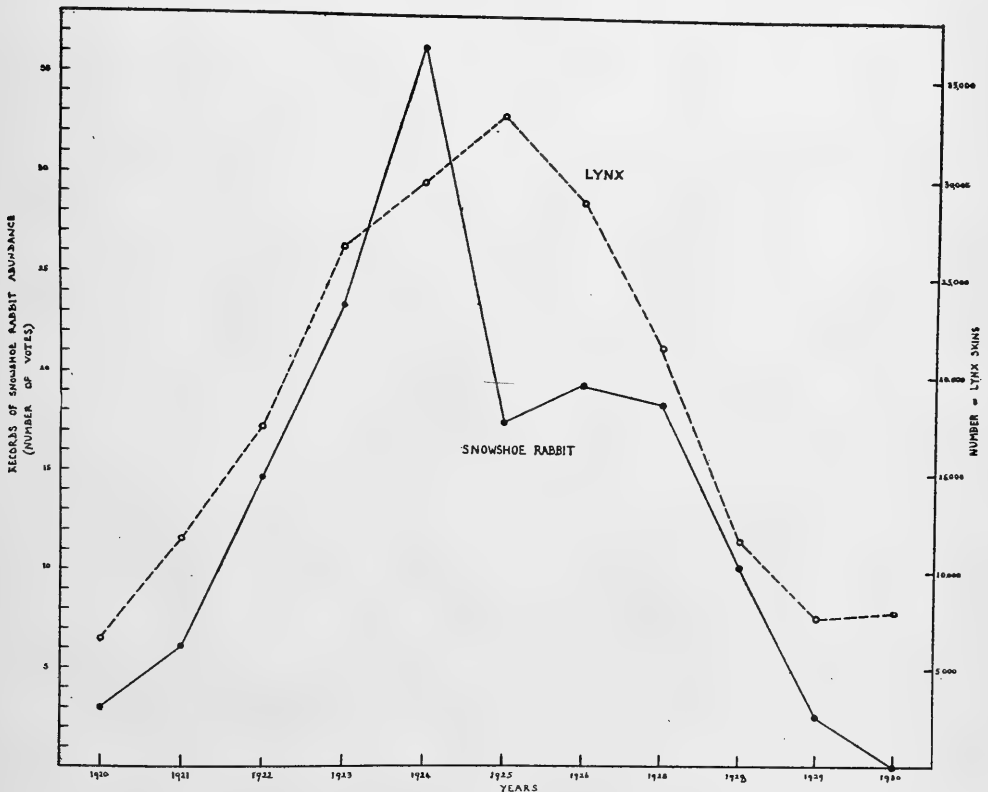


FIGURE 4. Solid line connects points showing number of observers recording rabbit abundance (or maxima) in different years. Broken line shows lynx production for all Canada, (from Dominion Bureau of Statistics, Ottawa).

abundance. (In many cases this year is confirmed by his recorded years of scarcity). Records are given usually in three ways in the questionnaire (1) "1926"; (2) "1926 and 1927"; (3) "1926 or 1927". With the first two types a vote is given to each year of abundance. Where two or more years are mentioned it is not usually possible to say which was the year of maximum abundance, and so each year simply gets classified as a year of great abundance and given equal value for the present purpose. With the third type of answer the vote is split between the two years, so as to spread out the chance of either year being the correct one. When the answer is still more vague *e.g.* "six or seven years ago" a convention has been adopted of spreading the answer over three or four years, and giving a third or a quarter of a vote to each year. These methods of giving weight to the different answers enable a rough curve of frequency to be constructed, which represents the trend of observation and opinion as to the last era of snowshoe rabbit abundance in

Canada. The results for the three prairie provinces, the North-west Territories, Yukon, Ontario, Quebec, and New Brunswick, are given in Figure 4, together with the fur curve for lynx for the whole of Canada. It will be seen that there is a marked correspondence between the lynx cycle shown and the snowshoe rabbit peak as determined by the present rough method. Probably the fit is as near as could be expected by the use of these methods. The detailed figures are given in the table shown below. It is clear that the period of rabbit abundance between 1923-25 forms a reasonable explanation of the increase and subsequent decrease of its fur-bearer enemies during the same period. It is not thought necessary to publish the detailed records upon which these curves are based, since taken individually they may not be absolutely reliable in any single instance and since their publication would take up much space. They can be consulted in the original questionnaires at Ottawa and Oxford.

Province	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
Alberta	2.0	2.3	7.6	9.6	16.6	7.3	3.6	6.3	5.3	2.0	0
Saskatchewan	0	0	0	5.0	6.6	2.1	5.4	2.3	0.3	1.3	0
Manitoba	1.0	3.0	2.0	0	4.0	2.0	5.0	4.0	0	0	0
Total for Central Provinces . . .	3.0	5.3	9.6	14.6	27.2	11.4	14.0	12.6	5.6	2.3	0
North-west Territories	0	0	2.0	5.0	5.0	1.0	1.0	0	0	0	0
Yukon Territories . . .	0	0	0.3	1.3	0.3	3.0	3.0	1.3	0.3	0.3	0
Ontario	0	0.5	1.5	1.3	3.6	0.9	0.9	1.3	2.0	0	0
Quebec	0	0	1.0	1.0	0.3	1.3	0.6	1.3	0.3	0	0
New Brunswick	0	0.3	0.3	0.3	0	0	0	2.0	1.0	0	0
Total of all Provinces shown . . .	3.0	6.1	14.7	23.5	36.4	17.6	19.5	18.5	10.2	2.6	0

Table showing the frequency of the "last years of rabbit abundance" taken from answers to Question 7 of the Questionnaire. Fractions are the result of methods used in weighing the results.

AN ANCIENT LAVA FIELD IN THE CANADIAN SHIELD*

By M. E. WILSON

THERE are few, if any, parts of the earth's surface in which there have been no volcanic eruptions for so long a period of geological time or in which the earth movements that accompany volcanic eruptions have been less important for so long a time as the Canadian Pre-Cambrian Shield. Yet, the immense areas of ancient (Pre-Cambrian) lavas found, here and there, throughout the Shield show that this has not always been so, and that in Pre-Cambrian time volcanic eruptions occurred in the Shield on a much vaster scale than anywhere on the earth's surface today. Nowhere are these ancient lavas more typically represented or better exposed than in the Noranda district, in north-western Quebec, where successive forest fires have stripped the bed-rocks of vegetation exposing them in barren nakedness suggestive of desert regions rather than of our Canadian North (Figure 1).

Why have geologists concluded that these "greenstones", the descriptive name by which they have long been known, are lavas extruded from geologically ancient volcanoes? Some of the

features of these rocks proving that they are lavas, are: their fine-grained igneous texture, indicating that they cooled quickly from a molten condition; their amygdaloidal and cavernous weathering character, showing that they contained abundant gas cavities; the presence of lines of flowage and other forms resulting from movement during consolidation; and, perhaps most characteristic of all, the occurrence in them of the peculiar forms known as pillow structure. (Figure 2). In those outcrops exhibiting these pillows, that have not been deformed by later earth movements, the larger masses are commonly flat on both their tops and bottoms whereas the smaller have flat bottoms but round tops and hence have a bun-like form, ("bun structure").

Geologists are not wholly in agreement regarding the mode of development of pillow or bun structure in lavas. It is known, however: (1) that the structure has been observed in the lavas of practically every part of the earth and in rocks of all geological ages; (2) that most of the lavas in which pillow structure occurs, are interbedded with fossiliferous sediments or occur in such relationships as to indicate that they were extruded into water;

* Published with the permission of the Director, Geological Survey of Canada, Department of Mines, Ottawa.

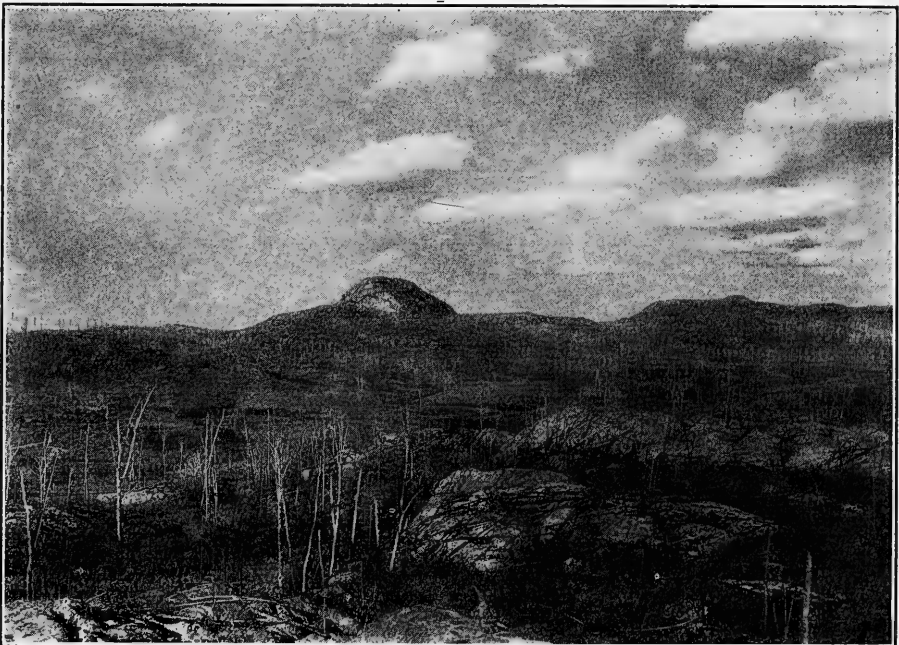


FIGURE 1

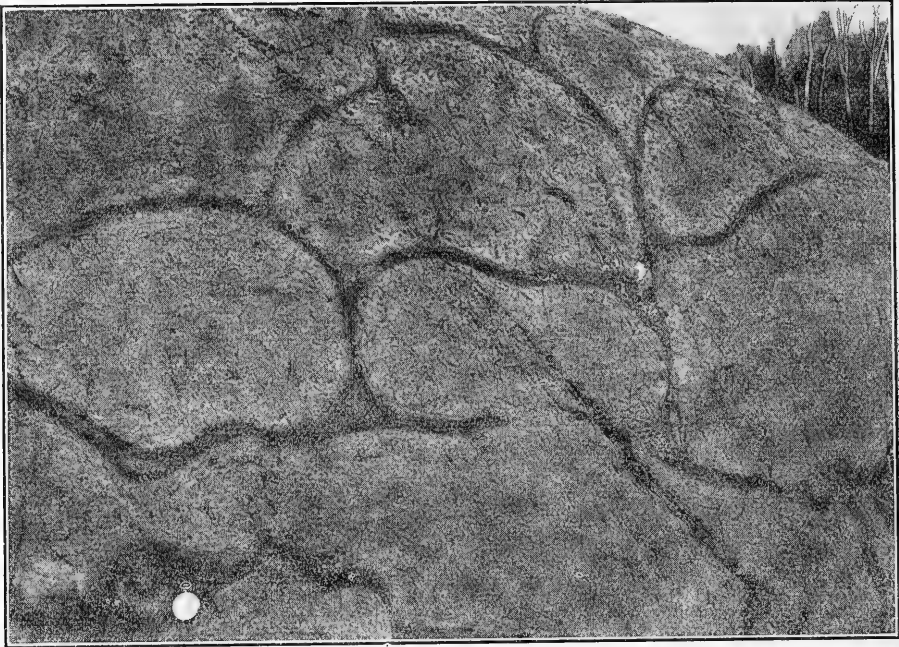


FIGURE 2

and (3) that Dr. Tempest Anderson observed pillow structure forming where a lava stream from Montavanu volcano, in the island of Savaii in the Samoan group, flowed into the sea. He states that the corded structure is ".....formed in the usual manner above the water. Where, however, it falls direct into the sea, the surface is chilled before there is time for it to be wrinkled up into the corded structure, and it becomes consolidated into the characteristic form of one variety of pillow-lava."*

It may be concluded, therefore, that although

* *The Geographical Journal*, 39:129, 1912.

it is not established that extrusion into water is necessary for the formation of pillow structure, it has almost certainly been an important factor in its development in most of its occurrences.

The pillow structure shown in Figure 2 occurs in a mass of greenstone (variety, andesite) outcropping about three-quarters of a mile northwest of the Waite-Ackermann-Montgomery mine, in Duprat township, Abitibi county, Quebec. The structure may also be observed in many other localities, however, in the greenstones of north-western Quebec and in numerous similar greenstone belts in other parts of the Canadian Shield.

A STUDY OF KUMLIEN'S GULL (*Larus kumlieni* Erewster)*

By P. A. TAVERNER

EVER SINCE it was first noted, Kumlien's Gull has been somewhat of a puzzle to ornithologists. At first, due to its pale grey wing tips and our incomplete data on distribution, occasional specimens were identified as *Larus glaucescens*. In 1883 Brewster recognized and described it as a distinct species, *Larus kumlieni*. In 1906 Dwight studied the species and

(*Auk*, 23:26-43, 1906) described and figured in colours what we now acknowledge to be the second year plumage. Later, (The Gulls of the World, 1925) in convincing argument on specimens and data then available, he advanced the theory that *L. kumlieni* is a hybrid between *L. argentatus thayeri* and *L. leucopterus*, and therefore not entitled to specific recognition. In 1930, the A. O. U. Committee adopted this view and embodied it in the fourth edition of its Check-List.

*Published with the permission of the Director, National Museum of Canada, Department of Mines, Ottawa.

Since Dwight's researches, however, a good deal of evidence contradictory to that available to him has come to light, and a reconsideration of the question seems advisable.

Larus kumlieni is of the Herring Gull type, a little smaller than *L. argentatus*; the adult with very slightly lighter grey mantle and wing tip pattern washed out to grey and greatly reduced in area. In all other characters it seems indistinguishable from that species. The difference in size and in mantle colouring are only in average and may not hold in every individual, so that the wing pattern of the adult is practically the most certain criterion of diagnosis from that species. Even this character is quite variable and sometimes leads to confusion. The wing markings may be reduced to mere traces or even to absence, producing practical identity with those of the white-winged group of the genus; or they may be deepened in colour and extended in area until they approximate the wing pattern of the more extreme examples of the *thayeri* form of *L. argentatus*. This variation has no correlation with sex; whether it has any with age or distribution is uncertain. In juvenile and sub-adult, *kumlieni* is still more difficult to recognize. Juveniles of sure identity have never been positively demonstrated and specimens so designated have been named more by process of elimination and careful judgement (neither of which I care to question here but suggest possibilities of doubt) than by evidence of parentage. In all probability, juveniles are practically identical with those of *argentatus* of any race, follow the same plumage sequence and are to be distinguished with certainty from them only in the later stages of adolescence.

The hybrid theory of *kumlieni* is based upon the following assumptions:

1. The apparent intergradation with *L. leucopterus* on one hand and *L. argentatus thayeri* on the other.
2. The extreme variability of *kumlieni* in the specimens examined.
3. The supposed origin of the form where the two postulated parents breed.
4. Analogy with known gull hybrids raised in captivity in Europe.

The first of these two postulates can be accepted though it is to be noted that a series of eleven summer adults taken on their breeding grounds in southwestern Baffin Island do not show the same wide variation as is exhibited by the collected occasional migrants along the Atlantic coast that were hitherto available for examination. This suggests that there may be a more definite wing pattern for full breeding maturity than was sus-

pected or that there may be a geographical variation yet to be discovered.

The fourth postulate leaves something to be desired, though it can not be arbitrarily dismissed. It acknowledges that *kumlieni* can not be the result of a first generation crossing but must arise from subsequent ones. While it is a characteristic of first generation crossing that it often produces offspring of remarkably consistent characters, those of subsequent generations show great and confusing diversity. Though it is admitted that *kumlieni* is variable, the variation is not so extreme as would be anticipated from succeeding generation hybrids. That the birds of the southern Baffin Island breeding communities show comparative stability of essential characters introduces doubts as to their mixed ancestry.

In any event the third postulate, an essential one to the hybrid hypothesis, proves quite contrary to fact. Recent trips of J. Dewey Soper and others to the higher regions of the north and his intensive work from 1924 to 1930 in southern Baffin Island have shown:—

1. That Kumlien's Gull breeds commonly on the southwestern Baffin Island coast, single, in pure communities and in association with *L. argentatus smithsonianus* and *L. hyperboreus* but having no contact with either *L. a. thayeri* or *L. leucopterus*. To date, this, Cape Wolstenholme across the straits (Sutton 1826) and Cumberland Sound (Kumlien in 1877, not Soper in 1923 who spent two seasons there) are the only known breeding localities for the species and in none of them are the two supposed parental forms known to occur in breeding season. A specimen of *kumlieni* from Beechy Island, Devon Island, in August suggests a more northern distribution and the possibility of occurrence within the breeding range common to the postulated parents, but does not obviate the necessity within the theory for the presence of those parents in the more southern actively breeding communities.

2. That the southern breeding limit of *L. argentatus thayeri* is considerably higher north than was supposed, not below northern Baffin Island, the *argentatus* of Hudson Strait being typical of the form recognized in the Check-List as *smithsonianus*. *Thayeri* therefore cannot be a parent of *kumlieni* raised in that locality.

3. Records have been searched in vain for substantiating evidence of *L. leucopterus* breeding in the western Arctic or west of Greenland. The probabilities are that it does so in high latitudes but definite evidence to that effect is lacking. Such occurrences are noted in literature and have been generally accepted at their face value but such as have been possible of investigation have

proved to be confusions with *L. hyperboreus* that breeds commonly throughout the region, and the others are at the best doubtful. Until more definite proof to the contrary is produced the Iceland Gull must be relegated to the American hypothetical breeding list. *Leucopterus* is so like *hyperboreus* that confusion between them is very natural. When we consider the condition of high northern ornithology up to a very recent date, the personality of the actual observers on the old voyages and the conditions under which they worked, such mistakes are not only to be expected, but seem inevitable.

In eastern North America *L. hyperboreus* is fairly constant in its large size, but even there a few small birds occur that require some discrimination with specimen in hand to separate from *L. leucopterus*. In the west, a small form of *hyperboreus*, the so-called *barrovianus* type, occurs, closely approximating *leucopterus* in size as in all other observable characters. It is these small *hyperborea* that Dwight, consistently refusing to recognize *barrovianus*, referred to *leucopterus*, and formed the grounds for the Iceland Gulls that he attributed to the western Arctics. I do not wish to raise the question here of the validity of *barrovianus*, but to point out the possibility that all the so-called *leucopterus* from western localities may be small *hyperboreus*. As far as the writer knows no certainly and unmistakably identifiable *leucopterus* or *kumlieni* have ever been produced from the western Arctics or the Pacific coast of North America. All that he has seen or seen described are young or faded birds whose identity is a matter of balanced judgement rather than of unquestionable demonstration. I do not wish seriously to question any particular record but to point out that a residual doubt is attached to all of them.

The rare *L. nelsoni* is just an enlarged *kumlieni* and may, or probably does, intergrade with that species as *hyperboreus* apparently intergrades with *leucopterus*. But too little is known of this species to warrant any but the most generalized of speculation. It seems to be a western representative of *kumlieni* bearing the same genetic relation to it that *hyperboreus* does to *leucopterus*, and that is about as far as we can conservatively postulate. It was an attractive theory that *nelsoni* is a hybrid between *leucopterus* and *argentatus vegae* as *kumlieni* is between *leucopterus* and *argentatus thayeri* but unfortunately one case falls to the ground

with the other and, by analogy, if *kumlieni* is reinstated as a species, *nelsoni* should be also.

Larus argentatus thayeri presents some interesting complications and can stand further study when critically pertinent specimens are available. Although there has been considerable recent observational activity in the southern Arctic, yet the race has escaped detection under probable breeding conditions south of Pond's Inlet, northern Baffin Island, and at present we have no authority for extending its breeding range south of that point in the eastern Arctic. In the west, however it breeds on Victoria Island, the adjacent main coast, and probably even southward along Alaska; but the blood strains east and west are not identical. Characters that are essentially stable in eastern birds break up into wide variation in the western group. A series of ten specimens from the west side of Baffin Bay from Pond's Inlet northward, show a quite constant similarity of characters with little or no evidence of intergrading with *smithsonianus*. On the other hand, specimens from the western Arctics and the Pacific coast intergrade with the *smithsonianus* of the region so perfectly that hardly two individuals can be found alike, and it is difficult to tell where one form begins and the other leaves off. It seems a case of two subspecies blending into each other along a line of intergradation but meeting at their extremes with all the appearance of specific distinction.

There are many other questions regarding American Laridae that still lack evidence for elucidation but whatever may be the real relationship between the puzzling grey-winged gulls intermediate with a number of other well characterized forms, it seems evident that *kumlieni* should be reinstated as a definite and individual species.

It may be advanced that the *kumlieni* hybrid was produced by a cross-breeding in the past that has become fixed and capable of independent continuation through natural processes as our domestic mixed breeds have by artificial selection. It does not seem that this, interesting as it would be if demonstrable, alters the nomenclatural or taxonomic facts that it presents today. Origin of species by hybridity, mutation or gradual evolution are controversial subjects that are outside the limit of the present paper. The question here is not the origin of Kumlien's Gull but its present specific relation to other factors of the biotic complex.

OBSERVATIONS ON A NEST OF SPRAGUE'S PIPIT (*Anthus spraguei*)

By R. D. HARRIS

DURING the summers of 1930 and 1931, the writer was engaged in a study of Baird's Sparrow at Deer Lodge, a suburb of Winnipeg. Sprague's Pipit is not an uncommon breeding species in the district, and on the field where the observations were carried out, it was represented by about two pairs. These were observed incidentally to the work on Baird's Sparrow, but because of their extreme secretiveness, their affairs remained a total mystery almost until the end.

After a good deal of effort, a nest was at last found on August 24, 1931. Two days previously a pipit was seen carrying food in its bill, but little importance was attached to this because young birds not long out of the nest were known to be in the neighbourhood, and because the season appeared extremely late for any nests to be still under way. However, when, on August 24, the bird was again seen carrying food, it was watched with the hope of locating its secret. Time after time the bird dived to the ground, disappeared in the grass, and after some minutes, reappeared and climbed up to resume a steady circling in the sky. Finally it returned to a place where it had once before alighted. When, after thirty minutes had elapsed, it still remained hidden, the writer began to walk toward the spot where it was last seen. Half way towards this spot lay an old grass-grown roadway, and as this was being crossed, the bird suddenly flew up from the shoulder of the road. A few seconds were all that were required then to locate the nest, hidden so cunningly below ground level that only a small hole in the grass revealed its presence.

The nest was immediately made the subject of a brief study, the results of which are presented below.

ACKNOWLEDGMENTS.

For help received in making and recording the observations that follow, the writer wishes to express his thanks to Mr. Norman Criddle, Dominion Entomologist at Treesbank, Manitoba, who identified insect specimens submitted to him; and to Messrs. B. W. Cartwright, T. M. Shortt, and A. H. Shortt, who kindly made available their notes on a nest of Sprague's Pipit found by them in 1931, and who rendered assistance in the field.

TERRITORY.

Sprague's Pipit has perhaps the least defined territory of all the passerine prairie nesters. The territory of this pair consisted essentially of a few square feet of ground surrounding the nest, and two or three more or less distant spots where food was procured for the young. Singing, observing, and such activities are carried on high in the air. When the bird returns to earth, it may do so anywhere within the general vicinity of the nest, regardless of what birds own the land.

NEST.

Although of the grass type common to most prairie birds, the nest was a rather complex structure. The road on which it was located was one of several built during a real estate "boom" far out on the prairie, but never used. In the pasture field, grass had overgrown them and the trampling of cattle in muddy weather had pitted them with hoof marks and depressions.

In a cavity thus formed the nest was placed. Being six inches deep and six inches in diameter, the cavity was much too large for the purpose. The birds had met the situation, however, by filling in the unwanted space to a depth of three inches with dead grass, thus forming a kind of platform beside the nest which undoubtedly was found useful during nesting operations. The nest proper was composed of dried grasses two to six inches long. Unlike the filling, it was packed and woven into a firm structure. The rim was placed level with the filling three inches from the bottom, and the interior measured (after the young had left) three inches in diameter and about one and one half inches deep. It occupied the position farthest from the entrance, with one side resting against the earth wall of the cavity. Overhead, the nest was shielded by a frail roof of dead grass anchored in the plants that stood at the edge of the depression. The entrance hole was barely more than two inches in diameter, and as the grass filling was interposed between it and the nest, the latter could be seen only from a very low angle. This arrangement thus aided concealment.

As the days passed by, however, the roof was gradually destroyed by the combined activities of the weather, observers, and the bird itself in feeding the young. By the time the young ones left, little of it remained.

ACTIONS AND HABITS OF PARENT BIRDS.

The day after the nest was found, a blind was set up two and a half feet from it, and on the following day this was occupied for the first time. As I was securing the entrance, I heard a low "ship" uttered behind me. Turning, I beheld the pipit standing in front of the nest, eyeing the blind, camera, and whatever part of me protruded beneath the sack wall, with mixed alarm and curiosity. After remaining thus for a few moments, it walked a foot or two off and flew away. Seven minutes later I again heard the "ship" note and saw the pipit walking to the nest with two small grasshoppers in its bill. After being in the nest a second or two, it reappeared, inspected the blind for two or three minutes, and then flew away as before. From that time on, it kept arriving at the nest with food at an average rate of once every four and a half minutes throughout the three hours that I remained in the blind. This bird was presumed to be the female. The other one could be heard circling overhead, uttering the typical pipit "squi-quick," for fifteen minutes after I had entered the blind, thereafter it was silent.

The behaviour of the parents outlined in the above paragraph proved to be typical of their reactions to an observer in the blind on subsequent visits. They tended to become increasingly bold, however, as the young grew older. For instance, the female once happened to alight near the back of the blind, which was slightly defective here in its concealing properties. Seeing me, the bird, with some "squick" ejaculations of anger, deliberately walked round to the front to inspect the nest and make sure that it was unharmed. Not the least concern did it show for its own safety. On another occasion, the bird came to the nest but saw me through an opening and left hurriedly. Yet, four minutes later it was back with food, as unconcerned as ever. Again, when the young were just leaving the nest, they were taken inside the blind to be examined more closely. When this occurred the parent birds circled anxiously around, uttering the "squick" note, to which the young ones occasionally responded. Drawn by their voice, the mother bird frequently alighted by the nest barely an arm's length from me. From this position, no matter whether I spoke to it or thrust my hand at it from beneath the intervening wall of the blind, it refused to be frightened away.

It was noticed that when an observer was approaching the nest but was still some distance away, one bird or both would circle overhead

with evident uneasiness. When, however the observer drew closer to the nest, no birds would be seen.

The work of caring for the young in the nest appeared to be assumed entirely by the female. The male was never observed to take part in it. Indeed, the male was detected near the nest only twice, and on both these occasions the female drove it away. The male had ceased its singing rather abruptly about the beginning of August, and was not heard during the course of this nesting. On August 24, the day the nest was found, it was seen with one well-grown young bird, which was presumed to be of the first brood. From this it was concluded that, as in many other species, the male takes charge of the young after they leave the nest while the female proceeds to build another nest and lay the next set of eggs. The young birds of the first nest were noted with the male as late as August 28, but they were doubtless independent of their parents by that time.

Observations had not been made long from the blind before it was discovered that the female used a definite route in entering and in departing from the nest. After securing food from an adjacent patch of open grass, it would fly low over the ground directly to about six feet north-west of the nest. Here it would alight and walk along a curving path to enter the nest finally from the south. On leaving, the bird would stand for a few moments on the edge of the depression to watch and listen. Then it would move directly west for about two feet—crossing its path of approach—and again pause at another "listening post." From here it would mount into the air and fly off in search of more food. The path used was always the same, and once known, it could just be discerned because of its slightly trodden appearance. Rarely did the bird depart from the nest without first standing for several minutes at both "listening posts." At these times, the bird's ear coverts were frequently seen to be raised slightly, showing how keenly alert it was. Preening occasionally took place at these intervals also.

The use of such a regular path near the nest resulted mostly, no doubt, from habit, perhaps fixed by the bird's tendency to choose a course offering the least resistance to its progress. This belief arose from the fact that the pipit displayed a certain remarkable awkwardness in thick tangled grass. Even on the pathway its feet were sometimes seen to slip. Also, it was noticed that when the grass around the nest became trampled

down by observers, the bird began to alight in the trodden area closer to the nest, often ignoring the path entirely. It would be natural, therefore, for the bird to be caused by this condition to use one well-known route which it could thread with ease and speed on the countless trips it had to make.

DEVELOPMENT OF YOUNG.

When found, the nest contained five young perhaps three or four days old. Some of them, however, were farther advanced than others, and this difference was maintained during their stay in the nest. As the smallest was judged to be the youngest, it was selected for detailed study, and descriptions given below are taken from this bird.

August 24 (estimated 3rd or 4th day after hatching).—Down: light grey in colour, long and dense; on head, 3 to 10 mm. long, beginning in two rows close together on forehead but diverging gradually to pass over tops of eyeballs; on occiput, in two small clumps 10 mm. long, one on each side; about 10 mm. on scapular region, between elbow and wrist, and on spinal tract,*—two short clumps on crural tract; one tuft on each side of caudal tract. Feathers: dark sheaths appearing under skin on lores; a few visible around ear coverts; sheaths almost through skin on crown, occiput, and hind-neck; just coming through on scapular region; secondary sheaths through skin for 2 mm.; greater covert sheaths coming through; primary sheaths 1.5 mm. long; primary covert sheaths appearing above skin; sheaths through skin on back; nearly through on rump; faintly visible under skin on upper tail coverts; none on tail or under tail coverts; dark sheaths just breaking through skin on foreneck, the tract dividing and white sheaths, a little longer, continuing down sides; white sheaths on flanks just protruding through skin; white sheaths just appearing on thigh tract. Skin transparent. Eyelids separated slightly but incapable of movement.

At this stage, the bird is very weak and struggles much less than would a Baird's or Savannah Sparrow in a corresponding state of development. Its only desire appears to keep huddled against something warm, and if allowed to do so, it remains quiet. Its sense of fear is not yet developed, the struggling being occasioned by the uncomfortable positions in which the bird is

placed. A small wingless grasshopper, offered to the bird, was accepted by it after a little hesitation.

August 26 (5 or 6 days after hatching).—The blind was occupied for the first time. The young were heard to utter a faint peeping noise when they were being fed. Intervals between visits of the parent with food—seldom lasting more than five minutes—were spent by the birds in drowsing. Once or twice the parent uttered a soft "squeak" when entering the nest. Whether or not, however, this was to awaken the young ones, could not be learned. A slight jarring of the nest usually sufficed to make the birds extend their necks and open their mouths for food.

The parent maintained sanitation in the nest by carrying away the faeces in its bill and probably dropping them while in flight. If, however, there were two sacs in the nest at once, one was eaten and the other was carried away. Small sacs were usually eaten.

The parent did not brood either on this occasion or at later times.

Great changes in the feathering could be noticed on this day. Down was becoming scanty, and the juvenal plumage was quickly supplanting it. Feather sheaths were out for 1 mm. on forehead, increasing on crown, occiput, and hind-neck to 4 mm. on back; sheaths 5 mm. long on scapulars; 4 to 5 mm. long on secondaries; greater covert sheaths 3 mm. long; primary sheaths 6 mm. long; primary covert sheaths 5 mm.; sheaths of rectrices 1.5 mm.; sheaths around chin just appearing faintly, giving skin a rough quality; sheaths on foreneck 1.5 mm. long; on sides, 2 mm.; on flanks, 1 mm.; feathers on thigh just bursting through sheaths, the first to do so.

August 27 and 28.—Heavy rains fell, accompanied by strong wind and low temperatures. When examined on the latter day, the birds appeared unharmed by the severe drenching they had received. Their eyes at this date were fully open.

August 29 (8 or 9 days after hatching).—The young were very active and almost refused to stay in the nest after having been taken out. In seeking cover they would bore forward strongly with their bills. They uttered no sound except the peeping used when they were being fed. The down was now nearly gone except on the head, where a good deal still remained. Feathers were now exposed for one to six millimeters on all capital (except ear coverts), spinal, alar, and caudal regions. Sheaths were just breaking on foreneck. Feathers were exposed for 5

*T. M. Shortt records that in a nest of Sprague's Pipit examined by him, the down on the dorsal tract of the young was shortest on the interscapular region. The young were two days old.

mm. on sides, 4 mm. on flanks, and 6 mm. on thighs.

August 30 (9 or 10 days after hatching).—The young were restless. One bird was observed to preen itself. It may have been the same bird that, a few minutes later, elevated itself upon the grass "platform" beside the nest, where—as perhaps it discovered—it could intercept all the food. A minute or two later, however, the venturesome one was back in the nest.

August 31 (10 or 11 days after hatching).—The young departed from the nest. Three had already disappeared when I entered the blind at 10 a.m. Both adults were visibly excited and remained in the air a good deal, uttering the loud "squick." At 10.08, the female resumed its interrupted task of feeding the remaining two in the nest. For some reason, during the next two hours it came to the nest seven times without bringing food. On these occasions it contented itself merely with looking into the nest and then departing, usually with an accompanying "squick" of comment. These visits were suspected to be a means of enticing the young to leave their nest and follow their comrades into the world. The young, however, appeared to need no such urging. At 11.59 a.m. one of them preened itself. The adult came at this moment without food. It looked at the young, and then, after listening for a few seconds, uttered a "squick" and flew off. The young imitated this note. At twelve o'clock the parent came as before without food. The young ones peeped and uttered a muffled "squick." At 12.10 p.m., after being fed a moth, one young bird was looking out of the nest and preening itself. At 12.11 p.m., when the parent arrived with a grasshopper, one youngster spread its wings and peeped for food. Finally, at 12.13, one of the two suddenly scrambled out of the nest and crawled away into the grass, boring forward with its bill and picking its way round the thick clumps. After progressing for about three feet, it squatted down to rest. Here the adult, with a grasshopper in its bill, came upon it and fed it. The young one then moved on for another two feet before resting again. At this point the remaining bird left the nest, and the two were now caught and examined for the last time.

The description of them then taken follows. Down remaining only on sides of crown, on back and on secondary coverts. Feathers on forehead and crown, black margined with buff; buff more extensive on occipital region; on hind-neck, black tipped with white; on scapulars, black tipped with buff; on lesser, middle, and greater coverts,

black margined with buff, turning paler on extreme feather tips; secondaries, primaries, and primary coverts, black whitening on extreme tips; on back and rump, black tipped with buff; on upper tail coverts, black margined with darker buff; rectrices, black except for the two white outer feathers,—tips of all feathers greyish; ear coverts ochrish, small muffy feather sheaths growing at inner edge of coverts; a patch of greyish feathers behind and below ear coverts, continuing round to chin; on foreneck, feathers buffy with black starting half way down shaft and covering almost all of vane at tip, giving tract a striped appearance; this pattern continuing on upper breast; buff, with a few black spots, passing down sides nearest wings, inner parts of sides white; flanks and under tail coverts white. Feathers varied in length from 3 mm. on forehead to 33 mm. on primaries. Most of them, especially the remiges and rectrices, were partly enclosed in their sheaths. Iris brown. Gape yellow; interior of mouth orange; mandibles "dull grey pink,"* lower one paler than upper, both darker at tips; nostrils slightly paler. Feet and tarsi translucent flesh color. Measurements (taken from a living bird, these are more approximate than exact): length, about 80 mm.; tarsus, 23 mm.; hind toe, 19 mm.; culmen, 7 mm.

The young birds were now very active, and they seized in a flash any opportunity to escape. Although they exerted a remarkable strength at times, they soon became exhausted and were forced to rest frequently. They had as yet found no use for their wings, save as additional limbs with which to balance themselves. Even when the birds escaped from my hand and dropped to the ground, their wings hung limp at their sides. Legs and feet were strong, but the birds could not yet stand upright. A faint "squick" was sometimes uttered in answer to their parents' cries. Their eyes were keen and ready, and their ears were alert. All in all, they appeared quite determined to face the world, helpless though they were.

Graphical representation of feather growth shows a fairly uniform rate for body feathers, but a sharp increase for remiges and rectrices during the last two days of nest occupancy.

FOOD.

Eight hours out of the total number spent in the blind (including one hour by B. W. Cartwright) were devoted to observing the feeding of the young. In this time the parent bird made 91

*From the notes of A. H. Shortt.

trips to the nest with food, or one every 5.27 minutes. In 21 cases the food was not identified. Of the remaining 70 trips, 7 (or 10.00%) were made with crickets, 4 (or 5.71%) were made with moths, and 59 (or 84.29%) were made with grasshoppers. Crickets and moths were brought one at a time, while grasshoppers were brought at an average rate of 1.58 per trip.

Specimens of grasshoppers were collected from this area by T. M. Shortt and the writer and forwarded through B. W. Cartwright to Mr. Norman Criddle for identification. Mr. Criddle pronounced them as belonging to the following species: *Cauthippus curtippennis* Harr., *Camnula pellucida* Scud., *Arphia pseudonietana* Thom., *Melanoplus dawsoni* Scud., *Melanoplus bivittatus* Say. A moth similar to the ones fed to the young was also collected and was identified by him as *Caenurgia erechtea* Cram., while a cricket of the kind given to the young was determined to be *Gryllus assimilis* Fab.

In feeding the young, the parent would drop the whole insect into the opened mouth of one bird. If the insect did not disappear within a second or two, it was taken away and given to another one. Grasshoppers appeared to be fed unmodified, but crickets, it was noticed by Mr. Cartwright, were crushed before being given to the birds. No rotation in feeding the young seemed to be used.

VOICE.

The silver-toned, jingling song of the male was not heard while this brood was being raised and need only be mentioned here.

Other notes of the adults were (1) a rapid, loud "squick," "squi-quick," or "squi-qui-quick," expressing anxiety or anger, used mostly on the wing but sometimes at the nest; (2) a harsh snarling note once heard from the blind when

the bird dived at some unknown object in the grass near the nest; (3) a soft slow "shup" or "ship," used at the nest and indicative of uneasiness.

When five or six days old, the young began to use a faint peeping note when the mother bird approached with food. At ten or eleven days, when the young left the nest, they acquired the "squick," learned, perhaps, by imitating their parents. It possibly served as a location note, and if so, its acquisition was timely.

LATER NOTES.

Once the young were out of the nest, the adults changed their attitude completely, reverting to their former secretive habits. They were now almost wholly silent. All flying necessary in the care of the young was done unobtrusively low over the grass. Only when flushed from the ground would they now mount aloft in their customary manner, and once settled again, they would remain hidden for the rest of the observer's visit.

Although the area round the nest was searched diligently, it was not until September 10 that the young birds were again seen. On that date, two of them were flushed from the grass about 100 feet from the nest. One flew for some 200 feet, and the other for 100 feet, before they returned to the ground. A faint "squick" was uttered by one of them. They had grown amazingly, and were comparable in size and actions to their parents.

On September 12, both young and old were noted. This was the last time they were seen, for the field was not again visited until late in the fall. It could not have been long after this date, however, that the family abandoned its home on the prairie and began the adventurous southward flight.

NOTES AND OBSERVATIONS

ROCKY MOUNTAIN GOAT ON VANCOUVER ISLAND, BRITISH COLUMBIA.—In January, 1924, four Rocky Mountain Goats obtained from Rocky Mountain Park, Alberta, were released at the head of Cowichan Lake, Vancouver Island, British Columbia (*Canadian Field-Naturalist*, 39: 151, 1925.). The locality in which the goats were liberated is out of the usual course of travel and the mountain range to which the animals presumably made their way is remote and difficult of access. Consequently it is not surprising that no reports concerning the subsequent movements of these animals were received for some time. But in

June, 1930, Game Wardens Marshall and Weir of the British Columbia Game Branch made a patrol into the Shaw Creek Game Reserve and it is considered desirable to record their observations.

Game Warden Marshall's report, dated June 30, 1930, and obtained through the courtesy of Mr. A. Bryan Williams, Game Commissioner, is substantially as follows:

"Our procedure was to climb all likely looking mountains in the Shaw Creek region with the object of searching for goat signs and to investigate the elk range in this area. The

mountains ascended were: Marmot Mountain at the head of the west fork; Heather Mountain on the south side of the west fork; the mountains to the west and to the east of Heather Mountain (names unknown); the divide between the west and north forks and a mountain on the south side of the north fork, where there is a tributary stream from the east, which we named Goat Mountain as it was here we saw goats. No signs were observed on any of the other mountains climbed.

"We climbed Goat Mountain on the side facing north which we found difficult to ascend. Near the top we were greatly encouraged by finding fresh goat droppings and later some goat hair attached to bushes. Farther on we saw fresh tracks near water and finally two goats, one of which was feeding in full view about 500 yards distant. This animal was under observation for half an hour. From the number of tracks and signs observed it would seem that the original stock of four animals has increased. Goat Mountain is very precipitous and travelling is difficult. The portion on which the goats were feeding was inaccessible to us.—J. A. MUNRO.

STRANGE BEHAVIOUR OF LEWIS' WOODPECKER.
—Last summer (1932), I was informed by my nephew, who is a keen student of birds, that he had seen a Lewis's Woodpecker in flight carrying in its claws a short-tailed field mouse (*Microtus townsendi*), that it dropped the mouse, swooped down and caught it again before it reached the ground, dropped it a second time on to the ground

and abandoned it through fear of my nephew who had come running up to investigate.

The mouse looked as if it had been dead for some time and probably had not been killed by the bird but was being taken to feed the nestlings in a dead poplar close by. My nephew is quite positive that it carried the mouse in its claws which seems an extraordinary feat for a woodpecker. But then Lewis's Woodpecker is given to abnormal habits as I have often found to my cost when sometimes in the fall they suddenly begin to raise havoc with my apples and plums and can only be stopped by extermination.—JOHN RONAYNE, Pemberton, British Columbia.

A SHELL NEW TO THE CANADIAN LIST.—*Valvata perdepressa walkeri* was described by Dr. Frank Collins Baker in 1930 (*The Molluscan Fauna of the Southern Part of Lake Michigan and Its Relationship to Old Glacial Lake Chicago*). Trans. Ill. State Acad. of Sci. 22:188, 1930) and specimens were presented by Dr. Baker to the National Museum of Canada in 1932 (Cat. No. Mollusca 3229). On comparing some unidentified *Valvatas* from Lake Erie at Kingsville, I found that they agreed very well with *V. perdepressa walkeri*. Specimens were sent to Dr. Baker who confirms my identification. *Valvata perdepressa walkeri* Baker should therefore be added to the Canadian list.

This variety has been recorded as *V. bicarinata* in most publications referring to Lake Erie. It is a small shell with a low spire, and at first sight looks very much like a *Gyraulus*. For a description and figures of the variety, see the paper quoted above.—A. LA ROCQUE.

BOOK REVIEWS

THE BIRDS OF MINNESOTA BY DR. T. S. ROBERTS, *Illustrated with ninety-two colour plates by Allan Brooks, George Miksch Sutton, Walter Alois Weber, Francis Lee Jaques, Walter John Breckenridge, including one plate by the late Louis Agassiz Fuertes. 606 text figures, pp. 691 plus 821. The University of Minnesota Press, Minneapolis, Minnesota, 1932. 2 Vols., Quarto. Price \$6.00. A limited edition de luxe is also issued at \$25.00.*

An extensive introduction pp. 135, contains an historical review of the birds of Minnesota and descriptions of the state's geography, physiography, life-zones and climate, synopses of bird-life past and present and at various seasons, tables of arrivals and departures, progress of conservation, bird-songs and calls, bird-banding and general discussion of state ornithological problems: The

main body of the work, pp. 135-691 and 1-455, consists of a Systematic Account of all the birds found in the state, defining their status, distribution and much life-history. The remainder of the second volume is taken by artificial keys, minutely described plumage descriptions, Bibliography and Index. The plates are bound together at the backs of their respective volumes.

The present generation of rising ornithologists and popular bird observers is particularly fortunate. This reviewer did not come upon the scene very early, but he can remember that his only book of reference was a much-thumbed and dog's-eared copy of Cook's *Birds of Michigan* without descriptive matter and illustrated with small, worn wood-cuts that had served their turn in many a similar publication. Other books were heard of, occasionally seen, always coveted

but practically unobtainable. Passing glimpses of the lithographic illustrations in some of the Pacific Railroad Reports suggested resources available to real ornithologists, but, alas, treated of species beyond our knowledge and experience. Fisher's Hawks and Owls was the first book with coloured illustrations of familiar species that fell to our hand and was the pride of our library.

But times have changed. Where once we looked vainly for bird information, now it is produced on every hand, superbly illustrated by artist-ornithologists and at prices absurdly low. This has been made possible by reproductive processes that were unheard of then but also much credit must be given to the general awakening of popular interest in the subject and the benevolence of enlightened legislatures, institutions and philanthropic individuals that have absorbed the expenses of production and presented results to the world near, or even below, cost.

Robert's *Birds of Minnesota* is the present peak of sumptuous regional bird books. Beginning with Eaton's *Birds of New York*, a succession of super-illustrated and sympathetically written bird books has been produced, each being, in one direction or another, some little advance on the last. What the next will be is difficult to prophesy as this seems to be the practical limit of general edition popular books. Owing to the close neighbourhood of Minnesota to western Ontario and Manitoba the work will be of particular interest to those provinces and a much wider field of Canada can obtain great profit from it.

The text matter has been gathered through many years of Dr. Robert's active life and is a monument to his enthusiasm and energy in field and study. His experience as a teacher and lecturer has well prepared him to present his material agreeably and adequately for the amateur to whose needs the work is principally directed. Scattered through the text are many line cuts of enlightening details and photographs of birds and their habitats. The half-tones have necessitated a well-coated paper throughout that has made the volumes rather heavy for casual reference and constitute the only grounds for criticism of format. The reviewer has detected but one serious error in the two volumes. On pages 210 and 211 the two smaller Canada Geese have been unfortunately transposed. The goose to which the name "Hutchins's" has now to be attached is not the middle-sized one as formerly but the minute fellow that has often been confused with *minima* of the west coast. It was to prevent this very misunderstanding that the name "Richardson's" was proposed in the vernacular for the little goose to which the inflex-

ible rules of nomenclature the scientific term *hutchinsi* has to be applied.

The coloured illustrations are full-paged seven-colour offset instead of the usual four-colour direct process. The additional printings give better colour reproduction and compensate for slight inaccuracies of registration so difficult to maintain in run of press. The off-set process allows the use of a soft-grained paper instead of a hard shiny one and the whole result is greatly superior in accuracy, delicacy of colour and artistic appeal to the illustrations of any similar bird-book that has appeared before. The detail in which reproduction most apparently fails is in the occasional hand corrections that have been made on the plates, particularly the black plate. It is perhaps too much to demand of the plate-etcher the same technical and artistic knowledge that we find in the original artist but perhaps some day process work will arrive at a fool-proof stage where reproduction is mechanically perfect and no foreign hand need come between the artist and his pictures.

The work of the various artists is sufficiently represented to invite comparisons. Each has been faced in numerous cases with the necessity of placing a number of birds on the same sheet. It is interesting to note the various ways in which this "happy family" arrangement has been handled. Probably the most satisfactory solution of the difficulty is that adopted in some of Brook's plates by scattering in well balanced masses and harmonious colourings, small vignettes over a tinted background without drawing them together in a single composition. An admirable example of this is Plate 14 of Accipters. Of course, in comparison of work, Brook's long experience with brush and in the field tells heavily and there is no doubt but that he divides the honours of excellence with the late lamented Fuertes. Perhaps no one will ever draw birds with a finer feeling or greater accuracy than the latter, but Brooks excels in his background and general pictorial handling, and the purity and transparency of his skies and water is remarkable. The work of Jaques is of a very high order and with charming Japanese simplicity and purity of colour. Some of his plates, as No. 25, of Pheasants, are about as fine as anything we have seen in bird illustration. It is evident that as an artist he has taken long strides ahead. We note that he gives the Green Heron red legs and feet. If this is a character of Minnesota birds it is interesting for none of the birds of this species that we are acquainted with have these members other than greenish-yellow.

Sutton's work is satisfactory, but it is unfair to

judge him by the pictures here presented. His subjects are the dull and artistically uninspiring *Empidonaces* and Vireos and he has had to crowd his sheets. From other work of his it is evident that he is advancing rapidly and if he so continues will accomplish much. Weber is practically a new brush in general bird illustration but here makes a very promising bow of introduction to the public. He is a brilliant colourist and seems to have studied Brooks to advantage without being an imitator. He appears to know his birds and, though the plums of assignment do not fall to his share and he has had to work on

crowded sheets, we should say that when he overcomes a little hardness of treatment he will paint himself a future. On the other hand Breckenridge paints soft, perhaps with too dry a brush. When experience gives him more boldness and decision much may be expected of him.

Altogether Dr. Roberts, his assistants and the friends who have made this magnificent publication possible at a price within the reach of all are to be heartily congratulated on having produced a work that may long be a standard to aim at in similar future publications.—P.A.T.

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SEPTEMBER, 1933



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OTTAWA FIELD-NATURALISTS' CLUB

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CONTENTS

	PAGE
The Wapiti of the Riding Mountain, Manitoba. <i>An Ecological Study and Commentary.</i> By H. U. Green.....	105
Identifications in the Comox Bird Census.....	112
Contribution to the Knowledge of the Flora of Northern Manitoba and the North-western Territories, Dominion of Canada, (Lat. 58° - 62°; Long. 95° - 100°. Hudson Bay). By William Carruthers Gussow.....	116
Autumn Excursions of the Ottawa Field-Naturalists' Club, 1933.....	120

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OTTAWA, CANADA, SEPTEMBER, 1933

No. 6

THE WAPITI OF THE RIDING MOUNTAIN, MANITOBA

An Ecological Study and Commentary

By H. U. GREEN

PREFACE

THE NECESSITY for serious ecological research in respect to the Wapiti of the Riding Mountain, Manitoba, prompted the writer's intensive study in an endeavour to gain more specific knowledge of this, the most majestic species of our native deer. The result, compiled from a vast number of field notes and observations reduced to popular form, is recorded in the following pages in the hope that the information will prove of interest to the conservationist, ecologist, and student of mammalogical science. Although the field work was confined to the Riding Mountain area, much of the data, it is believed, will apply to Wapiti elsewhere in Canada.

After a general survey of the Riding Mountain in the spring of 1929, it was decided to make the headwaters of the Vermilion River and adjacent terrain the locus of study, especially as the selected area included the main winter range of the herd and the calving grounds about the Kennice Meadow district.

Recorded observations were commenced in July, 1929, and terminated in October, 1932. During the period cited the Wapiti were studied during every month of the year, often necessitating residence in camp during the winter and when the rutting and calving seasons were at their height. Prolonged research was made possible owing to the close proximity of the writer's residence to the area under observation.

Believing that originality increases the value of field research, no reference has been sought from, and no comparison made with, any text which may have been written on the subject of Wapiti, other than of a pathological and taxonomic nature. Consequently, it is possible and entirely probable that questionable assertions, particularly of a psychological character, may be evident to other in-

vestigators. However, should such occur, they will stimulate healthy and constructive discussion and enhance the importance of the work already accomplished.

It is fully realized that the study must of necessity be considered incomplete, for no one individual can expect successfully to acquire complete data on all phases of animal life histories and ecology.

No observations have been recorded of Wapiti confined within enclosures, because it is appreciated that, in general, the conduct of captive specimens in nowise resembles the habits, reactions and emotions of their more fortunate brethren existing in a natural state.

The valuable field assistance afforded by Kenneth Fuller Lee and Thelda Lee during the spring of 1930, and Constable M. G. G. Goldie of the Royal Canadian Mounted Police in 1930 and 1931, is gratefully acknowledged.

—H. U. GREEN, *Mistamick Lodge, Dauphin, Manitoba, January, 1933.*

HISTORY

THERE is little doubt that the nucleus of the present Riding Mountain herd was a surviving remnant of the vast numbers of Wapiti who ranged about the uplands of southern and central Manitoba in the early days and, by virtue of isolation, survived sufficiently through protection afforded in later years to permit an increase to present proportions. It is indeed gratifying, in this age of diminishing wild life, to realize that the sincere efforts of far-seeing citizens have borne fruit, resulting in Manitoba's proud possession of the largest single herd of these majestic mammals in Canada.

Information regarding the status of the herd prior to the settlement of the area surrounding the Riding Mountain is somewhat meagre. La Verandrye undoubtedly came in contact



Typical Feeding Grounds of Riding Mountain Wapiti. Beaver Meadow in Background.

with individuals roaming the lowlands thereabouts; Henry Youle Hind must have seen many Wapiti during his exploration of the surrounding area, and Tyrell no doubt encountered scattered bands. Records of their observations, however, are not available to the writer.

Sam McLeod, a very ancient full-blooded Swampy Cree Indian, unhappily now deceased, whom I knew quite well, informed me that, as a young man, he remembered hunting the Wapiti on the park-like plains about where the town of Dauphin now stands. He told me that there were many Wapiti then and likened their numbers to the buffalo. (This may be a slight exaggeration.) He said that during the summer months the herd ranged high in the hills to the south, (the Riding Mountain) invading the sheltered lowlands at the approach of winter. From what I could learn from him, the Wapiti about the Riding Mountain were killed in hundreds by the Indians who bartered their skins to "white" traders who, he said, "came from the east with ox carts". He said, too, that the Wapiti in and about the Riding Mountain were badly decimated before the first settlers arrived, but that there were still many left about 50 years ago. (This statement was made in 1926.)

Mr. William B. Miller, who settled in the Dauphin district in 1890, reported Wapiti as being plentiful in the Riding Mountain at that

time, although it was evident that their numbers had once been much greater. He also referred to their habit of drifting down from the Riding Mountain to the surrounding lowlands in the winter season.

Many of my old Indian friends resident about Lakes Manitoba and Winnipegosis have often related stories to me regarding the prevalence of Wapiti in the Riding Mountain. Wapiti hides were much used for the manufacture of moccasins, they said, being superior in texture to moosehide and the "tusks" (canine teeth) prized for decorating raiment. According to their reckoning, fifty years have elapsed since these conditions prevailed.

The ease with which Wapiti could be destroyed individually and in numbers, and the value of their flesh to Indians and pioneer settlers, was in a great measure responsible for later extravagant destruction. The creation of the Riding Mountain as a Dominion Forest Reserve some thirty years ago alone saved what remained of the original herd by preserving a portion of their habitat, which otherwise would eventually have been tenanted by the agriculturist.

The approximate Wapiti population of the Riding Mountain at the present time may be liberally considered to be in the neighbourhood of 3,500 head, a vast increase since 1917 when the Manitoba government prohibited the taking of Wapiti, except during one season

several years ago when a few days' hunting were permitted about a restricted area.

In 1914 Mr. Chas. Barber, Chief Game Guardian for Manitoba at that time, estimated that about 500 head of Wapiti ranged the Riding Mountain. In 1925 Mr. Fred Smith, Supervisor of the Reserve, stated: "There are at the present time approximately 2,000 elk (Wapiti) in the Reserve. In December, 1924, Mr. May took the photograph* herewith showing over 1,000 in one herd on the Kennice plains. At the same time, as we had a close season for several years, there is not the increase that might be expected"

The additional protection afforded by the Parks Branch, Department of the Interior, since July, 1930, when the Riding Mountain was created a National Park, will, with proper management, tend further to increase the herd and thus permit the restocking of old ranges throughout the Dominion once generously inhabited by Wapiti.

It is gratifying to realize that the future of the Manitoba Wapiti is assured, and that this beautiful animal will not share the fate of other species of native fauna which have gone and left us wondering.

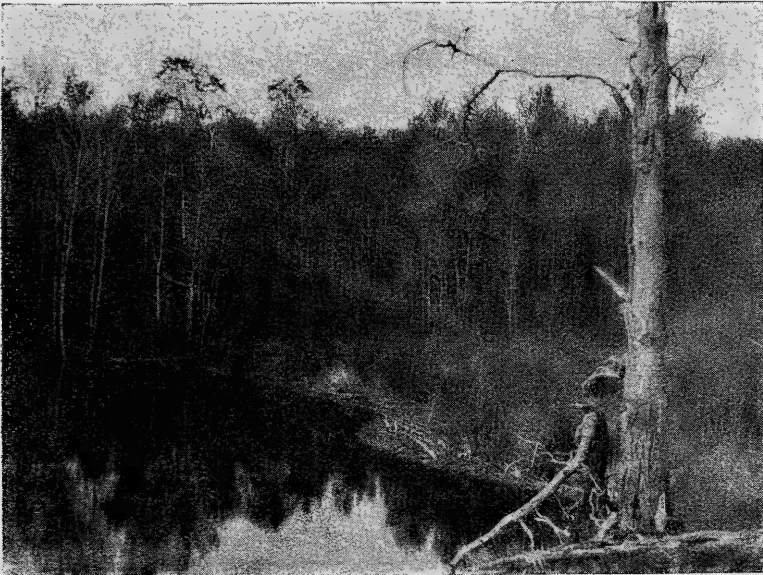
*I have in my possession a print of the photograph referred to by Mr. Fred Smith and attributed to Mr. May. It is not included to illustrate the text of this study, for the reason that its authenticity is questioned by several authorities.

PRESENT RANGE

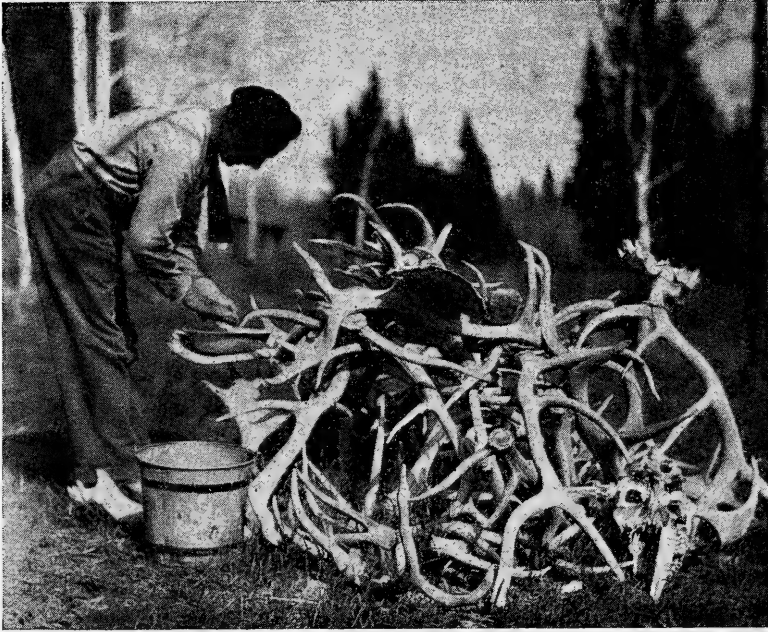
The range of the Riding Mountain Wapiti may be considered as the entire area known as the Riding Mountain National Park. The "mountain" can best be described as an elevated plateau, consisting of some 600,000 acres, rising amid an otherwise partially open and prairie terrain. Terminating in steep escarpments with a mean elevation of 2,200 feet above sea level and 900 feet above the plains below, the northern and eastern boundaries are visible for many miles. The southern and western borders, however, merge imperceptibly into the surrounding country with a decided loss of altitude.

While Wapiti may be found in favoured sections elsewhere, the main range is about the height of land within seven miles of the north boundary, at an elevation of some 1,800 feet above sea level. It extends from the Kennice plains and spreads fanwise to the south, east and west, for a distance of approximately twelve miles. The range is readily reached via the town of Dauphin by a well-travelled automobile road.

From nearly every point of view, the Riding Mountain as a Wapiti country is ideal, providing every requirement peculiar to their needs. Although sparsely watered in the general sense, many small spring-fed streams and



Beaver Pond and Dam in the Heart of the Wapiti Country.



Pile of Wapiti Antlers, Riding Mountain Range

lakes abound which supply sufficient water during the open months of the year. The whole area supports a heavy growth of deciduous and coniferous trees, liberally interspersed in the central and western portions with many small areas of sheltered prairie which afford in normal seasons ample ground herbage for feed.

CLASSIFICATION AND DESCRIPTION.

Common Names:	Wapiti; Elk; American Elk; Round-horned Elk; American Stag.
Local Indian Name:	O-muus-koos (Salteaux)
Order:	Artiodactyla.
Family:	Cervidae.
Sub-family:	Cervinae.
Genus:	Cervus.
Type Species:	<i>Cervus canadensis canadensis</i> (Erxleben) (<i>Cervus elaphas</i>) <i>canadensis</i> Erxleben, Syst. Regni. Anim. p. 305. 1777.
Sub-species under observation:	<i>Cervus canadensis manitobensis</i> Millais.

With the exception of the moose, the Wapiti is the largest of the North American deer.

It is closely related to the Red Deer of Europe and ranges in several parts of Asia. The genus, according to Anthony, apart from the type species, includes two sub-species: *Cervus canadensis manitobensis* Millais, the Manitoba Wapiti, and *Cervus canadensis occidentalis* (Hamilton Smith), the Roosevelt Wapiti, besides two species: *Cervus merriami* Nelson, the Arizona Wapiti, and *Cervus nannodes* Merriam, the California Wapiti.

The designation, elk, as applied to the Wapiti is scientifically incorrect. The true elk is the moose; the name moose, having been applied and accepted by the early settlers of the east from the Algonquian appellation, *muus*.

In general, the Wapiti is typically deer-like in character. Mature males carry large, branching, solid deciduous antlers with well-developed brow and bezel tines. Antlers are wanting in the female, except for occasional freak appearances. The neck is well maned, but scantily clothed at the time of the spring moult. Tail short and inconspicuous. Well-defined rump patch. Ante-orbital glands very prominent. Metatarsal scent glands present. Upper lip prehensile in adaption for browsing. Ears of medium length and in proportion to size.

The Wapiti of the Riding Mountain may be further described as follows:

COLOUR; Summer pelage, Male. Summer pelage, rich chestnut brown above, with head and neck of deeper shade. Underparts somewhat darker, with whitish coloration between hind legs extending to posterior portion of abdominal region. Rump, straw-coloured, presenting a conspicuous patch of large area. Tail, same colour as rump. Hair, coarse and brittle. Eyes, hazel.

Summer pelage, Female. Slightly lighter in colour than males.

Winter pelage, both sexes. Somewhat lighter than summer coat and considerably longer and more dense.

Colour; Young. Medium chestnut brown above. Underparts lighter. Covered with irregular white spots which persist from birth until the winter pelage grows. Rump patch barely definable, and in some cases totally absent.

WEIGHTS; MEASUREMENTS; ANTLER GROWTH; DENTITION

During the period of observation five specimens were measured and weighed shortly after death, and many carcasses examined under various conditions. The former consisted of one prime adult male, about six years of

age; one aged female in good flesh; two male yearlings, and one female, two years old. As I had every reason to believe that the adult specimens were representative of the Riding Mountain herd, their weights and measurements were recorded:

WEIGHTS: Male (less blood and viscera and with normal ten point antlers) 685 lbs.

Female (less blood and viscera) 515 lbs.

MEASUREMENTS: Male total length, 110 inches; tail vertebrae, 6.5 inches; hind foot, 25 inches; height at shoulder, 58 inches.

Female total length, 97 inches; tail vertebrae, 5 inches; hind foot, 24 inches; height at shoulder, 54 inches.

The phenomenon of antler growth, as with other deer, commences when tender, fleshy, dome-shaped knobs clothed with hairy integument known as "velvet" emerge from the frontal bone of the skull. These grow apace as bony matter is rapidly deposited through the medium of blood vessels coursing through the velvety covering. When full size is attained, the rings of soft protuberances, which have formed at the base of each antler, harden and constrict the blood vessels supplying the "velvet", separating them from the circulatory system. Devoid of nourishment, the "velvet" quickly dries and is rubbed off, leaving the



Beaver Lodge and Pond, Kennice Plains District. Riding Mountain.



The Writer's Winter Camp, Riding Mountain, Manitoba. Seasons of 1930-31.

bone beneath hard and insensible. Growth is usually complete in about eight weeks.

Suggestion of antler growth is evident at a very early age, for shortly after birth one may feel button-like processes beneath the skin. Actual development, however, is not apparent until about the beginning of the second year of life, when spike-like horns appear. The animal is then known as a spike-horn. The next annual growth, commencing almost immediately after the first is shed, produces a crotch on otherwise single tines, and the bearer is called a crotch-horn. Variations are sometimes evident, as both spike-horns and crotch-horns may have an extra diminutive point. This, though, is the exception rather than the rule. When rising four years of age the crotch-horns are replaced by fully defined antlers, carrying from four to five points on each beam. At the beginning of the fifth year a good spread is worn, and, I believe, growth continues with each new pair until the animal is seven years old, after which deterioration commences.

Wapiti shed their antlers from midwinter until spring depending, I believe, upon the age of the animal. As a general rule it may be said that the younger the individual the later the annual growth is shed. The latest record of Wapiti carrying fully developed antlers is dated March 29th (1931).

The average number of fully developed points arising from the beam of each antler at maturity is five, but six point antlers may, on occasion, be seen or found. The counts do not include nubbins and small supernumerary points an inch or two in length or the freakish growths often evident in all male deer.

Over a hundred antlers have been examined. These, for the most part, were picked up on the range. A number of mature pairs were scaled and measured and are recorded here-with:

Average weight	24.4 lbs.
Minimum weight	17.2 lbs.
Maximum weight	28.2 lbs.
Average length measured	
outside of beam	52.5 inches
Minimum length	48.0 inches
Maximum length	57.0 inches
Average circumference of	
beam measured immediately	
above "bur"	7.5 inches
Minimum circumference	5.5 inches
Maximum circumference	8.0 inches

Wapiti have thirty four teeth, and, with the exception of the caribou, are the only American deer thus endowed: Their dentition formula is as follows:

Incisors: $\frac{0-0}{4-4}$;	Canines: $\frac{1-1}{0-0}$;	Premolars: $\frac{3-3}{3-3}$
Molars: $\frac{3-3}{3-3}$;		

The canines vary in size with individual animals; they are invariably present at maturity, diminutive in juveniles and sub-adults, and totally absent in calves.

FEEDING HABITS AND FOOD SUPPLY

Wapiti are essentially grazing animals and if grasses are available they browse only lightly upon trees and shrubs to supply the necessary roughage essential for a balanced diet.

My observations show that the Riding Mountain Wapiti subsist almost entirely during the spring and summer upon various soft grasses and weeds in preference to coarser ground herbage everywhere abundant. The variety of winter feed obtainable, however, is determined largely by the depth of snow. Consequently, what during the open months would ordinarily be disdained is heartily relished and consumed when climatic conditions create the necessity.

With the loss of succulent food plants at the approach of winter, the frosted stems of tall grasses and weeds are eaten, and as the snow deepens, windswept ridges afford sustenance to supplement a diet consisting of a greater proportion of browse.

Normally, sufficient ground feed exists until about the middle of March, after which browse is almost entirely eaten until the verdure of spring appears. During this somewhat trying period the annual growth of browse trees and shrubs is often consumed in its entirety, and even conifer needles, cones, and aspen bark, are not despised. It is a common sight in the forest about the winter range to see many aspen trunks scarred by the gouging marks of Wapiti teeth. The damage, according to silvicultural experts, is considerable, for it is said that the wounds facilitate the entrance of disease spores which eventually cause heart-rot and death before maturity.

Unless badly crusted, Wapiti are able to secure without difficulty herbage buried beneath from three and a half to four feet of snow. Their front feet are well adapted for

pawing away the covering, but crusted conditions arising from comparatively long periods of unseasonably warm weather followed by freezing temperatures, soon preclude the use of feet alone to lay bare a sufficient supply of ground feed.

Depending for the most part upon desiccated grasses and coarse weeds for winter sustenance, the Wapiti will then become very weak and emaciated, and should unseasonable weather appear early in the winter, death from famine takes a heavy toll among over-mature and juvenile animals unable to assimilate a diet composed mostly of browse.

The danger to the Riding Mountain herd, though, during exceptional winters is of a forced nature rather than a natural one. Compelled by civilization's invasion and occupation to vacate a natural winter range on the wooded plains several hundred feet below the summer pastures, they suffer to a greater extent from adverse conditions encountered at the higher altitude with its heavier snow-fall and threatened food supply. In this respect they are less fortunate than their near relatives, the moose, white-tailed deer, and mule deer, occupying the present winter range, for these thrive wherever tender twigs abound.

The food utilized by the Riding Mountain Wapiti throughout the year may, for convenience, be divided into four groups: Grasses, Sedges, Weeds and Browse. Food plants, etc., observed to have been eaten, and collected and identified by the writer, are listed here under separate headings. The varieties consumed, however, may vary with the ecological associations of the type regions common to the Riding Mountain country and, in consequence, species consumed on one range may be used to a lesser degree on another. The compilation is, of course, incomplete, as there is no doubt whatever that numerous other species of plant life are included in the diet.

Editor's Note.—Owing to limitation of space the list of food plants referred to is held over to next month's issue.

(To be continued)

IDENTIFICATIONS IN THE COMOX BIRD CENSUS



THE QUESTION of the length to which an observer may go in sight identification in taking the mid-winter bird census may be an open one but it would seem that too fine a splitting in the field is bound to lead to as much confusion as a classification left too open. A consideration of some of the published lists from Comox, Vancouver Island, will illustrate this better than many places because nowhere in Canada can an observer show such an extensive winter list nor a region where geographic probabilities are more apt to lead to error.

Because of the fact that a large number of eastern birds, from juncos to burrowing owls, turn up in winter on Vancouver Island too fine a classification of such birds as robins, kinglets, juncos, evening grosbeaks, etc., is bound to bring confusion. Then there are western forms impossible of identification afield,—fox sparrows for example. When to this is added the human factor, the liability to error, a Christmas list in such difficult area may be misleading.

Thus golden-crowned kinglets in the lists published in February 1931 and March 1933 are given as "Western" while in the list for February 1932 they are "Eastern". The editorial correction re kinglets, (April, 1932, page 96), lumps all such kinglets as western and likewise all Vancouver Island ruby-crowns as Sitka Kinglets. No one, of course, can make such fine distinctions in the field on a dark winter's day and it would seem that for the purposes of a bird census the term Golden-crown or Ruby-crown alone might fit the case of kinglets.

Had the editorial correction been more closely applied to the same list (Census Comox, 1st and 2nd January, 1932) exception might better have been taken to "Common" Canada Goose. This observation (my own without the "common") undoubtedly applied to the large dark form of Canada Goose usually classed as *B.c. occidentalis*. In twelve years' residence on Vancouver Island I have found no evidence that the Common Canada goose (*B.c. canadensis*) is ever found here.

Western fox sparrows in winter are quite impossible of field identification. To lump

them under Sooty, the darkest form, is as misleading as to lump them under any other. It is safe to say that if I submitted the skins of five races of *Passerella* all taken in winter in my woods, to any of our authorities, no two would agree, even with specimens in hand. Usually in any half dozen birds called out of the thickets on a winter day, two or three races will be represented.

On the other hand such terms as "heron" (Comox List, December 26, 1932) are too broad and should at least be given as Blue Heron. "Flicker" (Comox list, December 27, 1929) is another example because the classification should at least go as far as Red-shafted or Yellow-shafted*, this being quite possible afield.

Again in the list of December 26, 1932, published in March, 1933, "Black-headed Jay" is cited when the Steller's has long been recognized as the Vancouver Island form and field classification of the two is quite impossible. In this same list enumeration of thirty-five Oregon Chickadees passes unchallenged as also it did in a previous list when, as far as I am aware, there is not a record of this form for the Island, the very common chickadee being the Chestnut-backed, the other being limited to a small corner of the south-western mainland.—HAMILTON M. LAING.

NOMENCLATURE IN THE CHRISTMAS BIRD CENSUS

The preceding note by Hamilton M. Laing opens for discussion a subject that is badly in need of it. Evidence to that effect may, no doubt, be found in the recent census reports as published, but it abounds much more in the reports as they are originally received and are placed before the editorial worker for preparation for publication. Of last December's reports all but one required some editorial correction of the names (not necessarily the identifications) contained therein, and the majority had to be rewritten. This is quite understandable in the case of workers who do not have access to a copy of the Fourth Edition

*But these, and in fact all, determinations should be made by the observer and not by editorial revision. (Ornith. Ed.)

of the A.O.U. "Check-List", but unfortunately it occurs also in the case of experienced ornithologists who have this edition of the "Check-List" at hand. If all writers of census reports would use care to follow exactly the nomenclature of the book referred to and indicate doubt where doubt exists it would save many long hours of wearisome editorial toil and would be appreciated by no one more than by the writer, who is responsible for the correction of names in the last two censuses, the ones published since the Fourth Edition of the A.O.U. "Check-List" appeared.

The facts are as follows:

1. The Fourth Edition of the A.O.U. "Check-List" was made the standard of ornithological nomenclature for *The Canadian Field-Naturalist* by editorial decision duly published in volume lxvi, page 25, January, 1932. This decision governs the usage in census reports as well as in all other ornithological material appearing in the magazine.

2. The ornithological nomenclature and sequence of species in most of the census reports received from the census-takers do not conform entirely to this standard. In a number of cases they are so far from it that much of their content would be quite useless if published as received.

3. If *The Canadian Field-Naturalist* is to conform to the standard that it has publicly adopted, reports that do not so conform must either be rejected, which is very undesirable, or be brought into conformity by some one before they are published.

4. Identifications which are doubtful should be so reported by the census-taker, and, if so reported, are never revised to a more definite form by an editorial worker. Identifications not reported as doubtful are usually considered as definite and are merely "translated" into the exact terminology of the Check-List as carefully as possible. It is undeniable that deficiency of knowledge or experience on the part of the translator may cause error at times in this task, but this could be avoided very easily and completely if census-takers would use ordinary care in the preparation of the original reports.

It is quite true that the Fourth Edition of the A.O.U. "Check-List" contains an English-language nomenclature which is far from ideal for the purposes of the census-taker. It lacks species names in the cases of those species that

are divided into two or more subspecies, and in some cases the names used for the subspecies in a single species are not logically or symmetrically constructed upon a basal name peculiar to that species and no other. These things have been pointed out in various reviews; they are beside our present point. It is very important that scientific data appearing in the census reports shall be universally available; shall be potentially as useful to some unknown worker in Berlin, Moscow, or Tokyo, either to-day or a hundred years hence, as they are to scientists in Vancouver or Halifax. To bring this about with the minimum expenditure of time, space, and effort involves making all names identifiable by reference to some standard that is accessible to all working scientists, and there is no doubt that, despite its faults, the Fourth Edition of the A.O.U. "Check-List" is the best standard now available for this purpose, and that all concerned should therefore conform cheerfully to it, without regard to their personal preferences or beliefs. Since *The Canadian Field-Naturalist* has hoisted this edition of the "Check-List" to its ornithological masthead, it is detrimental to the common cause of science for either contributor or ornithological worker to try to swing it from the yard-arm instead! Until a new edition appears, we must bear with this one with patience.

Some appreciation of the amount of revision that may be needed by a census report when it is first received by *The Canadian Field-Naturalist* may be gained by scanning carefully the following reproduction of the original form of the report from Comox, B.C., in the census for December, 1932. Although Mr. Laing's name was not appended to this report, it is used as an example here because it is commented upon by him and because the original reports for previous years, some of which carried his name, have been destroyed.

Comox Vancouver Is. B.C. Courtenay to head of Comox Harbour (mainly along river and shore line). 26th Decr 1932, 9.30 to 4.30 Distance covered approximately 8 miles. Weather frosty and dull later sunny and spring-like. Temp around 45. Weather previously mild with severe wind storm previous week. Hutton Vireo seen within few yards. In Comox Bay, at least, 1000 unidentified ducks. Common Loon 10. Pacific Loon 2. Red throated Loon 4. Western Grebe 33. Holboel Grebe 9.

Horned Grebe 10. Violet Green Comorant 2. Heron 3. Mallard 350*. Am. Widgeon 150*. Green winged Teal 1. Canvas Back 7. Scaup Greater and Lesser 250*. American golden Eye 300*. Buffle head 66. Long tailed Duck 2. American Scoter 13. White winged Scoter 1000*. Surf Scoter 150*. American Merganser 14. Redbreasted Merganser 1. Hooded Merganser 1. Sharp Sinned Hawk 1. (Pheasant 1.). Coot 18. Kildeer 16. Glaucous Winged Gull 500*. Thayers Gull 2. Short billed Gull 60*. California Murre 1. Marbled Murrelet 1. Kingfisher 7. Harris Woodpecker 2. Gairdner Woodpecker 1. Pileated Woodpecker 3 Flicker 6. Black Headed Jay 4. Raven 13. Fish Crow 125*. Chickadee 35*. Seattle Wren 12. Winter Wren 16. Varied Thrush 1. Robin 2. Golden Crowned Kinglet 15*. Hutton Vireo 1. Purple Finch 4. Siskin 30. Oregon Towhee 28. Oregon Junco 185. Song Sparrow (Rusty) 26 (English Sparrow 10). 53 Species (2introduced) * indicates estimate, probably more
Theed Pearse, David Guthrie, together

A careful count shows that this report required, in order to bring it into the form in which it was published (*Can. Field-Nat.*, xlvii p. 56, March, 1933) just forty-nine corrections of either bird names or the sequence in which they were placed, as well as addition of the numbers of individuals of the 53 species recorded.

If the Ornithological Editor's foot-note to Mr. Laing's paper means that all of the identifications concerned should have been carefully worked out as far as possible by the census-takers and should have been recorded in their report with equal care, we are in hearty agreement with him, but if his foot-note means that a report such as this actually was when received, with its "Fish Crow" (from Vancouver Island!), "Flicker", "Chickadee", "Kingfisher", etc., should be published without any editorial revision whatever, then we respectfully dissent, for publication of such material would be useless, if not worse. We shall be so bold, however, as to assert that he doesn't really mean the latter alternative and shall support this assertion with a historical record of an editorial incident. When this census report was undergoing revision by the present writer, the Ornithological Editor was consulted by telephone as to the possible meaning of the record of "Fish Crow" at Comox,

and he readily agreed that it didn't mean what it said and should not be published in the form in which it was received, but that it undoubtedly meant "Northwestern Crow" and should be altered thereto by editorial revision!

Conformity to an adopted standard means conformity to it, and nothing less, whether the revision involved requires changing the entire name or only a hyphen, an apostrophe, or a capital letter. In most such cases, fortunately, no question of identification arises, but when such a question does arise, the editorial reviser must proceed with all the caution, ornithological information, common sense, and good advice that he can assemble for the occasion, indicating his editorial doubt where this seems advisable, even where the census-taker perhaps felt no doubt at all. Careful recording of names and of doubt by the census-takers would do away with nearly all of such difficulties.

Brief comment may be made on the particular cases cited by Mr. Laing.

If census-takers on Vancouver Island or elsewhere are in doubt as to the subspecific identity of their Golden-crowned Kinglets this could easily be indicated by recording them as Golden-crowned Kinglet (subsp?). Such a treatment is not available, however, for records of *Corthylio calendula* where subspecific identity is uncertain, because the English-language names of the subspecies of this species in the "Check-List" are not symmetrically formed. In such cases recourse must be had to a combination of common and scientific names, with record of doubt of subspecific identification, thus: "Kinglet (*Corthylio calendula* (subsp?))".

If, as Mr. Laing states, his record of *Branta canadensis* in January, 1932, "undoubtedly applied to the large dark form of Canada Goose usually classed as *B.c. occidentalis*" it is pertinent to inquire why he did not record it as "White-cheeked Goose", which name must have been well known to him, since it was the same in the Third Edition of the "Check-List" as it is in the Fourth Edition. If this record appeared erroneously as "Common Canada Goose", the error is greatly regretted, but the very fact that an ornithologist of Mr. Laing's standing and experience did not use the name "White-cheeked Goose" was considered by the editorial reviser a clear indication that some other form of *Branta canadensis* was intended.

In the case of the Fox Sparrows, since the sub-specific names are symmetrically formed, it would have been easy for the observer to indicate his doubt by writing "Fox Sparrow (subsp?)" and all chance of error would thereby have been eliminated.

As for the term "heron", which Mr. Laing says is too broad (we are glad to agree with him!), reference to the original report from Comox as published above will show that "Heron" is all the information furnished by the census-takers, so the editorial reviser played safe and indicated his doubt by inserting in the record the symbol "(sp?-Ed.)". We are unable to agree that this record "should at least be given as Blue Heron", either by the census-takers in their original manuscript or as a result of editorial amendment, for there is no "Blue Heron" in the "Check-List". There are, it is true, the "Great Blue Heron" and the "Little Blue Heron", but they are separate species, and to write merely "Blue Heron" would be confusing and useless. Since the common names of the subspecies of *Ardea herodias* are not symmetrically formed, it is suggested that individuals of this species whose subspecific identity is uncertain should be recorded as "Heron (*Ardea herodias* (subsp?))".

Mr. Laing suggests that, in the case of Flickers, "the classification should at least go as far as Red-shafted or Yellow-shafted", but these terms will not do, as there is no "Yellow-shafted Flicker" in the "Check-List", while the term "Red-shafted Flicker" indicates only the subspecies, *Colaptes cafer collaris*, and cannot refer in exact usage to any individuals of *C.c. cafer*. We agree that "Flicker" alone is not enough, but here again, on account of inadequacy of the subspecific English-language names, individuals whose subspecific identity is doubtful should be recorded by a combination of the generic English term with the specific scientific name, followed by definite record of doubt as to the sub-specific identity. Objection may be made that this is awkward. So it is, but the difficulty arises from defects inherent in the English-language nomenclature of the present "Check-List". In making a public record of scientific data it is important to be as exact as possible, even at the expense of grace and ease of style.

The Black-headed Jay was reported as that subspecies by the census-takers at Comox

and their record was accepted. Perhaps there should have been editorial correction here, but the present writer confesses insufficient familiarity with distributional details on the Pacific coast to feel warranted in taking responsibility for it.

In the case of the Chickadees, which were reported solely by the generic term, "Chickadee", leaving the editorial reviser a rather wide field for exercise of judgment, it was considered that use by an ornithologist of the unmodified name "Chickadee" must certainly refer to some subspecies of *Penthestes atricapillus*, since *P.a. atricapillus* was known as "Chickadee" in the Third Edition of the "Check-List". We are glad to have attention called to our error and we hope that Chestnut-backed Chickadees will be so recorded in future census reports.

Perhaps it will be useful to conclude these comments with some suggestions for writers of census reports, as follows:

1. The Fourth Edition of the A. O. U. "Check-List" should be followed exactly in nomenclature and sequence of names. For most writers, including the present one, it is not sufficient to trust to memory of the names in the "Check-List"; the book itself should be consulted, so that every letter, hyphen, and apostrophe may be set down in its proper place.

2. If the Fourth Edition of the "Check-List" is not available, recourse may be had to the Third Edition or to some standard bird-book, but in such a case it will be helpful to send the editor a note, stating what standard was used.

3. When subspecific identity is doubtful, that fact should be clearly indicated by an appropriate symbol in each case. When individuals in question belong to a species whose subspecies have symmetrically-formed common names, with a base common to all the subspecies of that species and to no other forms, then the expression of doubt may follow the specific part of the common name, as "Fox Sparrow (subsp?)". When these conditions do not obtain, recourse may be had to such a combination as "Heron (*Ardea herodias* (subsp?))".

Census-writers are invited, urged, and pleaded with to observe as far as possible these suggestions, which it is hoped they may find reasonable. If they do not observe them it means

much extra and unsought labour for some one, who may, despite the best of intentions, make sad mistakes which the personal and local knowledge of the original writers might help them to avoid.—HARRISON F. LEWIS, *Chairman, Bird Census Committee.*

COMMENT BY ORNITHOLOGICAL EDITOR

Mr. Laing's justified protest against inaccuracies in certain informal bird lists and Dr. Lewis' reply in justification of his process of treatment of them raise an important question. It would seem to this critic that Dr. Lewis takes an exaggerated view of the fidelity that we owe to the A.O.U. Check-List even after having stated our allegiance to it. It does not seem justifiable to follow every comma and detail of it when so doing exposes us to the danger of error.

The discussion brings prominently into view one of the most serious of the defects of the Fourth Edition of that Check-List. It does not provide specific entities for just such uses as this. In fact, if its dicta are as strictly followed as Dr. Lewis attempts, there is no way, without awkward circumlocution, of referring to many groups of subspecies or to designate forms whose subspecific status may be uncertain. The case of the Flickers is an example. Three species are included under nine component subspecific headings but nowhere appears a name for either of these three groups. Ordinal, family and generic groups are well captioned but the specific group names that are most frequently required in general practice are absent. In formal use the scientific binominal is always available to the instructed but the general public who have little

occasion to familiarize themselves with scientific technicalities are given no vernacular alternative but to make exact subspecific designation whether they are justified in doing so or not. In the case of the Flickers it is quite apparent to common sense and common usage that *Colaptes auratus* is the "Yellow-shafted Flicker" and *Colaptes cafer* is the "Red-shafted Flicker" yet in the Check-list the former name does not appear and the latter, restricted to one particular race of the species, is not available for the specific designation to which it obviously applies.

We cannot condone carelessly written manuscript and it is to be hoped that census-takers will take the tenor of Dr. Lewis' words to heart and profit by them. On the other hand it does not seem expedient in lists of eyesight records by observers of various ornithological judgment to use subspecific terminology at all. In disregarding these finer distinctions there may be some slight loss of value in the case of a very few highly developed and well qualified specialists, but the danger of inaccuracy from others less prepared who naturally wish to follow their example more than negatives the benefits so obtained. It seems most desirable to make all such future Christmas Bird-censuses in terms of species, eliminating subspecific designation except where there are strong and valid reasons for the contrary. If the Check-List does not give us facilities for so doing, then so much the worse for the Check-List. That volume bears no imprint of infallibility and when it interferes with, or endangers, accuracy it should be disregarded.—P. A. TAVERNER.

CONTRIBUTION TO THE KNOWLEDGE OF THE FLORA OF NORTHERN MANITOBA AND THE NORTH-WESTERN TERRITORIES, DOMINION OF CANADA. (LAT. 58° - 62°; LONG. 95° - 100°. HUDSON BAY)

By WILLIAM CARRUTHERS GÜSSOW



HAVING been assigned to a Geological Survey Field Party under the direction of Dr. L. J. Weeks during the summer months of 1932, I was afforded a good opportunity to follow suggestions made by my father, the Dominion Botanist, to collect and preserve plant material at

any of the points touched. My regular duties as a member of the party enabled me to devote only my spare time to an occupation which I found increasingly fascinating, but I believe I have succeeded in making the most of my limited opportunity. One set of the collections enumerated below has been

placed with the Herbarium of the Division of Botany, Dominion Experimental Farm, Ottawa, a duplicate set has been accepted by the National Herbarium of Canada, and a third set has been deposited with the British Museum (Natural History), South Kensington, London.

For the critical determination of the specimens (Phanerogams and vascular Cryptogams) collected, I am greatly indebted to the late Dr. M. O. Malte, Chief Botanist, National Museum, Ottawa, and to Mr. Herbert Groh of the Division of Botany, both of whom devoted much valuable time and also greatly stimulated my interest.

The cryptogams (fungi) were kindly identified by Mr. I. L. Connors of the Division of Botany and Dr. Eleanor S. Dowding, who, I am informed, succeeded in isolating an interesting new species of the genus *Fimetaria*, unique in two features, viz. a four-spored ascus and perforated spore walls, from ptarmigan dung.

Geologically there occurs but few outcrops in the territory covered, at least not until about 60 miles inland; the rock being hidden under heavy glacial gravel with occasional boulders. Most of the area is underlain by greenstone cut by small masses of granite. At Padli, about 150 miles inland, there are some hills of quartzite and conglomerate. The underlying rock, however, has little bearing on the flora, as the glacial deposits are laid down regardless of the substrata. Indeed the only specimens collected growing on rocks were *Thelypteris fragrans*, *Salix herbacea*, and the usual crop of lichens. Some plants were found only in certain definite zones bordering lakes or sloughs, or on characteristic sand and gravel beaches or typical surface swamps. Generally speaking, vegetation occurs on more or less shallow deposits of humus and it is truly remarkable what an interesting and varying flora is thus supported. The chief characteristic of the topography is the absence of prominent features. The inland is dotted with many small lakes; the rivers are shallow and navigable only by lightest craft. Eskers miles in length occur inland or form long winding points along the coast.

There was a profusion of fleshy fungi, especially Boleti; unfortunately there was no time for preparing the necessary notes on specimens collected. They were as common

as dandelions in the east and were found from July to September. Here and there in hollows and along the lake and river shores occurred sparse low shrubs (willows, alder, some birch and poplar). Near Padli only, there was a vestige of timber, mainly spruce.

Thelypteris fragrans (L.) Nieuwl.

Maguse Lake, N.W.T., July 19; in rocky crevices.

Equisetum arvense L.

Maguse Lake, N.W.T., July 20; on sand.

Lycopodium Solago L.

Padli, N.W.T., August 16; in moist ground along water's edge.

Lycopodium annotinum L.

Padli, N.W.T., August 16.

Potamogeton tenuifolius Raf.

Padli, N.W.T., August 16; freshwater.

Hierochlæ alpina (Sw.) R. & S.

Maguse River (25 miles up) N.W.T., July 7.

Trisetum spicatum (L.) Richter var. *molle* Piper ex Fern.

Maguse Lake, N.W.T., August 8.

Carex aquatilis Wahlenb.

Henningayuk Lake, N.W.T., August 12; growing in swamps along lake.

Carex concolor R.Br.

Maguse River (25 miles up) N.W.T., July 7; growing on sand.

Maguse River N.W.T., July 20; growing on sand.

Tofieldia palustris Huds.

Maguse River, N.W.T., July 12.

Salix reticulata L.

Churchill, Man., June 19;

Long Point, Man., June 30.

Salix herbacea L.

Kaminak Lake, N.W.T., August 28;

Mouth of Maguse River, N.W.T., July 12.

Polygonum viriparum L.

Upper Maguse River, 2nd portage, N.W.T., August 29.

Honkenya peploides (L.) Ehrh.

Long Point, Man., June 29; growing on sand.

Minuartia rubella (Wg.) Graebn.

Kaminak Lake, N.W.T., August 28.

Stellaria longipes Goldie

Along right of way, H. B. Ry. Gillam to Churchill, Man., June 13;

Churchill, Man., June 19;

Long Point, Man., June 29; in sand.

Maguse River, (25 miles up) N.W.T., June 8; in sand.

Silene acaulis L. var. *excursa* (All.) DC.

Mouth of Maguse River, N.W.T., July 12.

- Ranunculus trichophyllus* Chaix.
Padli, N.W.T., August 16; fresh water, along edge of lake.
- Ranunculus lapponicus* L.
Eskimo Point, N.W.T., July 12; wet ground.
- Ranunculus pedatifidus* J. E. Smith
Long Point, Man., June 29.
- Anemone multifida* Poir.
Along right of way, H.B.Ry. Gillam to Churchill, Man., June 13.
- Anemone parviflora* Michx.
Upper Maguse River, N.W.T., August 9.
- Corydalis aurea* Willd.
Along right of way, H.B.Ry. Gillam to Churchill, Man., June 13.
- Cardamine digitata* Richards.
Maguse River (25 miles up) N.W.T., July 7.
- Eutrema Edwardsii* R Br.
Maguse River (25 miles up) N.W.T., July 7.
- Saxifraga nivalis* L.
Kaminak Lake, N.W.T., August 28.
- Saxifraga Hirculus* L.
Maguse Lake (west end), N.W.T., August 23.
- Saxifraga tricuspidata* Rottb.
Churchill, Man., June 19; Maguse River (25 miles up) N.W.T., July 8, and Henningayuk Lake, N.W.T., August 12.
- Saxifraga cornua* L.
Maguse Lake, N.W.T., August 5; in sand.
- Parnassia parviflora* D.C.
Parnassia Kotzebuei C. & S.
Kaminak Lake, N.W.T., August 27.
- Parnassia multiseta* (Led.) Fern.
Padli, N.W.T., August 16; moist ground near water's edge.
- Dryas integrifolia* Vahl.
Maguse River (25 miles up) N.W.T., July 7, and Maguse Lake, N.W.T., July 28.
- Potentilla palustris* (L.) Scop.
Padli, N.W.T., August 16.
- Rubus arcticus* L.
Long Point, Man., June 30. Growing only in specific places; grass margin above high water mark of lakes.
- Rubus Champemorus* L.
Maguse River (25 miles up) N.W.T., July 7.
- Astragalus alpinus* L.
Maguse River (25 miles up) N.W.T., July 8, and Henningayuk Lake, N.W.T., August 12.
- Oxytropis Belli* (Britton) Palibine
Long Point, Man., June 29; sand.
- Oxytropis Maydelliana* Trautv.
Maguse River (25 miles up) N.W.T., July 7.
- Hedyscram boreale* Nutt.
Maguse River, N.W.T., July 12.
- Lathyrus palustris* L.
Along right of way, H. B. Ry., Gillam to Churchill, Man., June 13.
- Polygala Senega* L.
Along right of way, H. B. Ry., Gillam to Churchill, Man., June 13.
- Empetrum nigrum* L.
Point Churchill, Man., June 19 and Long Point, Man., June 30.
- Shepherdia canadensis* Nutt.
Churchill, Man., June 19.
- Epilobium angustifolium* L.
Maguse Lake, N.W.T., June 30.
- Epilobium latifolium* L.
Maguse Lake, N.W.T., July 18; sand and gravel.
- Hippuris vulgaris* L.
Maguse River, N.W.T., September 10; close to water's edge.
- Pyrola grandiflora* Rad.
Maguse River (25 miles up) N.W.T., July 7.
- Ledum palustre* L. var. *decumbens* Ait.
Churchill, Man., June 19, and Maguse River (25 miles up) N.W.T., July 7.
- Rhododendron lapponicum* (L.) Wahlenb.
Churchill, Man., June 19, and Maguse River (25 miles up) N.W.T., July 7.
- Loiseleuria procumbens* (L.) Desv.
Maguse River (25 miles up) N.W.T., July 7.
- Kalmia polifolia* Wang.
Maguse Lake, N.W.T., July 18; in wet moss on south-west exposure of banks.
- Phyllodoce coerulea* (L.) Bab.
Southern exposures of steep banks. Maguse Lake, N.W.T., July 26.
- Cassiope hypnoides* (L.) D. Don.
Maguse Lake, N.W.T., July 28; moist ground near water's edge.
- Cassiope tetragona* (L.) D. Don.
Maguse River, (25 miles up) N.W.T., July 7, also found along Padli River, N.W.T., 100 miles further inland.
- Andromeda Polifolia* L.
Eskimo Point, N.W.T., July 12.
- Arctostaphylos rubra* (Rehder & Wilson) Fern.
Long Point, Man., June 30.
- Vaccinium uliginosum* L. var. *alpinum* Big.
Maguse River (25 miles up) N.W.T., July 7.
- Vaccinium Vitis-idaea* L.
Long Point, Man., June 30.
- Diapensia lapponica* L.
Maguse River, (25 miles up) N.W.T., July 7.
- Androsace septentrionalis* L.
Churchill, Man., June 19; and Maguse River (25 miles up) N.W.T., July 8; sand.

Armeria labradorica Wallr.

Maguse River (25 miles up) N.W.T., July 8, and Maguse Lake, N.W.T., July 20; sand and gravel.

Mertensia maritima (L.) S. F. Gray

Long Point, Man., June 29; on sand.

Castilleja pallida (L.) Spreng. (var. *septentrionalis* A. Gray?).

Upper Maguse River, N.W.T., August 9.

Pedicularis arctica R. Br.

Maguse Lake, N.W.T., July 19, and Hennin-gayuk Lake, N.W.T., August 12.

Pedicularis lapponica L.

Maguse River, N.W.T., July 12.

Pedicularis flammea L.

Eskimo Point, N.W.T., July 12; wet ground.

Pinguicula vulgaris L.

Maguse Lake, N.W.T., July 27; swamps in clefts in the ground caused by polygonal solifluction.

Pinguicula villosa L.

Maguse Lake, N.W.T., July 18.

Campanula uniflora L.

Maguse Lake, N.W.T., July 25.

Erigeron eriocephalus J. Vahl.

Maguse River (25 miles up) N.W.T., July 8; sand.

Erigeron hyssopifolius Michx.

Upper Maguse River, N.W.T., August 9.

Erigeron acris L.

Upper Maguse River, N.W.T., August 9.

Antennaria campestris Rydb.

Along right of way, H.B.Ry. Gillam to Churchill, Man., June 19.

Antennaria isolepis Greene

Long Point, Man., June 30; Padli River, N.W. T., August 9, and Padli, N.W.T., August 12.

Saussurea angustifolia DC.

Maguse Lake, N.W.T., August 5; very common locally.

Arnica terra-novae Fernald.

Maguse Lake, N.W.T., July 20 and Padli River, N.W.T., August 9, sand.

Taraxacum ceratophorum (Ledeb) DC.

Maguse Lake, N.W.T., July 20, and Padli River, N.W.T., August 9.

Puccinia Urticae Lagerh.; on *Urtica gracilis* Ait.

Churchill, Man., June 19.

Melampsora arctica Rostr.; on *Salix reticulata* L.

Long Point, Man., June 30; on *Salix* sp.

Maguse Lake, N.W.T., July 20.

Thekapsora sparsa (Wint.) P. Magn.; on *Arctostaphylos rubra* (Rehder & Wilson) Fernald.

Churchill, Man., June 19.

Leocarpus fragilis (Dicks), Rost.; fruiting on woody base of *Rhododendron lapponicum* (L.) Wahlenb.

Churchill, Man., June 19. Det. H. T. Güssow.

Mycosphaerella Astrogali (Currey) Cke. (or near); on *Oxytropis Belli* (Britt.) Palabine.

Long Point, Man., June 29. Det. J. Dearness.

Pleospora herbarum (Pers.) Rabh., on *Eutrema Edwardsii* R.Br.

Maguse River, N.W.T. (25 miles up), July 7. Det. J. Dearness.

Delitschia furfuraceae Niessl.; on rabbit dung.

Long Point, Man., June 30.

Sporormia corynespora Niessl.; on rabbit dung.

Long Point, Man., June 30.

Sporormia leporina Niessl.; on rabbit dung and grouse droppings.

Long Point, Man.; June 30.

Fimiliaria fimicola Griff. & Seaver, on rabbit and cariboo dung.

Long Point, Man., and Maguse Lake, N.W.T., June 30.

Fimiliaria sp., on ptarmigan droppings.

Long Point, Man., June 30.

Fimiliaria discospora (Auersw.) G. & S.; on grouse droppings.

Long Point, Man., June 30.

**AUTUMN EXCURSIONS OF THE OTTAWA FIELD-NATURALISTS'
CLUB, 1933**

SEPT. 9—Hog's Back. Take Bronson Ave. O.E.R. car, and meet at bridge over Rideau Canal, 3 p.m. Walk along canal to Hog's Back.
Leader—C. M. STERNBERG.

SEPT. 16—Long Lake 12 miles N.E. of Buckingham. Meet outside Mines Branch, George and Sussex Sts., 3 p.m. Bring lunch, or good meal may be obtained at Mr. Daly's for 50c.
Leader—F. J. FRASER.

SEPT. 23—Berry's Landing. Meet at the front entrance of the National Museum at 3.15 p.m. Bring refreshments.
Leader—DOUGLAS LEECHMAN.

SEPT. 30—Chelsea Dam. Meet at Chelsea C.P.R. Station 3.30 p.m.
Leader—W. H. LANCELEY.

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ISSUED OCTOBER 2nd, 1933.

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CONTENTS

	PAGE
Supposed Blue Grosbeak Seen at Chatham, Ontario, in 1923. By E. H. Dorey.....	121
The Wapiti of the Riding Mountain, Manitoba. <i>An Ecological Study and Commentary.</i> By H. U. Green.....	122
Rotifera of Ottawa and District. By W. S. Odell and William E. Harris.....	132
Notes on <i>Helisoma latchfordi</i> Pils. and <i>Physa latchfordi</i> F. G. Baker. By A. LaRocque.....	134
Observations on the Nesting of the Killdeer Plover in the Prince Albert District in Central Saskatchewan. By O. C. Furniss.....	135
The Behaviour of a Land Bird at Sea. By R. Owen Merriman.....	139
Book Reviews:—	
The Exploration of Southampton Island, Hudson Bay. By P.A.T.....	140
Excursions to Long Lake, Quebec.....	142
Notes and Observations:—	
Tapeworm in Rabbits. By R. G. Law.....	142
Brünnichs Murre (<i>Uria lomvia lomvia</i>) in North Frontenac County, Ontario. By Robert Vince Lindsay.....	142
Barn Owls Nesting at Strathroy, Ontario. By A. A. Wood.....	143
Do Bullfrogs Eat Fish? By W. L. Scott.....	143
Birds and Their Winter Food. Susan K. Squires.....	143

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The Canadian Field-Naturalist

VOL. XLVII

OTTAWA, CANADA, OCTOBER, 1933

No. 7

SUPPOSED BLUE GROSBEAK SEEN AT CHATHAM, ONTARIO, IN 1923

By E. H. DOREY



THE FOLLOWING excerpt from the notebook of E. H. Dorey, of Chatham, Ontario, has been forwarded to the editor of *The Canadian Field-Naturalist*. While one hesitates to report a primary record for a locality on sight evidence alone, this account is so circumstantial and the essential details are so convincingly given that it is in many ways a model for similar reports. It is to be noted that all the evidence is given and the basis of the identification and the conditions of observation presented as recorded at the time in a manner that carries conviction and permits the reader to form his own judgment as to the accuracy of the conclusion.—P.A.T.

(May 18, 1923) “. . . Then came the biggest thrill of the day, and the biggest for many a day. I have been studying birds now for nine years and it is a red-letter day when I can add a new bird to my list of acquaintances. For ten or fifteen minutes under ideal light conditions I kept within from thirty to one hundred feet of a Blue Grosbeak, the first I have ever seen.

I was in McKerrall's woods and had just worked through the heavier and darker part of the taller timber which is already pretty well leafed out and was emerging into the open space covered with second growth, scrubby stuff and briars. As usual, I was working my way slowly and cautiously and stood for several minutes looking out over this sun-drenched opening in the woods. I had for some minutes been smiling to myself as I cocked my ear to the Indigo Bunting's song and looking forward with delight to the thrill that never grows old of seeing this brilliant little gem in the bright sunlight. I see him every year on the edges of this clearing and like to think it is the same individual. I was, of course, working with the light, which was very intense for the middle of May. Sure enough, there he was, right where he should be, sitting in the top of the half-grown elm where I have seen him for several years and singing for dear life. And he will be singing for many a week into hot July and

August when most of the other singers have given up! Quickly I had him in the field and there flashed on me that momentary thrill of delight and almost surprise at the strength and vividness of colour under a good glass.

I took the glasses away and stood listening again to his high-pitched, brilliant, but rather hard, little song. I like many others better, but it will do very well and the combination of colour and song should satisfy anyone!

Off to my right in the half-shade on the edge of the clearing I saw a bird moving and threw my glass on him leisurely to see what he was. Instantly I was excited in a way I haven't experienced in a long while. The Blue Grosbeak! I had often studied his picture but had never expected to see him without journeying south. I was all a-tingle. I had studied birds too long to be in doubt as to the identity, but rapidly I scrutinized him to make assurance doubly sure. Sure enough, there could not be a doubt of it. Noticeably larger than the Indigo Bunting and a single close look at his big nose was sufficient. I had seen scores of Indigo Buntings but this was something different! He looked pretty dark in the shade and his reddish shoulders did not show up clearly though he was obliging enough not to be frightened and moved slowly about a shrub.

Perhaps I could get him into the sunlight! I had made the identification certain, but wanted to see more of him. I moved slowly to my right keeping within the shady part. He did not seem nervous and I stopped from time to time and looked him over. I find that I can usually approach closer by taking plenty of time, and particularly by pausing for a few moments from time to time. I believe that they get used to one's presence and come to the conclusion that there is no harm meant.

Soon I was opposite him and moved slowly towards him. Step by step with my heart thumping I approached him. Sometimes he would sit and look at me while I raised the glasses slowly to my eyes and then he would jump so close that I held my breath. I began to feel that I

would see him in the sunlight for the air was heavy and hot and he didn't show that nervousness that birds and animals exhibit when they feel alarmed.

I came within thirty to forty feet of him. This was great. So many, many times I have felt heart-sick when I had a rare bird within sight and he wouldn't have the consideration to turn himself and let you make identification positive, with the result that I had been only almost certain and had refused to set him down on my list as another addition.

He moved a little more briskly and I knew he would fly. He did—right out into the open sunlight. How he flashed. Oh! How blue he was! A darker blue than the Indigo Bunting but very rich in the full sunlight and the reddish shoulders showed conspicuously. And his big dark beak!

The odd look that all the Grosbeaks have, particularly when you see them full face. What a beauty he was. Much larger and heavier than the Bunting. Lovely.

Slowly I followed him from shrub to shrub. I had already compared him with the illustration in Reed's *Bird Guide*. It is good and very like him, though the shoulder-patches are not quite so prominent as in the picture and the colour is about right for sunlight. I wondered whether the female was around. I saw nothing of her and kept hoping that he would sing. I was disappointed in this however. I kept within sight of him for a long time until finally he drifted back towards the shady part and I stopped following. This has been a wonderful treat and I will hunt for him again a few days later."

THE WAPITI OF THE RIDING MOUNTAIN, MANITOBA
An Ecological Study and Commentary
 By H. U. GREEN

(Continued from Page 111)

FOOD PLANTS CONSUMED BY WAPITI

GRASSES

Consumed during spring, summer, fall, and winter.

<i>Bromus ciliatus</i>	Brome Grass
<i>Cinna latifolia</i>	Reed Grass
<i>Festuca elatior</i>	Meadow Fesque
<i>Hordeum nodosum</i>	Squirrel-tail Grass
<i>Panicum virgatum</i>	Switch Grass
<i>Phleum pratense</i>	*Timothy Grass
<i>Spartina michauxina</i>	Slough Grass

*Probably introduced.

SEDGES

Consumed for the most part during fall and early winter.

<i>Carex albolutescens</i>	<i>Carex muskingumensis</i>
" <i>bicknellii</i>	" <i>pedunculata</i> .
" <i>cristata</i>	" <i>straminea</i>
" <i>fenea</i>	" <i>tenniflora</i>
" <i>mirabilis</i>	

WEEDS

Consumed during spring, summer, and early fall.

<i>Aquilegia canadensis</i>	Columbine
<i>Artemisia ludoviciana</i>	White Sage
<i>Cirsium</i> sp.	Thistle
<i>Fragaria virginiana</i>	Wild Strawberry
<i>Hieracium aurantiacum</i>	Paint Brush
<i>Polygala Senega</i>	Snake Root
<i>Senecio integerrimus</i>	Squaw Weed
<i>Sonchus arvensis</i>	Sow Thistle

Taraxacum officinale Dandelion

Mainly consumed during late fall and winter.

<i>Aster commutatus</i>	Wild Aster
" <i>juncceus</i>	" "
" <i>modestus</i>	" "
" <i>puniceus</i>	" "
" <i>siriceus</i>	" "
" <i>umbellatus</i>	" "
<i>Solidago</i> sp?	Golden Rod

BROWSE

During the open months leaves for the most part are consumed and tender annual growth in the early fall, winter, and early spring.

<i>Acer negundo</i>	Box Elder
" <i>spicatum</i>	Mountain Maple
<i>Alnus incana</i>	Alder
<i>Amelanchier spicata</i>	June Berry
<i>Betula pendula</i>	White Birch
<i>Cornus canadensis</i>	Bunch Berry
<i>Fraxinus nigra</i>	Black Ash
<i>Populus balsamifera</i>	Balsam Poplar
<i>Populus tremuloides</i>	Aspen Poplar
<i>Pyrus americana</i>	Mountain Ash
<i>Quercus macrocarpa</i>	Bur Oak
<i>Ribes cynosbati</i>	Wild Gooseberry
<i>Rosa blanda</i>	*Wild Rose

*No record of woody growth being consumed. The thorns apparently give the plant ample protection.

<i>Rubus idæus</i>	Wild Raspberry
<i>Salix glaucophylla</i>	Willow
“ <i>longifolia</i>	“
“ <i>pedicellaris</i>	“
<i>Sambucus canadensis</i>	Elder
<i>Viburnum opulus</i>	High Bush Cranberry

TIMES OF ACTIVITY; SEASONAL MOVEMENTS AND ASSOCIATED HABITS

Strictly speaking, Wapiti may be considered as crepuscular and nocturnal rather than diurnal, for during the brightest hours of the day they usually remain concealed, or at best stay close to the protective cover of thickets and heavy timber. This does not imply that activity actually ceases at sunrise, but that it is modified and confined to small areas within the forest and about small clearings offering possibilities for an easy get-away in case of danger.

When the deepening shadows of evening dull the sky, solitary individuals and little bands begin to appear about the forested edges of large meadows, ridges, and extensive prairie areas, grazing slowly into the open as darkness descends. From dusk until about midnight grazing progresses continuously, followed by a period of rest to chew the cud. Then, feeding is again in order, but as dawn approaches they drift slowly towards the cover of the forest and thick brushy areas. By sun-up, if the dawn is bright, not an animal is to be seen in the open.

During the temperate seasons, water is sought in the numerous creeks and ponds as soon as shelter is reached. After drinking copious drafts and browsing on the lush vegetation thereabouts, a move is made to the daytime range when they lie and rest again and chew the cud. Shortly before noon, activity is again noticed, and one by one the animals rise and commence to browse, and graze on the sparse vegetation of the forest floor. At mid-afternoon they may lie down again for an hour or two, or rest standing. Towards evening a leisured drift towards some open place ushers in the beginning of another night's excursion.

Throughout the year there is little variation in the daily movements. However, exceptions sometimes occur. For instance, Wapiti may be observed on the open prairies at mid-day when it is dull and stormy with light conditions

simulating evening. The seasons though, do affect the number of individuals seen in company with one another, the herd relation of the sexes, and the relative closeness of the scattered bands.

In winter, the coherence of Wapiti reaches its greatest proportions. Hundreds will be seen together, males apart from females or among them without close contact, coming many miles to feed on the open plains in the Kennice and Audy districts. It is not an uncommon sight to see herds up to 500 or more in number about these areas when the snow is deep. Other portions of the range are inhabited by small bands, but the general trend of winter movement is towards the districts mentioned.

At the advent of spring, the large congregations break up, males and females dispersing separately in little bands each drifting off to the chosen ranges, often some distance apart. A further dissolution among the females is evident as parturition approaches, at which time the yearling females become separated from their dams.

It is often said, especially by Indians, that, whenever possible, females of the deer family return to the place of their birth to bring forth their young. This, I believe, is suggested in the case of the Riding Mountain Wapiti by the large assemblage of females who frequent the basin about the headwaters of the Vermilion River at calving time. I have noted 300 or more female Wapiti in this area during the months of May and June in the seasons during which the Wapiti were under observation, many of whom were pregnant or had already calved. Other areas nearby were also observed to harbour many Wapiti heavy with calf. Isolation is the exception rather than the rule.

When about to drop their young, female Wapiti temporarily desert the bands they have been running with and seek some secluded and sheltered spot to calve, remaining in the vicinity until their offspring have gained sufficient strength to follow them. Then, they bunch again, staying more or less together throughout the summer.

In the meantime, the males continue their bachelor existence until the approach of the rutting season when the mature males move towards the female ranges to breed, followed by the sub-adults and juveniles.



Wapiti Calf, Riding Mountain Range.

Photo by H. U. GREEN.

There is also a tendency at this time for the female bands to close together without actually forming a herd. The sub-adult and juvenile females, too, return to bands of mature animals of their sex.

After the rutting season, both sexes, irrespective of age, remain on the same range without association until the following spring, when the seasonal movements are repeated.

Wapiti, however, akin to other mammals, refuse to conform always to an established mode of life and, consequently, exceptions are evident from time to time. Therefore, this outline of their activities and seasonal movements must be considered as representing general behavior without reference to contrary and occasional observations which, by virtue of their isolation, are apt to confuse rather than assist.

TRAILS; FÆCES; TRACKS AND OTHER SIGNS

There are few sections within the reserved area of the Riding Mountain where evidence of Wapiti habitation cannot be observed. Game trails used almost exclusively by them, but on occasion travelled by moose, white-tailed deer, mule deer, and domestic cattle, criss-cross the range at frequent intervals. Generally, the trails lead from the forest and

thickets to the open prairies, follow the valleys of the creeks and streams, and approach favoured watering places from all directions.

When much used, the main Wapiti trails are often from four to six inches deep, forming, as it were, trunk highways from which side paths radiate to favourite daytime cover. During the winter months, when the snow is deep, the trails are seldom used, except near the borders of the main feeding grounds or by small detached bands wandering here and there about the outskirts of the range.

In the Riding Mountain, a well-worn game trail, irrespective of other signs, can at once be attributed to Wapiti. Tracks in the moist places, fæces, and the height from which vegetation has been browsed, aid a determination should doubt exist when other members of the deer family and domestic cattle have passed along.

The fæces of Wapiti, when normal, are distinctive and not readily confused with the fæces of any other wild or domestic mammal, except, perhaps, the porcupine (*Erethizon dorsatum*) which, however, is not known to inhabit the Riding Mountain.

Wapiti fæces may be described as ovate, cylindrical pellets composed of minute particles of fibrous vegetable mater, measuring on an average, when passed by adults, 35 mm.

in length and 18 mm. in diameter. The normal colour when dropped is a shiny medium brown, turning in a few hours to a deep dull chocolate brown, which again changes in about 24 hours to a dull black. The size of the pellets, of course, varies with the age of the animal. Very small calves, though subsisting entirely upon milk, pass fæces, until vegetation is added to the diet, similar in texture and consistency to those of the young of domestic cattle. This, also, is the case with all Wapiti during the early spring when a diet of dry vegetation is abruptly changed to tender shoots of green grass and other succulent food. Wapiti prefer to remain still while defecating. The number of pellets passed at one time varies from ten to thirty.

Evidence of where numbers of Wapiti have remained from day to day in the winter season can be readily seen in the spring from the quantity of fæces thereabouts, which often entirely cover the ground to a depth of several inches.

There is little likelihood of mistaking the fæcal pellets of Wapiti for those of white-tailed and mule deer. The latter are proportionally smaller, less ovate and passed in greater number.

At no season of the year are signs of urination alone of any particular value without

the presence of other signs, for Wapiti and moose leave similar indications. However, when snow is on the ground the sex of the animal leaving the tell-tale characteristic mark is unmistakably evident. Males create a more or less circular hole, standing with hind legs close together, while females, with hind legs apart, make a somewhat lengthy depression, both in every way like humans.

Wapiti tracks can be observed to best advantage in tacky mud about two inches deep, which receives a true impression capable of furnishing data of appreciable worth. The tracks are distinctive, but may be confused at first glance with those of domestic cattle. Close inspection, however, together with other evidence usually available, reveals the difference. Wapiti tracks on hillsides and in fairly deep mud, invariably show the marks of the false hoofs not noticable with domestic cattle under like conditions.

The difference existing between the various hoof impressions found on the Riding Mountain Wapiti range may be briefly described as follows: (Reference is made to adult animals.)

Moose.—The largest cloven hoof-print found on the Riding Mountain range. Longer and more distinctly oval than those of wapiti and domestic cattle. Tips of front toes more pointed. Delicate in outline in spite of size in com-



The Protective Colouration of Young Wapiti is Evident to the Camera.

Photo by H. U. GREEN.



Front and Hind Foot Tracks of Adult Male Wapiti Cast in Plaster.

Plaster Cast by H. U. GREEN.

Photo by G. AIKMAN.

parison to wide clumsy appearance of domestic cattle tracks.

Wapiti.—Smaller and less oval than moose tracks. Points of toes more rounded. General shape somewhat similar and equally delicate. Metatarsal joints very flexible, often leaving impressions of false hoofs.

Cattle.—Tracks of adult cattle are clumsy in comparison with those of Wapiti, being

longer and of greater width in relation to length. In the case of two year old cattle the length is about the same. The greater width, though, is quite evident. Generally, it may be said that cattle tracks have a more rounded appearance irrespective of the animal's age.

White-tailed Deer.—Small tracks, almost round, and outline delicately heart-shaped. Cannot possibly be confused with the tracks of



Front and Hind Foot Tracks of Three Year Old Steer Cast in Plaster.

Plaster Cast by H. U. GREEN.

Photo by G. AIKMAN.

young cattle, moose, or Wapiti. Heart-shaped outline obvious at first glance.

Mule Deer.—Hardly distinguishable from white-tailed deer, except that heart-shaped impressions are not quite so pronounced in outline.

For the purpose of comparing the front and hind foot tracks of Wapiti and cattle, I cast in plaster those of a three-year-old steer and an adult male Wapiti. The resulting plaques were photographed and are presented with this study.

Comparative measurements are as follows:

Wapiti.—Extreme length: Fore, 105 mm.; Hind, 111 mm.

Extreme width: Fore, 80 mm.; Hind, 86 mm.

Width of heel: Fore, 65 mm.; Hind, 68 mm.

Steer.—Extreme length: Fore, 112 mm.; Hind, 121 mm.

Extreme width: Fore, 98 mm.; Hind, 109 mm.

Width of heel: Fore, 70 mm.; Hind, 100 mm.

One glance at the photographs, I believe, clearly illustrates the difference which exists.

In addition to trails, fæces, and foot tracks, the following other characteristic Wapiti signs are listed:

- (1) Marks of incisor teeth on the trunks of aspen trees to secure bark for food.
- (2) Dirt and shale slides along the banks of creeks and streams, utilized for the purpose of play.
- (3) Torn-up circles in the earth saturated with strong-smelling urine, made by the front feet of stamping adult males prior to rutting time.
- (4) Willows and small trees barked and torn by slashing antlers to remove "velvet" and polish tines.
- (5) Forms or beds made at night in the open and in the forest during the day.
- (6) Height of browsed vegetation in comparison with other deer. Moose feed the greatest distance from the ground when standing on all four feet.
- (7) Distinctive audible sounds characteristic of Wapiti.

Each is formally mentioned elsewhere under separate headings.

GAITS; SPEED AND ENDURANCE; SWIMMING; JUMPING; PLAY

When not alarmed or suspicious, Wapiti never seem in any hurry and move about quietly without fuss at a slow even walk, stopping occasionally to browse or graze. The walk is deer-like and graceful for so large an animal.

Three other gaits are evident: a trot, a canter, and a somewhat laboured gallop.

The trotting gait is favoured when making a get-away in timber and heavy bush, or when danger is observed at a distance and undue haste unnecessary. I have also seen small bands trot when approaching a watering place, in the same manner as horses often do. The canter is favoured, according to my observations, when individuals or small bands are suddenly surprised in the open at relatively close quarters, but if not pursued or greatly agitated they soon revert to a fast trot.

Only one Wapiti, a mature male, was observed to gallop. I almost stumbled over him as he rested in a small hollow. His astonishment was as great as mine, and his desire to reach a place of refuge as quickly as possible was no doubt responsible for the best speed at his command. It was a true gallop.

The gaits briefly mentioned are common to Wapiti of all ages. In very young animals, though, the canter at first glance appears to differ, but close observation proved that the variation in distance between footfalls was responsible for the visual error.

The acts of lying down and rising from the ground resemble those of the deer-family in general. When about to lie down, Wapiti first assume a kneeling posture while the hind legs remain rigid; then the hind quarters relax and the prone position is taken. When getting up the reverse is the rule, for the hind quarters rise first, followed by the fore quarters from bended knees.

When alarmed the head of both sexes is held high with muzzle slightly elevated. This is particularly noticeable when the animals mill suspiciously prior to speeding away. Heavily horned males invariably adopt this attitude when in motion, and often it seems as if the tips of their antlers almost touch their backs. This posture, though, is not without value when negotiating heavy brush and timber; for contrary to expectation the antlers in no way retard progress and even assist to fend away

branches and low-hanging boughs which otherwise might prove a hindrance.

Regarding the speeds of the various gaits, I have only one authentic observation to offer. The speed of any wild animal under natural conditions can only be roughly approximated and such an estimate, consequently, is of little value. An unlooked-for opportunity, however, presented itself of accurately timing by automobile speedometer, a small band of cantering Wapiti, well represented by different ages.

On the morning of December 15th, 1930, I travelled across the Wapiti range from Dauphin to Kippan's Mill by way of the road from Dauphin to Clear Lake in a new Ford truck, the property of the Canadian National Parks, driven by a Parks Branch employee, Chas. W. McLachlin. There was a slight covering of snow upon the ground, and the air was heavy with frost. When emerging from the bush to a narrow strip of prairie fringed with aspen growth near Mile 12, a band of seven Wapiti—three adult females, two yearlings rising two years old, and two calves—was observed grazing on the west side of the road. They were not unduly alarmed by the approaching truck which was moving at about 18 miles per hour, but speed was reduced to 8 miles per hour when we came close to them. Usually, under similar conditions, Wapiti would have immediately turned at a right angle and sped to cover. For some reason, though, this particular band wished to cross the road to the east, for they cantered parallel to the truck about 50 feet away as if endeavouring to get sufficiently ahead to cross in front of it. As they increased their speed the truck kept even pace. My records show that the truck was moving at 11.5 miles per hour. The distance traversed at this speed was seven-tenths of a mile when the leader of the band apparently gave up the idea of crossing the road and turned sharply to the west, followed by the others. During the whole time the band kept an even pace with the leader, an adult female, who in turn was followed almost in line by the second adult, the yearlings, and, in the rear, the two calves. The adults showed no signs of tiring, the yearlings were obviously fatigued, and the calves visibly distressed with tongues hanging out, panting heavily.

By comparison, I would think, a fast trot approximates about 8 miles per hour; a slow

trot from 6-7 miles per hour, and a gallop about 13 miles per hour.

Wapiti are quite at home in water, wading to a considerable depth to enjoy its coolness during the heat of the summer days. There is little deep water to be found on the main Wapiti range, but in any event it is doubtful if, without some good reason, they would resort to swimming for the purpose of reaching a destination, which could be attained by land, unless closely pressed. I have witnessed, however, on two noted occasions individual Wapiti traverse deep beaver ponds. Both were surprised while grazing on the lush grass at the water's edge and chose the quickest way to make themselves scarce upon my sudden appearance at close quarters. The beaver ponds were less than 50 yards in width. Both swam without effort with head and shoulders well above water.

I have also a further record of a young calf about three weeks old taking to the comparatively deep water of a flooded hay meadow to avoid capture. After swimming about 20 yards of, approximately, a 150 yard stretch, it became entangled in a thick clump of partially submerged tules and unfortunately drowned before it could be rescued. I doubt, though, owing to its tender age if it could have completed the journey to the opposite side.

Compared with the white-tailed and mule deer, the Wapiti is a poor jumper, although the usual forest barriers are cleared without effort. White-tailed and mule deer leap high above the average obstacle, while Wapiti, under all circumstances, invariably detour when the object in their path is over three feet in height, unless able to break through it. White-tailed and mule deer will jump a three-strand barbed-wire fence. Wapiti, on the other hand, will push against the strands until the wire is loose and saggy or the staples fly from the posts. For this reason it is impossible to keep a barbed-wire fence intact in the Wapiti country.

Like most animals, Wapiti delight to gambol and play, to vary, no doubt, the seeming monotony of a somewhat placid existence. On the banks of the creek valleys cutting deep through the Wapiti range, numerous steep slides of earth and shale approached by well-worn game trails, may be constantly observed. For some time their continual fresh appearance was not



Study of Head of Young Wapiti Calf.

Photo by H. U. GREEN.

understood, until one morning when approaching a beaver pond under observation I came upon four adult males and two yearlings of undetermined sex amusing themselves near the top of a shaly incline. The yearlings seemed to enjoy biting each other about the hind legs, meanwhile slipping down almost to the bottom. After a few minutes, they laboriously climbed back again and began teasing the adults by butting their flanks and making friendly passes at them with their fore feet. Impelled by the yearlings' frolic, the adults began to play rather languidly, sliding down the incline together. This went on until I showed myself some five minutes later, when they sought the top of the slide and disappeared.

Since this occurrence I have noted many similar performances on shale and dirt slides and about grassy slopes. One other observation was recorded when in company with Mr. James Smart, Superintendent of the Riding Mountain National Park. Walking along an elevated ridge above a stretch of meadow land, we noticed nine adult and sub-adult Wapiti playing on a grassy slope about 500 yards away. All were close together, milling around, bucking, and rising on their hind feet. Suddenly, one pair and then another engaged in a contest of strength, pushing with head against

head as cattle often do. Then, without any warning, one feigned alarm and trotted with head held high to the cover of an aspen bluff close by, followed by the rest of the band. In a moment they all returned to the slope and carried on with the play until frightened by our appearance.

Small calves, too, find diversion in frolic, although not so intensely as their elders. I have often watched two or three little fellows scampering about together while their mothers stood watching them with apparent satisfaction.

CALLS; ODOUR; SCENT AND HEARING; EYESIGHT

The calls of Wapiti once heard and identified are unlikely to be confused with any other forest sound. They are distinctive and noticeably different, whether voiced by male, female, or tiny calf.

Contrary to local opinion, both adult males and females utter the call known as "bugling". When heard at close quarters it would be expressed phonetically as: *ai-eeeeeeee-ea-yeough*, commencing on a clear low note and rising rapidly in pitch and intensity to a shrill whistle, terminating on a low note followed by a grunting rattle as if caused by an intake

of breath. (I have not expressed the sound of the rattle in the phonetic interpretation.) When heard from a distance the first low note and the grunting rattle are not audible: *eeeeee-ea yeough*.

The "bugling" of male Wapiti is evidently a secondary sexual characteristic, for it was never heard except during rutting season and about a week prior to its inception. Before the commencement of the rutting season, however, the call lacks full-throated intensity and volume.

At first it was believed that male Wapiti "bugled" in the spring and early summer, but intensive study showed that the females were responsible. The "bugling" call of the female is similar in every way to that of the male but without masculine volume. In fact, by comparison, it is noticeably feminine once its origin is definitely determined. As in males, "bugling" among females is seasonal and evident only during calving time. Consequently it may also be considered as a secondary sexual characteristic, although remote from actual sexual activity.

*No evidence was gathered which in any way would suggest that "bugling" in either sex is used as a means of communication. Neither is there any evidence to show that

it is applied by rutting males as a vocal medium for challenging rivals to combat. With both males and females, I have come to believe, it is merely an outlet for self-expression much as domestic animals voice their emotions without apparent purpose.

One other distinctive call common to both sexes is heard at all seasons of the year. It may be classified as a call of curiosity or apprehension, depending upon the circumstances responsible for its utterance. Expressed phonetically this call resembles a hoarse throaty bark: *eeeeeeee-cough*, deeper in males than females, the difference being readily distinguished by an experienced ear.

Travelling about the Wapiti country this call is repeatedly heard as individual animals scent or see the human intruder. Scent, without sight of its origin, calls for a "bark" which expresses apprehension rather than curiosity. On the other hand, sight without scent when the intruder is at a respectful distance and moving parallel to or away from them incites a "bark" of less insistence which registers nervous curiosity. When surprised at close quarters by either human presence or scent, no sound is uttered.

On several occasions in summer and winter Wapiti have approached my camp in daylight



This Little Fellow Required Restraint before he Consented to Pose.

Photo by H. U. GREEN.

and under cover of darkness, remaining in the vicinity "barking" at irregular intervals often for more than an hour. The voice in these instances expressed only mild curiosity. In fact, it is a simple matter after working amongst Wapiti for any length of time to determine their reactions to different stimuli by the tone and deliverance of this expressive call.

I doubt very much if, from my observations, it can be inferred that the "barking" call of Wapiti is altruistic in its purpose, for it is not only uttered by individuals of a band or herd, but by isolated animals remote from their kind. Unquestionably though, cognizance is taken of its meaning when Wapiti are together, as they react to the curiosity or apprehension of the member who voices it even if they do not realize its purpose. This point has been amply proved.

During the rutting season male Wapiti have been heard to grunt: *ugh-ugh*, while covering their females, caused, no doubt, by sexual excitement.

The cry of young Wapiti calves is normally a shrill petulant *eeeeeeeee*, which is intensified to an actual shriek when unduly alarmed. The noise a youngster can produce when handled by humans is astonishing. Their mothers often answer them with a similar sound of deeper tone approaching a murmur. As calves grow older there is a tendency for their voice to become less infantile. I have heard them in the first winter after birth utter sounds which closely simulate the voice of infancy, except that the tone was harsher. I do not think that young Wapiti utter the calls of adults until they are two years old.

The secretion of the metatarsal glands would seem to be a means of communication, or at least a medium by which the fact is conveyed that individuals or bands have recently frequented or passed through certain areas. The unctuous secretion is, without doubt, produced involuntarily, tainting the foliage of the forest and prairie as contact is made during the animals' movements. The odour of the glands is distinctly nauseating to the average human, yet difficult to describe. It is, however, not as objectionable as the metatarsal secretion of the white-tailed and mule deer. The odour can often be detected under natural conditions by a sensitive nose about heavy vegetation and areas of hazel scrub, especially when the

air is damp and heavy. During the rutting season a similar odour is particularly noticeable in the vicinity of bands of breeding animals. This smell is sweeter and more musky and, I believe, may be attributed to sexual activity and excitement. Wapiti calves, like all young of the deer family, apparently have no odour which can be detected by humans and other mammals.

The prong-horned antelope, an animal of the open prairie, depends on keen eyesight alone as a means of detecting the presence of unfriendly forms; the moose, inhabiting dense forest where keen vision is of little use, relies on scent and hearing to acquaint itself of enemies, and the Wapiti, a denizen of both forest and plains, is endowed with scent, hearing, and a good measure of sight for a similar purpose.

It is difficult to estimate just how far, under favourable conditions, Wapiti can detect man-scent. The greatest distance recorded in semi-open country where, by careful manoeuvring, visual detection was impossible, is approximately 300 yards. Hearing, generally, especially in timber, is difficult to estimate. I have one noted observation, though, where the ordinary tone of the human voice carried with the wind was heard by Wapiti grazing in the open a quarter of a mile away.

The eyesight of Wapiti is very keen, and moving objects are noticed at a considerable distance. On many occasions when emerging from the forest bordering extensive prairies and meadows I have been detected without the aid of scent approximately three quarters of a mile from where they stood.

In the forest, the Riding Mountain Wapiti may, with caution, be approached upwind to within about thirty yards, a feat impossible in the open without intervening shelter.

Like the moose, it is apparent that Wapiti can only detect life through motion, but at a much greater distance. This, however, does not apply in the case of humans when bright clothes are worn, for a red blanket coat used by the writer to make the necessary test was readily detected at about 300 yards through intervening trees while motionless. Apparel of sombre colour would not have been noticed under the same conditions 100 yards away, which also proves that Wapiti, unlike moose, are not insensible to brilliant hues.

Clothing of forest-green, khaki, and olive-

drab was used by the writer when observing white blanket coat and white tuque afforded Wapiti during the open months. In winter, a the best means of avoiding visual detection.

(To be continued)

ROTIFERA OF OTTAWA AND DISTRICT

By W. S. ODELL and WILLIAM E. HARRIS



URING the summer of 1932 the authors made a tour of the lakes, ponds and rivers in the Ottawa district, collecting and examining the microscopic life therein. Below will be found a list of the rotifers which have been definitely identified. The list was submitted to Mr. Frank J. Myers, Research Associate in Rotifera, of the American Museum of Natural History, who kindly revised the nomenclature, bringing it up to date and in line with the laws of the International Code of Zoological Nomenclature, which has been adopted by all authorities. The list has been arranged in alphabetical order, giving first, the correct name; secondly, the old name (this is for the assistance of those who have old textbooks); and thirdly, the place where found.

In making a systematic series of visits to various ponds, etc., it has been found that the Rotifera change considerably; specimens that were plentiful on one visit, two or three days later were completely missing. The explanation may be that many of the Rotifera react very definitely to the pH of the water so that heavy rain after a period of dry weather may so upset the pH as to kill off many types that require a definite pH for their continued existence.

Mr. Odell reports having found *Asplanchna* in the Rideau Canal in such quantities as to give the water a milky appearance, whilst a day or two later the water was clear and not an *Asplanchna* to be found. Mr. Myers reports similar experience in the States and that the *Asplanchnas* had either reached an optimum and there was not enough food to go round, or, due to rain meantime, the pH had been so upset that all the animals died.

Many other forms of microscopic life were observed but only the Rotifera were studied.

The following is the list of ponds and lakes visited, with the abbreviations used in the list below. Central Experimental Farm, (C.E.F.),

Patterson's Creek, (P.C.), Rideau River, (R.R.), Brown's Inlet, (B.I.), Pond at Wychwood, (P.W.), Pond at mouth of Jock River (P.J.R.), Bay of Ottawa River at Val Tetreau, (V.T.), Rideau Canal at Hartwell's Locks (C.H.L.).

McKay Lake, Rockcliffe (McK.L.) McDonald's Lily Ponds, Montreal Road (McD.), Mecharicsville, Ottawa River (M.O.R.), Dow's Lake (D.L.), Rideau Canal, (R.C.), Pond on Carling Avenue, (P.C.A.).

LIST OF SPECIES, SUMMER, 1932.

Not—Where no second name is given, the first name is retained.

- Anuraeopsis fissa* (Gosse) R.R.
Ascomorpha eucadis Perty (*Sacculus Viridis* Gosse) R.R.
Asplanchna brightwellii Gosse. C.E.F. R.R.
pridonta Cosse. C.E.F. B.I. (The male)
pridonta Gosse. P.C. (common)
multiceps (Schrank) (*Asplanchnopus myrmelio* Ehr) P.W.
Beauchampia crucigera (Dutrochet) (*Cephalosiphon limnias* Ehr.) B.I.
Brachionus capsuliflorus Pallas (*Brachionus Bakeri* Ehr) C.E.F.
calyciflorus Pallas (*Brachionus Pala* Ehr) P.J.R.
patulus Muller (*Brachionus Militaris* H and Gosse) C.E.F.
Colurella bicuspidata (Ehrenberg) (*Colurus bicuspidatus* Ehr) R.R.
colurus (Ehrenberg) (*Colurus grallator* Gosse) R.R.
Collotheca ambigua (Hudson) (*Floscularia ambigua* Hudson) McD.
campanulata (Dobie) (*Floscularia campanulata* Dobie) McD.
cornuta (Dobie) (*Floscularia cornuta* Dobie) McD.
coronetta (Cubitt) (*Floscularia coronetta* Cubitt) McD.
ornata (Ehrenberg) (*Floscularia ornata* Ehr) McD.
trilobata (Collins) (*Floscularia trilobata* Collins) McD.

- Conochilus hippocrepis* (Schrank) (*Conochilus volvox* Ehr) R.R.
unicornis Rousselet B.I.
- Cyrtonia tuba* (Ehrenberg) McK.L.
- Dissotrocha aculeata* (Ehrenberg) (*Philodina aculeata* Ehr) R.R.
- Epiphanes brachionus* (Ehrenberg) (*Notops brachionus* Ehr) McK.L.
senia (Muller) (*Hydatina Senta* Ehr) M.O.
- Euchlanis dilatata* Ehrenberg. C.E.F. (common)
macrura Ehrenberg R.R. (common)
triqueta Ehrenberg P.C. C.E.F. (common)
- Filina longiseta* (Ehrenberg) (*Triarthra longiseta* Ehr) C.E.F.
- Floscularia conifera* (Hudson) (*Melicerta conifera* Hudson) C.E.F.
ringens (Linnaeus) (*Melicerta ringens* Schrank) R.R. (common)
- Gastropus stylifer* Imhof C.E.F.
- Keratella cochlearis* Gosse (*Anurea cochlearis* Gosse) P.C. (common)
cochlearis var: *tecta* (Gosse) (*Anurea tecta* Gosse) C.E.F.
quadra (Muller) (*Anurea Aculeata* Ehr) C.E.F.
- Lacinularia flosculosa* (Muller) (*Lacinularia socialis* Ehr.) C.E.F.
- Lecane luna* (Muller) (*Cathypna luna* Ehr.) P.J.R.
- Lepadella ovalis* (Muller) (*Metopidia solidus* Gosse) C.E.F.
- Limnias ceratophylli* Schrank R.R.
melicerta Wisse (*Limnias annulatus* Bailey) R.R.
- Macrochaetus collinsii* (Gosse) (*Dinocharis collinsii* Gosse) (*Polychaetus collinsii* Gosse) B.I.
- Monommata longiseta* (Muller) (*Furcularia longiseta* Ehr) R.R.
- Monostyla lunaris* Ehrenberg R.C.
quadridentata Ehrenberg McD. swimming pool.
- Mytilina mucronata* (Muller) (*Salpina mucronata* Ehr) C.E.F.
ventralis var: *brevispina* (Ehrenberg) (*Mytilina brevispina*) R.R.
ventralis (*Mytilina eustata* Gosse) C.E.F.
- Notholca longispina* Kellicott McK.L.
striata var: *acuminata* Hudson (*Notholca acuminata* Ehr) B.I.
striata var: *labis* Gosse (*Notholca labis*) D.L.
- Notommata aurita* (Ehrenberg) R.R.
contorta (Stokes) B.I.
copeus Ehrenberg (*Copeus labiatus* Gosse) V.T.
- Notommata pachyura* (Gosse) (*Copeus pachyura* Gosse) C.E.F.
tripus Ehrenberg C.E.F. P.J.R.
- Pedalia mira* (Hudson) (*Pedalion mirum* Hudson) C.E.F.
- Platyias quadricornis* (Ehrenberg) (*Noteus quadricornis*) McK.L. C.E.F.
- Ploesoma hudsoni* (Imhof) R.C.
lenticulare (Herrick) B.I.
truncatum (Levander) B.I.
- Polyarthra trigla* Ehrenberg (*Polyarthra platyptera* Ehr) R.C.
- Ptygura longipes* (Wills) R.R.
- Rotaria macrura* (Ehrenberg) (*Rotifer macrurus* Schrank) P.C.A.
neptunia (Ehrenberg) (*Actinurus neptunius* Dobie) C.E.F. (*Rotifer neptunius* Schrank) P.C.A.
rotatoria (Pallas) (*Rotifer vulgaris* Schrank) C.E.F.
tardigrada (Ehrenberg) (*Rotifer tardis-citirunus* Ehr) C.E.F.
- Scardidium longicaudum* Ehrenberg R.R. Fairy Lake
- Sinantharina socialis* (Linnaeus) (*Megalotrocha alboflavicans* Ehr) R.R.
- Squatinella mutica* (Ehrenberg) (*Stephanops muticus* Ehr) R.R.
- Stephanoceros fimbriatus* (Goldfuss) (*Stephanoceros eichornii* Ehr) B.I. R.R.
- Synchoeta oblonga* Ehrenberg P.C. R.R.
stylata Wierzejski C.E.E.
pectinata Ehrenberg P.C.
tremula Ehrenberg C.E.F.
- Testudinella patina* (Hermam) (*Pterodina patina* Ehr) P.C.
reflexa (Gosse) (*Pterodina reflexa* Gosse) C.E.F.
- Trichocerca cylindrica* (Imhof) (*Rattulus cylindricus* Imhof) R.R.
cristata (Ehrenberg) (*Mastigocerca carinata* Ehr) R.R.
elongata (Gosse) (*Mastigocerca elongata* Gosse) B.I.
longiseta (Schrank) (*Mastigocerca bicornis* Ehr) V.T.
rattus (Muller) (*Mastigocerca rattus* Ehr) R.R.
- Trichotria pocillum* (Muller) (*Dinocharis pocillum* Ehr) B.I. (common)
tetractis (Ehrenberg) (*Dinocharis tetractis* Ehr) C.E.F.

NOTES ON *Helisoma latchfordi* Pils. and *Physa latchfordi* F. G. Baker

By A. LaROCQUE



EACH LAKE, about twelve miles northwest of Ottawa, is inhabited by two snails of unusual interest. The first is a variety of *Helisoma antrosum* and the second a *Physa*, both distinguished for their unusually large size. Both have long been known to conchologists through the work of the Honourable F. R. Latchford, dean of Canadian conchologists, who collected them and distributed them through exchange. Appropriately enough, both have been named in his honour.

In June, 1932, the writer visited Meach Lake to obtain specimens of these two snails and this paper is the result of the observations made at that time.

HISTORICAL

Physa latchfordi was long known as *Physa lordi* and *Helisoma antrosum latchfordi* did not receive a name until 1927, so a brief summary of the history of each may prove interesting.

Helisoma antrosum latchfordi (Pils.)

In 1884 Latchford and Poirier noted the "*Planorbis bicarinatus* of much greater size than any previously found" which occurred in Meach Lake. In 1893 a special excursion of the Conchological Branch of the Ottawa Field-Naturalists' Club had as its main object the collecting of this "extraordinary form of *P. bicarinatus* which Meach Lake and Brome Lake of all the waters of America are alone known to furnish" (Latchford 1893-94). Walker (1909:6) referred this form to *Planorbis bicarinatus percarinatus* but Pilsbry (1927) considered it distinct and described it under the name *Planorbis antrosum latchfordi* in the *Nautilus* for January, 1927. For the use of *Helisoma* as the generic name, see Baker, 1928, p. 310.

Physa latchfordi F. C. Baker

This was first noted by Gilbert Heron (1880) who identified it as *Physa lordi* Baird and gave some details as to the altitude of the lake, the age of the rocks in the vicinity and the accompanying mollusca. Subsequent workers accepted Heron's identification and noted the occurrence of "*lordi*" in Harrington and McGoey's Lakes in the same drainage and, doubtfully, in Chicott Lake twelve miles farther north. Baker (1928 p. 423) in discussing the *lordi*-like *Physae* of Wisconsin, writes of the Meach Lake species; "This *Physella* seems not to have been noticed

and it should receive a name. It may be called *Physella latchfordi* sp. nov., the type locality being Meach's Lake."

ECOLOGY

Meach Lake is one of a series of four connected lakes draining into the Gatineau River. The three larger lakes are Philippe, Harrington and Meach, the first being the northernmost. Meach Lake drains into McGoey's Lake much smaller than the other three, which in turn empties into Meach Lake, which joins the Gatineau River between Farm Point and Cascades.

The rocks, as noted by Heron (1880) are of Laurentian age and form a large part of the lake bottom. On both the north and south sides however, there are shallow, sandy bays with scanty vegetation in which *H. antrosum latchfordi* and *Physa latchfordi* are plentifully found.

While these two molluscs are not entirely restricted to the above habitat, a few specimens having been found on rocks and clinging to submerged logs, they are most plentiful on sand in from one inch to four feet of water in the sandy bays described above. The relative numbers of the two are about the same.

Both snails are absent from exposed, gravelly parts of the lake which is covered with cat-tails. From this end of the lake an entirely different assemblage of molluscs was collected:

- Lymnaea stagnalis jugularis* (Say)
- Helisoma campanulatum* (Say)
- Helisoma* cf. *infracarinatum* F.C.B.
- Cameloma* cf. *decisum* (Say)

MISCELLANEOUS

Some of the specimens of *H. antrosum latchfordi* bore eggs presumably of their own species, attached in a flat mass to the body whorl of the shell. No eggs of the *Physa* were seen.

An 'albino' specimen of *H. antrosum latchfordi* was collected and I attempted to keep it alive in an aquarium but was not successful. The animal was light red, somewhat lighter than the *Planorbis corneus* commonly kept in aquaria.

Other specimens of both the *Helisoma* and *Physa* brought back alive died very quickly (within a week) in my aquaria.

Some ten small leeches were found attached in the umbilicus of the *Helisoma*, one to a shell. These are about half an inch in length, broad and flat, with a granular dorsal surface. All were

found in the umbilicus of *Helisoma* and nowhere else.

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OBSERVATIONS ON THE NESTING OF THE KILLDEER PLOVER IN THE PRINCE ALBERT DISTRICT IN CENTRAL SASKATCHEWAN

By O. C. FURNISS



THE FOLLOWING notes are a collection of observations carried on during the last few years in the Prince Albert district. The country is rolling, with a considerable number of sloughs and pot-holes and is fairly well wooded. A large number of the smaller sloughs usually dry up by the end of August but get a little water from the fall rains at the end of September and beginning of October.

The Killdeer Plover usually arrives with the earliest of the spring migrants such as the Robin, Phoebe, and Meadowlark. Its loud cry soon informs everyone that it is back after its sojourn in the south. The average arrival is the second week in April. The earliest arrival that I have a record for in this district is April 5 and the latest April 20. The actual temperature or amount of snow on the ground seem to have no influence. The males and females arrive together and immediately settle down to the important business of raising their young.

In some cases the Killdeers seem to be already mated upon arrival here, while with others it is only a few days before they all have mates. My reason for saying that some have already mated is that there appears to be, in some cases, no actual courtship and as the ritual of courtship plays a very great part in animal behaviour I have presumed that it has been entered upon and completed before the arrival here of those particular birds; or within a day or two of arrival. If such has been the case, then territory can have played a very small part in the actual mating.

CASE 1

In April, 1930, Killdeers were first noted on the 8th and observed daily from then on throughout the season. The same pair, or presumably so, were constantly together and in

the same territory. They were not nearly so noisy as other Killdeers on an adjoining territory, and the territory that they had occupied from their arrival eventually turned out to be their breeding territory.

CASE 2

On April 5, 1932, the Killdeer was first noted and again on April 10. On April 12 a pair were noted as evidently mated because no display took place and the same pair were observed next day copulating. On the same dates, April 12 and 13, courtship was being carried on by other Killdeers in an adjoining territory about one hundred yards away. None of the others came near the mated pair without being scolded, and seemed to leave of their own free will within a few seconds.

In a previous sentence I have stated that if they were already mated upon arrival here, then territory can have played a very small part. Yet other cases indicate, to me, that some Killdeers mate after they arrive and territory plays an important part in the actual mating.

CASE 3

On April 12, 1932, among some dried-up sloughs several mating Killdeers were observed about 5 p.m. One group consisted of three birds, one female and two males. Although other Killdeers were around none attempted to join this particular group, while under observation, 5 p.m. to 6 p.m. One bird, the sex of which was undetermined, appeared very restless and continually started up but its flight was in no way suggestive of an aerial display, being very irregular. When flying and when on the ground, the birds were very noisy and their ground actions were certainly those

of courtship, both displaying and fighting being indulged in. In the air the restless bird flew at considerable distance from the others but always came back and settled very close to the remaining two, being only a few inches from them. One bird crouched down until its breast touched the ground, then raised and spread its tail fanwise, showing the orange markings, all the time uttering a quick "dee, dee, dee". The other two appeared to take no notice whatever but continued to "dee, dee, dee," to one another. The sex of the displaying bird was puzzling because if the bird displaying was the male, then the female followed him for a short way upon completion of the display and then stopped. One bird continually tried to come between the other two and separate them. Several times this resulted in a fighting attitude being adopted when both would jump into the air and take a peck at each other, "dee, dee, dee," very quickly then turn and pursue the female. The bird that followed the displayer must have been the female because the other two fought, one displayed, and both tried to pursue the female.

On April 13 these Killdeers had been joined by a fourth and evidently mated into two pairs as they were never seen in courtship again although observed daily and two nests were later found in the same territory as that in which the original display took place.

CASE 4

I mentioned in Case 3 that if the displaying bird was the male then the female followed him upon completion of the display. On April 13, the Killdeers mentioned in Case 2, when observed at 5.30 p. m., were fairly quiet and about five yards apart. At 5.55 the male flew about one hundred yards to the other end of the slough. The female followed in about four minutes and came to within about ten feet of the male, who rapidly "dee, dee, d" went through a display by ruffling his wings and showing his orange tail feathers. Copulation then took place, upon completion the female returned to the place from which she had originally come and the male flew away about one hundred yards to a small meadow pond near which the nest was later found.

I have found Killdeer nests in this district from within about twenty feet of water to about a mile and a half away.

CASE 5

Nest found May 21, 1932, six paces from the edge of a slough and contained four newly laid

eggs. The ground was fairly firm and there was no chance of the eggs getting wet, except from the usual rains.

CASE 6

Nest found June 6, 1922, about a mile and a half from the nearest slough and contained two eggs and two young just hatched.

The nest consists usually of a hollowed depression lined with chips or broken grass stems about an inch long. As the nesting season is usually early in the year the new grass has not started to grow but, by the time the eggs are ready to hatch, the new grass may be seen coming up between the eggs which makes them that much more difficult to see. Favourite nesting sites appear to be near or in old dried-up cow or horse manure, chips from wood-piles and in some cases among the loose sand on sand-bars along the streams or rivers. There are several unlined depressions around the actual nest from within a few feet to about one hundred yards and in every way resembling the real nest.

CASE 7

Nest found April 28, 1932, and contained no eggs. The second visit on May 3 revealed that, besides the depression that actually formed the nest, which now contained one egg, as many as eight other unlined depressions were to be found at varying distances from the actual site chosen.

The eggs appear to be laid quite a time after the first copulation; in Case 1 it was eleven days and in Case 2 twenty days. I have attributed the cause as that given by Prof. Thomson in his *'Biology of Birds'*, page 176. This seems a very long time and yet these two dates are the only evidence that I have been able to get as to the actual time of laying between first copulation and the laying of the eggs.

The site of the nest is chosen a considerable time before the eggs are laid.

IN CASE 1

Nest first found April 22, 1930, but the first egg was not laid until April 28.

IN CASE 7

Nest first found April 28, 1932, but the first egg was not laid until May 2.

The eggs are nearly always four in number; in about fifty nests that I have found during the last few years there has never been any variation in that number. They are always deposited with the points turned inwards and as incubation proceeds they become about a quarter buried in the lining of the nest. Never in any case have I ob-

served the bird turning the eggs. The eggs as usual vary a little in size, shape, and colour.

The eggs, in my experience, are not laid upon consecutive days, but seem to vary.

CASE 8

In Case 1. The nest contained on April 28, one egg; April 29, two eggs; April 30, three eggs; May 1, three eggs; May 2, four eggs

In Case 3. The nest contained on May 2, one egg; May 3, two eggs; May 4, three eggs; May 5, three eggs; May 6, four eggs.

According to this evidence there was a lapse of one day between the laying of the third and fourth egg of both nests.

The eggs appear to be laid about eight A.M.

CASE 9

A nest found April 29, 1923, at 7.30 A.M. contained one egg. Upon returning to the nest at 9 A.M. it then contained two eggs. In several cases since then, visits to the nests of other Killdeers always showed that if visited at about 7.39 A.M. or a little later, the adult could always be driven from off the nest even before the full complement of eggs was laid.

The actual nesting season in this district seems to cover about two months, that is, the length of time during which eggs may be found.

CASE 10

Nest found June 26, 1921, contained four well incubated eggs.

Nest found April 29, 1929, contained two eggs.

Young observed May 30, 1931, and thought to be about a week old.

Young observed July 13, 1931, and were the same age as those observed on May 30, of the same year.

It will be seen that the actual period over which eggs may be found is from April 28, until the first week in July. The young referred to in Case 10 on both dates had no trace of feathers and could not have been more than a few days old.

The time of incubation seems to be about three and one-half weeks.

CASE 11

(1) In Case 1, on May 2 the nest contained four eggs when it was presumed that the bird started to incubate. The eggs hatched on May 26, the time being twenty-four days.

(2) In Case 4, on May 7 the nest contained four eggs when it was presumed that the bird started to incubate. The eggs were in the nest on the morning of May 30 but the young could be heard in the egg. On the afternoon of May 31 the nest was visited and there was

no trace of either eggs or young. The time was twenty-four days and agrees with case 10-1.

Several times I have heard the young in the egg—but did not have the actual time of laying.

The young, when hatched, are covered with down and can run about a few hours later. They are marked black and white similar to the adults, differing in having one dark breast band instead of two. The young are very active and when only a few hours old are very difficult to find and catch. They will take to water if necessary and swim with apparent ease. I have never seen the adult birds swim.

CASE 12

On July 13, 1931, a Killdeer was observed with two young which could not have been more than a week old. I made an attempt to capture them but they were very active and managed to elude my hands every time that I thought that I had them cornered. Eventually they were forced along a narrow sandy point; when they came to the end of the point they either had to run the risk of being caught or take to the water. They took to the water and swam back to the place that they had started from, which must have been forty yards, and immediately ran and hid in the long grass. The lake was very calm which possibly accounts for their being able to swim so far.

The adult birds are very solicitous on behalf of their young, and although very resentful of an intruder near their nest are far more so of one near their young.

CASE 13

A nest was found on June 6, 1922, in an open field and contained two young just hatched and two eggs just hatching, the bill of one bird being out of the egg. One adult, thought to be the female, approached to within about two feet while the other adult did not come closer than about twenty feet. All tactics had been used to try and draw me off, but when they had all failed and I had found the nest and was kneeling beside it, the adult then made the close approach.

On the approach of an intruder, while the bird is incubating the eggs, it will quickly and silently rise and leave the nest. In my personal experience, the direction taken seems to be at right angles from that at which the nest is approached. When the bird has gone about thirty or forty yards or when they know that they have been observed, which is when the intruder involuntarily stops to look at the bird,

or hesitates for a second, they (the Killdeer) will commence to give their alarm notes. The alarm call at first is a low rapid "dee, dee, dee," but not similar to the courtship call. When the person approaching the nest has commenced to search for it, the bird will resort to various ruses to mislead and draw him off.

The most common is the broken wing ruse which is usually successful unless the person has had past experience or been told about it by others. If the bird is followed, they will fly up and wheel away if they think that they are far enough away from their nest; if not, the broken wing ruse will be followed by a run of a few feet and then repeated. Eventually, however, they will rise and fly up, scolding all the time.

Often when a pair are disturbed they will be joined by other Killdeers from adjoining territories who all join in the scolding of an intruder. My reason for thinking that the birds, when disturbed from their nest run at right angles to the direction from which is approached, is this: if the person approaching does not see the bird he will continue on right towards the nest and possibly tread on the eggs, which I have known to happen. Again, if the bird is observed and the nest is between the intruder and the bird, and the bird pretends to have a broken wing, most people would run to the bird, again possibly treading on the eggs. I have observed the Killdeer leaving its nest many times and think that this is the general rule.

CASE 14

While out walking one day three of us passed near a Killdeer's nest, one of the party trod on the eggs before we saw the bird. We had been in conversation and had not seen nor heard the adult bird.

Often the Killdeer will approach an intruder long before they go near the nest and while the other mate is on the nest attempt to mislead the possible intruder.

CASE 15

In the spring of 1932 a pair of Killdeers were nesting in a field about fifty yards from

the provincial highway and separated from it by a few yards of small trees and shrubs. On walking down the highway, and while still about a hundred yards from the nest, one of the birds would come out and attempt to mislead me. It was impossible for the bird on the nest to see me approach as we were separated by about thirty yards of shrubbery as well as a slight rise in the bank of the road. The nest had been visited several times before by myself so possibly the other mate had recognized me, particularly so when others were not scolded nearly so much, even though the road was well used by traffic and pedestrians.

The young stay with, and are protected by their parents all summer. They are not always, taken to the water as soon as hatched.

CASE 16

Young Killdeers which were hatched in a field near our house were seen several times over a period of about ten days before they were taken to the nearest body of water about one-half to three-quarters of a mile away.

CASE 17

During August, 1931, while the shore birds were gathering after the breeding season, Lesser Yellowlegs were noted as being particularly quarrelsome. Several times they chased young Killdeers which happened to be feeding near them. The parent Killdeers immediately flew at the Lesser Yellowlegs and drove them away.

The Killdeer will sometimes go through the courtship display after the eggs are hatched.

CASE 18

On June 26, 1932, Killdeers were observed around a slough, one of them scolded me continually as though the nest or young were somewhere in the immediate vicinity. Another Killdeer came up to the scolding bird and went through a courtship display exactly the same as the courtship display given by the other birds when mating earlier in the season. The display was not given once but several times.

THE BEHAVIOUR OF A LAND BIRD AT SEA*

By R. OWEN MERRIMAN



THE mere fact that Slate-coloured Juncos came on board the east-bound R.M.S. *Duchess of Bedford* in the Gulf of St. Lawrence on May 11, 1931, and remained on board until the ship was within three or four hundred miles of the British Isles is not in itself of sufficient interest to be recorded here; but the manner in which one of them left the ship is perhaps significant.

The R.M.S. *Duchess of Bedford* left Montreal on May 9, and on the morning of May 11 a White-throated Sparrow was seen on board, not apparently tired but very thirsty. Later on that morning, but some hours before we passed Cape Race and while we were out of sight of land, I saw several small land birds, never more than one at a time, flying northward close to the water, apparently crossing the Gulf. Each turned and followed the ship for a few minutes as though attempting to overtake her; but each one which I watched soon turned northward again without coming on board. Evidently some came aboard unseen by me; for later in the day, after we had left Cape Race and were on the open ocean out of sight of land, I saw a small bird leave the ship and fly back over her wake towards Newfoundland. It flew so far from the ship that I had difficulty in following it with my 6X prism binoculars; but before it passed out of sight, it turned and flew back after the ship. It seemed to have considerable difficulty in overtaking her; but it succeeded in doing so, and flew into B deck just below me. I think it was a Junco but am not certain. On three occasions on the following day, May 12, I saw a bird fly out from the stern of B deck, below me, and watched it fly westward along the ship's wake until through my glasses it was little more than a speck against the water, and then saw it turn and overtake the ship again. Once the bird attempted to alight on the rapidly-revolving lead-line and was thrown off by the motion. On the third occasion on this day, the bird

landed on A deck, close to me, and I saw that it was a Slate-coloured Junco. It seemed much exhausted. The deck steward, at my suggestion, sprinkled some crumbs and spilled a little fresh water on the deck for it. On the next afternoon, May 13, I saw a small land bird, apparently a Junco, leave the ship as on the two previous days and fly directly back over her course. I followed it closely through my 6X prisms until it passed out of sight, and I feel sure that this time the bird did not return to the ship. We had evidently carried more than one stowaway land bird; for on May 14 I again saw a Slate-coloured Junco on deck, very tame and apparently somewhat weak. I did not see it again, and on May 16 we reached the Clyde.

Throughout the whole voyage the weather was bright, with little or no wind. In the Gulf, the sea was quite calm; but after we passed Cape Race and until we entered the Irish Sea we felt a long, rolling swell.

Stewards and sailors on the ship told me that it is not at all unusual for land birds to be carried almost across or even right across the ocean on board ship at that time of year, and this is confirmed by many published notes and by information given me by friends who have crossed the North Atlantic in the spring. I am told, for example, that the S.S. *Laurentic* which left Montreal on the same day that we did carried White-throated Sparrows across to within a few hours sailing of Northern Ireland. These frequent occurrences on shipboard would lead one to expect more frequent reports of American birds as accidental or occasional in the British Isles. The behaviour of the birds here described suggests a possible reason why such reports are not more frequent. It may be that birds carried on board ship out of their normal range possess such a strong impulse to return to their own region that they do not remain in the region to which they are thus transported but attempt to fly back again to their own land and are lost at sea in the attempt. This certainly seems to have been so with one of the birds which was carried away on this voyage of the R.M.S.

Duchess of Bedford in May, 1932.

*Read at the Fiftieth Meeting of the American Ornithologists' Union, Quebec, October 20, 1932.

WAIFS ON SHIP-BOARD AT SEA

While coming down the Labrador coast, about one hundred and fifty miles to sea, specifically Lat. 57°N., Long. 57°W., on the morning of August 31st, 1929, a Wood Pewee was found in the last stage of exhaustion clinging to a cargo boom on the ship. It expired shortly after. On making the unfortunate into a specimen it was found that its tissues were so dry and lacking in moisture that the skin stuck to the body and could be removed only with some difficulty. It was evident that the bird had perished primarily through lack of water rather than from over-exertion, stress of weather or hunger.

Stray birds, lost at sea, are continually taking refuge on passing shipping as described by Mr. Merriman above. That a few waifs successfully cross the ocean in this way is to be expected and is demonstrated by the number of American casualties that appear on the English bird list, but according to observation most of these stowaways fail of that goal by a more or less narrow margin. It can be suggested that lack of fresh water may be the determining factor in such survival. The difference in passage time of

ships going east and west across the Atlantic may explain the preponderance of occurrence of American birds in England over that of English species in America. Birds can stand inclement weather in many sheltered nooks on ship-board and can go without food for a comparatively considerable period, but without fresh water, which can normally be found on board ship, only at the leak of some steam valve or other accidental supply, a very definitely limited term is placed upon their survival. Even such littoral sea birds as gulls that regularly follow ships far from shore and meet them well out to sea may be prevented from making the complete crossing by dependence upon a base of fresh water supply ashore.

It is probable that if trans-atlantic travel is ultimately speeded up so that the time of crossing is less than the limits of fresh water requirements of general bird life, many more trans-atlantic casualties will be noted and perhaps some of them will make permanent settlement. Whether this is a desirable eventuality is a moot question. Certainly our experience with artificial introductions does not reassure us as to its benefits.—P. A. TAVENER, National Museum of Canada.

BOOK REVIEWS

THE EXPLORATION OF SOUTHAMPTON ISLAND, HUDSON BAY, by George Miksch Sutton, sponsored by Mr. John Bonner Semple, 1929-1930. *Memoirs of the Carnegie Museum; Vol. XII, Part I; Section 1, Prefatory; Section 2, Introductory; Section 3, Bibliography of part i and part ii, section 2, pp. 1-75, pl. 5, March 28, 1932. Part II, Section 2, The Birds of Southampton Island, pp. 1-267, pl. 10-26, three in colour. May 31, 1932 Folio. Published by authority of the Board of Trustees of the Carnegie Institute, Pittsburgh.*

DURING the activity of arctic exploration when the search for Franklin and the Northwest Passage was at its height, great advances were made in the knowledge of the biology of the high north. In fact at one time we probably knew more of the biota of the great arctic wastes than we did of many more accessible lands farther south. Then the tide of northern investigation stood still and for years comparatively little systematic work was done there. With the

advance of general ornithological knowledge and the resultant requirement of greater refinement in methods, it has become increasingly evident that attention should be redirected northward; but difficulty of access to the field and the expense of elaborate expeditions has prevented all but casual natural history survey of the higher regions. The northwestern mainland has been systematically worked as far eastwards as Coronation Gulf by the Canadian Arctic Expedition of 1913-1918. The great region of the Boothia Peninsula and adjoining areas is still, unfortunately, a terra incognita but Preble has published on the west coast of Hudson Bay, and Todd is preparing an account of the east coast. Northern Labrador has been critically studied by Hantzsch and both Hantzsch and Soper have given us detailed reports on southern Baffin Island. An analysis of these results and others supplementary to them has accentuated the desirability of a re-investigation of the arctic regions.

The establishment of Royal Canadian Mounted Police detachments north to 78° and the numerous fur-trading posts along the southern fringe of islands have opened up prospects of more careful and detailed work than has ever before been possible in the Arctic Archipelago. Even yet, however, the difficulties of the work are great. No ship can get in or out of the grounds until late in summer and a comparatively barren winter must be spent in storm-bound quarters before really profitable work can be undertaken and the results brought out. Undoubtedly air-planes eventually will be developed that can deposit an observer at critical points profitably early in the season and bring him out before that season closes but as yet biological investigation of the arctic by air-plane is too hazardous to be practicable. However, given a competent naturalist willing to sacrifice a whole year for the sake of a short season of hectic work and with stamina and enthusiasm to endure the discomforts and ennui of the long arctic winter, there are several promising points of attack on the secrets of the forbidding north. Of these Southampton Island has long been in view as easiest of access, a key point, and a logical beginning for more extensive arctic survey. In fact an expedition to this very locality was under consideration by the National Museum of Canada when it was learned that Mr. Sutton had decided upon the trip.

He spent the autumn of 1929, the winter, and the spring and summer of 1930 at Coral Harbour, the Hudson Bay Company trading post on the southern side of the island. Part I of this report presents a history of the island, its physiographic features, the writer's itinerary and methods of work, and a general discussion of conditions. Part II, as far as published, contains the ornithological results and is the writer's thesis for his doctor's degree. Other parts, devoted to mammals, insects, etc., are promised to follow. These results fully justify the work undertaken and prove Mr. Sutton's ability, with pen or pencil, in field or study, to perform it adequately. Part I demonstrates the great amount of reading and research he has given to the geographical and zoological history of the island that he might fully grasp its biological problems. Part II consists of an elaborately annotated list of birds observed, defining their status and giving valuable life history. His

work corrects many common errors and has added much new information. In connection with other investigations already reported on, or in course of preparation, it rounds out our knowledge of the birds of Hudson Bay and gives a firm base line from which to project further work.

An important outcome is the light thrown on the remarkable number of surprising records attributed by the British Museum Catalogue of Birds to Repulse Bay. It is brought out clearly that many of these must have been taken by Rae's expedition en route and much farther south on the Bay than the exact statement of their data indicates. These will, in future, have to be disregarded in our distributions or treated with great circumspection. Perhaps the most popular interest lies in the establishment of the nesting of the Blue Goose on the island, extending its breeding range considerably eastward of Soper's original discovery of its nesting on southwestern Baffin Island in the previous year.

The plates are mostly half-tone photographs arranged four on a sheet and illustrate characteristic conditions and plants, people and bird life. The three plates in colour are reproduced from originals from the brush of the author and illustrate four spectacular species of birds and a full page of details of thirteen species of downy young, many of which have never been so presented before. The originals are undoubtedly up to the standard of this talented artist-naturalist but for these days of fine process work the reproductions leave a little something to be desired. The downy young form a valuable plate but some cautionary note should have been appended calling attention to the fact that they are field sketches showing details, and not completed drawings. Bodies are often drawn without being fully rendered and are to be taken as authority for the colours of the soft parts and facial characters only.

The whole makes a most impressive volume, folio size, and a credit to all concerned. The paper is white and well surfaced, the print is good, margins spacious and the proof-reading seems excellently done. The only criticism this reviewer would make is regarding its size. A large volume like this is awkward to handle or use for common reference. After being once skimmed, it is likely to be prized as a fine volume but allowed to gather dust

on the shelf, unread. There is necessity for folios when large plates are essential to the subject but otherwise they seem to be made

more for the gratification of governing boards and influential patrons than for actual scientific use.—P.A.T.

EXCURSION TO LONG LAKE, QUEBEC

"In the old days of the Ottawa Field Club it was customary to publish in *The Ottawa Naturalist* a short account of each Field Excursion with some particulars of the more interesting specimens of plants or animals, etc., met with. This practice was discontinued when the excursions each year were over the same ground in the vicinity of Ottawa, ranging from Rockcliffe to Britannia. Now that the practice of going further afield has been resumed it might be advisable to have a short write-up of each excursion as likely to be of general interest. In any case I am enclosing a short botanical account of the visit to Long Lake."

The above is a letter from a member and is so apt to the present excursion situation that it is given here without comment except that perhaps other members would note and follow such a good example. Long Lake is 12 miles N. E. of Buckingham, and easily accessible from Ottawa by road (about 30 miles). It is typical of many Laurentian Lakes in that the water is cold and deep, the banks are steep, and the bush comes down to the water line leaving no shore or beach. Long Lake has no river or creek inlet or outlet, supply being maintained by springs and surface drainage. Seepage through the drift at the south end is most probably the cause of the constant level of the lake. Map: Dept. of Interior, Buckingham (Quebec-Ontario).—Convener's Note.—F. J. F.

PLANTS OBSERVED AT LONG LAKE, QUEBEC, ON 16 SEPTEMBER, 1933.

Owing to the lateness of the season, and the short time available for collecting, comparatively few plants were found. The rocky heights bordering the west side of the lake were covered with forest, red oak, white birch, large-toothed aspen, basswood, sugar maple red maple with leaves already assuming a scarlet hue, and striped maple. Some evergreen species were also noted, such as white pine, balsam, and hemlock.

Owing to the dryness of the season fleshy fungi were extremely scarce but some good specimens of *Polyporus betulinus* were found on a dead trunk of white birch.

Ferns were represented by the Bracken, Polypody, and Marginate Shield-fern. But the most interesting species found during the visit was the Leathery Grape-fern (*Botrychium silaifolium*) which occurred on ground that had been cleared.

Partridge berry (*Mitchella repens*) and Wintergreen (*Gaultheria procumbens*) were plentiful, while a few plants of Prince's Pine (*Chimaphila umbellata*) were also observed. But the only plants found in flower were two species of Aster, namely, *Aster acuminatus* and *A. macrophyllus*, and four species of Golden Rod including *Solidago canadensis*, *S. caesia*, *S. graminifolia* and *S. squarrosa*.—J. ADAMS.

NOTES AND OBSERVATIONS

TAPEWORM IN RABBITS.—Four rabbits, taken in the vicinity of Sioux Lookout, Ontario, were examined and all were found to be infested with the larval form of tapeworm (*Cysticercus pisiformis*). Two of these rabbits were very seriously infested, the cysts being attached to the intestines in sufficient numbers to bring about a well defined peritonitis.

It is reasonable to believe that the presence of these larval forms of tape worms would ultimately lead to the death of the animal and that parasitic infestation is responsible to some extent and may explain the fluctuation in numbers in our wild life from year to year.

There is evidence from examinations made this year that rabbits are reaching a high peak of parasitism.—R. G. LAW.

BRÜNNICH'S MURRE (*Uria lomvia lomvia*) in NORTH FRONTENAC COUNTY, ONTARIO.—On December 15, 1932, the writer was fortunate enough to secure a living Brünnich's Murre. The bird had been picked up immediately south of the village of Henderson, seven miles north of Arden, North Frontenac County, Ontario, on that day by a Mr. Loyst who had found it in a sitting posture in the centre of a country road. Mr. Loyst being impressed with its unusual appearance fully intended to have the specimen mounted, but after considerable persuasion the writer was able to obtain the bird and forward it to the Royal Ontario Museum at Toronto. The bird died two days after its capture and when the specimen was prepared it was found to be in a very emaciated condition. The

stomach was, of course, quite empty.

It may be worthy of record here that according to my notes taken during the period when this bird must have been voyaging inland to the place where it was captured there were no violent gales or storms in our district. On December 10th and 11th there was a moderately strong north-east wind.—ROBERT VINCE LINDSAY.

BARN OWLS NESTING AT STRATHROY, ONTARIO.—On April 5th, 1933, I was notified that a new bird had been captured at a local factory. Some of the factory employees had been detailed to repair the water tower, access to which is gained through a small door in the circular roof about 110 feet from the ground. The door had blown open during the winter, remaining so until spring. Quite a surprise awaited the men as they climbed through the small door: a pair of Barn Owls, *Aluco pratincola*, had their "nest" with three eggs and both birds were at home. The eggs were laid on the bare boards of the platform under the roof, inside the tank. One of the men claimed the owls attacked him as he went through the door into the tower; he captured one after knocking it over with a broom.

When I visited the factory the unfortunate owl was crowded into a very small crate and the eggs had been carried down from the tower. I released the owl which circled over the town a couple of times then flew into the tower. Hoping that the owls would remain for a time a hurry call was sent to some members of the McIlwraith Ornithological Club, London, Ontario, several of whom arrived the next morning at 6:30 but the birds were not in the tower nor have they been seen since. Noise and coal smoke apparently were not obnoxious to the birds as the factory whistle and smoke stack were quite close to the water tower, then the railway station was only about 300 yards distant. The eggs were perfectly fresh so doubtless housekeeping duties are under way in new quarters.—A. A. WOOD.

DO BULLFROGS EAT FISH?—The note in the April number brings back to my mind an incident of my boyhood's days of which, though it occurred so long ago, I have a very distinct recollection. On one occasion, when I was about fifteen or sixteen, a friend and I went fishing in the small stream that crosses the road just west of the village of Old Chelsea, in what is now the County of Wright, P.Q. I do not know how it is now, but in those days the stream contained quantities of brook trout, though for the most part very small ones. Having caught a dozen or so of the fish in the portion of the

stream above the road, we decided to try our luck further down and in order to keep alive what we had already caught, we placed them in a shallow pool, about two or three feet in diameter, with a barricade of stones, to prevent their getting back into the stream. The fish ranged, as I recall, about from three to six inches in length. Returning some time later, we disturbed four or five bullfrogs, who endeavoured to beat a hasty retreat, all of them with tails of our fish, too large for them to swallow, protruding from their mouths. When we left them, the fish were alive, though doubtless more or less injured by the hooks with which they had been caught, but some may, of course, have died while we were away. How long we were absent I do not remember, but I should say probably about an hour. Whether or not the frogs caught any of the fish while the latter were still alive I cannot of course say, but with so many fish swimming in so small an area, this would not, I imagine, have been very difficult.—W. L. SCOTT.

BIRDS AND THEIR WINTER FOOD.—I have never had very marked success feeding winter birds. Perhaps the reason is that the birds which stay with us in winter can usually feed themselves. I have fed suet to chickadees, red-breasted nuthatches, and downy woodpeckers, and oatmeal to the early juncos. My most successful attempt has been feeding hayseed to redpolls. Different years I have scattered basketfuls of hayseed and chaff from the bottom of the hay-mow over the snow and generally succeeded in attracting quite a flock of these interesting little birds.

On March the second, 1928, I put out a bushel basketful of hayseed in an angle of the house where I could watch the birds eating from the window. The next morning the first bird appeared. He came at half-past ten and stayed until one o'clock picking almost continuously. I timed him different minutes and he picked up from sixty to ninety seeds in a minute stopping occasionally to eat snow between seeds. He left at one o'clock and at two a male which was probably the same bird was back with a female, next day there were four. By the end of the week a flock of twenty-three birds was coming and this was finally augmented to sixty-five. They did not scratch but only picked throwing the litter about with their bills. Perhaps this was only because there were plenty of seeds to be seen without scratching.

But it is more interesting to watch the birds hunt out their own food. Along the upper side of the orchard there are quite a number of

bunches of high-bush cranberries. The fruit was so sour that one would not expect the birds to eat it but they do. Both pine grosbeaks and cedar-waxwings eat the berries readily. It is quite amusing to see how unlike the two species are in their taste. The pine grosbeaks eat the flat seeds. Very often they leave the skin of the berry on the bushes, the birds in some way extracting the frozen pulp and seed. Then the pulp is expelled from the bird's mouth, the snow under the bushes often becoming quite pink with the scattered juice. They desire only the seeds which in most cases are cracked open, the contents eaten, and the covering of the seeds rejected. They even skin some of the apple seeds they eat. I suppose they must swallow some of the pulp of the apple while they are digging for the seeds but when they get the seeds they leave the apple and start work on another. I saw what looked like a partnership business one spring. Four pine grosbeaks were in a crab tree pecking holes in the apples and discarding the pulp and a robin was on the snow under the tree eating the pulp. As it was only March the second, I wondered where that robin came from. When the grosbeaks flew it followed them.

One year a new cellar had been dug and when the snow came a big pile of earth had not been levelled but extended above the snow all winter. The grosbeaks found it and visited it repeatedly, pecking off bits of frozen earth and sand as a mouse would nibble cheese.

No matter how many cranberries are left on the bushes in the fall, they all seem to be eaten by spring, the chipmunks and red squirrels helping considerably. One winter there were no grosbeaks and cranberries were plentiful when a flock of sixty-two cedar waxwings arrived on April the thirteenth. The waxwings ate the skin and pulp of the berries. A bird would pick one or two berries and then fly up into an apple tree, work them around in its mouth and after a while drop the seeds. They were usually so clean that they were scarcely pink although sometimes a little skin adhered to the seed. If there were two or three waxwings perched on the same limb they would occasionally pass a berry from one to another. They also picked the skin from old apples left on the trees but did not eat the apple.

Ruffed grouse also eat cranberries with relish. Several times two or three grouse have spent the winter in a little pasture just above the orchard fence. It has usually been winters after the beechnuts have been plentiful in the fall. One year an early frost came before the nuts were mature enough to drop, tent caterpillars having denuded the beeches of their foliage in June. Many of the nuts stayed in the burs and kept dropping with each successive gale all winter. The grouse varied their diet, beechnuts, apple and birch buds, and cranberries.

We could see them coming after the cranberries just as the twilight began to make things look indistinct. There were three of them and they walked in Indian file along the top of an old stone fence until they reached the cranberry bushes. They did not fly into the bushes much but stood on the snow which was deep and stretched their necks or gave funny little awkward jumps into the air to catch the fruit on the ends of the twigs. After they had satisfied their hunger, if the snow were soft, they would sometimes fly up into an apple tree and glide down "flop" into the snow for the night. When I examined the imprint of their bodies in the snow there was a wing mark on each side. I thought perhaps the wings were spread out to keep them from sinking too deeply. I was told by someone however that the bird closes its wings as it drops and the wing marks are made when it gets out of bed in the morning. At other times when the snow was too hard for them to drop into they spent the night in the apple trees or a big yellow birch. We could see their bodies as round balls in the bare branches against the radiance of the early morning sky but they were always gone by daylight. I wondered why they always walked when they came for fruit as they always flew if I happened to flush them out from under the sweeping branches of the spruces where they often spent their days. Their single file led from the stone wall across the pasture to an impenetrable tangle of weeds and brambles in the corner of a neighbour's field. Their footprints reminded me of the cross-stitches in my mother's old sampler. They stayed in the spring after the snow had melted and again scratched for beechnuts in the dead leaves until the urge of Nature took them back to their solitudes.—
SUSAN K. SQUIRES.

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CONTENTS

	PAGE
Norman Criddle 1875-1933.....	145
The Age of the Devonian Limestone at McMurray, Alberta. By P. S. Warren.....	148
The Wapiti of the Riding Mountain, Manitoba. An Ecological Study and Commentary. By H. U. Green.....	150
Bull-Frog Appetites. By P. A. Taverner.....	157
Notes and Observations:—	
Bird Notes from Unity, Saskatchewan. By S. Humphry.....	158
White-Crowned Sparrows in Nova Scotia. By R. W. Tufts.....	158
Migration of Swans. By A. Hole.....	158
Western Mocking Bird (<i>Mimus polyglottis leucopterus</i>) on Vancouver Island. By Kenneth Racey.....	159
Book Reviews:—	
Birds of the Battle River Region of Central Alberta. By P. A. T.....	159
"Game Management". By Aldo Leopold. By H. L.....	159

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NORMAN CRIDDLE 1875-1933



Norman Criddle



AN OUTSTANDING naturalist versed in many fields was lost to Canada when Norman Criddle passed away at Brandon, Manitoba, on May 4, 1933, shortly after an operation.

He was born at Addlestone, Surrey, England, on May 14, 1875, and came to Manitoba with his parents in 1882. The family settled about twenty-five miles south-east of Brandon, in a district that was a few years later named Aweme, and there

he received his early education from his father and mother and made his life-time home, although he regularly spent a few months in Ottawa in winter.

In entomology his observations are known to have begun at an early date and it was in this science that he made his life work and not only reached the top of his profession, but was esteemed and loved by his fellow-workers.

So long ago as 1901 he devised the "Criddle

mixture" for grasshopper control as an alternate for the bran bait then in use, and it was largely in protecting crops against grasshoppers that he continued active till the time of his death.

The late Dr. James Fletcher, Dominion Entomologist, met him in July, 1900, and the two at once struck up an acquaintanceship which soon became a real friendship as will be readily understood by those who had the privilege of knowing the two men.

Omitting for the moment the period 1905-1913, Mr. Criddle became Temporary Entomological Field Officer for Manitoba, Division of Entomology, Experimental Farms Branch, Department of Agriculture, in the summer of 1913, and this position became permanent in 1914. In 1919 he was styled "Entomologist" and held this position till his death.

At the time he became connected with the Entomological Branch he had already published eight papers on entomology including both studies of individual insects and general appraisals covering wide areas. He had, however, a vast store of unpublished knowledge of prairie entomology, and from 1914 on, his influence was felt, and his papers on the subject were watched for with interest and respect.

Grasshoppers were his specialty. He pursued the study of them throughout his career and the debt that prairie agriculture owes to his lifetime of effort on this important and vital problem is scarcely realized by the people who benefited. He knew the life history of some seventy species of grasshoppers and could identify most of them in any stage of development. In one paper ready for publication when he died the egg-sacs of seventy-two species are described and figured, and in a second the ecology and food habits of eighty species are reported. All this life-long accumulation of technical knowledge of the subject was directed to the control of grasshoppers as a crop pest, and Norman Criddle held the unquestioned leadership particularly in the scientific basis for control measures. Grasshopper control in the Prairie of Canada was built on Criddle's foundation.

Reverting now to the period of 1905-1913, segregated here as the botanical part of his career, we find that Mr. Criddle entered the public service as an artist to illustrate the publication *Farm Weeds* by George H. Clark and James Fletcher (1906 1st edition, 1909 2nd edition). On January 19th, 1905, he attended a meeting of the entomological section of the Ottawa Field-Naturalists' Club at the home of Mr. Arthur Gibson and gave the members of the section a description of the part of Manitoba in which he

lived, with special reference to insects and plants.

During the period 1906-1910 he supervised for the Dominion Seed Commissioner some of the collection of weed seeds which were used in the preparation of reference collections supplied to seedmen. In this work he was assisted by his brothers, mainly Evelyn and Stuart. In the winters 1910-1913 he was employed as a seed analyst with headquarters at Calgary, Alberta, and in the next summer he entered officially the field of entomological endeavour as already told.

His artistic ability was again sought in connexion with the preparation of twenty-seven coloured plates used to illustrate *Fodder and Pasture Plants*, Clark and Malte, 1913.

Although botanical work was curtailed because of entomological studies, he never lost his interest and was able to help materially in the preparation of a revised check list of Manitoba Flora in 1922 and continued to publish botanical articles such as "A Calendar of Flowers". (*C.F.-N.* 41; 48 55, 1927). This was taken from notes covering over twenty years of observation. In 1929 he published "Memoirs of the Eighties." (*C.F.-N.* 43; 176-181) thus preserving all too briefly his impressions of the early flora of Manitoba.

Mr. Criddle's observations in the field of mammalogy began as a boy and his interest continued through life. His observations began at such an early date in his home territory and were continued so regularly for the same region that he was able to record about fifty years of changes in the fauna and flora, during which time the prairies of Manitoba changed from primitive to settled conditions. Most of Norman's work with mammals was in collaboration with his brother Stuart, and some of Stuart's papers include observations by his brothers, Norman, Evelyn and Talbot. He was interested in game and fur mammals and in the role played by predatory mammals in the control of rodents and insects. Although he did not publish many lengthy papers on mammals he was a recognized authority on the life history of prairie species. He was generous with his notes and reported annually to the National Museum at Ottawa, giving changes and developments affecting mammals and other wild life.

In ornithology he was esteemed as a sound and practical observer whose knowledge was based on first-hand study from boyhood through life. He and his brothers invented their own names for prairie birds and proceeded independently of books to learn about them and with marked success.

The overpowering desire to learn overcame obstacles that nowadays would be thought insurmountable. His deep knowledge was apparent to his friends and in casual conversation, for he had

in his head at least twice as much as he had published, and lots of it had never yet reached text-books. He said once he loved cowbirds and so would any one else who had known them so intimately. Enlarging upon this he told of ploughing with oxen on the prairies when he was a boy and of having cowbirds all over the oxen and all over him all day. In economic ornithology he insisted on the need for a fair trial before any species was condemned and this made his conclusions differ from those of many who were perhaps more inclined to take snap judgement.

Astronomers and others who have been studying the fluctuations in animal populations as being an indication of astronomical cycles consider the Criddle records of abundance of species as the most homogeneous observations of this kind in America. They began in 1895 and the accounts of variations in some important or key species such as Grasshoppers, Ruffed Grouse, Sharp-tailed Grouse, and Varying Hares have been published. The rhythmic nature of his charts has been particularly commented upon by the astronomers who have studied them. Of course they were of great practical value to Mr. Criddle himself and his co workers in foretelling and preparing to meet grasshopper plagues. Accurate records of variations in animal populations made by competent observers are scarce, except for Man, and all the more valuable in consequence. It is hoped the Criddle observations will be continued.

In the conservation of wild life Mr. Criddle was especially active for he had seen the changes brought about by settlement and knew of the old days of prairie abundance which have gone forever. He regularly represented the Department of Agriculture at the Conferences of Provincial and Dominion Game Officials which have been called for many years by the Department of the Interior. His considered opinion on any topic was always highly regarded by the delegates to these conferences for he held well-balanced, practical, level-

headed views on the many complicated wild life problems which came before these conferences, and he presented them in a quiet, unassuming manner that carried conviction. His influence was all for adequate conservation measures and he made this felt whenever and wherever he could.

On March 31st, Mr. Criddle was honoured by the Manitoba Agricultural College in being awarded the honorary diploma in agriculture as a recognition of the service which he had rendered to the province. This well-merited public recognition was the occasion for the greatest satisfaction to his host of personal and professional friends.

Mr. Criddle was a member of several scientific and other organizations, in some of which he took a very active interest. Among these may be listed:—the Entomological Society of Ontario, the Ottawa Field-Naturalists' Club (past president), the National Association of Audubon Societies (sustaining member), the American Ornithologists' Union (associate), the Manitoba Natural History Society (honorary president), the American Association of Economic Entomologists, the Entomological Society of America, International Great Plains Crop Pest Committee (permanent chairman), the American Society of Mammalogists (charter member), the Professional Institute of the Civil Service of Canada and the Ottawa Vegetable Growers' Association (honorary).

A list of his publications in *The Canadian Entomologist* 65:197-200, Sept. 1933, gives sixty-nine titles in entomology, thirty-one titles in ornithology, seven titles in botany, eleven titles in mammalogy and general wild life, and seven titles of miscellaneous character, or one hundred and twenty-five titles in all. It is known that others are in manuscript.

Norman Criddle personally was kindly, retiring, modest, and of the finest of men; in his scientific labours he was a unique member of an old school that made all nature its field. His breadth of experience was faithfully devoted to the service of his country, and Canada in losing him has lost her best field-naturalist.—HOYES LLOYD.

THE AGE OF THE DEVONIAN LIMESTONE AT McMURRAY, ALBERTA

By P. S. WARREN



ENTERING the Mackenzie River area by the usual route, the first appearance of Devonian limestone is at McMurray at the confluence of the Athabaska and Clearwater Rivers. The outcrops of limestone on Athabaska River below McMurray have, doubtless, been examined by many geologists entering the northern area but so far there has been no mention made of the exact age of these beds. Camsell and Malcolm, in their treatise on the Mackenzie River basin, state that they "appear to belong to the Upper Devonian series but represent a very different faunal and lithological facies from that shown in the sections to the west and north." The writer agrees with these authors as to the age and difference in facies of the strata and their contained fauna. The purpose of this paper is to define more accurately the age of the beds and to correlate them with other Devonian sections.

The fossils on which this study is based were collected by various geologists at different times. The principal collections were made by Dr. J. A. Allan of the Department of Geology, University of Alberta, and Dr. K. A. Clark, Research Council of Alberta. No attempt was made to collect systematically, the fossils being obtained from various beds in different localities. The total collections were probably obtained from a considerable thickness of strata. The species identified by the writer in these collections are given below:—

Spirorbis omphaloides Goldfuss
Schizophoria striatula (Schlot.)
Stropheodonta demissa (Conrad)
 " *perplana* (Conrad)
 " *inequivariata* Hall
 " *inflexa* Swallow
 " *subdemissa* Hall
Chonetes sp.
Productella callawayensis Swallow
 " *hallana* Walcott
Pugnax pugnax (Martin)
Atrypa reticularis (Linn.)
 " *spinosa* Hall
 " *gregeri* Rowley
Spirifer tullia Hall, varieties
Cyrtina billingsi Meek
 " *hamiltonensis* Hall?
Athyris angelica var. *occidentalis* Whiteaves
Modiomorpha sp.
Paracyclas elliptica Hall
Aviculopecten cf. *flabellum* (Conrad)

Before discussing the age of this fauna it is best to review briefly our knowledge of the Upper Devonian faunas of the Mackenzie Valley area. Two distinct faunas have been delimited in the Upper Devonian rocks:—² Firstly, an upper fauna containing *Spirifer disjunctus* or *whitneyi* occurring in the Hay River limestones and shales to the south and west of Great Slave Lake and in beds of similar age in the lower Mackenzie valley. This fauna has been correlated with that of Chemung of New York State. Secondly, a lower fauna of Portage age contained in the Simpson shale lying below the Hay River shale and outcropping along Mackenzie valley south of Simpson. This latter fauna is characterized by such forms as *Buchiola retirostriata*, *Ontaria clarkei* and *Entomis variostrata*. A fauna of Portage age but of a different facies occurs on Peace River at Peace Point where Kindle³ has collected the following species:—

Crinoid stems
Aulopora cf. *adnascens* Fenton
Spirorbis omphaloides Goldfuss
Crania sp.
Schizophoria striatula (Schlotheim)
Camarotoechia sp.
Pugnax pugnax Martin var.
Leiorhynchus mesacostale Hall
Atrypa reticularis (Linn.)
Atrypa cf. *spinosa* Hall
Cyrtina hamiltonensis Hall var.
 " *billingsi* Meek
 " *billingsi* var. *symmetrica* Kindle
Spirifer tullia var. *Whiteaves*
Palaeoneila filosa (Conrad)
Leda cf. *diversa* (Hall)
Modiomorpha sp. undet.
Leptodesma cf. *naviforme* Hall

This fauna was contained in blue shale and thin-bedded limestone considerably different in lithological character from the Simpson shale, the main difference being the introduction of limestone beds.

It is with the Portage fauna at Peace Point that our collections are to be correlated. Though some of the typical Portage elements of that fauna are missing in the McMurray fauna, other species are sufficiently typical to warrant the correlation. The numerous *Atrypas* and large *Schizophorias*, varieties of *Spirifer tullia*, *Cyrtina billingsi* and

² Kindle, E. M., A Portage fauna in the Mackenzie River valley: Geol. Surv. Can., Mus. Bull. No. 29, 1919.

³ Kindle, E. M., The occurrence and correlation of a Devonian fauna from Peace River, Alberta: Geol. Surv., Can., Bull. 49, pp. 14-18, 1928.

¹ Camsell, C. and Malcolm, W., The Mackenzie River basin: Geol. Surv., Can., Mem. 108, p. 66, 1921.

Pugnax pugnax are common to both faunas. The absence of *Spirifer whitneyi* at both localities also strengthens the correlation. The differences between the two faunas are probably due to differences in environment. The McMurray fauna occurs largely in limestone beds with a minor amount of shale whereas the Peace Point fauna occurs in the shale with thin limestone beds.

It is our conclusion, therefore, that the limestone beds on the Athabaska River at McMurray correspond in age to the Devonian beds at Peace Point and to the Simpson shale on the Mackenzie River.

The thickness of the limestone and shale containing the Portage fauna on the Athabaska River is accurately known through the log of the salt well drilled at McMurray.⁴ The log shows a thickness of 405 feet of limestone and shale overlying gypsum beds. The upper boundary is an erosion surface. The fauna obtained from the well core has previously been examined by the writer.⁵ It is characterized by large numbers of *Atrypas* and *Schizophorias* and, in certain beds, by numerous examples of *Spirifer tullia* var., *Cyrtina billingsi* and *Productella hallana*. Towards the base of the formation *Lingula spatulata* occurs in great abundance. This is the same fauna that occurs in the limestones outcropping on the Athabaska River.

Cameron gives the thickness of the Simpson shale on the Mackenzie River as 250 feet.⁶ The strata containing the Portage fauna, therefore, not only change to a more calcareous facies in a southeasterly direction but thicken considerably also. Kindle considers that the change in faunal facies from the Mackenzie River to the lower Peace as being due to nearer shore-line conditions at the latter locality.⁷ This is probably a correct interpretation but it seems preferable to consider the Peace Point and Athabaska River faunas a limey facies and the Simpson shale faunule a shaly facies of the same fauna.

The relationships of the Devonian beds on the Athabaska River and at Peace Point appear to be identical, both sequences overlying gypsum beds which have been proved to be of Silurian age at Peace Point.⁸ On the Mackenzie, on the other hand, the Simpson shale overlies Middle Devonian limestone. The Upper Devonian sea was, therefore, much more widespread in this area than that of the Middle Devonian.

It is proposed to name the limestone and shale on the Athabaska River, carrying the Portage fauna and correlative with the Simpson shale on Mackenzie River, the Waterways formation. The name is derived from the town of Waterways at the end of steel about three miles from McMurray.

The fauna of the Waterways limestone, so far as it is known, seems to bear a considerable resemblance to that of the Snider Creek shale of Missouri.⁹ The numerous *Atrypas*, *Schizophorias* and *Stropheodonts* as well as *Productella callawayensis* and *Atrypa gregeri* are common features of both faunas. It should also be mentioned that a variety of *Spirifer tullia* from the Waterways limestone appears to be identical with *Spirifer annae* of the Snider Creek shale, and *Cyrtina billingsi* from the northern locality is a very closely allied form of *Cyrtina missouriensis* of the Missouri formation.

The Waterways fauna does not seem to be quite so closely allied with the Hackberry fauna of Iowa.¹⁰ It should be mentioned, however, that *Spirifer tullia* and its varieties from Athabaska River are quite closely allied with the Hackberry *Spirifer orestes* and appear to be nearly as variable as the Iowa species.

A fauna of similar age to that of the Waterways formation is found throughout the Canadian Rockies. Though the resemblance is not striking, it is interesting to note the occurrence in the mountains of *Spirifer jasperensis*, a variable form which has much in common with certain varieties of *Spirifer tullia*.¹¹ It is notable that the *Spirifer jasperensis* fauna is more closely allied with the Iowan Hackberry fauna than with the Waterways or Snider Creek faunas.

An interesting fauna of similar age has been noted in cuttings from the Duvernay well drilled by the Alberta Pacific Consolidated Oils, Ltd. near North Saskatchewan River in sec. 34, tp. 55, rg. 12, W. 4th Mer., being nearly due south of McMurray. In a series of limestones and shales at depths between 2,240 and 2,330 feet the following fossils were identified:—*Lingula spatulata* Vanux., *Buchiola retirostriata* Von Buch, and *Tentaculites* cf. *mackenziensis* Kindle. This fauna has more resemblance to that of the Simpson shale than it has to the Waterways fauna, but the formation from which it was obtained strongly resembles the Waterways.

⁴Allan, J. A., Second Ann. Rept., Min. Res. of Alta., pp. 102-114, 1920.

⁵In Allan, J. A., loc. cit.

⁶Cameron, A. E., Hay and Buffalo Rivers, Great Slave Lake and adjacent country: Geol. Surv. Can., Sum. Rept., pt. B, pp. 1-44, 1921.

⁷Kindle, E. M., loc. cit.

⁸Kindle, E. M., loc. cit.

⁹Branson, E. B., The Devonian of Missouri: Missouri Bureau of Geology and Mines, Vol. 17, 1923.

¹⁰Fenton, C. L. and M. A., The stratigraphy and fauna of the Hackberry stage of the Upper Devonian: Contributions from the Museum of Geology, Univ. of Mich. Pub., Vol. 1, 1924.

¹¹Allan, J. A., Warren, P. S., Rutherford, R. L., Geology of the Eastern ranges of the Rocky Mountains, Jasper Park, Alta.: Roy. Soc., Can., Trans., Vol. 26, sec. 4, 1932.

THE WAPITI OF THE RIDING MOUNTAIN, MANITOBA

An Ecological Study and Commentary

By H. U. GREEN

(Continued from Page 132)

BREEDING AND ASSOCIATED HABITS; GESTATION; NUMBER OF YOUNG

Male Wapiti are strictly polygamous and their one ambition during the few weeks of the rutting season is to acquire as many females as possible. The degree of success attained in the venture is governed alone by the virility and age of the individual. In other words, two or three year olds, although desirous, and capable, of performing the sexual act, stand little chance in open competition with their elders to copulate with more than an occasional unattached female unless a degree of guile, which is sometimes the case, is successfully exercised, a fact which equally applies to old males.

There is ample evidence, borne out by observation during parturition, that female Wapiti breed at the age of two years, giving birth to their first offspring when three years old. The duration of fertility is not known.

At the approach of the rutting season, which commences about September 10th and continues until about October 15th, the scattered bands of females, as previously stated, tend to foregather throughout the range without actually forming a herd. On the other hand, the males who have lived bachelor lives as individuals or in small companies remote from the females, drift in towards them from the terrain they have occupied since the breaking up of the winter congregations.

For a week or ten days prior to the beginning of the rut, the males commence to "bugle" their high-pitched calls which increase in intensity and volume with the passing days. Again mention may be made of the suggestion that the purpose of "bugling" is not one of challenge, for I have on several occasions noted males "bugling" when in the company of others of their sex. No animosity was observed. In fact, they paid no attention whatever to the vocal plaint of their companion, neither did he evince a pugnacious attitude towards his erotic friends.

Just before the rut begins the adult males draw apart, the "bugling" is more often heard,

especially during the evening and at night, and it is evident in every way that a degree of intense sexual passion controls the mental and physical reflexes of the individual. One quite often hears call after call emanating from one locality. A careful search of the vicinity guided by one's sense of smell shows where a male had stood and assumed a frenzied attitude of anticipation. The ground is torn up by pawing feet in a deep circular patch and soaked with strong-smelling urine. Nearby bushes are twisted and slashed by massive antlers. The vicinity of twenty-three such "calling stands" was examined for evidence of combat, but without avail. It seems quite certain that male Wapiti do not fight unless there are feminine spoils to reward the victor.

Seemingly overnight the period of rut commences and the most virile males appear spontaneously with a harem of females. I have no evidence to show by what manner they are acquired as the gathering is apparently accomplished under cover of darkness.

During the period of observation the breeding phenomena of nine herds were witnessed with the naked eye and by the aid of field glasses, and their numbers and other data duly recorded. The number of Wapiti in each herd was as follows:

1930

Field Note No. 67. 1 male 7 females 6 calves
Field Note No. 73. 1 male 9 females 9 calves
Field Note No. 84. 1 male 4 females 3 calves
Field Note No. 86. 1 male 11 females 9 calves

1931

Field Note No. 157. 1 male 13 females 10 calves
Field Note No. 163. 1 male 3 females 2 calves
Field Note No. 175. 1 male 12 females 9 calves
Field Note No. 189. 1 male 8 females 7 calves

1932

Field Note No. 260. 1 male 5 females 3 calves

It is quite obvious that, unlike female moose, the female Wapiti does not seek the male, but, on the other hand, is evasive and even indifferent. This is suggested, I believe, by the continual vigilance necessary on the part of male Wapiti to hold together their females who will wander off and break herd at every



Female Wapiti in Early Spring, Riding Mountain, Manitoba.

favourable opportunity. The question might therefore arise as to whether or not female Wapiti have a period of true oestrus like moose and domestic cattle, or akin to another female ruminant, the camel, depend on fertilization from a seasonal sexual activity of the males alone. In other words, while the female organs of reproduction are receptive to copulation and fertilization during the period of rut in the males, there is no conscious urge to seek connexion, and participation is a matter of course, unattended by sexual desire in the common acceptance of the term.

Among the herds listed, copulation was observed on eleven occasions, and at the time Field Note No. 157 was recorded the act was performed by the male thrice within four hours. Considering the length of the rutting period, there is little wonder that the males enter the fray as virile animals in good flesh and retire almost shadows of their former selves. It should be noted that this observation was made at the beginning of the rutting season when sexual vigour was at its height.

Copulation is effected without any amorous preliminaries. Once only was the male observed to approach a female near at hand and cover her. The remaining records show a lengthy run from some distance away—twenty or thirty yards—with the copulatory organ

partly extended, ending in what would almost seem a collision if the standing female did not sense the approach of the male and walk forward to ease the force of the impact. Accurate intromission is invariable, and the male withdraws almost immediately the female is covered and wanders off among the herd.

The testicles are scarcely noticeable until just before the rut, when they then appear to descend lower in the scrotum. Their normal size, judging from those examined in recently killed animals, is that of a pullet's egg. A flaccid penis, dissected from the sheath of an adult male in the spring of the year, measured 15.5 inches in length.

At the conclusion of the rut the sexes separate and the males show no further interest in the females until the advent of the next breeding season.

With mammals in a wild state it is impossible to estimate accurately the period of gestation. A fair approximation, however, can be gained by computing the intervening period between the beginning of the rut and the appearance of the first calves. In 1930 the rut commenced about September 8th and the following spring, 1931, the first calf was observed on May 20th. In 1931, the first evidence of the rut was noted on September 12th, and the first calf was seen in the spring of 1932 on

May 25th. Therefore it may be figured roughly that the period of gestation in Wapiti is about 32 weeks.

Local opinion is to the effect that female Wapiti give birth to twin calves. This, however, is not borne out by observation. My field notes contain data relative to 19 bands of females with calves at foot composed of from one to nine adults. Two observations were made of two calves suckled by one female. One observation of a band of five females with six calves, and the remainder with less or equal number of offspring in comparison with the number of adults. The observations quoted are dated during the months of July and August, 1930 and 1931, at which time of the year the calves follow their mothers in their ramblings. It would seem that twins are the exception rather than the rule, and that generally only one calf is born each season.

Little information upon the subject of twins can be gathered at calving time, as any twins born would be cached and nursed apart from one another.

ENEMIES AND DEFENCE

As in the case of all game animals, the Riding Mountain Wapiti's greatest enemy is Man. Extravagant destruction in the past was

fostered by the same inconsiderate attitude which exists to-day in a moderated form, for despite the efforts of wardens to prevent poaching, the Wapiti range is invaded from all sides to supply individuals who live thereabouts with a liberal amount of wild meat at all seasons of the year.

The original enemies of the Riding Mountain herd may be considered as the Gray Wolf, (*Canis lycaon nubilis*); Brush Wolf, (*Canis latrans*); Prairie Coyote, (*Canis n. nebracensis*); and Lynx *Lynx canadensis*. The Gray Wolf and Lynx no longer exist on the Riding Mountain range.

Apart from Man, the Brush Wolf has proved the only observed predator. Its cousin, the Prairie Coyote does not prefer a timbered terrain for a habitat, but no doubt took a fair toll of young and decrepit animals when the herd, in days gone by, occupied the lowlands during the winter months.

The greatest damage done by the Brush Wolf is apparently accomplished during the calving season in the months of May and June. In all, seventeen carcasses of small Wapiti calves were found showing signs of destruction by canine predators. The remains of eleven others were also encountered but the cause



Wapiti in Confinement Lead Unnatural Lives. Male with Antlers in "Velvet" at Brandon, Manitoba, in forced Company of Female.



Male Wapiti "Bugling".

of death could only be suggested. That a natural mortality exists during parturition, there can be no doubt. The percentage, though, would be small in comparison to the destruction brought about by Brush Wolves.

Regarding the destruction of Wapiti calves by Brush Wolves, it is appreciated that ocular proof is necessary in order definitely to establish a case. In this respect I was fortunate enough in June, 1930, to witness the death of one of these pretty creatures and, later, to gain additional visual evidence to support the fact.

The first instance occurred when Kenneth Fuller Lee and I were observing the behaviour of a female Wapiti in the Kennice meadow district. We watched her for some time behind the cover of a willow thicket on the edge of an open meadow. Presently, she must have caught our wind, for she cautiously walked towards where we were hidden, "barking" her apprehension. From her actions it was evident that she had a young calf cached in the vicinity. Suddenly she bounded away, whereupon a calf rushed from a small clump of willows close by, headed in the opposite direction, for the shelter of the forest. For a moment we watched its progress with interest, little expecting the untimely end it would suddenly

meet. It had scarcely entered a vista between the trees when three Brush Wolves appeared and fell upon the unfortunate animal, bearing it to the ground. It was the work of a moment, which we were powerless to prevent, although we hurried forward shouting lustily in an effort to drive the marauders away. Upon examination of the lifeless form we found the throat torn, the tender underparts cruelly lacerated, and the left hind leg hamstrung. The means employed to bring down the quarry resembled the gang tactics of the Gray Wolf, for they worked team-like to attain the end. No. 1 took a throat hold; No. 2 rent the underparts, and No. 3 grasped the hind leg.

The second instance happened during the latter part of May, 1931, in the same vicinity. Shortly after daybreak I set out alone from camp for the purpose of observing females. Emerging from the forest I settled down with field glasses beside the bole of a large spruce tree. About 400 yards away, five female Wapiti grazed on the lush grass of a meadow. Two young calves were partially visible, lying in the grass. Presently, the five females started off across the meadow heading for the forest on the other side. When about 200 yards away from the calves, who made no attempt to follow their dams, two Brush

Wolves appeared from a clump of bush and walked boldly towards them. I could see the calves hug the ground as the wolves approached. Then, one gained its feet and ran, uttering high-pitched cries, towards the nearest cover, followed closely by two wolves. I found its mutilated body a few minutes later. I did not, however, witness the actual killing as it happened in a thicket of willows. The evidence, although circumstantial, was sufficient to establish another case against the Brush Wolf. The second calf remained motionless during the tragic happening. It was still in its form which I returned to camp an hour later.

Brush Wolves also frequent the vicinity of the winter feeding grounds and may, when the snow is deep, pull down aged and weak individuals. Although numerous carcasses of dead Wapiti have been seen about the winter range, there was no evidence to show that their death was occasioned by wolves. The probability of Brush Wolves killing Wapiti over six months old is, I think, remote. Badly wounded or sickly animals could be secured with comparative ease, but at the present time there are no facts to substantiate the assumption.

As to the prevalence of Bush Wolves on the ranges under observation, it is impossible to arrive at even an approximate estimate. The slaughter of the Wapiti calves through their activity in the spring and early summer does not offer any tangible evidence, for when calves are plentifully scattered throughout a comparatively small area, even four or five wolves will search out and kill a goodly number in a very short period.

Mention may be made of the Black Bear as a possible predator on infant Wapiti. There is no particular reason for so doing other than to appraise the value of insistent statements made from time to time to the effect that bears have a penchant for tender Wapiti meat. Persons who informed me that local bears killed Wapiti calves could not furnish any evidence whatever to support the assertion and convicted on suspicion alone. There would seem no doubt, though, that a Black Bear might not overlook an opportunity to dine upon a Wapiti calf, but it would be unfair to condemn the animal without proof. Personally, I have no evidence to offer which would even suggest that the Black Bear on

the Riding Mountain range preys upon young Wapiti.

The degree to which female Wapiti might protect their offspring from Brush Wolves was evident on the last occasion on which I witnessed the destructive ability of these predators, as previously related. When the victim of the tragedy plaintively cried in terror, two of the females from the little band of five, who were still in sight when the wolves attacked, turned and ran towards the two calves, and although they could see what danger threatened their offspring their attitude showed aggression rather than fear. They were still advancing when I ran to see what had happened to the unfortunate creature the wolves had heeled to cover. Had I remained in hiding, I should no doubt have learned to what extent the maternal instinct of Wapiti asserts itself. As it was, they hesitated when I appeared and sought their companions who, by this time, had disappeared in the forest.

On several occasions I have seen female Wapiti during the calving season advance boldly towards a dog who was doing nothing but minding its own business. These instances, too, furnished no direct information as to what would eventually have happened, for the dog in question, well-behaved animal that it was, believed that discretion was the better part of valour and sought safety in flight. There seems little doubt, however, that, whenever possible, female Wapiti will defend their offspring against wolves and other small animal predators.

Unlike cow-moose, who countenance no familiarity with their young by Man, the female Wapiti is ever fearful when humans are concerned. During the calving seasons when the Wapiti were under observation three occasions were experienced of females returning to their calves when they cried lustily for a few moments after being captured for examination. In all, 63 calves were handled, 37 of which were found in company with their dams who, with the exception of the three occasions mentioned, left them to whatever fate might befall them. The females who returned left the scene hurriedly upon being disturbed and were absent from sight for some minutes. Every opportunity was allowed for a show of aggressiveness, but fear for their calves rather than a desire to drive off an interfering intruder was evident from their demeanour.

One advanced to within 20 yards; the others were content to remain at an even more respectful distance.

I have nothing to offer regarding the defence attitude of males.

POSSIBILITY OF DISEASE; EXTERNAL AND INTERNAL PARASITES; BITING FLIES

It is evident that during the past few years no epizootic outbreaks have occurred among the Riding Mountain Wapiti. However, epizootics originating from domestic animals who range about the borders of the reserved area and, during the open months, the most heavily populated Wapiti terrain, are deserving of consideration as possible menaces of the future.

Epizootics of hemorrhagic septicemia, Bangs disease (contagious abortion) and necrobacillosis, would, should they occur, reduce the herd appreciably. Bangs disease and necrobacillosis have already been encountered among the Wapiti in the United States. Anthrax, too, is a possibility.

Hemorrhagic septicemia broke out during the summer of 1931 among sheep which ranged a few miles distant from the Wapiti country, with the usual casualties. Had the infected flock pastured on the borders of the reserved area, which is often the case, the resulting consequences would undoubtedly have given genuine cause for alarm.

Bangs disease is a malady commonly acquired through the mouth by consuming food and drink contaminated with *Bacillus abortus*, left by infected animals. Regarding the prevalence of this disease among Wapiti, probably originating from domestic cattle permitted to occupy their range, I quote W. M. Rush of the Yellowstone National Park, Wyoming, U. S., who recently investigated the cause of Bangs disease among the buffalo and Wapiti in the Yellowstone National Park. It is believed that the buffalo became infected from a range occupied by domestic cattle and that neighbouring Wapiti also acquired the disease from a similar source.

Mr. Rush says ¹, referring to the agglutination test for *Bacillus abortus*: "... as part of the elk [Wapiti] herd uses the same range as the buffalo some tests from these animals were made. Thirty-five blood samples were taken from elk [Wapiti] wintering in the

vicinity of Mammoth, 30 miles from the buffalo range. Two of these showed contact with *Bacillus abortus* and were classified as suspicious. . . ."

"Thirty-two samples were taken from elk [Wapiti] ranging in proximity to the buffalo range. Of these three were positive, eight suspicious, and twenty-one negative. These tests indicate that the disease has become established in the elk [Wapiti] herd and will be another factor in further depleting the number of these animals."

The action necessary to prevent the possibility of Bangs disease appearing among the Riding Mountain Wapiti is obvious and worth the effort required to prevent domestic stock invading the range. Once introduced it would be difficult indeed to detect and control, for every infected male becomes a life-long carrier of the malady without apparent ill-effect to itself.

An epizootic of necrobacillosis among the elk, (Wapiti) moose and deer of Jackson Hole, Wyoming, U. S. broke out in the winter of 1927-1928 during the course of an investigation by Mr. O. J. Murie, U. S. Biological Survey, who was at the time engaged in field work relative to the problems of herd management. A study of the disease revealed the fact that *Bacillus necrophorus* invaded the system by way of oral lesions attributed to Squirrel-tail and other objectionable grasses in hay fed during the winter months. The mortality amongst the elk (Wapiti) at Jackson Hole in the winter of 1927-1928 totalled 409, a few of which died from other causes.

The data accumulated by Mr. Murie are invaluable for reference in the event of a possible outbreak of necrobacillosis among the Riding Mountain Wapiti should the disease be acquired at any future time, either through the necessity for winter feeding or under natural range conditions.

Mr. Murie² in his etiology of the subject states: "In the majority of cases grass seeds were found lodged in the lesions of the mouth, or wedged rigidly between the teeth or in the ulcerated tooth sockets. These were identified as the seeds of *Hordeum nodosum* (Squirrel-tail grass) with a lesser amount of *Bromus tectorum* (Brome grass). Short dried fragments of *Juncus* stem (Rush) were also found in a few cases."

¹ Journal of Mammalogy 13: 371-372.

² Journal of Mammalogy 12: 217-220.



Herd of Bachelor Male Wapiti Awaiting the Advent of the Rutting Season.

"Probably the most serious factor is the presence of Squirrel-tail grass in the hay. The action of the awns of these seeds in domestic animals is well known. Once having gained entrance to the tissues of the mouth or throat, they produce lesions. Suppuration takes place, and often results in great lumpy exostosis on the jaw. Any such break in the lining of the mouth offers an opportunity for entrance of *Bacillus necrophorus*, which takes the advantage with deadly result."

Mr. Murie continues: "It is rather impractical to treat diseases in wild game and the solution must be prevention as far as possible. The obvious thing to do is to eliminate Squirrel-tail and similar obnoxious grasses from any hay that is fed to the animals."

The importance of Mr. Murie's suggestion is of great value, for large quantities of Squirrel-tail grass (*Hordeum nodosum*) grow in and about the many meadows on the Riding Mountain range which, if hay feeding ever became necessary, would be drawn upon for a supply.

The presence of osseous necrophorus lesions about the articular surfaces of long bones arising as a secondary condition of necrobacillosis, has been sought among old skeletal remains of Wapiti on the Riding Mountain in an effort to establish the possibility (with the necessary assistance) of early infections. No evidence, however, was obtained.

Other possible diseases suggest themselves, but it is felt that the limited knowledge of animal pathology acquired by the writer, forbids a deeper invasion of the subject. Sufficient has been said to stress the importance of prevention through competent herd management of the Riding Mountain Wapiti and other native deer indigenous to the wapiti range.

Only one external parasite has been observed to infest the Riding Mountain Wapiti: the Moose tick, (*Dermacentor albipictus*). This parasite is invariably, but not abundantly, present on the hides of recently killed animals at all seasons of the year. They are very noticeable in the spring when shedding commences, for many are rubbed off with the detached hair when the host seeks to rid itself of the clinging encumbrance and, incidentally, its numerous guests. I believe that the moose inhabiting the same terrain are generally more infested by the moose tick and, consequently, more irritated. I have often seen moose during the first warm days of spring whose flanks and shoulders were raw and bleeding, presumably the result of rubbing against the rough bark of trees in an effort to allay excessive irritation. Wapiti have never been observed suffering from similar conditions or who in any way appeared discomforted, although undoubtedly infested to some degree. This fact might suggest that *Dermacentor albipictus* was originally an isolated parasite peculiar to

the genus *Alces* on which it finds greater protection and comfort amid denser pelage. Unfortunately, I have no information to offer at this time regarding its breeding habits and larval development.

Observed internal parasites of the Riding Mountain Wapiti are: Tapeworm (sp?); Round worms (*Ascaris*); and Stomach worms (*Strongylus*). Although subject to infestation by the liver fluke (*Fasciola magna*) this parasite was not noted in the livers examined.

Biting flies of the several species which irritate domestic cattle are evident in due season

and without doubt cause the Wapiti annoyance. On numerous occasions Wapiti have been seen to behave as if bothered by nose-flies, running with tossing heads and from time to time rubbing their noses against their fore legs.

A small unidentified insect is invariably found infesting the muzzle and nasal orifices of young calves. Apparently they do not bite or otherwise cause irritation, as their presence is tolerated without objection. I believe they are attracted by the natural moisture.

Further study is necessary regarding the parasitology of the Riding Mountain Wapiti by more competent authority.

(To be concluded)

BULL-FROG APPETITES

By P. A. TAVERNER



WITH reference to W. E. Scott's note in the September, 1933, number of *The Naturalist*, p. 143, on Bull-frogs eating trout.

Though not a herpetologist in general or a "frog-ologist" in particular, I have had considerable to do with Bull-frogs, especially in "collecting" them for epicurean purposes. The method of catching them with red flannel bait on a hook has been used and found admirable where frogs were plentiful, or sport, rather than frogs' legs, the principal objective. An early discovery in this method of capture was that after the red flannel had been shed on surrounding bushes or whipped off in the air, the bare hooks remained practically as efficiently attractive as before, the only loss seeming to be their decreased visibility. Another practical observation made was that the bait or the hook had to be in motion to arouse the interest of the victim. It was evident that it was motion, not form, shape or colour, that was essential to the deception that barbed hooks were tempting provender. Experiments with various baits and methods developed that a Bull-frog will attempt to eat anything that moves within its immediate field of observation. A rolling pebble is snapped up as quickly as a scurrying beetle, and a dangling grass plume is jumped at as readily as is a passing insect. The object may be rejected as inedible after trial but the general policy is to catch first and try afterwards that no possible opportunity be wasted. Even then memory seems short, or tactile reactions are deemed unreliable, for often second and third attempts may be made on the same object and sometimes even alarming,

or presumably painful, experience with lacerating hooks will not deter from further and immediate adventure. A frog's psychology seems to be that anything that moves is alive and anything alive is good to eat,—bar nothing it can swallow. Size is a secondary consideration, trial is the only criterion and the size that a hungry Bull-frog with grim determination can envelope sufficiently for the process of digestion is surprising. If a tail or two, or other odd parts have to hang without for a while, it is too bad but cannot be helped and is certainly no reason for foregoing the bellyful that does find comfortable lodgment inside.

Old readers of *The Naturalist* may remember reports of Bull-frogs eating Orioles and Olive-sided Flycatchers, and some years ago naturalist circles were stirred to the depths by charges of nature-faking, and elections to the Ananias Club, because one had embroidered his tale with a story of a Bull-frog fielding Tree Swallows in flight. It is not at all probable that Bull-frogs regularly climb trees or tall dead stubs after Orioles or Olive-sided Flycatchers or go careening into the air to catch Swallows overhead, but there is little doubt that, should a bird of any reasonable degree of smallness come down to drink or bathe too near to a semi-concealed Bull-frog of proper bigness, the latter would avail itself of the opportunity, with very good chances of success. The same would undoubtedly be true of fish, tadpoles, mice or anything else that proclaimed its vitality within seizing distance of this animated grave-yard.

Bull-frogs have long been blamed and probably justly so, for considerable mortality among the downy young of ducks and water birds that are

raised in their marshy habitats. I have never seen a frog catch a duckling but I believe ducklings have been taken from the stomachs of frogs and that lack of opportunity would be the only preventive to their so doing.

A good many years ago I watched an interesting episode from its comic beginning to its tragic end. It was on Lake Muskoka, Ontario. An only fair sized Bull-frog (it may have been a Green Frog) was sunning itself in a semi-comatose condition at the water's mossy edge when a rather medium-sized Garter Snake came up behind and struck it on the back. Why the snake made this gratuitous attack on an animal hopelessly too large to eat is a mystery. Its eyes were obviously out of scale with its swallow. Anyway the attack was suicidal. The reaction was immediate and positive. At the touch, and like a flash, the apparently sleeping frog turned, grabbed the snake by the middle and plunged into deep water. There was a splash and turmoil, the water boiled and bubbled, the mud was stirred up from the bottom, and for a minute all that could be seen was a rapidly moving con-

fused mass of frog and snake obscured by white water and mud. The snake strenuously objected to being swallowed alive while the frog was grimly determined that it should be. Then quietness came and the frog slowly rose to the surface with the head and a mid section of the snake's body well swallowed. A moment's pause and the struggle began again, this time rather shorter and when time was called it was evident that the frog had still more of the snake where it could be of most use. Several such spasms followed each other until finally the frog slowly climbed up on a floating log nearby and blinked in the sun, its belly stretched to its fullest rotundity and the end of the snake's tail feebly squirming out of the corner of its mouth. We saw the same frog several times within the next few days in the same locality, recognizing it by the faint scratches the snake's teeth had made in the original attack. It seemed a perfectly well and satisfied frog, content with the world in general, and hopeful that providence would again send such a treasure trove its way.

NOTES AND OBSERVATIONS

BIRD NOTES FROM UNITY, SASKATCHEWAN—The following birds have become more numerous in the last three years in the neighbourhood of Unity, which is 120 miles west and slightly north of Saskatoon.

Evening Grosbeaks: These were not seen in town here until a very few years ago but have been more present in the winter time during each of the last three years. Last winter there was one flock of about 16 around in January and another flock of about the same number toward the end of February and in both cases the flocks seemed to stop about two weeks. Probably it may have been the same flock here twice.

Magpies: I first saw one pair in Manito Forest Reserve 10 miles north west of Unity about 1926, since then having seen no more till two years ago in that neighbourhood.

Last year magpies were quite common in the said Reserve and were frequently seen around the Unity neighbourhood. I saw one pair quite late last Fall in a somewhat wooded valley two miles from Unity and a pair again in about the same spot on the 23rd of April, 1933. I am wondering if these birds may have spent the winter here.—S. HUMPHRY.

WHITE-CROWNED SPARROWS IN NOVA SCOTIA.—A perusal of my permanent field notes discloses the fact that in May, 1922, a White-crowned Sparrow was seen at Greenwich, Kings County,

by Mrs. H. M. Neary. Again in May, 1929, several were reported by J. W. Piggott at Bridgetown who stated that they stayed about his farm premises for several days. None of these were collected, however, for which reason the species has not been included in the Nova Scotia list.

That this bird does visit Nova Scotia in transit, however, has now been definitely established, for on May 15, 1933, one was seen on my premises at Wolfville at close range. My attention was first attracted to it by the bird's striking and, to me, unfamiliar song. The following day, May 16th, two specimens were collected, one at Bridgetown by J. W. Piggott, and the other at Wolfville by W. E. Godfrey, and this would suggest that a migrating wave of the species has come to our Province. The two specimens above mentioned will shortly be added to the Provincial Museum collection at Halifax and will fill a long-felt want.—R. W. TUFTS.

MIGRATION OF SWANS.—During each of the past three years I have observed what struck me as very interesting behaviour on the part of migrating swans.

On November 9, 1930, eleven passed over my house, flying east, and fairly low. They came from the north, but when they were about a quarter of a mile due west of my place, they turned and came east. On November 9, 1931, a

number came over, but I could not count them, as it was nearly dark. They took the same line and turned at the same spot. I got the location by the noise they made when they made the turn. On November 9, 1932, forty-three passed over, and took the exact same line of flight, as if they were following a well-marked trail. I believe they go to a small lake two miles east of my place.

The interesting feature of these migrations is that they have happened on the same date every year, and also within a few hours of the same time, and also that the swans fly so low (about one hundred yards high). What puzzles me is why they make that turn in the same place every year.—A. HOLE, *Rennie, Manitoba*.

WESTERN MOCKING BIRD (*Mimus polyglottis leucopterus*) ON VANCOUVER ISLAND, B. C.—On June 7th, 1931, when walking through the residential section "On the Hill" in Port Alberni, V. I., B. C. attention was drawn to the loud whistling of a bird in a nearby garden. On investigation it was found that the whistling came from a mocking bird which could be seen flying from tree to tree until it finally perched on the telephone wire only a few feet above our heads, when the bird was positively identified. During the half hour this mocking bird was under observation, it was heard to imitate perfectly the robin, blue-bird, purple finch, Bewick wren, and towhee.

Local residents stated that this bird had been about the district for two or three weeks and that their attention had been drawn to it by its lively and delightful song.—KENNETH RACEY.

BOOK REVIEWS

BIRDS OF THE BATTLE RIVER REGION OF CENTRAL ALBERTA by Frank L. Farley. Published by The Institute of Applied Art Limited, 10042, 109th St., Edmonton, Alberta, July, 1932. 8vo. pp. 85. Map and 12 halftones. Price 50 cts.

This little brochure fills a long felt want in giving us a basic list of the birds of the midsection of Alberta. It is based on twenty-five years, observation in the locality during the critical period of change from practical wilderness to cultivation. Thirteen pages are taken up with a Foreword describing the country and making acknowledgements. To page 59 is a list of 238 species of birds, many of them extensively annotated. Following is a Supplement giving tables of arrivals and discussions of Summer Birds in a Camrose Garden, Birds and Weather, The Whooping Crane, Changes in the Status of Certain Birds and Animals in Central Alberta during the Past Fifty Years, Tracing the Gulls to their Winter Homes, A Christmas Bird Census in Alberta, Settlement and Cultivation of the Prairies and its Effect on Bird-life, and an Index.

It seems excellently done and good judgement and restraint are used in accepting evidence. Of particular interest are the faunal changes that have taken place and are still in progress. The falling off in numbers of various species of ducks is particularly notable. "Formerly very common, now quite scarce" or its equivalent is regrettably often repeated. Of fifteen sporting species listed, but three are not so characterized. Unfortunately while the author lists cultivation, grazing, drought and Crows as contributory causes he makes no mention of the most important one and the only one that is within ready control, that is, over-shooting.

It seems so apparent that if breeding grounds are restricted and production reduced through uncontrollable influences we have just that much less surplus for sporting purposes. Yet it is just this obvious fact that many shooters refuse to face. They embrace any specious or theoretical method of conservation except the obvious one that is most easily applied and certain to work,—reduction of kill. Until practical means of increasing production are developed and *their efficiency demonstrated by use* the only salvation of our wild water fowl seems to lie in further restriction of shooting.

A strong plea is made for the Buzzard Hawks, those useful, ever-set gopher-traps that are daily being killed off to the great detriment of agriculture. Thousands of dollars are spent annually in rodent control yet these particular birds, that even the most bitter vermin haters acknowledge are wholly beneficial, continue to be sacrificed to foolish prejudice. It is doubtful if any thing can be said that will alter the general public's attitude towards them. To talk protection of any hawk or serious shooting restriction seems like whistling against the wind yet both are vitally necessary to conservation.

Altogether this is a valuable addition to the bird literature of the west and especially to that of the region particularly dealt with.—P.A.T.

"GAME MANAGEMENT" by ALDO LEOPOLD with drawings by Allan Brooks—Charles Scribner's Sons, London, 1933. 481 Pages and Preface. \$5.00.

To those who are interested in the field of conservation whether they be sportsmen, land-

owners, or those engaged professionally in the work, this book is indispensable if they would know the trend of modern thought on this subject.

The field of conservation is affected by so many sciences, and the literature of conservation has been so widely scattered, that, in consequence, the gathering together of this information, and placing it on record in one volume is a major effort in itself. The Author states the book has three purposes:

"First, to serve as a text for those practising game management or studying it as a profession.

"Second, to interpret for the thinking sportsman or nature-lover the significance of some of the things he sees while afield with gun or glass, or does in his capacity as a voting conservationist.

"Third, to explain to the naturalist, biologist, agricultural expert, and forester how his own science relates to game management, and how his practices condition its application to the land."

To the reviewer, one of the most interesting chapters of all is the History of Ideas in Game Management. In this part of the work the author begins with what is probably the first written restriction on the taking of game, contained in the Mosaic Law, in the Book of the Covenant. (Deuteronomy 22:6). The Author considers this law as an advance beyond that of the Egyptian task masters, who were known to be keen sportsmen, but whose records reveal no worries over conservation. Solon forbade the Athenians to hunt because they "gave themselves up to the chase, to the neglect of the mechanical arts". On the other hand Xenophon considered there was no small advantage to be reaped from sport chiefly because it was an excellent training for war. The question is still debated as to whether sport is an asset to society or not.

In the Mongol Empire, Marco Polo found that Kublai Khan, 1259-1294, had promulgated an order which forbade the killing of game between the months of March and October so that game might increase and multiply. From this date, through feudal Europe to the present our author traces the evolution of game management. In addition to the very interesting historical chapter he discusses in other chapters the mechanism of game management, the properties of game populations, including cyclic variations in populations, game range, measurement of populations and game censuses, diagnosis of productivity, game refuges, control of hunting, predator control, control of food and water, control of cover, control of disease, accidents, such as burning, drowning, destruction by oil, miscellaneous techniques, game economics and esthetics, policy and administration, game as a profession.

An extensive bibliography is given in the appendix.

The author gives the following items in his comments defining game management:

"The central thesis of game management is this: game can be restored by the creative use of the same tools which have heretofore destroyed it—axe, plow, cow, fire, and gun.

The conservation movement has sought to restore wild life by the control of guns alone, with little visible success.

Game management has the same end, but by more visible means.

Game management has long been an empirical art in Europe.

The attempt to adapt that art to biological principles and to American conditions and traditions is new."

Altogether this is a splendid new contribution in a field which has been neglected because its scientific relationships are not with one science but with many.—H.L.

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DECEMBER, 1933



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CONTENTS

	PAGE
William T. Macoun—January 27, 1869-August 13, 1933. An Appreciation.....	161
Some Canadian Auduboniana. By Harrison F. Lewis.....	162
The Wapiti of the Riding Mountain, Manitoba. <i>An Ecological Study and Commentary.</i> By H. U. Green.....	172
The Oldest Mountains in Canada. By M. E. Wilson.....	174
Two New Mammals for the Toronto Region List. By Clifford E. Hope.....	176
Reporting Sub-Species in the Christmas Census. By W. E. Saunders.....	176
Notes and Observations:—	
Christmas Bird Census.....	177
Index to Volume XLVII.....	179

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No. 9

WILLIAM T. MACOUN—JANUARY 27, 1869—AUGUST 13, 1933

AN APPRECIATION



W. T. Macoun



IN THE PASSING of Dr. William T. Macoun, Canadian horticulture has lost its most eminent authority. This will be acknowledged not only throughout the Dominion but in the United States and Europe, for his work and writings, by reason of their intensely practical value, have received wide recognition. Ability and hard, conscientious, well-directed work, applied in the field of his choice

over a long period of years, placed him *facile princeps* among those competent to advise in this country in horticultural matters. Of this work, of Macoun's achievements and successes in Canadian horticulture we cannot here write in detail; it must be left to another, better qualified than the writer, to discuss and evaluate such matters. It will be found no light task to gather together and record with proper emphasis the many outstand-

ing features of Macoun's scientific investigations, which are already giving results in a number of cases of very considerable commercial value.

However, it is not necessary for our Ottawa members to go far afield to realize and appreciate his thought and handiwork in one phase of his activities, one in which he took particular delight. It is a case of *circumspice*; the fine grounds of the Experimental Farm, the Driveway, the Civic Hospital Grounds, many another beauty spot in and about the Capital bear eloquent testimony to his skill in landscape gardening. Much indeed might be written respecting his successful efforts towards the beautification of the home and school surroundings throughout the country. His advice and encouragement in this matter have borne good fruit, to the benefit and enjoyment of the individual and the community at large. And in this connection it should be recorded that he did a fine work in encouraging, and assisting in, the formation of local horticultural societies and garden clubs in cities, towns and villages throughout the country. In this he was a pioneer.

Leaving to others the special tribute which assuredly will be paid to Macoun's scientific and practical service to Canadian horticulture, it is my present purpose in this notice to speak of him as an associate in scientific investigation, as a fellow member and worker in the Field-Naturalists' Club over a period of more than forty years. As a friend I can think of no one more staunch and loyal, and the same may be truly said with respect to his membership in the Field Naturalists' Club and other organizations. He did his duty and more than his duty by them. A task

or responsibility once assumed was faithfully, meticulously carried on. He was a hard worker in all he undertook. He was absolutely reliable and sincere. These—sincerity, reliability, loyalty—I take it were the outstanding qualities in his sterling character. Further, I found him a man of definite views but, withal, broad-minded and willing to consider those of others. A pleasant and satisfactory friend with whom to converse.

With regard to his own attainments and achievements and to the many honours which deservedly came to him, he was modest to a fault.

His long and active interest in the Field-Naturalists' Club must be known to all its members. He did much for its welfare in Council meetings, on the lecture platform, in the columns of *The Naturalist* and perhaps above all as a "leader" on field days. It may be honestly said that Dr. Macoun became, through years of enthusiastic interest and work, one of the Club's benefactors.

In closing this brief tribute to the memory of our friend I would bear witness to the deep and sincere regret expressed by all who knew him or knew of him. His sudden death after a very short illness came as great and acute shock to us all, for he was, so far as we knew, one who had always enjoyed good, indeed robust, health. As yet, I think we have scarcely realized that he has gone from us; as time passes we shall miss him more and more but the recollection of his good acts in our midst, of pleasant incidents and bits of conversation with him in our way through his life and the enjoyment of his skill and good taste in beautifying our City, will serve to keep his memory green.—FRANK T. SHUTT.

SOME CANADIAN AUDUBONIANA

By HARRISON F. LEWIS

JOHN JAMES AUDUBON, famous naturalist and artist, paid an extended visit, in 1833, one hundred years ago, to maritime regions in north-eastern North America that are now parts of the Canadian provinces of Quebec, Nova Scotia, and New Brunswick. Following that journey he carried on for a number of years a correspondence with Mr. Thomas McCulloch, Jr., of Pictou, Nova Scotia, and received from him and from his father, Dr. Thomas McCulloch, information relating to the habits and life histories of Nova Scotian birds and also specimens of some species.

The purpose of this present paper is to mark this centennial year of Audubon's visit, or "Labrador trip", as it is often called, by publication of several letters, previously unpublished,

written by Audubon to Thomas McCulloch, Jr., together with a brief summary of the journey, quotation of some of Audubon's comments on the places visited, and some mention of the McCulloch family and his relations with them.

Accompanied by several young men who were to act as collectors, Audubon, then 48 years of age, sailed from Eastport, Maine, in the schooner *Ripley*, on June 6, 1833, with the intention of visiting the north shore of the Gulf of St. Lawrence (then known as "Labrador" because it is the southern part of the Labrador Peninsula) in order to collect and figure the birds of that region and to obtain information about them for use in his great work, *The Birds of America*. Audubon hoped to find in this remote and sparsely settled region a number of species of birds previously un-

known to science, but in this he had little success, for the only previously-undescribed bird found in Labrador by his party was the Lincoln's Sparrow, *Melospiza lincolni lincolni*, the type specimen of which was obtained at Natashquan on June 27th, 1833. The bird was named by Audubon in honour of Thomas Lincoln, the young member of his party who collected the first specimen.

On June 9th Audubon and his party arrived at Canso (spelled "Canseau" by him), concerning which he says:

"We had been in view of the southeastern coast of Nova Scotia all day, a dreary, poor, and inhospitable-looking country. As we dropped our anchor we had a snowfall, and the sky had an appearance such as I never before recollect having seen. . . . Going on shore we found not a tree in blossom, though the low plants near the ground were all in bloom; I saw azaleas, white and blue violets, etc., and in some situations the grass really looked well. The Robins were in full song; one nest of that bird was found; the White-throated Sparrow and Savannah Finch were also in full song. The *Fringilla nivalis* [Eastern Snow Bunting] was seen, and we were told that *Tetras canadensis* [Canada Spruce Grouse] was very abundant, but saw none. About a dozen houses form this settlement; there was no Custom House officer, and not an individual who could give an answer of any value to our many questions. . . . It snowed and rained at intervals. . . ."

Favourable weather permitted the *Ripley* to pass through the Gut of Canso and enter the Gulf of St. Lawrence on June 11th. Of the passage through the Gut, Audubon records:

"The land rises on each side in the form of an amphitheatre, and on the Nova Scotia side, to a considerable height. Many appearances of dwellings exist, but the country is too poor for comfort, the timber is small, and the land, very stony. Here and there a small patch of ploughed land, planted, or to be planted, with potatoes, was all we could see evincing cultivation. Near one house we saw a few apple-trees, yet without leaves. The general appearance of this passage reminded me of some parts of the Hudson River. . . ."

June 12th to 14th were spent at the Magdalen Islands, where cold and disagreeable weather was at first experienced, Audubon's record for the 12th concluding with the remark that "The wind is so cold that it feels to us all like the middle of

December at Boston."³ The next day, however, after a visit to one of the islands, he says, "During our ramble on the island we found the temperature quite agreeable; indeed, in some situations the sun was pleasant and warm. Strawberry blossoms were under our feet at every step, and here and there the grass looked well."⁴ He was told of the numerous ponds in the sand-dune region near East Cape, where many kinds of water-fowl nested, and he made plans to visit this interesting area on the 14th, but was obliged to forgo this side-trip because, on the morning of the day in question, the wind blew fair for continuing the voyage to Labrador, so the *Ripley* promptly weighed anchor and resumed her northward course.

Great Bird Rock, which is a famous nesting-place of seabirds north of the Magdalen Islands, and is now included in a Dominion Bird Sanctuary, was passed on June 14th by Audubon, who was amazed at the great numbers of Gannets that were seen nesting there. He says:

"At eleven I could distinguish its top plainly from the deck, and thought it covered with snow to the depth of several feet; this appearance existed on every portion of the flat projecting shelves. Godwin [the pilot] said, with the coolness of a man who had visited this Rock for ten successive seasons, that what we saw was not snow—but Gannets! I rubbed my eyes, took my spy-glass, and in an instant the strangest picture stood before me. They were birds we saw,—a mass of birds of such a size as I never before cast my eyes on. The whole of my party stood astounded and amazed, and all came to the conclusion that such a sight was of itself sufficient to invite any one to come across the Gulf to view it at this season. The nearer we approached, the greater our surprise at the enormous number of these birds, all calmly seated on their eggs or newly hatched brood, their heads all turned to windward, and towards us. The air above for a hundred yards, and for some distance around the whole rock, was filled with Gannets on the wing, which from our position made it appear as if a heavy fall of snow was directly above us. Our pilot told us the wind was too high to permit us to land, and I felt sadly grieved at this unwelcome news."⁵

The north shore of the Gulf of St. Lawrence was finally reached at the harbour of Natashquan, north of the eastern end of Anticosti Island, on June 17th. Audubon was greatly excited on the occasion of this arrival in the long-desired land of

¹ Audubon and His Journals, by Maria R. Audubon, London, 1898, vol. I, pp. 351-352.

² *op. cit.*, p. 353.

³ *idem*, p. 355.

⁴ *idem*, p. 357.

⁵ *idem*, p. 360.

Labrador. He tells us:

"I was on deck at three this morning. . . . I looked on our landing on the coast of Labrador as a matter of great importance. . . . At five o'clock the cry of land rang in our ears, and my heart bounded with joy; so much for anticipation. . . . The shores appeared to be margined with a broad and handsome sand-beach; our imaginations now saw Bears, Wolves, and Devils of all sorts scampering away on the rugged shore."⁶

His ardour soon changed to disappointment and unhappiness. Cold, dampness, and stormy weather combined with the bare ruggedness of the country and the lack of much novelty in its avifauna to depress and discourage him. After his first landing, on the very day of arrival, he writes:

"But what a country! When we landed and passed the beach, we sank nearly up to our knees in mosses of various sorts, producing as we moved through them a curious sensation. These mosses, which at a distance look like hard rocks, are, under foot, like a velvet cushion. We scrambled about, and with anxiety stretched our necks and looked over the country far and near, but not a square foot of earth could we see. A poor, rugged, miserable country; the trees like so many mops of wiry composition, and where the soil is not rocky it is boggy up to a man's waist. We searched and searched; but, after all, only shot an adult Pigeon-Hawk, a summer-plumage Tell-tale Godwit, and an *Alca torda*. We visited all the islands about the harbor; they were all rocky, nothing but rocks."⁷

From Natashquan some members of the party made a brief excursion by small boat along the coast to the westward for a distance of forty miles, to a place that they called Partridge Bay. Audubon himself did not go far from the *Ripley*, which remained at Natashquan until June 28th, when it sailed for harbours farther eastward along the north shore of the Gulf. Fairly long stops were made at Wapitagan, Little Mecatina Island, and Mutton Bay, and, finally, at Bradore Bay, which is close to the western end of the Strait of Belle Isle. Audubon's opinion of this northern land did not improve as he journeyed eastward to the cooler parts of it, with their more stunted vegetation. He speaks of the country as being made up of "Bare, high, rugged rocks, grand indeed, but not a shrub a foot above the ground", and of Little Mecatina Island he writes, "Nothing but rocks—barren rocks—wild as the wildest of the Apen-

nines everywhere". He refers also to the "Bays without end, sprinkled with rocky islands of all shapes and sizes", to the "beautiful fresh-water lakes", and to an iceberg that looked "like a large man-of-war dressed in light green muslin". Concerning the weather he says, "Could I describe one of these dismal gales which blow ever and anon over this desolate country, it would in all probability be of interest to one unacquainted with the inclemency of the climate. Nowhere else is the power of the northeast gale, which blows every week on the coast of Labrador, so keenly felt as here. I cannot describe it. . . ."⁸

Yet there were times, even during that stormy summer, when fine weather induced a happier mood in the great naturalist. On July 2nd he records in his journal "A beautiful day for Labrador" and speaks of the beautiful flowers, butterflies, and bees that he observed, and on July 20th he writes, "Labrador deserves credit for one fine day! To-day has been calm, warm, and actually such a day as one might expect in the Middle States about the month of May."⁹ It is true that, when the *Ripley* finally turned her prow southward from Bradore Bay, on August 11th, he expressed his feelings in the words, "Seldom in my life have I left a country with as little regret as I do this", but his pleasant memories, like those of other travellers, outlasted the unpleasant ones, so that a few years later he could say, "Although several years have elapsed since I visited the sterile country of Labrador, I yet enjoy the remembrance of my rambles there; nay, reader, many times have I wished that you and I were in it once more, especially in the winter season."¹⁰

Audubon decided to leave the *Ripley* and journey homeward through Nova Scotia. After a stop for five days at Bay St. George, on the west coast of Newfoundland, an attempt was made to reach Pictou, Nova Scotia, in the schooner, so that Audubon and his party might be landed there. Light and contrary winds prevented this, however, and Audubon, becoming impatient, decided, on August 22nd, that the party should be put ashore on the nearest available part of Nova Scotia, whence they would make their way to Pictou as best they might. Accordingly, they were landed that day on "Ruy's Island", presumably Roy's Island, Pictou County, several miles east of Pictou. Here they found some haymakers, two of whom they engaged to transport their baggage and two of their party to Pictou. The other members of the party, including Audubon himself, after being conveyed to the mainland, walked to Pictou

⁶ *idem*, p. 393.

⁹ *idem*, p. 405.

¹⁰ *The Birds of America*, New York, 1871, vol. VII, p. 48.

⁶ *idem*, pp. 363-364-365.

idem, p. 365.

Landing and were ferried across Pictou Harbour to Pictou. Audubon enjoyed that walk very much, for the contrast between the cold, rough coast of Labrador and the warm weather and green fields of Nova Scotia was very marked and he rejoiced in the change in his surroundings. He says:

" we felt so refreshed that the thought of walking nine miles seemed like nothing more than dancing a quadrille. The air felt deliciously warm, the country, compared with those we have so lately left, appeared perfectly beautiful, and the smell of the new-mown grass was the sweetest that ever existed. Even the music of the crickets was delightful to mine ears, for no such insect does either Labrador or Newfoundland afford. The voice of a Blue Jay was melody to me, and the sight of a Humming-bird quite filled my heart with delight. The roads were good, or seemed to be so; the woods were all of tall timber, and the air that circulated freely was filled with perfume. Almost every plant we saw brought to mind some portion of the United States; in a word, all of us felt quite happy." ¹¹

Of Pictou itself he writes:

"A number of American vessels were in the harbor, loading with coal; the village, placed at the upper end of a fine bay, looked well, though small. Three churches rose above the rest of the buildings, all of which are of wood, and several vessels were on the stocks. The whole country appeared in a high state of cultivation, and looked well; the population is about two thousand." ¹²

That evening Audubon and his party "called on Professor McCulloch, who received us very kindly, gave us a glass of wine, showed his fine collection of well-preserved birds and other things, and invited us to breakfast to-morrow at eight, when we are again to inspect his curiosities. The Professor's mansion is a quarter of a mile out of town, and looks much like a small English villa." ¹³

On the following day, Audubon recorded in his journal:

"We had an excellent Scotch breakfast at Professor McCulloch's. His whole family were present, four sons and a daughter, besides his wife and her ¹⁴ sister. I became more pleased with the professor the more he talked. I showed a few Labrador drawings, after which we went in a body to the University [=Pictou Academy],

once more to examine his fine collection. I found there half a dozen specimens of birds which I longed for and said so; the Professor had the cases opened, the specimens taken out, and he offered them to me with so much apparent good will that I took them. He then asked me to look around and not to leave any object which might be of assistance in my publication; but so generous had he already proved himself that I remained mute; I saw several I would have liked to have, but I could not mention them. He offered me all his fresh-water shells, and any minerals I might choose. I took a few specimens of iron and copper. ¹⁵ I am much surprised that this valuable collection is not purchased by the government of the Province; he offered it for £500. I think it well worth £1,000." ¹⁶

From Pictou Audubon drove to Truro, "through a fine tract of country, well wooded, well cultivated", over a road "as good as any in England, and broader". ¹⁷ At Truro he met "Samuel George Archibald, Esq., Speaker of the Assembly" and "several members of the Assembly of this Province". After an introductory reference to Truro as a "pretty, scattered village, in sight of the head waters of the Bay of Fundy", he gives a more detailed record of his impressions of the place in the following words:

"The village of Truro demands a few words. It is situated in the middle of a most beautiful valley, of great extent and well cultivated; several brooks water this valley, and empty into the Bay of Fundy, the broad expanse of which we see to the westward. The buildings, though principally of wood, are good-looking, and as cleanly as those in our pretty eastern villages, white, with green shutters. The style of the people, be it loyal or otherwise, is extremely genteel, and I was more than pleased with all those whom I saw." ¹⁸

From Truro Audubon's party departed at night by coach for Halifax, where they arrived the following morning. He says:

"We crossed the harbor, in which rode a sixty-four-gun flag-ship, and arrived at the house of one Mr Paul. This was the best hotel in Halifax, yet with great difficulty we obtained

¹¹ Here the text as given in *The Life and Adventures of John James Audubon*, by Robert Buchanan, London, 1868, p. 303, includes the following statement: "He asked me what I thought of his collection, and I gave him my answer in writing, adding F. R. S. to my name, and telling him that I wished it might prove useful to him".

¹² *Audubon and His Journals*, M. R. Audubon, London, 1898, vol. I, p. 437.

¹³ The reading in *The Life and Adventures of John James Audubon*, by Robert Buchanan, London, 1868, p. 303, is "on as good a road as any in England, were it only a little broader", which is more probably the sense intended.

¹⁴ *Audubon and His Journals*, M. R. Audubon, London, 1898, vol. I, pp. 438-439.

¹¹ *Audubon and His Journals*, M. R. Audubon, London, 1898, vol. I, pp. 435-436.

¹² *idem*, p. 436.

¹³ *idem*, p. 436.

¹⁴ Miss Isabella McCulloch states that this should read "his", instead of "her".

one room with four beds, but no private parlor—which we thought necessary. With a population of eighteen thousand souls, and just now two thousand soldiers added to these, Halifax has not one good hotel, for here the attendance is miserable, and the table far from good. We have walked about to see the town, and all have aching feet and leg-bones in consequence of walking on hard ground after tramping only on the softest, deepest mosses for two months.”¹⁹

On the next day, August 25th, which was Sunday, he writes:

“I was surprised to find every wharf gated, the gates locked and barred, and sentinels at every point. I searched everywhere for a barber; they do not here shave on Sunday; finally, by dint of begging, and assuring the man that I was utterly unacquainted with the laws of Halifax, being a stranger, my long beard was cut at last. Four of us went to church where the Bishop read and preached; the soldiers are divided up among the different churches and attend in full uniform.”²⁰

On August 27th the party went by coach to Windsor. Of the drive to that place Audubon says, in part:

“The road between Halifax and Windsor, where we now are, is macadamized and good, over hills and through valleys, and though the distance is forty-five miles, we had only one pair of horses, which nevertheless travelled about six and a half miles an hour. Nine miles of our road lay along the Bay of Halifax, and was very pleasant. Here and there a country home came in sight. . . . We saw *en passant* the abandoned lodge of Prince Edward, who spent a million pounds on the building, grounds, etc. The whole now is in the greatest state of ruin; thirty years have gone by since it was in its splendor. On leaving the bay, we followed the Salmon River, a small rivulet of swift water, which abounds in salmon, trout, and other fish. The whole country is miserably poor, yet much cultivation is seen all the way. Much game and good fishing was to be had round the inn where we dined; the landlord said his terms were five dollars a week, and it would be a pleasant summer residence. We passed the seat of Mr. Jeffries, President of the Assembly, now Acting Governor. The house is large and the grounds in fine order. It is between two handsome fresh-water lakes; indeed, the country is covered with lakes, all of which are well supplied with trout. We saw the college and the common school, built of freestone,

both handsome buildings. We crossed the head of the St. Croix River, which rolls its impetuous waters into the Bay of Fundy. From here to Windsor the country improved rapidly and the crops looked well. Windsor is a neat, pretty village; the vast banks of plaster of Paris all about it give employment to the inhabitants and bring wealth to the place; it is shipped from here in large quantities. Our coach stopped at the best *boarding-house* here, for nowhere in the Provinces have we heard of hotels; the house was full and we were conveyed to another, where, after more than two hours' delay, we had a very indifferent supper. Meantime we walked to see the Windsor River, on the east bank of which the village is situated. The view was indeed novel; the bed of the river, nearly a mile wide and quite bare as far as eye could reach, - about ten miles. Scarcely any water to be seen, and yet the spot where we stood, sixty-five feet above the river bed, showed that at high tide this wonderful basin must be filled to the brim. Opposite to us, indeed, the country is diked in, and vessels left dry at the wharves had a strange appearance. We are told that there have been instances when vessels have slid sidewise from the top of the bank to the level of the gravelly bed of the river. The shores are covered for a hundred yards with mud of a reddish color.”²¹

The next day Audubon watched with great interest the rapid rise of the tide at Windsor, an account of which he has included in the “Episode” entitled “The Bay of Fundy”.

Leaving Windsor by steamboat shortly before noon on August 29th, Audubon and his party arrived at St. John, New Brunswick, at two o'clock the next morning. Of the short stay that they made in that place he says: “We perambulated the streets of St. John's by moonlight, and when the shops opened I purchased two suits of excellent stuff for shooting garments”.²²

From Saint John the voyage to Eastport, Maine, was made on the steamer *Maid of the Mist*, on August 30th. Thus ended Audubon's Labrador trip.

Four original letters from Audubon to Thomas McCulloch, Jr., fourth son of Dr. Thomas McCulloch, and the one of his family who was especially active in the study of natural history, are published hereunder. None of these letters, as far as I have been able to ascertain, has been published before. They came into the possession of the Misses McCulloch, of Truro, Nova Scotia, granddaughters of Dr. Thomas McCulloch,

¹⁹ *idem*, p. 441.

²⁰ *idem*, p. 441.

²¹ *idem*, pp. 442-443.

²² *idem*, p. 444.

and nieces of Thomas McCulloch, Jr., who have given most of them to public institutions. The Misses McCulloch have very graciously approved of this publication of these letters.

New York Sep 12th 1836.²³

My dear young friend

Should you not have heard of my return to the United States prior to this, this will confirm the fact to you. I have been here with John one week. Along with this I send you a copy of my third Vol. of Ornithological Biography, hoping that it may give you some pleasure.—I am extremely desirous to procure *in the flesh* (*feathers and all as when shot*) as soon as possible after being procured or shot.—certain species of Birds more abundant and more easily procured in your section of America than south of it, and now beg of you of [=to] fulfill for me the following commission.—That is to say, to procure for me all the species annexed on the other side, or as many of these as you can procure, and put in common Rum or whatever spirits sufficiently strong to save them for [=from] putrefaction, in *paires* as much as possible, and if not, by Twos of each Species. to have these put into good casks, with a list of the Specimen contained therein, and to ship this to New York on the 1st of May Next, to Nicholas Berthoud Merchant who is my Brother in Law and on whom I now authorize you to draw at Sight for the amount laid out by you for the Specimen, Spirits, etc.—

If you will attend to this, you will render to Science and to myself a very great obligation, and I shall feel great pleasure to do anything for you in return which you may desire at my hands.²⁴ I hope that your Dear Father and family are all well; Your Friends in London were so when we

left. Please present my sincerest regards and thanks to your Father and family; accept the good Wishes of mine and believe me ever Your sincerely attached Friend and Servant

John J. Audubon

Please to acknowledge the receipt of this, and tell me whither you will undertake this commission for me. Address care of N. Berthoud, Merchant New York.—²⁵

P. S. You may lay out to the amount of One hundred and Fifty Dollars.—for Birds, Spirits & Casks.

J.J.A.

LAND BIRDS.

- Goshawk Falco palumbarius—
- Broad-winged Hawk " pennsylvanicus
- Roughed legged Do. " lagopus—
- *Snowy Owl²⁶ Strix nyctea
- *Little Acadian Owl " acadica.
- *Hawk Owl " funerea.
- *Three toed Woodpecker Picus tridactylus.
- *Raven Corvus corax.
- *Canada Jay " canadensis—
- Republican or Cliff Swallow Hirundo fulvus
- Great Shrike Lanius excubitor.
- Every species of Warbler which you can procure.
- 127* Red bellied Nuthatch Sitta canadensis.
- *Hudson Bay Titmouse Parus hudsonicus.
- Shore Lark Alauda alpestris.
- *Snow Bunting Emberiza nivalis
- Snow Bird Fringilla hyæmalis.
- 2 *Pine Grosbeak Pyrrhula enucleator.
- *Canada Grouse Tetrao canadensis.
- Willow Grouse " saliceti.
- Marsh Hawk Falco cyaneus
- Common Buzzard " vulgaris.
- *Cinereous Owl Strix cinerea a *very large* Grey Species—
- Slender billed Grackle Such as you gave me at London
- Great Cedar bird D D D D D²⁸
- 12* Common Titmouse D D D D D
- *Lesser red Poll D D D D D
- Lapland longspur Fringilla laponica.

²³ As appears from its contents, Audubon wrote two copies of this letter and sent them from New York by two different ships, in order to ensure that at least one copy of this important communication should be received. Both copies were received and have been preserved. One copy, marked "No. 1", is in the possession of Dalhousie University, Halifax, Nova Scotia, to which institution it was given by the Misses McCulloch. The present writer has not seen this copy, but through the kindness of the university authorities and of Mr. E. Chesley Allen, of Halifax, has received a type-written transcription of it, with permission to use it in connection with this paper. The other copy, marked "Duplicate" and "(No. 2)" in Audubon's hand, and written in ink by Audubon himself throughout, is still the property of the Misses McCulloch, who have most kindly lent it to the present writer for publication in this paper. Because this is the copy seen by the present writer, and because it is an original in the sense of having been written by Audubon himself (although it is a "duplicate" in the sense of being the second copy of this letter to be written), this copy is the one here published *in extenso*. There are slight textual differences between the two copies, and where these appear to be of any moment the reading of the Dalhousie University copy is given in a foot-note. The copy here published is addressed "To | Thomas McCulloch Esq | Pictou | Nova Scotia" and bears the following postal stamps: "New-York, Sep 18"; "St. Andrews, 26" (rest of stamp illegible); "St. John, N.B., 27" (rest of stamp illegible). This copy was transcribed from the original text by Harrison F. Lewis.

²⁴ "which you or Yours may desire at my hands."—Dal. Univ. copy.

²⁵ "Please to acknowledge the receipt of this care of N. Berthoud New York—It goes by duplicate."—Dal Univ. copy.

²⁶ Species marked in the printed list with * are checked in pencil on the copy of this letter belonging to the Misses McCulloch. They may have been so checked by Thomas McCulloch, Jr., perhaps as he collected them.

²⁷ The figures "1", "2", and "12", appearing in the left-hand margin of the Misses McCulloch's copy of this letter, opposite the names of certain birds as shown above, are written in ink, probably not by Audubon but by Thomas McCulloch, Jr.

²⁸ See *The Birds of America*, New York, 1871, vol. IV, p. 166.

Arctic ground Finch.. a Species of Tohee bunting less than the Common²⁹

White winged Cross bill *Loxia leucoptera*— and whatever else that you may procure that you will think either rare or curious.³⁰

WATER BIRDS.—

Hudsonian Curlew .. *Numenius hudsonicus*— Purple Sandpiper... *Tringa maritima*— Hudsonian Godwit... *Limosa hudsonica*. you gave me Two.³¹

Hyperborean Phalarope *Phalaropus hyperboreus*—

Wilson's.....Do... Do.... *Wilsonii*— Red (*Grey in Winter*) Do. Do. *fulvicastrus* who [=you] gave me 2.

Every species of Gulls and Terns you may be able to get.

Pomarine Jager..... *Lestris pomerina*. Arctic Do..... " *parasitica* Richardson Do..... " *Richardsonii*— Forked tailed Petrel. *Thalassidroma Leachii* (you gave me 2.—

Fulmar Petrel..... *Procellaria glacialis*.— Wandering Shear-

water..... *Puffinus cinereus*.— Hutchins' Goose.... *Anser hutchinsii*—

Snow Goose..... " *hyperboreus*— Brant Goose..... " *berniciæ*.—

Pied Duck..... *Anas labradora* (*Fuligula*) Long tailed Duck.. *Anas glacialis*.— "

Eider Duck..... " *mollissima*.— King Duck..... " *Spectabilis*.—

Harlequin Duck.... " *histrionica*.—

I should like to have 3 or 4 of these, but particularly the Male!

Little Auk... .. *Uria alle*. Great Do. *Alca impennis*—

Foolish Guillemot.. *Uria troile*— Black.....Do... " *—grille*—

Large-billed Do... " *brunnickii*— Common Puffin... *Mormon arcticus*.—

and all others of the family— Razor-billed Auk... *Alca torda*

I conceive that it would be well to have the land Birds and the Water Birds divided into different casks, say one for each Division.— This is a troublesome affair to you, but I sincerely hope

²⁹ "a Species of Towhee Bunting with 2 White Stripes on the Wings"—Dal. Univ. copy.

³⁰ Below this sentence, on the Misses McCulloch's copy, is written in ink, in a hand not Audubon's, probably that of Thomas McCulloch, Jr.,

"1 G C Wren
1 Creeper
1 large Redpole
1 smallest Woodpecker."

³¹ See *Ornithological Biography*, Edinburgh, 1835, vol. III, p. 426.

that you will assist me in this, as I would do in any thing conducive to your pleasure or comfort. I send this by one ship, and for fear of its miscarriage forward a duplicate by another in a few Days—

Yours most truly
J. J. Audubon³²

.....
Charleston, S.C.—Jan'y 1st—1836³³ [=1837].³⁴

My Dear Friend.—

Some few weeks ago I received a letter from my Brother in Law Mr. N. Berthoud, in which he mentioned his having received one from you, the purport of which was to know whether you could ship direct for England from Pictou; the specimen of Birds you may have collected & preserved in spirits for me.—

This you may do of course, and indeed it will save me from expense, but I do not wish you to hurry yourself in this shipment, and wrote to you to that effect about Six Weeks ago from hence.— On the contrary I will feel greatly obliged to you by your continuing to augment the collection until the months of June or July, in hopes that you may procure some of the rarest in my list.— Here and elsewhere in the United States I have already Two hundred species in pairs at least.—

When you procure Young Birds such as Owls, Hawks or any other species please save these also.

— Should you Know any further particulars connected with the *Habits* of any of the species which you have not spoken of to me, pray transmit your observations to Care of N. Berthoud New York or Robt. Havell 77 Oxford Street London— We leave this on the 1st of next month for the Mexican Gulph.³⁵ With John & my own best re-

³² In a letter written to Thomas M. Brewer from Philadelphia, October 23, 1836, Audubon says, "My friend Thomas McCulloch, of Pictou, Nova Scotia, writes me that he also is at work for me there". See Thomas M. Brewer in *Harp'r's New Monthly Magazine*, 1880, vol. LXI, pp. 668-675.

³³ This letter is addressed "To | Thomas McCulloch | Pictou | Nova Scotia" and bears the following postal stamps: "Charleston, S. C., Jan 3"; one which is legible only as "REWS", presumably St Andrews N. B. (at the international boundary) with the date, 19 Jan. 37, written on the stamp in ink; "St. John, N. B., Jan. 25, 37". The address side is marked "Paid" and shows the name "J. J. Audubon" written in the lower left-hand corner. This letter was transcribed from the original text by Harrison F. Lewis. The letter is in the possession of the "MacCulloch Bird Club", an organization of school pupils in Grade VII of Pictou Central School, Pictou, Nova Scotia, having been presented to that Club on April 6, 1832, by the Misses McCulloch, of Truro. Miss Ada S. Macdonald, teacher of the grade before mentioned and organizer of the MacCulloch Bird Club, and Mr. R. A. Baxter, Principal of Central School, facilitated the making of the transcription and gave their permission for its publication.

³⁴ The letter was written on January 1st, 1837, as shown by place of writing, contents, and postal stamps. Evidently Audubon like almost every one else, sometimes wrote the number of the old year instead of the new when dating letters in early January. A letter written by Audubon on the same day (January 1st, 1837) to Thomas M. Brewer is also erroneously dated "Jan. 1, 1836" (*vide* Thomas M. Brewer, *loc. cit.*).

³⁵ This expedition was delayed until the spring of 1837.

gards to your whole family and to Yourself believe me I am my Dear Friend

Yours most truly

John J. Audubon

Charleston S.C. June 12th 1837—³⁶

My Dear Friend.—

My son John and Self have just returned to this City from our last South-western expedition and contemplate sailing for England pretty early in Next Month. May I beg of you therefor to Ship the Birds etc. which you have collected for me in Rum, either to London direct if you have a good and safe early oppy. or to the care of my Brother in Law James Berthoud merchant at New York. I would feel greatly obliged to you by receiving a list and numbers of the Birds you have collected, and the amount of the Sum I will now owe you for your layings out, which you can receive by—Drawing at a few days sight on James Berthoud, or on me at London should you want the money then.—

By letters from my beloved Wife dated London April 15th she tells me that two of your Brothers³⁷ were there then.— Pray offer my sincerest regards to Your Father and family, accept my thanks, and believe me always

Your sincerely attached Friend & Servant

John J. Audubon

Should you ship to London do so, Care of Robt Havell Engraver 77 Oxford Street, London.

New York August 21st 1841³⁸—

My Dear Friend

Your letter dated Pereau³⁹ July 30th came to hand yesterday and along with it the Jar con-

³⁶ This letter is addressed "To | Thomas McCulloch Esq | Pictou | Nova Scotia" and bears the following postal stamps: "Charleston, S. C., Jun 15"; "St. John, N. B. Ju 5. 1837"; and the faint impress of a stamp beginning "St", presumably St. Andrews, N.B. The word "Paid" is also stamped on the outside of the letter. In the upper left-hand corner of the address side is written in Audubon's handwriting, "Postage paid to Eastport, Maine", and in the lower left-hand corner of the same side is written in the same hand, "Via Eastport in Maine". The letter is in the possession of The Antiquarian and Numismatic Society of Montreal to whom it was presented by the Misses McCulloch and who have kindly consented to its publication here. An excellent photostat of the letter has been supplied for this purpose by Dr. Victor Morin, President of the above-mentioned Society, and from this photostat transcription has been made by Harrison F. Lewis. The original is in the Museum at the Chateau de Ramezay, Montreal.

³⁷ William and David. Information from a letter from Miss Isabella McCulloch.

³⁸ This letter is addressed "Thomas McCulloch Esq | Care of | Professor McCulloch | Dalhousie College | Halifax | Nova Scotia". The letter is in the possession of the Public Archives of Nova Scotia, to which it was presented by the Misses McCulloch and which have kindly permitted its publication here. A typewritten transcription, made in the Public Archives of Nova Scotia and collated with the original by Professor D. C. Harvey, Archivist, has been furnished for use in this connection through the kindness of Mr. E. Chesley Allen.

taining the Labrador Jumping Mouse, (*Meriones Labradoria*) and the Ground Squirrel (*Tamias Stelleri*) both in good order and valuable to me. Many thanks for your kind attentions. We will be glad to receive the Moose Horns.

As I have had no answer from you to a long letter which I wrote to you about two months since and forwarded by mail; I suspect that it has miscarried and therefor must repeat here almost all that was contained in it.

That letter was especially written to you for the purpose of receiving all the assistance in your power in the procuring specimens of quadrupeds, large & small and of every kind that may be found near you or at a distance from you.— The larger animals, I must have of course in the skins with the leg bones and clavicles, and the skull entire; but when ever it can be done I should like also to have the *heads and feet* of the said large animals put in Rum, and if with large horns, the latters sawed off about 2 inches above the roots, the upper parts n^{ed} and put in a box or Cask with skins.— All the smaller animals to be placed in Rum that can be. I sent you a list of which I have no copy but now send another which I hope will comprise nearly as much. I said to you that I will cheerfully pay all the monies you may disburse for me in such accounts, either by your drawing upon me at sight or in any other manner most agreeable to Yourself.— I am Joined by my Friend the Rev^d John Bachman in this second great publication and therefore feel desirous to render the Work as complete as possible.

Quadrupeds wanted—

Bats, Wood Rats, Wood Mice, field Rats & Mice of any sort.—

Squirrels, Mynxes [= Minks], Polecats, Marmots of every sort.— Shrews & moles also, I am anxious to have *young ones* of the Star-nosed Mole to see whether their tail is as large in proportion as in the specimen you sent me last Year?— *Wolverene. Pekan or Fisher, Weasels, Ermines, Pine Martin, Hudson's Bay Skunk. Canada Otter. Arctic Fox. every species of Lynxes. Quebec marmot, the Whistler Marmot. Flying Squirrels. Canada pouched Rat. Canada Procupine. American Hare in summer peltage, and white in Winter. Polar Hare (is abundant at New Foundland.) Tail-less Marmot. Moose Deer and Young Fawn if possible. The Caribou Deer &c &c. Wapiti or Elk &c &c.—Musk ox ??? although you might peradventure procure the latter?*

I long to have the young if possible of every species and as many of them put in Rum as can be sent thus. —It is probable that by your offering good prices for rare animals, perhaps some new species could be obtained. In skinning the animals,

³⁹ Pereau is near Kingsport, Kings County, Nova Scotia.

the skins should be detached to the nostrils so as to enable us to come at the skull without disfiguring the animals—In every instance, each animal not sent in Rum, should be accurately measured, from Tip of nose to posterior angle of the eye, Ear, Shoulder, root of Tail, and end of Tail, and the Girth and weight given.

Please to let me know whether you will or can attend to all this for me as soon as you can. Offer our best regards to all your family circle and believe me always

Your sincerely attached Friend,
John J. Audubon

N^o 38 of our little Work is out, but I cannot forward you any numbers until you send us the address (again) of Your Friends at Boston.—

Th^s McCulloch Esq,

Letter addressed on the outside to

Thomas McCulloch Esq.
Care of
Professor McCulloch
Dalhousie College
Halifax
Nova Scotia

Single)

Dr. Thomas McCulloch, whom Audubon visited at Pictou on August 22nd and 23rd, 1833, and to whose son, Thomas McCulloch, Jr., the letters published above were addressed, was born at Fereze, Parish of Neilston, Renfrewshire, Scotland, in the year 1776. He was educated in the parish school, the University of Glasgow, and the Secession Divinity Hall at Whitburn. At the University of Glasgow he took not only the course usual for candidates for the ministry, but also the medical course, although in the latter he never proceeded to a degree.⁴⁰ At the conclusion of his studies at the Divinity Hall he became a minister of the Secession Church, in Scotland.

In 1803, with his wife and three small children, he sailed from Scotland for America, intending to settle in Prince Edward Island, but the vessel in which the voyage was made arrived at Pictou, Nova Scotia, so late in the fall that it was deemed imprudent to attempt to cross Northumberland Strait to Prince Edward Island before the following spring. At that time Pictou consisted of only about eighteen buildings all told, with no church, but so pleased were the inhabitants with Mr. McCulloch's arrival and stay in their com-

munity that in the spring they engaged him as minister, at a salary of £150 per annum, which was seldom fully, and always irregularly paid.

Perceiving the great need for better educational facilities in the new country, Mr. McCulloch, with characteristic vigour and determination, not only attended to his pastoral duties but devoted a great deal of his time and attention to teaching and to developing a liberal and thorough system of education. Despite great and at times bitter opposition from various sources, he founded Pictou Academy and was its Principal and its indispensable champion for many years, including the time of Audubon's visit. He twice received the degree of D. D.; first, in 1821, from Union College, Schenectady, New York, and later from the University of Glasgow. In 1838 he became the first Principal of Dalhousie College, Halifax, a position which he still held at the time of his death, in 1843.

Possessed of great energy, ability, foresight, courage, and zeal, and equipped with an education that was both of a very high standard and unusually diversified, Dr. Thomas McCulloch so influenced the Nova Scotia of his day by organization, inspiration, and sound reasoning that he took a major part in establishing in the Province that ardour for a liberal and advanced education that is still a prominent characteristic of its citizenry. Gifted with an able pen, he published a number of books and innumerable contributions to the press of the time. His writings deal chiefly with subjects of a religious, educational, political, or social nature. Some idea of the outstanding position that he occupied in Nova Scotia in the early nineteenth century is given by the following statement by Dr. Archibald, Speaker of the House of Assembly of the Province, uttered during a debate on the affairs of Pictou Academy:

" if the decision of that day should dismiss Dr. McCulloch from the land of his adoption, the country would see many a weary day before she would again number in the lists of her population as much learning, talent, and disinterested devotion in the cause of education."⁴¹

Thomas McCulloch, Jr., the fourth son of Dr. McCulloch, proved to be the member of the family most interested in natural history, and, as he was not robust, this interest was encouraged for the sake of his health. Although all members of the doctor's family, as well as friends and pupils, appear to have assisted in building up his natural history collections, it was Thomas, Jr., who took the leading part in this work, who was afterwards entrusted with the

⁴⁰ See *The Life of Thomas McCulloch, D.D.*, by his son, William McCulloch, D.D., Truro, 1920, to which the present writer is indebted for much information included in this section of this paper.

⁴¹ *History of the Mission of the Secession Church to Nova Scotia and Prince Edward Island*, by Rev. James Robertson, Edinburgh, 1847, p. 220.

salé of the collections in London, and who supplied Audubon with much information about life histories and with numerous specimens of birds. When his father was Principal of Dalhousie College, father and son were both active in making natural history collections in various parts of Nova Scotia. Thomas McCulloch, Jr., died in 1865, being then Professor of Natural Philosophy in Dalhousie College, Halifax.

The Museum which was built up by Dr. Thomas McCulloch in connection with Pictou Academy and which was seen and praised by Audubon in 1833 began as a collection of insects, some time prior to 1825. During a visit to Scotland in 1825-26, renewed stimulus was undoubtedly given to Dr. McCulloch's native interest in natural history by his contact with several great naturalists who were then active there, and he sent by letter a request to his family in Pictou to gather natural history specimens of all kinds as rapidly as possible. After Dr. McCulloch's return to Pictou, the collections were arranged to form a small Museum, which received a great deal of care and attention and was built up apace and made as attractive as possible. To what extent Dr. McCulloch himself collected birds and mammals is problematical. His son James wrote in 1834, "Father has turned an inveterate hunter, he is very anxious to make a respectable thing of the collection of birds—and between what he shoots and Thomas buys we have been kept busy stuffing and skinning."⁴² On the other hand, Thomas McCulloch, Jr., wrote to Audubon, about the Bohemian Waxwing, "A single one was observed by my father. . . . but not being accustomed to the use of a gun, he did not procure it."⁴³

However that may be, in a few years, under Dr. McCulloch's enthusiastic direction and care, the collection became so large as to have quite a widespread fame. Haliburton's two-volume work on Nova Scotia, published four years before Audubon's visit to Pictou, contains, in its account of Pictou Academy, the following statements:

"It contains a library, not very extensive but valuable, and also a museum of the Natural History of Nova Scotia. It is the most extensive collection of the Zoology of the Country, which has yet been made. The birds in particular are finely preserved and make a beautiful appearance. This branch is nearly completed, and exhibits in one group almost every variety in the Province."⁴⁴

In building up this Museum, however, Dr.

⁴² Quoted in a letter to the present writer from Miss Isabella McCulloch, of Truro.

⁴³ *The Birds of America*, New York, 1871, vol. IV, p. 168.

⁴⁴ *An Historical and Statistical Account of Nova Scotia*, by Thomas C. Haliburton, Halifax, 1829, vol. II, pp. 55-56.

McCulloch was much in advance of the views of most of the population among which he lived, who could see no use in such a collection, and eventually, as the needs of his growing family increased and troubles in connection with Pictou Academy multiplied, he came to feel that the Museum demanded greater care and expense than he could afford to give it. To his own great disappointment, he was obliged, having failed in an attempt to obtain a government grant for the Museum, to abandon the idea of keeping and using the collection as an aid to education and to sell the accumulated specimens for what they would bring. Thomas McCulloch, Jr., took the collection to England in 1834 and sold it in London in detached portions, the Earl of Derby⁴⁵ being the largest purchaser. Audubon, who was in London at the time, befriended the young Nova Scotian, and aided him to dispose of the collection.⁴⁶ It was at this time, during the winter of 1834-35, that young McCulloch gave Audubon a number of specimens of birds, some of which are referred to in the latter's letter of September 12th, 1836, and some of which are mentioned here and there in *The Birds of America*. Among them were the Bohemian Waxwings (*Bombycilla garrula pallidiceps*) which Audubon used in preparing his plate of that species, for in his account of the "Black-throated Waxwing, or Bohemian Chatterer" he says:⁴⁷

"The specimens from which I made the figures of the male and female represented in the plate, were given to me by my friend Thomas McCulloch of Pictou, in Nova Scotia, who procured several others in the winter of 1834."

The letter above mentioned, which is published herewith, shows that the gift was made in London.

There is every reason to believe that Audubon and Dr. McCulloch had not met each other prior to the former's visit to Pictou in August, 1833, although Audubon may have heard of the Doctor's museum, for William McCulloch, who was a member of the family when Audubon called on his father, says, in introducing his account of this call, "The existence of the museum had in some way come to the knowledge of Mr. Audubon, the American naturalist."⁴⁸ It is quite probable that Audubon had learned of Dr. McCulloch and his collections from their mutual friends in Scotland. That they had such mutual friends is made clear by the following facts.

⁴⁵ The 13th Earl of Derby, not the 14th, as is stated in *Audubon and His Journals*, M. R. Audubon, London, 1898, foot-note on p. 109 of Vol. I. He was President of the Zoological Society of London and a subscriber to Audubon's *Birds of America*.

⁴⁶ Letter from Miss Isabella McCulloch, of Truro, to the present writer.

⁴⁷ *The Birds of America*, New York, 1871, vol. IV, p. 166.

⁴⁸ *Life of Thomas McCulloch, D. D.*, Truro, 1920, p. 147

Dr. McCulloch re-visited Scotland from the autumn of 1825 to October 8, 1826, partly for the purpose of raising funds for aid to Pictou Academy. When travelling from place to place to accomplish this object he carried with him a written testimonial, signed by forty-two prominent Scotchmen, most of whom were residents of Edinburgh and Glasgow and whose names have since been published.⁴⁹ Audubon entered Scotland, in search of support for his projected work on the birds of America, on October 25, 1826, only seventeen days after Dr. McCulloch had left that country. Among the people whom he met in Scotland during the weeks that followed, as recorded by him in his Journal,⁵⁰ we find the following who were also among the signers of Dr. McCulloch's testimonial.

Robert Jameson, Professor of Natural History,
Edinburgh University

Dr. Patrick Neill, Edinburgh

Andrew Brown, Professor of Rhetoric, Edinburgh University

Francis Jeffrey

John Brown, Edinburgh

Professor Robert Jameson and Dr. Patrick Neill were particularly active in assisting Audubon and it was the latter who introduced Audubon to Lizars, the engraver.⁵¹

⁴⁹ *idem*, pp. 86-87.

⁵⁰ See *Audubon and His Journals*, by M. R. Audubon, London, 1898.

⁵¹ In the *Ornithological Biography*, vol. III, p. 313, Audubon has published a quotation from Dr. Neill, written in 1835 (two years after Audubon's visit to Pictou), which includes a foot-note that refers to the presence at a funeral in Scotland in 1826 of "your friend Dr. MacCulloch of Pictou, who happened to be in Edinburgh at the time, and whose friendship I have also the happiness to enjoy". This shows conclusively that Audubon and Dr. McCulloch possessed a mutual friend in Dr. Neill, but it does not mean that Audubon and Dr. McCulloch were friends to each other as early as 1826. It is sufficiently explained by the fact that Dr. McCulloch, who attended the funeral in question in 1826, had become Audubon's friend, to the knowledge of Dr. Neill, prior to 1835, in which latter year Dr. Neill wrote this reference to the funeral of nine years before.

Audubon's accounts of the life histories of North American birds, as published in his *Ornithological Biography*⁵² and in the later editions of *The Birds of America*,⁵³ indicate what a large amount of useful information he received from Dr. Thomas McCulloch and from Thomas McCulloch, Jr., for their names are frequently mentioned in the text of these works as authority for statements presented, and a number of long quotations from the letters of Thomas McCulloch, Jr., are published *in extenso*, in the life histories of the Brant, the Spotted Sandpiper, Wilson's Snipe, the Bohemian Waxwing, the Flicker, the Black-capped Chickadee, and the Saw-whet Owl. The elder McCulloch is generally referred to by Audubon as "Professor MacCulloch", but once or twice as "Dr. MacCulloch", and once as "President MacCulloch of Dalhousie Cottage [= College], Halifax, N.S."⁵⁴ His son is generally referred to as "my friend Thomas MacCulloch", but there are such variations as "my kind friend Thomas M'Culloch", "Mr. T. MacCulloch", and "Mr. T. MacCulloch, jun.". The McCullochs' place of residence is usually given as "Pictou", but in a few cases as "Halifax", the references of the latter kind having undoubtedly been written after the McCulloch family moved to that city, in 1838.

It is clear that the brief meeting of Audubon and Dr. McCulloch in Pictou in 1833 was an experience that remained unobscured in the memory of each throughout his later life and that was of importance in providing for Audubon a source of much information concerning the fauna of Nova Scotia.

⁵² *Ornithological Biography*, Edinburgh, 1831-1839.

⁵³ *The Birds of America*, New York and Philadelphia, 1840-1844 and subsequent editions.

⁵⁴ In the account of the Blackburnian Warbler, *The Birds of America*, New York, 1841, vol. II, p. 48.

THE WAPITI OF THE RIDING MOUNTAIN, MANITOBA An Ecological Study and Commentary

By H. U. GREEN

(Concluded from Page 157)

THE POACHER AND HIS METHODS. WAPITI AND THE COMMUNITY

Unfortunately the Wapiti of the Riding Mountain live under the perpetual shadow of the hill-billy poacher. The ease with which they can be approached to within rifle shot by an experienced woodsman, their habit of visiting certain areas near settlements where salt licks abound, and the delicate nature of their

flesh, sets them apart from other big game more difficult to secure.

The average poacher who knows what he is about takes no great risk when invading the Riding Mountain range. More than often he is conversant with the whereabouts and movements of the local warden before he sets out on his foray to the hills. Consequently, even the ringing shot of his rifle seldom attracts unwelcome attention. He is encouraged, I

am led to believe, by the fact that no direct trespassing clause, so necessary when an animal sanctuary is entirely surrounded by settlement, is included in the provisions of the Dominion Parks Act and regulations. As a result any individual, whatever his reputation, may roam when and where he pleases armed with a reasonable excuse to account for his presence if intercepted. Although the presence of firearms within the reserved area is an offence it is a very easy matter to rid oneself of the accusing encumbrance should the nearness of humans be suspected.

The most popular method of poaching generally adhered to by the local fraternity is to proceed into the hills on foot during the late afternoon, choosing in preference a day when the atmosphere is heavy, to preclude the possibility of a rifle shot being heard from a distance. Travelled trails are seldom followed and every precaution is taken not to be found in possession of firearms. Usually little time elapses before Wapiti are encountered, a choice animal selected, killed, bled, and paunched. Immediately the poacher retires from the scene to await possible developments and, when satisfied that all is well, wends his way homewards, leaving the carcass of his victim where it fell. Before daylight he returns with a team and wagon if the meat can be removed readily or lies within reasonable distance of a trail, otherwise a pack horse is necessary for the purpose. The hide is slipped, the canine teeth drawn from the upper jaw, and the carcass quartered. With luck the meat is home and hidden by sun-up.

Possession of Wapiti meat in Manitoba constitutes an offence at all seasons of the year and further precautions are necessary lest premises be later searched by inquisitive and suspicious officials. To overcome this obvious disadvantage several methods are resorted to. Generally, and especially in the winter, the meat is kept off the premises some distance away. Legal proof of actual possession is then difficult to establish. Small portions of boneless meat, cooked or uncooked, found in the abode of a suspect are of little value as evidence owing to the inability of even an expert to determine definitely to what species of animal they were originally attached.

During the warm months of the year the brine barrel is employed as a means of preser-

vation. All bones are removed and destroyed and the meat cut in thin strips which are carefully washed to remove identifying hairs. The question of identity is again made impossible, or at the best, improbable, for a good poacher has always a plausible story to tell, and whether it is believed or not he is usually safe from the clutches of the law.

The reason that the bones of poached game animals are removed is because the poacher realizes that the identity of certain portions of suspected meat may be proved if they are found with the flesh. The cross section of the long bones of all deer near their articulating surfaces is round, while that of long bones of domestic cattle, sheep, and swine is slightly ovate.

Several other means are employed to bring about the destruction of Wapiti, among them pitfalls, snares, traps, trap guns, and sniping from platforms erected in trees near salt licks. These methods become popular in districts where a warden's luck has brought about the downfall of an individual or two who preferred to use a rifle with its pervading noisiness.

Local poachers may be divided into two classes. Those who kill Wapiti (and other game) through dire necessity, or in preference to slaughtering their own domestic animals for meat, and others who for monetary gain bring the result of their illegal act to local towns for barter and sale. All are a blight on the best interests of conservational ideals.

Until quite recently many despicable individuals preyed upon the Riding Mountain Wapiti to obtain the canine teeth for sale to members of a well known fraternal organization which had adopted these relics as an emblem. The decision to abolish it in the interests of Wapiti conservation did much to discourage the practice. It was not an uncommon sight, a few years ago, to come upon many carcasses of adult male Wapiti left to pollute the clean air of the woods. Not a pound of flesh had been taken, only the canine teeth removed.

Unfortunately the local attitude towards the poacher is one of indifference, for generally speaking the value of game life to the community is its gastronomic importance and the sport it affords. Aesthetic appreciation scarcely exists. The fact that the Riding Mountain, as a National Park, supports the largest

herd of Wapiti in Canada and affords sanctuary for *42 out of the 59 mammals common to Manitoba is of only passing interest to the average person too busy with work-a-day affairs to give the matter more than a passing thought. Their welfare depends on the untiring efforts of the National Parks branch, Department of the Interior, conservationists, and the growing army of non-killing nature

lovers who, profiting by the lessons of the past, seek to establish a more abundant future in their determination to endow coming generations of Canadians with the results of their foresight.

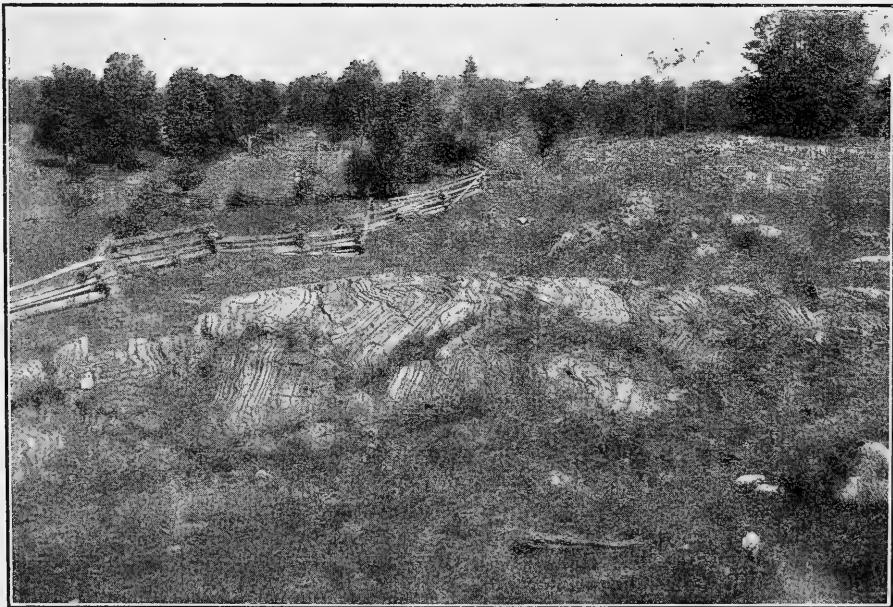
* V. W. Jackson, Professor of Biology, University of Manitoba gives 59 as the total number of mammals in Manitoba. The figure, 42 supplied by the writer as the result of his research. See Mammals of the Riding Mountain National Park by H. U. Green *Canadian Field-Naturalist* Vol. 46:149-152.

THE OLDEST MOUNTAINS IN CANADA

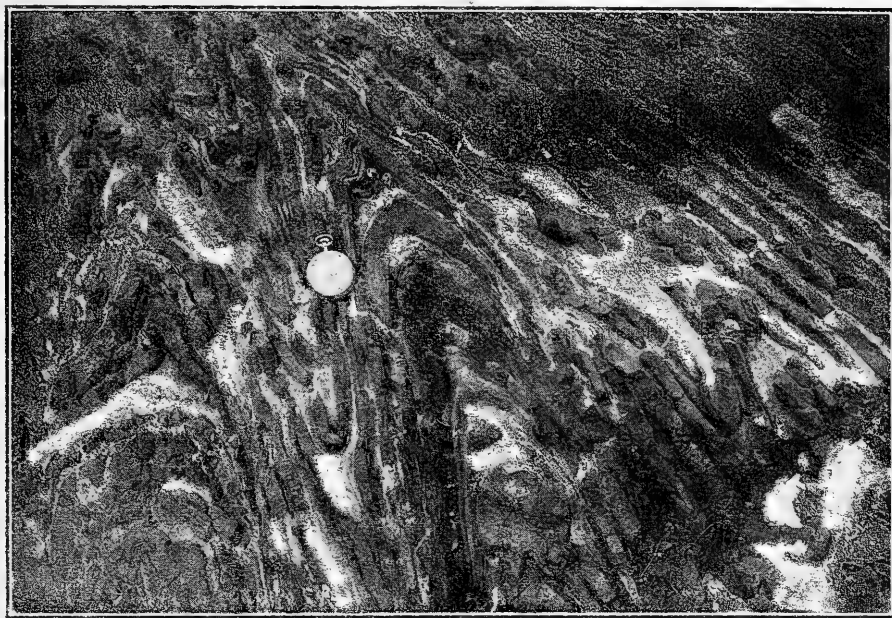
By M. E. WILSON

THE vast upland area, nearly two million square miles in extent, that occupies the greater part of northeastern Canada, known as the Laurentian Highland or the Canadian Pre-Cambrian Shield is physiographically peculiar in that although its elevation is relatively low its surface in detail is exceedingly rocky and rough suggesting miniature mountains. It differs also from non-mountainous regions, except when it is covered by lake clays as in the clay belt of northern Ontario and Quebec, in the absence of extensive areas of soil suitable for agriculture.

Why does this region, the largest of its kind in the world, possess these unusual characteristics? Geologists believe that it is due to the fact that in the geological long ago this huge area was occupied by mountains possibly as high as the Himalayas, the Andes or the Canadian Rockies, and these have since been worn down to their present low general elevation. The reason for this conclusion is that nearly everywhere throughout the Shield the superficial rocks, that is sediments and lava flows, in contrast with the flat bedded rocks underlying non-mountainous regions are highly folded as in Figures 1 and 2.



Crumpled limestone and siliceous argillite of Hastings Series, Lot 16, Concession III, Belmont Township, Peterborough County, Ontario.



Folded Dolomite of Hastings Series, Lot 22, Concession X, Madoc Township, Hastings County, Ontario.

If the Canadian Shield is a region of ancient mountains now truncated, then on its surface the interiors of these mountains are now exposed and from the rocks it should be possible to learn something of what occurs in the interior of mountains when they are uplifted. An examination of the rocks of the Shield shows them to include a great many varieties, a considerable part of which are granite and related igneous types that have crystallized from a molten condition. The relationship of these igneous rocks show that they have been thrust into the superficial rocks with which they are associated, partly in masses both large and small, partly as injections along their planes of bedding, and partly as filling in fractures. It is evident, therefore, that as mountains are uplifted huge masses of molten rock are formed in their interiors which are thrust upward as an accompaniment of the crustal crumpling by which the mountains are formed. It is also known that the mountains of the Canadian Shield were not all uplifted at the

same time but they were all worn down to approximately their present condition before the end of Pre-Cambrian time which occurred not less than several hundred million years ago.

The irregularity of the present surface of the Shield is partly the result of the varying resistance to weathering of the great variety of rocks composing it and partly the effect on denudation of the variable attitudes of its superficial rocks, both features resulting from the mountain building to which its rocks have been subjected. The peculiar physiographic characteristics of the Shield are therefore directly related to its former mountainous condition.

The outcrops of crumpled strata shown in Figures 1 and 2 are found in the counties of Hastings and Peterborough, Ontario, near the southern border of the Shield, but, except for some local areas of late Pre-Cambrian strata, all the superficial rocks of the great upland have been similarly folded.

TWO NEW MAMMALS FOR THE TORONTO REGION LIST

By CLIFFORD E. HOPE



WHILE spending the day in the woods near Forks of Credit, Peel County, Ontario, on June 12th, 1933, the writer captured a living specimen of the Woodland Jumping Mouse, *Napeozapus insignis*. This individual, the first to be taken in the Toronto region, was preserved and is now in the collection of the Royal Ontario Museum of Zoology.

Subsequent efforts have resulted in the taking of twenty-three additional specimens. Of this number only four were secured by means of mouse traps. The remainder were taken in a pit device which consisted of a wooden box, approximately two feet in depth, sunk in the ground in a situation in which it became half filled with cold spring water. The series of specimens indicates that the Woodland Jumping Mouse of this region is referable to the form *N. i. insignis*. Although some of the specimens were secured from moist areas forested with mixed deciduous and coniferous

growth, by far the greater number came from low ground, rather thickly covered with poplars, bracken, etc.

Another notable addition to the list of mammals known to occur in the Toronto region was made in October, 1932. A line of one hundred and ten mouse traps was set in the poplar-bracken habitat mentioned above. On the following morning, October 10, one of the traps contained a Bog Lemming Mouse, *Synaptomys cooperi*. Geographically the form for this region is *S. c. cooperi*. The specimen proved to be a pregnant female, two large embryos having been found when the mouse was dissected.

Again, on September 4, 1933, a male specimen of this mouse was picked up dead from a path not fifty yards from where the first specimen was trapped. Two small abrasions were discovered on the side of the specimen which suggested that it may have died from mechanical injury.

REPORTING SUB-SPECIES IN THE CHRISTMAS CENSUS

By W. E. SAUNDERS



AN IMPORTANT point with regard to this discussion, and one which has not been sufficiently stressed, is the absolute inability of even the keenest observer to determine sub-species in life. Even with the specimen in hand, the difficulty facing any but the most experienced is all but insuperable, while in the case of birds in the field, it simply cannot be done.

Many sub-species mix during the migrations. Take a song sparrow for instance. Our authority, the A. O. U. Checklist, gives *melodia* for northern Ontario, *beata* for the Mississippi Valley, and no Song Sparrow whatever for the Great Lakes region which includes London, Toronto and Ottawa! Now, these places have plenty of birds which we call Song Sparrows, and which doubtless really belong to the species; but, to which variety? The latest census from London mentions the Eastern Song Sparrow, and the guess (for such it was) was probably wrong, because our fauna is almost transitional, and the A. O. U. Committee were evidently afraid to commit themselves; so puzzled were they, that they were unable to say what birds we have. That being the case, who are we, to rise above them and declare that our sparrow is the Eastern, when there is not a single person among us who

has the ability to name the sub-species of the local bird from a specimen in hand?

Why, then, should we carry on the farce of naming the sub-species of birds seen in the field? Why not follow the sage advice of the Ornithological Editor and, admitting that we can only guess at the sub-species (and it does not matter anyway) simply call it a Song Sparrow? Then, if the committee refuses to give us a name for the species as a whole, let us thus make one for ourselves, and when it is in general use, the Committee must come to it, whether they like it or not; and, when all is said, are not the vernacular names supposed to be set by usage, and not by any Committee?

The Robin might be taken as another example. It is quite likely that the Western bird may pass through here on occasion, and it is likely that we may be visited by the race proposed by Mr. Todd, from the Ungava Peninsula; yet, if a Robin is seen on our Christmas census, down it goes as an Eastern, when we are using the term merely as a supposition. The truth is that, unless we have the specimen in hand and submit it to an expert, we can seldom do more than guess at it. Granted that the guess will probably be correct, when we are really guessing we should in all candour state plainly

that "All of the sub-species mentioned in this report are merely guesses and nothing more", a statement which would be absolutely truthful. Experienced ornithologists understand perfectly well that such reports are guesses, but what sufficient reason is there for us to make such a guess, when we can follow the guidance of our Ornithological Editor and use the name of the species. As for those who desire to have the sub-species named, why, let them look it up for themselves and make their own guess. Then, if they are wrong, they will have no one but themselves to blame.

Sub-species are for the closest student, not for the field worker.

Editor, *Canadian Field-Naturalist*.

As the originator of the much discussed 1932 Comox Bird Census I claim the right to reply to the learned chairman of the Committee. I have no objection to an Editor correcting my list but do strongly object to his adding his imaginary identifications and to his attempt at hairsplitting over the exact sub-species of birds that he has not seen and, evidently, is not well acquainted with. This attempt at meticulous exactness in these lists is neither scientific or possible. How can an enumerator, with probably only a momentary glimpse, in a very poor light, say for sure that this particular bird is a particular sub-species when, possibly, it is one over which our cleverest ornithologists quarrel with a series of skins in front of them? When I read such lists I have hitherto marvelled that there were such clever field-naturalists, now I know where the sub-species has, probably, originated.

I will admit that my list did require correction to comply with the last Check-list, but, not having this, I took the order from a recently published (1927) work that professed to adopt this order, in this way three or four families did not come in the correct order.

To describe a bird by its vernacular name without adding any distinguishing geograph-

ical or other appellation, seems to me quite as correct as adding after this "(sub-species?)". Admittedly, it should be the particular sub-species ordinarily found there or the only member of the family occurring. Heron for instance here can only be Blue Heron but whether Greater or Lesser is another matter.

Does it add to the scientific value of these lists by jumping to conclusions that the bird belongs to the most probable sub-species such as to connect my Raven to the Northern, my Robin to Northwestern (we have both Eastern and Western forms here). Why add Northern Pine to my very obvious Siskin? Western to my Winter Wren?

Some of the so called corrections expressed Mr. Lewis' opinion of expressing the common name. American Wigeon is as good as (better than) his Baldpate. Longtailed Duck as Old Squaw. Then is it a mistake to enumerate "Scaup Greater and Lesser" against his "Greater and Lesser Scaup Ducks". What else could a B. C. Coot be but "American"? At least the additions should be reasonably correct, witness his mistaken identification of the Chickadee. Surely it was better to leave it at this than bring on to Vancouver Island a Chickadee that does not occur there; we have only the one.

My description of our Crow as a Fish Crow seems to have been a source of sad trouble but had Mr. Lewis been acquainted with the Vancouver Island Crow he would have known, whatever it may be called, it is a fish Crow. Moreover this is given as an alternative name in most works on the Pacific Coast Birds. Can one conceive of a more clumsy distinction than the Northern Crow and the North-Western Crow?

In conclusion, I think these list should be published as sent in. The Editor may add his opinion if he likes, but after all the list represents the opinion of the man who saw the birds.

Yours, etc.

THEED PEARSE

Courtenay, B. C.

NOTES AND OBSERVATIONS

CHRISTMAS BIRD CENSUS—The Bird Census Committee wishes to remind any interested readers to take a Christmas Bird Census on some day between December 20 and 23, and send a report of it to the Editor as promptly as possible. For

the kind of report desired, please see published reports of previous years and discussion in *The Canadian Field-Naturalist* for September, 1933, pages 112-116.

INDEX TO VOLUME XLVII

- Abies balsamea* 42
Acanthis linaria 5, 30
linaria holboellii 72
Accipiter cooperi 26
velox 2
velox velox 26
Acer negundo 122
rubra 43
saccharum 42
spicatum 122
Actitis macularia 3, 27
 Adams, J.,
 Plants at Long Lake,
 Que. 142
Aechmophorus occidentalis 2
 Age of the Devonian Lime-
 stone at McMurray,
 Alberta 148
Agelaius phoeniceus 5
phoeniceus arctolegus 30
Alca torda 163
Alces americana 31
americana americana 49
 Alder 24, 42, 57, 122
 Allen, G. M.,
 Big Brown Bat 31
Alnus incana 42, 122
sitchensis 57
Aluco pratincola 143
Amelanchier spicata 122
Ammodramus savannarum
 australis 71
Anas platyrhynchos 2
platyrhynchos platyrhy-
 nchos 25
 Ancient lava field in the
 Canadian Shield 87
Andromeda Polifolia 118
Androsace septentrionalis 118
Anemone multifida 118
parviflora 118
Antennaria campestris 119
isolepis 119
Anthus spinoletta rubescens
 spraguei 4, 91
Aquila chrysaetos canadensis
 canadensis 26
Aquilegia canadensis 122
Aralia nudicaulis 43
Arctostaphylos rubra 118
Archilochus colubris 3
 Ardagh, J.,
 "Florula Canadensis" 32
Ardea herodias 2, 115
Arisaema triphyllum 43
Armeria labradorica 119
Arnica terra-novae 119
Arphia pseudonietana 95
Artemisia ludoviciana 122
Ascaris 157
 Ash, Black 122
 Mountain 122
Asio flammeus 3
flammeus flammeus 27
wilsonianus 3
 Aspen 57
 Aster, Wild 122
Aster acuminatus 142
commutatus 122
junceus 122
macrophyllus 142
modestus 122
punicieus 122
sericeus 122
umbellatus 122
Astragalus alpinus 118
Astur atricapillus 2
 atricapillus atricapillus 26
 Athabasca, Birds of 1
Athyris angelica occidentalis
 atricapillus 148
Atrypa gregeri 148
 reticularis 148
 spinosa 148
 Audubon, J. J., 162
 Auk, Great 168
 Little 168
 Razor-billed 168
Aulopora cf. adnascens 148
Aviculopecten cf. flabellum 148
Bacillus abortus 155
 necrophorus 155
 Baldpate 2, 25
Bartramia longicauda 3
 Bat, Big Brown 31
 Little Brown 45
 Silver-haired 74
 Trouessart's Little
 Brown 45
 Bear, Black 30, 45
 Beaver 47
 Bedstraw, Rough 8
 Beech 42
 Beech-drops 43
 Behaviour of a land bird at
 sea 139
 Belemnoida 12
 Bernard, H.,
 Bullfrogs and fish 75
Betula fontinalis 57
 lulea 42
 pendula 42, 122
 populifolia 42
 Bind weed 8
 Biological notes covering
 parts of the Peace,
 Liard, Mackenzie and
 Great Bear River basins 23
 Biology of the Amphibia:
 Review 77
 Birch 42, 57
 Grey 42
 White 24, 122
 Bird Census, Christmas,
 1932 50
 Bird notes from Cochrane,
 Alberta 36
 Bird watching in the West:
 Review 60
 Birds, Desired by
 Audubon 167, 168
 Birds and their winter food 143
 Birds of Minnesota:
 Review 96
 Birds of the Battle River
 region of Central Alb-
 erta: Review 159
 Bittern, American 2
 Blackbird, Brewer's 1, 5
 Red-winged 5
 Rusty 5, 30
 Yellow-headed 5, 36
 Bladderwort 43
Blarina brevicauda brevi-
 cauda 73
 brevicauda talpoides 44
 Blueberry 42
 Blue Limestone of Hastings
 County, Ontario 33
 Bluebird, Mountain 4, 24, 29
 Bobolink 35
Bombycilla cedrorum 5, 29
 garrula 5
 garrula pallidiceps
 29, 72, 171
Bonasa umbellus 2
 umbellus umbellus 27
Botaurus lentiginosus 2
Botrychium silafolium 142
 Bracken 42, 142
Branta canadensis 2, 25, 112
 British Columbia Wood-
 chuck 57
Bromus ciliatus 122
 tectorum 155
 Brooks, A.,
 Nova Scotia notes 70
 Bruggeman, P. F.,
 Mourning Doves 75
Bubo virginianus 3
 virginianus saturatus 27
Buchiola retrostriata 148
 Bufflehead 2, 25
 Bull-frog 75, 143, 157
 Bunch-berry 42, 122
 Bunting, Eastern Snow 163
 Indigo 121
 Lark 72
 Snow 36, 167
Buteo borealis 2
 borealis calurus 26
 platypterus 2
 regalis 26
Butoroides virescens virescens
 canadensis canadensis 71
 Buzzard, Common 167
Caenurgia erectea 95
Calamospiza melanocorys 72
Calcarius lapponicus alasc-
 ensis 30
 ornatus 72
Camarotoechia sp. 148
Camnula pellucida 95
Campanula uniflora 119
Campeloma cf. decisum 134
Canachites canadensis 2
 canadensis canadensis 26
 Canadian Snowshoe Rabbit
 Enquiry 63, 84
Canis lycaon 46

- Canvas-back 2, 25
Capella delicata 3, 27
Cardamine digitata 118
Carex albolutescens 122
 aquatilis 117
 bicknelli 122
 concolor 117
 cristata 122
 fænea 122
 mirabilis 122
 muskingumensis 122
 pedunculata 122
 straminea 122
 tenuiflora 122
 Caribou 50
 Barren Ground 31
 Carolina Wren at Toronto 36
Carpodacus purpureus 5
 purpureus purpureus 30
 Cartwright, B. W.,
 Geese and lightning 72
Casmerodius albus egretta 71
Cassiope hypnoides 118
 tetragona 118
Castalia 43
Castilleja pallida 119
Castor canadensis canadensis 47
 Catbird 1, 4
 Caterpillar, Tent 144
 Cat-tail 8
 Cattle, Tracks of 126
Caulhippus curtippennis 95
 Cedar-bird, Great 167
 Census of Birds, Christmas
 1932 50
Ceophleus pileatus 3
 pileatus abieticola 28
*Cervus canadensis man-
 itobensis* 105, 122, 150 172
 canadensis occidentalis 108
 merriami 108
 nannodes 108
Chara 43
Charitonetta albeola 2, 25
Chauletasmus streperus 2
Chen cærulescens 72
 hyperborea hyperborea
 25, 71, 72
 Chickadee 143
 Black-capped 4
 Brown-headed 4
 Chestnut-backed 112
 Hudsonian 29
 Long-tailed 29
 Oregon 112
Chimaphila umbellata 142
 Chipmunk 46
 Eastern 74
 Northern 31, 74
 Chipmunk vs. Snake 76
Chlidonias nigra 3
 nigra surinamensis 71
Chondestes grammacus 72
 grammacus strigatus 71
Chonetes sp. 148
Chordeiles minor 3
 minor minor 27
 Christmas Bird Census 176, 177
 Christmas Bird Census 1932 50
Cinna latifolia 122
Circus hudsonius 2, 26
Cirsium sp. 122
Cladonia rangifer 42
 Clark, T. H.,
 Review by 60
 Clarke, C. H. D.,
 Abundance of small
 mammals 73
Clethrionomys gapperi 48
Clintonia borealis 42
Coccyzus erythrophthalmus 3, 7
Colaptes auratus 3, 116
 auratus luteus 28
 cafer collaris 115
 Columbine 122
Colymbus auritus 2
 grisegena 2
 grisegena holboelli 25
 nigricollis 2
Condylura cristata 44
 Contribution to the know-
 ledge of the flora of
 northern Manitoba
 and the North-western
 Territories 116
Convolvulus sepium 8
 Coot, American 3
Cornus canadensis 42, 122
Corthylo calendula 4, 114
 calendula calendula 29
Corvus brachyrhynchus 4
 brachyrhynchus hesperis 28
 corax principalis 28
Corydalis aurea 118
Coturnicops noveboracensis 3, 70
 Cowan, I. McT.,
 Silverhaired Bat 74
 Cowbird 5, 6, 17
 Nevada 30
 Cowbirds, The:
 Review 17
 Cranberry, High-bush 123, 144
 Crane, Sandhill 3
Crania sp. 148
 Creeper 168
 Crested Flycatcher and cast
 snake skins 36
 Crickmay, C. H.,
 Belemnites 12
 Criddle, N., Obituary 145
 Crinoid stems 148
Crocethia alba 27
 Crossbill, White-
 winged 30, 36, 168
 Crow 24
 American 4
 Western 28
Cryptoglaux acadica 3
 funerea 3
 Cuckoo, Black-billed 3, 7
 European 7
Cuculus canorus 7
 Cucumber, Indian 43
 Curlew, Hudsonian 168
Cyanocitta cristata 4
 Cycles, Solar 63
Cypripedium hirsutum 43
Cyrtina billingsi 148
 billingsi symmetrica 148
 hamiltonensis 148
 missouriensis 149
Cysticercus pisiformis 142

Dafila acuta 2
 acuta tzizihoa 25
 Deer 49
 Mule 127
 White-tailed 126
Delitschia furfuracea 119
 Dempsey, J. H. C.,
 Epipactis Helleborine 12
Dendroica æstiva 5
 æstiva æstiva 29
 castanea 29
 coronata 5, 29
 magnolia 29
 palmarum 5
 pennsylvanica 9
 pinus 5
 striata 5, 29
Dermacentor albipictus 156
Diapensia lapponica 118
 Do Bullfrogs eat fish? 143
 Dorey, E. H.,
 Blue Grosbeak 121
 Dove, Mourning 75
 Dowitcher 3, 70
Dryas integrifolia 118
Dryobates pubescens 4
 villosus 4
 villosus septentrionalis 28
 Duck, Eider 70, 168
 Harlequin 168
 King 168
 Lesser Scaup 25
 Long-tailed 168
 Pied 168
 Ring-necked 2
 Ruddy 2
Dumetella carolinensis 4

 Eagle, Golden 26
 Northern Bald 26
 Egret, American 71
 Eider, Northern 71
 Elder 123
 Box 122
 Elk 105, 122, 150, 172
 Elton, C.,
 Rabbit Cycles 63, 84
Empetrum nigrum 118
Empidonax flaviventris 4
 minimus 4, 28
 trailli 4
Entomis variostrata 148
Epifagus virginianus 43
Epilobium angustifolium 118
 latifolium 118
Epipactis Helleborine 12

- Eptesicus fuscus bernadinus* 31, 32
fuscus fuscus 31
fuscus melanopterus 31, 32
fuscus miradorensis 32
fuscus oseola 32
fuscus pallidus 32
fuscus peninsulæ 32
propinquus 32
Equisetum arvense 117
Erethizon dorsatum dorsatum 49, 124
Erigeron acris 119
eriocephalus 119
hyssopifolius 119
Erismatura jamaicensis 2
Euarctos americanus 30
americanus americanus 45
Euphagus carolinus 5, 30
cynocephalus 5
Eutamias minimus borealis 31, 74
Eutrema Edwardsii 118
Excursions, Announcements
of 62, 104, 120
Exploration of Southamp-
ton Island, Hudson Bay:
Review 140
Fagus grandifolia 42
Falco columbarius bendirei 26
peregrinus 2
peregrinus anatum 26
sparverius 2
sparverius sparverius 26
Falcon, Peregrine 2
Farley, F. L.,
Varied Thrush 76
Fasciola magna 157
Faunal investigation of
Long Point and vic-
inity, Norfolk county
Ontario: Review 77
Ferguson, M. S.,
European Starling 60
Fern, Leathery Grape 142
Marginate Shield 142
Polypody 142
Royal 43
Fesque, Meadow 122
Festuca elatior 122
Fimetaria discospora 119
fimicola 119
Finch, Arctic Ground 168
Grey-crowned Rosy 30
Purple 5, 24, 30
Savannah 163
Fir 42
Douglas 57
Fish eaten by Bullfrog? 75
Fisher 45
Flicker 1
Northern 28
Red-shafted 112
Yellow-shafted 3, 112
Florida cærulea 70
Florula Canadensis 32
Flycatcher, Acadian 77
Alder 1
Crested 36, 71
Least 1, 4, 28
Olive-sided 4, 28, 157
Scissor-tailed 71
Traill's 4
Yellow-bellied 4
Food, Winter, of Birds 143
Fox, Cross 46
Red 31, 46
Fragaria virginiana 122
Fraxinus nigra 122
Frog, Northern Spotted 31
Fulica americana 3
Furniss, O. C.,
Killdeer Plover 135
Further notes on the Hen-
slow's Sparrow at Tor-
onto 58
Gadwall 2
Gale, Sweet 43
Galium asprellum 8
Gallinula chloropus cachin-
nans 70
Gallinule, Florida 70
Purple 72
Game Management: Re-
view 159
Gannet 163
Gaultheria 42
Gaultheria procumbens 142
Gavia arctica pacifica 25
immer 2, 25
Genotype of Belemnites;
with a synopsis of
North American spe-
cies of Belemnoidea 12
Geographic variation in the
Big Brown Bat 31
Geothlypis trichas 5
trichas brachidactyla 6
Gissing, A.,
Notes from Cochrane,
Alta. 36
Glaucionetta clangula 2
clangula americana 25
islandica 25
Glaucomyx sabrinus macro-
tis 47
Goat, Rocky Mountain 95
Godwit, Hudsonian 168
Tell-tale 163
Goldeneye, American 2
Barrow's 24, 25
Golden-rod 122, 142
Lance-leaved 8
Goldfinch 1, 24, 38
American 5
Eastern 30
Goose, Blue 72, 141
Brant 168
Canada 2, 25, 97
"Common" Canada 112
Hutchin's 97, 168
Lesser Snow 25, 71, 72
Richardson's 97
Snow 168
Gooseberry, Wild 122
Gorgosaurus libratus 81
Goshawk 38, 167
American 2
Eastern 26
Grackle, Bronzed 5
Slender-billed 167
Grass, Blue-joint 43
Brome 122, 155
Reed 122
Slough 122
Squirrel-tail 122, 155
Switch 122
Timothy 122
Grasshoppers 147
Grebe, Eared 2
Holboell's 2, 25
Horned 2
Pied-billed 2
Western 2
Green, H. U.,
Wapiti. 105, 122, 150, 172
Groh, H.,
Lilium umbellatum 59
New plant records 10
Grosbeak, Blue 121
Eastern Evening 72
Evening 5, 36, 112, 158
Pine 144, 167
Rose-breasted 5, 30
Grouse, Canada 167
Canada Spruce 163
Gray Ruffed 27
Hudsonian Spruce 26
Northern Sharp-tailed 27
Prairie Sharp-tailed 27
Ruffed 2, 74, 144, 147
Sharp-tailed 3, 24, 147
Spruce 2
Willow 167
Grus canadensis 3
Gryllus assimilis 95
Guillemot, Black 168
Foolish 168
Large-billed 168
Gull, Bonaparte's 3
Franklin's 71
Glaucous-winged 76
Greater Black-backed 70
Herring 27, 70
Kumlien's 88
Güssow, W. C.,
Flora of northern Man-
itoba 117
Haliaeetus leucocephalus al-
ascanus 26
Hare, Varying 31, 49, 63, 84, 147
Harris, R. D.,
Sprague's Pipit 91
Harris, W. E. and
Odell, W. S.,
Rotifers 132
Haultain, A. G.,
Flycatcher and Snake-
skin 36

- Hawk, American Sparrow 2
 Broad-winged 2, 38, 167
 Cooper's 26, 38
 Duck 26
 Eastern Sparrow 26
 Ferruginous Rough-legged 26
 Marsh 2, 26, 38, 70, 167
 Pigeon 38, 70, 163
 Red-shouldered 38
 Red-tailed 2, 24, 26
 Rough-legged 38, 167
 Sharp-shinned 2, 26, 70
 Sparrow 38
 Western Pigeon 26
- Hawks and Owls of Ontario: Review 37
 Hawks, Food of 38
Hedymeles ludovicianus 5, 30
Hedysarum boreale 118
Helisoma antrosom 134
campanulatum 134
 cf. *infracarinatum* 134
latchfordi 134
 Hemlock 42
 Heron, Blue 112
 Eastern Green 71
 Great Blue 2
 Green 97
 Little Blue 70
Hesperiphona vespertina 5
vespertina vespertina 72
Hieracium aurantiacum 122
Hierochlce alpina 117
Hippuris vulgaris 118
 Hole, A.,
 Migration of Swans 158
Honkenya peploides 117
 Hope, C. E.,
 Carolina Wren 36
 Two new mammals 176
Hordeum nodosum 122, 155
 Hummingbird, Ruby-throated 3
 Humphry, S.,
 Bird notes from Saskatchewan 158
Hylocichla guttata 4
guttata faxoni 29
minima aliciae 29
ustulata 4
ustulata swainsoni 29
Icterus galbula 5
 Identifications in the Co-mox Bird-census 112, 176
 Illustrations
 Ancient Lava Field 87
 Beaver Lodge and Pond 109
 Beaver Pond and Dam 107
 Blue Limestone 33, 34
 Crumpled Limestone 174
 Female Wapiti 151
 Folded dolomite 175
 Geese and lightning 73
 Head of Wapiti Calf 129
 Herd of Male Wapiti 156
 Lynx Cycles 64, 85
 Male Wapiti "bugling" 153
 Male Wapiti in "velvet" 152
Ornithomimus edmontonicus 80, 81, 82
 Pillow structure in lava 88
 Rabbit population 66, 67, 85
 Teeth of *Merychippus* 11
 Tracks of Cattle 126
 Tracks of Wapiti 126
 Type of *Belemnites paxillosus* 13
 Wapiti Antlers 108
 Wapiti Calf 124, 130
 Wapiti Calf in form 125
 Wapiti Feeding
 Grounds 106
 W. T. Macoun 161
 William Spreadborough 39
 Winter Camp, Riding Mt. 110
 In Bermuda during the Ice Age: Review 60
 Indian pipe 43
 Introduction to bird-study in British Columbia: Review 61
 Investigation on the European Starling 60
Ionornis martinica 72
Iridoprocne bicolor 4, 28
Ixoreus naevius 76
naevius meruloides 29
 Jack-in-the-pulpit 43
 Jaeger, Arctic 168
 Pomarine 59, 168
 Richardson 168
 Jay, Black-headed 112
 Blue 4
 Canada 4, 23, 28, 167
 Steller's 112
 Junco 112, 143
 Slate-colored 6, 30, 139
Junco hyemalis 6
hyemalis hyemalis 30
Juncus sp. 155
Kalmia 42
polifolia 118
 Killdeer 3, 135
 Kingbird 1
 Eastern 4
 Kingfisher, Belted 3
 Eastern Belted 28
 Kinglet 112
 Eastern Ruby-crowned 29
 Golden-crowned, Eastern 112
 Golden-crowned, Western 112
 Ruby-crowned 4, 112
 Sitka 112
 Knot 70
 L., H.
 Review by 159
 Lady's slipper 43
Lagopus lagopus albus 27
rupestris rupestris 27
 Laing, H. M.,
 Pygmy Nuthatch 36
 Sub-species identifications 112
 Yellow-headed Blackbird 36
 Lapwing 71
Larix laricina 43
 Lark, Horned 4, 28
 Shore 167
 LaRocque, A.,
Helisoma latchfordi 134
Polygyra dentifera 59
Valvata perdepressa walkeri 96
Larus argentatus smithsonianus 27, 39
argentatus thayeri 88
glaucescens 88
hyperboreus 89
hyperboreus barrovianus 90
kumlieni 88
leucopterus 88
nelsoni 90
philadelphia 3
pipixcan 71
Lasionyxteris noctrivagans 74
Lathyrus palustris 118
 Laurel 42
 Mountain 24
 Lava field, Ancient 87
 Law, R. G.,
 Tapeworm in Rabbits 142
Leda cf. *diversa* 148
Ledum palustre decumbens 118
 Leech 134
Leiorhynchus mesacostale 148
Leocarpus fragilis 119
Leptodesma cf. *naviforme* 148
Lepus americanus 31, 63
americana struthopus 49
Leucosticte tephrocotis tephrocotis 30
 Lewis, H. F.,
 Auduboniana 162
 Nomenclature in census 112
 Lightning Kills Geese 72
Lilium philadelphicum 59
umbellatum 59
 Limestone, Blue 33
 Devonian 148
Limnodromus griseus 3
 Lindsay, R. V.,
 Brünnich's Murre 142
Lingula spatulata 149
Linnaea borealis 43
 List of the breeding birds of the Athabasca district, Alta. 1
 Liver-fluke 157
 Lloyd, H.,
 Clay-colored Sparrow 36
 Criddle obituary 145

- Lockwood, R. D.,
 Review by 17
- Loiseleuria procumbens* . . . 118
- Long Lake, Excursion to . . . 142
- Longspur, Alaska 30
- Chestnut-collared 72
- Lapland 167
- Loon, Common 2, 25
- Pacific 25
- Lopseed 10
- Loxia leucoptera* 30
- Lutra canadensis canadensis* 46
- Lycopodium annotinum* . . . 117
- selago* 117
- Lymnaea stagnalis jugularis* 134
- Lynx 31, 46, 63
- Lynx Cycles 64
- Lynx canadensis* 31
- gigas* 46
- rufus rufus* 46
- McArthur, J. M.,
 Chipmunk vs. Snake 76
- Mackenzie River basin 23
- Macoun, W. T.,—Obituary . . . 161
- Macrophalangia canadensis* 79
- Maggie 4, 158
- Mallard 2, 25
- Mammals, Desired by Audubon 168
- Nova Scotia 41
- Small, abundance of 73
- Manitoba, Northern, Flora 117
- Maple 42
- Manitoba 122
- Mountain 122
- Soft 43
- Mareca americana* 2, 25
- Marmota monax canadensis* . 31, 46
- monax petrensis* 57
- Marten 31, 45
- Martes americana americana* 31, 45
- pennanti pennanti* 45
- Martin, Purple 4
- McTaggart-Cowan, I.,
 B. C. Woodchuck 57
- Meadowlark 1, 135
- Western 5
- Meadow-sweet 43
- Medeola virginiana* 43
- Megaceryle alcyon* 3
- alcyon alcyon* 28
- Melampsora arctica* 119
- Melanerpes erythrocephalus* . 71
- Melanitta deglandi* 2, 26
- perspicillati* 26
- Melanoplus dawsoni* 95
- Melospiza georgiana* 6, 30
- lincolni* 6
- lincolni lincolni* 163
- melodia* 6
- Mephitis mephitis* 46
- Merriman, R. O.,
 Land Bird at Sea 139
- Mertensia maritima* 119
- Merychippus praeocidens* 11
- Microsorex hoyi thompsoni* . 44
- Microtus* sp. 31
- pennsylvanicus acadicus* . . . 48
- Mimus polyglottos leucopterus* . 159
- polyglottos polyglottos* . . 72
- Mink 45
- Minuartia rubella* 117
- Mitchella repens* 142
- Mniotilta varia* 5
- Mockingbird 72
- Western 159
- Modiomorpha* sp. 148
- Mole, Star-nosed 44
- Molothrus ater* 5, 6
- ater artemisiae* 30
- Monotropa uniflora* 43
- Moose 31, 49, 125
- Moss, Reindeer 42
- Mouse, Bog Lemming 176
- Jumping 48
- Lemming 48
- Meadow 31, 48
- Red-backed 48
- White-footed 47, 74
- Woodland Jumping 49, 176
- Mousley, H.,
 Northern Yellow-throat 6
- Munro, J. A.,
 Rocky Mountain Goat 95
- Murre, Brünnich's 142
- Muscivora forficata* 71
- Muskkrat 31, 48
- Mustela* sp. 31
- cigognanii cigognanii* 45
- vison vison* 45
- Myadestes townsendi* 29
- Mycosphaerella Astragali* . . 119
- Myiarchus crinitus* 71
- Myiochanes richardsoni* 4
- Myotis keeni septentrionalis* 45
- lucifugus lucifugus* 45
- Myrica Gale* 43
- Nannus hiemalis* 4
- Napeozapus insignis insignis* . 49, 176
- Nettion carolinense* 2, 25
- New *Ornithomimus* with complete abdominal cuirass 79
- New species of *Merychippus* from the Miocene of Saskatchewan 11
- Nighthawk 1, 3, 27
- Nomenclature in the Christmas Bird-census . 112, 176
- North, G. W.,
 Pomarine Jaeger 59
- Notes on the mammals of the interior of western Nova Scotia 41
- Nova Scotia, Mammals of . . . 41
- Nuthatch, Pygmy 36
- Red-bellied 167
- Red-breasted 4, 29, 36, 143
- Slender-billed 36
- Nuttallornis mesoleucus* 4, 28
- Nyctea nyctea* 27
- Nymphaca advena* 43
- Nyroca affinis* 2, 25
- americana* 2
- collaris* 2
- valisineria* 2, 25
- Oak 43
- Bur 122
- Obituaries:
 Criddle, Norman 145
- Macoun, Wm. T. 161
- Spreadborough, Wm., 39
- Observations on a nest of Sprague's Pipit 91
- Occurrence of the Clay-colored sparrow in Renfrew County, Ontario 36
- Odell, W. S., and
 Harris, W. E.,
 Rotifers 132
- Odocoileus virginianus borealis* 49
- Oenothera cruciata* 10
- Oldest mountains in Canada 174
- Ondatra zibethica* 31
- zibethica zibethica* 48
- Ontaria clarkei* 148
- Oporornis agilis* 5, 71
- philadelphia* 5
- Oriole 157
- Baltimore 5
- Ornithomimus edmontonicus** 79
- velox* 79
- Osmunda cinnamomea* 43
- regalis* 43
- Osprey 2, 26, 38, 70
- Otocoris alpestris* 4
- alpestris hoyti* 28
- Ottawa District, Rotifers . . . 132
- Ottawa Field-Naturalists' Club, Excursions 104
- 54th Annual Meeting 15
- Life Membership 22
- List of Members 98
- Report of Council 15
- Statement of financial standing 16
- Otter 26
- Ovenbird 5, 29
- Owl, American Hawk 3, 27
- Barn 143
- Barred 38
- Burrowing 112
- Cinereous 167
- Dusky Horned 27
- Great Grey 3
- Great Horned 3, 38
- Hawk 23, 167
- Little Acadian 167
- Long-eared 3, 38
- Richardson's 3
- Saw-whet 3
- Screech 38
- Short-eared 3, 27, 38
- Snowy 27, 38, 167

- Owls, Food of 38
Oxyechus vociferus 3
Oxytropis Belli 118
Maydelliana 118
- P., C. L.,
 Review by 77
 Paint-brush, (plant) 122
Palaeoneila filosa 148
Pandion haliaëtus 2
haliaëtus carolinensis 26
Panicum virgatum 122
Paracyclas elliptica 148
Parnassia Kotzebuei 118
multiseta 118
parviflora 118
 Partridge, European 3
 Partridge-berry 142
Passer domesticus 5, 30
Passerculus princeps 72
sandwichensis 6
sandwichensis alaudinus 30
Passerella iliaca 6
iliaca iliaca 30
Passerherbulus caudacutus 6
- Pearse, T.,
 Christmas Bird Census 177
 White pelican 59
Pedicularis arctica 119
flammea 119
lapponica 119
Pedioecetes phasianellus 3
phasianellus campestris 27
phasianellus phasianellus 27
Pelecanus erythrorhynchus 25
 Pelican, White 25, 59
Penhestes atricapillus 4, 115
atricapillus septentrionalis 29
hudsonicus 4
hudsonicus hudsonicus 29
Perdix perdix 3
Perisoreus canadensis 4
canadensis canadensis 28
Peromyscus maniculatus abietorum 47
maniculatus gracilis 74
 Petrel, Fork-tailed 168
 Fulmar 168
 Leach's 70
Petrochelidon albifrons 4
albifrons albifrons 28
 Pewee, Western Wood 4
 Phalarope, Hyperborean 168
 Red 168
 Wilson's 3, 168
Phleum pratense 122
 Phoebe 135
 Eastern 4, 28
 Say's 4, 24, 28
Phryma Leptostachya 10
Phyllodoce coerulea 118
Physa litchfordi 134
lordi 134
Physella litchfordi 134
Pica pica 4
Picea 42
engelmanni 57
Picoides arcticus 4, 28
tridactylus 4
tridactylus bocatus 28
 Pine, Jack 24
Pinguicula villosa 119
vulgaris 119
 Pintail, American 2, 25
Pipilo erythrophthalmus erythrophthalmus 72
 Pipit, American 29
 Sprague's 4, 91
Piranga ludoviciana 5
Planorbis bicarinatus 134
Plantago ramosa 10
 Plants observed at Long Lake, Que. 142
Pleospora herbarum 119
 Plover, Blackbellied 70
 Killdeer 3, 135
 Piping 70
 Semipalmated 70
 Upland 3
Podilymbus podiceps 2
Polygala Senega 118, 122
Polygonum viviparum 117
Polygyra albolabris dentifera 59
dentifera 59
Polyporus betulinus 142
 Pond-life 132
Pontedena cordata 43
Poecetes gramineus 6
gramineus confinis 30
 Poplar 42
 Aspen 122
 Balsam 122
 Black 24, 57
 White 24
 Population cycles, Animal 147
Populus 42
balsamifera 122
tremuloides 57, 122
trichocarpa 57
 Porcupine 49, 122
Porzana carolina 3
Potamogeton tenuifolius 117
Potentilla palustris 118
 Prince's-pine 142
Procyon lotor lotor 45
Productella callawayensis 148
hallana 148
Progne subis 4
Pseudotsuga taxifolia 57
 Ptarmigan, Rock 24, 27
 Willow 24, 27
Puccinia urticae 119
 Puffin, Common 168
Pugnax pugnax 148
 Pygmy Nuthatch on Vancouver Island 36
Pyrola grandiflora 118
Pyrus americana 122
Quercus 43
macrocarpa 122
Querquedula discors 2
Quiscalus quiscula 5
 Rabbit, Snowshoe 63, 84
 Rabbit Cycles 63, 84
 Rabbits, Tapeworm in 142
 Raccoon 45
 Racey, K.,
 Western Mocking-bird 159
 Rail, Sora 3
 Yellow 3, 70
 Rand, A. L.,
 Nova Scotia Mammals 41
 Randall, T. E.,
 Birds of Athabasca 1
Rangifer arcticus 31
caribou caribou 50
Ranunculus lapponicus 118
pedatifidus 118
trichophyllus 118
 Raspberry, Wild 123
 Rat, Norway 44, 74
Rattus norvegicus 44, 74
 Raven 167
 Northern 28
 Redhead 2
 Redpoll, Common 5, 30, 36
 Holboëll's 72
 Lesser 167
 Redstart, American 1, 5, 29
 Red-wing, Giant 30
 Reviews:
 Biology of the Amphibia 77
 Bird watching in the West 60
 Birds of Battle River region of central Alberta 159
 Birds of Minnesota 96
 Cowbirds 17
 Exploration of Southampton Island 140
 Faunal investigation of Long Point and vicinity, Ontario 77
 Game Management 159
 Hawks and Owls of Ontario 37
 In Bermuda during the Ice Age 60
 Introduction to bird-study in British Columbia 61
Rhododendron 42
lapponicum 118
Ribes cynosbati 122
 Richardson, H.,
 Henslow's Sparrow 58
 Riding Mountain
 Wapiti 105, 122, 150, 172
Riparia riparia 4
riparia riparia 28
 Robin 1, 112, 135, 144, 163
 American 4
 Eastern 29
 Rocky Mountain Goat on Vancouver Island 95

- Ronayne, J.,
Lewis' Woodpecker... 96
- Rosa blanda*..... 122
- Rotatoria..... 132
- Rotifers of Ottawa district 132
- Rotifers..... 132
- Round-worm..... 157
- Rubus arcticus*..... 118
- chamaemorus*..... 118
- idæus*..... 123
- Rush..... 155
- Russell, L. S.,
Merychippus præcoci-
dens..... 11
- Rynchops nigra nigra*..... 71
- Sage, White..... 122
- Salix glaucophylla*..... 123
- herbacea*..... 117
- longifolia*..... 123
- pedicellaris*..... 123
- reticulata*..... 117
- Sambucus canadensis*..... 123
- Sanderling..... 27, 70
- Sandpiper, Purple..... 168
- Semipalmated..... 70
- Solitary..... 3
- Spotted..... 3, 27
- Western..... 77
- Western Solitary..... 27
- White-rumped..... 70
- Sapsucker, Yellow-bellied 4, 28
- Sarsaparilla, Wild..... 43
- Sassafras variifolium*..... 42
- Saunders, W. E.,
Christmas Bird Census 176
- Saussurea angustifolia*..... 119
- Saxifraga cernua*..... 118
- Hirculus*..... 118
- nivalis*..... 118
- tricuspidata*..... 118
- Sayornis phæbe*..... 4, 28
- saya*..... 4
- saya saya*..... 28
- Scaup, Lesser..... 2
- Schizophoria striatula*..... 143
- Sciurus carolinensis*..... 47
- hudsonicus*..... 31
- hudsonicus gymnicus* 47, 74
- Scoter, Surf..... 26
- White-winged..... 2, 26
- Scotiaptex nebulosa*..... 3
- Scott, W. L.,
Food of Bullfrogs... 143
- Sedge..... 122
- Seiurus aurocapillus*..... 5, 29
- noveboracensis*..... 5, 29
- Senecio integerrimus*..... 122
- Setophaga ruticilla*..... 5, 29
- Shearwater, Wandering... 168
- Shell new to the Canadian
list..... 96
- Shepherdia canadensis*..... 118
- Showeller..... 2
- Shrew, Cinerous..... 44, 73
- Long-tailed..... 77
- Pygmy..... 44
- Saddle-backed..... 44
- Short-tailed..... 44, 73
- Smoky..... 44
- Water..... 44
- Shrieke, Great..... 167
- Shutt, F. T.,
W. T. Macoun..... 161
- Sialia corrucoides*..... 4, 29
- Silene acaulis exscapa*..... 117
- Siskin, Northern Pine..... 30
- Sitta canadensis*..... 4, 29
- carolinensis aculeata*... 36
- pygmæa pygmæa*..... 36
- Skimmer, Black..... 71
- Skunk..... 46
- Snake, Garter..... 31
- Snake vs. Chipmunk..... 76
- Snake-root..... 122
- Snipe, Wilson's..... 3, 27
- Snow-bird..... 167
- Solidago* sp..... 122
- caesia*..... 142
- canadensis*..... 142
- graminifolia*..... 8, 142
- squarrosa*..... 142
- Solitaire, Townsend..... 29
- Somateria mollissima borealis* 71
- Some Canadian Audubon-
iana..... 162
- Some field notes on the
abundance of small
mammals..... 73
- Some notes on the Henslow
Sparrow..... 35
- Sonchus arvensis*..... 122
- Sorex arcticus arcticus*..... 44
- cinereus cinereus*..... 44, 73
- fumeus umbrosus*..... 44
- palustris gloveralleni*... 43
- Sparrow, Acadian..... 70
- Bachman's..... 77
- Chipping..... 6
- Clay-colored..... 1, 6, 36
- Eastern Fox..... 30
- Eastern Grasshopper... 71
- English..... 5, 30
- Fox..... 6, 112
- Gambell's..... 30, 72
- Henslow..... 35, 58
- Ipswich..... 72
- Lark..... 72
- Leconte's..... 6
- Lincoln's..... 6, 163
- Savanna..... 6
- Song..... 6
- Sooty Fox..... 112
- Swamp..... 6, 30, 70
- Tree..... 30
- Vesper..... 1, 6
- Western Chipping..... 30
- Western Lark..... 71
- Western Savannah..... 30
- Western Vesper..... 30
- White-crowned..... 158
- White-throated
1, 6, 23, 30, 139, 163
- Spartina michauxiana*..... 122
- Spatula clypeata*..... 2
- Speirs, J. M.,
Henslow Sparrow... 35
- Sphagnum..... 24, 43
- Sphyrapicus varius*..... 4
- varius varius*..... 28
- Spinus pinus pinus*..... 30
- tristis*..... 5
- tristis tristis*..... 30
- Spiræa*..... 43
- Spirifer annæ*..... 149
- disjunctus*..... 148
- jasperensis*..... 149
- orestes*..... 149
- tullia*..... 148
- whitneyi*..... 148
- Spirorbis omphaloides*..... 148
- Spizella arborea arborea*... 30
- pallida*..... 6, 36
- passerina*..... 6
- passerina arizonæ*..... 30
- Sporormia corynespora*... 119
- leporina*..... 119
- Spreadborough, Wm.,
Obituary of..... 39
- Sprot, G. D.,
Glaucous-winged Gull... 76
- Spruce..... 42
- Black..... 24
- Englemann..... 57
- White..... 24
- Squaw-weed..... 122
- Squires, S. K.,
Winter food of birds. 143
- Squirrel, Flying..... 47
- Grey..... 47
- Red..... 31, 47, 74
- Starling, European..... 60, 72
- Steganopus tricolor*..... 3
- Stellaria longipes*..... 117
- Stercorarius pomarinus*... 59
- Sterna dougalli*..... 70
- Sternberg, C. M.,
Ornithomimus edmon-
tonicus..... 79
- Stomach-worm..... 157
- Strange behaviour of Lewis'
Woodpecker..... 96
- Strawberry, Wild..... 122
- Streptopus*..... 43
- Strongylus* sp..... 157
- Stropheodonta demissa*... 148
- inequirdiata*..... 148
- inflexa*..... 148
- perplana*..... 148
- subdemissa*..... 148
- Struthiomimus altus*..... 79
- brevitertius*..... 79
- Study of Kumlien's Gull. 88
- Study of the home life of
the Northern Yellow-
throat..... 6
- Sturnella neglecta*..... 5
- Sturnus vulgaris vulgaris*... 72
- Sub-species, Identification
of..... 112, 176
- Surnia ulula*..... 3
- ulula caparoch*..... 27
- Swallow, Bank..... 4, 28
- Cliff..... 4, 28, 167
- Tree..... 4, 28, 157
- Swans, Migration of..... 158
- Synaptomys cooperi*..... 48, 176

- T., P. A.,
 Reviews by
 37, 60, 61, 77, 96, 140, 159
- Tamarack..... 43
- Tamias striatus lysteri*... 46, 74
- Tanager, Western..... 5
- Tape worm in Rabbits..... 142
 in Wapiti..... 157
- Taraxacum ceratophorum*..... 119
officinale..... 122
- Taverner, P. A.,
 Birds on ships..... 140
 Bull-frog appetites... 157
 Identification of sub-species..... 116
 Kumlien's Gull..... 88
 William Spreadborough 39
- Tea, Labrador..... 24
- Teal, Blue-winged..... 2
 Green-winged..... 2, 25
- Telmatodytes palustris*... 4, 71
palustris dissæptus... 71
palustris waynei..... 71
- Tentaculites cf. mackenzien-*
sis..... 149
- Tern, Black..... 3, 71
 Roseate..... 70
- Thekapsora sparsa*..... 119
- Thelypteris fragrans*..... 117
- Thistle..... 122
 Sow..... 122
- Thrush, Eastern Hermit... 29
 Grey-cheeked..... 29
 Hermit..... 1, 4
 Northern Varied..... 29
 Olive-backed..... 4, 29
 Varied..... 76
- Thryothorus ludovicianus*
ludovicianus..... 36
- Tick, Moose..... 156
- Titmouse, Common..... 167
 Hudson Bay..... 167
- Tofieldia palustris*..... 117
- Totanus flavipes*..... 3
melanoleucus..... 3, 27
- Towhee, Red-eyed..... 72
- Trillium*..... 42
- Tringa solitaria*..... 3
solitaria cinnamomea... 27
- Trisetum spicatum molle*... 117
- Troglodytes aedon*..... 4
- Tsuga canadensis*..... 42
- Tufts, R. W.,
 White-crowned Sparrow 158
- Turdus migratorius*..... 4
migratorius migratorius 29
- Turnstone, Ruddy..... 70
- Twin-flower..... 43
- Twister-stalk..... 43
- Two new mammals for the
 Toronto region list... 176
- Typha latifolia*..... 8
- Tyrannus tyrannus*..... 4
- Uria lomvia lomvia*..... 142
- Urtica gracilis*..... 119
- Utricularia*..... 43
- Vaccinium*..... 42
uliginosum alpinum... 118
vitis-idaea..... 118
- Valvata perdepressa walkeri* 96
- Vanellus vanellus*..... 71
- Varied Thrush in Central
 Alberta..... 76
 Vetch, Cow..... 8
- Viburnum opulus*..... 123
- Vicia Cracca*..... 8
- Vireo, Philadelphia..... 1, 5
 Red-eyed..... 1, 5, 29
 Solitary..... 5
 Warbling..... 5
- Vireo gilvus*..... 5
olivaceus..... 5, 29
philadelphicus..... 5
solitarius..... 5
- Vermivora celata*..... 5
peregrina..... 5
- Vulpes sp.*..... 31
fulva rubricosa..... 46
- Waifs on Ship-board at Sea 140
- Wapiti, Diseases of..... 155
- Wapiti of the Riding Moun-
 tain, Manitoba. 105, 122
 150, 172
- Warbler, Bay-breasted... 29
 Black-and-white..... 5
 Black-poll..... 5, 6, 29
 Blue-winged..... 58
 Chestnut-sided..... 9
 Connecticut..... 5, 71
 Eastern Yellow..... 29
 Magnolia..... 29
 Mourning..... 5
 Myrtle..... 5, 29
 Orange-crowned..... 5
 Palm..... 5
 Pine..... 5
 Tennessee..... 5
 Yellow..... 1, 5
- Warren, P. S.,
 Devonian Limestone.. 148
- Waterlily, White..... 43
 Yellow..... 43
- Water-thrush, Grinnell's... 29
 Louisiana..... 77
 Northern..... 5
- Waxwing, Black-throated. 171
 Bohemian... 5, 36, 72, 171
 Cedar..... 1, 5, 29, 144
- Weasel..... 31, 45
- Weed, Pickerel..... 43
- White Pelicans on Van-
 couver Island..... 59
- Wild Geese killed by light-
 ning..... 72
- Wildcat..... 46
- Willet, Eastern..... 70
- William Marwick's "Flo-
 rula Canadensis"..... 32
- Williams, M. Y.,
 Mackenzie River basin 23
- Willow..... 24, 123
- Wilson, M. E.,
 Ancient lava field.... 87
 Blue Limestone..... 33
 Oldest Mountains in
 Canada..... 174
- Wintergreen..... 42, 142
- Wolf..... 46
- Wood, A. A.,
 Blue-winged Warbler... 58
 Nesting Barn Owls... 143
- Woodchuck..... 31, 46
 British Columbia..... 57
- Woodpecker, American
 Three-toed..... 4, 28
 Arctic Three-toed... 4, 28
 Downy..... 4, 143
 Hairy..... 4
 Lewis..... 96
 Northern Hairy..... 28
 Northern Pileated... 28
 Pileated..... 3
 Red-headed..... 71
 Three-toed..... 167
- Wren, Carolina..... 36
 Golden-crested..... 168
 House..... 4
 Long-billed Marsh... 4, 71
 Marsh..... 71
 Prairie Marsh..... 71
 Winter..... 4, 6
- Xanthocephalus xantho-*
cephalus..... 5, 36
- Yellow-headed Blackbird
 in B. C..... 36
- Yellow-legs, Greater... 3, 27
 Lesser..... 1, 3, 138
- Yellow-throat..... 5, 6
 Maryland..... 1, 70
- Zapus hudsonius hudsonius* 48
- Zonotrichia albicollis*... 6, 30
gambeli..... 72
leucophrys gambeli... 30

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OCT 1 1954

~~JUN 1970~~~~MAR 1973~~~~FEB 1976~~~~JUL 77~~

