

# THE CANADIAN FIELD-NATURALIST

VOL. XXXIII.

NOVEMBER, 1919.

No. 5.

## CANADIAN SPHAERIIDAE.

BY THE HON. MR. JUSTICE LATCHFORD.

There are few more fascinating objects of study in natural history than the members of the family of small bivalve mussels known as the *Sphaeriidae*. They abound in the vicinity of Ottawa, and indeed throughout the whole Nearctic region. The drainage area of the Great Lakes, and of their outlet, our own St. Lawrence, may be regarded as the metropolis of the family in North America. Yet, as Dr. Vincent Sterki recently pointed out,<sup>1</sup> the fauna of the Great Lakes themselves is only fragmentarily known; but, so far as known, presents many peculiar forms and possibly species. Still less are we acquainted with the fauna of the vast areas northward, extending from Newfoundland through Labrador and across Canada to the Rocky Mountains. In Prince Edward Island, Mr. C. Ives, of Miscouche, has collected a few species. In the vicinity of Ottawa, in Ontario and Quebec, considerable work was done many years ago by the members of the Ottawa Field-Naturalists' Club, especially by Gilbert Heron, Dr. Fletcher, the Rev. Geo. W. Taylor, and the writer. Officers of the Geological and Natural History Survey, notably Mr. W. McInnes, gathered some material in the waters flowing into Hudson Bay. Little, however, is known of the family as it exists over the far-flung plains of the Canadian West. In Southern British Columbia, Lord found and described two new species,<sup>2</sup> and farther north, and on Vancouver Island, Prof. John Macoun and Mr. Taylor collected in a few localities.

Heron died before reaching the prime of his promising manhood. Fletcher, Taylor and Whiteaves passed away all too soon—not, however, without having accomplished and recorded achievements in various departments of natural science that will long keep their memory green. Of those who were active in the early days of the club in collecting and studying the mollusca of Canada only two remain, Prof. John Macoun and the writer. One is spending the decline of his fruitful life in distant Vancouver Island. The other for ten

months of the year is far removed from his native valley and concerned about matters but little related to natural history. Owing to lack of a leader, Conchology has for some years been dropped from the list of the club's activities. With such wide and productive areas open for original investigation, the want of interest shown is greatly to be regretted. It is not so much to publish a record of work as a member of the club as to arouse fresh interest in others, and to facilitate the collection and study of our most numerous and least known shells that the following observations are submitted. My hope is that some of our younger members may be induced to devote a part of their leisure to what I am sure they will find a delightful diversion, both out of doors and over their cabinets.

The *Sphaeriidae* are small in size, only a few species exceeding half-an-inch in length. As they ordinarily lie buried—though only slightly—in the sand or other material at the bottom of streams, ponds and lakes, they are seldom seen—never, indeed, unless where, in very dry seasons, the water has receded or evaporated, when the shells may sometimes be observed on the exposed surface. But so generally are they distributed that it might almost be said they are to be found—they should certainly be looked for—wherever there is water that is not within the category known to golfers as "casual." Yet mere depressions that contain water for but short periods in any year often yield these and several other fluvial shells.

To collect in quantity, except under conditions which seldom exist, a dredge of some kind is required. The beginner will find that a common bowl-shaped wire strainer will best serve his purpose. The size I find most useful has twelve meshes to the inch, and is six inches in diameter. I remove the handle and rim, which are too flexible and soon break, and substitute narrow, stiff, hoop-iron; but good results may be obtained without making such a change. The handle must be extended for all but very shallow water by whipping it firmly to a walking cane or light pole. On sifting in water the material raised by the dredge the shells will be

<sup>1</sup>Annals of the Carnegie Museum, Vol. X, 1916, p. 431.

<sup>2</sup>Proc. Zoo. Soc. of London, 1863, p. 69.

found. Each lot should be kept separate and numbered. A brief record under the same number on a field card or in a note book should be made. If the shells are stained they may be cleaned by placing them in a bottle containing sharp sand and soapy water. On no account should an acid be used. By rotating the contents the shells will be cleaned on the outside. Mere drying out then suffices, when the shells are minute; but when large, the animals must be removed after boiling, or rendered innocuous by immersion overnight in a five to one dilution of formalin—by far the more rapid process, as the tying or wrapping of each shell is not then necessary. When thoroughly dried, after treatment with formalin, the largest shells will not gape, or cause offence by their odor, and may be placed in the collector's cabinet.

As he examines his specimens he will observe that they fall naturally into three groups or genera. By far the greater number ordinarily found are minute shells, triangular in outline, very unequilateral, and, with rather sharp terminal beaks. They resemble small peas, and belong to a genus fittingly called *Pisidium*.

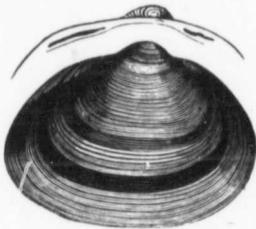


Fig. 1

*Sphaerium sulcatum*  $\times 1\frac{1}{2}$ .<sup>3</sup>

Other shells will be noticed which are larger, less inflated, though never exceeding half an inch in length; and usually more delicate and fragile. They bear little caps on the beaks, separated from the aftergrowth by a distinct furrow, and form the genus known as *Musculia*.

Still larger shells, often adorned with distinct color bands, denoting periods of arrested development, and others of no greater size than some *Musculia*, but of heavier texture, and as a rule more deeply striated, bear *Sphaerium* as their generic name. The term was devised by Scopoli, an Italian naturalist and chemist in 1777. It has priority to *Cyclas* (Brugaiere, 1789); and *Sphaeriidae*, according to the laws of modern zoological nomenclature has replaced *Cycladidae* as the proper designation of the family to which the little mussels belong.

<sup>3</sup>For this and the other figures in the text I am under the greatest obligation to my friend Dr. Bryant Walker of Detroit, Mich.

1. *SPHAERIUM SULCAIUM* Lamarck, the largest of the genus in the species most commonly observed in the vicinity of Ottawa. It was described in 1816 by the famous French naturalist in his "*Animaux sans Vertèbres*," from specimens obtained in Lake Champlain. In the same year Thomas Say described the shell in the American edition of Nicholson's Encyclopedia as *Cyclas similis*, and Say's name may have priority. However, the Lamarckian name is more generally adopted, and is that used in the Club's lists.

*S. sulcatum* is the largest of the genus. It is oval in outline; distinctly, rather than deeply, striate; and, when adult, is usually banded with concentric dark lines, marking periods of arrested development such as occur every winter. The body color is of varying shades of grey or brown. Young shells are almost white.

But one other species, restricted in Canada, so far as known, to a single locality near Ottawa, approaches this in size. All bivalves found elsewhere that are about three-quarters of an inch in length, and have not the corrugated beaks which indicate membership in the family of our large mussels, or *Unionidae*, may safely be named *Sphaerium sulcatum*.

This species is found in many places within the city limits. It is common in the Rideau river, especially on the muddy bottom of the reach above the islands at Billings' Bridge. In the canal, after the water has been let out, it may be easily collected on the shoal near the right bank west of the Bronson avenue bridge, and anywhere above Hartwell's locks. Very large and perfect shells were obtainable at one time in the bay at the east end of the small lake below the outlet of Meach lake; but owing to accumulations of sawdust and bark the locality is now barren of this shell, though it still produces sparingly the most remarkable specimens I have ever seen anywhere of *Anodonta cataracta* Say (= *fluviatilis* Dillw.) and, in addition, *Lymnaea megasoma*, and the shell called *Physa lordi* in our lists.

In the Laurentides, north of Meach lake, *S. sulcatum* abounds, as in Gauvreau lake and its outlet, near Ste. Cecile de Masham, and in the brook flowing past the orchid swamp still farther north, so well known to members of the botanical branch of the Club, and now, alas! to many others. What a day that was, nearly thirty years ago, when, after visiting the brook and its outlet, Fletcher, Harrington and the writer were the first naturalists to discover the sequestered glades where the shy wood nymphs, then literally in thousands, swayed to one another in virgin grace and loveliness! Whoever studies shells should have a mind receptive to the

delightful impressions that may be derived from flowers and birds, and the many strange four and six-footed creatures that he will encounter on his rambles in places seldom frequented by man.

A very fine form of *S. sulcatum* occurs on the Scott Graham farm in Nepean, now called Britannia Highlands. In dry seasons the narrow bottom of the stream lying about halfway between Carling Avenue and the Grand Trunk railway is exposed for some distance west of the boundary of the Shouldis farm. The shell may then be easily found in considerable numbers. At other times collecting is slow and difficult, even though the collector is equipped with a good dredge, and—what are indispensable in such localities—rubber boots. This stream is again productive near its outlet into the Ottawa below the Deschênes rapids.

conditions of environment. In fact nothing is so wonderful in nature as the adherence to type of every organized being properly regarded as a species. More interest is, however, manifested in departures from the normal than in persistence of type, just as variant races of men, like the giant Patagonians and pygmy Papuans, commonly attract more attention than races of ordinary stature. Variations from the usual form of *S. sulcatum* are few and limited. One is found in Bond lake, near Toronto. Another, which is well marked and constant, occurs in Masham, north of Ottawa, and, notably, in Lake Gorman, near Brudenell, in the county of Renfrew, at an elevation of about eleven hundred feet above sea level.

Dr. Sterki thinks it entitled to rank as a variety and calls it *palmatum*.<sup>4</sup> He describes it as smaller

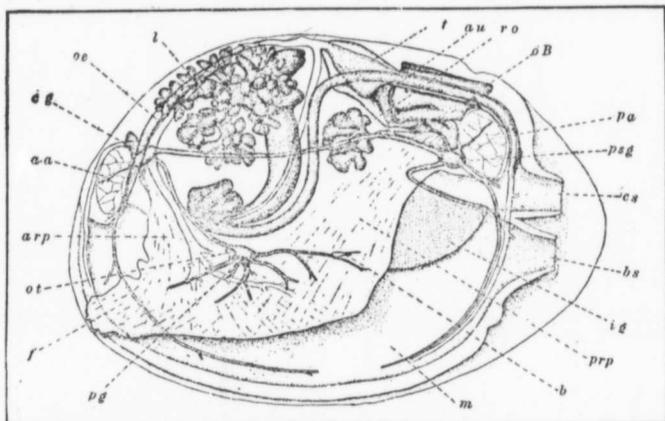


Fig. 2.

a.a.—Anterior adductor muscle.  
a.p.—Ant. retractor-pedis muscle.  
ar.—Auricle.  
b.—Byssal gland rudiment.  
bs.—Branchial siphon.  
cg.—Cerebral ganglion.  
cs.—Cloacal siphon.  
f.—Foot.  
ig.—Inner gill.  
l.—Liver.

m.—Mantle.  
ob.—Organ of Bojanns.  
oe.—Oesophagus.  
ot.—Otocyst.  
pa.—Posterior adductor muscle.  
pg.—Pedal ganglion.  
prp.—Post retractor-pedis muscle.  
psg.—Parieto-splanchnic ganglion.  
r.—Reproductive organs.  
t.—Male follicle.

Fair specimens are obtainable in shallow water at Graham Bay station, at the intersection of the Richmond road and the Grand Trunk railway. A few miles farther to the southwest the shell is common in the creek north of Stittville; but nowhere have I found it in such numbers as in the stream about a hundred yards west of Ste. Justine station, in the county of Vaudreuil. In either place the shell may be readily collected in large numbers by means of a dredge with a quarter-inch mesh, such as is afforded by a kitchen utensil in common use.

As *S. sulcatum* is a true species, with an objective existence not depending on the opinion or whim of any systematist, it does not vary greatly in its characteristic features throughout the vast area over which it is disseminated, though it is occasionally modified in appearance by different

than the common or typical *sulcatum*, more inequipartite, the beaks being markedly anterior; less inflated, especially flattened over the lower part of the valves, more truncate anteriorly and posteriorly, inferior margin less curved; beaks narrower and little elevated; surface striae slighter; shell and hinge slighter.

In Lake Gorman the shell is quite abundant buried about an inch in the sand of the bay near the boathouse on the Rockingham road.

The animal of the variety *palmatum* has not been described. It is probably not distinguishable from the normal form represented in the following illustration, which may be regarded as typical of the anatomy of all the genus:

<sup>4</sup>Preliminary Catalogue of N. A. Sphaerilidea, An. Carg. Mus., Vol. X (1916), p. 432.

The foot is capable of great extension as may be observed if living shells are placed in a glass bowl or aquarium. Cilia in the bronchial siphon, and along the inner and outer gills and mantle, induce currents which bring diatoms and other minute organisms contained in the water into contact with the libial palpi, whence they pass into the stomach to be in part elaborated for the preservation and growth of the individual and the propagation of its kind, and in part rejected through the excurrent or cloacal siphon.

Unlike the *Unionidae* in which each individual is dioecious, that is, either a male or a female, as is the case also with our native oyster (*O. virginica*, Gmelin), though not, strange to say, with its European relative (*O. edulis*, Linn.), *S. sulcatum*, like all other species of the *Sphaeriidae*, is monoecious, or produces both sperm and ova within the same shell. However, it is not hermaphroditic in the way that many, if not all, pond and other snails are hermaphroditic. In their case, while each animal is perfectly bisexual, the conjunction of two individuals is requisite for fertilization. In the *Sphaeriidae*, on the other hand, the process of fertilization is similar to that which takes place within the closed keel of the pea blossom and other legumes. Cross

fertilization is impossible naturally, and could not be induced artificially were another Mendel to arise. The reproductive organs are located behind the stomach, and consist of racemose glands, the anterior of which produces sperm, and the posterior ova. A common genital duct leads in the cloacal chambers of the inner gills, where the young reach before birth, in the case of this species, a length of seven or eight millimeters, or nearly half that of the father-mother.<sup>5</sup> If living shells are left for a day or two in water that is warmer or colder than that of their usual habitat, they will, ordinarily, be found to have produced a large number of nepionic young. These should be separately boxed and labelled with the name of the parent and will be found very useful when the collector is trying to identify shells which are no larger when aged than some *Sphaeria* are at birth.

(To be continued)

<sup>5</sup>The reproduction and growth of *S. sulcatum* are treated at length by Ralph J. Gilmour in *The Nautilus*, Vol. 31 (1917), pp. 16-28.

Note.—It is my intention to place in the Museum of the Geological and Natural History Survey at Ottawa specimens of the forms and varieties of *S. sulcatum*, and of the species mentioned in the continuation of this paper, of which I possess duplicates.

## FIELD STUDY OF LIFE-HISTORIES OF CANADIAN MAMMALS.<sup>1</sup>

BY RUDOLPH MARTIN ANDERSON, BIOLOGICAL DIVISION, GEOLOGICAL SURVEY, OTTAWA.

A recent and timely publication of the United States Department of Agriculture<sup>2</sup> calls attention to the gaps in our knowledge of the habits of many of the commoner species of mammals. The study of birds has been developed so extensively in a popular way in recent years through the Audubon Society movement, local bird clubs, and nature studies in the public schools, as well as technically by the scientific ornithologists, that the objects and methods of bird study have become fairly well known throughout the country, and the economic importance and aesthetic and sentimental value of bird life are becoming matters of common knowledge.

The study of mammals, though not less important in many ways, has not been developed so broadly or systematically. The study of the comparative anatomy and physiology of the major mammalian groups, through their closer relation

to the human subject, has received close attention, but the relations of species to one another and to their environment, and their life-histories, are undoubtedly less well known than the like relations of birds. It is true that the horse, cow, sheep, pig, and a few other mammals have been domesticated, but few attempts have been made to domesticate other species except in a sporadic way. A rather extensive but scattered literature has been developed concerning the deer, elk, moose, bison, antelope, and other large game animals, which are of interest to the sportsman. Unfortunately, this in many cases consists principally of the lore of hunting field and methods of capture, and what may be termed their more intimate history has been neglected until many of the species have been exterminated over most of their former ranges, and it is forever too late to obtain complete data in regard to these animals' relations to their primitive condition. Where efforts have been made, often too late, to conserve a remnant of these animals, to replenish the game of the sportsman, add to the food supply, or for other practical or sentimental reasons, it is found that there is a lamentable lack

<sup>1</sup>Published by permission of the Geological Survey, Ottawa, Canada.

<sup>2</sup>Suggestions for Field Studies of Mammalian Life-Histories. By Walter P. Taylor, Assistant Biologist. September, 1919. U.S. Department of Agriculture. Department Circular 59. Contribution from the Bureau of Biological Survey, E. W. Nelson, Chief; pp. 1-8.

of knowledge even of an elementary kind regarding their habits.

Intimate knowledge of the furbearers was left largely to the trapper, whose interest usually did not extend beyond the means of outwitting the animal during the trapping season, putting its pelt on the stretcher or drying-board, and increasing his own personal fur-return for the time being. As the furbearers have become reduced in numbers, and the prices of fur have increased, the importance of the fur industry to the country is becoming recognized; measures of conservation are being proposed, and fur-farms are being started, the practical success of which depends largely upon the application of a knowledge of life-histories or habits of the animals which are to be reared.

Many species of animals which have no direct economic value as food or for their fur, or skins, are nevertheless often of enormous indirect importance, and must be recognized as beneficial, or means taken to combat them as detrimental to the interests of man. Rats, mice, ground squirrels, etc., have been recognized as carriers of trichinae and the germs of bubonic plague, anthrax, and other diseases. Ground squirrels, prairie dogs, pouched gophers, and other rodents have caused such extensive damage to grain-fields, running into millions of dollars annually in some parts of the country, as to make necessary concerted action by the government and by associations of individual farmers. Rabbits, hares, voles (field-mice), and the like frequently cause great damage to fruit trees and young forest trees. Coyotes, wolves, and mountain lions take a large toll of the sheep, cattle, and horse-raising industries, and thousands of dollars had been expended in indiscriminate bounties without commensurate results until systematic study of these carnivorous pests pointed a way for their practical elimination in many districts.

The ravages of "The house rat, the most destructive animal in the world," are given by Lantz (Yearbook of the United States Department of Agriculture, 1917), from studies made by the Biological Survey in 1908, as amounting to actual losses in produce and other property in one year in the two cities of Washington and Baltimore, of \$400,000 and \$700,000 respectively, the sums being nearly in ratio to the population. In the same report he quotes a recent statement of the Women's Municipal League of Boston to the effect that losses from the rats in that city amounted to \$1,350,000 annually. Losses in Pittsburg, Pa., have been estimated at over \$1,000,000 a year, and no doubt the present values of produce would greatly increase these estimates.

While the study of the living animal is of as

great interest and attractiveness to the naturalist as any other branch of natural history and has consequently an aesthetic and sentimental value, it can be shown to have a very practical value also. As Professor Herbert Osborn says: "Not a single farm product but is affected directly or indirectly by some animal activity."

Dr. Taylor, in his recent paper, states that the leading museums have been acquiring exhibits and studying material representatives of different groups of birds and mammals, until at present the American collections are in many respects unsurpassed by those of any other country in the world, and that the relative completeness of research collections permits increased attention to be paid to the study of life-histories.

It is, of course, well recognized that species closely resembling each other often have quite different habits, and to avoid misapprehension and confusion of records we must have a certain amount of systematic taxonomic study before detailed investigations can be made along other lines. Valuable observations may be made without drawing the lines of differentiation too finely, but in general, we must learn the names of our animals before we can write about them. In other words, we must have pegs on which to hang our observations, if they are to be of value.

Unfortunately, we must admit that there is not in Canada today any collection of mammals approaching in completeness, even in Canadian species, several collections in the United States, among which may be mentioned the Biological Survey and the United States National Museum of Washington, the American Museum of Natural History of New York, the Museum of Comparative Zoology of Cambridge, and possibly two or three others. Many American zoologists have worked in Canada for the enrichment of American museums, and Canadian naturalists have done intensive work in many districts, but many regions of Canada have even yet been little worked in the field of mammalogy.

The development of a national collection of the mammals of Canada, as well as of other forms of animal life, should be of interest to all Canadians. Such a collection is useful as a place of reference for students from all parts of the country, and a permanent repository for specimens of many species which may ultimately become extinct. In addition to the national collection, represented by the Victoria Memorial Museum, under the Geological Survey, of the Department of Mines, each province should have a representative collection of the mammals and other vertebrates found within its borders. The private collector has a field of his own for investigation and experiment which should be en-

couraged, for he often has opportunities, resources, and freedom to carry on important investigations along side paths of knowledge which the government investigator or professional naturalist is not able to follow at his own inclination. The universities, colleges, and other schools, scientific surveys and commissions, local museums and associations for the protection of fish and game, all have an opportunity to do good work for the country in this field.

The value of detailed knowledge in fields which have previously appeared seemingly trivial, has been illustrated many times during the late war. As an example of this, the pest of rats became exceedingly serious at the Bush Terminal of the port of New York, the principal shipping point of the immense amount of stores required for the American or other expeditionary forces of the Allies. The use of poison was impracticable around such great quantities of food stuffs, but by detailing field biologists to the Sanitary Corps and directing their field experience to the problem of exterminating rats, within a few months more than 50,000 rodent allies of the enemy were accounted for, and it is estimated that several million dollars worth of commissary and quartermaster stores were saved at a critical time.

The secretive and nocturnal habits of some species of small mammals are responsible for so little being known of them. They are correspondingly more difficult to photograph than the birds. For this reason field photographs of mammals—their nests, runways, tracks, and general habitat, are particularly desirable. Although the mammals as a rule are more shy than the birds, and are less often seen; the larger animals on account of constant pursuit by man for generations as objects of sport and of food, and the smaller ones from fear of swooping birds of prey, the presence of the mammal in a certain region may be detected where the flying bird leaves no trace. The pads of little paws on dusty roads or the muddy brinks of pools or streams, or the delicate tracery of tracks on the newly fallen snow, leave a record, which though evanescent, may be read and interpreted by the initiated, and lends interest to walks in the great out-doors.

In a field like this no one can cover every detail, and the notes of many persons are needed for working out complete life-histories of any species, even the commonest. A young observer may find out something that was not known before and, in classic phrase, "add something to the sum total of human knowledge." As a suggestion to aspiring naturalists who are at a loss to know what to do or how to begin, we can not do better than quote from Dr. Taylor's paper cited above:

#### DATA THAT ARE IMPORTANT.

##### MEANS OF DETECTING PRESENCE OF PARTICULAR SPECIES.

"Tracks, distances between footfalls; differences in tracks with different speeds or movements of animal.

Feces—abundance, shape, size, color, composition, place of deposit.

Claw marks on trees, logs, or ground.

Tooth marks on wood or bone.

Wallows, dust baths, beds, forms, nests, shelters, runways, holes, trails, cropped or harvested vegetation.

##### HABITAT RELATIONS.

Relation of soil, rocks, water, air, climate to habits and distribution.

Effects of unusual climatic conditions, as storms, floods, and forest fires; degree and rapidity of recovery from disaster.

Relation of animal populations to climatic cycles.

##### INTERRELATIONSHIPS OF SPECIES.

Friends.

Enemies—times of activity; enemies in youth, middle age, old age.

Prey—modes of capture.

Parasitic habits of species with reference to each other.

Parasites, internal and external.

Bacteria and disease germs (carriage and transmission of disease to stock or to mankind; species as victims; decimation of animal populations; periodicity of contagious diseases in animals; degree and rapidity of recovery).

Adaptations of animals to each other or to plants.

Competition between species, particularly between those closely related.

##### TIMES OF ACTIVITY.

Hours of beginning and cessation of daily activity.

Unusual activity, as of diurnal species at night or of the nocturnal by day.

##### MIGRATION.

Local or general movements before and after breeding.

Dates of appearance and disappearance (especially of bats).

Extent and direction of movements, local and general.

Causes of migration—food supply, climatic, physiological.

Unusual migratory movements, as the spasmodic irruptions of lemmings, with causes therefor.

##### HIBERNATION AND ESTIVATION.

Date of entering upon and emerging from hibernation.

Causes of hibernation and estivation—the relation of climate, soil, physiology, and food supply.

Condition of animal before, during, and after hibernation.

Details as to completeness or incompleteness of torpidity.

Place of hibernation or estivation.

Habits associated with hibernation and estivation.

#### MOVEMENT.

Modes of running, jumping, climbing, digging, swimming, flying.

Gait; speed; endurance.

Other activities.

#### VOICE AND OTHER MEANS OF INTERCOMMUNICATION

Calls in general; courting; alarm; challenge; warning calls.

Descriptions of barking, baying, screaming, howling, squeaking, squealing, singing, roaring, bugling.

Warning attitudes; flash signals.

Emission of glandular secretions.

Odor posts.

Touch.

Other means of intercommunication.

Organization of communities—leaders, sentries, rank and file.

#### HABITS ASSOCIATED WITH FEEDING AND DRINKING.

List of foods eaten.

Food at different seasons.

Physical characteristics and habits associated with food getting.

Conveyance and storage of food; hay making.

Dependence on water; times and manner of drinking; other associated habits.

#### INDIVIDUAL CHARACTERISTICS.

General disposition and temperament; intelligence; attitudes; strength; vitality; tenacity of life; courage; esthetic sense; eating of young by parents; cannibalism in general; degree of sociability; playfulness; length of life.

Sanitation, cleanly or filthy habits.

Reactions to sound, light, odor, taste, touch.

Relation of physical characteristics to sense reactions.

#### RELATION OF CHARACTERISTICS AND HABITS TO EXISTENCE AND SURVIVAL.

Movements.

Attitudes.

Instincts.

Intelligence.

Coloration—concealing, disruptive, directive, warning, mimicking.

#### BREEDING HABITS.

Courting antics.

Relations of the sexes in general; polygamy (manner of acquisition of harem by male, mode of

protection of harem, bachelor males); polyandry; promiscuity; monogamy.

Dates of heat and copulation; associated habits.

Length of period of gestation.

Date of birth of young.

Number of young.

Family life; relation of father to family; care of young—feeding; mode of carrying; how long cared for by parents; precocious or backward; length of time in nest; behavior.

Behavior of adults in postbreeding season; in winter.

Hybridization between related species.

#### NESTS, SHELTERS, AND OTHER PLACES OF RESORT.

Natural resorts at different seasons.

Shelter chambers in general.

Lairs; dens; forms; beds.

Nests—plan, elevation, accurate measurements; storage chambers; breeding chambers; chambers for deposit of excrement or for other purposes.

Nests for different purposes; unoccupied nests.

Approaches to nests—trails, burrows, tunnels, or runways; protection of nests through the closing of burrows during the daytime or in other ways.

Habits associated with nest approach.

Extent of home range.

#### MISCELLANEOUS.

Are any mammals strictly crepuscular?

Periodic phenomena of any kind of mammals, aside from migration and hibernation.

Habits as affected by the seasons of the year.

Effect of long days, very dark days, full moon, dark of the moon, on activity.

Use of glands of various sorts, as hip glands of meadow mice, metatarsal glands of deer, musk glands, anal glands.

Weights and dimensions of bats; precise hour of appearance in the evening and disappearance in the morning; numbers and habits as observed in caves; relative numbers of the sexes; method of hanging; condition of females with reference to pregnancy.

#### PRESENT AND FORMER STATUS.

Present and former numbers of valuable species, as fur-bearing and game animals, and of pests or those otherwise important; causes of increase or decrease.

Estimates and counts of numbers of animals per unit of area.

Fluctuations in numbers from year to year, and causes.

Plagues, due to unusual increase or destructiveness of species; origin, course, and virulence; natural checks and methods of control.

## WILD LIFE AND THE COMMUNITY.

Local names; local ideas concerning wild life.

Sentiment regarding game laws and legislation.

Trapping and hunting methods in local use; prices received for pelts or animals sold.

Relation of mammals to the public health; to agriculture.

Possible undeveloped resources in mammals, as of flesh for food, fur or hides for clothing, or other useful animal products for various purposes.

Possibilities of utilization, through domestication or semidomestication, of beneficial species."

No one individual can hope to acquire full information on all the items listed, but any naturalist who knows a species at all can put down something, and apparently trivial things often turn out to be

really important when considered in their relation to other factors. "These relative lines of inquiry include problems in scientific agriculture, geographical distribution, phenology, migration, ecology, physiology, medical zoology, behavior, game protection and the conservation of natural resources, morphology, heredity, organic evolution, and economic zoology."

The Division of Biology (Mammalogy), The Geological Survey, Ottawa, Canada, is interested in building up a collection, and in gathering of life-histories and other data in regard to the mammals of Canada, and correspondence is solicited from any person or institution working along these lines, and advice or suggestions will be gladly given as opportunity is offered.

## BIRDS IN RELATION TO SUNFLOWER GROWING IN MANITOBA.

By NORMAN CRIDDLE, TREESBANK, MANITOBA.

There are several indigenous species of sunflower in Manitoba some of them such as *Helianthus maximiliani* being weeds of importance while others merely add to the attractiveness of the landscape, without being otherwise of interest to mankind. All, however, have their values in the economy of nature and for ages past have proved a valuable source of food supply for certain native birds, as well as for several rodents. While animals thus take heavy toll of the sunflower seeds, they also assist materially in the spread of the species and it seems at least possible that these unusually large seeds have been evolved for just such an end. In other words, the plants offer an especially attractive food, in return for which the animals carry a certain indefinite percentage of the seeds far beyond the range that they would otherwise fall—an unconscious form of reciprocity very commonly met with in the realms of nature.

Under the ordinary course of events, the conditions depicted above might have continued almost indefinitely, but, as frequently happens, man has intervened. Sunflowers have become of economic importance from the human standpoint, the larger ones for their seeds and the smaller kinds for fodder purposes; this apart from the fact that many are grown in gardens as ornamental plants. We have, therefore, to view the relations of birds to sunflowers in another light presumably, again placing the economic importance before the aesthetic. This I have endeavored to do in the following sketch. My observations are drawn largely from notes made in a garden and refer especially to a bushy type of sunflower originated by my brother Stuart. It

seems well to mention also, that the garden is surrounded by shrubs and young spruce trees, planted to shelter the more tender plants therein.

At Treesbank, Man., sunflowers are usually above ground by the middle of May and it is at this time that the first injury is done to them by birds which eat the cotyledons. In doing this the birds often follow the rows to the end and practically destroy every plant. The House Sparrow having a bad name, at once got the blame for this injury and we accordingly set a watch who was prepared to shoot the none too popular bird. But suspicion may be misdirected as it proved to be in this case. There was the thief at work, pulling and eating the plants, and it proved to be no other than the White-throated Sparrow, one of the most popular of all the feathered tribe. No wonder the gun was lowered or that the watcher, who happened to be my brother Evelyn, should return to the house disgusted at his discovery. Later we found that the White-throat made a practice of sunflower eating and that it continued from the time of its arrival in early May until about the first of June when the nesting period commenced. Occasionally other sparrows, such as the White-crowned or Harris' Sparrow would pull up a few plants, but they were only casual depredaters whereas the White-throat went in search of the plants daily. Naturally such injury would not take place in the open country though it is possible that Longspurs or other birds might prove equally troublesome under field conditions.

The injury to the newly sprouted sunflowers is over early in June and from that time no further

damage takes place until the plants commence to form seeds. This second attack commences about the middle of August and continues until the plants are harvested in early October. Four birds stand out prominently in the work of destruction at this time, namely the American Goldfinch (*A. tristis*), the Pine Siskin (*S. pinus*), the Crossbill, or as it is known in these parts, the Red Crossbill (*L. curvirostra minor*), and the White-winged Crossbill (*L. leucoptera*). The first mentioned is by far the most persistent of all of these and it is probable that fully 80 per cent of this bird's food consists of sunflower seeds when they are available. The ripening of the seeds also coincide with the Goldfinch's breeding season and in consequence the young are largely reared on the same food supply. Later as the nestlings learn to fly all find their way to the sunflower patch and from then on make their headquarters in the vicinity. To see one of these beautiful little birds resting upon a sunflower at once sets one speculating as to the probable origin of colors that harmonize so remarkably with the plant the birds feed upon. Who could possibly select a more perfect background for concealment and yet endow a bird with such brilliant colors at the same time? The females and young are also wonderfully hidden when resting upon their favorite food plant and it, therefore, seems strange that the name sunflower bird has not been applied to this species.

While sunflower seeds unquestionably form the chief food of Goldfinches during the autumn months, the birds also consume a variety of other seeds such as Gaillardia, thistle, dandelion, and many others of composite plants. All such seeds are usually gathered while the bird rests upon the plant and the seeds dropped are seldom sought after on the ground.

Pine Siskins though not so persistent sunflower-seed eaters as their relatives the Goldfinches, are, nevertheless, quite destructive in the course of a season and when in large flocks might do serious harm. With us, however, a family or two are all that visit the neighborhood in autumn and they would not, therefore, be a serious menace to a large field, though troublesome enough in a garden where but a few thousand plants are grown. Both Pine Siskins and American Goldfinches leave us in October; the latter have all gone by about the 20th, while the former remain a week or more longer. Indeed, there are records of Siskins being seen in winter time though I have no personal records of winter birds. They return in May and breed in the woods close at hand.

The two Crossbills have such similar habits that they may well be treated as one in this article. They

are, apparently, both residents throughout the year and breed in the spruce woods close by.

Crossbills are not regular visitors to the sunflowers but being great wanderers probably arrive accidentally while in search of spruce cones. Seeing the plants, however, they soon descend upon them and are quickly engaged in tearing the heads to pieces. They usually come in flocks of half a dozen or so, these being doubtless single families, as a majority are in juvenile plumage. Indeed, observation shows that the young birds are far more persistent in their depredations than the adults, and it may be that like various other birds, these have a habit when first seeking food for themselves which they later abandon for the more general one of gathering the seeds of the coniferous trees. This, however, is only partly true as I have observed perfectly colored males as busy in the work of destruction as were the young alongside.

Crossbills though not as persistent sunflower-feeders as the Goldfinches are in other respects even more injurious owing to their lack of discrimination in selecting suitable heads. They may thus tear to pieces half a dozen heads before discovering one with seeds sufficiently mature for food purposes. Under these conditions the damage done in a day is often severe. In the case of the garden referred to, the depredations become so extensive that I eventually went out with a gun, but to my joy found it unnecessary, as the handsome marauders had departed.

Of the other eaters of sunflower seeds little need be said as their influence on the ultimate production is insignificant. Blue Jays prefer the larger seeds and in autumn store them for future use. House Sparrows and other sparrows gather them from the ground as do also Mourning Doves and the various species of blackbirds. Chickadees are almost daily visitors to the sunflower patch in late autumn and during the winter. No one, however, begrudges them their tiny share and that they do feed upon the seeds is more of interest as a means of attracting them than otherwise.

This then is a brief sketch of the birds that might affect the industry of growing sunflowers, or their seeds, for agricultural purposes; none of them, however, are particularly abundant though there is no gainsaying the fact that even in their present numbers they might cause considerable loss on a large field. If the sunflower industry ever develops, as it promises to do, then it may be necessary to go further into the matter and perhaps a gun will be required. In our garden, where we were experimenting and crossing, losses, of course, had to be guarded against. For the seedlings we used various devices for hiding the plants and placed numerous

obstructions along the rows to prevent a continuous thoroughfare. As the seeds began to ripen we covered the heads with cheese-cloth. By these measures of precaution we managed to obtain sufficient seed for our purpose, which was about a tenth of the total grown, the rest going to the birds. To be

permitted to watch these little robbers day after day, busily engaged in pulling out the seeds was to me, at least, sufficient compensation, and for those who love birds and gardens, I know of few better attachments than a hedge of sunflowers.

#### NOTES ON THE BEHAVIOUR OF THE CHIPMUNK.

By A. BROOKER KLUGH, M.A., BIOLOGICAL DEPT., QUEEN'S UNIVERSITY,  
KINGSTON, CANADA.

While in camp at Lake Missanog, Frontenac county, Ontario, from August 19 to September 19, 1919, a chipmunk (*Tamias striatus lysteri*), had its abode in the vicinity of our tent. This individual had an unusually short tail and deep coloration, and consequently could be readily distinguished from other chipmunks in the neighborhood.

**HOME RANGE.** The home range of this chipmunk was 100 yards by 75 yards, and she was never observed out of this area.

**FOOD.** She was feeding on three things which I have not previously seen this species eating—the fruits of the bunch-berry or dwarf cornel (*Cornus canadensis*), the fruits of the wild lily-of-the-valley (*Maianthemum canadense*), and the seeds of the star-flower (*Trientalis americana*). As far as I could ascertain she was not storing any of these articles of food.

I tried her with various food substances and found that neither meat nor sweet substances, both of which are relished by the red squirrel, were accepted, but only seeds, fruits and tubers.

By far her favorite item among the foods offered her was corn—either raw or boiled. While she sometimes ate a kernel or two she carried most of it away in her pouches. In loading up her pouches she placed the kernels alternately first in one pouch and then in the other, and when the pouches were nearly full she shoved the last few kernels in with one of her forepaws. A full load, as tested several times, consisted of thirty-one large kernels of corn—equal to two heaped-up tablespoonfuls. When full each pouch was as broad as the head, when viewed from above.

**NOTES.** Three different notes were used by this chipmunk—the sharp “chip” which appeared to indicate a state of unrest, the “chip-chir-r-r” of alarm, and the resonant “chonk-chonk-chonk.” The latter note is an intercommunication call and is rarely repeated for any length of time unless a response is evoked. This call is frequently begun quite softly and slowly, but when answered in kind both tone and tempo are increased. In uttering this note the

checks are slightly distended before each “chonk” is emitted.

**PSYCHOLOGY.** The shortness of the period of observation made any detailed study of the psychology of this individual an impossibility, but I was able to secure accurate data on one phase of this subject—the rapidity of the formation of associations. After I had placed kernels of corn for her a few times I began to throw kernels to her. At the first trial the sudden motion of my arm in throwing naturally frightened her, as any sudden motion will do with any wild animal. At the second trial she started only slightly and came and picked up the kernels, and at the third trial she showed no alarm at the motion, but ran immediately towards me and picked up each kernel as it fell. I next threw her half-a-dozen kernels, each one nearer to me than the last, and then held out the cob near the ground, when she came up and bit the corn from the cob. After this she associated the holding out of anything with the procuring of food and came at once. The third test made was to ascertain her ability to associate sounds with the securing of food. I held out a cob of corn and made a squeaking noise with my lips, and after five trials, two on one day and three on the subsequent day, she came running up on hearing this sound, even though I held nothing extended towards her. The rapidity with which she made these associations exceeded my anticipations very considerably.

That associations remained for some length of time was shown by an incident which was not planned as an experiment. My Indian friend, Sowatis Lachance, had given me a cob of the peculiar hybrid corn which he grows, in which the kernels are of various and brilliant colors—red, pink, purple, brown, dark grey, yellow and white. This I had placed on the top shelf of a set of shelves in the tent. Early the next morning the chipmunk came into the tent, climbed up to the shelf, and stripped the cob. For five days subsequently she continued to investigate that top shelf, visiting it

regularly every morning and usually several times during the day, though no more corn was placed there, nor anything else edible.

After the chipmunk had learned to come and take corn from the cob held in my hand she would

come after it no matter where I held the cob, running up my leg and sitting on my knee while loading up her pouches, and would sit up on a cob and strip off the kernels even when I lifted the cob up in the air.

## THE ORNITHOLOGICAL COLLECTOR AND THE LAW.

BY HOYES LLOYD.

As the provisions of the Migratory Birds Convention Act and Regulations which concern the scientific collector are perhaps not fully understood by all collectors in Canada, a short explanation of the status of the collector, with respect to this law, seems desirable at the present time.

The federal bird protection law, which is known as the Migratory Birds Convention Act, allows *birds protected by the Act* to be taken, shipped, transported, or possessed for scientific purposes, but only by persons holding a permit from the Minister of the Interior.

This permit is required by all museums or individuals wishing to collect birds, nests, or eggs, protected by the Act.

The director of a recognized museum should make application for each of his collectors. Individual collectors must furnish written testimonials from two well-known ornithologists before their application can be considered. Applications should be addressed to the Commissioner, Dominion Parks Branch, Department of the Interior, Ottawa.

All applicants should state the province in which they wish to collect. They may be required to make returns stating the result of their work. Every encouragement is offered the collector, who is honestly working to extend our knowledge of Canadian birds, but useless waste of bird life will not be allowed.

A package in which specimens of birds, protected by this Act, is to be shipped must be marked on the outside with the number of the permit, the name and address of the shipper and a statement of the contents. It is contrary to the law to ship any of the protected birds, eggs or nests and the use of the mails is forbidden, unless the packages are so marked.

So that every Canadian naturalist will understand the principles governing the issue of these permits, this article is concluded by repeating these principles in full. They are printed with and form a part of every scientific permit.

### PERMIT PRINCIPLES.

Permits to take migratory birds, their nests and eggs, under the Migratory Birds Convention Act

and Regulations are granted for the sole purpose of scientific study and not for the collection of objects of curiosity or personal or household adornment. Therefore only such persons as take a serious interest in ornithology, and are competent to exercise the privilege for the advancement of knowledge, are eligible to receive such permits.

It is expected that the holders of permits will use them with reasonable discretion, taking only such specimens as their scientific needs require and avoiding unnecessary waste of life. The habitual taking of numbers of individuals for the purpose of obtaining a few specially desirable ones is deprecated and it is urged that the collector take no more specimens than he has reasonable prospects of caring for and will conscientiously endeavor to properly prepare each and all when taken.

It is also recommended that the holders of permits will, so far as is consistent with their object, be considerate of the local feeling in the neighborhood where they collect and will demonstrate both by actions and speech that the scientific collector is sympathetic towards the principles of wild life conservation and not the rival of legitimate sportsmen.

It is required as an evidence of good faith that holders of permits label their specimens with the customary scientific data and properly care for them not only at the time of collection but thereafter, giving them all reasonable protection against insect pests and other agencies of destruction, and will not permit them to be destroyed through carelessness or indifference.

As permits are granted for the purpose of general scientific advancement and not for individual benefit, specimens taken under them are to be regarded as being in the nature of public trusts, and should be accessible to all duly qualified students under only such reasonable restrictions as are necessary for their protection or as is consistent with the owner's work.

Finally it is urged that provision be made so that specimens taken will ultimately find their way into permanent or public collections where they will be available for study by future generations and not be wasted and lost through neglect.

While all these conditions are not strictly mandatory, and their spirit will be liberally interpreted, they will be considered in the granting or renewal of each permit, and evidence of gross violation of them may be deemed sufficient ground for the re-

fusal of an application or for the revocation of any permit already granted.

It is hoped and expected that the justice of these principles will be realized and that collectors will co-operate in advancing science to the utmost without unnecessary waste of valuable bird life.

## RIBES DIVARICATUM X RIBES LOBBII.

BY J. K. HENRY, VANCOUVER, B.C.

A few years ago Mr. George H. Knight, nurseryman, Mount Tolmie, Victoria, B.C., found a peculiar gooseberry growing among *Ribes divaricatum* Dougl. and *R. Lobbii* Gray, at Mill Hill, Vancouver Island. He removed it to his nursery and propagated it. It fruited freely, as *R. Lobbii* usually does, producing claret-colored berries of excellent flavor. Finally blundering workmen grubbed it up. The plant is now known to exist only in the nursery of Mr. George Fraser, Ucluelet, to whom Mr. Knight, remembering his friend's interest in hybrids, had sent cuttings.

In April, 1919, Mr. Fraser sent me flowering specimens of the plant, which show pretty clearly that it is, as Mr. Fraser surmised, a natural hybrid between *R. divaricatum* and *R. Lobbii*. The combination of two such important characteristics as the hairy style of *R. divaricatum* and the glandular ovary of *R. Lobbii* is alone almost conclusive evidence of its parentage.

In general appearance the plant looks like a small-flowered specimen of *R. Lobbii*. It has the pubescent shoots, the triple spines, and, in its spring form, the glandular leaves and the glandular-pubescent petioles of that species. The pubescence of the mature petioles is, however, hardly at all glandular. The evidence of its hybrid nature is found not only in the combination of these characteristics of *R. Lobbii* with the small flowers of *R. divaricatum*, but especially in the flowers and the inflorescence. The relationship of these plants may be further indicated by the following analysis:

### R. DIVARICATUM.

Flowers (ovary and calyx) 7-10 mm. long; in number 1-4, usually 2; peduncles smooth; pedicels smooth, longer than the bracts; ovary smooth; style

hirsute; calyx-tube greenish, smooth; sepals dark purple, smooth; petals fan-shaped; anthers green.

### R. LOBBII.

Flowers (ovary and calyx), 14-20 mm. long; in number 1-4, usually 1 or 2; peduncles glandular-pubescent; pedicels glandular-pubescent, shorter than the bracts; ovary glandular; style smooth; calyx-tube dark red, pubescent; sepals dark red, pubescent; petals wedge-shaped; anthers purple.

### R. DIVARICATUM X R. LOBBII.

Flowers (ovary and calyx) 8-10 mm. long; in number usually 3, (D); peduncles smooth or nearly so, (D); pedicels smooth or nearly so, longer than the bracts, (D); ovary glandular, (L); style hirsute, (D); calyx-tube greenish, nearly smooth, (D); sepals dark red, pubescent, (L); petals wedge-shaped, (L); anthers green, (D).

(D and L indicate that the characteristics are those of *R. divaricatum* and *R. Lobbii* respectively.)

While this evidence is fairly conclusive, one cannot affirm with certainty that the plant is a hybrid until the character of its progeny is known. At Ucluelet the plant does not set fruit. At Victoria it fruited abundantly, the claret-colored berries being somewhat intermediate in hue between the dark red of *R. Lobbii* and the deep purple of *R. divaricatum*. Further, one hesitates to be dogmatic, since not only are *Ribes* hybrids produced with difficulty by the horticulturist, but natural hybrids of this genus are unknown in North America. This note is published pending further investigations in order that collectors on Vancouver Island and in the States of the Northern Pacific coast may be on the look-out for the plant.



## A NEW CLIFF SWALLOW FROM CANADA.

BY HARRY C. OBERHOLSER.

The form of *Petrochelidon albifrons*<sup>1</sup> inhabiting most of western Canada proves to be subspecifically distinct from the typical race. It may be described as follows:

PETROCHELIDON ALBIFRONS HYPOPOLIA, subsp. nov.

*Chars. subsp.*—Similar to *Petrochelidon albifrons albifrons* from eastern United States and Colorado, but larger; frontal band paler, more whitish; breast more grayish (less ochraceous).

*Description.*—Type, adult male, No. 195055, U. S. Nat. Mus., Biological Survey collection; Fort Norman, Mackenzie, June 11, 1904; E. A. Preble, original number, 1830. Forehead creamy white; crown metallic blue black; hind neck brownish gray; back and scapulars, like crown, but streaked with brownish gray and whitish; rump cinnamon; upper tail-coverts light fuscous, the tips of the feathers whitish; tail fuscous; wings fuscous black, with a slight metallic bluish or greenish sheen, the inner edges of the primaries and secondaries paler and on terminal portion narrowly edged with brownish white, the outer webs of the inner secondaries and of the tertials margined with the same, and the greater wing-coverts slightly tipped with paler brown; lores and narial bristles, brownish black; sides of the head below the eyes, together with the upper throat, between chestnut and bay; chin and centre of the lower throat, black; sides of neck light brownish gray; breast, sides, and flanks, light brownish gray, the centre of the breast washed with pale cinnamon; remainder of the lower parts dull white, the crissum washed with chestnut; lining of wing light brownish gray; edge of wing barred with dull light cinnamon and brownish gray.

*Measurements.*—Male:<sup>2</sup> wing, 110-115 (average, 112.1) mm.; tail, 49-52 (50.7); exposed culmen, 6-8 (7.2); tarsus, 11-13 (12.3); middle toe without claw, 10.5-12 (11.3).

Female: wing, 108-111.5 (average, 110.2) mm.; tail, 49.5-51.5 (50.7); exposed culmen, 6-8-7.2 (7.0); tarsus, 13; middle toe without claw, 12-12.5 (12.3).

*Geographic distribution.*—Breeds in northwestern North America, north to Mackenzie and central Alaska; west to central British Columbia; south to Montana; and east to Alberta and Mackenzie. Migrates through Wyoming and California. Winters probably in South America.

This is the largest of the races of *Petrochelidon albifrons*, and differs from *Petrochelidon albifrons tachina* still more than from the typical *Petrochelidon albifrons albifrons*. The difference in measurements between *Petrochelidon albifrons albifrons* and our new Canadian race may be seen by comparison of the figures above given for the latter with the following dimensions of *Petrochelidon albifrons albifrons* taken from Colorado, Wyoming, and eastern United States birds.

Male:<sup>3</sup> wing, 105-112 (average, 107.6) mm.; tail, 47-51 (49.9); exposed culmen, 7-8 (7.2); tarsus, 12-13 (12.6); middle toe without claw, 11-12 (11.8).

Female:<sup>4</sup> wing, 102-109 (average, 107.2) mm.; tail, 47-51 (48.9); exposed culmen, 7-8 (7.4); tarsus, 11.5-13 (12.5); middle toe without claw, 11-13 (11.9).

Breeding birds from Dickey in southern Idaho, the Snake River in eastern Washington, and from Ashcroft in central southern British Columbia, are apparently referable to *Petrochelidon albifrons albifrons*. Specimens from Greybull and Saratoga, Wyoming, are in size about half-way between *Petrochelidon albifrons albifrons* and *Petrochelidon albifrons hypopolia*, but in color they are decidedly nearer the former, and are here included under that race. A single specimen from Pembina, North Dakota, indicates that the bird from at least the northeastern part of North Dakota is the eastern form. The present new race migrates through the western United States, as spring examples from Wyoming and southern California indicate.

All the specimens of *Petrochelidon albifrons hypopolia* examined are included in the following list:

*Alaska.* Nulato (May 24, 1867); St. Paul Island (about June 10, 1918).

*Arizona.* Tucson (April 18, 1918).

*Mackenzie.* Fort Resolution (June 23, —); Fort Good Hope (June 20, 1904); Fort Norman (June 11, 12, and 14, 1904).

*California.* Laguna Station, San Diego County (May 4, 1894).

*Montana.* Milk River at 49° north latitude (July 25, 1874); Johnson Lake (June 3, 1910); Fort Benton.

*Wyoming.* Ten Sleep (May 31, 1910).

<sup>1</sup>For the change of name from *Petrochelidon lunifrons* to *Petrochelidon albifrons*, cf. Rhoades, Auk, XXIX, No. 2, April, 1912, pp. 193-195.

<sup>2</sup>Five specimens, from Alaska, Mackenzie, and Montana.

<sup>3</sup>Seven specimens.

<sup>4</sup>Eleven specimens.

THE CLIMATIC INTERPRETATION OF TWO EARLY ORDOVICIAN  
MUD-CRACK HORIZONS.\*

BY E. M. KINDLE.

A mud-crack horizon which has not been previously reported occurs in the Grenville section on the Ottawa river. This horizon which is exposed on the north bank of the river immediately above the Canadian Northern railroad bridge is in the upper part of the Beekmantown formation. Its relationship to the associated beds is indicated in the section below which was studied by the writer in company with Dr. M. E. Wilson.

Section above C.N.R. bridge at Hawkesbury.

- |   |      |
|---|------|
| a. Sandstone with coarse sand and fine gravel in upper part and fine sand in lower. Numerous vertical worm tube impressions (Base of Chazy) ----- | 2'   |
| b. Thin bedded limy shale (top of Beekmantown) -----  | 2'   |
| c. Dark grey fine grained limestone with botryoidal fracture -----  | 8'   |
| d. Coarse textured grey limestone full of small fossils -----   | 1'6" |
| e. Thin bedded shaly limestone -----  | 3'   |
| f. Heavy bedded grey limestone and covered  | 10'  |
| g. Thin bedded grey argillaceous and magnesian limestone with mud-crack throughout the upper 4' Resembles sandstone when weathered -----          | 6'   |

Between *a* and *b* of this section there is probably a disconformity. All of the Ottawa valley sections show a rather abrupt change in lithology at this horizon. The change in fauna is equally marked.

The very sharp and clearly defined character of the fossil mud-crack in bed *g* of this section is its most noteworthy feature. The mud-crack polygons exhibit a rather unusual and significant feature in their upturned margins. Many examples of this mud-crack show the unwarped margins of the polygons rising above the centre as much as  $\frac{1}{4}$  inch. Associated with these is a surface structure suggesting raindrop impressions.

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<sup>1</sup>Kindle, E. M. Some factors affecting the development of mud-cracks. Journ. Geol., vol. 25, 1917, pp. 140-142.

Separation of salt and saline water and mud. Bull. Geol. Soc. Amer., vol. 29, pp. 479-483, 1918.

It has been shown experimentally<sup>1</sup> that this type of mud-crack results from the dessication of fresh water mud and that flat or slightly downwarped polygons develop from saline mud. Since mud-crack with upwarped margins is produced only in fresh or brackish water muds we must conclude that this mud-crack horizon represents intertidal mud-flats which were covered at high tide by relatively fresh waters comparable perhaps with those of the upper Baltic sea. The reappearance of a marine fauna in the section a few feet above the mud-crack horizon appears to indicate the return of normal marine conditions. The relatively fresh or slightly brackish water conditions under which these mud-cracks were formed point toward their development in lagoons near a shore which contributed an abundance of river water to partially land-locked arms of the sea. Such a land must have had a moist climate or at least not an arid one.

Another mud-crack horizon occurs about 100 feet higher in the Ontario Ordovician section at Kingston in the Pamela limestone. Cushing<sup>2</sup> has reported this horizon in New York and the writer has described its peculiar features at Kingston.<sup>3</sup> Attention is directed to it here because it suggests climatic conditions near the close of Pamela sedimentation just the opposite of those indicated by the Grenville mud-crack. The flat polygons of the Pamela mud-crack horizon show features which have been interpreted<sup>4</sup> as the product of a highly saline condition of the calcareous mud in which they were developed. Sea water would be likely to develop the high degree of salinity represented by the Kingston mud-crack only in an arid climate.

It seems therefore that a relatively arid climate prevailed during late Pamela time in the lands adjacent to the Ontario sea. This arid climate succeeded a cycle of moist climate in late Chazy time if the inference which has been drawn from the character of the mud-crack is correct.

<sup>2</sup>Bull. N.Y. State Mus. Nat. Hist. No. 145, p. 76, 1917, pp. 135-144.

<sup>3</sup>The Ordovician Limestones of the Kingston Area. Rept. of the Ontario Bureau of Mines, vol. 25, pt. 3, p. 8, 1916.

<sup>4</sup>Kindle, E. M. Some factors affecting the development of mud-cracks. Journ. Geol., vol. 25, 1917, pp. 140-142.

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BOTRYCHIUM OBLIQUUM MUHL., AND VAR. DISSECTUM (SPRENG.)  
NEW TO THE PROVINCE OF QUEBEC.

BY H. MOUSLEY, HATLEY, QUE.

It has been said in one of the handbooks on ferns that if you begin your search for them in March you will hardly be rewarded by finding any but the evergreen species, and even these are not likely to be especially conspicuous at this season. If this is so, what excuse I am going to make for searching for them in December I hardly know except that my enthusiasm for all natural history pursuits knows no bounds, and refuses to be curbed by conventional ideas. I search almost as eagerly for rare Warblers' nests late in the fall as I do in the summer, and having just taken up the study of ferns I was anxious to see whether it was not possible even in the depths of winter to locate and name quite a number by means of their dead and dried fruiting fronds. Now I do not wish to pose as a kind of super-human person, for had not nature in the present instance come to my aid in the shape of a very rapid thaw during the second week in December, I am afraid this paper would never have appeared in print nor would I have obtained very many evidences of the existence of even dead fruiting fronds, as most of these in the natural order of things would have been buried under a heavy coating of snow, which in these parts is generally in evidence (more or less) for seven months out of the twelve.

However, this winter (1918-19) has been particularly kind and from December 15 to 23 (owing to the afore-mentioned thaw) the fields were practically clear of snow, and the woods had comparatively little in them as compared with other years. This state of things made it possible, therefore, to indulge in winter fern hunting, and for a week I spent a good deal of my time in visiting spots where I had previously noticed some of the large *Osmundas*, *Oncleas* and others, whose fruiting fronds are so very different from the sterile ones, and which as a rule can generally be found even in winter, when there is hardly a vestige of the latter left. During the above week I found the following species and varieties, viz: Maiden hair (*Adiantum pedatum*), Common Brake or Bracken (*Pteris aquilina*), Silvery Spennwort (*Asplenium acrostichoides*), Christmas Fern (*Polystrichum acrostichoides*), Marsh Fern (*Aspidium thelypteris*), Crested Shield Fern (*Aspidium cristatum*), Clinton's Wood Fern (*Aspidium cristatum* var. *Clintonianum*), Boott's Shield Fern (*Aspidium Boottii*), Spinulose Wood Fern (*Aspidium spinulosum* var. *intermedium*), Hay-scented Fern (*Dichsonia punctilobula*), Sensitive Fern (*Onclea sensibilis*), Ostrich Fern (*Onclea struthiopteris*), Royal Fern (*Osmunda regalis*),

Interrupted Fern (*Osmunda claytoniana*), and last but by no means least the Ternate Grape Fern (*Botrychium obliquum*), and the var. *dissectum*, both of which form the title of this paper.

Little did I think when I set out on the morning of December 21, that I was going to add an additional species and variety to the list of Quebec ferns, yet such was the case, as Mr. J. M. Macoun tells me that there are no records at Ottawa of the two ever having been found in the province before, nor are there any examples in the Herbarium of the Geological Survey from this section of Canada.

Of *B. obliquum*, however, there are examples from two localities in Nova Scotia, and from several around Niagara Falls, whilst of the var. *dissectum* some are from New Brunswick, and some from localities also around Niagara Falls. In Gray's Manual, 7th edition, p. 49, there are several illustrations of the varieties of *B. obliquum*, including one of the var. *dissectum*, and seeing that the species is polymorphous there are no doubt many others yet to be found, so that it is altogether quite an interesting plant and one well worth looking for. As a matter of fact neither of my examples are quite typical, and do not agree exactly either with those from Nova Scotia, New Brunswick or Niagara Falls.

I only found one example of each in a very sheltered spot under a cedar tree on the outskirts of a large wood about two miles to the south of Hatley village, this wood forming part of the farm originally known as the Poole farm, but now belonging to Mr. Will Hunter. The specimens were quite fresh and green when found, and after having been duly pressed and preserved they were subsequently presented to the Herbarium at Ottawa. Of the var. *dissectum*, Gray in his Manual says: "Often found with the typical form in New England," and so I found it here, the two not being more than twelve inches apart from one another, which fact I imagine is all in favor of *dissectum* being pronounced a variety of *B. obliquum* and not a separate species as some are still inclined to consider it I believe.

In conclusion I may say that besides the species already enumerated I had previously found the following additional ones, viz: Long Beech Fern (*Phegopteris polypodioides*), and Oak Fern (*Phegopteris dryopteris*), these two bringing my list up to a total of eighteen, which may be considered very satisfactory, I think, for the amount of time so far spent on the subject.

## NOTES AND OBSERVATIONS.

REMARKS ON THE METAMORPHOSIS OF THE SCALLOP (*Pecten tenuicostatus*).—After hatching, the young scallops attach themselves to rocks, scallop shells, or other objects to which they remain as fixtures for a year or two. I can tell this from numerous young specimens obtained which possess an aperture through which a portion of the creature protrudes for attachment, and from a few specimens I came across which possess an elastic byssus for attachment, which protrudes from the so-called foot, and also from the margins of growth, the striations, and other points of structure which undergo a modification.

In the earlier stages the byssal attachment appears to agree with that of *Anomia* throughout the life-history of that genus; that is, there is an aperture near the apex of the under valve through which a portion of the mollusk itself protrudes, so that it is directly attached to the object. But its agreement with *Anomia* in this respect is only temporary, for in time the scallop develops a byssus which is of elastic constituency, such as the mussel (*Mytilus*) possesses throughout its life-history. In the instance of the scallop again this provision is only temporary, for in time as it continues to grow the byssus disappears, and the scallop is free and can then move about by the flapping of its valves.

Sometimes I was able to determine a stage of development from a single example. For instance, the fact that at one time in its life-history the scallop develops an elastic byssus secreted from the foot for attachment to an external object. This I know from only one specimen which had such a byssus. Two other specimens of the same character were obtained, but the byssus of one of them had been broken off in the raking, and it was found lying loose, and the other, a much smaller one, was also detached from the object.

Considering that the byssus always occurs on the same side of the scallop, and that the aperture of the more immature form extends to the margin of the valve, it is evident that the elastic elongation simply evolves from the original attachment, and that the aperture of the under valve as it becomes obliterated, leaves the scallop, except that it is now moored to an external object, otherwise free.

Judging from an illustration from Parker and Haswell, these zoologists seem to regard the pectens as hermaphrodite, as they show one part of the gonad in the same individual as male and the other as female. But this is not so, at least in the case of the scallop. The sexes are distinct, and out of 209 scallops specially examined by me in my observational work, 100 were males, 108 females, and in

one the sex was indeterminable. The gonad of this last mentioned was completely empty, not that I consider the scallop had spawned, for it was impoverished generally, and apparently in a sickly condition. I might have been able, had I known it at the time, to determine the sex by the digestive organs, but this was a later discovery. This fact, however, helps to emphasize what I say as to the sexes being distinct. The gonad of the male is cream-colored and the stomach and its appendages gray, whereas the gonad of the female is a sort of brick-red color and the stomach and its appendages brown.

ANDREW HALKETT.

A ROBIN'S MISTAKE.—A pair of robins have for some years been in the habit of building their nest among the creepers which grow on the side of my house, having for neighbors a pair of crow blackbirds. This year the two nests were placed on either side of a bay window, only a couple of yards apart. Both young families left the nest at about the same time, and this circumstance evidently led to complications. The parent crow blackbirds showed no lack of interest in their young family. On the contrary, for the first day or two after the latter left the nest the old birds resented the appearance of anyone on the lawn where the young were, complaining loudly and making savage darts at the intruder, as though intending to do him grievous bodily harm. Nevertheless, in spite of all this parental solicitude, one of the young crow blackbirds was adopted by one of the parent robins. How it originally came about I do not know; but a few days later, when all of the other members of both families had disappeared, I was attracted by the novel sight of the robin working industriously early and late to satisfy the voracious appetite of his adopted progeny, who followed him about continually demanding more. This proceeding continued for about three weeks and as the pair remained all that time in my garden, I was able to keep close watch on them and to note the gradual growth of the young blackbird, until when I last saw them he was fully plumed and almost indistinguishable from an adult. There was, therefore, no doubt whatever as to the correctness of the identification. It was not, as some might be inclined to suggest, a cow bird, but unquestionably a crow blackbird. Once, on the second or third day of my observations a pair of adult crow blackbirds—possibly the real parents—arrived on the scene and for a time evinced considerable excitement over their "lost heir," but as the latter took

no notice of them whatever, but stuck to the robin and as he, poor bird, was much too busy hunting worms to notice anything else, the blackbirds presently calmed down and flew away, no doubt concluding that it must be a case of mistaken identity.

Has any reader of THE FIELD-NATURALIST ever heard of such a curious mix-up as this? It is, I suppose, just possible that the explanation may be that a crow blackbird's egg was laid in the robin's nest. The nest was so situated close to the glass of a window that one could look into it quite easily from one of the rooms of my house. Nevertheless

I did not examine it until the eggs were hatched, and then only very cursorally. It is, therefore, possible, though I think unlikely, that the young crow blackbird was in the nest and escaped my notice. Naturally I was not expecting that any question would arise as to the identity of the young robins. Still I think the more likely explanation to be that by some curious chance the robin accidentally adopted one of his neighbor's children soon after the two families had simultaneously left their respective nests.

W. L. SCOTT.

Tredinnock, Ottawa.

### BOOK NOTICES AND REVIEWS.

THE BIRDS OF MIDDLE AND NORTH AMERICA. By Robt. Ridgway, Part VIII, Continuation of Bulletin 50, U.S. National Museum, Washington, Government Printing Office, 1919.

The monumental task of monographing all the birds of North and Middle America was begun by this veteran ornithologist, now probably the Dean of the science in America, many years ago. The first volume covering the Finches and Sparrows appeared in October, 1901. Since then the following parts have appeared. The contents covering Canadian species only is given here.

Part II, 1902, The Tanagers, Troupials (black-bird and orioles) and Wood Warblers.

Part III, 1904, Pipits, Swallows, Waxwings, Vireos, Shrikes, Crows and Jays; Titmice, Nuthatches, Creepers, Wrens, and Dippers.

Part IV, 1907, Thrushes, Mockingbirds, Starlings, Larks and Tyrant Flycatchers.

Part V, 1911, Hummingbirds and Swifts.

Part VI, 1914, Woodpeckers, Kingfishers, Goatsuckers, and the Barn and Eared Owls.

Part VII, 1916, Cuckoos and Pigeons.

This present volume now appearing includes Oyster-catchers, Turnstones, Surf Birds, Plovers, Snipes, Phalaropes, Avocets, Skimmers, Terns, Gulls, Skuas and Auks.

The next Part, namely IX, now in course of preparation, will contain Cranes, Rails, Gallinules and Coots; Turkeys, American Partridge, Grouse, Falcons, Hawks and Eagles and American Vultures.

It is contemplated that Part X will complete the work.

The magnitude of this work can be partially appreciated by the fact that each volume runs from 550 to 875 closely printed pages, many of them consisting of masses of abbreviated bibliographical references and synonymy requiring immense research and exact transcription and proofreading. Dr. Elliott Coues said that bibliography required the work of an "inspired idiot." On these grounds alone the

Birds of Middle and North America would be notable, but as each species and subspecies is accompanied by the fullest detailed description and each has been subjected to the strictest scrutiny as to taxonomic standing and relationship by one of the keenest observers in America it is evident that this will stand as a monument to the author for many years. It will be noted that the classification does not follow that of the A.O.U. Check list and is not familiar to the majority of American ornithologists. In this it probably shows a considerable step in advance. The latter is acknowledged to be faulty, but it has not been thought expedient to change it until a system can be presented that will meet a more general approval than any hitherto advanced receives. The work is not popular, but confines itself to strictly scientific aspects of taxonomy, nomenclature, identification and distribution. The purely popular nature student has little interest in it except as a reservoir of ascertained facts to guide, control and direct his esthetic impressions and investigations.

P. A. TAVERNER.

HAMILTON M. LAING. Whilst it is not the custom to treat newspapers as serious scientific publications it seems that some attention should be called to the series of excellent articles on popular ornithology appearing more or less regularly in the *Toronto Globe*. These are from the pen of Hamilton M. Laing, who is taking the place of the late lamented Sam Woods who conducted this nature column with but scanty recognition for a long period. Mr. Laing is a Canadian, of considerable experience in Manitoba, now resident in Portland, Oregon. During the latter days of the war he was in the aviation corps and assisted in training many of our fliers who later made a good account of themselves at the front.

The subject of these papers cover such a range of subjects as "The Shore Birds in Autumn,"

"Hawks Everyone Should Know," "The Wood Warblers," etc. The subjects are treated in a popular, entertaining manner, in a style that more than occasionally warrants the term "fine writing", sympathetically but with an absence of gush and with a good substratum of personal knowledge and common sense. We can stand many more of such popular science writers in Canada as well as elsewhere.

P. A. TAVERNER,

In the *Auk* for April, 1919, appears the following titles of especial interest to Canadians:

WINTER ROBINS IN NOVA SCOTIA, by Harrison F. Lewis, pp. 205-217. This records the unusual appearance of robins in widely separated localities of Nova Scotia, in late December, January, February and early March. The interesting point brought out is that the number of robins increased during the season of greatest cold, culminating in early February in weather below zero and disappearing when the temperature moderated. It is suggested that these winter visitors are not unseasonably early migrants from the south, but a collection of winter lingerers from the north or interior gathered together by the unusual inclement weather.

PROBLEMS SUGGESTED BY NESTS OF WABBLERS OF THE GENUS *Dendroica*, by John Tredwell Nichols, pp. 225-228, raises some interesting questions as to the nest-building instinct and the facility or otherwise with which birds substitute new materials of civilization for their ancestral supplies.

ON THE POPULAR NAMES OF BIRDS, by Ernest Thompson Seton, pp. 229-235, is a plea for more characteristic common names for birds, advocating terms of spontaneous and natural origin over those of more clumsy manufacture.

THE REALITY OF SPECIES, by Leverett Mills Loomis, pp. 235-237. This is a short paper discussing the subspecies question. The conclusion of the author (quite in harmony with the ideas of this reviewer) is that whilst the species with its component races is a reality, the lesser subspecific subdivision is but a concept.

GEOGRAPHICAL VARIATIONS IN THE BLACK-THROATED LOONS, by A. C. Bent, pp. 238-242. This is a brief discussion of the occurrence of these allied species in America. The writer lumps four forms *Gavia arctica*, the Black-throated Loon, *G. pacifica*, the Pacific Loon, *G. viridigularis*, the lately described Green-throated Loon, and *G. suschkini*, the Asiatic form, in one species as geographical races of *G. arctica*. *Pacifica* appears to be the common North American form with *viridigularis* of erratic occurrence on the Pacific coast. He questions the specific, even the subspecific dis-

inction of this form as he can limit it to no geographical range. It does not appear that true *G. a. arctica*, in spite of repeated records to the contrary, has even been satisfactorily recorded from America.

REASONS FOR DISCARDING A PROPOSED RACE OF THE GLAUCUS GULL (*Larus hyperboreus*) by Johnathan Dwight, pp. 242-248. In this paper Dr. Dwight brings his keen analytical pen to bear on H. C. Oberholser's proposal (*Auk*, 1918, p. 472) to recognize the rejected northwestern American form *Larus barrovianus* as a subspecies of the Glaucus Gull. By a series of graphic diagrams he shows that the size distinctions upon which the form is based are too variable for recognition, further driving his argument home by superimposed outlines of the average bills of the two supposed races in which the distinction of size is shown to be absurdly small. In conclusion, he says:

"In our gropings after the truth it is wasteful of too much time to spend so much of it stumbling over names of groups so poorly defined that they convey only a vague meaning to a few specialists and none at all to everybody else. Decking the subspecies in all the glittering panoply of diagnosis, dimensions and distribution makes it an impressive spectacle, but this does not necessarily make of it a good subspecies."

These are sentiments of which the reviewer heartily approves.

THE BIRDS OF RED DEER RIVER, by P. A. Taverner, pp. 248-265. This is the last half of a paper begun in a previous number. Including an addenda it brings the number of species annotated to 194.

FOURTH ANNUAL LIST OF PROPOSED CHANGES IN THE A. O. U. CHECK LIST OF NORTH AMERICAN BIRDS by Harry C. Oberholser, pp. 266-273. In this are gathered together all the various proposals of the past year that may affect American Ornithological nomenclature. It deals with about seventy-two names. Without doubt some of these will be accepted according to the canons of our Code of Nomenclature, but it is a matter of some congratulation to us that this lengthy list is one of mere proposal and not accepted fact. These late lists of proposals show that the genus splitter is in full action. It is to be hoped that the committee on nomenclature will bear in mind that the genera is but a conception adopted for convenience and that it defeats its own end when each genus approaches the monospecific and in place of simplifying our system but adds to its complexity.

Under General Notes, Harry C. Oberholser, pp. 282-283, in Status of the Generic Name *Archibuteo* decides that *Archibuteo* is a *nomen nudum* and therefore untenable and that the next name applicable for the genus of the Rough-legged Hawks is

*Triorchis* Kaup. This would change the accepted name of both our Roughlegs.

In the Division of Correspondence, P. A. Taverner writes urging that caution be used in identifying birds subspecifically by either geography or slight characters alone advocating, except where the case is clear or indisputable, that the specific binomial be used leaving subspecific status open until such times as more evidence is available. This is replied to by Witmer Stone, the editor, with a qualified assent, but advancing a negative argument that the present reviewer (the author of the original letter) regards as dodging the question.

Information of peculiar interest to us is the report upon the J. H. Fleming, Toronto, Ontario, collection of birds, on page 321, which is also copied by the *Ibis* for July. It reads:

"This is one of the largest private collections and covers the birds of the entire world—a most commendable feature. We learn that it comprises about 25,000 specimens representing 5,377 species and 1,925 genera, as recognized in Sharpe's Hand List.' When we note that there are, according to this authority, some 17,000 species of birds and 2,647 genera, we realize that Mr. Fleming has about one-third of the known species and three-fourths of the genera represented, the latter being evidence of the painstaking care that he has exercised in bringing together this notable series of specimens."

This is one of the really notable private collections in English-speaking America; in some directions, as in the thoroughness with which it covers its broad field, equalling or even outranking those of the larger American museums.

The gathering of this monumental series has been results of a life time and if the future Canadian student of ornithology in its broader aspects, finds the working tools for his investigations within this Dominion it will be entirely due to Mr. Fleming's efforts.

This is by far the largest collection of birds in Canada, outranking even in mere point of numbers its nearest rival, that of the Museum of the Geological Survey at Ottawa, representing the Dominion Government's national collections, which though practically confined to the Canadian field, numbers barely 14,000 specimens. Whilst these figures may seem large to the uninitiated they are really small in comparison with the more notable collections abroad. There are a number of private collections in the United States ranging in the neighborhood of 60,000. The collection of the United States National Museum, a comparable institution to ours, has, exclusive of large collections of the Biological Survey which are practically amalgamated with it,

reached 200,000, whilst the British Museum bird collections passed the half-million milestone ten years ago. These comparative figures are merely given here to indicate that while Canada may be congratulated on having made a healthy start in this branch of scientific investigation, she has still a long way to go before she can compete on a par with other countries which have had a longer start in the field of zoological research.

P. A. TAVERNER.

WILD ANIMALS OF GLACIER NATIONAL PARK. *The Mammals*, with notes on Physiography and Life Zones, by Vernon Bailey, Chief Field Naturalist, Bureau of Biological Survey, Department of Agriculture. *The Birds*, by Florence Merriam Bailey, author of Handbook of Birds of the Western United States. Dept. of the Interior, Franklin K. Lane, Secretary. National Park Service, Stephen T. Mather, Director. Washington: Government Printing Office, 1918. (Pp. 1-210, with 21 halftone plates of mammals and 16 of birds, 18 text figures of mammals, and 78 of birds. Copies may be procured from the Superintendent of Documents, Government Printing Office, Washington, D.C., at 50 cents per copy).

Glacier National Park lies in northwestern Montana, along the main range of the Rocky Mountains, the "Continental Divide," from the Canadian boundary, where it adjoins one of our own Canadian national parks, the Waterton Lakes Park, on the north, to the line of the Great Northern Railway on the south. Glacier Park, though one of the more recently established United States parks, is rapidly becoming famous as a region of great scenic beauty, celebrated by painters and photographic artists. The present volume is a praiseworthy effort of the United States park management, during the recent turning of the movement of vacation tourists to "See America First," resulting in many new visitors to the national parks, to set forth some of the less known natural advantages of these great national playgrounds to a large and constantly growing class of people. The scenic mountain-peaks, icy glaciers, and mirroring lakes scarcely need to be pointed out, but other fascinating possibilities are not so obvious. Interest in wild life is growing everywhere, and nothing adds to the interest of our parks more than glimpses of animated life. A few squirrels or sprightly chipmunks obviously add a touch of life even to a city park, and a sight of the picturesque and rapidly disappearing large game animals of the Rockies in their native habitat is worth going far to see. Soon the parks may be the only place where we shall have this privilege.

Glacier Park has a wonderful natural variety of plants and animals, containing within its boundaries areas ranging from the lower Transition Zone of its open plains borders, through the dense forests of lodgepole pine, spruce and fir in the Canadian Zone at the base of the mountains, the narrow belt of dwarfed timber at or near timberline in the Hudsonian Zone, and the Arctic-Alpine Zone of the higher mountain-tops. Mr. Bailey has sketched briefly the botanical wealth of these varied climatic and life zones, but the book deals mainly with mammals and birds, and no one is better qualified to treat them than Mr. Bailey with his lifetime of experience in field work in the West, accompanied on many trips by the accomplished "bird woman" who is his wife. While the book is of aid to every beginning naturalist or enquiring tourist who may visit the region, it will prove useful as a Baedeker for the most expert, telling him where the species he is most interested in may be found at the proper time. A good assortment of interesting life-history notes on each species is given, with suggestions of many things which may be of value for succeeding visitors to the park to watch for and add to our knowledge. Most of the mammals are illustrated by photographs from life. The bird section is well illustrated by new life photographs from various sources, and well-selected reproductions of photographs, sketches, and paintings which have been used in other publications. A systematic key is given for the classification of the commoner summer birds of the park which will be useful in other

places in the northern Rockies.

In addition to the pleasure and profit which this book gives to a person already interested in natural history, and its value as a strictly biological report, its chief value will probably lie in introducing the fascinating possibilities of wild life study to the average citizen, the casual tourist and park visitor, whose numbers are increasing from year to year. When this interest is developed, and the parks need only be entered and intelligent attention called to their advantages for the interest to be kindled, a new force is added to the protection of wild life, rational conservation, and public recreation, the influence of which can not be overestimated.

The Canadian National Parks offer similar if not greater possibilities. Waterton Lakes Park (just north of Glacier Park), Rocky Mountains Park at Banff, Jasper Park in Alberta, Point Pelee Park in Ontario (the most southerly point in Canada, on the great migratory bird route along the shore of Lake Erie) and the Percé and Bonaventure reservation for the protection of the great seabird rookeries at the tip of the Gaspé peninsula of Quebec, have their own peculiar attractions to the nature lover, and are bound to be still more attractive when their wild life attractions are more generally known to the public. For such areas, the little books which teach the eye to know what it sees, as well as to notice what is often hidden to the unseeing eye, have an increasing function in popular education.

R. M. ANDERSON.



(The October Number was mailed on November 18, 1919.)