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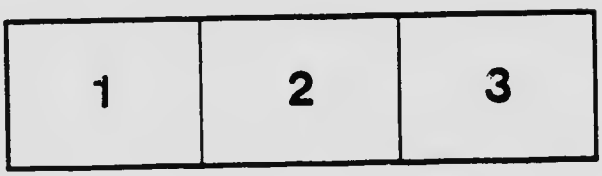
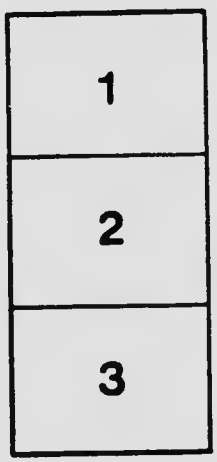
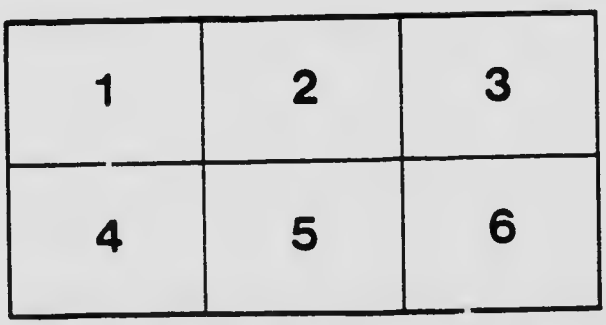


# LIFE-HISTORIES OF NORTHERN ANIMALS


PLATE I.—SKETCH FOR BUGLING ELK.

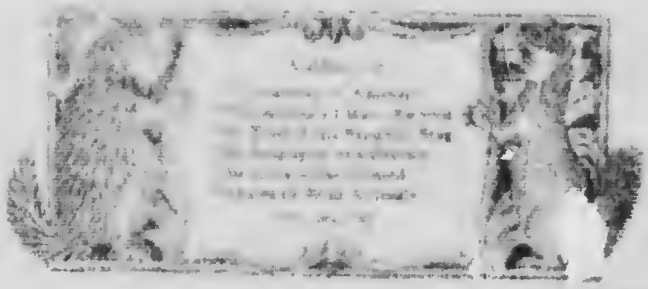
# LIFE HISTORIES OF NORTHERN ANIMALS

AN ACCOUNT OF THE

## MAMMALS OF MANITOBA

BY

ERNEST THOMPSON SETON



MAPS AND 580 DRAWINGS BY THE AUTHOR

CHARLES SCRIBNER'S SONS, New York City :: 1909

# LIFE-HISTORIES OF NORTHERN ANIMALS

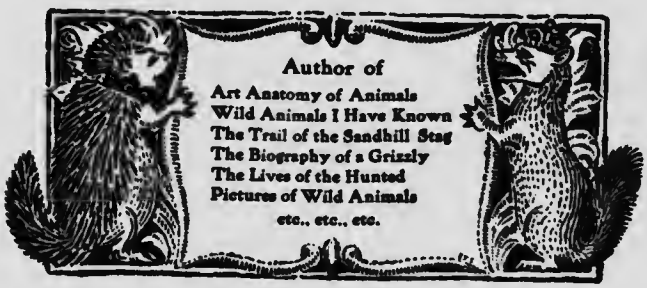
## AN ACCOUNT OF THE

## MAMMALS OF MANITOBA

BY

**ERNEST THOMPSON SETON**

Naturalist to the Government of Manitoba






VOLUME I. GRASS-EATERS

**WITH 68 MAPS AND 560 DRAWINGS BY THE AUTHOR**

**Published by CHARLES SCRIBNER'S SONS, New York City :: 1909**

Published October, 1909

Dedicated
by Special Permission
to
HIS ROYAL HIGHNESS THE PRINCE
OF WALES
The First of the Royal Family
to Enjoy in Person
the Game-Fields
of
Manitoba


The red lines show the author's travels in gathering the material for this book; the dots indicate his actual camps or dwelling places.

# PREFACE.

THIS aims to be a book of popular Natural History on a strictly scientific basis. In it are treated some 60 quadrupeds that I have known and studied for many years.

Although I have limited the scope to the 60 species that are found in Manitoba, this takes in all the large land mammals of the United States, except about a dozen, including five of the big game. Having followed these 60 into all parts of their ranges, I have virtually included the Continent from Labrador to California.

A glance at the map will show that I have had unusual opportunities for gathering material, having visited nearly every State in the Union, on trips to collect specimens or information. Thirty years of personal observations are herein set forth; every known fact bearing on the habits of these animals has, so far as possible, been presented, and everything in my power has been done to make this a serious, painstaking, loving attempt to penetrate the intimate side of the animals' lives—the side that has so long been overlooked, because until lately we have persistently re-

garded wild things as mere living targets, and have seen in them nothing but savage or timorous creatures, killing, or escaping being killed, quite forgetting that they have their homes, their mates, their problems and their sorrows—in short, a home-life that is their real life, and very often much larger and more important than that of which our hostile standpoint has given us such fleeting glimpses.

The facts in these two volumes have, for the most part, long been known to me, and have formed a part of my equipment, yet I set them forth accredited to the men who first observed them. I have done this, even when they have been covered and more than covered by my own observations.

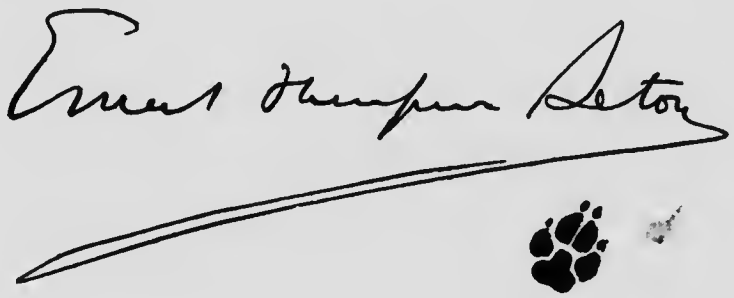
Theoretically, I have treated each species under thirty divisions' heads, but am shocked to find in how many cases the heading is missing, because there were no facts available for classification under it. No one knows better than I, then, how many gaps and imperfections are to be found herein, and in view of this I hope the critics will overlook the weak spots, and seek rather for the things that make for usefulness.

As this is a book of Life-histories or habits, I have occupied myself as little as possible with anatomy, and have given only so much description of each animal as is necessary for identification. My theme is *the living animal.*

No one who believes in Evolution can doubt that man's mind, as well as his body, had its origin in the animals below him.

Otherwise expressed, we may say that: Just as surely as we find among the wild animals the germs or beginnings of man's material make-up, so surely may we find there also the foundations and possibilities of what he has attained to in the world of mind. This thought lends new interest to the doings of animals in their home-life, and I have sought among these our lesser brethren for evidences of it—in the rudiments of speech, sign-language, musical sense, æsthetics, amusements, home-making, social system, sanitation, wed-law, morals, personal and territorial property law, etc.

As much as possible, I have kept my theories apart from my facts, in order that the reader may judge the former for himself.



# ACKNOWLEDGMENTS.

My thanks are due to the United States Biological Survey, Department of Agriculture, for electros of many cuts, made chiefly from my own drawings, ordered by the Department in years gone by; to Dr. C. Hart Merriam for the identification of many specimens and much assistance; also to Mr. Edward A. Preble for a critical reading of parts of the text.

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To Dr. Robert Bell I am indebted for essential aid in preparing the geological sketch of Manitoba; to Professor John Macoun and Mr. James M. Macoun, for many notes and other assistance; also to Messrs. George M. Dawson, A. P. Low, Percy H. Selwyn, all of the Canadian Geological Survey.

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To Mr. Henry M. Ami, of the Geological Ottawa, for assistance with the French Canadian names of the animals.

In collecting the Indian names, although I consulted many natives, the following were my principal informants:

*Ojibwa.*—Ah-nee-mee′-kong (Little Thunder), a full-blood whom I met at Lake of the Woods, Albert Chief, a half-breed of Kenora, acting as interpreter.

*Sauteaux.*—Baptiste Nee′-pee-nak (Summer Bear), a full-blood at Winnipegosis, Mr. J. J. G. Rosser acting as interpreter, besides giving additional information.

*Cree.*—Mr. W. G. Tweddell, of Woonona, Manitoba, and, in part, Mr. Hector MacKenzie, of Winnipeg.

*Muskego.*—Swampy or Wood Cree. Isadore Nee′-ah-poo, a full-blood living at Winnipegosis, Mr. J. J. G. Rosser acting as interpreter, and adding many items of information.

*Chipewyan.*—Weeso (Louison d'Noire), a Fort Resolution Chipewyan who went with me to the Barren Grounds in 1907.

*Yankton Sioux.*—Mr. C. C. Chipman, Commissioner of the Hudson's Bay Company at Winnipeg.

*Ogallala Sioux.*—Dr. James R. Walker, resident physician of the Pine Ridge Indian Agency, S. D.

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D. Nicholson, Morden, Man.,
John S. Charleson, MacDonald, Man.

Other assistance is acknowledged in the context.

E. T. S.

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## *VOLUME I.*

## *VOLUME II.*

## A LIST OF THE SPECIES HEREIN TREATED.

# Class MAMMALIA.

(Comprising all backboned air-breathing creatures whose young are *born alive* (except the Australian Monotremes) *and suck milk.*)

*VOLUME I.*

## Hoofed Beasts—Order Ungulata.

(Which includes all *hoofed* mammals; these are mostly of large size.)

**DEER FAMILY** or *Cervidæ*—



**PRONGHORNED ANTELOPE FAMILY** or *Antilocapridæ*—

## Rodents—Order Glires.

Nearly all the animals of this order are of small size. Their most obvious general character is in the teeth; they have no canines, and but *two incisors in each jaw* (except in the Rabbits, which have *four* incisors in the upper jaw); these are chisel-edged, have persistent pulps, and are *separated from the grinders by a wide, vacant space.*

*VOLUME II.*

## Flesh-eaters—Order Carnivora.

Mostly large animals (except the Weasels); all (our species) have *six* small incisors in each jaw; *four large canine teeth*, and the premolars developed, not to grind, but to cut like shears.

## Bug-eaters—Order Insectivora.

These (the Canadian species) are small mouse-like creatures, but usually seem to have neither eyes nor ears; their teeth are remarkably different from those of rodents, as they are sharp-pointed and close set without any vacant interspace, and most of them are tipped with dark brown.

## Bats—Order Chiroptera.

Known at once by their skin or membranous wings and their power of flight. In character their teeth are between those of Carnivora and Insectivora.

# PLATES.

# FULL-PAGE AND OTHER ILLUSTRATIONS.

# MAPS.

# LIFE-HISTORIES OF NORTHERN ANIMALS

# INTRODUCTION.

## A Sketch of the Physical Features of Manitoba.

MANITOBA lies between 49° and 52° 50′ North Latitude; and between 95° 15′ and nearly 191° 30′ West Longitude. It is 47 Townships wide (=282 miles) by 44 Townships high (=264 miles), and has a total area of 74,448 square miles.

### GEOLOGY.[1]

The Laurentian system, which constitutes the largest part of the Archæan or fundamental crystalline series, includes the oldest rocks of the earth's crust. They are divided into older and newer parts. The north-eastern quarter of North America, including Greenland and most of the larger islands in that direction, consists of the older or primitive gneiss series, of Lower Laurentian age; but the newer Laurentian is also represented in Baffin-land and in eastern Labrador. Most of this immense Laurentian area is not greatly elevated, the general surface constituting a pene-plain with a mammillated surface.

In north-eastern Labrador and throughout the great island of Baffin-land, more than 1,000 miles in length, the same rocks form mountain ridges from 3,000 to 8,000 feet in height, the higher parts of which are not glaciated like the extensive Laurentian pene-plains just described.

The Huronian system, consisting of older and newer divisions, constitute the upper portion of the Archæan rocks. This is the great metalliferous series of the Dominion. Between it and the Laurentian, a volcanic group to which the name Kiwaitin ("Keewatin") has been given, is generally, but not always, found.

[1] For a revision of this chapter I am indebted to Dr. Robert Bell, of the Canadian Geological Survey.

In Manitoba the Laurentian area lies to the eastward of Lake Winnipeg and the prairies of the Red River Valley, and its rocks belong to the lower division, or that of the primitive gneiss. They extend eastward a long distance toward Hudson Bay. In St. Martin's Lake some small islands consist of gneiss, and the same rock has been found, by boring, to underlie the horizontal sedimentary rocks to the southward of Lake Manitoba. The Archæan rocks probably underlie these strata throughout Manitoba, their depth from the surface increasing to the south and west.

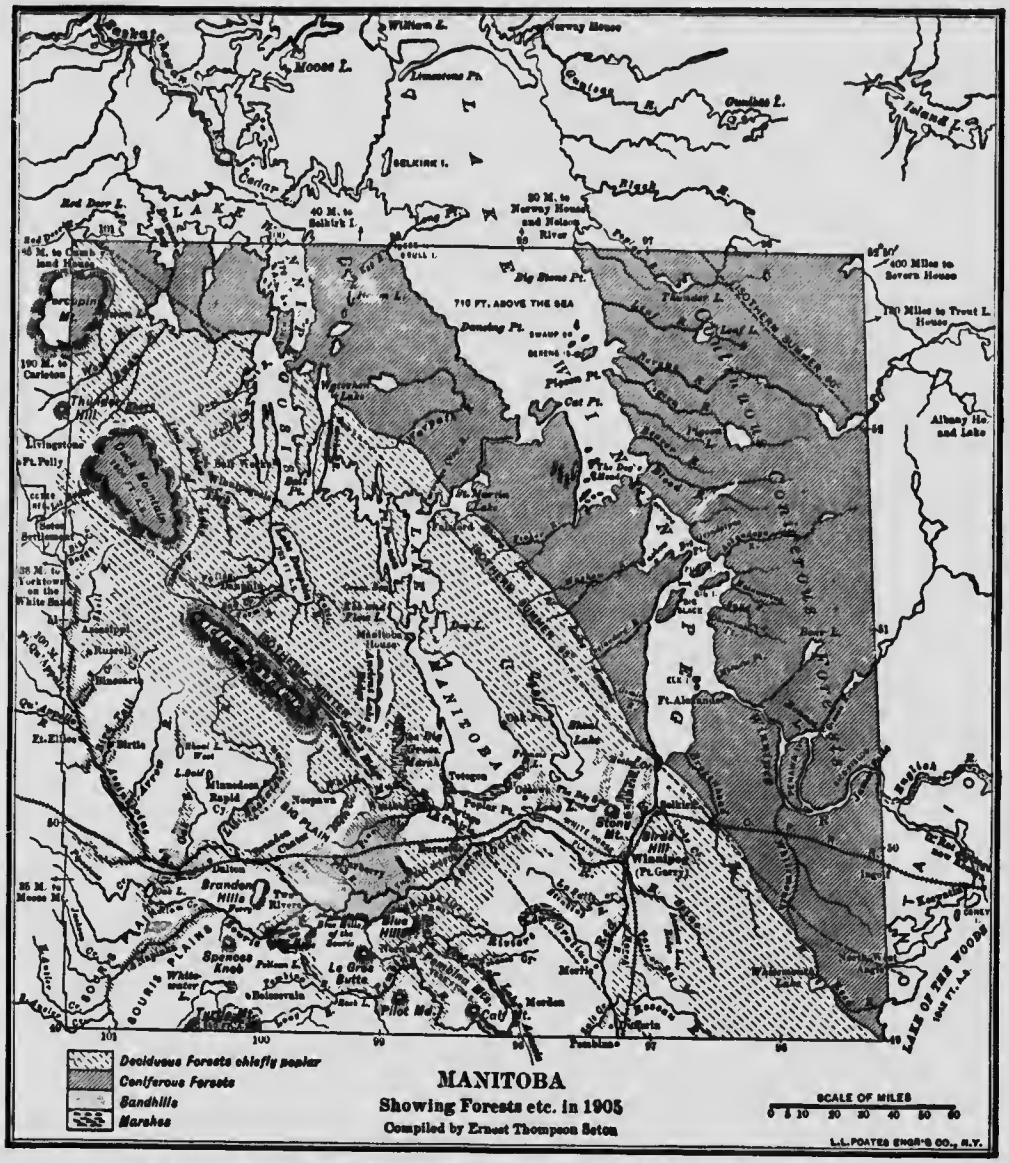
The Laurentian rocks of the province are immediately overlaid to the westward by unaltered and almost horizontal beds of the Ordivician or Cambro-Silurian system. Along the west side of Lake Winnipeg these consist of sandstones at the bottom, overlaid by impure magnesian limestones. Thick-bedded mottled yellowish-gray magnesian limestones of the same horizon are found at East and West Selkirk. At Stoney Mountain fossiliferous limestones occur which are somewhat higher in the series.

Above the Ordivician rocks, the Devonian system is represented on both sides of Lakes Manitoba and Winnipegosis by limestones which are much less magnesian than those of that series. Rocks belonging to one or the other of the two systems just mentioned are believed to underlie most of the Red River Valley in Manitoba. At Burnside a boring made by the Canadian Pacific Railway Company in 1874 showed the Devonian at that locality to be lying directly upon Laurentian gneiss.

On the second prairie level, that is, all the Assiniboine prairies west of the escarpment of Pembina, Riding, and Duck Mountain, the Devonian is overlaid by a series of Cretaceous shales that are exposed at many points along the river valleys, as well as on the eastern front of the above-named escarpment.

On Turtle Mountain we find the Laramie limestones between the Cretaceous shales and the surface deposits or drift.

The drift is composed of boulder clay, overlaid in places with lake-bottom clay or sometimes delta sand. The clay and




**MAP 1—MANITOBA, SHOWING FORESTS AND PRAIRIES IN 1905.**

Also the places mentioned in this work.

other surface materials have in most parts of our province been worked up by plant and animal agencies, into a layer of rich black mould. The important part played in this by the Pocket-gopher is duly set forth in the chapter devoted to that species.

### The Steppes of the Prairie.

*The first or lowest Prairie Steppe* embraces all the Red River Valley proper. It slopes from 710 feet above the sea at Lake Winnipeg to nearly 1,000 feet in Minnesota. This is


Map 2—The Glacial Lake Agassiz.
Redrawn from sketch in Dr. George Bryce's paper. See foot-note 2, opposite.

really the floor of the old *Lake Agassiz*, whose waters, imprisoned by a great glacier to the northward, or by some other cause, flooded the region and overflowed southward into the Mississippi at Lake Traverse. Its western bank is the escarpment known as Pembina, Riding, Duck, and Porcupine Mountains. It receded by degrees owing to relative changes of elevation in the land; or, as some suppose, with the melting

of an ice-barrier. Records of the levels are found in at least seventeen different beaches.

This lake was there so recently—5,000 to 7,000 years ago, it is estimated[1]—that the land it once covered is yet unfurrowed by erosion, and the rivers that cross its bed have not had time to scoop out valleys for themselves.

Stoney Mountain, rising eighty feet above the plain, is a mass of Hudson River (Silurian) limestone that escaped part of the erosion of the glaciers, and stands in its original position a monument of former levels and formations.

Bird's Hill, north-east of Winnipeg, an accumulation of gravel and sand, is now believed to be an "osar," that is, either a glacial river-delta or the slack-water dump where two glacial rivers joined.

The long gravel ridges formed in various parts of the First Prairie Steppe are the ancient beaches of Lake Agassiz at its different levels. The highest of these is to be seen on the Pembina Mountain, between Morden and Thornhill. Each of these beaches has an upward slope to the northward of about one foot to the mile, showing a total elevation of about 300 feet at the outlet of Lake Winnipeg, as compared with the level of the ridges of the former Lake Agassiz opposite the southern part of Lake Manitoba.

*The Second Prairie Steppe* finds its eastern border at the west shore line of Lake Agassiz. It includes the rest of the province on that side, except Turtle Mountain, and is bounded westerly by the Coteau du Missouri, or Third Prairie Steppe.

This second prairie level had apparently two great lakes in early glacial times—one Lake Saskatchewan, the other Lake Souris. The level plains of the Souris country were the floor of the latter, and White-water Lake is its last remnant. At this time we believe Lake Saskatchewan was cut off by the land ice and the Pasquia Hills from Lake Agassiz, and the

[1] Dr. George Bryce, Surface Geol. Red River. Trans. Hist. and Sci. Soc. Man., No. 41, 1891, p. 1.

waters of both Saskatchewan rivers, discharging into it, found their overflow near the Elbow and went by way of the present Qu'Appelle Valley into Lake Souris. The sandhills extending west of Griswold are the delta sands of this old Saskatchewan.

Lake Souris, receiving the waters of the Saskatchewan, Assiniboine, and Souris Rivers, found its overflow in a mighty flood that swept down through Lang's Valley, Rock Lake, Swan Lake, and Pembina Valley to discharge into Lake Agassiz, where it formed an extensive sandy delta, now represented by the sandhills where the Pembina River issues from Pembina Hills, in Dakota.

But probably the receding of the supposed glacier allowed the overflow of Lake Souris to find a lower channel into Lake Agassiz, by way of the Grand Valley of the Assiniboine, at Brandon. The Carberry and adjoining sandhills are the delta deposits at the new mouth of the great river. The varied forms of these hills are due to the piling and sculpturing power of the wind.

A further recession of the glacier lowered Lake Saskatchewan to the level of Lake Agassiz, joining them together at the north of Pasquia Hills, as shown in the map. Thus Manitoba lost the Saskatchewan; for now that famous stream had dropped lower than the slight ridge that cuts it off from its ancient channel—the valley of Qu'Appelle—and following the low lands to the north it settled into the bed wherein we see it to-day.

The average altitude of this Second Prairie Steppe is, according to Dr. George M. Dawson,[3] 1,600 feet above the sea, or about 800 feet above the first Prairie Steppe. The rise is well shown between Morden and Thornhill where there is a difference of over 300 feet in six miles.

Dr. George Bryce considers[4] that the Tiger Hills, Brandon Hills, Arrow Hills, etc., are vast moraines, or dumps of drift material that was side-tracked from the glaciers.

[3] Geol. and Resour., 49th Parallel, B. N. A., Bound Comm., 1875, p. 5.
[4] Surface Geol. Red River Trans. Hist. and Sci. Soc. Man., No. 41, 1891, p. 5.

*The Third Prairie Steppe*, or Coteau du Missouri, is far beyond our limits, except for the Turtle Mountain, which, rising some 500 feet above the plain to the east of it, is more than 2,000 feet above the sea, and is a sort of island or eastern outlier of the Third Prairie Steppe, which extends to the foot of the Rocky Mountains.

### Salt Springs.

In Professor Macoun's book, "Manitoba and the Great Northwest,"[1] I find the following: "Numerous salt springs are found in connection with them [the Devonian Rocks].

* * * * * * *

"The subjoined list of those known to occur on Lakes Manitoba and Winnipegosis may tend to excite interest in these extensive deposits:

1. Crane River, Lake Manitoba.
2. Waterhen River, Dickson's Landing.
3. Salt Point, east side of Lake Winnipegosis.
4. Salt Springs, Lake Winnipegosis.
5. Pine River, Lake Winnipegosis.
6. Rivers near Duck Bay.
7. Turtle River, Lake Dauphin.
8. Swan or Shoal River, two localities.
9. Salt River, flowing into Dawson Bay.
10. Numerous salt springs and bare, saturated tracts of many acres in extent on Red Deer River, which flows into the head of Dawson Bay, Lake Winnipegosis. For ten miles up this river, salt springs are quite frequent, and in former years excellent salt was collected in three places, where it formed a crust on the surface of the ground. Some springs were examined where a respectable rivulet of strong brine issued from them, as clear as crystal, and evidently quite pure. All the springs and marshes seen were bordered with seaside plants, and one of them, which has never been found from the sea coast before in America, was found in abundance. The plant referred

[1] Manitoba and the Great Northwest, 1883, p. 400.

to is Sea-Side Plantain (*Plantago maritima*)." To this Dr. Robert Bell adds: "In the country lying immediately to the south-west of Westbourne are several springs or . ter holes which are slightly saline."

The following extracts from Professor H. Y. Hind's report[6] shows that this line of saliferous strata goes quite across our Province:

"Near and west of Stoney Mountain many small barren areas occur, covered with a saline efflorescence; they may be traced to the Assiniboine, and beyond that river in a direction nearly due south to La Riviére Salé and the forty-ninth parallel. These saline deposits are important, as they in all probability serve, as will be shown hereafter, to denote the presence of salt-bearing rocks beneath them, similar to those from which the salt springs of Swan River, Manitoba Lake, and La Riviére Salé issue."

### Alkaline Lakes.

In addition to the Salt springs and numerous fresh-water lakes, there are hundreds of alkaline lakes and ponds. These are mere drainage basins, depending solely on evaporation for the removal of their accumulated waters. They owe their alkaline impregnation, not to anything of the nature of salt-bearing strata, but to the continual influx and evaporation of surface water, very slightly impregnated with alkali, through running over the prairie soils derived from the Cretaceous marls which contain alkaline salts. These "dead waters" rarely have fish in them, but they are usually swarming with a species of amby-stoma, besides numerous kinds of leeches, frogs, aquatic insects, and larvæ. They have, I believe, several peculiar sedges, and are frequented by certain birds that seem to avoid fresher waters; of these the Baird sparrow and the avocet are examples.

White-water, the relic of Lake Souris, is the largest of the strongly alkaline lakes. Shoal Lake is larger but is intermediate in character, its waters being but slightly alkaline and

[6] Assin. and Sask. Expl. Exped., 1859, p. 40.

having an occasional overflow into Lake Manitoba; it abounds in jackfish and sticklebacks.

A remarkable circumstance about these lakes is the fact that they grow larger and deeper, for a time, then gradually shrink. That is to say, the general level of water in the whole Province, rises and falls in a cycle of years. Just what the period of years is has not been determined. In 1882 at Carberry the water was high, but falling; in 1884 it was much lower; 1892 was a year of very low water; in 1904 it was very high. The explanation is unknown to me.

### Forests and Prairies.

Four-fifths of Manitoba is in the forest region. The true Prairies are found only in the south-western quarter of our country; and this is so much varied by tracts of hills and wooded river-valleys, occupying fully one-quarter of the area, that the prairies themselves do not aggregate more than one-sixth of the entire province.

The map showing the distribution of timber I compiled in 1890, from personal observations, assisted by Reports of the Dominion Geographical and Geological Survey, and the Reports of the United States Tenth Census. In 1905 I found that though much good timber had been cut, there was no very material change in the boundaries of the tracts formerly classed as wooded country.

There can be no doubt that in past ages large areas were denuded of trees and turned into prairies, by wild-fire; but this agency has become inoperative. The true Plains were treeless from other causes.

## The Faunal Areas and Life Zones of Canada.[7]

By far the most important factor in the distribution of life is *temperature*.

The grand temperature point in nature, the one at which

[7] This is founded chiefly on Dr. J. A. Allen's Natural Provinces of the North American Temperate Region, 1871, his Geographical Distribution of the Mammals

all life conditions are changed suddenly, is the *freezing point of water*, and the two most important divisions of North America are shown by lines drawn across the continent indicating:

(a) The region in which water *never freezes*, and

(b) The region in which water is *always more or less frozen;*

Or in other words:

(a) The south *limit of frost*, and

(b) The south limit of *perpetual frost* in the ground that is exposed to the direct rays of the sun.

These lines demark respectively the north edge of the Tropical and the south edge of the Arctic Realms; the region between is the Temperate Realm. Thus we have the primary division of the northern hemisphere, into *Tropical, Temperate, and Arctic Realms*, corresponding with the distribution of plants and animals, and that portion of each which belongs to North America is called a Region.

### 1 *The Tropical Region*

If the earth were flat and without currents of air or water, the north boundary of the Tropical Realm would coincide exactly with the geographical Tropic of Cancer (N. Lat. 23½°), which is the northernmost limit where at some time each year the sun is direct overhead. It is virtually this line modified by local influences, pushed northward by currents of warm water and southward by cool high uplands.

This is the region where frost is *unknown*, where the summer is long and hot, and where there is no cold winter. It is the land of the palm-trees, the parrots and monkeys, the home of the black human races.

(Bull. U. S. Geol. and Geog. Survey Terr., 1878, Vol. IV, No. 2), his Geographical Distribution of North American Mammals (Bull. Am. Mus. Nat. Hist., Dec. 29, 1892, read Jan. 26, 1891), Dr. C. Hart Merriam's Geographical Distribution of Life in North America (Proc. Biol. Soc. Wash., April 13, 1892), and Life Zones and Crop Zones of the United States (Bull. No. 10, Biological Survey, 1898); with assistance in California from Joseph Grinnell's maps in Pacific Coast Avifauna, No. 3, 1902.

I have taken Dr. Allen's nomenclature as a basis, adopted Dr. Merriam's main lines of division, and, for the region north of the northern boundary of the United States, have proposed some new names and subdivisions.

2 *The Arctic Region.*

Similarly, the south boundary of the Arctic Region is virtually the Arctic Circle (N. Lat. 66½°), which is the south limit of day without night in mid-summer; and night without day in mid-winter, that is, the land of the midnight sun; and this would be the exact south boundary of the Arctic Region, but that in America the cold currents of Hudson's Bay, etc., and the warm currents of the Mackenzie and Yukon, etc., have bent the line southward and northward as indicated.

This is the land of long, cold winters and short, mild summers, the country where *frost never leaves the soil.* It is a region *without trees*, the home of the White Bear, the White Fox, the Polar White Hare, the White Lemming, white owl, and the snowbird.

And whether considered in the far north, or on the mountain tops which form Arctic islands in the warmer regions, its south or lower boundary is the best-marked faunal line in America.

3 *The Temperate Region.*

Lying between these two takes in the United States and the greater part of Canada. *Its north line is the limit of trees, its south line the limit of frost.* This is the region of long, bright summer, and of short, cold winter that comes with frost and snow. This is the range of deciduous trees, as well as of pines and spruces, the land of corn and wine, the proper home of the agricultural white man.

Canada is concerned only with the ARCTIC and TEMPERATE REGIONS. Each of these regions is divisible into several life-zones, which theoretically extend east and west across the continent.

These also are bounded on the north and on the south chiefly by the lines of temperature. Concerning these limits Merriam says: "Investigations conducted by the Biological Survey have shown that *the northern distribution of terrestrial animals and plants is governed by the sum of the positive temperatures for the entire season of growth and reproduction,*

and that *the southward distribution is governed by the mean temperature of a brief period during the hottest part of the year.*"[8]

But other factors enter the problem of distribution. Of these humidity is probably most important. In North America it makes divisional lines and cuts each of the temperate zones in two or three segments called Faunas. This is a theoretical limitation. As a matter of practice the boundaries of the Faunas were arrived at by actual observation, thus:

When a great many of the well-marked life-forms called species agree in recognizing a common limit, the fact is accepted as evidence that within that area is a set of conditions necessary to create a *Fauna* (or *Flora*).

A *Faunal area* may be divided into several *subfaunas*. These are of course less pronounced. When a species is found ranging over several subfaunas it is usually represented in each by a geographical race.

The Arctic Region is divided into five Faunas:

*Alaskan*, characterized by the Fur-seal, Northern Sea-lion, Banded-seal, Pacific Walrus, Grant Caribou, yellow wagtail, Emperor goose, Steller eider, Nelson gull.

*Barren-ground*, characterized in its main area by Muskox, Parry Ground-squirrel, Lemmings, blue-goose, snow-goose, willow ptarmigan, etc. (*Ungava* and certain *Polar Islands* should probably be ranked as *subfaunas* of this.)

*Greenland*, characterized by Greenland Caribou, Ward Muskox, Greenland redpoll linnets, Reinhardt ptarmigan, and various European species.

*Alpine*, which is the top of each mountain that rises above timber line anywhere in North America, and characterized by white-tailed ptarmigan, pipit, Calling-hare, etc.

*Aleutian Fauna*,[9] comprising the Aleutian Peninsula and contiguous Islands, a treeless coast region characterized chiefly by peculiar species of Voles; also of birds, such as

[8] Life Zones and Crop Zones, etc., 1898, p. 54.

[9] In moving this from the Temperate to the Arctic Realm I follow Osgood, N. A. Fauna, No. 24, 1904, p. 24.

Alaska wren, gray-naped finch, gray song-sparrow, Nelson ptarmigan, Atken ptarmigan, etc.

Some consider the Arctic to be of one fauna; if this view be accepted these five will be subfaunas.

The Temperate Region is divided into the following:

*The Hudsonian Zone or Fauna* comprises the northern or spruce belt of the great coniferous forest that stretches across the continent from Labrador to Alaska—and that runs southward along the upper timbered slopes of the higher mountains of the United States and Mexico. It lies next the Barren-grounds of the north, and the Alpine of the high mountains, and in both is the region of stunted spruce, and the home of many characteristic birds and mammals.

It is found in five subfaunas:

(a) The Hudsonian Subfauna or true Hudsonian, whose south limit is about summer isotherm 55°. Characteristic species are: northern shrike, common red-poll, Harris sparrow, tree-sparrow, white-crowned sparrow, gray-cheeked thrush.

(b) The Yukon Hudsonian Subfauna, the region of the White Sheep, the Alaskan Grizzly, several species of Brown bear, etc.

(c) The Subalpine or Mountain Hudsonian Subfauna chiefly in Yukon and British Columbia, characterized by Mountain-goat, Black-sheep, Clark crow, etc.

(d) The Labrador or Atlantic Hudsonian Subfauna, characterized chiefly by very dark races of species that are widely spread over several faunas. In this subfauna, at Hamilton Inlet, is an island of the Canadian fauna.

(e) The Newfoundland Subfauna. This is the Hudsonian part of Newfoundland; owing to its isolation it is fairly well marked. Its species are many, for example, the Newfoundland or White Caribou, the Newfoundland Lynx, Newfoundland Red-fox, Welch ptarmigan, etc.

*The Canadian Fauna.*—The Canadian Fauna is the southern part of the great transcontinental coniferous forest

and is prolonged southward, as shown, along elevated plateaus and mountains in irregular capes and islands as far as Mexico. Among the many characteristic mammals and birds of the Canadian Zone are the Porcupines, Woodland Caribou, Star-nosed, Brewer and Gibbs Moles, Water-shrews, Voles and Long-tailed Shrews of various species, Northern Jumping-mice. The north limit of this Fauna forms the northern limit of the large Skunks, the Star-nosed Moles, the Hoary-bat, the Woodchuck, etc. Its southern edge is also the southern limit of the Canada Lynx, the Wolverene, Pine-martens, Moose, Caribou, the Porcupines, and various species of Short-tailed Meadow-mice of the genus *Phenacomys*, etc. Characteristic birds are the white-throated sparrow, Blackburnian, yellow-rumped, and Audubon warblers, olive-backed thrush, hermit-thrush, three-toed woodpeckers, crossbills, and Canada jays.

It is found in two subfaunas:

(a) The Canadian subfauna, or Canadian proper, extending in its main area from the Atlantic Ocean westward to the east slope of the Coast Range. This is a land of coniferous trees and aspens. Among its characteristic animals are Moose, Woodland Caribou, Canada Porcupine, hermit-thrush, spruce grouse.

(b) The Rocky Mountain subfauna, extending from Southern British Columbia southward along the higher mountains into Mexico. The Mountain Caribou, Canadian Mountain-sheep, the Yellow-haired Porcupine, Yellow-bellied Marmot, Rhoads Marten, Baird Hare, etc., are characteristic of its main area.

*The Sitkan Fauna* might be considered a west-coast division of the Canadian. It is characterized chiefly by exceptional rainfall, dense forests, and heavy-coloured races of birds and mammals that have a wide distribution; but it has very few distinctive species of animals.

*The Pacific Coast Fauna*, comprising the immediate coast from Queen Charlotte Islands down to middle California, characterized by mild winters, very heavy rainfall, forests of

enormous trees, and many peculiar animals, as Sewelle[1], Coast Deer, Pacific Raccoon, etc.

(N. B.—Merriam combines the Arctic Realm with Hudsonian, Canadian, and Pacific faunas to form his Boreal Zone.)

*The Campestrian Fauna.*—The region of the northern plains, where there is yet rain enough to banish aridity. In British America this appears as two subfaunas:

(a) The Campestrian proper or Saskatchewan, of which characteristic species are: Richardson Ground-squirrel, Long-tailed Weasel, Northern Kit-fox, Northern Pocket-gopher, Prairie-hare, Richardson merlin, Columbia sharp-tailed grouse, white-winged blackbird. Its north limit is also the limit of western meadow-lark, McCown longspur, oriole, Cooper hawk, etc.

(b) The Okanagan Subfauna in Southern British Columbia, a dry region in which we find: Okanagan Marmot, Douglas Pocket-gopher, Pocket-mice (*Perognathus*), Jack-rabbit, Badger, Whitetailed Deer, etc.

*The Alleghanian Fauna* takes in part of the new Province of Saskatchewan, south-western Manitoba, most of southern Ontario and Nova Scotia. At its northern border the Alleghanian forms about the northern limit of the Panther, the Raccoon, the Mole-shrew, the bluebird, catbird, chewink, brown thrasher, and bobolink. Its north border is the south limit of Moose and Caribou. Its southern border forms about the southern limit of the Ermines, the Harbour Seal, the Common Chipmunk, several species of Field-mice (genera *Evotomys* and *Synaptomys*), the Snowshoe-hare, etc.

It appears in two subfaunas:

(a) The Western or Prairie Alleghanian subfauna westward of Lake Michigan. Characteristic species are: Gray Chipmunk, Loring Red-vole, Minnesota Red-squirrel, etc.

(b) The Eastern or Woodland Alleghanian subfauna chiefly east of Lake Michigan. Characteristic species are: Ontario Gray-squirrel and Northern Cottontail.


MAP 3—FAUNAL AREAS OF NORTH AMERICA EXCLUSIVE OF THE TROPICS.

*The Divisions on the Map opposite may be set forth thus:*

**Arctic Region** divided into:

*Faunas*

- GREENLAND
- ALASKAN
- BARRENGROUND
- ALPINE
- ALEUTIAN

**Temperate Region** divided into:

*Faunas*

- HUDSONIAN
  - Subalpine subfauna
  - Yukon "
  - Hudsonian "
  - Labrador "
  - Newfoundland subfauna
- CANADIAN
  - Canadian subfauna
  - Rocky Mt. subfauna
- SITKAN

} Boreal Zone

- PACIFIC COAST
- CAMPESTRIAN
  - Saskatchewan or True Campestrian subfauna
  - Okanagan subfauna
- ALLEGHANIAN
  - Western or Prairie Alleghanian subf.
  - Eastern or Woodland subfauna

} Transition Zone

- CAROLINIAN (with Upper Sonoran)=Upper Austral
- LOUISIANIAN (The Gulf-strip and the Lower Sonoran together) = Lower Austral

} Austral Zone

**Tropical Region:**

Shown here in broad outline only

(The Pacific, Campestrian and Alleghanian Faunas together are Merriam's Transition Zone.)

*The Carolinian Fauna*, touching the extreme of southern Ontario, that is, the lower region along the north shore of Lake Erie. The northern boundary of this Fauna forms, in a general way, the northern limit of the Gray-fox, the Northern Fox-squirrels, the Pine-mouse, the Opossum, and the Bats of the genus *Nycticejus*.

(The Carolinian and Upper Sonoran Faunas together are Merriam's Upper Austral Zone.)

Map 3 sets forth these main divisions, but cannot, of course, give the complex local details. As a matter of fact every high mountain must and does exhibit a succession of faunal areas from its base to its summit. So that all the great mountain ranges of western Canada should be spotted on the summits with islands of Arctic fauna around which are Hudsonian rings. Furthermore, the valleys that run east and west are always more boreal on the shady side than on the north side, where the slope gives them more directly the rays of the sun.

### Faunal Areas of Manitoba.

We find that our Province falls within the limits of two of the subfaunas: The true Canadian and the Western Alleghanian; and the dividing line between is drawn nearly straight from the south-eastern to the north-western angle of the Province. This coincides with the summer isotherm or 65°. North of it is:

*The Canadian Fauna.*—The country embraced is one stretch of rugged, rocky hills, chiefly Laurentian, varied with numerous rivers and clear-water lakes, and covered with a continuous coniferous forest. The most characteristic trees of this forest are white spruce (*Picea canadensis*), black

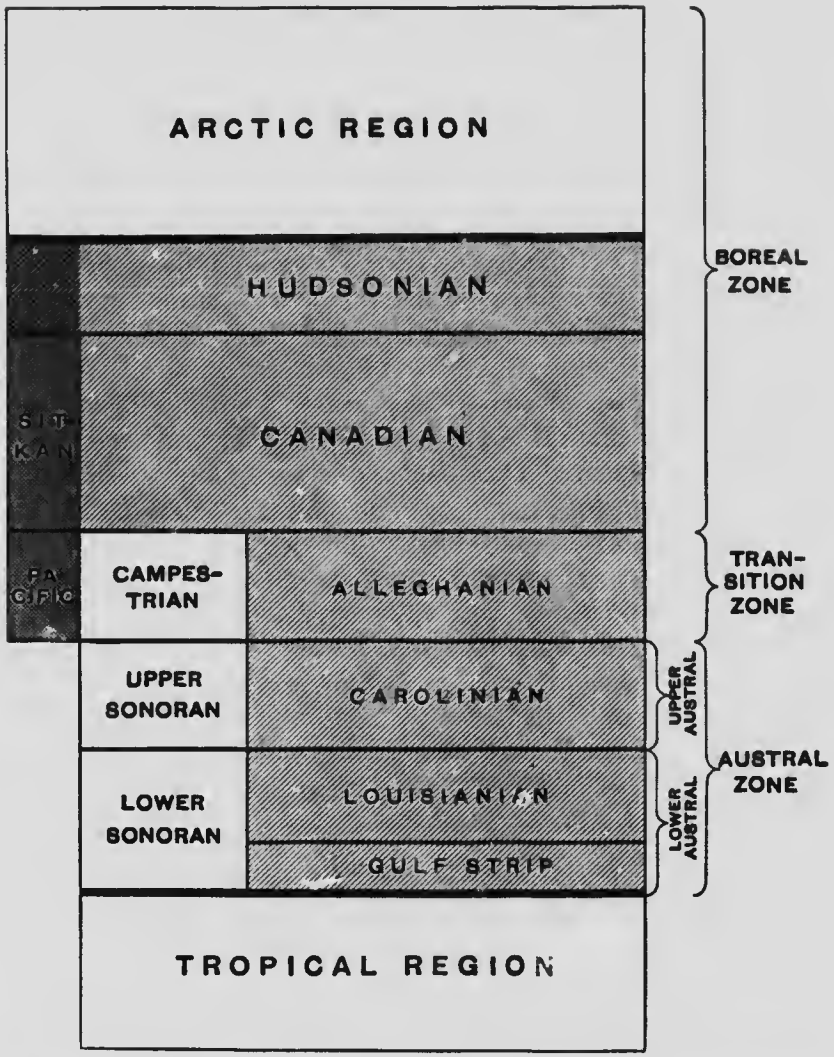



FIG. 1—Diagram showing the [illegible]ship of the Zones and Faunas of the Temperate Region. A Zone usually comprises one or more faunas. Subfaunas are not entered. The shading is heavy in proportion to the rainfall.

spruce (*P. mariana*), jack pine (*Pinus divaricata*), tamarack (*Larix laricina*), and canoe birch (*Betula papyrifera*). Among the characteristic animals are: The Caribou, Porcupine, Moose, Marten, and Wolverene. The Hudsonian chickadee, Arctic three-toed woodpecker, Canada nuthatch, spruce grouse, and Canada jay are distinctive birds.

Riding, Duck, and Porcupine Mountains may be considered islands of this region lying far south of its proper limits and surrounded by Alleghanian conditions, but so elevated as to be Canadian in fauna and flora.

*Alleghanian Fauna.*—South of this great diagonal line is the Alleghanian Fauna. In this we find our prairies and deciduous forests. The most abundant tree of these forests is the poplar or quaking aspen (*Populus tremuloides*). The elm (*Ulmus americana*) and mossy-cup oak (*Quercus macrocarpa*) are the most characteristic. We find also the mountain ash (*Pyrus sambucifolia*), box elder or ash-leaved maple (*Acer negundo*), black poplar (*Populus balsamifera*), and canoe birch (*Betula papyrifera*). The last two named occur likewise in the Canadian. This is the region of the Province where the Antelope and the Kit-fox were formerly abundant.

Characteristic species found there to-day are Elk, White-tailed Deer, Mule-deer, Badger, Pocket-gopher, Yellow Ground-squirrel, and Coyote; among reptiles, the snapping turtle, painted turtle, red-bellied snake, and green-snake; and among birds, the wood-duck, the chestnut-sided warbler, the night heron.

## The General Plan of Treatment for Each Species.

In order to cover the ground more fully and systematically I have considered each animal under some thirty different heads, asking of each in turn—What do we know of it in this department, or how far has it progressed along these lines? When nothing is said it means that nothing is known. In the light of this, then, we are struck by the number of blanks and

are thus brought to a realization of how much there is to be done. In many cases we have got no further than giving the creature a name.

The sections are briefly indicated below. Their order is varied whenever it has seemed best suited to the material.

NOMENCLATURE

The accepted or acceptable English names are first recorded, second, the scientific names used by the leading American mammalogists with the important references. The French-Canadian names have next place.

Experience shows that a record of the Indian names may be of great service to travelers and historians; therefore I give them as full as possible of the language of each of the tribes that touch Manitoba, or that have recently come in contact with it.

In my preliminary account of the "Mammals of Manitoba" in 1887 I gave only the Cree and Ojibwa names, and used a special alphabet that had been recommended by several Ethnologists; but I found it open to at least two objections: first, that the ethnologists themselves were not agreed on it; and, second, that only the few who had the alphabet could use my list. The records were meant for the whole world of students in and out of Manitoba. Therefore I have now adopted Sir John Richardson's plan, and have given the Indian names in the English alphabet, the letter "g" being hard always.

CAPITALS

The names of species treated in this book are capitalized throughout.

NUMBERS

When a number is used in an exact or mathematical sense I prefer to express it in figures; except for 1 and 2 figure divisions of time, or where obscurity might result, or when the number begins a sentence, or when it is a very small number that stands isolated—in which cases it is spelled out.

GENDER

When dealing with the animal as a race or species I use the neuter gender as consistently as possible. When speaking of an individual I use the gender that seems fittest.

DESCRIPTION

I have aimed to give only so much description of each animal as is necessary for identification, and even then have usually described each animal three times. Setting forth:

(a) The impression it makes as one sees it alive at a short distance.

(b) A sufficiently full description, assuming the specimen to be in hand.

(c) The peculiar points that will distinguish it from its nearest allies.

I set the family and generic characters in close context with those of the species, because when set elsewhere they are commonly overlooked by beginners.

MEASUREMENTS

Three standard measurements are given:

*Total length.*—This is the distance in a straight line from tip of nose to tip of bone in tail (ignoring the hair), when the creature is fairly stretched out.

*Tail.*—Set the tail at right angles to the back, take the distance from the back to the tip of the bone in tail (ignoring the hair). This is the length of tail.

*Hind-foot.*—This is the distance in a straight line from the end of the heel to the tip of the longest claw.

The measurements, usually those of an adult male, are approximate. A 10 per cent. variation over and under is understood. They are given in inches; in parentheses are their approximate equivalents in millimetres.

In the Horned Ruminants—known as Big Game—I have devoted some space to the subject of horns and antlers, and aimed to show the record heads. If any have been overlooked I shall be glad to have the facts for future use.

SPEED

The speed of wild animals is usually exaggerated. I do not believe that there exists anywhere on earth a wild quadruped that on level ground, can outrun a good horse. These facts I set forth in the Antelope chapter; I have further gathered

all evidence I could, bearing on the gait, speed, and the climbing and swimming powers of the species treated.

TRACKS

The tracks of each species are drawn and one or two general principles pointed out. Predaceous animals commonly set the hind-foot in the same track as the front-foot of that side; this correct register enables them to go more silently.

Tree-climbing animals when running on the ground, bound, and commonly set the front-feet together in a line across the body; ground animals trot or if they bound set the front-feet in a line along the body. This corresponds with the hopping of tree-birds and the walking of ground-birds.

SCATOLOGY, ETC.

The dung and signs are of great importance to the student as to the hunter. They offer much history of animals whose presence might otherwise be unsuspected, and they are here recorded as far as my material made possible.

ITS MIND

After considering the visible animal the ground is clear to discuss the real subject, the *study of the little mind* that preceded and fathered the mind of man.

The first aspect of this study is environment.

ENVIRONMENT

The environment is the creator of the animal, the mould in which each species was cast. Therefore no two can have exactly the same environment, otherwise they would be one and the same species. We look for important light in determining exactly the environment that created each.

RANGE

The range of the animal is part of its environment, and long ago I came to the conclusion that every creature is changing its range. So the question becomes not "Is it changing?" but "In what direction is it changing?" Is it winning or losing territory? In this connection it is noteworthy that the species with many extra-limital records are usually the ones that are extending their ranges. It looks as though these wander-

ers were the advance guard or scouts in a region that ultimately their tribe is to possess.

MAPS

The Maps, begun for the most part ten years ago, aim to show the present distribution of the species, except when otherwise stated. They are fairly complete for the large game animals, but the material does not yet exist to make maps for all species. In some, like the Bats, I have spotted the actual records and added an outline that is probably the range of the species. In others, as the Squirrels, I have offered a provisional and diagrammatic map of the ranges.

A spot with a ring around it stands for type locality.

HOME-RANGE

The home-range of each individual is next to be considered. No wild animal roams at random over the country; each has a home-region, even if it has not an actual home. The size of this home-region corresponds somewhat with the size of the animal. Flesh-eaters as a class have a larger home-region than herb-eaters. The more evidence we get, the smaller the home-region of each animal appears.

In the idea of a home-region is the germ of territorial rights. At every step it presents close and interesting parallels with the growth of territorial law in man.

MIGRATIONS

Some animals have two home-regions, and make a regular seasonal change from one to the other; such animals are said to be migratory. Extremes of the habit are illustrated by the Woodchuck, individuals of which make a short move from the summer-den in the open fields to a winter-den in the woods, and by the Barren-ground Caribou, which makes a very complete migration from the open Arctic plains that it frequents in summer to the woods of its winter range, 500 miles away.

But there is another kind of migration, best illustrated by the Moose, though observed in many species. After dwelling for a number of years in a given region they move out in a body to some other and hitherto unoccupied region. The causes of this are not obvious.

NUMBERS

An attempt is made whenever possible to estimate the actual number of each kind of animal. The data for the calculation are given so that the effort, if not satisfactory, at least affords a starting point for a better estimate.

The numbers of each species seem to increase and decrease in cycles varying from five to ten years. These periods, as far as possible, are recorded and note made of every point that seems to account for the variations; nevertheless, they are far from explained.

FOOD

The food of each species is carefully considered as far as present light admits. Especially remembering that:

> Each is classed as the foe of all it feeds upon. And that:
> In the food question we find the beginning of all property rights, even those of range.

PROPERTY

The high development of the property instinct is remarkable in some of the lowest forms of mammalian life. Beginning with food or mates, it extends to nest and range, and, finally, to personal property that has nothing but an æsthetic claim to notice.

The devices used as property-marks are most interesting. Some animals, as Bears, claw and gnaw the trees on their range —but most kinds use the scent produced by special glands. Of this class are Weasels and Wolves.

STORAGE HABIT

The frugal habit of storing food is found in most of our higher animals, probably in all except the Horned Ruminants. It is one of the most civilized instincts, and attains its maximum development in those animals which store not for themselves but for their communities—of this class are Mice and Beavers.

RELATION TO LIGHT

The relation of the animal to light is an interesting department of environment—as a general rule birds are diurnal, beasts crepuscular. But there are few birds or beasts that

prefer the full glare of noon-day or the black gloom of a dark night. No animals can literally *see* in the absolute dark, they need some light, but not much. Coons and Skunks are night creatures, Squirrels are sun-seekers, but most others, even Bats, are lovers of twilight.

Among savage nations there is a prejudice against sleeping in the moonlight. It is said to produce many kinds of trouble. I have sought for sound reasons in this or for parallels among the animals, so far without success. On the contrary, it would seem that some species, as certain Deer and Bats, will regulate their movements to take advantage of the light of the moon.

SOCIABILITY

Gregarious animals are not necessarily sociable. Bank swallows nest together, *i. e.*, gregariously, but do not assist each other in any important way—so are not sociable. Antelope run in herds at a time, so are gregarious, but do not unite their efforts for a common purpose, so are scarcely sociable. On the other hand, Wolves do not den in colonies or continually move in bands, yet they unite their powers to help each other in tasks beyond the strength of one, so are eminently sociable.

Sociability reaches its highest pitch in certain rodents, such as Voles, that have communal dwellings or villages under a crude law of common interest, or the Beaver, with its wonderful pond community—patriarchal rather than democratic.

MEANS OF COMMUNICATION

Communication must progress with sociability. Other things equal, we find animals profiting by each other's society; that is, truly sociable in proportion as they have advanced in methods of communicating one with another, and *vice versa*.

While voice, gesture, and touch are widely used, the most surprising are the smell signals. These are highly developed in the Antelope and several other species, but are of less interest than the smelling-posts of Bears, dogs, Wolves, Foxes, etc. These I have examined and treated at length.

SENSES

Evidence as to the powers of touch, taste, sight, hearing, smell, and direction have been sought for.

But some cases, like those cited in the Coyote, are so extraordinary and so difficult of explanation by the operation of the ordinary senses that many field-naturalists have been led to believe in a special sense, called second-sight or telepathy. Modern psychologists, however, do not accept the telepathic theory, but suggest, rather, that hitherto we have failed to gauge accurately the sense-capacity of animals.

AMUSEMENTS

The evolution of amusements is a fascinating theme. We find all stages among our animals. A high pitch is reached when many adults of a species will meet together under circumstances divesting the meeting of any sex or food impulse and engage in some friendly contest for the joy of combat, without anger or danger. The highest stage is reached when there is a set place with special apparatus. This is seen in the Otter slide and the European Badger's game of "King of the Castle."

MATING

The marriage customs of animals are full of human interest and lessons. There can be no doubt that at first animals were hermaphrodite; and that as soon as sex appeared, promiscuity was the order of the time. This, through ages of experiment, was displaced by polyandry and polygamy, and these in turn by pure monogamy in the highest animals. So that although all forms are represented to-day, monogamy is proving its superiority.

Other things equal, a monogamous animal will beat a polygamous in the struggle for life. As a rule, the higher quadrupeds in North America that hold their own against man are monogamous.

The relation of the father to the family is important for observation here. As soon as he becomes a member of the family group an entirely new and much higher plane is reached.

HOME

Home is the abiding place of the family. The home group among all higher creatures is essentially a trinity of father, mother and young. Any other grouping with more factors or less is not successful; therefore, only the truly monog-

amous quadrupeds have a home. A study of the species herein treated shows this to be literally true. In each case I have endeavoured to describe in detail the home-place of the species; including not only the nest itself with its linings and approaches, but the storage places, chambers, galleries and ventilators in connection, as well as the burrows and above ground runways, with their various signs and marks, to indicate their direction, use or owners.

SANITATION

Co-incident with the founding of a home must appear the rudiments of sanitation. The more elaborate the home the higher the idea of keeping it clean. The many devices of animals show gradation between the communal midden-heaps of the Voles, the daily cleansing of the Wolves, and the wonderful dry-earth closets of the Pocket-gophers. I have sought to learn how far each species has progressed on this line.

TRAINING OF THE YOUNG

While the young of some low animals never see their parents at all, but begin life with nothing save an equipment of instincts, others are wholly dependent on their parents, and the higher they are the more dependent they are and the more they profit by parental training. It was notorious among falconers that a falcon trained by its mother was always superior to one trained by man. The same remark applies to the cheetah or hunting leopard of India.[10] Training is given chiefly by means of example; whether consciously or not, I do not know. I do not know what consciousness is; it may be that most human acts are not conscious, but that is another question, and it does not alter the fact of training.

LOVE OF THE BEAUTIFUL

Very few mammals show a love of the beautiful in sight or sound. The gift is much less developed than in birds, yet the faculty is not absent. It is, I believe, axiomatic that no creature can *respond* to music, much less produce it, without having pleasure in it. The readiness of the Coyote and the Gray-wolf to respond to certain sounds and their power to produce

[10] See Mam. of India, T. C. Jerdon, 1874, p. 117.

sounds, some of which are highly musical even to us, is evidence of their having progressed far in this direction, and the enjoyment of the Pack-rat in its pile of glittering baubles is founded, as I see it, on no other sense than the love of the beautiful.

It is possible to show that five of the Ten Commandments are natural laws, namely, the ordinances against disobedience, murder, impurity, theft, and falsification, the breach of which among animals entails severe punishment.

These things I have set forth in detail elsewhere.[11]

Vice among animals affords an interesting field of enquiry. There is more of it than is generally known.

VICE

Vice I assume to be the deflection of any natural part or power from its proper purpose, to one which works harm for the species. Thus we see self-mutilation among monkeys and parrots. We see hens devouring their own eggs, the loco-habit among range cattle and horses, rare cases of infidelity among pigeons, of stealing among pack-rats, and incest among geese, as well as unholy barren alliances between species wide apart.

We have, indeed, recorded among animals nearly every kind of vice that was known among men and forbidden by Mosaic law.

With few exceptions, however, these cases are among domesticated or captive animals; and the questions arise: Has all this evil been developed in the animals by their captivity or has their captivity merely given us unusual opportunities for observing it?

The latter seems more probable, though there is some truth also in the former explanation.

CRIME

In the way of animal crime nothing is better known than infanticide by father or mother. In most cases it arises from man's interference with the young. If we handle the new-born young of a rabbit the mother is likely to kill them; this I have

[11] See Natural History of the Ten Commandments Charles Scribner's Sons, 1907.

seen many times. In menageries many little Bears are born and a large proportion killed by the mother. It may be objected that she killed them accidentally in her anxiety to carry them beyond the reach of man, but the detailed cases given in the Lynx and Otter chapters cannot be so explained. This generalization I draw, that when man tampers with the young it oftentimes so affects or obliterates the maternal instinct that the mother deliberately destroys her own offspring.

Whether or not this occurs in a state of nature is another question. The hunters and trappers generally believe that it does. The male parent especially is charged with occasional infanticide. The evidence is conflicting.

SUICIDE

If suicide means realization of the fact that such and such an act means death and escape from certain unpleasant conditions, and that this full realization is followed by deliberate choice of death, then animal suicide is not proven and is not likely to be.

If, on the other hand, we allow it to be suicide when the animal, driven frantic by grief, pain, anger, or despair, blindly turns its destructive powers against itself—that is, allows its destructive or defiant instincts to overpower its self-preservative instincts with results disastrous and sometimes fatal—then is animal suicide of frequent occurrence.

There are many degrees of this.

An orang which I was watching in Philadelphia flew into a fit of jealous rage on seeing the keeper give some favourite food to its neighbour only, and dashed its own head against the floor violently and repeatedly.

Wolves suffering the pains of poisoning often bite their own legs and flanks.

A Blackbear observed by Richard Kearton was so infuriated at its strong fellow-prisoner getting all the cakes thrown in, that it bit its own paws.

In each of these cases we see a form of suicidal instinct, which needs only to be pushed a little further to be literally suicide.

ENEMIES AND DISEASE

The enemies of each species should be considered and gauged with care. The struggle for life is at all times so bitter that each species is barely able to hold its own, has all the burdens it can bear (a thought that has its meed of comfort for us); a trifle more of destruction and down it goes, a trifle less and it spreads mightily.

Parasites are sometimes to be enumerated as disease. The kinds and the modes of combating them are important. But all parasites are not enemies. The species of fly which pupates in the dung of the Grizzly-bear is as likely to be a friend as a foe.

ODD PARTNERSHIPS

One of the most interesting and obscure traits observed in wild animals is their unexpected friendships. The British Badger is known to share its den occasionally with the Fox, and the Fox with the Rabbit. Instances are here given of a friendship between a Badger and a lost child, a Badger and a Coyote, also of a Red-squirrel and an Acadian owl.

Whatever the explanation, it is always gratifying to find that any animal has reached a plane above the purely carnal.

COMMENSALISM

Strange comradeships and parasitism are on opposite sides akin to commensalism. Of this nature is the habit seen in some Mice, of quartering themselves on the hoards of certain Ground-squirrels.

Many cases not easily classed will come to mind. For example, the Water-shrew that lives in the Beaver house, the fly that pupates in the Bear's dung, the beetles that live in the filth at the bottom of a Red-squirrel's nest.

AGE

Quadrupeds are supposed to live from four to five times as long as the time they need to attain maturity. Their life is three parts, youth, prime and age. Many facts in line with this belief are adduced, as well as all available data fixing the normal life term of each species.

STRANGE INCIDENTS

Strange incidents not referable to any of the above constitute another chapter.

RELATION TO MAN

Finally, space is devoted to a consideration of the animal in its relation to man; either indirectly as a helper or hindrance to agriculture or as source of commercial products.

REFERENCES

References are in foot-notes with a brief identification of the work. Full details of the same will be found in the list at the end of the work.

*LIFE-HISTORIES OF THE*
*GRASS-EATERS*

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**HOOFED BEASTS**
**ORDER UNGULATA**

PLATE II.—WAPITI GROUP, MALE AND TWO FEMALES
(*Cervus canadensis* Erxleben.)

## I.

## The Wapiti, Canada Stag, American Red-deer or Round-horned Elk.

*Cervus canadensis* Erxleben.
(L. *Cervus*, a stag; *canadensis*, of Canada.)

*Cervus elaphus canadensis* ERXLEBEN, 1777, Syst. Reg. An. I, p. 305.
*Cervus canadensis* SCHREBER, 1783, Säugth. V, pl. 246 a.
TYPE LOCALITY.—Eastern Canada, probably near Montreal.

FRENCH CANADIAN, *le Cerf* (male); *la Biche* (female). *le Wapiti.*
CREE, *Mus-koose.* Richardson gives[1] also as Cree names: *Wawaskeeshoo, Awaskees,* and *Moostoosh.*
OJIB. & SAUT., *Mush-koose.*
YANKTON SIOUX, *Eh-kahg-tchick-kah.*
OGALLALA SIOUX, *Hay-hah'-kah* (male).

FAMILY CHARACTERS

The Deer Family, or *Cervidæ*, are hoofed ruminant mammals, with solid antlers that are grown and shed periodically. They have 4 hoofs on each foot, the hinder pair much smaller than the front; no gall-bladder; mammæ, 4; tear-pit below inner corner of eye, well developed.

Teeth: Inc. $\frac{0-0}{4-4}$; can. $\frac{1-1}{0-0}$; or wanting; prem. $\frac{3-3}{3-3}$;

mol. $\frac{3-3}{3-3}$ = 32 to 34

The genus *Cervus* (Linnæus, 1758), of which the European Red-deer is the type, and to which the Wapiti belongs, is

[1] F. B. A., 1829, I, p. 251.

characterized by great size, many-tined antlers, of which the beam is behind; well-marked brow and bez-tines; spotted colouring of the fawns; short tail; naked, moist muzzle; maned neck; a tuft of hair on inside of hock, and within this a scent-gland (tarsal gland).

$$\text{Teeth: Inc. } \frac{0-0}{4-4}\text{; can. } \frac{1-1}{0-0}\text{; prem. } \frac{3-3}{3-3}\text{; mol. } \frac{3-3}{3-3} = 34$$

The "Elk tusks" are the rudimentary canines; they are found in both sexes, but are very minute in the female.

The Wapiti has all the characteristics of its family and genus. Its specific peculiarities of size, colour, etc., may be recognized by the following:

SIZE

A fine eight-year-old bull Elk, killed in the New York Zoological Park, October 3, 1903, was carefully measured by Dr. Hornaday,[2] as follows: Length, 86¾ inches (2,205 mm.); height at shoulders, 56½ inches (1,435 mm.); circumference of chest, 78 inches (1,982 mm.).

Another, measured by Professor L. L. Dyche,[3] was 97 inches (2,465 mm.) in length of body and head.

A three-year-old bull that I measured in Wyoming was: In length, 102 inches (2,592 mm.); tail, 5½ inches (140 mm.); hind-foot, 25 inches (635 mm.); height at withers, 47¾ inches (1,214 mm.).

As extremes: Caton had a five-year-old bull Wapiti over 16 hands (or 64 inches) at the withers,[4] and C. Phillipps-Wolley records[5] a Colorado bull, measured by Andrew Williamson, at 17 hands, or 5 feet 8 inches, at the shoulder, 9 feet long, and 6 feet 8 inches around the chest; that is, 2 feet longer and 20 inches higher than the three-year-old specimen above mentioned.

An adult cow, which I measured on the Graybull, in Wyoming, October 12, 1898, was: In length, 88 inches (2,237

[2] American Natural History, 1904, p. 124. [3] *Ibid.*
[4] Antelope and Deer of America, 1877, p. 81.
[5] Big-Game Shooting, Vol. I, The Badminton Library, 1894, p. 406.

mm.); tail, 4½ inches (114 mm.); hind-foot, 25 inches (636 mm.); height at withers, 56 inches (1,423 mm.).

WEIGHT

The three-year-old bull, whose dimensions are given above, weighed 550 pounds after bleeding; another three-year-old, taken at the same time and place, weighed 531½ pounds after bleeding. Judge Caton had a very large three-year-old that weighed 650 pounds. (*Loc. cit.*) He thought[6] 600 pounds would exceed the average live weight of a full-grown buck, although he believed that they sometimes reached 1,000 or 1,100 pounds. The bull measured by Hornaday, as above, was 706 pounds, live weight.

M. P. Dunham states[7] that he weighed an Elk at a little over 800 pounds after entrails were removed. This would give a live weight of about 1,000 pounds.[8]

We may safely affirm, then, that an average bull Wapiti at full growth stands nearly 5 feet at the withers, and weighs about 700 pounds.

The cow, whose dimensions are given above, weighed 490¾ pounds after bleeding.

Hornaday found[9] that a new-born fawn or calf weighed 30½ pounds.

COLOUR

The body colour of a young bull Wapiti killed in Jackson's Hole, Wyoming, September 10, is brownish gray, a little darker along the spine, and becoming dark chestnut or brown on head, neck, and legs, and reddish-brown or sienna colour on breast and belly. The inside and lower back part of ears, a patch around the eye, a spot on each side of the lower lip, and a spot under the jaw, are very pale brown or dull brownish white; the disk or rump patch is very large, of a pale, buffy white, and continued above the tail, which is of the same colour; bordering this patch in front, on each ham, is a brownish-black stripe

[6] *Loc. cit.*, p. 82.
[7] Recreation Magazine, April, 1896, p. 193.
[8] The rule for Deer is: Add a quarter to the dressed weight to find the live weight.
[9] American Natural History, 1904, p. 122.

that nearly fades out toward the spine, where it joins its fellow. The peculiarities of the disk are diagnostic of the various species of *Cervus*. Some, like the Red-deer of Europe, have a dark mark crossing it from spine to tail, some have the tail of a different colour; the Wapiti has tail and disk of one even shade, or but slightly yellower above the tail.

As this coat ages it fades greatly. In spring I have seen bulls so bleached that, at a distance, their bodies looked nearly white, thus justifying the name Wapiti (which is supposed to be from the Algonkin roots *wab*, white, and *atik*, deer) and the New England name of "Gray Moose."

The summer coat, worn from May to September, is a little deeper in colour than the winter coat.

The females, or cows, in summer coat resemble the males; but in fall and winter coat they are less intense in colour, and sometimes have a dark shade uniting the tail with the spine.

The calf or fawn when born is dull yellowish, thickly dappled on body, neck, and thighs, with large spots of dull white. In late September, when the first winter coat appears, these spots are lost.

Four forms of Wapiti are recognized:

*canadensis* Erxl., the typical form.
*occidentalis* H. Smith, the very dark Wapiti of the Olympics and West Coast.
*merriami* Nelson, paler and more reddish than the typical form.
*nannodes* Merriam, the very pale and dwarfed Wapiti of Southern California.

They have also marked cranial differences.

HISTORY AND NAMES

In 1535 Jacques Cartier ascended the St. Lawrence as far as Hochelaga—now Montreal. On his return he reported[10] "great stores of Stags, Deere, Beares, * * * other

[10] Hakluyt, Voyages, Vol. III, p. 225.

such like sorts of Beasts." He saw, then, *two* kinds of Deer. We know that both Whitetail and Wapiti abounded in the country where he wintered. The Wapiti has always been the "Stag" *in* Canada, as well as the "Stag" *of* Canada. So this we believe to be the first record of the Wapiti being seen by white men.

There is just a possibility that Cartier was antedated by Niña de Guzman, who, according to Herrara,[11] in 1532 explored the west coast of Mexico, near north latitude 28 degrees, and reported that "Many Cattle and many Deer of very large size were found on the banks of the Yaquimi."

In 1605 Captain George Waymouth, in his "Voyage to Virginia," found, according to Rosier,[12] "Deere, red and fallow, Beares, etc. * * * Some like our other Beasts, the Savages signe unto us with horns and broad ears, which we take to be Olkes or Loshes."

This is the earliest-known printed use of the word "Olkes" or "Elk" with reference to the American animal. It appears in the latter form in 1650, when Virginia is credited not only with abundance of Deer, but also with "Elks bigger than oxen."[13]

Champlain's map (1632)[14] marks the region of Kingston, Ontario, as "Lieu ou il y a force cerfs," and with a portrait of a stag, certainly not that of either a Virginian Deer, a Moose, or a Caribou.

In 1653–4[15] Father Lemoine, voyaging on the St. Lawrence a few leagues above Montreal, found great droves of creatures, which from his description must have been Wapiti.

After this date the number of travellers increased in America, and their accounts frequently included descrip-

[11] Herrara, Hist. Ind. Oc., 1728, Tom. III, p. 16 (cited in Allen's American Bison, p. 518).

[12] Purchas, Vol. IV, p. 1667.

[13] Force, Coll. Hist. Trav., Vol. III, No. 11, p. 11.

[14] Champlain's Voyages, 1632.

[15] Relation de la Nouv. France, 1653-4, p. 85.

tions of the "Great Stag that was of the bigness of a Horse," and whose numbers were so great, in the high country, that their trails through the woods were convenient ways of travel.

Thus Mark Catesby, in 1731, remarks[16] on "the Stag of America. * * * They usually accompany the Buffaloes, with whom they range in droves in the upper and remote parts of Carolina, where, as well as in our other colonies, they are improperly called Elks. The French in America call this beast the *Canada Stag*. In New England it is known by the name of the Gray Moose, to distinguish it from the preceding beast, which they call the Black Moose."

In 1777 Erxleben recognized the Wapiti as a new animal and gave it the distinctive name of *Canadensis*.

In March, 1806, Dr. B. S. Barton published[17] "An account of the Cervus Wapiti or Southern Elk of North America." He remarks: "As the Elk has not to my knowledge been described by any systematic writer on Zoology, I have assumed the liberty of giving it a specific name. I have called it *Wapiti*, which is the name by which it is known among the Shawnese or Shawnees Indians * * * This animal is generally known in Pennsylvania and in other parts of the United States by the name of Elk." (*Loc. cit.*, p. 37.)

This is the first use in print of the word "Wapiti," so far as known, and should settle several old disputes as to the origin and application of the name.

## Life-history.

RANGE

Map 4 sets forth sufficiently the range of the various forms of Wapiti. It is founded on the records of over three hundred travellers and historians, and compiled with assistance from the Biological Survey of the United States De-

[16] Catesby, Nat. Hist. Car., Flor. and Bah. Ids., II, 1731-43, p. xviii.
[17] Phila. Med. and Phys. Journal, March, 1806, Art. VII, pp. 36-55.


**MAP 4—DISTRIBUTION OF WAPITI OR ELK IN 1500 AND IN 1900.**

The heavy outlines show the primitive range of each form. The shaded portion is the range in 1900.
The map is founded on the records and reports of several hundred ancient and modern travellers, with some help from the U. S. Biological Survey.
The outlying records are marked with a cross.

**The four forms are:**

*Cervus canadensis* **Erxl.**
*Cervus occidentalis* **H. Smith.**
*Cervus nannodes* **Marriam.**
*Cervus merriami* **Nelson. Probably extinct.**

partment of Agriculture. The outlying records (marked with X on the map) are as follows:

In Mexico by Guzman, as already given.

On the north-west by Lord, who says, in 1866:[18] "It is found along the entire coast range from California to Sitka."

A single skull found in Nova Scotia[19] seems to extend the range to that Province; an extension that one is fully prepared for, after a study of the faunal areas of the region.

The Ottawa Valley was well known as Elk country until about one hundred years ago. According to W. P. Lett,[20] Elk were quite numerous there in early days, and were seen as late as 1814. Antlers are often found in the swamps of the region.

H. Y. Hind says:[21] "Charles Taché enumerates the Elk and Ground-hog as common about the Saguenay previous to 1823. * * * The Moose also was very common."

At the Sportsman's Show, New York, March 2, 1899, L. Z. Joncas, Superintendent of Fish and Game for the Province of Quebec, exhibited three Wapiti heads taken near Lake Victoria, at the sources of the Ottawa, in Pontiac country, about 1896. Several small bands of the primitive Elk, he was told, still exist in those wilds. He personally did not follow the matter up, and the record is very questionable.

The great Basin between the Rockies and the coast range seems never to have been the home of the Wapiti, at least I can find no records covering the region.

ANCIENT NUMBERS

The early accounts of travel in Eastern America during the sixteenth, seventeenth, and eighteenth centuries abound with descriptions of the "great stagge."

Among these early writers we find frequent use of such terms as "immense bands," "great numbers," "great store," "covered with stags," etc., etc., describing the abundance of

[18] J. K. Lord, Naturalist in Vancouver Id. and Br. Col., 1866, Vol. II, p. 182.
[19] W. Ogilby, P. Z. S., VII, 1839, pp. 93–94.
[20] Trans. Ottawa Nat. Field Club, 1884, No. 5, pp. 101–117.
[21] Expl. Labrador Penin., 1863, Vol. I, p. 224.

the Wapiti. Dr. Barton, quoted above, says: "Within the memory of many persons now living the droves of Elks which used to frequent the salines west of the River Susquehanna, in Pennsylvania, were so great, that, for five or six miles leading to the 'licks,' the paths of these animals were as large as many of the great public roads of our country." (*Loc. cit.*)

But how are we to get an idea of their actual numbers in those days?

When I was living in Yellowstone Park, in 1897, I used all possible means to reach an estimate of the number of Wapiti it contained. The officials in charge agreed with me that there were fully 50,000 head. The actual park is 3,000 square miles, but the winter range of these herds includes Jackson's Hole and some other outside territory, which increases the total area to 5,000 square miles, or ten Wapiti to the square mile. In this region the species is described as "abundant."

In early days the total range of this species was about 2,500,000 square miles, over half of which it was, by all accounts, very abundant. We are safe, therefore, in believing that in those days there may have been 10,000,000 head.

DWINDLING

The beginning of the nineteenth century saw the Wapiti perfectly described, catalogued, and started on the road to extermination. Thenceforth, travellers in Eastern America were obliged to record only the reminiscences of old settlers or the discovery of fossil horns and skulls.

A glance at Map 4 (page 43) will show the original and the present range of the species.

A melancholy shrinkage is set forth, a shrinkage which went on with tremendous and increasing rapidity until near the end of the century.

IN MANITOBA

In Manitoba the Wapiti was found throughout the southwestern half of the Province. From Henry's Journal[22] we

[22] A. Henry's Journal, 1897, p. 224, *et seq.*

learn that it was particularly abundant along the Upper Red River and in the Pembina or Hair Hills. In 1857, when Professor Hind went through from Winnipeg to Fort Ellice, he saw but one Wapiti. It was in the sand-hills near the present town of Carberry, and its appearance put his half-breed guides in a state of excitement.[22]

In 1882, when first I visited the Province, there were plenty of old antlers on the Carberry Sandhills. In the three years which followed I saw tracks three times, but once only did I see a Wapiti. This was a bull that was killed and brought to Carberry by some Indians in 1884. The head now hangs in the Western Hotel of that town. At that time the Wapiti was practically exterminated, except in the Pembina Hills and the Duck and Riding Mountains.

The dwindling process went on everywhere till about 1895. That was the low-ebb year in many parts of America for many kinds of game, but it was also the year of the great awakening. The lesson of the vanished Buffalo had sunk deep in men's minds. Thinking people everywhere recognized that unless the methods then practised were stopped all our fine game animals would go the way of the Buffalo. They saw, too, that there was nothing to gain by extermination, and much to lose. Game protective societies, founded in various parts of America by men who viewed with hate the approaching desolation of the wilds, have now secured sound legislation for the protection of harmless wild animals, and public sentiment has secured a rigorous enforcement of these new laws. Thus in many regions the process of extermination has been stopped.

And not only has an end been put to extirpatory hunting, but the awakening has found its logical climax in serious efforts to re-stock many of the deserted ranges. Several areas whence the species had long disappeared have been re-peopled with Wapiti. Noteworthy among these are the Algonquin Park and the Adirondack Mountains Park. The former is in charge of

[22] Assin. and Sask. Expl. Exped., 1859, p. 41.

Government officials, but the latter has been re-stocked chiefly through the efforts of a private "Society for Restoration of the Moose, the Wapiti, and the Beaver to the Adirondacks."

The energetic Secretary, Harry V. Radford, has sent me the following particulars:

"The first liberations occurred in June, 1901, when 22 Wapiti, donated to the State by the late William C. Whitney—a vice-president of the Restoring Association—were released on State land near Raquette Lake. Whitney donated additional Wapiti in 1902 and 1903, his total gifts to the State reaching nearly 90. The Park Commissioners of the City of Binghamton, N. Y., contributed 5 Wapiti in 1903, and this spring (March, 1906) we obtained from Austin Corbin 26 Wapiti, which were successfully released under the supervision of State officials.

"The latest estimate of the Commission (September, 1905) placed the number of wild Wapiti in the Adirondacks at 250. Add to this number Corbin's donation and the natural increase since, and the number of Adirondack Wapiti at the present time, February 11, 1907, is close upon 400, and rapidly increasing. These are widely distributed, and seem to thrive even better than the native Deer. Additional donations are expected, and a few more years ought to complete the restoration of the Wapiti."

PRESENT NUMBERS

In Manitoba there are to-day, I believe, more Wapiti than at any time since 1850. From Charles Barber, Chief Game Warden, I learn that in 1906 about 445, and in 1907 365 Wapiti were legally killed in the Province. But the number killed by Indians and white hunters, and not recorded, must raise the annual total at least to 1,000. To stand this drain and still increase as they do, the numbers must be fully five times as great, or, say, 5,000. I offer this as a conservative estimate of the numbers of Wapiti in Manitoba to-day (1907).

Unfortunately, these extensions of range have been more than offset by the shrinkage elsewhere.

The present numbers may be thus estimated:[24]

| | |
|---|---|
| Yellowstone Park | 20,000 |
| Wyoming, outside the Park | 5,000 |
| Manitoba | 5,000 |
| Idaho | 5,000 |
| Montana | 4,000 |
| Vancouver Island | 2,000 |
| Washington | 1,500 |
| Alberta | 1,000 |
| Saskatchewan | 500 |
| Oregon | 200 |
| California | 200 |
| British Columbia | 200 |
| Minnesota | 50 |
| In various Zoos, Parks, etc. | 1,000 |
| Total in 1907 | 45,650 |

During the past ten years the number in Wyoming has decreased. On the other hand, in all regions where adequate protection has been accorded the number has increased; and there can be no doubt that, with a system of permanent safe havens, proper limitation of bags, and an absolute prohibition of repeating rifles and of the sale of game, we may keep these fine animals with us as long as we have wild land for them to range on—that is, *forever*.

SIGNS

As is usually the case with big game, one may be in a land abounding with Wapiti and see nothing of them for long, but the hunter cannot fail to see, on every hand, the little telltale "signs."

During my hunting trip in the Shoshones, in October, 1898, I saw many Wapiti, or Elk, as they are there called, and got none at all. But I got what I went for—a lot of

[24] In making this I have been assisted by Stanley H. Hopper, C. Phillipps-Wolley, W. T. Hornaday, E. W. Darbey, George B. Grinnell, General S. B. M. Young, and the United States Biological Survey.

observations, and made the sketches and notes which are reproduced.

Plate IV shows the tracks of three Elk, travelling in TRACKS the general direction of "down wind." Here, H I I, crossing from the middle below out at the top left corner, is a stale track. Its size and general character, together with the place, show it to be that of a bull Elk. He was travelling toward I, because, in spite of its dimness, we can see a faint sharpness at one side of the track and a suggestion of squareness at the other, showing the toe and heel marks, respectively, and also because on the bank, at the bottom, H, the tracks are shortened, showing that he was coming *up*.

In case of doubt, one can sometimes determine the direction of a doubtful track by lightly brushing away the snow. The wet ground below may have a clearer impression, or a ball of hard snow may remain to tell the tale. The track is stale; but how stale? Yesterday the wind came from the point he is headed for, and last night came the fresh snow; therefore he is twenty-four hours ahead, and though unalarmed —witness his easy stride and trailing toes—it might take several hours to come up with the maker of that track.

But the three we are following are quite fresh. A is the track of a big bull, because the hoof-mark is 5 inches long (4 inches would be middle-sized). His hoofs might be overgrown, but the tracks are wide apart, showing the thick body; and he has fine antlers, because the cow went through a four-foot opening, which he avoided for a wider door. Also, the snow is knocked off the lower branches where he passed, and a spike-horn rarely touches a branch with his antlers.

That he is not alarmed is shown by his short steps and the lazy dragging of his toes, as well as by his *halting* (K) to drop, an important hunter's sign. The track is fresh, because it was made since last night's snow, but it is at least an hour old, because the sign at K is no longer hot; is sprinkled, indeed, with hoar-frost.

Here, at B, the bull "bedded." He was there for an hour at least, because the snow under him is melted.

The trail C is that of a full-grown cow; a cow, because at L the creature had stopped and straddled (told by the hoof-marks LH, LH) to leave the liquid sign; and full-grown, because the hoof-mark is 4 inches long.

Her trail shows no sign of alarm. At D she lay down, but rose up after she had been long enough to melt the snow—perhaps an hour; looked about with the usual watchfulness of a cow, and lay down again in the same place for nearly as long, as shown by the second mark, not quite tallying with the first.

The trail E is that of a calf of the year, born late in May, and not yet (October) quite weaned. He lay down by his mother. But see, each bed is still wet with melted snow, and the tracks that were a couple of hours old are now quite fresh. *We have jumped the three Elk.*

They sprang up when they heard us coming through the woods. See the long strides of the bull as he trotted off, no longer trailing his toes; see how all three fell into line! But what is this sign at J? That animal stayed to do something that all Deer do every few hours in cold weather, and nearly always on rising. She was not greatly alarmed (less so than the bull), or she would not have stayed, for the small quantity shows that she was not greatly pressed, therefore we may yet see them, for the Elk will swing round, probably to the left, as that is uphill, till they either see us or get our wind. Quick, now—a rapid advance—keeping a sharp lookout—here we are at the edge of an open glade, and there across it, gazing toward us, are the Elk. For a moment they stand, then up go their noses, and away they trot at speed, with the cow, as usual, in advance.

SPRING-TIME

The great haven of the Rocky Mountain Elk is the Yellowstone Park. Thither, as the snow melts, the Elk bands wend their way from the lower winter range along the Snake River, and other Park-born streams.

YOUNG

The cows remain in the rich upper valleys, but the bulls go on and form another social circle still higher up. The

PLATE III.—ELK APPROACHING TO ATTACK (IN A PARK)
Photograph by E. T. Seton.

PLATE IV.—TRACKS OF BULL, COW AND CALF ELK IN SNOW.

cows have important duties ere long. Some time in May or very early in June the portlier ones wander severally from the herd into some quiet hollow, where are born the fawns or calves, usually 1 to each mother, but sometimes 2, and rarely 3. For a few days (one or two according to Caton)[28] they are left concealed in the bushes after the manner of Deer, though for a shorter time than with most other kinds. The mother lurks in the neighbourhood and comes to suckle them at times, no doubt as the pressure of milk gives notice, and this is adjusted to the needs of the young. None can see them now without marvelling at their stillness. They feign to be logs, lumps, dead things, but all their pretty and lawful deceit is belied by the bright, unblinking eyes, which take in every movement of whoever happens to find them. The white spots, so far from making the croucher conspicuous under the leaves, look like the dappling spots of sunlight glancing through foliage on a log or ground below. They are, indeed, a valuable piece of protective colouration.

For some days the calf is thus hidden; and even after it is old enough to follow the mother she will hide it on the appearance of danger. How it is made to understand the danger—whether by signal from the mother or by sighting the menace—I have not been able to determine. Late in June, on the Yellowstone, I saw the cow Elks in bands and the calves running with the mothers.

I once saw a fawn that was born so late that on October 15 he was still in his full spots. He was, in fact, not yet running with his mother, and must have been, therefore, less than a week old. I saw her come to feed him. After he had sucked as much as she thought proper, he teased her so much that she ran away. He persisted in following, but she took refuge in a water-hole, standing where it was nearly three feet deep. He circled all round the edge, but did not dare to wet his feet.

In September the spots on most of the calves are much faded, and, when their new coats come, with October, the

[28] Antelope and Deer of America, 1877, p. 294.

spots usually disappear. Now the young are able to forage for themselves. The drain on the mother becomes less, and gradually ceases; and as the pasturage is now rich and abundant, all become sleeker and fatter with every week, September finding them in perfect condition.

WALLOWS

In many parts of Colorado and Wyoming during fall I have seen earth wallows made by Wapiti. These are accredited to the bull. He is known, indeed, to wallow in ther 'ike a hog, whether as an amusement or as an instinctive s .ry measure is not ascertained.

On September 8, 1898, I was witness of a most interesting social function attended by a number of Wapiti. It was at a small upland lake in Jackson's Hole, when, about 4 P. M., a band of Elk, nine in all, came trotting from the woods, led by a cow, but with a bull bringing up the rear. They plunged into the water and played there for some time, rolling, wallowing, splashing, and chasing each other. The scene was somewhat like a social bathing at a fashionable watering-place. At last their game was ended by the discovery of my presence.

DANCE

But the grand curious amusement of the Elk, one which several hunters have witnessed, may be called their "circle dance." H. W. Skinner, of Chicago, sends me his observations on this performance:

"About four o'clock one afternoon, late in August, 1890, I was riding north-east up a small stream flowing into one of the tributaries of the Green River, near its source in north-western Wyoming. The intense heat was relieved only by an occasional faint breath of breeze from the north. My attention was attracted by a column of fine dark-brown dust rising ahead of me and on the opposite side of the creek (I was on the south side). The column of dust looked almost as if caused by a whirlwind. On reaching a point as close to it as I could get without crossing the creek—I was perhaps 100 yards from it—I found that it was caused by a band of Elk, numbering from twelve to twenty, who seemed to be trotting

quite rapidly, with occasional awkward galloping plunges, in a circle perhaps thirty feet in diameter. They were going in the same direction as the hands of a watch, in the edge of a little belt of second-growth timber—mainly, I think, quaking asp. They were moving, not with heads up, but with noses only a foot or two from the ground. My impression is that they were all bulls. Owing to the dense clouds of dust which occasional light puffs of wind blew almost toward me, I could not see very clearly. It seemed to me that they were running about as "milling" cattle do, except that I never knew of cattle to "mill" in such a small bunch. I have related this incident several times to hunters and trappers, who could offer no explanation of it. There were large numbers of Elk in that country at the time, in bands of various sizes."

This remarkable exercise differs from the preceding in that it has obvious relation either to the sexual instinct or to hygiene.

MATING

The natural history of monogamy is an interesting subject that is receiving some attention. In a recent number of the *Contemporary Review*, Dr. Woods Hutchinson claims[26] that in the long run a monogamous race will triumph over a polygamous one. He might have gone further, and pointed out the facts that among birds the *Pigeons* as a family, and among quadrupeds the *Canidæ*, are considered among the most successful, that is, families which are spreading, and can hold their own against all rivals, including man, and that these two are strictly monogamous. Theoretically, polygamy should be better for the race, since only the very finest males leave progeny. Judge Caton has recorded[27] a curious case that sheds light on this. Referring to Sultan, the great bull Wapiti, that was monarch of the herd in his park for a longer time than any other, he says:

"At first his progeny were reasonably numerous, but during the last few years of his life they gradually diminished

[26] Animal Marriage, Contemporary Review, London, October, 1904, pp. 485–96.
[27] Antelope and Deer of America, 1877, pp. 294–5.

from a dozen to a single fawn in 1875, with about twenty-five females, more than half of which had previously produced fawns."

Though able to hold the harem by force, he was removed and replaced by a younger buck. The result was twelve fawns the next season, including one pair of twins.

As the Elk is the most polygamous of all Deer (in America, probably in the world), it is interesting to note that it is the first of the family to disappear before civilization. This may be due in part to its large size, but it is further remarkable that the most successful of all our Deer (the common Whitetail) is the least polygamous. In this connection we may consider the question of leadership, that is, the rudiments of government.

There is a widespread idea that the big bull is, as a matter of course, the leader of the Wapiti herd. This is not the case. It is well to remember how the animals get their leader. They certainly do not have any formal election, but they have instead a sort of natural election or process of elimination. This is the process: The individual in that band who can impress on the others that he is the *wise one*—the safe one to follow—eventually becomes the leader, and if there are any members of the band who do not wish to follow him, they have an obvious alternative—to go the other way. Thus the herd reaches unanimity.

Numberless observations show that this wise one is not the big bull, but almost invariably an *elderly female*. The big bull might drive them, but not lead them. She is the one that has impressed the others with the idea that she is safe to follow—that she will lead into no fool-traps; that she knows the best pastures and the best ways to them; that she has learned the salt-licks, and the watering-places that are safe and open all around; that her eyes and ears are keen; and that she will take good care of herself and incidentally of the band. This female leadership is common to most, if not all, horned ruminants. One may ask, therefore, if it be not also a corollary of polygamy.

ANTLERS

The crowning glory of the stag is his antlers, and the Wapiti, the finest stag in the world, has antlers befitting his size and dignity.

While the cows among the mountain valleys devote all summer to the calves, the bulls at a much higher elevation, above the torment of heat and flies, have consecrated their entire energies to the growing of new antlers. If it were not like arguing in an egg-and-chicken circle, we might claim that the production of these antlers is the whole end and aim of the Wapiti's existence. Their growth is one of the miracles of nature that we never cease to consider a miracle.

About the end of the winter—that is, in mid-March—the antlers of the year before break off flush with their horny base an inch or more above the skull. Frequently they are found lying close together, showing that they fall nearly at the same time.

At first the place of each antler is a broad raw spot. A few days later it shows a thick rounded pad of blood-gorged skin. This swells rapidly and, in a fortnight, the great, bulbous, fuzzy young antler-beginning has shot up to a height of several inches. At exactly the right time and place, and in just the right direction, a bump comes forth to be the foundation of the brow tine. In a few days the bez-tine is projected by the invisible architect. In a month the structure is nearly a foot high and all enveloped in a turgid mass of feverish, throbbing blood-vessels—the scaffolding and workmen of this wonderful structure. Night and day the work is pushed with astounding speed, and in four months this "skyscraper" is finished. A marvel, indeed; an edifice that, according to ordinary rules, would have taken a lifetime, and yet it has been rushed through in a single summer.

August sees the building done, but it is still cluttered with scaffolding. The supplies of blood at the base are now reduced. But the antler is still in vital touch with the animal; it begins to die when the process of peeling is begun. The sensitiveness leaves each part, the velvet covering soon dries, cracks, and peels, and the stag assists the process of clearing

off the skin by scraping his new antlers on the brushwood. September sees him fully armed in his bony spears, strong in body, glorying in his weapons and his strength, and ready to battle with all comers.

Those who have studied the Washington Monument will remember the dark weather-mark which came when the Civil War stopped the growth of the structure for a time. They will recognize the signs of slow growth at the massive base, the stones contributed by the various States, when their reverent patriotism was roused, and the less eventful ending as the point was reached. In the same way the stag's antlers are a record of the life that grew them, brought them forth in fever heat, produced with a rush at enormous cost, draining all the bodily resources for a time. The faintest slacking of the supplies, an excess of antler material in the food, the slightest weakening of the heart that is backing the enterprise, an injury to the sexual organs that inspired it, or any hurt on the growing antler, a cold, an attack of indigestion—is reflected at once in the structure that is a-building. The most vigorous constitution produces the finest antlers. A stag too young or too old produces antlers which are below standard. All antlers are a reflex of the owner's vicissitudes while he was growing them. What wonder, then, that no two antlers are alike! The thousand different haps have produced a thousand different types. Most of these must be accepted as strange instances due to unexplained causes; "freak horns," the hunters call them. They are beyond our present comprehension.

Through the kindness of his Grace the Duke of Bedford I am enabled to show a series of antlers, the successive growths of one bull Wapiti that lived in the Park at Woburn Abbey (Fig. 2.)

The second of the spikes grown in his first year was never found, but it was very small. The two switches (No. 8 in the series) were grown in a year of sickness. The stag was weak and ill without known cause, and shed not only his horns, but the two large hoofs of each foot, going sore-footed for

FIG. 2—The antlers of one Wapiti.

From photograph supplied by his Grace the Duke of Bedford.

Beginning at the bottom this shows the successive sets of one Wapiti stag up to his tenth year. The first pair, the dags or spikes, are grown in his second year—only one of these was found. The antlers increased up to the sixth or seventh pair (when the stag was in his seventh or eighth year). After that they began to go back, and the stag was killed. This individual was kept in the park at Woburn Abbey.

FIG. 3.
The A. L. Tulloch twenty-point Wapiti head.
Montana 1883.
From photograph by W. A. Baillie-Grohman.

FIG. 4
The Wyoming Wapiti head.
Belonging to Schoverling, Daly & Gales, New York.
Right beam, 64 inches.
Left beam, 60¾ inches.
Greatest spread, 52⅜ inches.



FIG. 5
S. N. Leek—Eighteen points.
1878.

weeks. The small hind hoofs, however, were not shed. In his tenth year the stag was evidently on the decline, so he was killed for the museum.

Some freak antlers are shown on page 61. (Figs. 9–14.) One of the most remarkable cases is the finding of three antlers on one head. Occasionally does (or "cows," as they are called) are found with rudimentary antlers. In the Jardin des Plantes is a doe that grows two antlers each year, on one side of her head. (Fig. 8.) Stags of the European Red-deer are sometimes found permanently hornless. I have not heard of any such among the Wapiti, but expect that they will be discovered.

The highly developed antler, however, is the most interesting. The typical form is shown in Plate I. Keeping this general symmetry, additional points are scored for additional size, aggregate length of beams and tines, number of points, weight, beading, and colour.

The antlers are second-class if they are under 55 inches in length of main beam, following the curves.

RECORD HEADS

The largest Rocky Mountain head of which I can find record is in possession of the Montana Armory. It is known as the 21-point head. I have not seen it, but the beams are said to be 66½ and 64¼ inches long, respectively, and the spread 52 inches. (Fig. 6.)

The largest antlers that I have measured are in the possession of Messrs. Schoverling, Daly & Gales, of New York, the right beam being 64 inches long, the left 60¼. (Fig. 4.)

A 61-inch pair shot in Wyoming by Lewis S. Thompson, of Redbank, N. J., is near the first place in size, as well as in symmetry. (Fig. 7.)

A fine 18-point head is shown in Fig. 5. I saw it in the possession of S. N. Leek, of Jackson's Hole, Wyoming, where it was killed in 1896.

But most judges give the palm for beauty to a superb 20-point head shown by A. L. Tulloch at the American Trophy Exhibition at London, 1898. (Fig. 3.) Its size and points have been exceeded, but its massive beams, perfect symmetry, and

FIG. 6

Montana Armory Wapiti head.

Right beam, 66⅛ inches long.
Left beam, 64¼ inches long.
Spread, 52 inches.

Killed in Gallatin County, Montana.
Mounted by Aug. Gottschalck.

FIG. 7

Fifteen-point Wapiti.

Shot in Wyoming by Lewis S. Thompson, of Red Bank, N. J.

The beams are 61 inches long each; the spread 48 inches. A remarkable combination of grace and symmetry with nearly record size.

FIG. 8—Cow Elk with horns, in Jardin des Plantes.

wonderful pearling are so far unrivalled. The animal was killed in Montana in 1883.

What becomes of these wonderful growths? Why is not the forest littered with them, since they are dropped and renewed each year?

First, the forest *is* littered with them to some extent in districts where the Elk abound. In several parts of the West I have seen small garden fences made of the cast-off antlers, and I am told that in California it was common to see a rotted survey stake replaced by a pile of Elk horns, which were the handiest and most abundant substitute. But still their numbers are nothing compared with what one might expect. If they were as durable as stones they would be as plentiful as stones in an ordinary Montana valley. The explanation is that they are easily destroyed by the elements and are habitually preyed on by Mice and other rodents. In all the thousands of shed Elk horns that I have picked up or seen in the West, I do not think I ever saw one that was not more or less gnawed by Mice, Rats, Gophers, or Porcupines.

The skull of the Elk may resist the weather for twenty years, the horns may crumble in half that time. As Caton long ago showed,[28] while bone is one-third animal matter or gelatine, the antler substance is "about 39 parts animal matter and 61 parts earthy matter of the same kind and proportions as is found in common bone"; besides which the inner structure of the antler is exceedingly porous or cellular. "Soon ripe, soon rotten," is a North-of-England proverb that has a bearing on this case.

AUTUMN

If the antler is the life-aim of the bull Wapiti and the sole end of the antler is the battle, then is the autumn in his years of perfect prime the crowning epoch of the great stag's life. Then from the mountain, whither he retired last spring, he descends to the level of the cows.

Fat and well-favoured is he become. A new blue coat

[28] Antelope and Deer of America, 1877, p. 169.

FIG. 9—George A. Clark, Colorado.
1895.

FIG. 12—Carter Collection, Colorado.
Egeria Park, 1894.

FIG. 10—Carter Collection, Colorado.
Egeria Park, 1877.

FIG. 13—Colorado, 1900. W. McFadden.

FIG. 11—Three-horned Manitoba head.
F. W. Stobart. January, 1887.

FIG. 14—The W. W. Hart twenty-eight-point head.
The record Elk for points.

has replaced the rusty brown; his beard is not so long as in late winter, but it is full, dark, and trim; his neck is swollen; his muscles are tense; he is tingling with life and vigour; and, above all, his antlers are perfect, new grown, clean, and sharp—heavier now than they will be later. A new feeling comes over both sexes—first in the bull, with overwhelming power; next in the cow, with lesser force.

THE WAR CRY

Filled with courage and desire, proud of his horns, and conscious of his strength, this greatest bull of the valley, gets up on some commanding ridge, fills his lungs, and raising his muzzle, he pours forth a tremendous guttural roaring that rises in pitch to trumpet tones, higher and higher, till it breaks into a shrill screaming whistle, then fades and drops again to the guttural, concluding with a few savage grunts. This is the world-famed bugling of the Elk. I have heard it likened to the braying of a jackass, but among those who know it in its native mountains, there is only one opinion—that it is the most inspiring music in nature. Here is this magnificent creature, nearly half a ton in weight, strong as a bull, fierce as a lion, in all the glory of his new antlers, proud of them, surrounded already by a band of his cows. He is challenging all the world to a fight; he is prepared to stake his all on the issue. "I am out to fight," he roars, in tones that tell of his huge round chest, "my horns are clean and sharp, I am big and strong, I fear no living thing. On this fight I will stake my range, my family, my social position, my limbs, my life." The martial clamour borne over hill and valley can scarcely fail to reach others of the same kind and in the same mood. Soon the distant woods give forth reply—the bugled answer of some other knight—maybe one like himself, with many possessions in the form of wives, to stake—maybe a youngster, just coming into his strength, with nothing to risk but life and limb, with all his fortunes yet to make, and glad to get his chance.

But the deep bugle-notes are characteristic of the prime bull. Younger bulls are often called "squealers," and, being more numerous, they are responsible for the bugling being sometimes called "whistling."

J. A. Ricker, of Denver, related to me an incident that he witnessed on two different occasions. One day, November 1, 1899, while hunting in Routt County, Colorado, he heard a bull Elk *whistle*. He got off his horse and, sneaking over a ridge, saw the bull in a hollow with three cows. Suddenly a reply to the challenge came from a distant bull that had a splendid *bugle*-note, winding up with three separate toots. The bull near at hand no sooner heard this than he dashed at the nearest cow, prodding her severely with his horns, then at the others, driving them as fast as he could away from the direction of the other bull. Evidently he was afraid to risk a fight with the *owner of that voice*.

PUGNACITY

It is rarely that a wild Elk will go out of its way to attack a man, but this has happened more than once. Charles H. Stonebridge, of New York, vouches for the following:

About two years ago John Legg, one of the ranchers in the Valley of the Stinking Water, Wyoming, had been up in the mountains hunting and was returning with his trophies on a pack-horse. The trail from the Continental Divide runs along the bank of the river and is very dangerous in a great many places. After coming down about forty miles, Legg came to a particularly bad part of the trail; nothing more, in fact, than a shelf about two feet wide on the side of a cliff and extending for about three hundred feet. On one side there was a sheer wall of rock, on the other a sheer fall to the cañon below. A single misstep meant instant death. Legg had been over this trail many times with the horses he was then using, and, without hesitation, drove his pack animal before him. When about half-way across he was suddenly confronted by a large bull Elk, coming from the other direction. The Elk seemed to consider that he had right of way, as without a moment's hesitation he lowered his head, dashed at the pack-horse and hurled it over the cliff into the cañon below, where it was instantly killed. Having got rid of the pack-horse, the bull now turned on the saddle-beast, and Legg was in imminent peril. It was impossible for him to get off his

horse on either side, or turn around, and the least misstep of his horse would have thrown both over the cliff. The horse, however, remained perfectly quiet. The rider drew his revolver, as the Elk charged, and by one shot sent him crashing down the cañon below almost on top of his victim. Legg crossed to the other side and worked his way to the bottom of the cañon. Here he found his pack-horse terribly smashed and the stuff he carried more or less injured. He secured the blankets and other things not broken and, loading them on his saddle-horse, returned to his ranch on foot.

THE BATTLE

We all love to see a fight when not personally in danger. I have tried many times to see a real Wapiti duel. I have heard them in the woods more than once, but never actually saw one.

In October, 1900, I was witness of a curious incident in a trifling Wapiti skirmish near Richmond, Va. A fine big bull Elk was bugling in the woods of the Elk Park. A smaller bull, a 4-pointer, replied with a whistle, then came on in slow and stately march. They locked horns rather deliberately, but the second bull was too light. Again and again he was forced backward, and broke away to save himself. After resting each time some fifty yards off, he would shake his head, squeal and try again, with no better success. At length, the big bull put a little more life into his attack and drove the young one afar. As he returned, a cow Elk came out of the woods and, at the same time, from under a few sprigs of brush on the much-trampled battle-ground, there rose a spotted fawn, which had been crouching th re during the lively fight which was all around him. Whether the bulls were careful not to crush him, or whether he escaped injury by accident, I do not know, but I suspect the latter.

W. A. Baillie-Grohman, the well-known sportsman, was witness of a tremendous fight. His description is well worth reproducing:[29] The author was camped in the mountains of western Wyoming, and one moonlight night in "bugling time"

[29] Sport and Life in British Columbia, 1900, pp. 80–81.

went forth afoot, when the woods were astir with Wapiti. After seeing a large bull scatter a band of small ones he saw a second prime fellow come bugling into the lists, and once they had clashed together Baillie-Grohman came up within thirty yards, knowing, says he, from former experience, that "probably I might have walked close to the stags without interrupting the tussle; but I was afraid that one or the other, or both, might turn against me, as I knew our European Red-deer do during the rutting season, and an Express [rifle] is but a poor weapon at night time. So I kept at a respectful distance, some twenty or thirty yards from cover, and from there I watched the fight for quite half an hour. For several minutes at a time the antlers appeared inextricably locked together, and as one of the stags seemed the stronger, though not the more agile of the two, superior weight would in those moments enable the heavier animal to fling his adversary from side to side, without, however, being able to free his own horns wherewith to do grievous injury to his foe. Before long, one was on his knees, pressed down, apparently by main force; then the other, staggering back, would for a brief moment halt before rushing with deadly intent at his adversary; but by the time he had regained his breath and was ready for the onslaught the foe was on his legs again and antler crashed against antler with a force that seemed irresistible. The heavier of the two stags appeared to be well aware of the one advantage his superiority in weight gave him, for the tactics just described were repeatedly tried by him, only to be foiled by his agile adversary, who invariably managed to regain his feet and receive the charge with lowered head and antlers *en garde*. The combatants had moved about the meadow, much as expert boxers would, though after a quarter of an hour's fighting weight had told its tale, and the smaller stag had to retreat more frequently than ever, and the adversaries were fast approaching the edge of the forest at the latter's back. Here a last stand was made by the defeated one, and a ten-minutes' tussle ended by bringing both onto their knees; and here, too, the repulsed one received his death wound, though I failed to see exactly how it

was inflicted, the movements being so rapid and the light too indistinct. It appeared to me, however, that the weaker stag, on regaining his feet first, made a dash at his foe, but from some cause or other his lunge missed its aim and, while the impetus carried him past his still kneeling adversary, his whole flank was exposed to the thrust of the latter's horns. The next second he was down, too, but this time with a heavy thud, stretched out at full length, just out of reach of the kneeling victor, who, too exhausted to rise, kept butting at the body which he could not reach. A minute later they were both up again, but the battle was decided, and the wounded hart fled into the forest, where I found him next morning dead, with a ghastly slash two feet in length that had ripped open his side and penetrated his vitals."

THE FINISH

There may be another finish to the combat—a finish that is even more final. The knights have clashed together, the strong and springy antlers have yielded a little under shock of onset, but sprung together locked—locked so firmly that now there is no fencing, nothing but pushing and wrestling. It is as if each held the sword-wrist of his foe in a riveted clutch, and when at length one of the wrestlers would spring back to avoid defeat or for a better thrust, he finds himself absolutely bound to his foe, with antlers intertwined. Try as he may, he cannot wrench them free. Strong and weak alike are now face to face with a lingering death. Many a time have two carcasses been seen thus antler-bound. Several times White-tailed Deer have been found thus—one still alive, the other dead a day or two, the stronger just able to drag his fallen foe enough so he could gather a little food, that could but prolong his misery. More than once the first to die has been partly eaten by Wolves, which the other feebly struggled to avoid. A score of times I have seen the remains of this among the smaller Deer, but only once have I found it among the Wapiti.

It is years ago now, at the Palette Ranch, on the head-waters of the Greybull, where choicest elk-lands sloped to buffalo-plains, in a little valley where it all befell, I saw the

records and the proofs. Here was the harrowed earth where the fight took place, here, on the battle-ground, the lankened forms of the knights, big and of even might. The Wolves had picked their frames, but the peeling skulls were there, with the two great pairs of branching gear inextricably locked and gripped and interlocked. In fancy's eye I saw the tragic end; while with the living eye I saw, not far away, a skurrying herd of cows with the lesser bull that had inherited what his betters had battled for in vain.

## II.

## The Northern Whitetail, Northern Whitetailed Deer, or Northern Virginian Deer.

*Odocoileus virginianus borealis* Miller.

(Gr. *Odous*, a tooth, and *koilos*, a hollow or cave, badly Latinized by Rafinesque into *Odocoileus*, should have been *Odontocœlus;* probably given because the type tooth was found in a cave; L. *virginianus*, of Virginia; L. *borealis*, of the north.)

*Cervus virginianus* Bodd., 1784, Elen. Ani., I, p. 136.
*Odocoileus virginianus* Merriam, 1898, Proc. Biol. Soc. Wash., April 30, XII, p. 100.
Type Locality.—Virginia.

*Odocoileus americanus borealis* Miller, 1900, Key to Land Mammals N. E. Am., Bull. N. Y. State Mus., p. 83.
*Odocoileus virginianus borealis* G. M. Allen, 1901, Am. Nat., June, 1901, p. 450.
Type Locality.—Bucksport, Maine.

French Canadian, *le Dain fauve à queue blanche; le Chevreuil; le Cerf de Virginie.*
Cree & Ojib., *Wab-ai-ush'* (Whitetail).
Yankton Sioux, *Tah-chah Tseen-tay-skah.*
Ogallala Sioux, *Tah-heen-cha'-h[illegible]* (Deer).

The genus *Odocoileus* (Rafinesque, 1832) has, in addition to all the family characteristics: Antlers in the male only; no brow or bez-tines, but an upright snag near the base inside; a metatarsal or mid-leg gland on outer side; tail, long; no canine teeth, the distal or lower ends of the metacarpals or outer front toes, remaining; young, spotted. Teeth as in *Cervus*, but canines rarely present.

GENERAL CHARACTERS

The Virginian Deer is easily distinguished from the Mule-deer and Coast Deer group by the form of its antlers (Fig. 16), which have one main beam, bending forward and bearing the tines behind, also by the metatarsal or mid-leg gland on the outer side of the hind shank (Fig. 15), which is about 1 inch long in the

PLATE V.—WHITETAILED DEER.
(*Odocoileus virginianus* Bodd.)

Virginian Deer, 2 inches in the Coast Deer, and about 5 in the Mule-deer. The tails also are very distinctive, as will be seen on reference to Fig. 17.

The Northern Whitetail is much larger than the typical form from Virginia, being nearly double the weight of the latter; the Whitetail group present, indeed, a complete gradation of size from the pygmy Acapulco Deer found in Mexico, or the Florida Deer a little larger, to the giant form of Maine and Manitoba.

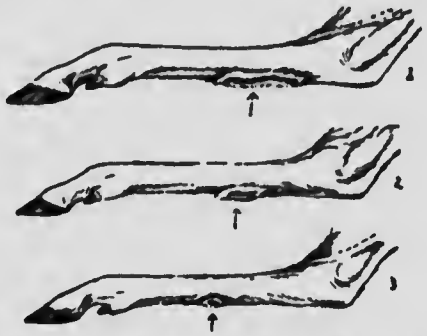


FIG. 15—Left hind leg of Mule-deer (1), Coast Deer (2), and Whitetail (3), to show the size of the metatarsal glands, respectively, 5, 2, and 1 inch long.

Caton considered the Acapulco Deer the smallest of the North American species. None of the specimens he had weighed over thirty or forty pounds.[1]

FIG. 16—Typical antlers of Whitetail (1) and of Mule-deer (2).

Bucks of the Florida Deer are commonly said to be about eighty pounds o ninety pounds, and, according to Cory,[2] not often over 110 pounds. The does are proportionately less in weight.

A fine adult male of the Northern form (No. 104891 U. S. N. M.), killed November 15, 1900, near Floodwood on the St. Louis River, sixty miles west of Duluth, Minn., I measured in the flesh, as follows: SIZE

Length, 6 feet 5½ inches (1,970 mm.); tail, 11½ inches

[1] Antelope and Deer of America, 1877, p. 121.
[2] C. B. Cory, Hunting and Fishing in Florida, 1896, p. 63.

(292 mm.); hind-foot, 20½ inches (520 mm.); height at shoulders, 3 feet 5 inches (1,042 mm.); body, ischium to manubrium, 4 feet 2 inches (1,271 mm.); depth at chest, 16


FIG. 17—The tails and discs of: 1. New England Whitetail. 2. Colorado Mule-deer. 3. Oregon Coast Deer. 4. Wyoming Wapiti. 5. British Red-deer.

inches (406 mm.); elbow to ground, 26 inches (661 mm.); length of head, nose to occiput, 13½ inches (343 mm.); length of ear, 9 inches (228 mm.).

WEIGHT

The weight of the carcass (gutted) was 222 pounds, which would give a live weight of about 280 pounds. Another specimen, taken about the same time and place, was 150 pounds in weight, that is, about 190 pounds live weight. The maximum weight of the Northern Whitetail is commonly given at 350 pounds, but I find good testimony for considerably higher

In 1877 a large buck was shot in Franklin County, Adirondack, N. Y., by John T. Denny, of New York. It weighed 286 pounds dressed, which would give 357 pounds live weight.[3]

John W. Titcomb, of the United States Bureau of Fisheries, writes me that a buck weighing 370 pounds was killed in Vermont in 1899.

One that weighed when dressed 299½ pounds, or 375 pounds live weight,[4] was killed in Essex County, N. Y., by Albert H. Thomas, of Warrensburg, N. Y.,

A still larger animal was shot by Warren S. Potter, of Glens Falls, N. Y., shortly before 1896, at Thirteenth Pond, Warren

[3]First Annual Report Com. F. G. & F., N. Y. S., 1896, p. 200. [4]*Ibid.*

County, N. Y. It weighed 318 pounds dressed, which means a live weight of 400 pounds.[5]

The most remarkable Adirondack buck, that I can find authenticated, was killed by Henry Ordway near Mud Lake, in 1890, and is described by James M. Patterson in Col. Fox's Forestry Report, as follows:[6] "Weight, before being dressed, 388 pounds [bleeding and drying must have robbed it of fully 12 pounds, so that its live weight was about 400 pounds]; height over withers, 4 feet 3 inches. There are 9 prongs on one antler and 10 on the other. Length of antlers, 32 inches; distance between antlers, 26½ inches; length from tip of nose to tip of tail, 9 feet 7 inches." To this A. N. Cheney adds:[7] "I have talked with Mr. Patterson (who is a brother of ex-District Attorney Patterson, of Warren County) since his letter was printed, and he added to the figures given, that the Deer measured 37 inches around the neck back of the head, and that the longest spike on one beam was 13 inches. The buck had been seen on several occasions, during two or more years, before it was secured, and a number of sportsmen had made several efforts to kill it. It appeared to have no fear of dogs that were put on its track, and on one occasion attacked and drove off two."

But these are the giants of their kind. The average dressed weight of 562 Deer shipped out of the Adirondacks by the express company in 1895 was only 109⅛ pounds, a live weight of 136¼ pounds each;[8] but this included many small Deer and August specimens of all ages and sexes. An average full-grown doe of the region weighs about 150 pounds (live weight) and an average buck 200 pounds. Bucks of 300 pounds weight are killed every year.

COLOUR

In its *summer* (or red) *coat* this Deer is a dull rusty red or yellowish brown, paler around the eyes and much darker on the upper side of tail, with a black spot on each side of the

[5] *Ibid.*, p. 201. [6] *Ibid.*, p. 200. [7] *Loc. cit.*, p. 201.
[8] W. F. Fox, Rep. Supt. Forests N. Y., First Annual Report Com. F. G. & F., N. Y. S., 1896, p. 200.

chin; while the band across the nose, the ring around each eye, the inside of each ear, the patch on the throat, the inside of each leg, the under side of the tail, and the region under the tail and belly are white.

In *winter* (or blue) *coat* the red is replaced by gray.

The sexes are alike in colour.

The young are bright bay or dull reddish yellow, spotted with pure white, but lose this coat when about four months old.

The following races are recognized:

*virginianus* Bodd., the typical form. With lower tooth-row of cheek 3 inches long (75 mm.); winter coat not very different from that of summer.

*borealis* Miller, paler in colour and much larger than *virginianus* (nearly double). Lower tooth-row of cheek 3⅜ inches long (85 mm.); winter coat much coarser and grayer than summer coat.

*macrourus* Raf., paler than *virginianus*.

*leucurus* Douglas, with little or no black and much white.

*texanus* Mearns, much smaller and paler than the typical form.

*osceola* Bangs, in size like *texanus*, but very dark in colour.

*louisianæ* G. M. Allen, in size like the typical, but pale and with slender skull.

DIRECTIVE MARKS

The sportsman-hunter, however, pays little heed to the colours and fine distinctions on which the scientist founds his species and races. He usually lumps the twenty-odd species and races of small American Deer as "Deer," and carries a general impression of a deer-coloured animal, paler on the under parts. This is a true impression as far as it goes; indeed, I know of no colour feature on the animal's trunk by means of which the various species may be distinguished. Nevertheless, nature has added a label to each, and, as though by kindly plan, this is the last part of the animal that the hunter sees as it dis-

appears in the woods. The tail and disk are totally different in each species. If every sportsman would bring the tail of his Deer (or failing that, make a sketch of it), with a note of its length, and the locality where he found it, we could tell with fair certainty the species he had got or seen.

DISCOVERY

One Thomas Hariot, an English mathematician in the service of Sir Walter Raleigh, visited Virginia in 1584. In his account of the colony he says:*

'Of * * * Deare, in some places there are great store; neare to the sea-coast, they are of the ordinairie bignes as ours in England, and some less; but further up in the countrey where there is better feed, they are greater. They differ from ours only in this, their tailes are longer, and the snags of their hornes look backwards."

There is no doubt that Cartier saw the Whitetail at Montreal in 1535, but Master Hariot, the mathematician, has given us the first identifiable description of the species. It is therefore with reason called the "Virginian Deer."

## Life-history.

RANGE

Since then we have traced the animal throughout its entire range, and naturalists have discriminated between the various species and races, as set forth on the accompanying map (No. 5).

This map illustrates an interesting fact in Whitetail distribution: that while the species has lost much territory in the East and in the centre of its range, it has gained a great deal in the North and West. The reason for this will be seen in its habits, especially in its adaptability to agricultural conditions.

Had the map been made in 1890 instead of 1900, it would have given a still smaller range; for, as stated elsewhere, 1890 seems to have been the low-ebb year for most of our game animals east of the Mississippi. Twenty years ago the Deer

*Thomas Hariot, Virginia, 1585-6; Stevens Reprint, 1900, p. 39.

were exterminated in New England, except in the remote north woods. Now they have re-possessed the whole country, even to the gates of New York City. Within the last year wild Deer have been seen about Greenwich, Conn., and even in Yonkers, N. Y. Northward the species has extended as far as latitude 50 degrees at least, in Algoma, and is likely to continue advancing till it reaches Hudson's Bay.

IN MANITOBA

The map (No. 5) shows sufficiently the general range and the range of the species in Manitoba. Its distribution here is that of a southern and eastern species that is forcing its way in, really following settlement toward the North-west. In 1800 it was unknown about Pembina, if we may judge by its continual omission from the yearly reports of Alex. Henry. In 1820 it had not yet appeared. When, in 1874, Dr. E. Coues explored the Pembina region it was still without Whitetail. The earliest accounts I can find are for 1881, about which time, according to many old Manitobans, the "Down-East Deer" first made its appearance.

This accords with the date when first the upper Red River Valley (or Minnesota) was well settled. From that time the creature has spread steadily, as shown by the successive encroachments indicated on the map.

HOME REGION

How large is the home locality of a Whitetail? Smaller, probably, than that of any other of the family in America. A Moose or a Mule Blacktail may pass the whole of a summer on a square mile. According to Audubon and Bachman[10] a Whitetail "is usually found in the same range or drive, as it is called, and often not fifty yards from the place where it was started before." These same naturalists remark with surprise on their finding a band of Deer that bedded at one place and fed nightly at another "nearly two miles off," and on a third case of Deer that daily covered four or five miles between bed and board. These, however, are very exceptional cases.

All the guides that I have consulted agree with me in giving the individual Whitetail a very limited range. In the

[10] Aud. and Bach., Quad. N. A., Vol. II, p. 222.


**MAP 5—RANGE OF THE NORTH AMERICAN WHITETAILED DEER.**

This map is founded on much personal experience and the records of several hundred ancient and modern travellers.
The heavy line shows the original range. The central area left blank shows where the species has been exterminated. In New England and Canada the Deer has followed the settler and gained much territory. Similarly the recent extension into Utah is a result of irrigation.
The many forms south of the Rio Grande have not yet been worked out.

The following are enumerated and complete the list north of Panama:

*...eus ...anus* (Bodd.) with its 7 ...,
*...leus co...oues and Yarrow),*
*...ileus batty*, Allen,
*...oileus sinaloae* Allen
*Odocoileus lichtensteini* (Allen),
*Odocoileus toltecus* (Saussure),
*Odocoileus acapulcensis* (Caton),
*Odocoileus thomasi* Merriam
*Odocoileus nelsoni* Merriam,
*Odocoileus truei* Merriam,
*Odocoileus nemoralis* (H. Smith),
*Odocoileus costaricensis* Miller,
*Odocoileus rothschildi* (Thomas).

Rockies I know that two or three hundred acres will often provide a sufficient homeland for a whole family of them the year round. For the Whitetail, unlike the Wapiti and the Mule-deer, seems to be entirely non-migratory.

ENVIRONMENT

It is essentially a creature of the denser woods and thickets where these alternate with open glades. Bare plains and rugged hillsides are an abomination unto it; but every Western river whose long flood-flat is belted and patched with far-reaching scrubby thicket is sure to carry with it a long-drawn-out population of skulking Whitetails, which, between scrub and bog, are able to hold their own and multiply, in spite of rifle and Wolf; while the hill-frequenting Blacktail is rapidly passing away.

In the hard-wood ranges of the East, this preference is less observable because all of the country is one thicket, but the life of the animal is the same, and its chosen resort is the borderland between sunny open and friendly cover.

In one other way the Whitetail is peculiar: It prefers the edges of civilization. There man wars on its foes, the Wolves; his axe makes sunny openings in the fir gloom; and, above all, his crops furnish delectable food in time of scarcity. In all parts of the North and East, therefore, the Whitetail has followed the settler into the woods and greatly extended its range thereby. In this we see the reasons of its extension into Manitoba and northern Ontario.

NUMBERS

In speaking of Whitetail the early travellers use expressions that tell of astounding numbers; thus Cartier's "great store of Wilde beasts as Faunes Stags, etc.,"[11] Hariot's "great store."[12] Morton, writing of New England and its Deer (1632), says:[13] "There are in the countrey 3 kinds of Deare, of which there are great plenty, and those are very useful."

Just what writers meant by "great plenty" I have endeavoured to ascertain.

[11] Hakluyt's Voyages, Vol. III, pp. 231–90.
[12] T. Morton, New English Canaan, London, 1632.
[13] *Op. cit.*, p. 39.

In the season of 1895 the official returns[14] showed that 4,900 Deer were killed in the Adirondacks. It is notorious that official returns are far below the actual slaughter, for we must add, further, the number of those killed illegally during or out of season, as well as those killed and not found; also a proportion destroyed by natural enemies. We may believe that 4,900 Deer reported means 6,000 or 7,000 actually killed.

I have heard hunters estimate that, under the most favourable circumstances, the Deer do not add more than a quarter each year by actual increase. If, therefore, more than a quarter are killed in a season, a falling-off results. But the Adirondack Deer are holding their own; that is, those killed are less than a quarter of their numbers. I should, therefore, estimate them at 30,000, or, roughly, 3 to a square mile.

The official report for Maine gives 7,579 Deer killed in 1899, which we are to believe makes a destruction of about 15,000 Deer. But they have ample room and are steadily increasing, so that I put the numbers existing in Maine to-day (1906) at not less than 75,000, or about 2 to the square mile. In doing so I find I have been properly conservative, as Dr. W. T. Hornaday, in 1904, gives[15] the estimate of Deer in Maine at 100,000, or 3 to the square mile.

All records agree, however, that in numbers the Deer in the Adirondacks and Maine now are as nothing to those of days gone by. Thus Morton says[16] of those in New England, about 1632: "There is such abundance that 100 have been found, at the spring of the year, within the compass of a mile." But even this, we learn from the accounts of innumerable travellers, was far surpassed by the incredible hosts of the Middle States east of the Mississippi and of Texas. In the last-named State, about 1850, I am assured by many old hunters that 500 in one band were met with commonly in the half-open country. Thousands could sometimes be seen in a day; they were there in tens of thousands.

In the mountains of Colorado I have seen Mule-deer so

[14] First Annual Report, 1896, N. Y. S. Com. F. G. & F., p. 192.
[15] American Natural History, 1904, p. 131.
[16] New English Canaan, 1632.

plentiful that 10 to the square mile would have been a very low estimate indeed, and 20 would be a safe rate for the region. The guides claimed that in favourite localities there were as many as 200 Deer to the square mile.

But the accounts of the hunters put the Whitetail, in point of numbers, far in advance of all other small Deer. Therefore, I feel satisfied that in primitive times 10 to the square mile is a safe estimate of Whitetailed population in its most favourable region—the immediate Mississippi Valley and the country to the east of it. This area was roughly 2,000,000 square miles. That is to say, it was the home of not less than 20,000,000 Whitetailed Deer.

Although the map of to-day shows a wide distribution, the distribution is on a very different basis from that of two hundred years ago. The Adirondacks, northern New England, northern Michigan, north-eastern Texas, and the dry parts of Florida (aggregating 100,000 square miles) may yet show an average of 3 Deer to the square mile. But we must consider the species as practically absent now from Ohio, Indiana, Illinois, Iowa, Nebraska, Kansas, Kentucky, the northern half of Missouri, and the southern halves of Minnesota, Wisconsin, Michigan, New York, and Ontario, a total area of about 600,000 square miles of their best country. Moreover, the rest of the region shown as inhabited by Whitetail in present times is so sparsely supplied that 1 Deer to 5 square miles would be a liberal estimate. These figures would make the entire Whitetail population north of the Rio Grande somewhere about 500,000.

The State of Maine, therefore, has now one-fifth of the Deer in the country. This is because she has learned that they are worth preserving.

ANTLERS

In the genus *Odocoileus* there are two well-marked types of antlers, as shown in Fig. 16. These represent average horns of full-grown bucks. In general style the Coast Deer antlers resemble those of the Mule-deer, but are more

FIG. 18—Deer horn embedded in oak.

Specimen in New York State Museum. Drawn from photograph supplied by the Director of the Museum.

Inscribed: "This portion of an oak tree with a Deer's head and horns was taken from a forest in the State of Michigan. It is believed that the tree was between 40 and 50 years old. Presented to the Museum by the Hon. William Kelley, of Rhinebeck, Nov. 24, 1859."

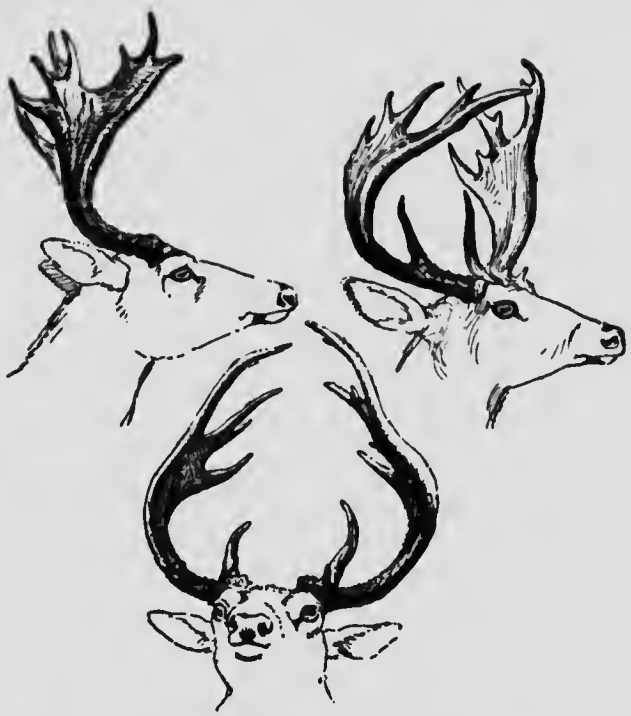


FIG. 20—Whitetail Buck with remarkable palmations.

Killed at North Lake Reservoir, town of Wilmurt, Herkimer County, N. Y., fall of 1891. Drawn from photographs by Egbert Bagg, of Utica, N. Y.

FIG. 19—Antler of Virginia Deer embedded in tree trunk.

Locality, New York State.
From photograph of specimen in New York State Museum, by courtesy of Director John M. Clarke.

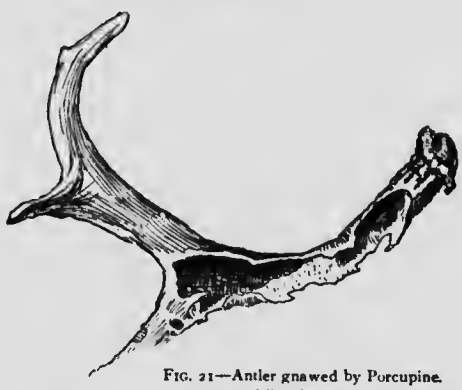


FIG. 21—Antler gnawed by Porcupine.

Adirondacks, 1908.

FIG. 22—Abnormal antlers of Whitetail.

Redrawn from Caton's figure.

slender. Those grown by a Whitetail buck are normally as shown in Plate V, but antlers are usually *abnormal*. J. W. Titcomb states[17] that a tame Deer which he knew grew, on its second autumn, a pair (its first) that were a foot long and had three points on each. A pair with many snags *probably* belonged to an old buck, and yet again an old buck may have mere spikes. Thus it will be seen that anyone pretending to tell the age by the horns alone is sure to err.

Some of the most remarkable variations are here shown. The record for points still rests with a pair owned by Albert Friedrich, of San Antonio, Texas, which are of such superabundant vigour as to have 78 points (Fig. 23). The 42-pointer from the Adirondacks (Fig. 24) and the 35-pointer from Minnesota (Fig. 25) claim second and third places, respectively.

Antlers are sexual appendages, and their connection with the genital system is close, though obscure. The latter cannot be deranged without creating a disturbance in antler production, and the effect of emasculation is extraordinary. Judge Caton, to whom we are so much indebted for light on the Deer family, shows[18] that a buck castrated when his antlers are nearly grown will drop them within thirty days after. Next year he will grow a new pair, according to rule, but they never ripen, harden, or peel. They continue full of blood and life until they are frozen and broken off by accident, leaving a stump. Each year thereafter the stump will grow larger and a new antler is projected, but never finished; and each succeeding year the antler will be smaller and more irregular

ANTLERED DOES

From time to time does are found wearing antlers, usually spikehorns, and in the velvet. As the connection between the reproductive organs and the horns is so close, Caton suggests[19] that likely the females wearing these masculine ornaments have some peculiarity of the genitalia.

Less interesting freaks are hornless adult bucks. I have

[17] McKinley, The History of a Vermont Deer, F. & S., May 18, 1899, p. 205.
[18] Antelope and Deer of America, 1877, pp. 186–7.
[19] *Ibid.*, p. 233.

FIG. 23—Seventy-eight-point Whitetail killed in Texas.
Spread, 28½ inches.
From photograph by their owner, Albert Friedrich, of San Antonio, Texas

FIG. 26—Three-horned Whitetail.
From Brainerd, Minn., Dec., 1897. Collection of C. J. Gunston, of Seattle, Wash.

FIG. 24—Forty-two-point Adirondack buck.
Redrawn from photograph in New York State Fish and Game Report, 1896.

FIG. 27—Quebec Whitetail.
From photograph by Norman H. H. Lett.

FIG. 25—Thirty-five-point Whitetail from Minnesota.
From photograph by [illegible], *Recreation*, June, 1897.

FIG. 28—Minnesota Whitetail.
From Brainerd, Minn., Dec., 1897. Collection of C. J. Gunston, of Seattle, Wash.

never seen one of them, but have often heard of them, and find several cases recorded.[20]

Hariot first called attention to the unique fact that the "snags" of the horns "look backwards." Caton points out[21] that this enables "the animal, by bowing his head in battle, as is his habit, to present the tines to the adversary in front. When two meet in the shock of battle thus armed, these antlers form such a complete shield that [he adds] I have never known a point to reach an adversary."

LOCKED ANTLERS

But the peculiarity has an offsetting disadvantage. More in this species than in any other in America do we find cases of fatally interlocked antlers—cases in which two bucks struggling for the mastery have in some way either sprung their antlers apart, or forced them together so that they are inextricably intertangled, and death to both combatants is the inevitable finish. Often it comes by starvation, so that antler-bound bucks are lucky if found by their natural enemies and put to a speedier and more merciful death.

FIG. 29—Two Whitetail bucks with locked horns.
Redrawn from Stanley Waterloo's photograph in Recreation for August, 1899.

Stanley Waterloo writes:[22] "In November, 1895, Mr. F. F. Strong, a well-known Chicago business man and an ardent sportsman, was, with a small party of friends, hunting near

[20] Forest and Stream, July 4, 1896, p. 5, and Forest and Stream, June 6, 1896, p. 454.
[21] Antelope and Deer of America, 1877, p. 224.
[22] Recreation Magazine, September, 1897, p. 236.

Indian River, in Schoolcraft County, Michigan. One day, when the party was out, ravens were noticed hovering noisily over a certain spot and, attracted by curiosity, the hunters sought the cause. Emerging into a comparatively open space in the wood, they made a discovery. For the space of nearly an acre the ground was torn and furrowed by the hoofs of two bucks, and near the centre of the open space lay the bucks themselves, with their horns inextricably locked (Fig. 29). One of the Deer was dead, and the hungry ravens had eaten both his eyes, though deterred from further feasting by the occasional spasmodic movements of the surviving combatant, whose eyes were already glazing."

I remember reading an account of a hunter finding two bucks thus locked—one dead, the other near death. He was a humane man, so went home for a saw and cut the living one free. The moment it felt at liberty it turned its feeble remaining strength on its deliverer, and he had much ado to save his own life before he could regain his rifle and lay the ingrate low.[23]

Audubon and Bachman tell[24] of three bucks whose antlers were thus interlocked. In the New York State Museum is shown a portion of a tree with the antler of a Deer driven through it, or, more likely, an antler with the tree grown around it (Fig. 18).

FREAK FOOT

The feet are much less subject to aberration than the horns, but Dr. E. Coues has described[25] a solid-hoofed Virginian Deer that was sent him by George A. Boardman, of Calais, Me. In this freak the two central or main hoofs were consolidated as one. A somewhat similar peculiarity has often been seen in pigs, but never before recorded for the Whitetailed Deer.

ALBINISM

There is a tendency to albinism among the Deer in some parts of the country. This appears usually on islands and isolated districts, where it seems to be a consequence of in-

[23] I am unable now to find the record and give due credit for the story.

[24] Quad. N A., 1849, Vol. II, p. 224.

[25] Bull. U. S. Geol. Survey, Notes Herpet. Dak. Mont., Feb. 5, 1878, Art. XII, pp. 293–4.

breeding. Albinism is a freak or disease by which the colouring matter is left out of the hair on those parts of the body that are affected, and the hair there comes white. Sometimes the entire animal is involved, in which case usually the hoofs are white and the eyes pink. It is not by any means certain that the albino of this year will be an albino next year also. The affection is sometimes associated with internal worms.

The protective value of their blended tints and the way in which many animals turn them to account raises the question: Are they conscious of their adaption to surroundings?

D. Wheeler writes me (January 7, 1901): "Deer seem to realize their colour; they come to the water to drink and commonly pause to reconnoitre among dead brush that matches their coat. I am sure that the Northern Hare does so; for in the spring of the year, when they are still in white and when the snow is in patches, they *invariably* squat or rest on the snow."

R. Nichols, of Portland, Ore., assures me that Ptarmigan in white always squat on the snow, if the ground be bare in places.

This does not agree with my own observations on Snowshoe Rabbits and White-jacks. Twice I saw a White-jack crouch on a white rock, but I many times saw them when in winter coat, crouch in brownish, grassy places where they were ridiculously conspicuous. On the bare ground they are of course more visible, and here they were very shy; though this might be explained by the absence of cover.

I am not yet satisfied that any animals actually realize the protective value of their colour.

EYE-SIGHT

The hearing and scent of Deer are marvellously acute, but their eyesight is not of the best. Audubon and Bachman considered it actually imperfect; stating as proof that[26] "we have often, when standing still, perceived the Deer passing within a few yards without observing us, but we have often noticed the affrighted start when we moved our position or when they scented us by the wind. On one occasion we had

[26] *Loc. cit.*, p. 227.

tied our horse for some time at a stand; on his becoming restless we removed him to a distance; a Deer pursued by dogs ran near the spot where the horse had originally stood, caught the scent, started suddenly back and passed within a few feet of the spot where we were standing without having observed us."

This animal seems, indeed, to regard all motionless objects down wind as mere features of the landscape. Hunters take advantage of this weakness, when stalking it in the open. They run toward it without concealment as long as it is grazing; but the moment it shows, by shaking its tail, that it is about to raise its head, they "freeze," crouching low and still. The Deer takes its customary look around and lowers its head to feed again; whereupon they repeat the open approach, and thus continue until within easy shot.

Col. Theodore Roosevelt observes:[27] "I cannot say whether the habit is a universal one, but on two occasions at least I was able thus to creep up to the feeding Deer, because before lifting its head it invariably shook its tail, thereby warning me to stay without moving until it had lifted its head, scrutinized the landscape, and again lowered its head to graze. The eyesight of the Whitetail, as compared with that of the Pronghorn Antelope, is poor. It notes whatever is in motion, but it seems unable to distinguish clearly anything that is not in motion. On the occasions in question no Antelope that I have ever seen would have failed to notice me at once and to take alarm. But the Whitetail, although it scrutinized me narrowly, while I lay motionless with my head toward it, seemed in each case to think that I must be harmless, and after a while it would go on feeding. In one instance the animal fed over a ridge and walked off before I could get a shot; in the other instance I killed it."

I have heard of this trick often, and have several times proved it a failure with Antelope. I never tried it on Whitetail Deer, but did it with complete success on a pair of Red-deer in Europe some years ago.

[27] Deer Fam., 1903, pp. 96–7.

VOICE

The Deer is generally considered a very silent animal, yet the list of its noises increases with fuller observation. According to Audubon and Bachman:[28] "The fawn has a gentle bleat that might be heard by the keen ears of its mother at the distance, probably, of 100 yards. We have never heard the voice of the female beyond a mere murmur when calling her young, except when shot, when she often bleats like a calf in pain. The buck when suddenly started sometimes utters a snort, and we have at night heard him *emitting* a shrill whistling sound, not unlike that of a chamois of the Alps, that could be heard the distance of half a mile."

"In riding through the woods at night in the vicinity of Deer we have often heard them stamp their feet, the bucks on such occasions giving a loud snort, then bounding off for a few yards, and again repeating the stamping and snorting, which appear to be nocturnal habits."[29]

They have also a louder, coarser snort or challenge, as noted later.

Franklin T. Payne describes[30] some park bucks that he shipped as "bawling with rage when captured."

"In all my experience [says A. Y. Walton[31]], extending over about forty years, I have never but once heard a Deer make use of the voice when seeking a lost mate. This occurred when, upon one occasion, having shot at and scattered a band of stags, one of the number, not having seen or scented us, turned back, evidently seeking his leader, and passed close by, making a low, muttering noise like that sometimes uttered by the domestic ram."

Commenting on the above facts, Ernest McVeigh, of Ottawa, Ont., writes me on October 19, 1906:

"My experience of Deer has been pretty much confined to the Province of Ontario, ranging from the Georgian Bay to Montreal, and I have noted all of the sounds mentioned by you. But two or three years ago I had a new experience. I

[28] Quad. N. A., 1849, Vol. II, pp. 226–7.
[29] *Ibid.*, p. 229.
[30] Recreation Magazine, May, 1898, p. 377.
[31] A. Y. Walton, Forest and Stream, June 15, 1895, p. 485.

went up the Gatineau, in the Province of Quebec, for a few days' hunting, and in discussing the hunt with our host, whose experience of Deer had been confined to his immediate surroundings, I was struck by his remark that he 'heard the Deer bleat as they came up through the valley ahead of the dog.' I asked him to explain, as this was new to me, and he informed me that nearly all Deer in his country did this when chased by dogs, as well as when disturbed by hunters. During my stay I saw Deer, both chased by dogs and started by hunters, that did not bleat; but I also had the good luck to hear and see some that did.

"* * * One of my friends shot at a Deer down in the valley, and started a bunch of 5 that went up over a smooth top hill about 800 yards from me. I should not have noticed them had it not been for the loud and continuous bleat they emitted as they went. The word 'bleat' does not quite describe the sound, as it was as much a bellow as a bleat, being a deep, throaty, continuous noise that seemed to fill all surrounding space for, I should judge, at least 1,000 yards; and to make the thing more peculiar, they went in single file and *trotted with flags down*, as Moose might have done. I had a good view of them, and they were ordinary Whitetailed Deer. But to remove any doubts of that, my friend managed to get a second shot and dropped one of them (a 160-pound buck), which did not differ in any way from others of his kind.

"Whether this phenomenon is peculiar to the district referred to or not, I cannot say, but my friend stated that both bucks and does had this habit."

ENEMIES

The greatest enemy of the Whitetail is the buckshot gun, with its unholy confederates, the jacklight and canoe. I hope and believe that a very few years will see them totally done away with in deer sport—classed with and scorned like the dynamite of the shameless "fish-hog."

Next comes the repeating rifle of the poacher and pot-hunter.

The third enemy is deep snow. It is deep snow that hides

their food, that robs them of their speed, that brings them easily within the power of the Cougar on its snow-shoes, and of the human Cougar who is similarly equipped for skimming over the drifts.

Another deadly peril from the snow in a hard winter is set forth by Raymond S. Spears.[32] After pointing out that the heedless burning of forests had destroyed the winter cover of the Adirondack Deer, he says:

"Perhaps the worst sight of all was that of Deer with 'saddles' of snow on their backs. The snow froze to the hair of the animals, which did not have life enough to melt it. The saddles grew larger and larger on scores of Deer, until the victims finally succumbed."

Wolves, too, rank high in the list of the Whitetail's foes, and have long played seesaw havoc with the Deer in the North. On the Upper Ottawa the Deer came in with the settlers. The Wolves followed, because in the Deer they found their winter support. In summer the Deer were safe among the countless lakes, and the Wolves subsisted on what small stuff they could pick up in the woods. But winter robbed the Deer of the water safe-havens, and then the Wolves could run them down; thus they wintered well.

But wintering well meant increasing, and the Wolves became so numerous that they destroyed their own support, when starvation, followed by extinction, was their lot. Again the Deer recovered locally or drifted in from other regions, and again the Wolves increased to repeat their own destruction. This has been the history of the Deer population along most of our frontier wherever winter is accompanied by deep snow. If we could exterminate the Gray-wolf we should half solve the question of deer-supply; but there is no evidence that we shall ever succeed in doing this.

However, I find one experienced old hunter (E. T. Merrill, of Reed City, Mich.,) who has little faith in the stories of Wolves running down Deer. He says:[33]

"I have not yet seen the race between Wolves and a Deer

[32] In Sat. Eve. Post, January 26, 1907. [33] Sports Afield, March, 1900, p. 229.

that lasted over ten minutes. Either the Deer gets to water or some clearing or road where the Wolves will not follow, or else he is killed at once. Very often they drag a Deer down within a few jumps of where he starts. In Michigan and Wisconsin, during winter, Deer generally feed along the edge of a swamp under thick hemlocks where there is plenty of ground hemlock, and the Wolves generally come in on them from two ways and drive them toward the swamp, and they will nearly always kill them within forty rods of where they start."

This is readily understood in country where Deer and other game animals abound. The Wolf knows very well that the Deer is far fleeter than itself and that, if it fails in that first dash, it is easier to go elsewhere and try to surprise another Deer. But when desperately hungry, in regions where Deer are not so plentiful, a Wolf will stick to any Deer it starts and will follow it to a finish, however far. I have heard accounts of many old Ontario hunters that entirely support this belief. These facts, it will be seen, are not opposed to those advanced by E. T. Merrill.

The Hon. George A. Shiras tells me that in the spring of 1906 he examined carefully a cedar-swamp in Alger County, northern Michigan, and found within a radius of three miles 325 carcasses of Deer killed by Wolves during the past winter.

It seems likely that Foxes will kill the very young fawns if they find them unprotected. There is, at least, good evidence that the Deer reckon the Fox as one of their foes.

W. G. Rockefeller tells me that about November 1, 1904, as he was still-hunting in the Adirondacks, he came on a Deer that was leaping about in an extraordinary way. On getting near he found it a doe in pursuit of a Fox. The Fox was running and dodging under logs or any other cover he could find; but the doe was intent on killing him, and would have succeeded, doubtless, had not my informant interfered by shooting the Fox. The doe was closely followed by her fawn of the year.

This same sportsman knew of a buck that discovered a Fox held in a trap. The Deer, promptly taking advantage

of his enemy's distress, tried to kill the Fox, but in some unknown way released it, and Reynard made good his escape.

MOSQUITOES, TICKS, AND DEER-FLIES

Mosquitoes, ticks, and deer-flies are also among the foes of this Deer. Mosquitoes bother them just as they do us. At times the Deer avoid these plagues by sinking themselves in the mud and water. Blue-ticks of the genus *Ixodes* are very troublesome; and G. M. Martin tells me that in the Adirondacks during June and July he has often seen these hanging on the Deer's legs, sucking their blood. The ticks do not cause the Deer much annoyance, but must be a great drain when present in large numbers. The deer-flies (*Oestrus*), however, are the most annoying of all these small enemies.

Catesby says[24] (in 1731): "Near the sea the Deer are always lean and ill-tasted, and subject to botts breeding in the head and throat." The bott mentioned is the larva of the gad-fly or deer-fly. Hunters assure me that this same complaint is found among Deer in the north.

R. Clark Fisk writes me that in Montana, on September 9, 1898, he "shot a young Whitetail buck whose horns were in full velvet. He was fat, but in his liver I found two large worms curled up. They were not unlike skin botts."

In the country about MacDonald Lake, in the Adirondacks, G. M. Martin tells me, Deer are often seen with warts on the legs and belly. Some of those observed were an inch across and one inch high. In the Rockies I found the Blacktails much infested by hydatid cysts. I expect that the same will prove true of the Whitetail.

The following case is given by E. T. Merrill, of Reed City, Michigan:[25]

DISEASES

"One fall a number of years ago a party hunting with me shot a yearling buck, and while we were trailing it up in a thick cedar swamp, we found, strung along the brush, what proved

[24] Nat. Hist. Car., Flor., Bah. Ids., II, 1731–43.
[25] Sports Afield, March, 1900, p. 228.

to be a tape-worm fully 150 feet in length. This Deer was very poor."[36]

Writing of the Whitetail in Texas, A. Y. Walton, says:[37]

"They continued to be very abundant in all the country towards the coast until 1856, when an epizootic distemper, called "black tongue," broke out among them and killed them by the thousands. I have known this disease to occur in Louisiana and Texas, and have examined subjects affected by it. The most marked symptoms seem to be a general emaciation and wasting away of the system, a mucous discharge from the nostrils, and a sloughing of the hoofs, all evidently accompanied with a fever and thirst, for the dead were found mostly at or near the water."

Many years ago tuberculosis broke out among the Deer of a certain section of New England and, according to the late Jenness Richardson, destroyed many. It was a common thing in the evening, he said, to hear the Deer coughing in the woods. E. T. Murch, of Bangor, Maine, tells me that in 1901 there was much lung trouble among the Maine Deer. The victims were usually the older ones.

At Woburn Abbey I learned from the Duchess of Bedford that many Virginian Deer have died there of a parasitic disease of the lungs and stomach.

There have been, doubtless, many destructive epidemics among the Deer of America, but the right conjunction of disease and bacteriologist has not yet occurred, so that we have no authentic details. In this connection Judge Caton's observations on the Deer in his parks are the best available. He says[38] "that they are liable to distempers in the wild state, either epidemic or contagious, which sometimes carry off great numbers, we may not doubt, as we sometimes receive pretty well authenticated accounts of such calamities. Such accounts

[36] On writing to the hunter and his guide, Anthony Wenzel, I learned, further, that the end of the tape-worm came out of the bullet hole when the shot was fired, and continued unbroken to the carcass, in which were still two or three quarts of the parasite.

[37] Forest and Stream, June 15, 1895, p. 485.

[38] Antelope and Deer of America, 1877, pp. 341–3.

as I have noticed have, however, been confined to the Virginian Deer.

* * * * * * *

"I have lost many Virginian Deer with a swelling under the lower jaw. It commences two or three inches back of the chin, and finally swells out as to involve the whole head below the eyes; sometimes it gathers in a sac of half an ounce of pus-like matter, one of which I opened, but the Deer died. I never knew one to break itself. When the tame Deer are attacked with this distemper, and it is observed in time, I have never failed to cure it. If, when it first appears, it is examined, a small, hard kernel is found just under the skin. If this is then cut out the Deer gets well at once. Later, the lump seems to be dissipated, but if the swelling has not extended above the lower jaw, though it may be three inches long, and the protuberance an inch thick, and really has an alarming appearance, a deep central incision an inch or more long has always proved effectual. But as only the tame Deer, which can be caught, can be treated, all the wild Virginian Deer which have been attacked, so far as I know, have died. In the early part of my experiments this disease was much more prevalent than in later years, and so I conclude that those more remotely descended from the wild stock are the least liable to it. It only attacks the adults, or those more than two years old. I have no account that this disease has ever been observed among the wild Deer of the forest; certainly I have never seen one afflicted with it."

ACCIDENTS

Many a man on first seeing Deer dash through the dangerous, mazy wreck of a storm-track has wondered how they could escape with their lives. As a matter of fact, they suffer many accidents in their haste. I suppose that not one adult Deer in ten has escaped being snagged many times, as shown by scars on legs and belly. One very strange case of the sort is recorded from Montana by R. C. Fisk.[39] He shot a doe Whitetail that had a "fir branch over a foot long and over half an inch thick" driven into her body. It had entered between the fourth and fifth ribs on the right side, missed the

[39] Outdoor Life, December, 1898.

right lung, pierced the top of the diaphragm and the point of the liver, and rested against the under side of the backbone. "That the animal met with this accident while it was yet young [says Fisk] I am thoroughly convinced, for the end at the ribs had been entirely drawn into the opening of the heart and lungs, and had thoroughly healed on the outside. The skin, which I now have, shows only the faintest trace of a scar. There was not a particle of pus or inflammatory matter of any kind. In fact, the branch, covered as it was with the white skin, exactly resembled one of the long bones of the leg. The animal was healthy and fat and the meat was fine" (Fig. 30).

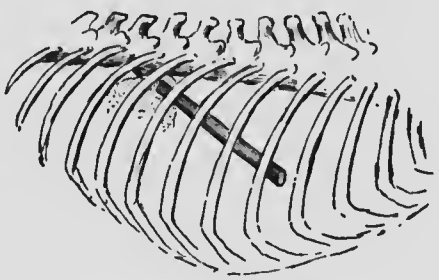


FIG. 30—The snag.
Redrawn from R. C. Fisk's sketch.

The ordinary gait of the Deer is a low, smooth bounding, with an occasional high jump. This low bounding is, at its best, I should estimate (according to the scale of speed as set forth in the Antelope), about twenty-seven or twenty-eight miles an hour. The ease with which the animal covers great spaces is marvellous. I have known a buck to clear a four-foot log and fifteen feet of ground in one leap. The occasional high jump, like the spy-hop of Jack-rabbit and springbok, is intended, no doubt, for purpose of observation.

SWIMMING

In the water, Whitetailed Deer are very much at home. They can go so fast that a canoe-man must race to overtake them; this means that they can swim for a time at four miles an hour. They are, indeed, so confident of their swimming powers that they invariably make for the water when hunted to extremity. There are many cases on record of Deer so pushed boldly striking out into the open sea, trusting to luck for finding another shore.

There is a record[40] of a Whitetail Deer captured at sea

[40] Forest and Stream, December 6, 1883, p. 362.

near Portland, Me., five miles from shore, and another[41] of one taken a mile and a half from Sachuest Point, R. I., as it was swimming at full speed *away from land*. In regions where there is plenty of open water the Deer have little to fear from Wolves and nothing at all from unaided dogs. In summer a Deer swims low in the water, showing little more than its head; and when shot it usually sinks. In the late fall it swims much higher, showing the back. This is due partly to the recently acquired fat, which has added more to its bulk than to its weight, but chiefly to the growth of the coat, each hair of which is a little barrel of air adding its flotation to the Deer. As Merriam says:[42] "When the blue coat, which grows very rapidly, is an inch in length, it will, as a rule, float the Deer that carries it, and this length is generally obtained about the first of October."

TRACKS AND SIGN

The tracks that are shown in Fig. 35 were drawn on the sandy shore of Big Dam Lake, forty miles from Kippewa, Que., September 15, 1906, . . show those of the buck, the doe, and the fawn. The t . . s of a pig (Fig. 33) and of a sheep (Fig. 31) are shown in contradiction of the statement that such may easily be mistaken for Deer tracks (Figs. 32, 34), even by the expert.

WALLOWS

In the mating season the European Red-deer makes what is known as a "*soiling pit.*" In some open glade he digs a hole in which the rain collects. This he paws and stirs till it becomes what our backwoodsmen would call "a regular dope." With the mud he besmears himself plentifully, rolling and grovelling in it like a hog that has only partly learned how to wallow. The habit is ascribed to both Moose and Wapiti, and is also seen to some extent in the Whitetailed Deer. What pleasure it gives the animal or what purpose it serves no one knows; but every hunter who finds one of these odoriferous cesspools of the forest knows at once that the bucks have begun to bestir themselves for the good of the next generation.

[41] Forest and Stream, April 4, 1896, p. 272.
[42] Mam. Adir., 1884, p. 130.

FIG. 31—Sheep tracks, front and hind, different sized sheep.

FIG. 33—Right feet of pig. August 6, 1903.

No clouts. Mud one-half in. deep.


FIG. 32—A. Hind-foot of Whitetail buck at full speed. B. Track of right fore-foot—5½ inches in length.

FIG. 34—Doe track.


FIG. 35—Tracks of Whitetail. Quebec, September 15, 1905.

A. Buck running after doe. From A to B he cleared, at one bound, 15 feet, and passed over the log X where it is 4½ feet from the ground. B. Doe, coming dripping out of the water, steps here about 18 inches; farther on she trotted and the steps a 2 2½ feet long. Her tracks register well; that is, the hind-foot falls in the mark of the front-foot. C. A half-grown fawn with the doe. For some reason its tracks do not register at all. Registering is better walking and especially lends silence to the tread.

SALT-LICKS

All our ruminants have a great fondness for salt and eagerly seek out anything of a salty nature that they can find in their native range. They doubtless need it for a tonic. Many different soluble mineral salts seem to satisfy this craving. Merriam calls attention[44] to one in the Adirondacks where "the Deer had licked the clay, possibly obtaining a trifle of potash, alumina, and iron derived from sulphates from decomposing pyrites."

LIFE OF THE DOE

If we begin in the early spring to follow the life of the Whitetail on its northern range, we shall find that up to the month of January the does and bucks are still in company. According to Audubon and Bachman,[45] it is only during the mating season that the sexes herd together. This is a general statement which has many exceptions, especially in the North. I think that both males and females are found in the deer-yards throughout the winter, and that young bucks may follow their mothers throughout their first year.

But the melting snow sets all free again. The older bucks go off in twos or threes, leaving the does to go their own way also, which they do in small groups, accompanied by their young of the year before.

All winter the herd has fed on twigs, moss, evergreens, and dry grass. Now, the new vegetation affords many changes of nutritious diet, consequently they begin to grow fatter, and the unborn young develop fast. The winter coat begins to drop and a general sleekness comes on both young and old. May sees the doe a renovated being, and usually also sees her alone, for now her 6½ months' gestation is nearing its end. Some day, about the middle of the month, she slinks quietly into a thick cover, perhaps a fallen tree-top, and there gives birth to her young. The number varies according to the age and vigour of the mother.

FAWNS

The first time, according to Audubon and Bachman,[46] "she has 1 fawn. If in good order, she has 2 the following year. A very large and healthy doe often produces 3, and we

[44] *Ibid.*, p. 135. [45] Quad. N. A., 1849, Vol. II, p. 226. [46] *Ibid.*, p. 226.

were present at Goose Creek when an immense one, killed by J. W. Audubon, was ascertained, on being opened, to contain 4 large and well-formed fawns. The average number of fawns in Carolina is 2, and the cases where 3 are produced are nearly as numerous as those in which the young does have only 1 at the birth."

Nevertheless, I have never heard of anyone seeing a doe actually accompanied by 4 fawns, or even 3. This recalls a fact that I have often noted: that in mammals the average number of young found in embryo is greater than the average found with the mother, even just after birth.

Audubon and Bachman say[46] that the doe does not produce till she is two years old; that is, the first fawn is born about the mother's second birthday. But A. N. Cheney has described[47] a remarkable case of a captive "female fawn born in 1895, that gave birth to a fawn of her own in 1896." I saw a case of this kind at Meeker, Colorado, in 1901. Dr. J. W. Collins showed me there a fifteen-months-old filly which, though not yet weaned, had produced the night before an abortive fœtus, which I examined carefully. It was apparently at three months' development. Dr. Collins knew nothing of its generation. Possibly this, as well as that above mentioned, was a case of *fœtus in fœto*.

Another strange instance is thus given by E. A. Weatherbee,[48] of Lincoln, Me.:

"Two years ago, in June, I went with a friend trout fishing on the Madunkeunk, a stream eight miles from here. At a place where the ground had been unusually soft by recent rains I saw some large Moose tracks, which were punched in to the depth of a foot. I told the boys to notice the tracks and passed on. One of the party called me to come back and see the Deer he had found. I had stepped directly over a track which contained a small fawn. It was dead and lay curled up in the track like a kitten. We thought it could not be over one day old, perhaps not that, and had either been dropped by the doe directly into

[46] *Ibid.*
[47] Forest and Stream, September 12, 1896, p. 205.
[48] Recreation Magazine, March, 1900, p. 205.

the Moose track or had fallen in and could not get out. It was about the size of a house cat, but with longer legs."

No North American member of the Deer family makes any pretence at a nest. The home of the young is the *neighbourhood* where they are born. They may consider the old tree-top their head-quarters, but they will lie in a different part of it every day. Moreover, in Texas, A. Y. Walton says:[49] "I have never known them to lie, at this stage of their life, as the young sheep and goats do, almost touching one another, but they lie with more or less distance separating them, never very far apart and never very close together."

The weight of the fawn at birth is about 4½ pounds.[50] J. W. Titcomb gives the weight of one at 3¼ pounds.[51]

The mother visits them perhaps half a dozen times a day to suckle them. I think that at night she lies next them to warm them, although the available testimony shows that, in the daytime, she frequents a solitary bed several yards away. I suppose that she never goes out of hearing of their squeak, except when in search of water. If found and handled at this time the fawns instinctively "play dead," are limp, silent, and unresisting.

Their natural enemies now are numerous. Bears, Wolves, Panthers, Lynxes, Fishers, dogs, Foxes, and eagles are the most dangerous of the large kind. But the spotted coats of the fawns and their death-like stillness are wonderful safeguards. Many hunters maintain, moreover, that fawns give out no scent. Doubtless this means that their body-scent is reduced to a minimum; and, since they do not travel, they leave no foot-scent at all.

There is one more large creature that some would put on the fawn's list of enemies (but, so far as I can learn, without good reason), and that is—*their own father*. I can believe that a doe coming upon a fawn clearly not her own, might

[49] Forest and Stream, June 15, 1895, p. 485.
[50] Hornaday, Am. Nat. Hist., 1904, p. 130.
[51] Forest and Stream, March 18, 1899, p. 205.

resent with a blow any attempted liberties, but I know of no reason for supposing that, in a wild state, the buck would go out of his way to injure his offspring.

The mother is ready at all times to render what defence she can to her fawn; and, unless hopelessly overmatched, she is wonderfully efficient. Her readiness to run to her young at their call of distress is (or was) often turned to unfair account by the hunters in the South-west. They manufactured a reed that imitated the fawn's bleat, and thus brought within gun-shot not only the anxious mother, but sometimes also the prowling Cougar and Lynx.

Natural questions that arise are: Does the mother never forget where she hid her young? Can she come back to the very spot in the unvaried woods, even when driven a mile or two away by some dreaded enemy?

In the vast majority of cases the mother's memory of the place enables her to come back to the very spot. Sometimes it happens that an enemy forces the little one to run and hide elsewhere, while the mother is away. In such cases, she sets to work to ransack the neighbourhood, to search the ground and the wind for a helpful scent, listening intently for every sound. A rustle or a squeak is enough to make her dash excitedly to the quarter whence it came. It is probable, though I have no conclusive proof, that now she *calls* for the fawn, as does a cow or a sheep whose young are missing.

In most cases her hearty endeavours succeed. But there is evidence that sometimes the end is a tragedy—that the fawns, like the children of the story, are lost in the woods.

The Moose and the Wapiti may hide their young two or three days, the Antelope for a week; but the Whitetail fawns are usually left in their first covert for a month or more.

At this age their rich brown coats are set off with pure white spots, like a brown log sprinkled with snow-drops, or flecked with spots of sunlight. This makes a colour scheme

that is protective as they crouch in the leaves, and is exquisitely beautiful when, later on, they bound or glide by their mother's side to the appreciative mirror furnished by their daily drinking pool.

At four or five weeks of age—that is, about the beginning of July—they begin to follow their mother. I examined one, however, that was found hidden in the grass near Dauphin Lake, Manitoba, as late as the 22d of August.

Analogy would prove that the fawns begin to eat solid food at this time. They develop rapidly and become very swift-footed. Some hunters maintain that they are even swifter than their parents, but this is, I think, not the case. As already noted, it is a rule that, of two animals going at the same rate, the smaller always *appears to be the faster*.

Their daily lives now are as unvaried as they can make them. They rest in some cool shelter during the heat of the morning, and about noon they go to their drinking place.

This daily drink is essential, and yet the map (p. 75) shows the Whitetail of the far South-west to be a dweller in arid country where no water is. Here, like the Antelope, they find their water-supply in the leaves and shoots of the provident cactus, which is among plants what the camel is among beasts—a living tank—able to store up, in times of rain, enough water for the thirsty days to come.

The mother Whitetail, after a copious draught, sufficient to last all day long, retires again with her family to chew the cud in their old retreat, where they escape the deer-flies and heat, but suffer the mosquitoes and ticks. As the sun lowers they get up and go forth stealthily to feed, perhaps by the margin of the forest, where grow their favourite grasses, or the nearest pond, where the lily-pads abound, and root, stem, or leaf provide a feast that will tempt the Deer from afar. They munch away till the night grows black, then sneak back to some other part of the home covert, rarely the same bed, where they doze or chew the cud till dawn comes on. Then, again, they take advantage of the half-light that they love, and go foraging till warned by the sunrise that they must once more hide away.

This is a skeleton of their daily programme in the wilderness, but they modify it considerably for life around the settlements. The noonday visit to the watering-place is dispensed with. Instead, they go by night. Foraging in daylight hours is given up. Secret and silent as the Coon, the Whitetail family lurks in their coppice all day, and at night go, not to the lily-padded shore but to the fields of grain, clover, turnips, or garden truck. Lightly the alert and shadow-like mother approaches the fence, behind in her track are the fawns—not even shadow-like, for they are actually invisible in their broken coats. A moment she listens; then, with a bound, she clears the fence and, followed by her young, lands in the banquet spread.

These visits are never during the day, nor are they during hours of black darkness, for even Deer require some light to see by. A favourite time for such a frontier foray is in the moonlight; and the rising of the moon is, in all much-hunted regions, a signal for the Deer to go forth. Many supposed irregularities in their habits will be explained by reference to the lunar calendar.

As September wanes there are two important changes in the fawns: first, they are weaned; second, they shed their spotted—their milk-spotted—coat; they are now fawns of the year. As Caton says,[52] they are weaned at about four months of age, but continue to follow the dam, "the males for one year, the females for two years." An exception to this rule is during that interesting first month of the little ones' lives. Then, the older sisters or brothers may be lurking in the neighbourhood; they join the mother at the drinking place; but during ing hours she does not want them near, and, if need be, ude means to prevent their coming.

In September, too, there is a disposition to reunite.

LIFE OF THE BUCK

The bucks shed their antlers in January—earlier, if very vigorous; weeks later, if puny. In Vermont, J. W. Titcomb's tame buck shed one antler on the 26th of February and the second on the 1st of March.[53] When the melting snow leaves

[52] Antelope and Deer of America, 1877, p. 308.
[53] Forest and Stream, March 18, 1899, p. 205.

the sexes free to seek or shun each other at their will, these turn their unantlered heads from the social herd, and wander off, usually two together, as with most of our horned ruminants.

Bare ground, with its sprouting grass and shoots, now supplies bountiful food. The surplus energies of the does go to the unborn young; that of the bucks to their budding antlers. These make their appearance from two to six weeks after the old ones are dropped.

FIG. 36—The Bonnechère head

From a Topley Studio photograph supplied by Norman H. H. Lett. This is the finest Whitetail set of which I have knowledge.
Beam, 26½ inches.
Spread, 24 inches.
Growth above burr, 5¾ inches.
Points, 24.
It was taken on Bonnechère River, Ont., about 1890, by J. Beckett.

Their growth goes on with the marvellous rapidity already noted. During the early stages they are so soft as to be almost plastic, and every accident to them is recorded in their shape. By August they are complete, though still in velvet. By the middle of September the buck has scraped them clean and polished them. Until the last two or three weeks the antlers have blood-vessels throbbing with blood; they have nerves and are sensitive, and they are integral parts of the animal's body.

The antlers are, of course, doomed to die and drop off within three months of reaching maturity. Death begins at the points and follows downward and inward till the whole structure is killed; and it is during the progress of this slow dying that the antlers fill the office for which they were created. This is well known, but Judge Caton, our great Deer authority, gives some surprising additional information.[84]

"The evidence," says he, "derived from a very great

[84] Antelope and Deer of America, 1877, p. 172.

multitude of observations, made through a course of years, is conclusive that nature prompts the animal to denude its antlers of their covering at a certain period of its growth, while yet the blood has as free access to that covering as it ever had."

That is to say, the buck voluntarily subjects himself to a painful operation while yet the horn is living and sensitive. Why? There must be good reason. I can only suppose that the earlier his antlers are cleaned, the sooner he can enter the arena in which wives go to the winner; natural selection, therefore, would tend to foster the habit.

All summer he has been living as quietly as the doe; sometimes frequenting the same places, but ignoring her if they chance there together. The margin of the forest and of the lake have powerful charms for him now, not only for his food supply, but because there he knows he can protect himself at once from the torment of the flies and the fiercer summer heat. In Audubon and Bachman[55] we find a most interesting case which shows his method of doing this, as well as the cunning of the old buck:

"To avoid the persecution of mosquitoes and ticks, it occasionally, like the Moose in Maine, resorts to some stream or pond and lies for a time immersed in the water, from which the nose and a part of the head only project. We recollect an occasion when, on sitting down to rest on the margin of the Santee River, we observed a pair of antlers on the surface of the water near an old tree, not ten steps from us. The half-closed eye of the buck was upon us; we were without a gun, and he was, therefore, safe from any injury we could inflict on him. Anxious to observe the cunning he would display, we turned our eyes another way and commenced a careless whistle, as if for our own amusement, walking gradually toward him in a circuitous route, until we arrived within a few feet of him. He had now sunk so deep in the water that an inch only of his nose and slight portions of his prongs were seen above the surface. We again sat down on the bank for

[55] Quad. N. A., 1849, Vol. II, p. 223.

some minutes, pretending to read a book. At length we suddenly directed our eyes toward him and raised our hand, when he rushed to the shore and dashed through the rattling canebrake in rapid style."

Late September is the season of nuts, and nuts are to the Deer what honey is to the Bear. Acorns in particular are their delight, and groves of oaks become a daily haunt of the reunited family. The effect of such rich food in quantity is quickly seen.

"Indeed," says Caton,[56] "it is astonishing to see how rapidly a buck and a doe will improve as soon as the acorns begin to fall. Ten days are sufficient to change a poor Deer to a fat one at the time when the summer coat is discarded and the glossy winter dress appears."

In view of this Deer's fondness for acorns it is interesting to note that in Sargent's map[57] the distribution of oaks in America east of the Rockies coincides closely with the range of the Whitetails.

SOCIAL AMUSEMENTS

If the Whitetail had any games or places of meeting, we should find them used at this season, when all are fat and free from care. But, so far as I have been able to learn, they do not slide, play "tag," or "king of the castle," splash or chase each other in circles, or in any way show that they have taken the first steps in the evolution of amusement.

RUT

As October comes on another change sets in with the bucks. Their necks begin to swell and their mating instincts to arouse. Hitherto they have been indifferent to the does when they met by chance, but now they set out to seek them. Of this I saw some signs on the Ottawa as early as the 15th of September. George Linklater, the guide there, assures me that he saw two bucks in full chase of a doe on the 10th of October.

[56] Antelope and Deer of America, 1877, p. 308.
[57] Atlas, Rep. Forest Trees N. A., 10th Census Office U. S. Dept. Int., 1884.

But the females are of another mind.

"The pursuit of the doe by the buck commences before her season has arrived, and hence for two or three weeks she remains as secluded as possible. He follows her track with his nose to the ground, and when started from her bed the race is very spirited." (Caton.[58])

An old hunter writes:[59] "Should anyone, hunting at this time in a good Deer range, observe a doe by herself, galloping along *with her tail down*, ever and anon looking back as if looking for something in pursuit and acting as if she were endeavouring to secrete herself, he should lose no time in availing himself of the situation."

This advice Dr. Bachman seems to have followed many years before it was given. He relates:[60] "We were one autumnal morning seated on a log in the pine lands of Carolina when a doe came running past us. In the course of ten minutes we observed a buck in pursuit, with his nose near the ground, following in all the windings of her course. Half an hour afterward came a second buck, and during another interval a third small buck pursued the same trail."

The buck does not gather around him a band of does as does the successful bull Wapiti, and it is sometimes said that he does not issue any sort of challenge. But the following curious paragraph by "Bachelor"[61] shows that he has both the disposition and the voice to challenge at times:

"Some years since, * * * I was still-hunting in Arkansas. * * * I had been standing several minutes when I heard three successive sounds, or noises, that were much louder and coarser than the whistle or snort of any Deer I had previously heard. At first I thought it some other animal, but presently he was in sight, and when within about 200 yards of me he ran into a flock of turkeys. He would single one out and chase it away, then another, until he had chased off nine or ten, likely all of the flock, when he returned to the line or track he was

[58] Antelope and Deer of America, 1877, p. 307.
[59] A. Y. Walton, Forest and Stream, June 15, 1895, p. 485.
[60] Quad. N. A., 1877, Vol. II, p. 227.
[61] Forest and Stream, October 5, 1895, p. 292.

following and came on, part of the time trotting and part of the time walking, but all the time travelling as if he were tracking something. When within eighty yards of me he came on my track and stopped, turning half around, giving me a fine shot. He was only a 3-point buck, and rather small for a 3-pointer, but he seemed to be on the warpath, judging by the way he chased the turkeys, and he seemed to care very little for me. Now, I have frequently heard Deer whistle when frightened, and have heard them snort from some cause, but this Deer made altogether a louder and different noise from either."

George Crawford and Linklater, guides of Mattawa, Ont., assure me that at this season the bucks utter a peculiar call, like a sheep bleating or like the creaking of two trees rubbing together.

As November, the true rutting time, draws near, the necks of the bucks become enormously enlarged. As early as the last week in October, Merriam measured[45] the neck of a buck that was 30 inches in circumference, only 10 inches behind the ear. Ordinarily it would have been about 20 around. The maximum development is attained about the middle of November, which is also the height of the rut.

A buck whose neck was 37 inches around, is recorded by A. N. Cheney.[46]

NOVEMBER MADNESS

Their whole nature seems to undergo a corresponding change at this time, and by November they are blind and mad with desire, as well as ready and eager to fight any of their own or other kind that seems likely to hinder their search for a mate.

"At this season [says Merriam[47]] the bucks not only fight among themselves, but occasionally attack man, and more than one unfortunate person has been gored to death by them. In battle they make use of their horns, and also of their fore-

[45] Merriam's Mam. Adir., 1884, p. 116.
[46] First Annual Report N. Y. State F. G. & F. Com., 1896, p. 201.
[47] Mam. Adir., 1884, p. 117.

feet, whose sharp hoofs are capable of inflicting terrible wounds. I was once sitting quietly on a log in a Deer park when a buck approached, and, making a sudden spring, dealt me such a powerful blow on the head with the hoofs of his fore-feet, as to render me unconscious. No sooner was I thrown upon the ground than the vicious beast sprang upon me and would doubtless have killed me outright had it not been for the intervention of a man, who rushed at him with a club and finally drove him off."

A similar experience is related by J. Parker Whitney.

"It is very rare [he says[a]] that a buck, however large and savage, will charge a stalker without provocation, but occasionally in the mating season, when wounded, they will charge. I had an encounter of this kind in 1859, on my second visit to this region, from which I escaped with scarcely a scratch, killing a buck which dressed up 230 pounds, with a single heart-thrust of my hunting-knife. It was before the day of the repeating rifles. I had barely time to drop my rifle and step aside and draw my hunting-knife when I was borne down into the snow by the weight of the descending buck, which I caught about the neck, and as he rose drove my knife to the hilt in his chest at the junction of the throat, severing his wind-pipe and splitting his heart. Death was instantaneous. I had difficulty in withdrawing myself quickly enough to escape the red torrent of life-blood which gushed forth."

If, however, the Deer is the conqueror, he never ceases to batter, spear, and trample his victim as long as any sign of life remains.

Several hunters have related to me how, when downed in the snow by some furious buck, they have saved their lives by feigning death. Their stillness convinced the stag that his revenge was complete, and he slowly withdrew, casting, nevertheless, many a backward glance to satisfy himself that truly his foe was done for.

But it is for the rival of his own race that his weapons

[a] Forest and Stream, December 26, 1896, p. 508.

are grown and his fiercest animosity poured out. Strange to tell, in battles with his own kind his antlers prove almost wholly weapons of defence. Desperate effort and trifling bloodshed seems to be a fair summary of the usual fight between two bucks.

A typical duel is thus described by Judge Caton:[66]

"The battle was joined by a rush together like rams, their faces bowed nearly to a level with the ground, when the clash of horns could have been heard at a great distance; but they did not again fall back to repeat the shock, as is usual with rams, but the battle was continued by pushing, guarding, and attempting to break each other's guard, and goading whenever a chance could be got, which was very rare. It was a trial of strength and endurance, assisted by skill in fencing and activity. The contest lasted for two hours without the animals being once separated, during which they fought over perhaps half an acre of ground. Almost from the beginning, both fought with their mouths open, for they do not protrude the tongue prominently like the ox, when breathing through the mouth. So evenly matched were they that both were nearly exhausted, when one at last suddenly turned tail to and fled; his adversary pursued him but a little way. I could not detect a scratch upon either sufficient to scrape off the hair, and the only punishment suffered was fatigue and a consciousness of defeat by the vanquished."

Still the affair must be considered a success, because it answers its purpose—it decides what the combatants set out to learn, namely, which is the better buck.

DURATION OF THE RUT

The rut of the Whitetail buck seems to be of unusual duration—commonly as long as two months. We cannot suppose it to be the same with the does. Many observations and inquiries lead me to conclude that the buck Whitetail is usually seen with one doe, sometimes with two, rarely with three, never more. It seems probable that the buck foregathers with some suitable female as soon as possible; but

[66] Antelope and Deer of America, 1877, p. 307.

her devotion does not last as long as his—no, not a quarter as long; and when she is no longer responsive he seeks another mate or mates. His ménage may be entirely changed, therefore, two or three times during the autumn period of excitement.

Thus the Whitetail, though far from monogamous, very flagrantly bigamous indeed, is still the least polygamous of our Deer.

In this connection, I note with interest that often the buck is seen leading the band; whereas, in the polygamous Wapiti and Red-deer, the leader is usually an old doe. One naturally asks the question, Is female leadership a penalty of polygamy? It would seem an inevitable outcome of the approved doctrine that the majority must be right.

In mid December, after this annual climax of their lives is over, the jealousies, the animosities, the aspirations of the males, the timidities and anxieties of the females are gradually forgotten. The Mad Moon wanes, a saner good-fellowship persists, and now the Whitetails—male, female, and young—roam in bands that are larger than at any other time of the year. Food is plentiful, and they fatten quickly, storing up (even as do Squirrel and Beaver) for the starvation-time ahead—only the Deer store it up in their persons, where it is available as soon as needed, where it helps to cover them from the cold, and whence it cannot be stolen, except "over their dead bodies," by a burglar stronger than the householder himself.

They wander thus, in their own little corner of the wilderness, till deepening snows cut down their daily roaming to a smaller reach, and still deeper till their countless tracks and trails, crossing and recrossing, make many safe foot-ways where the food is best, though roundabout them, twenty feet away, is the untrodden and deep-lying snow, that walls them in and holds them prisoners fast until its melting sets them free to live these many chapters over again.

TAMABILITY

Experience shows that young Whitetails, taken after they have begun to run with the mother, are so fully possessed of the feral nature that they remain wild and distrustful for the rest of their days in spite of all efforts to tame them; but that if caught during the hiding period of infancy, they are as easy to tame as puppies. Nevertheless, those who are tempted by opportunity would be warned that a Deer is the most treacherous of pets. The only change that domestication makes in them is to rob them of their fear of man. Their fierce, combative disposition remains and is ever ready to break out. Not only children and women but many strong men have met with tragic ends from some tame Deer—doe as often as buck—that was supposed to be the gentlest, loveliest creature on earth.

Merriam says:[67] "Both my father and myself have been knocked flat on the ground by being struck in the abdomen by the fore-feet of a very harmless looking doe."

TREACHEROUS PETS

I recollect a case that happened near Lindsay, Ont., during my early life. A tame Deer was confined in a certain orchard. The grandmother from the adjoining farm, paying a call, chanced to take a short cut through that orchard Hours afterward they found the shapeless remains of her body, cut and trampled to rags by the feet of the pet Deer that she had fed a hundred times.

One might easily collect scores of instances to show that all our American species of Deer—not only the bucks in autumn, but bucks or does in spring, summer, autumn, or winter—after the second year, *may* become dangerous animals, and are almost sure to become so if not fully inspired with fear of man.

Dr. W. T. Hornaday, who has had probably as much experience with captive animals as any man living in America, also writes a word of warning on the subject:[68]

"During the season immediately following the perfect development of the new antlers—say September, October, November—male Deer, Elk, Caribou, and Moose sometimes become as savage as whelp-robbed tigers. The neck swells

[67] Mam. Adir., 1884, p. 117.

[68] Amer. Nat. Hist., 1904, p. ...

far beyond its natural size, the eye-pits distend, and the buck goes stalking about with ears laid back and nostrils expanded, fairly spoiling for a fight. I have seen stags that were mild and gentle during eight or nine months of the year suddenly transformed into murderous demons, ready and anxious to stab to death any unarmed man who ventured near.

"At first a buck walks slowly up to his victim, makes a wry face, and with his sharp new antlers makes believe to play with him. Not wishing to be punctured, the intended victim lays hold of the antlers and seeks to keep them out of his vitals. On finding himself opposed the buck begins to drive forward like a battering ram, and then the struggle is on. Heaven help the man thus attacked, if no one is near! He shuts his teeth, grips the murderous beast with his strength, leans well forward, and, with all an nimbleness of desperation, struggles to maintain a grasp and keep his feet. Each passing instant the rage of the buck and his joy of combat increases. If the man goes down, and help fails to come quickly, his chances to escape the spears are few.

"Once, when unarmed and alone, I saved myself from an infuriated buck (fortunately a small one) by suddenly releasing one antler, seizing a fore-leg down, and pulling it up so high that the animal was powerless to lunge forward as he had been doing. In this way I held him at bay, and at last worked him to a spot where I secured a stout cudgel, with which I belaboured him so unmercifully that he was conquered for that day.

"The strength and fury of a buck of insignificant size are often beyond belief. The loving pet of May readily becomes the dangerous, fury-filled murderer of October. * * * Do not trust a pet of any male member of the Deer family after it is two years old."

It is the opinion of all who have studied tame Deer that they are more dangerous than tame Bears. A Bear, one knows, should be watched, and he has some respect for his friends. A Deer is always unsafe for every one, and no man should ever expose himself or his family to the possible treachery of such a pet.

USE TO MAN

There is no probability that the Whitetail will ever serve man in any domestic capacity, but it will always have a value by reason of its singular adaptability and gifts. It is the only one of our Deer that can live contentedly and unsuspectedly in a hundred acres of thicket. It is the only one that can sit unconcernedly all day long while factory whistles and bells are sounding around it, and yet distinguish at once the sinister twig-snap that tells of some prowling foe, as far away, perhaps, as the other noises. It is the only one that, hearing a hostile footfall, will sneak around to wind the cause, study its trail, and then glide, cat-like, through the brush to a further haven, without even trying to see the foe who thus gets no chance for a shot. It is the least migratory, the least polygamous, the least roving, as well as the swiftest, keenest, shyest, wisest, most prolific, and most successful of our Deer. It is the only one that has added to its range; that, in the North and West, has actually accompanied the settler into the woods; that has followed afar into newly opened parts of New England and Canada; that has fitted its map to man's, and that can hold its own on the frontier.

I shall always remember a scene at a mining-camp in Gilpin County, Col., some years ago. The Whitetailed Deer was known to have come into the region within a few years, and the Mule Blacktail was growing scarce. A man came in and said, as he stamped off the snow: "I just scared up a couple of Deer on the ridge."

An old hunter there became interested at once; he was minded to go, and reached for his gun. But, stopping, he said: "Whitetail or Blacktail?"

"Whitetail," was the reply.

"That settles it. A Blacktail I could get, but a scared Whitetail knows too much for me."

He sat down again and resumed his pipe.

The Whitetail is the American Deer of the past and the American Deer of the future. I have no doubt that whatever other species drop out of the hard fight, the Whitetail will

flourish in all the region of the plough as long as there are sentiments and laws to give it a time of respite each year during its breeding season.

In some ways it is no better game than others of our horned ruminants, but its habits fit it, in an unusual degree, to continue to exist in all parts of the country.

As a domestic animal it has not proved a success; but it may have another mission. The hunter makes the highest type of soldier, and the Whitetail makes the highest type of hunter that is widely possible to-day. The Whitetail trained the armies of the Revolution—even as the Antelope of the Veldt trained the Boers—and may supply the vital training of the country's armies in the future. When this people no longer has need of armies, when the nations learn war no more, and men cease to take pleasure in beautiful wild life—then only can we afford to lose the Whitetail Deer.

## III.

## Mule-deer, Mule Blacktail, Rocky Mountain Blacktail, Bounding Blacktail, or Jumping-deer.

*Odocoileus hemionus* (Rafinesque).

(Gr. *Odocoileus*, see ante; Gr. *hemionos*, a half-ass or mule.)

*Cervus hemionus* RAFINESQUE, 1817, Am. Month. Mag., I, October, p. 436.

*Odocoileus hemionus* MERRIAM, 1897, Proc. Biol. Soc. Wash., XII, p. 100.

TYPE LOCALITY.—Mouth of Sioux River, South Dakota.

FRENCH CANADIAN, *le Dain fauve à queue noire; le Cerf mulet.*

CREE, *Ap-is-chich'-i-koosh* or *Ah-pĕ-tchi-mu-sis'* (small Moose).

WOOD CREE & SAUT., *Muk-i-ti-wah'-no-wish* (black tail).

YANKTON SIOUX, *Tah-chah.*

OGALLALA SIOUX, *Tah-hen-cha'-la.*

When seen alive the Mule-deer strikes one as a large Deer with immense ears and white face which bears a large black patch on the forehead. From behind it shows an angular whitish patch taking in the tail, which latter has a black tip.

To the generic characters it adds the following:

SIZE Length, about 5½ feet (1,677 mm.); tail, 7 inches (177 mm.); hind-foot, 19½ inches (495 mm.); length of ear, about 10 inches (254 mm.); metatarsal gland, about 5 inches long (127 mm.).

The females are smaller.

WEIGHT A typical buck killed in Colorado, October 1, 1901, weighed 215¾ pounds. The largest of 5 that I weighed was 243½ pounds live weight, but I was told that specimens of 300

PLATE VI.—MULE-DEER FAWN.
(*Odocoileus hemionus* (Raf.).)

pounds weight were often taken. A doe killed in the Upper Wind River, Wyoming, weighed, after bleeding, 137½ pounds.

COLOUR

*Winter or blue coat.*—The above Colorado buck was in general of a warm brownish gray, thickly peppered with black tips and rings on the individual hairs. The inside of legs, the belly, and patch on buttocks are white. The face and throat are dull white with a large black patch on the forehead and a black bar around the chin. The tail is white, except the bunch on the tip, which is black all around. The legs below the knees and hocks are clear sienna brown. Sometimes the breast is brownish black.

This represents the blue coat; a month earlier it would have been much darker and slatier.

SUMMER OR RED COAT

*Summer or red coat.*—The red coat appears in May and is worn till late August. It is rusty yellow rather than red; the head, tail, and legs change little with the season.

The female is similar to the male, but duller. The fawn is dull yellowish, thickly spotted with white, as with the rest of the family.

CHANGE OF COAT

*Change of coat.*—The change from the very red coat to the very blue is made in Colorado about the end of August. The vigorous individuals are first to turn blue, the sickly last. As the change is somewhat abrupt and irregular it results in some very irregular effects and surprises. On September 3 I saw a Deer in red coat except the head, which was in blue. On September 4 I startled a fawn out of a thicket. As he passed into the open I saw that he was in bright red coat, but he took alarm, retreated into the thicket, and when he came out on the other side he was in bright blue. This was neither an optic illusion nor a lightning change. I found that he was all blue on the left side and all red on the other. Possibly this was a left-handed fawn that always lay on the left side, and so had completely worn the coat off there before it was broken on the right.

This red coat is remarkably conspicuous in the woods. It cannot be called protective, unless, perhaps, when the animal is among the red willows.

Five races of this species are recognized:

*hemionus* Raf., the typical form.
*californicus* Caton, with a dark stripe from the back along upper surface of tail.
*peninsulæ* Lyddeker, very small and brightly coloured.
*eremicus* Mearns, very pale.
*canus* Merriam, very small, pale, and gray.

From the Coast Blacktail (*O. columbianus*) the Mule Blacktail may be distinguished at once by the tail, which in *columbianus* is tapering from the base, and all above black, all below white; and by the metatarsal gland, which is about 3 inches long on the Coast Deer and about 5 inches on the Mule-deer.

Similarly, from the Virginian Deer or Whitetail it may be distinguished by the style of tail (which see) and the metatarsal gland, which in the Whitetail is about 1 inch long (Fig. 15).

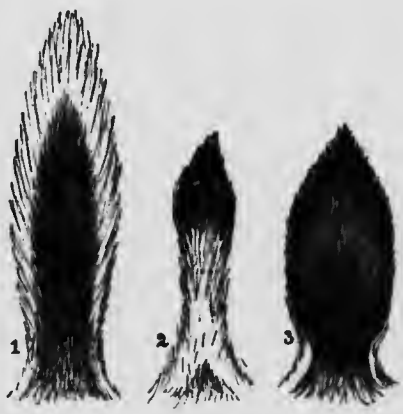



FIG. 37—Typical Tails.
1. Whitetail.
2. Mule-deer.
3. Coast Blacktail.

HISTORY Spaniard and Frenchman saw the Mule-deer long before any of the English race, but it was not described and named on paper till Lewis and Clark, in 1804, went up the Missouri on their famous journey. September 17 of that year, when on the Missouri below Sioux River, they wrote:[1]

"Among our acquisitions to-day were a Mule-deer, etc. * * * Captain Lewis and some men went out to hunt and killed * * * two Blacktailed Deer. * * * The Blacktailed or Mule-deer have much larger ears than the common Deer, and

[1] Lewis and Clark, Coues edition, 1893, Vol. 1, p. 121.

tail almost without hair except at the end where there is a bunch of black hair."

From this description Rafinesque, in 1817, gave it its first scientific name—*hemionus*, or 'the Mule.'

The name Jumping Deer, widely used in Manitoba, is derived from its wonderful gait.

## Life-history.

RANGE

The range, as set forth on Map 6, shows a surprisingly large extent of country—many faunal areas indeed—covered by the typical *hemionus*, without the appearance of corresponding races. In Manitoba it is barely holding its own, but on the Athabaska River it seeems to be spreading with agriculture. In ancient days it seems not to have ranged below Athabaska Landing, whereas now it is well known at least as far as Fort McMurray.

ENVIRONMENT

This is essentially a Deer of the lower hills or broken ground that is partly wooded. If we chart all the high mountains, the open plains, the dense continuous woods, and the swamps within the Mule-deer's range, and compare the result with a particular map of the animal's distribution, we shall find that the former are devoid of this species.

NUMBERS

Reference to the map (p. 119) shows that the keen-eyed discoverers of this Deer recognized it for a new kind as soon as they entered its country, from which we may also infer that it was abundant.

But what is meant by abundance? The September of 1901 I spent in the Flat-tops of Colorado, a favourite locality for the Mule Blacktail. During 27 days in wooded country I saw 750 Deer within easy rifle range. And they were not in herds at the time, but scattered; indeed, all seen were either single animals or families. Each day I saw from 10 to 80 Deer in a three or four mile walk. But the view was limited by the woods, so that I accepted the guide's estimate that they

numbered as high as 200 Deer to the square mile in favourite localities. But all localities are not equally good; 50 to the square mile would be more representative.

Yet everyone assured me that the Deer had greatly decreased in late years; that, indeed, they were *not half* so numerous as five years before, at which time 100 to the square mile might have prevailed throughout this high and favourite Deer country. The map shows that the chosen area is about 200 square miles, which would imply 20,000 Deer—figures which are more than justified by the reports of those who have watched along the main trail in the autumn, when these Deer move out to their winter home on the lower plains of Utah.

The total area of Blacktail country is 2,500,000 square miles. But it varies so in attractiveness that the Deer could not average more than 5 to the square mile; 10,000,000 would be a liberal allowance for the primitive Blacktail numbers. Thus they were far less numerous than the Whitetail.

On the other hand, they are far easier to kill. Their habits and their haunts lay them open to wholesale slaughter such as the Whitetail never knew. E. J. Duchesnay, C. E., of Ottawa, Ont., tells me that in the later 80's the winter haunts of the Blacktail in southern British Columbia were invaded by skin hunters. Thousands of the hides were sold at 25 cents a piece and the meat left in the woods to rot—a shameless destruction that finds a parallel among modern Egyptians, who, in their brutal blindness, are using priceless ancient papyri for fire-lighters.

Such methods could have but one result—the desolation of the range.

In September, 1896, I rode for 15 miles across the Badlands of the Little Missouri, with Howard Eaton, and saw in that time 3 Blacktail. Ten years before he had made that same ride and had seen 160. Since then they have further diminished. These figures unfortunately represent the shrinkage of the whole population. Although the nominal range is little changed it is probable that the present number of this


**MAP 6—PRIMITIVE RANGE OF THE MULE BLACKTAIL AND ITS FIVE RACES.**
*Odocoileus hemionus* (Raf.)

The outline remains to-day, though in many districts the species is exterminated. This map is founded on the accounts of numerous travellers, with personal experience in every State included, except Mexico, and on Dr. C. Hart Merriam's map in The Deer Family, 1903.

Deer is not a fiftieth of what it was; 400,000 as an estimate of Mule Blacktail to-day is *not under* the facts. I hope it is not too high.

IN MANITOBA

This Deer was scarce when first I came to Manitoba, in 1882. In all the region south of Carberry, between the Pine River and Sewell, there were, so the Indians told me, only 13 Deer. At all events, when one Chaska got that number in those sandhills there seemed to be none left.

In 1885 Deer were very scarce, but thanks to good game laws they have greatly increased and now exist in larger numbers than at any time since the settlement of the Province. They are found in all the Alleghanian region, where there is dry rolling country and cover.

ANTLERS

The antlers are very different from those of Whitetail, but resemble, somewhat, those of the Coast Deer. They are what scientists call dichotomous, that is, they are an arrangement of even forks, instead of having a main branch with snags. This, of course, is the type; the variations from it are endless, as suggested by the illustrations (Figs. 38 to 51). Their history of growth is much the same as that of the Whitetail.

No. 38—A remarkable Wyoming head.
In collection of Lewis S. Thompson, of Red Bank, N. J.

It is well known that the horns are in close touch with the sexual organs, and that any change, injury, or effect on these organs, is at once reflected in the horns. A remarkable illustration came from Colorado some years ago. Edwin Carter

FIG. 39—Mule-deer freak antlers.

1. Killed in Egeria Park, Colo. Now in E. Carter Collection.
2. Blacktail horns of Whitetail type. Taken near Meeker, Colo., 1894, by H. Campbell.
3. Taken near Meeker, Colo., in 1890, by Charles Givens.

tells me that the cowboys of Routt and Rio Blanco counties got the idea that they could improve the quality of their venison by castrating a large number of bucks. In the spring round-up of 1891 or thereabouts they castrated every Blacktail fawn they could find, and there were many.

The only known result was that in the years that followed some extraordinary freak antlers were seen among the Blacktail. The most curious one that I saw is illustrated in Fig. 46.

TAIL

The tail of a Deer should always be noticed by the sportsman. It is the surest easy external mark of identification for those not skilled in anatomy; that of the Mule-deer is shown in Fig. 37, No. 2.

Though the coat in general is changed twice a year, the hair on the tail, as Caton points out,[2] is shed but once a year, and the black switch on the tail of the present species is never shed at all. Thus it has passed through many stages of a

[2] Ant. and Deer Amer., 1877, p. 242.

FIG. 40—A 32-point head.
33⅝-inch spread; taken about 1884 in Middle Park, Colo. Now in E. Carter Collection.

FIG. 41—Br. Columbia head.
In Vancouver Club, Victoria, B. C. Spread, 30⅛ inches.

FIG. 42—Collected by G. M. Fear at Banff, Alta, in fall of 1893.
The buck was very old and very large; antlers still in velvet. Spread, 39 inches.

FIG. 43—A 3-antlered head.
From Meeker, Colo., 1892. Collection of W. R. McFadden, Denver. Spread, 25 inches.

FIG. 44—From Vernon, B. C.
Collection of W. F. Cameron. Spread, 36 inches. From photo. by C. W. Holliday.

FIG. 45—A 29-pointer.
29-inch spread. Taken at Banff, Alta. Now in collection of T. Wilson.

FIG. 46—Antler of emasculated buck.
Colorado, Feb., 1896. E. Carter Collection.

FIG. 49—From Swan River, Man., Dec., 1906.
Collection of E. W. Darbey.

FIG. 47—Taken near Meeker, Colo., about Nov. 1, 1900, by John Marshall.
Spread, 26 inches.

FIG. 50—Taken at Banff, Alta., by T. Wil[illegible], fall 1898.
At X the bone is 5 inches wide.

FIG. 48—Taken in Routt Co., Colo., by W. R. McFadden, 1896.

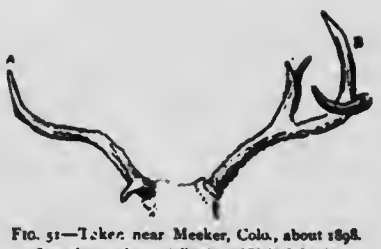


FIG. 51—Taken near Meeker, Colo., about 1898.
Spread, 25 inches. Collection of Blain & Purdy.

peculiar process. Most products of the skin are shed periodically—for example, the hairy coat of mammals, the outer skin of snakes, the feathers of birds—but some more highly specialized products, as the teeth of a snake, are shed at long intervals; those of still higher developments, as the rattle of a rattlesnake, the mane of a horse, or the beard of a gobbler, are so "expensive" that nature has economized in ordaining that they never be shed at all. Of this class are also the horns of a rhinoceros and the tuft on the Blacktail's tail.

The movements of the tail are as characteristic and expressive as its form. In bounding away the Whitetail holds its banner aloft and waves it from side to side. The Mule Blacktail carries its tail drooped and swings its black tuft back and forth over the white disk. Both species drop and quiver the tail when they are struck by the hunter's bullet.

VOICE, ETC. Though rather a silent Deer, this species has a number of sounds, with variations of each. The one most often heard is the "snort" or "blowing" of curiosity. The next is the whistle, simply a higher pitched and longer snort; this expresses alarm. The hunters generally credit the mother Deer with the utterance of a low, soft, murmuring sound, as she comes to the place where the fawn is hidden; a sound intended, no doubt, to let the little one know who it is that comes. And under circumstances of dire extremity, the does at least will utter a bleating like a sheep. Roosevelt credits[1] the bucks with uttering a barking challenge during the rutting season. The fawn, as is well known, bleats to call the mother's attention, especially when hungry or lost.

Another sound that is much used is made by the stamping with the forefoot. I have heard it when it seemed to mean defiance, but usually it means alarm, and spreads news of danger among those farther off.

MIGRANT The Blacktail is a migratory Deer in most of its range. Whenever so placed that a journey of 100 miles will take it

[1] The Deer Family, 1903, p. 48.

from high, bleak, and stormy, to low, warm, and sheltered, it fails not to travel in due season, and settle in bands where there is sufficient promise of food and cover.

In the Bitterroots of Idaho the Blacktail seemed scarce when I camped there in September and October, 1902. I did not see half a dozen during that time, and the tracks were far from plentiful. Yet every winter, the guides assured me, 700 to 800 Blacktail could be seen in a six-mile walk along that same creek.

The best-defined migration that I know of takes place each year in the Colorado Rockies. All summer long the Deer on the Flat-tops flourish, as already described, but the first touch of winter, usually in the early part of October, sends out the whole population, almost in a body, to seek some winter range where the snow is less dangerously deep.

Following the well-known, well-worn pathways, they travel steadily downward and westward. Their numbers increase as they go and the pathways become more worn and less numerous until, after a journey of 100 to 150 miles, they reach the open and semi-arid brakes of the Uintah country in Utah.

By coming here they eliminate at least the danger of deep snow, but the region is full of enemies, and the survivors of the host very gladly turn their noses to the hills again, as soon as the melting of the upper snow permits it.

In Manitoba I have seen no sign of such migration. The Deer that frequent the sandhills south of Carberry are, so far as I know, quite stationary. For the obvious reason that there they find plenty of cover and food, and not too much snow, they cannot better themselves by any seasonal change of surroundings.

HOME RANGE

In my many hunting-trips in the hills about Carberry, during the early 80's, I noticed that the Blacktail was satisfied with a very small home ground, if let alone. I knew a band of three or four Deer that spent several weeks in a wood of less than 100 acres, on the north side of Mitchell's Plain. When at length driven out of this they circled around Chaska-water,

the Lookout Hill, and sometimes went as far west as the Sewell woods and south to the Big Swamp, but never, so far as I could learn, more than four or five miles from their central woods. To this they always returned in a few days, as it abounded in good cover and the peavine that affords their favourite winter food.

Another band that I knew in the eastern sandhills showed the same adherence to a small locality along Pine Creek. The farthest south at which I found these at any time was Lee's Sandhill, that is, 4 or 5 miles from home.

From these observations and the corroboration of several hunters I conclude that the winter range of the Blacktail is but five or six miles across. In more open country it may be larger, in rougher country very much smaller.

During the summer I suspect they are satisfied with a still more limited home ground, since the hunters and hunger—their two great incentives to travel—are then inoperative.

In Colorado I was told of one large buck that for five years inhabited the little valley of Iker's Creek.

I remember a Deer, a barren doe, that lived all summer (1892) on the south side of Chaska-water (west of Carberry, Manitoba), within a mile of the lake. I am not sure that it was the same animal, but think so, because the Deer were exceedingly scarce that year; I saw tracks of only one Deer, never those of bucks or fawns; I saw these near the water, but none whatever in the belt of country farther away on each side; its whole range, then, was less than two square miles.

Thus each fresh observation seems to reduce further the extent of the individual range. Nevertheless, I think that the Blacktail's home region is larger than that of the Whitetail.

LIFE

The opening of the year with the Romans, the Indians, and all the wild things, including the Blacktail Deer, is the end of winter. Then comes the new birth, the new hope, the new start, the real new year. Let us, therefore, begin to follow the Blacktail from the New Year's Day of the Wilds.

The mixed company of all ages and sexes that wintered together take advantage of the melted snow and better forage to scatter from the place where common interest in the food supply had kept them together. There is in particular a repulsion between the sexes: if two Deer go off together at this time they are two bucks or two does, but never buck and doe.

BUCKS

The association of pairs of bucks is a curious, well-known fact.

Among the Red-deer of Scotland it is the rule for each big stag to have with him, all summer, a small stag as attendant or "squire." This follower is said to do sentinel duty for his superior at all times except during the rut, when he is most unceremoniously driven about his business elsewhere. Whether any parallel to this exists in the present species remains to be seen. It is, of course, quite common to see two bucks living together all summer, and one is usually bigger than the other, but observations are lacking to explain their relationship.

DOES

The does become still less sociable as the May moon wanes, and are now to be seen feeding and living alone. Grass and twigs are their staple foods, but there is little of vegetable origin that they will not eat. They drink twice a day, morning and evening. They are getting fat now and preparing for the great event of the year—the arrival of the young ones. This takes place in late May or in June. In some quiet woodsy hollow the 1, 2 or, rarely, 3 fawns are born. They appear in the white-spotted livery of true fawn-deer. It is like that of a young Whitetail, but the ground colour is duller, paler, and yellower.

FAWNS

The mother hides them usually at different points in the same thicket and comes to suckle them in the early morn and late evening for six or even eight weeks before she allows them to follow her. As late as July 30, in Manitoba, I have known the fawn to be hidden, though now well grown and probably seven or eight weeks old. The mother's vigilance and devotion at this time are most admirable. Every possible danger

is studied, and every creature that might injure her little ones is either fought or misled to the utmost of her powers.

At Carberry, Manitoba, on July 30, 1884, I saw a well-grown fawn that was found by Adam Shaw in the sandhills near Pine Creek. It had been hiding in the bushes, and was caught by the dogs. Its bleating brought the mother. She circled about, but did not dare to attack the numerous foe. This fawn was raised on cow's milk and—protected by a conspicuous collar—continued for years about Carberry.

In the latter part of July, 1896, W. R. McFadden, of Denver, while riding in the half-open country on the head of Calf Creek, in north-western Colorado, 60 miles beyond Hank's Peak, discovered a doe Blacktail, with her two fawns, in the long grass. He crawled up to within twenty-five feet before they saw him. The mother's back, that is, the back of her head, was toward him, so he rose up slowly; but she caught a glimpse of the enemy, gave a low snort, threw up her head, and sprang to one side in three or four bounds, then commenced to "blow" or "whistle."

The fawns slunk into the grass immediately, skulking as low as possible, and after going ten feet or so in different directions crouched and lay like sage hens, with heads down flat. They were about ten feet apart, and although so near to McFadden he had great difficulty in finding them; for, owing to the long grass, their stillness, and their colour they were wonderfully well concealed.

The mother ran off a long way, but circled near, whistling and trying to lead the intruder away.

On yet another occasion this fortunate observer was favoured with a peep into the nursery life and ways of the Blacktail. Early one August, while travelling on the headwaters of Trout Creek (between Routt and Rio Blanco Counties, Colorado), he saw a fawn with the mother and marked down the little one; although he knew within twenty feet of where it was, he could not find it in the grass. After looking for some time McFadden hid behind a tree. In fifteen or twenty minutes he saw a slight movement in the grass, then

slowly there came up the head and ears of the fawn. It looked cautiously about without rising; then the hunter showed himself. In a flash the fawn's head went down and it lay as still as a stone, with ears laid back on the neck. McFadden stood still within four feet of it, and at length it began to raise its head, but again dropped it on seeing him. He stepped nearer and stooped down; then the fawn leaped out and disappeared in the woods, not in the direction taken by its mother. This was a well-grown buck fawn, and had stub horns an inch long.

When I was at Marvine Lodge, Colorado, in September, 1901, I met several instances of the mother Blacktail's devotion. One day a Red-tailed Hawk, wheeling low and whistling over the hillside, was fiercely watched by a mother doe, whose bristling rump-patch showed what she felt. Doubtless she took him for an eagle.

At the same place, on September 17, William Purdy startled a Coyote, which ran across the river flat and up the farther hillside. A doe Blacktail with two fawns was on the hill, and all three watched the Coyote with intense interest until it became clear that he was coming toward them. When he was within 50 yards the doe left the fawns and rushed out at the enemy. He ran as fast as he could, with the doe in full chase, for about 400 yards, then she gave it up and returned in triumph to her young ones.

By the middle of August the fawns are following their mother, and now the spots on the coat have become somewhat dim.

An exceptional case came under my observation in Colorado, on September 3, 1901. My pack-train had halted while the men shot some grouse. After half a dozen shots three fawns got up from the grass among the horses, inspected them very deliberately, then quietly walked away.

By the first of September in Colorado most of the young appear in the new uniform coat. On September 7, however, I saw two fawns still bearing well-marked spots. By the end

of the month all the young except the very late ones are weaned and appear in the unspotted blue coat. They continue with the mother, however, and profit daily by her guidance and protection.

On September 28 I saw one in full blue coat, wandering alone and bleating piteously, announcing to all who heard that "here was a lost fawn"—an action not without its dangers, for a Lynx or Coyote was as likely to hear as the mother of the stray, and would understand the situation just as perfectly.

THE FATHER

So far as known, the buck takes no interest in the fawns, that is, he lives up to the rule of polygamous animals by ignoring the mating tie as soon as the season of its grosser pleasures is over. I do not, however, believe at all the notion that the buck makes a practice of killing the fawns. The thing is impossible on the face of it. This would indeed be "race suicide."

There are numberless cases of bucks killing fawns, but not, I think, as deliberate murders. It is rather the result of the impatient blow or thrust of a strong Deer at another that gets in its way, only in this case the second one was so weak that the result was fatal.

THE RUT

The mating season of the Mule-deer is at about the same time as that of the Whitetail, that is, November is their Moon of Madness. But it may last until late in December. On December 24, 1884, at Carberry, I saw a pair of this species in the full ardour of their time.

E. Carter, of Breckenridge, Col., tells me that once in the autumn he saw two large buck Blacktail and a doe coming over a ridge; a long way behind was a small buck. The two big bucks, after many threats, closed in for a fight, and while so engaged the little buck secured the doe.

Was this a failure of the survival of the fittest, or was it proof of the supremacy of mind over matter?

FATALITIES RARE

Fatalities seem to be very rare as a consequence of these battles, and all that I can find recorded are the result of interlocked antlers. The antlers themselves are developed along

lines that prevent the bucks hurting each other, rather than as deadly weapons, and in most cases the battle is little more than a pushing bout.

WINTER LIFE

During winter the Blacktail continue in mixed bands of all ages and sexes, usually under the leadership of an old doe who is the great grandmother of most of them.

In some favoured parts of the country these winter bands become very large. For example, in the Bitterroots, as already noted, and on the Okanagan, as I learn from E. J. Duchesnay, C. E. About April 1, 1892, as he was riding around the south-west corner of Dog Lake, which is an expansion of Okanagan River, he came on numerous bands of Blacktailed Deer, and during the day saw between 400 and 500. At one time the bunches were so thick that the whole of a hillside seemed moving with Deer.

Their food at this time is twigs, browse, what ground stuff they can get by nosing and pawing under the snow, and what tree stuff they can reach by standing on their hind legs. The various tree mosses, beardy-mosses, and lichen are especially sought after. My guide in that country, Abe Leeds, of Hamilton, Mont., described an interesting circumstance in the winter life of a fawn. It was in the winter of 1898–9 he went with his partner to the Upper Clearwater to build a shanty as head-quarters for hunting-trips. Deer were plentiful, and some began, as usual, to hang around where they salted the horses; among them was a little fawn of the year. He was a miserable, pot-bellied little specimen, seeming as though he had been left at an early age to shift for himself. He spent his whole time about the camp; the men began to put mossy branches where he could get them, and soon he came regularly to be fed. Each day they cut down a mossy tree for him, and at length he would come tearing down the hill as soon as he heard the axe, then would stand with his head cocked to one side, watching till he saw where the tree was going to fall, and would be into the top as soon as it touched the ground.

A big buck also learned the meaning of the tree-felling,

and used to come when they were gone and chase the little runt away. One day the hunter's partner saw the buck throw the runt head over heels, so he seized his gun and shot the bully dead. This was the only Deer they killed out of season.

When they came away, in the springtime, the runt was there still, but had now grown quite fat.

Through the winter and spring the young follow the mother and get at least the advantage of wise leadership and example. When about a year old they leave her, probably because she compels them to do so, as an instinctive preparation for the new family. There is reason, however, for believing that the young does continue to associate more or less with the mother all through their second season.

ENEMIES

Next after the rifle-bearing hunter the worst enemy of the Mule-deer is deep snow. It forms a league with famine to hide their food on the ground, and to prevent them travelling in search of that which grows higher. It betrays them to yet another foe—the Mountain Lion or Cougar.

When the Blacktail bands come down the mountain to settle in winter cover the Mountain Lion does the same. Now he knows just where to find his prey; now, thanks to the snow, it cannot escape him. He settles down then in the locality as in a private game preserve, or like some epicure with a larder stocked with game, so richly stocked, indeed, that he is tempted into shameful waste. One Deer a week is all he possibly can use, and yet I have been assured by such guides as Goff and Leeds that in wantonness of slaughter he will kill two or three a day until the band is all cleared out, then travel complacently over the snow in search of another winter colony.

Next to Lions we must place the Wolves, which also work havoc in the winter yards, but of this I have seen nothing personally. Coyotes, Lynxes, eagles, etc., take yearly toll of the fawns, but they are not to be reckoned among the dangerous foes of the species.

BIRD ASSOCIATES

Again and again I have had my attention attracted to lurking Deer by the bluejay and wiskajon. Every hunter tells the same story, but it seems that it works both ways. These birds are as likely to betray the hunter as the game, and many times they warn the Deer of the approaching hunter. What good these busybodies get by their interference I cannot comprehend. The case is of a kind that is widely known in all game countries.

FREEZING

Every hunter learns, and every wild animal seems to know instinctively, the value of "freezing," that is, becoming still as a frozen thing, when a stranger is discovered in the woods. The motionless object escapes notice and is better placed to notice others. The Mule-deer is an adept at freezing.

On September 3 I met a young buck some 40 yards off in the woods. We both froze at the same time. He kept his pose for half a minute, then turned and bounded off.

On the evening of September 6, 1901, my wife and I took a walk from camp, near Pagoda Peak, Col. A hundred yards away, in an open glade, was a Deer. It raised its head, gazed at us, and froze. It was in shadow and we were against the sky. We gazed at each other for a minute, then I whispered, "Let us see how long by the watch it will keep on," and cautiously opened my watch. After one and one-half minutes my companion said, "Why, that is no Deer, it's a stump." She raised her hand and the Deer bounded off.

But the most interesting case was noted next day.

As I went through the woods at sundown I came on a doe. She was walking through an open place about 60 yards away, but she saw me just as I saw her. In fact, we met face to face. At the same moment we both froze and stood gazing, each waiting for the other to make the first move.

I waited three or four minutes at least, but she did not stir. Then it occurred to me to time her. I very slowly slid my hand up to my watch and stood as before, the Deer still watching me.

One minute—two minutes—five minutes went by, and

still the Deer did not move. I began to wonder if I had not made a mistake after all, and watched a stump that had somewhat the form of a Deer. Then I thought, "No, I *saw* her walk there." Six minutes—eight minutes—ten minutes passed and still the Deer stood.

"It is not possible," I said to myself, "no Deer would stand like that for ten minutes. And yet there she is. That was plainly a Deer when it went there." I waited another minute—still no move. "I'll give her five minutes more, and if there is no move I shall know I have been fooled by a stump." Eleven and a half minutes, not counting the time before my watch was out, and there was a change, for it *was* a Deer that had been so intently watching me all the time, and it so happened that she now decided that *she* had been fooled by a stump. She changed her pose, turned to graze, and I had won the game of "freeze." I brought my camera slowly to bear and snapped it, but the light was too poor to get a picture. The Deer now saw *me* move and bounded away.

SLEEPING

J. B. Goff tells me that he has often come on Deer standing asleep in the daytime, with tightly closed eyes, and has sometimes approached within twenty feet. One day he watched a ranger named Jack Dunn as he crawled up to one of these sleeping Deer and caught its hind leg. Then ensued a remarkable fight, in which finally Dunn, though much scratched and dragged about, succeeded in killing the Deer with his knife.

BEDS

Deer beds are well known in the Deer ranges. They are hollow nests in prominent but sheltered places on the hillsides and hilltops, roughly circular, and about four feet across. They are used continually, possibly by the same individuals, and some of them are remarkably deep. One which I examined on Wilson's Flat-tops, Col., September 26, 1901, was on the hillside facing east and cut down three feet at the back to make a comfortable saucer shape.

At one point on the main trail where it crossed a burnt ridge was what the guides called a "*deer hotel*." It covered

about 25 yards square and contained about 70 beds, all of which bore evidence of having been used for years, as well as last night. There were 14 tiers of hollows like shelves, the largest contained 7 beds, the shortest 3, many were large enough for 2 Deer. In each bed the dust was pawed soft and fine.

The only sanitary efforts of this species seems to be the periodic seeking of the salt-licks. So far as I could learn it does not make a wallow.

SCRAPES

In origin similar to the beds, but probably akin to the wallows of Elk and Moose, are the "scrapes." These are simply areas of about a square yard, scraped clean of grass and leaves. They are made in autumn and are usually in moist places. I have seen many of them in Colorado, but have no evidence beyond the opinions of hunters that they are made by the bucks.

SWIMMING

This Deer can swim if it must, but it rarely needs to do it, and a photograph by Wallihan shows it to ride very low in the water. I imagine it to be the least aquatic of those found in our country.

AMUSEMENTS

Judge Caton has a very poor opinion of the Mule-deer's character. He considers it cowardly and treacherous above all its kind, but says:[4] "The Mule-deer is the only one I have ever seen manifest a clear and decided disposition to play. This they do something after the manner of lambs, by running courses and gambolling about, and running up and down the bluffs, manifestly for amusement only. I have once noticed something like this in a Common Deer, but at the best it was the faintest sort of play, if indeed that was its meaning. * * * But the Mule-deer not only amuses itself in the way described, but loves to have me join him in a little sham fight, and if I handle him a little roughly, or try to throw him down when he rears up and places his feet on my shoulders, he will recover and jump sideways and backward, twisting himself into grotesque

[4] Antelope and Deer of America, 1877, pp. 296–7.

attitudes, though he does this in an awkward way. I have not observed this disposition to play, after the animal is two or three years old, and the male seems more inclined to it than the female. I elsewhere mention that he sometimes appears to become very appreciative of his own importance, when he will strut around, his tail elevated to a vertical position, as is observed with the male goat."

Similar testimony is borne by many Colorado hunters. McFadden tells me that he has seen *five* of the fawns playing in this same way.

DISEASES AND ACCIDENTS

Those who have not thought of it before are surprised to learn that the old idea of man being *the* diseased animal is without foundation. To such it comes with a shock when they learn that practically all animals are more or less diseased, that none are perfect. The Mule-deer has many troubles of its own, as the following record of Deer examined in Routt County, Col., will show:

September 2, 1901, Lost Creek. Found a dead fawn much inflated; did not dissect it.

September 6, Pagoda Creek. C. E. shot a 2-year-old young buck; it weighed 153 pounds and seemed in perfect condition, but it had in the back a hole an inch deep as though it had been recently snagged. In its intestines was a worm 12 inches long and ⅛ inch thick; in the fat of the loins was a hydatid cyst (embryo of tapeworm) like a bag of jelly about 1 inch by 2 inches.

This buck had both ears split; it looked, the guide said, like the ear-mark of the "Cross-bar Z" Cattle Ranch.

September 12, Pagoda Creek. L. H. shot a 3-year-old buck; it weighed 226½ pounds. It was very fat and seemed free of all disease. It was accompanying a much larger buck.

September 18, Lost Park. L. H. shot a large buck. At first sight he thought it was an Elk, it was so large and pale in colour. It turned out to be a miserable cripple. It had evidently snagged itself badly some weeks before. There was a large hole into the belly; the entrails had been pierced by the

spike and much of their contents was loose in the cavity. The small bowels were highly inflamed and showed a dark purplish red. In the omentum I found over a dozen of the hydatid cysts. One corner of one lung was badly congested; the horns were large, but still in velvet. It was still in red coat, but this was much bleached, very scanty, and harsh. It was miserably thin and poor; and I wondered that it could continue to live with so many ailments.

September 21, Wilson's Flat-tops. J. B. shot a fine, fat buck. It weighed 243½ pounds. Its right hind leg had been broken in the middle of the shank (metatarsus) and healed in a clumsy knob. This Deer seemed quite healthy, but I found in the fat on the bowels 5 of the hydatid cysts.

September 25, Wilson's Flat-tops. Found a male fawn, dead about a week. In blue coat and fine condition, the only wound a small hole in the belly just under the loose flank. Possibly made by a buck's horn. I did not dissect it.

September 26, Wilson's Flat-tops, Col. Down by Deer Creek I found a female fawn, evidently dead about a week. It was in full blue coat and fine condition. Its right eye was bloody and there was blood at its nose as though it had been killed by a blow, but its neck was not broken. It was much blown up with gas. I did not dissect it. Goff says that at this season many die of a "bloat."

September 27, Wilson's Flat-tops. W. P. shot a young buck; it weighed 150½ pounds. It had no diseases or parasites, but the hoofs of the front feet were much splintered and broken, nearly an inch lacking on each.

October 1, Wilson's Flat-tops. G. G. S. shot a large buck; it weighed 215¾ pounds; was in good condition; the only sign of disease was a small body like a black bean in the omentum, but it had been snagged twice, once slightly in the breast and once very deeply in the ham. It had a front leg broken, but that was now healed.

Finally, a curious case was shown me by E. Carter, of Breckenridge, in October, 1899. In 1887 one Eli Loback had killed a Blacktail in Egeria Park, Col. On being skinned, it

proved to have been badly snagged some years before. The snag, a dry branch of spruce, 8 inches long and ¾-inch thick, had pierced the shoulder-blade, broken two ribs and entered 8 inches into the chest, where it still rested. It was completely encysted. The animal was fat and healthy (Fig. 52).

Thus one may well realize that trouble is not exclusively

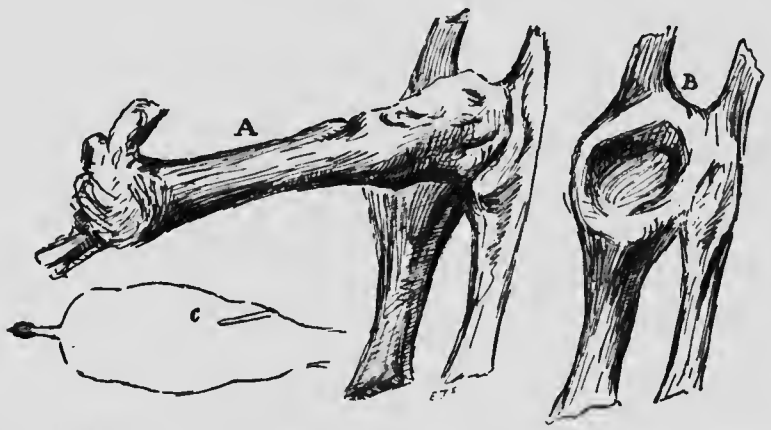



FIG. 52—A. The snag. B. The cap formed over the end by the ribs. C. The Deer, showing course of snag.

the lot of man, and that our brethren of hoofs and horns have their full share, without the human mind to point the way of comfort or to aggravate the ills by dwelling on them.

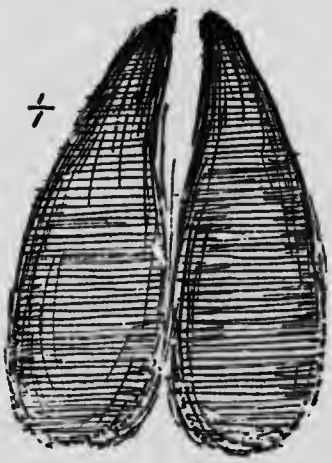
GAIT

The Mule-deer walks and trots like others of the Family, but when it comes to speeding it does not run like the Whitetail, but goes with a peculiar bounding, in which, with little leg movement, it rises as by an effort of the toes, leaping from all four and landing on all four. This action is seen also in the Coast Deer, but is quite different from the much swifter running of Whitetail and Antelope.

In the various parts of its wide range this fine animal has received names that reflect one or other of its peculiarities; thus Mule-deer or Donkey-deer (Burro) from its ears, Mule-tail Deer and Blacktail from its tail. But the best of its many names is "Bounding Blacktail"; in this we see the record of

Fig. 53—Blacktail, July 5, 1897.


Fig. 54—Track of Mule Blacktail.
The right-hand line in deep soft sand.
Oct. 6, 1898.



its most wonderful gift. I shall never forget the first time I saw this bounding in the sandhills near Carberry. It was my first sight not merely of Blacktail but of any wild Deer, and the marvelious manner of its flight, as entered in my journal of the time, ran thus:

"I stood gazing at the graceful creatures for a moment or two, then they moved off a little and commenced to rise in the air with a peculiar bounding movement, although without any apparent effort. They seemed to be playing, their movements were so entirely without any appearance of haste or alarm. It did not occur to me at first that they were running away. The idea I had in my mind of a Deer speeding was formed on seeing a dog or fox. I expected to see the laboured straining and the vast athletic bounds. But no! these evidently had not yet commenced to run, they seemed to be merely bounding up and down in the air, and it was only on noting the different hilltops which their feet touched lightly in succession and by seeing the fair, rounded forms rapidly becoming smaller in the distance that it dawned on me that *now* they were flying for safety.

"Higher and higher they rose each time; gracefully their bodies swayed inward as they described a curve along some bold ridge, or for a long space the white bannerets seemed hanging in the air, while these wingless birds were really sailing over a deep gully. I stood gazing until they were out of sight, and it never occured to me to shoot.

"When they were gone I went to their trail, where they had appeared to be rising and falling over the same place. Here was one track, where was the next? I looked all round, and was surprised to see a blank for 15 feet. I went on—another blank, and again and again. The blanks increased to 18 feet, then to 20 and then to 25. Each of these playful, effortless bounds covered a space of 18 to 25 feet. Ye gods! they do not run at all, they *fly*, and once in a while come down again to tap the hilltops with their dainty hoofs."

There is nothing more poetic in four-legged speed than the flight of the bounding Blacktail, and I have shown it to more

than one man as a thing which none had ever seen before—which I alone had witnessed and discovered. But following the wonder and pleasure of the discovery came a disappointment—this graceful flight, these light-foot bounds, are not so speedy as they seem and not so easy as they look, are frightfully laborious indeed. By slow degrees the conviction came that the Blacktail, winged as it seems, cannot run with the Whitetail. It has not the speed; it has not the endurance; the bounding is a thing of grace and beauty, but no more—the low running of the Eastern Deer is a better gait. So it seemed, so I believed it, as though this were not a contradiction, impossible in nature. This much is sure, that for all such strange things there is a most excellent reason and it is always rewarding to seek it out.

Why, then, these mighty, futile bounds? Thirteen years later I learned. Riding the Little Missouri hills, in 1897, with a company of wolf-hunters and followed by a pack of diverse dogs—trailing dogs, fighting dogs, and greyhounds, fleetest of their race to overtake the flying foe, we came by chance on a prey we sought not—a Blacktail mother with her twins. Great-eyed, great-eared, they stood at gaze, all three. We tried to turn our pack aside, but the greyhounds sighted game, and off like arrows shot they went, and the Blacktail turned for flight. We did our best to call the hounds away, but who can turn a greyhound from a foe that runs? Away they sped and the Blacktail sped away. How the memories of my youth came back as I watched them bounding along the level bottomlands, bounding—bounding—oh, it was beautiful, it was glorious, but it was sad! For, notwithstanding all their wondrous powers, their winged heels, *they were losing time.* The greyhounds, far behind at first, were low skimming like prairie hawks, were making three yards to the Blacktail's two, were gaining, went faster yet, were winning, would surely win. In vain we tried to ride ahead to cut them off, to turn or call them back; their speed, their mad impetuosity, grew only faster and fiercer. In spite of every effort, we knew that in a few minutes we should see three defenceless Blacktail mangled by our hounds.

On and on the chase. The little ones were suffering now, were weakening. It was a question of barely a quarter mile.

FIG. 55—Young buck.
Carberry, Manitoba. December, 1886.
This illustrates the typical style of antler.

Then we riders saw a thing that touched our hearts—that poor devoted mother, in despair, dropped back behind—deliberately it seemed—at least her young should have a chance, and my blood rushed hot. My hand sought the gun in reckless determination to stop those dogs. Only twenty-five yards ahead the mother now, when all at once an inspiration came. The unseen prompter whispered wisdom, and the mother turned

aside, made for the rugged piling hills so near, she—all three—soon reached their base and tapped with their toes, then rose in air to land some fifteen feet above, and tapped again—and tapped and tapped all three; and so they rose and sailed and soared. The greyhounds reached the rise and there were lost; their kingdom was the level plain; on the rugged hills they were helpless, balked, and left behind. But the mother and her two went bounding, soaring like hill-hawks, and so they sailed away till hidden in the heights, and safely at peace.

That day I learned the meaning of the bounding. These are the Deer of the broken lands; theirs is the way of the uplands; this pace is their gift, their power and their hold on life.

# IV.
## The Moose, or Flat-horned Elk.

*Alces americanus* Jardine.
(Gr. *alces*, an elk; L. *americanus*, American.)

*Alces americanus* JARDINE, 1835, Nat. Lib. XXI, p. 125
TYPE LOCALITY.—Eastern Canada.

FRENCH CANADIAN, *l'Orignal.*
CREE, *Moose, moos-wa.*
OJIB., *Moose.*
CHIPEWYAN, *Ten-nee'.*
YANKTON SIOUX, *Tahg-chah.*
OGALLALA SIOUX, *Tah.*

The genus *Alces* (Jardine, 1835) has all the characteristics of the Family (the *Cervidæ*) to which it belongs, but, further, has broadly palmated antlers, found only on the male, pendulous, muscular muzzle, with a small, naked triangular space between the nostrils, short neck and tail, small tarsal and no metatarsal glands; both sexes carry on the throat a bell or dewlap covered with long hair. In size these are the largest of living Deer, equalling or exceeding a horse in stature.

$$\text{Teeth: Inc.}\frac{0-0}{4-4};\ \text{can.}\frac{0-0}{0-0};\ \text{prem.}\frac{3-3}{3-3};\ \text{mol.}\frac{3-3}{3-3}=32$$

COLOUR

A fine bull Moose shot near Kippewa, Que., by Mrs. E. T. Seton, September 25, 1905, in prime condition, was black on fore-legs, breast, shoulders, flanks, and hams, shading into rusty brown on withers, back, neck, and head; palest on nose and lips and shading into white on the belly; the insides of the ears also are whitish, the legs from the knee to the ground are a pale warm gray or Caribou colour. The appearance of the

PLATE VII.—MOOSE FAMILY IN EARLY WINTER.

(*Alces americanus* Jardine.)

animal at a distance is that of a black beast, with brown head and white stockings. This is typical of all Eastern Moose; the coat fades toward springtime.

The sexes are much alike.

The calf is dull reddish brown without spots; it turns darker at three months.

The above bull measured as follows: SIZE

Length, 9 feet 6½ inches (2,896 mm.); snout to occiput 2 feet 5 inches (737 mm.); tail, 2½ inches (63 mm.); hind [illegible] 2 feet 7¼ inches (794 mm.); height at shoulders, 6 feet [illegible] mm.); length of ear, 10 inches (254 mm.); spread of antlers, 57⅜ inches (1,457 mm.).

The brow-tines were palmated continuously with the main web. These horns are figured on page 160. The individual was past his prime. He had several battle scars on his shoulders, and his right ear was badly torn by some recent encounter.

An ordinary bull Moose stands 6 feet high at the withers. HEIGHT

C. H. Stonebridge, of New York, tells me that while hunting at Chesuncook Lake, Maine, in October, 1897, he killed a bull Moose that was 6 feet 8 inches at the withers after skinning.

W. J. Hayes, of New York, records[1] that a young Moose shot in Nova Scotia stood 6 feet 9 inches at the shoulders, although on examination of the teeth, horns, etc., it proved to be only three years old.

William L. Roberts, of Springfield, Mass., is stated[2] to have killed a Nova Scotia Moose that measured 6 feet 10 inches at the withers.

One still larger, taken in New Brunswick by Carl Rungius, the animal painter, measured 7 feet at the withers as it lay on the ground.[3]

But the record-bearer in point of stature was killed at Mattawa, Que., in October, 1895, by Dr. Hamilton Vreeland and his brother. It stood 7 feet 4 inches at the withers.[4]

[1] Am. Nat., June, 1871, p. 251.
[2] Forest and Stream, November 25, 1899, p. 426.
[3] Hornaday, Am. Nat. Hist., 1904, p. 140.
[4] Recreation Magazine, February, 1896, p. 65.

Thus far I have dealt only with the Canadian Moose. The Alaskan Moose, of course, overtops it. The largest that I have found recorded by any competent authority was killed and measured[5] by Dall de Weese on the Yukon in September, 1897, and was 7 feet 8 inches at the withers.

WEIGHT

Not many authentic weights of Moose have been recorded, because of the difficulties of getting the scales and the Moose together. For long we had nothing but the hunters' guesses, which, of course, are of the same order as fishermen's. Now, however, we have some trustworthy evidence.

The only Moose I ever killed gave 500 pounds (Fairbanks scales) of dressed meat, which, according to butchers' reckoning, would be a live weight of 900 pounds; as he lay he measured 6 feet 2 inches at the withers, which means about 6 feet alive. He was of medium size.

S. L. Crosby, of Bangor, Maine, an undoubted authority, says:[6] "I have weighed several Moose; the heaviest was 1,009 pounds, without blood and entrails, which would surely have weighed 250 to 300 pounds." By actual weight I found that a 562-pound bull Wapiti lost 120 pounds when his blood and entrails were removed, so that Crosby's estimate appears fair, and his big Moose surely weighed nearly 1,300 pounds.

A large Moose killed near Penadomcook, Maine, by W. I. Miller, September, 1892, dressed 1,123 pounds,[7] equal to a live weight of over 1,400 pounds.

Three forms of Moose are recognized:

*americanus* Jardine. The Canadian or typical Moose.

*gigas* Miller. The great Alaskan Moose, which differs from *americanus* chiefly in being much larger.

*alces* Linnæus. The Old World Moose or Elk, the smallest and grayest.

[5] *Ibid.*, February, 1898, p. 151.

[6] *Ibid.*, January, 1896, p. 89.

[7] Recreation Magazine, March, 1895, p. 249.

HISTORY

The intrepid French voyageurs of the sixteenth century were the original explorers of northern North America and the first civilized men to see the Canadian Moose.

When they met with the Wapiti, the Virginian Deer, the Bear, and the Wolf, they, not being trained taxonomists, had no difficulty in satisfying themselves that these were identical with the animals they had known in *la belle France*, and named or misnamed them accordingly. The Wapiti became the "Cerf du Canada"; the Virginian Deer the "Dain" or Fallow Deer; the Bear and Wolf were yet more easily catalogued. But when these enterprising travellers found themselves confronted with the Moose, they were silent—nonplussed. Nothing like this had ever been seen "at home." He was "une type, un original,"[8] hence the French name *l'orignal*, *l'orignat*, or *l'orignac*.

The educated Frenchmen who had a literary knowledge of the European Elk made a feeble attempt to call this animal by its European name. Lescarbot writing, about 1609, of "The Chase" in New France, says:[9] "But first let us speak of the Ellan, which they [the Indians] call Aptaptou and our Basques, Orignacs. * * * It is the most abundant game which the savages have after the Fish." Sagard Theodat calls them "Eslans ov Orignats."[10]

Charlevoix, in 1744, uses "*elan*" once by way of explanation and "*orignal*" elsewhere throughout. Thus the lower-class nomenclature won, and it holds the ground to-day.[11]

The English had similar troubles, with even less light, for they were farmers, and in information and travel they were far behind the polished French chevaliers who exploited New France. They got out of their difficulty by adopting the Indian word "Moose," which, as pronounced in an Indian nose, is *mong-soa* or *mongswa*, said to mean "twig-eater." What a happy thing for our lexicographers had the early Scandinavian

[8] Madison Grant suggests that it is rather an adapted Basque word of quite different signification.

[9] Histoire de la Nouvelle France, Marc Lescarbot, 1618, p. 893.

[10] G. Sagard Theodat, Hist. du Canada, 1636, p. 308.

[11] F. F. X. de Charlevoix, Hist. descr. gen. Nouv. France, 1744.

explorers completed their conquest and allowed the noble creature its proper birthright in the name of *Elk!* But Moose it is, and not so bad, since it makes no confusion. Would that the Wapiti, Pronghorned Antelope, White Goat-antelope, and Bison were as happily placed!

FIG. 56—Earliest known drawing of a Moose: on Lescarbot's map (1609) of Port Royal, Nova Scotia.

Lescarbot's account, cited above, is the earliest mention I can find of the Moose. Cartier did not see the species in his famous journey to Hochelaga [Montreal] in 1535; at least he does not speak of it, which is pretty good proof, since he saw and wrote of many beasts.

Also the earliest drawing of Moose that I can find is on Lescarbot's map (1609) of Port Royal, Nova Scotia. The Moose (or *l'orignal*, as he calls it) was the characteristic animal of that region and therefore used as decoration of the map at *Rivière de l'orignac.*[12]

## LIFE-HISTORY.

In making the map of range (p. 151) I have tried to be conservative.[13] A number of outlying records are shown by crosses.

These are as follows:

In Prince Edward Island the Moose are now extinct, but "there are occasionally found palmated horns." (C. Birch Bagster, Pr. Ed. Id., 1861, p. 85.)

Massachusetts. "The Moose formerly undoubtedly existed in Massachusetts." (J. A. Allen, Cat. Mam. Mass. Bull. Mus. Comp. Zool., 1869, pp. 143–257.)

[12] *Loc. cit.*, p. 440.

[13] It is founded on the account of many travellers and the records of the Biological Survey of the Department of Agriculture, Washington, D. C.

Catskills, N. Y. Moose "ranged throughout nearly the whole of New England, and in New York as far south as the Catskills. (Madison Grant, "The Vanishing Moose," Century Magazine, January, 1894, p. 347.)

Colorado. "Remains of a Moose (*Alce americana*) said to have been killed in South Park, Col., in 1871, were observed by the Expedition. The statement is open to doubt; if correct it fixes the southernmost limit of the species." (H. C. Yarrow, Zool. West of 100 Mer., 1875, p. 71.)

? Colorado. "In the summer of 1887 I saw a small pair of well-bleached Moose antlers, on the dirt roof of a log cabin near the foot of Sweet Water Lake, about 15 miles north of Dotsero, which is a station on the Denver and Rio Grande Railway, about 12 miles east of Glenwood Springs, Col. The cabin was at least five or six years old, perhaps twice as old. It was at that time owned by a man named Peal, who told me that the Moose was the only one that had ever been known to be in that country, and was killed while with a band of Elk or a bunch of stock, I have forgotten which." (H. W. Skinner, of Chicago, in letter, March 4, 1901.)

? Oregon. "About eight years ago, while I and two others were hunting Deer on the head of the South Fork of Silver Creek, in Marion County, Ore., we found a pair of Moose horns in a fair state of preservation." (Abe Kromling, of Melville, Clatsop County, Ore., in letter, August 8, 1899.)

Records supported only by the finding of recent antlers are to be received with caution; and especially so when the antlers are imperfect. In several cases the supposed fragment of Moose antler has turned out to be merely an abnormal palmation from the common deer.

There is one peculiarity of the Moose range that is almost unique, at least among our Deer. Many observers state that Moose are *now found* in such and such a large region *where formerly they were unknown*. It has always seemed to me more likely that in these cases Moose are now common *where formerly rare*. If Moose can live there to-day, why not in primitive times?

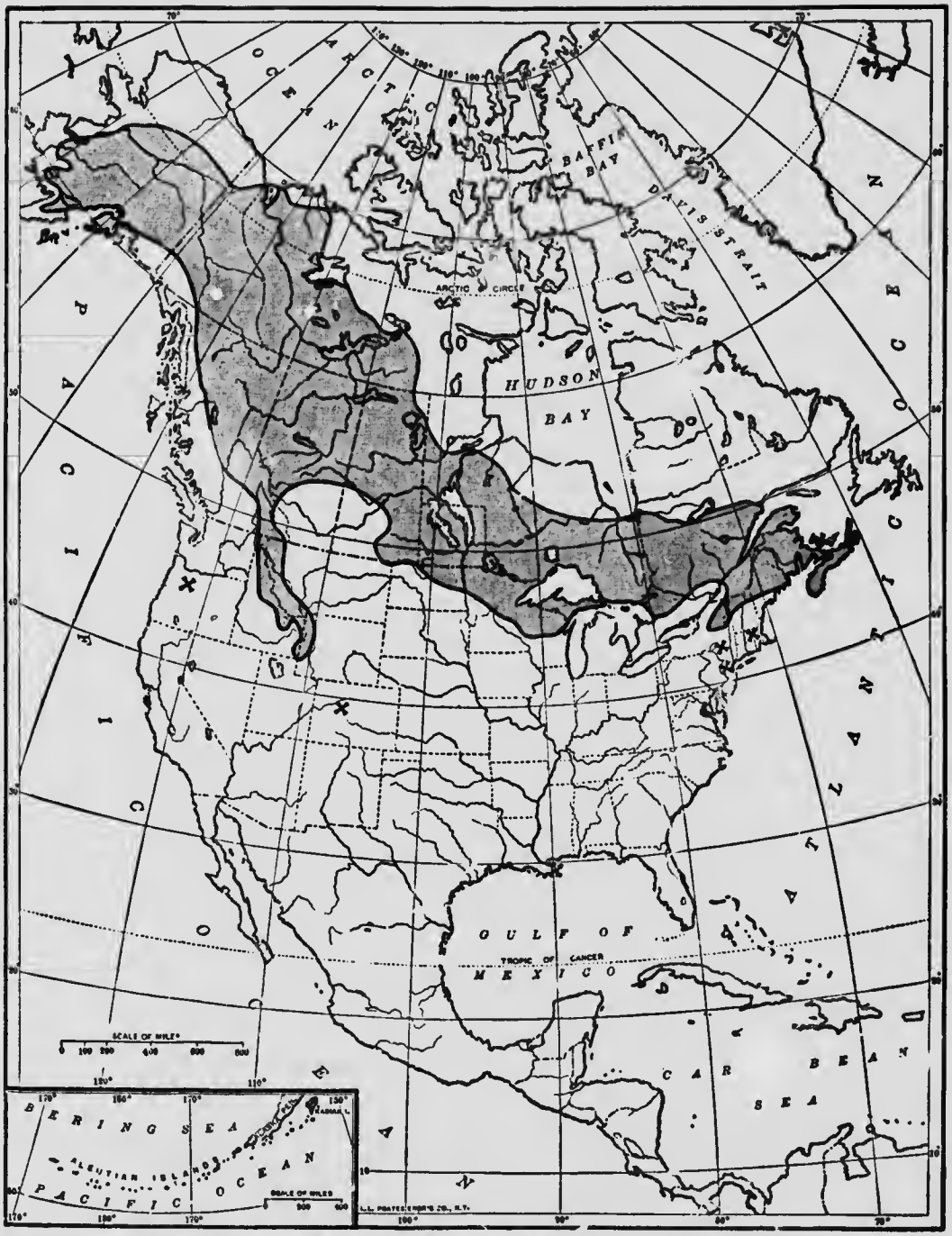
But the statements of many reliable travellers, among them Dr. Robert Bell, of the Canadian Geological Survey, are not to be ignored. Doubtless there is yet a curious chapter to be written on the distribution of the species. Dr. Bell says:[14] "The Moose or American Elk (*Alces americanus*) migrates slowly from one large area to another through periods extending over many years. For example, in the Gaspé Peninsula the last interval between its leaving and again returning to the same district was upward of half a century, and in the region between the Upper Great Lakes and James Bay the period between his last withdrawal and reappearance has been still longer."

The map shows, therefore, where the Moose was found at any time. The parts where it is known to have been exterminated by man are remarkably small, comprising, chiefly, Cape Breton and a strip in the United States along the southern border of the dotted area. The range of the Moose was actually more limited twenty years ago than it is to-day, for good game laws have resulted in a general increase of its numbers over much territory where once it was near extermination.

There is one oft-quoted error that requires correction. Richardson, Caton, and many others, who should have known better, say that formerly the Moose *ranged south to the Ohio*. All these writers refer to DuPratz as authority, but not one of them seems to have looked up DuPratz. Here is his whole statement:[15] "This is what we call the Wabache, and what *in Canada* and *New England* they call the Ohio. * * *

[14] Mammoth and Mastodon Remains, Hudson's Bay, Bull. Geol. Soc. Am., June 1898, p. 376.

[15] DuPratz, The Hist. Louis. Vol. I, pp. 300–1.




**MAP 7—PRIMITIVE RANGE OF THE MOOSE (but little changed to-day).**

*Alces americanus* Jardine.

This map is founded on the reports of numerous travellers and on many personal observations, with assistance in Alaska from the Biological Survey Map published by the United States Department of Agriculture in the Yearbook, 1907.
The extra-limital records are detailed on pp. 148-9.

To the north of this river lies Canada. * * * On the north of the Wabache we first began to see the Originaux." That is *in Canada*. He clearly distinguishes Canada from the land of Illinois, which name he applies to the country north of the Wabash on his map. Furthermore, he includes the whole of the Ohio valley as part of Louisiana, and in his list (*loc. cit.*) of "Quadrupeds" of Louisiana does not mention the *Orignal*, though he gives Buffalo, Stag [Wapiti], and Deer.

In a word, then, I find not the slightest reason here (or elsewhere) for believing that the Moose ever was found south of the Ohio, or indeed anywhere on the south shore of Lakes Erie and Ontario.

The range of this noble animal is likely to be artificially extended within the next few years. Thus, attempts are being made to introduce it into Newfoundland. The success of this is doubtful, but there is no reason why the Moose should not be restored to its ancient realm in the Adirondacks where once it was very numerous, and where it was exterminated only as late as 1861. The undertaking is in charge of a society, of which Harry V. Radford, the enterprising secretary, has sent me (1906) the following report:

"The first purchases of Moose were made by the State in 1902, and a few more were bought and liberated in 1903. In all only 12 had been liberated—at least half of which were bulls.

* * * * * * *

"Up to the present we have not been able to make such headway with the Moose for want of funds. Unfortunately, at the very outset of the enterprise it received a serious setback in the killing—accidental or malicious—of four or five of the Moose, most of which were cows. However, the remainder have held their own during the past few years, and they are occasionally seen in some part of the woods. The advocates of restoration claim—with reason and justice, we believe—that the Moose project has not yet been given a fair test, and that if we can only get enough released so as to make

a fair start there is no reason why we may not hope for as much success as has been had with the Wapiti."

HOME REGION

No wild animal roams at random. All have a certain range that they consider home. Some have two of these, one for summer, the other for winter, and these are called migratory animals. The Moose has but one home, and that it keeps to the year round. As a general rule the extent of an animal's range corresponds somewhat with its size. A Deer range is larger than that of a Rabbit because its wants are greater. Flesh-eaters are of course on a different basis. The Moose appears to be the widest ranger of the non-migratory ruminants.

The Carberry Swamp was the home of a small band of Moose that never left its limits at any time, so far as I could learn, though it was but three miles wide by ten long. The Moose that inhabit the east slopes of the Teton Mountains in Jackson's Hole, Wyoming, are known to continue all year in a narrow belt about three miles by ten on the east of Jackson's Lake. In the Bitterroot Mountains a few individuals live in the narrow valleys on the west slope of the mountain, and though these valleys are rarely over half a mile wide, the Moose seem content to dwell permanently in a part of them that is not more than two or three miles long.

While the Wolf and Fox may greatly extend their home range in winter time, the Moose and some others seem to restrict themselves to a smaller locality then than in summer, no doubt on account of the difficulty of travelling in the snow.

In the winter, according to all testimony, the Moose is satisfied with so small a range that it is called the winter yard. This may be less even than 50 acres. Indeed, George H. Measham writes me from Manitoba that he has known a family of 4 Moose to pass all winter within a radius of 300 feet. Having found a suitable place to yard, a family will stay there until the snow is gone, the food fails, or they are driven out by hunters. I should think that ordinarily a Moose, especially a cow, passes its life within 10 miles of the spot where it was born.

Although the species has no orderly migration, so far as

known, there is evidence of a migratory instinct, in the erratic wanderings of individuals, especially of the young bulls in their second and third years.

NUMBERS At the Moose's ordinary rate of increase, how long should it be in doubling its numbers? Supposing, for example, 100 Moose, equally divided in sex, to be shut up within an ample forest. Although 2 calves is the rule, they would be far from doubled at the end of the first year; for, of the 50 cows, some would go barren that year, some would lose their calves, some would have but 1, and many accidents would make a continual drain. Experience shows that under the most favourable circumstances we could not reckon on an annual increase of more than one-fifth of the herd. This would continue until the whole range was fully populated; that is, until checked by the food limits, the number would double in about five years. Evidently then an annual drain of one-quarter would lessen the number of Moose, but if the drain were one-fifth they might hold their own; if it were but one-sixth they might increase.

With these facts in view, let us take the report of G. H. Measham, an old resident of Manitoba. Writing from Shoal Lake, north-west of Winnipeg, in 1900, he says:

"The Moose is, however, far from being scarce or in much danger of becoming extinct. I can safely state that within 50 miles of Winnipeg there are hundreds of Moose, and that within 100 miles there are thousands of them.

"For example, in the districts of St. Laurent and Oak Point there must be some 60 or 70 hunters. Cutting them down to 2 Moose per annum, that would mean 130 Moose killed. Now it would be more nearly true to state the year's kill at 500 head of Deer, mostly Moose, and all killed in the municipality of Posen, and the greater part in townships 21 and 22, ranges 5 and 6, west of 1st Meridian. This slaughter has gone on for years, yet the Moose are still there, and lots of them. The fact is, that though there are districts (like Fisher River, Posen, Lake St. Martin, and so on) that are much hunted, yet there are vast districts that are practically un-

touched. The Indian hunter does not, nowadays, travel very far from his reserve, and I have reason to believe that the Moose are not only holding their own, but increasing."

The area in question is about 500 square miles. According to these figures there is a Moose population of a round 1,000, or 2 to the square mile. This is what most hunters consider fairly good Moose country, although a rate 10 times as high is found in some localities.

The entire range of the Moose is about 3,500,000 square miles, but it is not all equally good; at a very rough estimate, we may put the number on the whole range at a round million of Moose.

ANTLERS

The record-bearer for spread among antlers of the Canadian Moose is the 68¼-inch pair taken by Dr. W. L. Munro, of Providence, R. I., on the Nepisiguit, N. B., October 12, 1907.[1]

The previous record pair were those taken by F. H. Cook, of Leominster, Mass., in New Brunswick, October, 1898. These, as measured by S. L. Crosby, of Bangor, at the time of capture, were 67 inches from tip to tip. During the intervening eight years they have shrunk a little, by inevitable drying, and to-day are only 65¼ inches across. They now hang in the Leominster Club, at Leominster, Mass., where I examined them (Fig. 64).

Fig. 57—The 68¼-inch New Brunswick Moose, taken by Dr. W. L. Munro, of Providence, R. I., October 12, 1907.

Next comes a 66-inch pair,[17] also from New Brunswick, now in the collection of Stephen Decatur, of Portsmouth, N. H., and after them a 65-inch pair from Manitoba, belonging to Otho Shaw.[18]

[16] I have since learned of the 70-inch head secured by Lewis M. Gibb, of New York, in Caughnawana Club Preserve, Pontiac Co., Que., October 10, 1906. E. T. S.

[17] R. Ward's Records of Big Game, 1899, p. 11.

[18] *Ibid.*, p. 10.

FIG. 58—Freak head from Manitoba, 1899.
In collection of George Grieve, Winnipeg.
The spike below is 24 inches long. Right horn, 27 inches long; girth, 9; points, 8. Left horn, 33⅞ inches long; girth, 9; points, 10.

FIG. 61—From the Upper Ottawa, 1897.
The horns were porous and spongy; probably the animal had been emasculated.
Specimen now in collection of James H. Fleming, Toronto, Ontario.
(Greatest spread, 46 inches.)

FIG. 59—Abnormal antlers of three-yaar-old Moose shot at Lake Winnipeg, 1904.
Now in the possession of E. W. Darbey, of Winnipeg.
Spread, 31 inches; girth of right beam, 4 inches; of left, 4½ inches.

FIG. 62—From Manitoba.
In collection of Alex. Calder, of Winnipeg. (47 inches spread.)

FIG. 60—In Museum Can. Geol. Survey, Ottawa.
His right antler is 38 inches long.

FIG. 63—From Manitoba, Dec., 1905.
In collection of E. W. Darbey.

FIG. 64—Sixty-seven-inch Moose head from New Brunswick.
Shot by F. H. Cook, of Leominster, Mass., October, 1898.
Drawn from a photograph supplied by W. B. Chase, Esq.

FIG. 65—Sixty-four-inch Moose head from St. Louis County, Minn.
Killed by H. C. Percival, of Mine Centre, Ont.
Drawn from Recreation photograph, May, 1899.

FIG. 66—Winnipeg Moose.
Ideal 56-inch head; 34 points even.
Killed by H. C. Pierce, of St. Louis, November, 1890.
Drawn from photograph in Forest and Stream.

The Bierstadt head killed in New Brunswick, in 1880, is a marvel of palmation and size. Its spread is 64⅛ inches.[19]

Minnesota follows closely with a 64-inch head killed by H. C. Percival (of Mine Centre, Ont.), in St. Louis County, Minn.[20] These are singularly symmetrical, even to the pendant on the under side of each (Fig. 65).

A pair taken 90 miles north-east of Winnipeg by H. C. Pierce, of St. Louis, Mo.,[21] though only 56-inch spread, represent, to my mind, the most beautiful type of Moose antler. They have broad curving shovels behind, and a bold sweep of many-serried and even points in the brow clusters; it is a question whether, with due allowance for points of merit, they do not rank first among those of Canadian Moose. These four I have not personally examined (Fig. 66).

The record antlers of Alaska Moose, now in the Field Columbian Museum, measure 77½ inches across the widest part, and with the dry skull weighed 91 pounds. Prof. D. G. Elliott informed me that, when first shot, the hunter measured them at 84 inches across (Fig. 71).

C. Phillipps-Wolley writes me that there is in the Union Club, Victoria, B. C., a 76-inch head killed near Cook's Inlet, by A. S. Reed.

In view of the fact that weight, ruggedness, symmetry, and number of points are to be considered, the following are formidable competitors for the first place: a 74¼-inch head in the Chicago Academy of Sciences;[22] the 73¼-inch head belonging to the Duke of Westminster;[23] the 72-inch head in the Union Club, Victoria, B. C. (*Phillipps-Wolley*); the 70¼-inch head in the collection of W. W. Hart, of New York;[24] and the 69-inch head killed by Dall de Weese, September, 1897.[25]

Such remarkable growths are, of course, liable to great varia-

[19] Moose, by Madison Grant, 7th An. Rep. N. Y. S., F. F. G. Com., 1903, p. 232.
[20] Recreation Magazine, May, 1899, p. 357.
[21] Forest and Stream, November 30, 1895, p. 465.
[22] Forest and Stream, December 24, 1898, p. 508.
[23] Lydecker, Deer of All Lands, 1898, p. 53.
[24] Forest and Stream, January 23, 1897, p. 65, also January 30, p. 85.
[25] Recreation Magazine, February, 1898, p. 151.

tion. Freak horns are common among Moose, and some of the most curious are illustrated on page 156, all on the same scale.

The antlers' size and shape have even less relation to the age of the animal than with the Wapiti. After the third year no one can tell the age from the antlers.

The young bull Moose grows his first pair—two snags a few inches long—in his second summer, shedding them the following spring. Next year he grows his prongs, shedding them late the following winter or in spring. The third pair have a beginning of palmation. Thenceforth each pair is more palmated and is dropped earlier—usually in January or February; but bulls of exceptional vigour drop their antlers as early as December. As with most male Deer, the full development of the horns is attained about the seventh or eighth year; then comes a period of little change, followed after three or four years by a decline.

FIG. 67—Moose antlers, showing successive growths.

1. Appearance on the calf under a year old. 2. At eighteen months. 3. At two and one-half years. 4. At three and one-half years.

After this the brow points increase to two or three in number on each side; the webs or palms grow wider and the points more numerous for five or six years.

These drawings were made from specimens whose age was not positively ascertained, and are offered with much hesitancy.

After the Moose has grown old or passed his vigour "the palmation becomes wider, but the points fewer in number and shorter, until, in a very old specimen, the upper part of the antler is merely scalloped along the edge and the web is of great breadth. In the older and finer specimens the brow antlers are more complex and show three points instead of two." (*Madison Grant.*)[28]

[28] Moose, N. Y., F. F. & G. Com., 7th Ann. Rep., 1903, pp. 231–2.

FIG. 68—Spikes of a Maine Moose.

Shed March 1, 1899, when the Moose was 22 months old. *a*. Right antler 15 inches long, 6 inches in girth above burr. *b*. Left antler 13½ inches long, 4 inches in girth above burr. In base of each is a cup 2 inches wide and one inch deep.

FIG. 69—Ottawa Moose head.

Showing increased webbing and reduced size of tines in a very large Moose past his prime.

Collection of Mrs. Grace G. Seton. (57⅛ inches spread; 26 points.)

FIG. 70—Moose from Manitoba. Prime of life.

Showing three brow tines and broad palmations. (49¼-inch spread.)

At a later period the brow tines may increase in number, but they turn smaller, shorter, and the whole antler less massive.

FIG. 71—Field Museum Moose head from Alaska.
The record-bearer; 78½ inches across (originally said to have been 84 inches); weighs 93¼ pounds.
From a photograph.

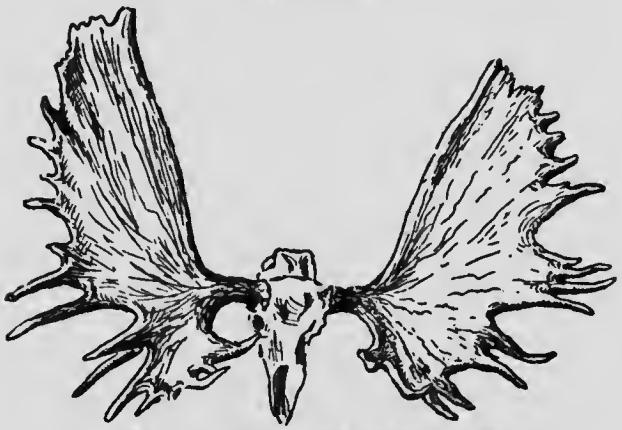


FIG. 72—Alaskan, 74½ inches (formerly 76 inches).
Taken on Kenai Peninsula by A. S Reed. Now in Nat. Coll. Heads and Horns, N. Y.
Reckoned by points of merit may claim first place.

FIG. 73—A 73¾-inch Moose head from Alaska.
In the collection of W. F. Sheard, Tacoma, Washington.
From e photograph.

The locked horns, so common among Wapiti, Caribou, Whitetail, and Blacktail Deer, are also found among Moose. One may wonder how these big, flat shovels can become entangled, and yet they do. There are several cases on record, the most wonderful being the antlers of a pair of giants from Alaska. These I saw in Sheard's establishment in Tacoma. The man who found them brought them out at great cost. He thought he had a wonderful prize, yet Sheard remarked: "I will give half as much more to any one who will unlock these antlers without using a saw. As they stand they are an unwieldy curiosity which no man wishes to buy, but separated each will make a fine trophy."

FIG. 74—Locked Moose antlers found in Algonkin Park, Ontario. From a photograph by Thomas W. Gibson, Toronto.

THE BELL

The second marked peculiarity in the bull Moose is the bell on his throat. I have examined many of these in the newly killed specimens and in the living animal, and could find nothing in them but a long dewlap of skin with appropriate blood-vessels. Sometimes it is round; sometimes flat, lying the long way; sometimes flat the cross way of the animal's throat; sometimes

FIG. 75—Unusual bell, 18 inches long exclusive of hair. Shot near Birnie, Manitoba.

simple; sometimes forked; sometimes hanging from the jaw, and sometimes from a long blade-like dewlap, but always without discernible scent-glands. I have squeezed and worked them with my hands on the living Moose and have been unable to discover any smell or signs of exudation, or indeed any specialization that would afford a hint of their purpose. No one yet has given any satisfactory explanation of this curious dangler. It is found on all Moose with little regard to age or sex, though usually largest in the young bull, the longest bell I ever heard of, however, was found on a cow Moose. Ordinarily it is 8 or 10 inches long; 14 inches would be exceptional for even a bull, but this one was *38 inches long*, exclusive of hair (Fig. 76). The Moose that wore it was shot by an Indian in Eastern Manitoba. He brought the head to Darbey's taxidermist shop in Winnipeg. E. W. Darbey and J. P. Turner, of Winnipeg, examined it critically in the flesh, and vouch for the genuineness of this extraordinary bell. Unfortunately, the owner insisted on having it mounted on a bull Moose head.

FIG. 76—Cow Moose bell, 38 inches long.
From photograph by E. W. Darbey. Specimen taken in Manitoba, 1903.

FIG. 77—Diagram of Moose bell, from old bull in about tenth year.
Dewlap 12 inches long, about half an inch thick, and 3½ inches deep.
Bell of same thickness and character but 8 inches long.

Fred. Talcott, who made extended observations on a family of Moose in Roger Williams Park, Providence, R. I., writes:[27]

"As the antlers increased the bell also increased until 13 or 14 inches long; and after the antlers were dropped, December 1st, the bell decreased in length."

[27] Forest and Stream, March 25, 1899, p. 224.

Since, then, the "bell" is a variable feature more or less present in the young of both sexes, and tending to disappear with age; it may be a character that is being lost, because no longer answering any useful purpose.

It is interesting to note that several animals have produced "Moose bells" on their throats as freaks. I have seen such growths in common cattle, Belgian hares, Merino rams, and once in a Cottontail (Fig. 78). They are usually associated with other excessive developments of the skin and its products.

SIGN

How are we to know that there are Moose in a swamp since they never give us a chance to see them?

The sure, certain, lasting sign is the "fumet," or dung-balls. These resemble in character those of other large Deer, but their size is distinctive.

FIG. 78—Cottontail Rabbit with bell like that of a Moose.

From specimen taken near Toronto, now in collection of James H. Fleming.

Bell, 2½ inches long. Second figure shows side view and sections.

Another important sign is the track. "Like the track of a cow, but sharper," is the earliest description I ever heard of it. This sign is soon changed by weather and tells the observer what time has elapsed since the Moose was here.

While feeding in winter the Moose will chisel the bark off saplings with its front teeth, as indeed do most Deer, but the size of the mark and the height from the ground will usually tell if such a mark was made by a Moose. It is often remarked that only one side of the bark is thus taken, and therefore the tree survives.

The nipping of twigs also at a great height is an important Moose sign.

Other telltale marks are the scrapings of the trees with the antlers and the deliberate crossing of bogs. In this last respect the Moose is second only to the Caribou. An important sign in fall is the wallow, fully described later.

The horns of the bull Moose are developed for battle with his own kind. As soon as the rut is over they are of little use, and Nature, true to her principle of economy, proceeds to get rid of them. In the depth of winter the useless lumber is dropped. Earlier if the Moose be very vigorous; later if he be a weakling. Yet he is not by any means disarmed, for his mighty fore feet, armed with a pair of stubby bayonets of horn, are ample protection against any Wolf or Bear that might dare to assail him or the family in his care.

The "yarding of the Moose" is a familiar phrase that has given rise to several misconceptions. Many persons think that a Moose yard is a large place, having all the snow in it trampled down smooth, and surrounded by a straight wall of untrodden snow rising to the level of the deep soft covering of the forest beyond. They imagine, farther, that, as soon as a storm begins, the Moose gets to work, hoof and horn, to hammer the new snow down level and hard within the yard.

The fact is that, when the snow commences to deepen, a Moose family—father, mother, and little ones—seek out some place of abundant food, and, by winding daily in this, cover the ground with a network of pathways. The longer they stay, the more numerous and the wider the pathways become, so that, finally, there are but few untrodden spaces of twenty yards across.

The deeper the snow in the woods the harder the Moose must work for their food, since the lower bushes and ground herbs are not now available, and thus the difference between the snow in the yard and that in the woods increases. If the food is sufficiently abundant in the yard, and no hunters approach, the Moose stay till spring. If the food gives out, they must begin a perilous journey through the snow in search of another good place. It is only dur' .g such a journey that they fear the Wolves. They make it in single file, so that the young ones in the rear do not have a very hard time, and it is usually done with judgment founded on their memory of the country.

MOOSE-BIRDS

A Moose yard is commonly frequented throughout the winter by the moose-birds or Canada-jays (*P. canadensis*). I cannnot guess why, unless the Moose, by tearing down and rooting up logs and dead trees, exposes worms, etc., or perhaps the parasitic insects in their hair furnish food for the bird. There are several other cases of small birds associating with large beasts, and in each the bird is believed to serve the beast as watchman and get his return in parasitic insects as food.

SPRING

With the melting of the snow the necessity for yarding ceases, and the Moose family scatters. For what reason they do so is not clear, because the young are not due to be born for two or three months yet. Perhaps like men who have been cooped up together in tight winter-quarters, or in a sailing vessel, they are glad to get away from each other for a change. The bulls go to some quiet spot, where their budding antlers may have every chance to grow. They may have travelled a dozen miles from their own range while seeking a mate in the fall, but summer finds each individual back in the very swamp and water-front that he has long considered his home. The cows go to some familiar, secluded place, where they can nourish the unborn calf, usually, however, accompanied at a respectful distance by their young of the year before.

It is very necessary in the economy of Nature that families should break up. Inbreeding is ruinous, and many animals have developed instincts that guard against this. I have made many observations to see whether the active party in the break-up is the parent or the young. Judging by humanity, it is the young. Among human beings the maternal feeling usually continues longer than the filial. But in most (possibly in all) the lower animals it is the other way. The young would keep on indefinitely demanding sustenance and comfort from the mother, if allowed. Who has not seen a cow, a mare, a sheep, a cat, a dog, or a rabbit, driving away, with harsh menace or even violence, the overgrown young one that teases persistently for the sustenance of earlier years? The feeling that overpowers the maternal is, I think in most cases,

the renewed mating instinct that springs from physical preparations for a new family. We can find even this paralleled in mankind, by the widow or widower who realizes that an already acquired family is an obstacle in the way of a new match.

YOUNG

The cow Moose may still be accompanied by her calf of the last year, but the instinct to be alone, when her time comes, leads the mother to sneak away for the final scene. This takes place in some remote swamp thicket during late May. As with most of our Deer she produces but 1 calf the first time, but afterward, 2, and in rare cases, 3. Though, as J. G. Lockhart says,[28] "No one ever saw a cow Moose followed by 3 sucklings or yearlings." These are dull reddish brown, without any of the lighter spots that characterize the rest of the Deer family in America. The small Deer hide the fawn for weeks; the Elk and Moose, for a few days only.

The young have all the family instincts for hiding at this age. William E. Bemis sends me a curious instance that he learned with satisfactory proof. Near his summer camp in Quebec, north of Deux Rivières, his guide chanced on two Moose calves in an open place. The little things ran here and there, looking for cover, then sought a shaggy fringe of short brush and disappeared over a low bank by a lake. There seemed to be no place for them to hide in; yet they had disappeared. A thorough search showed them to be in the water, completely submerged, except the tips of their noses. The mother was circling about in the neighbourhood, too much alarmed to come near, but frequently uttering a warning squeal that the little ones seemed to understand.

She never goes far afield while the calves are in hiding; and at proper times (probably two or three times a day) she comes to suckle them. As soon as they are strong enough they follow her about—exactly at what age, I cannot say.

On June 4, 1892, at Beauséjour, in Manitoba, I saw two Moose calves that were able to run alone and were probably a fortnight old. They stood between 30 and 36 inches at the

[28] Proc. U. S. Nat. Mus., Vol. XIII, No. 827, p. 305.

shoulder. One which Dr. W. T. Hornaday measured when seven weeks old was 37 inches at the shoulder."

The calves continue with the mother throughout the summer. I have been unable to determine whether or not several mothers join company at this season, as with the Wapiti, admitting young males also to their select society.

The bull Moose has led meanwhile a bachelor life, so far as known. The only evidence to the contrary was supplied by Tappan Adney. In answer to the query, Does the bull Moose accompany the cow while the calf is with her? he says: "In my notes I have a story, related by an old hunter with whom I lived on the Tobique, in New Brunswick, in 1896. He was telling me of the time when he first heard a Moose call to another. Though but a small boy then, he was in the woods alone. He was paddling on Sisson Branch of the Tobique, and had stopped his canoe by the bank to rest when, close at hand, he heard a low *mooh, mooh*, that he thought was a tree rubbing against another. In a moment a calf Moose came out of the bushes followed by the cow, and while he stood gazing a bull Moose appeared. At first they did not notice him, but having only a little shot-gun with birdshot, he was working to untie a bag containing bullets. The movement caught the bull's eye; he came toward the boy with bristling mane. Before anything happened, the cow and the calf walked away, and then the bull turned and followed them."

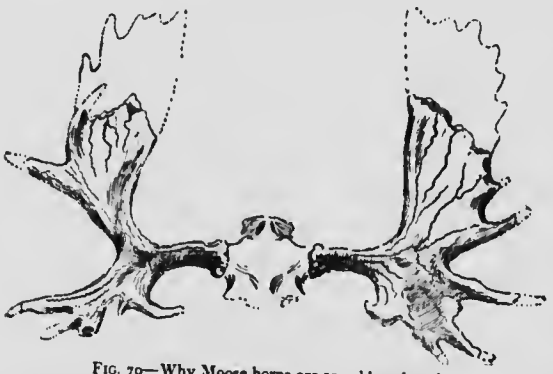


FIG. 79—Why Moose horns are so seldom found.

This massive pair from near Mattawa hung in a tree for only seven years. The weather and the Porcupines have reduced them to splintered and friable bone that could not last more than three or four years and much less if on the ground. Shot at Foley's Lake by Le Royer in 1898. (He went with the Ziegler expedition.) All rotten and eaten by Porcupine, but not by Mice. Every old vein is now a deep crack. Spread on brow, now 42 inches.

[29]Am. Nat. Hist., 1904, p. 140.

In mid-winter the bull Moose sheds his huge fan antlers, for, notwithstanding the voice of the people (which is said to be the voice of God), they are *not* used for shoveling snow all winter. As the hunters say, when the sap begins to flow in the trees the sap begins to run in the antlers of the Moose, which begin to grow afresh in April.

As the warm weather comes on the Moose are driven out of the thick woods by the heat and flies. They now gather at the lakes and beside large rivers, where they can enjoy a cool bath every day, get what breeze there is moving, and revel in the lily-pads that abound in such places. During the summer months the Moose may be considered a semi-aquatic animal. Male and female, old and young, thus frequent these summer watering-places, but usually the bulls keep by themselves in groups of two or even wander alone. Many of the guides say that the pair of bull Moose commonly seen together in summer are twin brothers.

In three months the antlers are finished and the velvet begins to shed off, showing the white bony structure below. I find, among the guides, a widespread notion that the Moose are right and left-handed—that a Moose that always lies on his left side will show the effects in a slight twist of the left antler and so on. By September the antlers are sunburnt to a deep brown, except the tips, which are white and polished from rubbing them on the brush and trees.

RUT

This brings us to the grand change in the Moose. "In the fall the bull Moose's fancy lightly turns to thoughts of love." The physiological change, called puberty in man, now sets in with the Moose. He is subject, indeed, to an annual puberty. At other times he is exempt from the much-mingled pleasures of the fatuous epoch, and free to mind his own business.

Early in September the rut sets in, with an exaggeration of everything that is male in his mental, moral, and physical make-up. He devotes all his energies to the matter in hand; he even neglects to eat; his all-dominant object now is to find a mate.

His summer life may have been spent on less than one hundred acres of swamp, but now he sets forth on his travels. Every few miles there is a sort of meeting-place of the sexes—a stretch of open woods—often a hardwood ridge between swamps. To these in turn he goes, nosing the earth and the wind for helpful suggestions. Standing with ears acock at every sound that might have been made by a Moose, and at length believing it to be from one of his own race, he challenges it with a deep, long grunt or a short bellow, and approaches it rapidly, slashing the brush with his horns to impress the other with the fact that he is a well-armed and fearless knight, circling about to try the wind from the stranger, or (if there be no wind) repeating his various calls and beatings of the brushwood.

There are two usual answers to all this—the long ringing reply of the responsive female or another deep grunt like his own, but varied with some guttural sounds that tell of a savage rival, who also is searching the woods with like object. In the latter case, there may be much grunting and manœuvring before they actually come together. As they approach they often express their defiance by slashing the brush with their new-grown spears and, when at last they meet and close with a crash, the spread and pointed antlers are at once their bucklers and their spears. It is rare to find a Moose horn without the dent of battle. I suppose that, without exception, every pair of full-grown Moose antlers has been in actual service "at the front," for every bull Moose hide has scars. In these combats the weaker generally saves himself by flight. It is but seldom that one of the knights is killed; yet this happens occasionally; and, as already noted, the battle has sometimes had a doubly fatal termination through the locking of the horns.

CALLING

The moose-calling hunter is one who, with a birch-bark trumpet, imitates the bellow of the cow Moose and tempts the bull forth into plain view for an easy shot.

Though the least sportsmanlike, it is popular because it is the most effectual way of getting a bull Moose. Fortunately,

it can be practised only for a fortnight or so, at the beginning of the season, and in exactly the right weather and surroundings. Dead calm is essential. If there be wind from the Moose to you, he cannot hear your call; if it be from you to the Moose, he smells you and flies to far regions. In a calm the call can be heard for miles—so far, indeed, that even if the Moose came directly and quickly he might be an hour or more in getting to you. I once called from a hill at sunset and learned later that friends four miles away heard me distinctly. Therefore, a Moose, with his keen hearing, might have heard it five or six miles off.

The experienced moose-caller begins very low, as there is always a possibility of a bull lurking in some near thicket; moreover, he calls not more than once in ten minutes. Some think every twenty minutes often enough; this is probably quite fast enough once the response has come. The bull's answer is a deep, long grunt, varied by the snapping of branches as he plunges forward through the woods, stopping at times to thrash some bush in his course. When at length, in the last dim afterglow, the much-heralded monster heaves his bulk into view, overtopping the shrubbery like an elephant, looming huge and black against the last streak of red light, he affords one of the most impressive sights in the animal world. No matter how much we may be expecting his coming, it is always a thrilling surprise. We knew how big he was, yet how startlingly huge he looks! And those antlers, a heavy burden for a man, he yet switches about as easily as an Indian does the eagle-feathers in his hair.

By softly modulated squeals, whines, and other sounds suggestive of the female Moose, a skilful caller can decoy the great beast within a few yards, and get the chance to see, shoot, or immortalize the giant, according to the mood and purpose of the party.

But there are many slips between a response and a fair view, even though it be an eager bull. A puff of wind may alarm the keen-sensed monster by bearing the human taint, he may detect a false note in the voice of the siren, or he may hear another and more attractive call, that of a cow.

The latter is what happened in the case described by Edward E. Flint, whose account of moose-calling is one of the best I ever read:

"On one occasion [he says],[20] when the conditions were favourable, I decided on calling one night, though the guide protested that at best only an uncertain shot would be obtained. We approached close to the stand selected by canoe, well supplied with blankets, and were soon comfortably established, sheltered by a spruce growing near the centre of a small marshy opening in the timber. The first call was made at ten o'clock, when the nearly full moon showed above the tree-tops. The answer was immediate and unmistakable. The *Oh-ah—oh-ah—oh-ah* of an old bull was as distinct and clear as possible. All was quiet for twenty minutes, when his approach began with calling at every step. This approach, calling, and stopping to listen, occurred many times in the next two hours, combined with much thrashing by the antlers, sounding, the guide said, like a man falling with a canoe on a rough portage. It was now full moonlight, the moon was high and the night unusually light; the air still and frosty, the Moose only 200 yards away, as revealed by the tracks the following morning. Any moment might afford the shot. Then the squalling call of a young cow, preceded by the deep notes of the bull, rang out sharp and clear. They remained near us perhaps half an hour, and when heard a second time were fully a mile distant, and an hour had elapsed since the meeting. While they were close at hand the bull challenge note brought back a short, hoarse, angry response, some thrashing with the antlers, and no more. * * * Several times I have heard a cow call, usually at sundown. In the bull call—*oh-ah*—the first sound of the vowel *o* is slightly prolonged, is clearly pronounced, and the short second sound of the vowel *u* is given in the last note of the call; accent and inflection can hardly be described. The cow call varies, usually consisting of three notes, the second one greatly prolonged and possessing the greatest volume of sound. *Moo-waugh-yuh* expresses the sound to me, and

[20] Forest and Stream, June 1, 1895, p. 442.

one of my guides always contended that the cow said plainly, 'Who are you?' I doubt if the first and last syllables can be heard at any great distance, and thus the call often seems to consist of one syllable."

Fred. Talcott, writing of the Moose in Roger Williams Park, tells how he imitated the Moose defiance on a call-horn not far from the park.

"At the first sound of the horn the bull sprang to his feet, giving his answer and darting toward me, and the cow answered with the long call. I thought also the calf answered, but of this, in the excitement and noise, I could not be sure. At the second sound of the note the bull answered again, and without an instant's hesitation charged against the fence in the greatest fury. As he came on his head was lowered, bringing his antlers about on a line with his shoulders.

"At other times, both day and evening, I tried to deceive him, but without success. The cow would repeatedly answer, always with a short call, quite different from the long call imitated to call the Moose of the wild woods. A number of different notes this cow used, usually in a tone that could be heard only a short distance."[21]

As this was after the rutting season, it is of unusual interest, and the patriarch is to be congratulated on the loyal sympathy of his family.

Flint states also that he found the Moose calling and coming from the middle of September to the end of October—six weeks, that is, much longer than the rut. To this I may add that in Manitoba, in 1884, I heard a Moose call as late as December 6.

Madison Grant says that "in Nova Scotia it seems to be a well-authenticated fact that Bear have been shot by moose-callers, the Bear, apparently, sneaking up to seize the supposed cow."[22]

Accounts of moose-calling are very various and indeed conflicting. One man says, "You must imitate the call of the bull

[21] Forest and Stream, March 25, 1899, p. 224.
[22] Moose, 7th Ann. Rep. N. Y. S., F. F. G. Com., 1903, p. 230.

to arouse the jealous wrath of the other bull"; another, "You must imitate the call of the cow to tempt the errant bull forward"; another, "It must be done with marvellous truthfulness or the bull detects the fraud"; others maintain that any kind of a noise will fetch the bull, so insane is he with wrath and desire; many say that moose-calling is confined to Maine and the East, because elsewhere the Moose do not call; still others declare that, from Canso to Yukon, the Moose call and are called.

There is little doubt that all these views are founded on actual observation. At the beginning of the calling season the bulls, full of amorous rage, will go anywhere at the slightest suggestion of a cow-call. When, at length, the cows respond and mating is about accomplished, they are ready to assail any bull that suggests a disturbance of their joy. When finally all are mated they no longer heed the call of another cow, and their varied later behaviour, sometimes coming, sometimes indifferent, means simply that the caller has chanced on an unmated bull, or else in a region where all are happy with their mates. After this merry moon is over it is considered useless to call for Moose.

Apart from the various uncatalogued and uncomprehended roars, bellows, grunts, and whines of the mating season, the Moose has many other vocal expressions that serve to tell the neighbours how he feels, or what he is thinking about. A number of young Moose that I have been among and handled uttered a soft whinnying sound when begging for bread. They proved their training by nosing in the neighbourhood of my pocket as they squealed. Again, the cow and the calf call to each other in a variety of soft whines.

MATING

The Moose has long been pointed out as the only Deer that is strictly monogamous. The evidence for this is as follows: There is no record of a bull Moose with *a herd* of cow Moose in the mating season. No man ever saw two adult Moose dwelling together in the mating season unless they were male and female. A Moose that is mated will not reply to a calling cow, call she never so tenderly. O exemplary Moose!

All observers agree that the Scandinavian Moose is monogamous, which is strong side-evidence, since the species is so closely related to our own. Finally, most of the hunters I have consulted, as well as Judge Caton, the leading authority on American Deer, say, unhesitatingly, that the American Moose is a strictly monogamous animal.

W. G. Tweddell, of Manitoba, an experienced Moose hunter, believes that the same pair will seek each other out on successive seasons, although separated for half the year.

On the other hand, most of the hunters in Manitoba and on the Ottawa maintain that the bull roves from one cow's range to another and will mate with many in the season, though he is rarely seen with more than one cow at a time. In the Kippewa country I was assured by several hunters that it is quite a common thing for the cow Moose to answer the cow-call while she is with her mate, and to come leading him as though she desired to share her position with another. In the few cases of calling that I have seen, however, it was a single roving bull that came in answer to the invitation.

The fact of the matter is that there are four degrees of monogamy among the animals:

1st. That in which a male and a female remain together for perhaps a week, after which the female no longer desires a mate, and the male seeks a second. That is, one mate at a time, but perhaps five or six in the season.

2d. That of certain Weasels, wherein the pair continue together during the mating season of a week or more, then separate completely.

3d. That of hawks, in which the pair continue together with little interruption until the young are able to care for themselves (say for four or five months), the father faithfully helping in caring for the young.

4th. That of eagles, which pair and live together continually till one is removed by death.

The first is the way of the Moose—one mate at a time, but maybe five or six in the season.

Whether the bond lasts more than one season is another

question, and one of great interest, but a point which I cannot decide, for lack of evidence. The fact that the male does not accompany the female while the calf is very young, rather goes to prove that their marriage, like their puberty, lasts but a brief and burning season, after which all is forgotten and forgiven, as the case may be, and every one is ready to begin over again with a clean slate on the next autumn.

THE YOUNG BULL

The young bull Moose is tolerated by the step-father while he is yet a calf; that is, he is allowed to be in the neighbourhood at a respectful distance. But in his second year he begins to have feelings of his own, and will fly from his new relative by marriage if he knows what is good for his young skin. At this time he is a "spike-buck," that is, his antlers (his second pair) are forked into a couple of spikes. After his mother's recurrent honeymoon he may drift back to the family group and thus come in a sense under the protection of his step-father till the end of the winter. Spring moving scatters the family as before, and September sees him fully equipped with flat horns, lusty body, and ambitions—everything, indeed, needful to replenish his corner of the earth except a mate, and personal prowess to secure one.

He may try a passage of arms with some big fellow who is on the road to good luck, but usually he has to save himself by flight into regions far away. At this season young bulls are found roving over the country in most unlikely places. One walked through the main street of Carberry, Manitoba, some years ago. Another was shot out on the open prairie 20 miles from Moose Mountain. Many similar cases are recorded from Vermont and New Hampshire, and in each it seems to have been a hopeful young bull Moose going out into the world to seek his fortune.

THE WALLOW

Meanwhile the pair that were left in possession of the swamp have been disporting themselves according to their minds. The bull Moose makes a wallow or "soil" or "gross," as it is called in the Old World. At a chosen spot in the thicket

he digs and paws the mud and irrigates it abundantly till it is a mud bath with every intensified odour that his physical personality can contribute. In this he wallows, and plays to his infinite satisfaction, and with results which seem to prove that it does not in the least repel the lady Moose of his choice.

I have seen this wallow many times in America, more especially on the Ottawa, but have no proof that this very spot is the trysting place of the pair, as it is supposed to be in Scandinavia.

It is an interesting beginning of civilization when we find an animal with special places for special things. This we see well developed in the "leks" of the capercailzie and the dancing and drumming places of the grouse, or among Mice which go out of their way to leave their dung at one spot, as well as certain species that repair to a given place at the approach of death. But, so far as known, the present species is the only one of our Deer that has advanced on these lines.

The Moose has to condense his intenser pleasures into a couple of weeks, so takes them seriously. During this time he even forgets to eat, and on returning from his wedding-trip he is no better than a spent salmon, or the last run of shad, which are parallelisms for the same effect from the same cause, and are understood to mean also "not fit for human food."

The old Moose has no longer any well-founded objections to receiving his step-children back into the family, and, as noted already, the group in the Moose yard that winter is usually the mother, the children, and the father that isn't theirs.

THE UNMATED

The "old bachelor" and the "old maid" are well-known characters in all the higher walks of animal life. Among American ruminants they are known as the "lone bull" and the "barren cow." The lone bull is usually an old fellow who has outgrown the ardour of youth. Some believe him to be one whose mate has died. He generally wanders alone and is of uncertain temper. The barren cow is commonly so by mis-

chance, and is distinguished first by her fine condition; second, the absence of calf. Roderick MacFarlane writes:[33] "Hunters assert that hermaphrodite and barren females are sometimes met with, and that these imperfect examples almost invariably attain a larger size and heavier weight than their fertile kindred."

FOOD

The food of the Moose is browse, twigs, and leaves of many hard woods, their particular favourite being moosewood or striped maple. Yet they do eat grass, as I have many times witnessed, and once found on dissection that the stomach contents were half grass. They do not always kneel for it, as is stated, but often eat like a horse, merely bending their necks if the grass is high, or adopting an inelegant giraffe-like straddle if it be low (see Plate VIII). Although they feed chiefly on twigs and bark in winter, I observed that about Carberry they devoured quantities of equisetum, or joint-grass, which sticks up through the snow.

"Moose rise and feed at dawn. About sunrise they again lie down to chew the cud or sleep till ten or eleven o'clock. Then they feed till two o'clock in the afternoon, again lie down till four or five o'clock, then feed till dusk, when they lie down for the night." (*J. G. Lockhart.*)[34]

STRANGE HABITS

Though the least gregarious of our Deer, the Moose is not without social amusements. Their yarding is a friendly gathering for the enjoyment and benefits of each other's society and they have also a weird performance that seems to be as contagious and psychologically deep-rooted as the "voodoo dance." This I have often heard of, but never seen. At certain seasons, more especially in high winds, these animals, I am told by many hunters, "go crazy," coursing around like dogs playing tag, chasing each other without regard to danger from their natural enemies, and yet apparently without any sex impulse. At such times they are easily approached and shot.

[33] Mam. N. W. Ter., Proc. U. S. N. M., 1905, pp. 678–9.
[34] Proc. U. S. N. M., Vol. XIII, No. 827, p. 308.

PLATE VIII.—MOOSE GRAZING.
(From photograph by Jenness Richardson.)

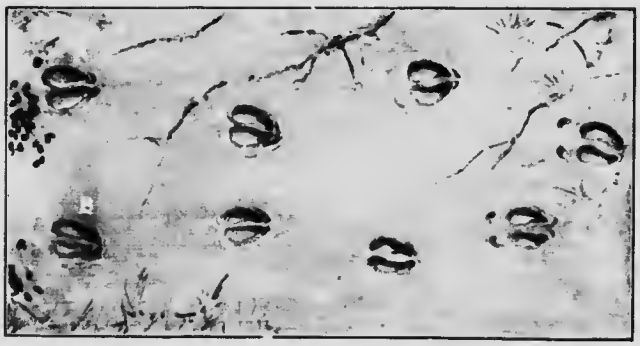



PLATE IX.—BULL AND COW MOOSE TRACKS IN ABOUT ONE INCH OF SNOW.

The bull tracks (A and C) are 5x6 inches: the strides vary from 2 feet to 5 feet. The softer ground and deeper snow causes the toes to spread and the hind hoofs to show.

The cow track (B) is 4x5½ inches, and is distinguished by its smaller size and slenderer form.

George H. Measham, of Woonona, Manitoba, writes me concerning a tame Moose that he knew: "It had an instinctive knowledge of changes in the weather, and before a winter's storm would always run around in a circle a few times, then lie down in the most exposed place it could find, facing the wind."

The Moose is so marvellously gifted with smell, hearing, wariness, and speed, that a skilful Moose hunter is conceded to have achieved the perfection of woodcraft. Yet it has been found numberless times that a Moose seeing a man, *without smelling* him, is likely to stand and gaze at him in blank curiosity. This happens oftenest during the summer, while the Moose is in the water, and the man in a canoe. Such occasions afford great chances to the camera hunter. Nearly all good photographs of wild Moose have been taken at such times.

Commenting on this habit R. MacFarlane says:[35] "While standing in the water they sometimes seem quite indifferent to the near presence of man, and will then retire only after being repeatedly fired at. I myself had proof of this on one occasion when ascending the Anderson River in the end of June, 1866. There were five of six in the party, when we discovered three full-grown Moose in the water. As they were not in good condition, we did not care to kill them, but in order to test the truth of this peculiarity I made the Indians fire a number of shots very close to them, but to no purpose. In fact, we had to scream and yell at them before they got out and stalked away at a very leisurely pace."

Another remarkable weakness of the species is the deep sleep that sometimes possesses it. An instance of this was related to me by William Clark, of the Hudson's Bay Company, at Winnipeg:

He was crossing the wooded country between Lakes Manitoba and Winnipeg in the early spring, and had with

[35] Mam. N. W. T. Proc. U. S. N. M., 1905, p. 678.

him a dog-team drawing a loaded sled, a couple of hounds running loose, and an Indian guide. The dogs were being driven with the usual amount of shouting and noise, and this was increased as they came to a steep place. On the hill was a tall spruce, and as there was no trail, the Indian climbed it to ascertain the best route. When he was at the top they held a conversation in tones suited to the distance between them. Just after he came down, the dogs that were beating about chanced into a thicket close by where Clark was, and with a great uproar put up a pair of Moose that had evidently lain asleep through all the clamour of their travelling and shouting. Of course no gun was handy, so they got away. (Miller Christy asks if it is not possible that these Moose were intentionally hiding.)

Ordinarily, Moose are the wariest of wild things. Says Lockhart:[36]

"They generally lie down with their tails to windward, trusting to their senses of hearing and smelling, which are remarkably acute, to warn them of approaching danger from that quarter; they can use their eyes to warn them from danger to leeward, where hearing, and especially smelling, would be of little use. * * *

"They also have the remarkable instinct to make a short turn and sleep below the wind of their fresh track, so that any one falling thereon and following it up is sure to be heard or smelt before he can get within shooting distance."

AS A DRAUGHT ANIMAL

Though the old bull Moose is apt to be bad tempered all the year, and is sure to be dangerous in the autumn, the species is blessed with a better disposition than most of the Deer family. A tame Deer is more dangerous than a wild Bear. But the Moose that has been brought up by hand is a gentle creature and usually quite safe, except in the autumn. George H. Measham writes me: "A neighbour of mine, Henry Stoggett, of Shoal Lake, had a tame Moose for a considerable time. It was very affectionate, and when called would come

[36] Proc. U. S. N. M., Vol. XIII, No. 827, p. 308.

like a dog; also it was as playful as a kitten, and would, like a kitten, play with a round pebble, or croquet ball, striking it with its front feet and running after it. It would also gambol with the children, dogs, or young cattle. But its playful slaps were no fun for whoever got them, so were not encouraged."

I have seen a number of Moose that had been broken to harness. They are docile, easily broken, exceedingly swift, and, being natural trotters, are well suited for light travel. They are so much more tractable and valuable than reindeer that one wonders why they have not been fully domesticated in the countries where they are indigenous; but if taken out of their native surroundings they rarely survive long.

GIFT OF MANITOU

In all the vast region that is dotted on my map the Moose is, or was, the Indians' staff of life. What the Buffalo was to the Plains, the Whitetail Deer to the southern woods, and the Caribou to the Barrens, the Moose is to this great northern belt of swamp and timber land.

It is the creature that enables the natives to live. Assisted in warm weather by various fish, it bears practically the burden of their support. Its delicious steaks are their staple food, but its nose or muffle is a delicacy. Its hide furnishes the best clothing and moccasin leather, or provides snow-shoes that enable the hunter to kill more Moose. Its back sinew is the sewing thread of the country, its horns and bones make tools, its hoofs can be converted into rattles, and its coarse, bristly mane, six inches long, and white except the tips, furnishes raw material for embroidery. When dyed with native dyes and skilfully worked into leather and birch-bark, these bristles are as effective as Porcupine quills—are indeed often mistaken for them by the uninitiated.

ENEMIES

The enemies of the Moose are, in order of danger: Man, mosquitoes, deer-flies, ticks, disease, deep snow, Wolves, Bears, and Cougars. Without doubt man should stand first, since pump guns have come into use.

Nature has two devices for offsetting deep snow: one is

snow-shoes, the other is stilts. These are illustrated respectively in the Lynx and the Moose. Undoubtedly, snow-shoes are superior. When the snow is deep and crusted, the Lynx is even better off, but the Moose is in a sad plight. Probably it is only at such times that the adults have cause to fear the Wolves.

It is a fact that the least danger man has to meet in wild countries is from wild beasts. It is so small to-day that it does not count; his greatest perils are wild men, disease, hunger, and insects. The Moose is in a similar case, except that he is in no danger of starvation, and, being a stay-at-home, is less likely to get disease than is a stranger in a strange climate.

ACCIDENTS AND DISEASES

A most singular case came to my knowledge in Manitoba some years ago. It will be remembered that after the failure of the first Atlantic cable, in 1858, a telegraph line was planned across the continent by way of Winnipeg and Alaska to be carried under Bering's Strait and overland to St. Petersburg and Paris. This was completed for some hundreds of miles when the success of the new cable in 1867 put a stop to the work and the useless wire hung there till the poles rotted. But this wire was made before the era of trusts; it was well galvanized, and is sound to-day. In the fall of 1884 a bull Moose butting playfully at one of the tottering poles brought it down on his head, and presently found the wire entangled in his antlers. He struggled and tusselled, getting more and more wound up, until he was helpless, and died there. The carcass was found by Chief Metayash some weeks afterward. It was a very fine, large Moose, and had over 200 pounds of wire fast to his head and horns. The ground around for an acre was beaten and trampled black—not a stick nor a green thing was left on it.

This, with another curious thing in Moose life, was reported to me by William G. Tweddell, of Woonona, Manitoba. He asked me if I ever heard of the *Peeto-mong-sons* or 'Little Moose in the Big Moose.' One Moose in about 500, he said, has a little medicine Moose in its skin. When this is

found it is cause for much rejoicing among the Indians. It is carefully preserved as great medicine, and the man who found it, is believed to have secured a mascot of eternal good luck in Moose hunting.

Cross examination did not shake his evidence. It was not a fœtus—Tweedell was sure of that. It was *in the skin*, and usually in that of a bull Moose. He had seen two; the most recent one was about a foot long; it had hoofs and hair, but no bones. Also he had seen the same sort of thing among Rabbits.

The explanation of the mystery is not far to seek. It is well known in surgery that within the skin may be formed a pocket in which are developed skin hair, teeth, nails, or any other product of the skin. These are known as dermoid cysts. They have no established relation to age, sex, or bodily locality. They are best known in the human species, because they have been most looked for there. Yet here, evidently, was a case of dermoid cyst in the Moose observed by a reliable and educated man.

Dr. Gordon Bell, of Winnipeg, explains such developments as "*fœtus in fœto*." Of this I met with a strange case at Meeker, Col., October 4, 1901. Dr. J. W. Collins, the veterinary, showed me a fœtus of apparently three months development that had been aborted the night before by a fifteen-month filly that was still sucking her dam. We examined the case together; there was no possibility, he said, of a male parent being concerned.

Thomas Hutchins mentions[37] that the buck Caribou has in the lower part of the neck a peculiar "cyst or bladder about the bigness of a half-crown piece, full of fine flaxen hair neatly coiled round to the thickness of almost an inch." This cyst has not been observed by other naturalists, but E W. Darbey has secured for me a similar one from the throat of a bull Moose. It measured about 1½ inches by 1¾ inches, and was situated half-way between jaw and chest on the middle line of

[37] Thos. Hutchins's MSS. Now in Archives of Hudson's Bay Co.

the throat. The flaxen hair coiled in it was much like that on the outside except in colour. It was in three layers, which probably corresp .id with the three coats the animal had grown.

George Linklater, of Deux Rivières, tells me that in June, 1904, he had a close view of three Moose—probably a family—crossing Lake Caughawanna, 40 miles east of Kippewa. One was a big bull, another a yearling bull, and the third an old cow. The big bull had four or five tumours hanging to his back and shoulders. They were each about three inches across and hung by a narrow neck to the skin, swinging about as he moved. His hair was so short that he seemed naked.

PSYCHOLOGY

There is a curious side to animal nature, seen in most highly organized species and illustrated in the Moose by the following instances:

The first was related by George Crawford, the well-known guide of Mattawa, as follows:

In March, 1888 (or 9), while out with his partner to catch Moose for Dr. S. Webb, they came on a Moose calf track in the deep snow. There was no sign of a cow, so they turned their dog loose. Very soon they heard him barking and came up to the calf. It rushed toward them with bristling mane. His partner ran and Crawford got behind a tree. The calf charged up to him and quickly wheeled to face the dog. It paid no heed to the man then, but when he turned homeward it followed for protection, crowding up close and watching the dog. At home he put a halter on it, and it allowed him to lead it quietly into the stable. It was shipped to Dr. Webb, and is now at large in the Adirondacks.

The following was related to me by Edouard Crête, of Deux Rivières:

In late September, in 1893, a mail-carrier was starting from Bear Lake to Deux Rivières. Crête showed him a short cut over Brule Lake. Some hours later two men were out

that way looking for axe handles, and heard the mail-carrier shouting for help. Instead of going to him they ran back to camp in great fear. Crête picked up a rifle and went with the foreman as fast as possible. They heard the mail-carrier as soon as they came within half a mile. When near enough he shouted, "A Moose has me up a tree." They came close and saw it was a cow Moose. She would neither go away nor charge. Indeed, she paid little attention to the newcomers. The foreman, Jean Basquin, walked up to within twenty yards and shot her.

The mail-carrier said that he came on the cow suddenly. She was alone, but came running toward him squealing. Her mane was up and she seemed to be threatening him. He had nothing but a hatchet, so he ran for a tree, and happened to find one leaning so much that he could walk up. She followed him within touching distance all the way, but did not strike at him. The tree at the highest point was only 10 feet up. Here the man sat, the Moose below. She could easily have struck him, but made no attempt to do so. There she stayed watching him; her mane bristled all the time. When she heard the other men coming she merely turned her head, but during the three hours she kept the man up that tree, she did not leave the spot for a moment.

After skinning her carcass a very unexpected condition was brought to light. Evidently she had been attacked by a bull Moose a few days before. The horns had pierced her left side in five places. Inflammation had begun and matter had formed in four places. She must have been suffering great pain, and would probably have died before long. They couldn't make out why she should go to the man, but it is quite sure she wasn't there to do him any harm, for she had every opportunity to do so and did not strike at him even once.

This instinct when in deep trouble or flying from great danger, to blindly trust another power, that may not be friendly but certainly is superior—to seize on the one remaining hope—is as deep-rooted as it is remarkable. We see signs of it

throughout the animal creation, and the higher the species the more marked it is.

We have been looking among the animals for the rudiments of civilization; possi , in this we see the rudiments of something else that finds its ghest development in man.

PLATE X.—WOODLAND CARIBOU, MALE AND FEMALE.

(*Rangifer caribou* (Gmelin).)

## V.

## The Woodland Caribou or American Reindeer.

*Rangifer caribou* (Gmelin).

(*Rangifer*, made up by Hamilton Smith in 1827, apparently from old French, *Rangier*, a Reindeer, and the L. *fera*, a wild beast (*Cent. Dict.*); *caribou*, the New England Indian name.)

*Cervus tarandus caribou* Gmelin, 1788, Syst. Nat. I, p. 177.
*Rangifer caribou*, AUD. and BACH., 1854, Quad. N. A. III, p. 111.
TYPE LOCALITY.—Eastern Canada.

FRENCH CANADIAN, *le Caribou.*
CREE, SAUT., & OJIB., *Ah-tik.*
CHIPEWYAN, *Et-then.*
YANKTON SIOUX, *See-hah Tang-kah.*

The genus *Rangifer* (H. Smith, 1827) shows the characteristics of the Family, *Cervidæ*, but has further: Palmated antlers, which are present in both sexes; muzzle, all hairy; a tarsal or inside hock gland, but no metatarsal or outside mid-leg gland; the hoofs broad and flat, the cloots or accessory hoofs so long as commonly to reach the ground; teeth as in the Wapiti, but often without canines. All the American species of Caribou agree with the present in general arrangement of white patches.

SIZE

How large is the Woodland Caribou? Larger than the Whitetail Deer, smaller than the Wapiti. This is a comparative answer that usually satisfies the hunter. Exact measurements of typical specimens are not available. Audubon and Bachman give[1] thus the dimensions of one two and one-half years old, presumably a male:

| | | | |
|---|---|---|---|
| Length from nose to root of tail . . . . | 6 feet | 0 inches | (1,830 mm.) |
| Length of tail (vertebræ) . . . . . | 4 | " | ( 102 mm.) |
| Length of tail (including hair) . . . . | 6½ | " | ( 165 mm.) |

[1] Quad. N. A., 1849, Vol. III, p. 113.

| | | | |
|---|---|---|---|
| Height of shoulder . . . . . | 3 feet 6 inches | | (1,067 mm.) |
| Width between the eyes . . . . . | 5½ " | | ( 140 mm.) |
| From point of nose to lower canthus of eye | 9 " | | ( 228 mm.) |
| From point of nose to ear . . . . . | 1 foot 2 " | | ( 355 mm.) |
| Height of ear posteriorly . . . . . | 5 " | | ( 127 mm.) |

Dr. W. T. Hornaday states[2] that a large male Woodland Caribou, from Maine, now in the New York Zoological Park, stands 48 inches (1,220 mm.) at the shoulder and weighs 280 pounds.

COLOUR

In winter the general body colour of the Woodland Caribou is a dull grayish-brown or dun, darker on the face and legs. The neck, forehead, belly, spot behind shoulder, under side of tail, the region about the tail, and the band around each foot are white.

In summer, its body colour is darker.

Individuals vary greatly, however, in respect of their body colour, as well as in the amount of white.

The young have traces of a few pale spots on the ground colour.

## Life-history.

RANGE

The accompanying map shows that the ranges of the four principal species of Caribou are distinct from one another, geographically, climatically, and botanically.

The earliest described of the four was the Woodland species. This is the Caribou proper; it must be the starting point and standard for discussing the others.

On the map the area given to the Woodland Caribou is the same now as it was in primitive days. It is said to be nearly exterminated in those small areas of the United States that happen to fall within this limit. But reference to early authority, such as Josselin (1672), shows that in these small areas the Caribou was at best merely a straggler. Its proper region is about 2,500 miles long from east to west, and 400 to 600 miles wide.

[2] Amer. Nat. Hist., 1904, p. 132.


**MAP 8—RANGE OF THE CARIBOU.**

This map is founded on the records of some hundreds of explorers and naturalists, with assistance from Madison Grant's maps (An. Rep. N. Y. Z. S., 1903), from E. A. Preble, and in Alaska from the Biological Survey Map published in the Yearbook, U. S. Dep. Agr., 1907. The crosses are extra-limital records.

The following species have been recognized:

*Rangifer groenlandicus* (Gmelin),
*Rangifer peanyi* Allen,
*Rangifer arcticus* (Richardson),
*Rangifer stonei* Allen,
*Rangifer granti* Allen,
*Rangifer dawsoni* Seton,
*Rangifer caribou* (Gmelin),
*Rangifer terraenovae* Bangs,
*Rangifer montanus* Seton,
*Rangifer osborni* Allen.

HOME RANGE

As noted in the introduction (p. 26), no wild animal literally wanders; all have a limit of individual range, a home locality. But I have failed entirely to get any light on the extent of the individual Caribou's range. More than any other animal I know, it roams with little regard to anything but food and wind.

During the winter it is not under the necessity of "yarding," as do Moose and many other kinds of Deer, for it can travel *over* the drifts when the snow is too deep to travel *through*, and travel it does the whole year round. I have yet to learn of this animal settling down contentedly in any given small locality. Its food is everywhere, it follows its food, and famine seems to be unknown in its world.

HISTORY

Although the habitat of the Caribou lay nearer Europe than that of any other of the American big game, and the animal was a common and characteristic inhabitant of those northern parts of the continent visited by Cabot (1497), Roberval (1534), and Cartier (1535), this species was not discovered by white-men until after the Wapiti, the Whitetailed Deer, and the Moose. So far, I have found no earlier mention than that by Les Carbot (or de Monts) in 1609.[3]

He lists as the principal beasts of the chase:

NAMES

"Ellan, Caribou, Cerf, etc." "Caribou" (in this spelling) is the word he uses throughout.

But G. Sagard-Theodat,[4] in 1636, wrote of these animals as Caribou or Wild Asses (*Caribous ou Asnes Sauvages*).

Josselin, writing in 1672,[5] says of this:

"The *Maccarib, Caribo, or Pohano*, a kind of Deer, as big as a Stag, round-hooved, smooth hair'd, and soft as silk, their horns grown backward along their backs to their rumps and turn again a handful beyond their Nose, having another Horn in the middle of their Forehead about half a yard long, very streight but wreathed like an Unicorn's Horn, of a brown

[3] Les Carbot, Nouvelle France, pub. 1618, p. 896.
[4] Hist. Canada, 1636, p. 750.
[5] New England Rareties, 1672, pp. 20–21.

jettie color, and very streight, the creature is nowhere to be found but upon Cape *Sable* in the *French* Quarters, and there too rarely, they being not numerous, some few of their Skins, and their Streight Horns are (but very sparingly) brought to the *English*."

From this it will be seen that "Caribou" or "Maccaribo" is a native American word—the Indian name of the animal. Generations later Sir John Richardson was misled into stating that[6] "'Caribou' was a French-Canadian word (from 'Quarre-bœuf,' a square ox), derived from the size of the Antlers." Why large antlers should constitute a *square ox* is a puzzle. and why the adjective should be transposed in this case is another. We can only regret that Richardson, usually so reliable, should have made the mistake of recording a *post hoc* and absurd explanation.

On the same page in which he gave forth this, Richardson KINDS
says:

"In Rupert's Land and the northern extremity of the Continent, east of the Rocky Mountans, three races of Reindeer are known and recognized by the natives and fur-traders, all passing under the French-Canadian appellation of Caribou. * * *

"The smallest is the Barren-ground Reindeer, which brings forth its young in the islands and on the coasts of the Arctic Sea, and does not migrate further south in winter than the skirts of the woods.

"The largest inhabits the wooded mountains and valleys of the Rocky Mountains, bordering on the Mackenzie.

"And the third race, of an intermediate size, frequents the wooded and hill districts of Rupert's Land, passing during winter into the interior and migrating in summer to the coast of James's Bay. This kind seems to have been formerly plentiful as far south as the State of Maine, and small herds still frequent the border of Lake Superior and many parts of Canada."

[6] Zool. of Voy. Herald, 1854, p. 20.

This is the first clear and correct discrimination of the various groups of Caribou found on the North American mainland, and although no fewer than ten species have now been described, I suspect that, in the end, we shall come back very nearly to Sir John Richardson's view. The ten will probably merge into geographical races of four well-marked species, namely:

(1) The very small gray Barren-ground Caribou (*arcticus*), with its six races, *greenlandicus*, *pearyi*, *arcticus*, *granti*, *dawsoni*, and *stonei*.
(2) The huge black Mountain Caribou (*montanus*), with its two races, *montanus* and *osborni*.
(3) The middle-sized gray Woodland Caribou (*caribou*).
(4) The White Newfoundland Caribou (*terræ-novæ*).

ANTLERS

To the sportsman the antlers are the all-important matter. Compared with them the creature's size and shape are very secondary.

Just as the proverbial Red Indian was disgusted to find that he had killed a bald white-man, instead of one with a showy scalp-lock for trophy, so the sportsman would rather kill a 200-pound beast with a fine head than a 400-pounder that had dropped his antlers.

There is no species of Deer in America of which the females have not occasionally been found with antlers. Among Caribou females it is the rule to wear them. In the herds of Norway I did not see any adult females without them. The females of the Woodland Caribou, however, sometimes are hornless. George Linklater even tells me that about Abitibi only the barren females have horns—that the cows bearing horns never bear young—a statement that requires further confirmation.

Dr. J. B. Gilpin says:[7] "Both sexes have horns, the doe comparatively small." According to various accounts the bull's horns are shed in midwinter, usually in January, but often in December, if the animal be in exceptional vigour;

[7] Mam. Nova Scotia, Proc. & Tr., N. S. Inst. Nat. Sci., III, 1872, p. 56.

the young bulls carry theirs till early spring; the cows keep theirs till summer is near, dropping them about the time the calf is born.

Frederick Talcot records[8] a case of an adult Caribou buck that was hornless.

Typical antlers of male and female Woodland Caribou are shown (Figs. 84 and 87), also examples of the allied species (Figs. 80, 81 and 82).

Although these specimens show well-marked differences, the diversity of form in each kind is so great that we can find in each of the species, examples that resemble the horns of each of the other species.

The finest horns are seen in the great Black Caribou of Alaska (*osborni*). These, more than any other, combine large size and many points with remarkable symmetry and six perfect shovels fully and evenly developed—a feature rarely seen in other parts of the mainland.

Of the American Reindeer, the Woodland Caribou is believed to have the smallest antlers, the Newfoundland the most massive, the Barren-ground the slenderest.

The largest pair of Caribou antlers mentioned in Ward's Records of Big Game (1899) are the property of Mrs. MacIntosh, of Havering Park, Essex, England, and are from Canada. They are given as 62 inches along the outside curves of the beam, have 49¼ inches spread, points 20 and 17.

Cartwright mentions[9] a Labrador specimen with 72 points. But Harry E. Lee's 57-point Alaskan (*R. osborni*) from Kenai Peninsula, is the finest head of which I have a picture (Fig. 82).

GLANDS

Judge Caton has pointed out[10] that the Woodland Caribou and Norway Reindeer have in each hind-foot, deep between the toes, a curious gland that exudes an unctuous substance. This is probably part of a system of scent signals; but, in

[8] Forest and Stream, September 12, 1896, p. 203.
[9] Journal, Sixteen Years Res. Labrador, 1792.
[10] Antelope and Deer of America, 1877, p. 265.

FIG. 80—Tanana Caribou.
Spread, 47½ inches; length of right beam, 53 inches; points, 20 and 18.
In the collection of W. F. Sheard.

FIG. 81—Horns of Mountain Caribou from the type specimen in Canadian Geological Survey Museum.
Taken at Revelstoke, B. C.
Beams, 39 inches long; 27 points.

FIG. 82—Fifty-seven-point Caribou from Kenai Peninsula.
In the collection of Harry E. Lee.
From a photograph by La Roche, Seattle.

FIG. 83—Thirty-nine-point Caribou.
Shot on the Miramichi River, New Brunswick, by Charles F. Riordan, November 13, 1896.
Drawn from his own photograph.

FIG. 86—A remarkable set in the collection of W. F. White, of Winnipeg, said to be from Lake Winnipeg.
Beams, 34 inches long; 40 points in all.

FIG. 84—Antlers of female Woodland Caribou from Lake Winnipeg.

FIG. 85—Antlers of female Caribou, each about ten inches long.
From a photograph of a specimen in the New York Zoological Park.
By permission of the New York Zoological Society.

FIG. 87—Antlers of Woodland Caribou (male) from Rat Portage, Ontario. (Winter, 1903-4.)
In the collection of E. W. Darbey, Winnipeg.

Norway, I have seen the Reindeer again and again rubbing the growing horns on the region of this gland. The Norwegians told me that it was done to oil the horns. I think, however, that probably the action was merely to scratch the tender velvet of the growing antlers; just as a cow or sheep always scratches its head with its hind-foot.

GREGARIOUS

The Woodland Caribou is found all winter in small bands of both sexes. Five to twenty are commonly seen together at this time. Thus the species is quite gregarious, yet is but slightly sociable, since individuals rarely combine their efforts for a common purpose.

COMMUNICATION

A gregarious animal has usually many means of communicating with its fellows. In this case, the well-marked livery of the species serves as his uniform does a soldier; it lets friend and foe alike know who this is.

Next in importance is the "white flag," the tail and its surrounding disk, with which, as in most Deer, the Caribou does its wigwag signalling. The sudden elevation of this white tail when danger is sensed, conveys at once a silent alarm to the nearest of its kind. Probably the white patch of hair on the throat is used much as the Antelope use their disk, that is, as a flash-signal.

VOICE

This Caribou's grunt I have never heard in a state of nature, but it is said to be much like that of the Norwegian Reindeer, and my notes on that are very full, thus:

"On July 4, 1900, got into a herd of about 1,000 half-wild Reindeer. Their only vocal sound is a grunt. This is uttered singly or else doubled; that is, two are given in rapid succession. It is sometimes the call of a cow to her calf, and sometimes is uttered by one that has been left behind, evidently a note of alarm or inquiry to find out if his friends are close at hand. When I imitated this call the near Reindeer came cautiously and curiously toward me. Usually, when one or two in the herd begin it, the others join in till it is like a valley of grunts."

In the rutting season, Linklater tells me, he has often

PLATE XI.—REINDEER ♂ HALF-SHED—HORNS IN VELVET.
Norway, July 8, 19

PLATE XII.—SKETCHES OF A MAINE CARIBOU.

heard the Caribou about Abitibi make a double grunting call, the first sound raucous and deep, as though uttered while taking breath, the second more like a light explosive cough or bark. The bulls also make a deep rumbling.

In several parts of Canada traditions exist that formerly the Indians u[illegible]d to call the Caribou as they do the Moose. My own experience would lead me to believe this quite possible, but the art has been forgotten.

HOOF-CLICKS

The most singular, perhaps, of the sounds made by the Caribou is the clicking or creaking of the hoof. At each step each foot gives out a loud, sharp crack.

This is easily heard at a distance of fifty feet in a wind, and twice as far in still weather. When a herd is moving along the countless crackles from their hoofs make a volume of low, continuous sound.

Persons who have never heard this curious clicking have no difficulty in explaining it: "Of course the hoofs spread when they bear the weight of the animal," they say, "and, when lifted, the hard surfaces spring together with a 'crack.'" But close observation shows that the crack is made by some mechanism *in the foot*, and that it "goes off" *while the weight is on it*.

It is not always one sharp crack, but sometimes a crackle, or several little sounds close together. Many examinations made in Norway and in the Winnipeg Zoo have shown me that the crack takes place just as the foot is relieved of the animal's weight, but before any part is lifted from the ground. The hoofs do *not* strike together during the stride, and the crackle is *not* heard until the foot is placed, and the weight is on it. Thus it may crackle twice at each tread, always once as the weight is coming on; usually a second time as it is going off. I have walked many times on hands and knees by the side of the Reindeer to make observations. On one occasion I induced one to walk beside me while (at considerable personal risk) I kept my hand on the knuckle-joint of his hind-foot. The crack took place each time with the *bending* of the knuckle-

joint. It was so violent that it jarred the hand laid on it. It was deep-seated and on the level of the cloots or back hoofs. Apparently it was made by tendons or sesamoids slipping over adjoining bones.

The object of this curious sound is, doubtless, the same as that of the whistling of a whistler's wing or the twittering of birds migrating by night. It is to let the rest know what is doing—that the band is up and moving—has gone such and such a way, or to notify the little one that his mother is on the march and that he should keep alongside.

HOOFS

The hoof of this animal has another claim on attention. As noted in the Moose article, nature has two answers for the problem of travel through deep snow, namely, stilts and snow-shoes. These are exemplified, respectively, by the feet of the Moose and the feet of the Lynx. Both contrivances are good, but, upon the whole, the latter is the better. In the Caribou we have a wonderful combination of the two. Nature has given to this creature of snow and swamp *both stilts and snow-shoes*. Its long, thin shanks are actually longer in proportion to its bulk than are those of the Moose, and its hoofs are a unique combination of snow-shoes and skates.

The ordinary track of a moving Reindeer I found to be 4 inches wide by 7 long. In places it spreads an inch wider and a couple of inches longer. As the need is increased the bearing surface is increased by bringing more of the foot to the ground. So that in crossing bogs or deep snow the whole leg from hoof to hock gives supporting surface. I noticed that in crossing snow-drifts I sunk much deeper than the Reindeer. I found, further, that a Reindeer has about 1 square inch of foot support for each 2 pounds of his weight, while the Moose in standing is under a pressure of 8 pounds to the square inch.

Captain Hardy states,[11] concerning the Caribou, "that its foot is a beautiful adaptation to the snow-covered country in

[11] Forest Life in Acadie, 1869, pp. 129–130.

which it resides, and that on ice it has naturally an advantage similar to that obtained artificially by the skate In winter time the frog is entirely absorbed, and the edges of the hoof, now quite concave, grow out in thin, sharp ridges, each division on the under surface presenting the appearance of a huge mussel shell. The frog is absorbed by the latter end of November, when the lakes are frozen; the shell grows with great rapid-

FIG. 88—Right hind-foot of Newfoundland Caribou.
From specimen No. 414, Field Museum, half natural size. Specimen taken in September, so that the frog is not yet absorbed.

ity, and the frog does not fill up again till spring, when the antlers bud out. With this singular conformation of the foot, its great lateral spread, and the additional assistance afforded in maintaining a foothold on slippery surfaces, by the long, stiff bristles which grow downward from the fetlock, curving upward underneath between the divisions, the Caribou is enabled to proceed over crusted snow, to cross frozen lakes, or ascend or descend icy precipices, with an ease which places him beyond the reach of all pursuers."

F. Forester says,[12] in his vivid description of the Caribou's flight: "Snow-shoes against him alone avail little, for, propped up on the broad, natural snow-shoe of his long, elastic

[12] Henry William Herbert ["Frank Forester"], American Game in its Seasons, 1853, pp. 29–30.

pasterns and wide-cleft crackling hoofs, he shoots over the crests of the deepest drifts, unbroken, in which the lordly Moose would soon flounder shoulder deep if hard pressed, and the graceful Deer would fall despairingly and bleat in vain for mercy."

In yet another particular the Caribou's foot stands first in its class, namely, as a paddle. With his broad-spreading

FIG. 89—Tracks of Woodland Caribou on Athabaska River, October, 1907.
The paces vary from 20 to 40 inches.

hoofs he is as truly web-footed as a coot, while the thin shank and closed foot give the perfect return.

HAIR

Clad next to the skin with a coat of oily wool, the Caribou is covered exteriorly with a dense pelage of fine quills. While they are truly hairs, each is a little barrel of air, which increases in thickness until the coat is perfect. Being air-cells, they are light and make excellent non-conductors, thus conserving the bodily warmth of the animal.

But they are of service also in another way, namely, as floats. Baillie-Grohman mentions the use of Caribou hair to fill life-belts, and says, farther, that a German, Dr. Mintz, has invented a Caribou or Reindeer-hair cloth which, when made into suits, prevents the human body from sinking.[13]

Every Caribou wears, in effect, a cork-jacket; and when this is in prime condition the creature seems *on* the water rather than *in* it. No other quadruped that I know floats as high out of the water as the Caribou.

[13] Sport and Life Br. Col., 1900, p. 133.

SWIMMING POWERS

The speed of the Caribou when swimming is so great that it takes the best of canoe-men to overtake a vigorous buck. A good canoeist is supposed to paddle about 5 miles an hour; so the Caribou may attain 4 for a short distance, though ordinarily its speed is little over 2. There are many kinds of woodland and rough country over which the animal cannot travel afoot so fast as this. What wonder, then, that it is so ready to take to the water on every occasion.

In Keewatin, W. R. Hine had interesting evidence of this. At many places he saw where, on coming to some rocky bluff over a lake, they had unhesitatingly toboganned down, caring nothing so long as they plumped into deep water at the bottom.

An animal with such powers and gifts is indifferent to the elements and superior to space. It dwells, moreover, in a country where man is rare and where its food is in measureless abundance. Thus it has little to dread from man or beast, and nothing from hunger or climate, the deadly enemies of most wild creatures.

ENEMIES

What, then, has it to fear? Why have not its numbers reached the limit of its food-supply? Probably because it has countless irresistible deadly foes in the insect wo

All through the summer the herds are harassed by clouds of mosquitoes that drive them to seek the open, where they are subject to the attacks of several kinds of verra-fly, or gad-fly.

MIGRATION

There is little doubt that the well-known migrations of the Caribou may be explained by a consideration of these insect clouds at one season in conjunction with deep snow at another; the latter by hiding their food in winter, and thus driving them into the woods; the insect hordes, by forcing them back again in spring to the partial solace of the kindly breezes that fan them in the open or on the highest levels of the nearest mountains.

In one sense all the Deer are migratory. The Moose may migrate only 5 or 10 miles from the low swamps in summer to the hardwood ridges in winter; the Blacktail of the mountains may descend from the high hill-tops of its summer range to

winter pastures of a lower level, miles away; the Wapiti may make a similar change on a still larger scale, when the first heavy snow comes down to warn it of the season's close; but the Caribou are the only Deer that at certain seasons gather in herds to travel clear out of one region to some entirely different region.

If we divide the vast range of this species the long way, into four equal zones, we may say that the main body of Caribou is found in the northern three all summer and in the southern three all winter, and thus give a fair idea of its migrations.

The Caribou is the Reindeer of America. This word Reindeer was long, though erroneously, supposed to mean *running deer*, in allusion to its speed (another after-thought, in the way of derivation, but so appropriate that it is still found in some very reputable dictionaries)—not that the Reindeer is speedy when compared with the Whitetail, but it keeps on so long and so straight that the hunter who follows the Caribou must be the best of travellers. The Moose may trot through the brush at the rate of 15 miles an hour; the Whitetail may bound over the ridges half as fast again; the Caribou may never rise above a 10-mile gait. The Moose, however, is satisfied when it has covered 5 or 6 miles and has merely removed to some other part of its range; the Whitetail is sure to stop after circling a mile or two and settle down again; but the startled Caribou keeps on, sometimes walking with long mile-eating strides, sometimes trotting, sometimes stopping to graze for a minute, rarely galloping or leaping, climbing hills, floundering through bogs, swimming lakes, turning aside for nothing, its lower speed offset by its persistence and directness, very often spending the night 100 miles from the place whence it started in the morning.

CHARACTER

In character, this creature is a strange mixture of wariness, erraticness, and stupidity. One never knows just what the Caribou is going to do next, but may be sure that the animal is going to do it with amazing energy and persistence. Its

sense of smell is exquisite, and its eyes and ears are good, but it relies mostly on its nose.

I once had an adventure with a Caribou which, though slight and unromantic, might have cost me my life. It illustrates the uncertain temper of the animal and the energy with which it can act on occasion:

About 1889 some one in Maine offered [illegible]m a fine bull Caribou. The genial showman at once secured [illegible]s animal, which, though so common in a wild state, is rare in menageries, and brought it, wild-eyed and sullen, to Madison Square Garden, New York. As soon as I heard of its arrival I wrote for permission to make some notes. Receiving this, I went to the Garden. The keeper in charge was as sulky as the prisoner. The letter of the Manager barely secured attention.

"You'll find him there," and he jerked his head toward a dark stall.

"That won't do," I said, "I am here to sketch him, and must see him."

"Well, suit yourself."

Proceeding to do so, I got a long rope halter on the creature's neck. The keeper, seeing me about the risky business of leading the Caribou into the ring, and knowing that he would be held responsible, got another long halter, and together we brought the animal out where he could be seen.

There was nothing to tie him to, so we had to stand holding the ropes and be ready to pull in different directions. In order to have my hands free for sketching, I tied the rope around my waist. Soon the keeper got very weary of his task. The clowns in the next ring were practicing for the afternoon performance and he turned to watch them. The Caribou seemed to see its chance. Giving a great bound it jerked the rope from the keeper's grasp and dashed the length of Madison Square Garden, dragging me by the rope which was tied about my waist. I rolled over many times, but, after about 50 yards, got my heels into the sawdust and my hands on the rope. The circus people did nothing but laugh and cheer as the powerful brute lunged along; but the keeper, realizing that he

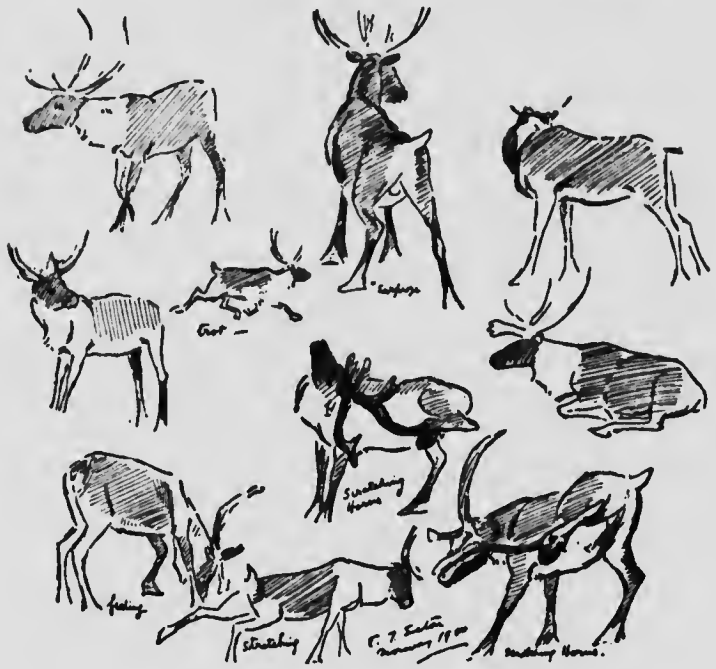


FIG. 90—Sketches of Norway Reindeer.

was laying up trouble for himself, came to the rescue and caught the end of the other rope.

Whereupon, the Caribou changed his behaviour and stood perfectly still, with head down, as though he were quite a different animal.

STRANGE HABITS

In the Abitibi country, and doubtless elsewhere, the Woodland Caribou has the habit, already ascribed to the Moose, of racing in a circle during a wind storm. George Linklater tells me that he has witnessed this several times.

FOOD

The Woodland species is more omnivorous than the moss-eating Barren-ground Caribou, as most green things are in its diet. In Norway the Reindeer is said to eat the Lemmings, or Moss-mice, but I find no record of such a depraved habit in any American species.

In the early spring, as soon as the snow gets soft, the large bands of Woodland Caribou drift in a northerly direction and speedily break up, the old males going off by themselves. It is interesting to note that, up to this time, the females still wear their antlers—will do so, indeed, till summer, while the old stags have been dehorned by mother nature in early winter. The females are, therefore, well equipped to send the males about their business in case there be any who conform not promptly to the established usage of the Caribou. SPRING

The calf is born in June and is of a reddish brown, varied with white, but not spotted all over, as in the true Deer. Sometimes twins are born. In Norway I was assured by the herdsmen that when this is the case the mother usually destroys the second arrival.

The Norwegian Reindeer and the Barren-ground Caribou do not hide the calf at all, so I suppose that the same is true of the Woodland species. The mother stays with it, never going far away for a minute, and it is strong enough to follow her within an hour after birth.

In the country around James's Bay M. Spencer says[14] that it is suckled for two months, and weaned by the 1st of September.

Early in October the rut sets in. The bulls begin to seek the cows, bellowing and fighting, much as do the Wapiti. I never had the luck to see them at this time, nor do I know any one who has. Linklater, after some years among the Caribou about Lake Abitibi, believes that they are polygamous, but has seen only two or three cows with one bull. MATING

Whether they make wallows or have any peculiar habits during this season, I can not learn. There is great lack of information, and at best we can do no more than fall back on analogy and reason from the habit of the Norwegian and Barren-ground species, that the bull beats off other bulls from as many cows as he can secure, and that he devotes himself to these for the season. In November, when the bands begin

[14] Low, Expl. James Bay. Can. Geol. Surv., 1888, App. III, p. 76.

their southward trek, he is with them still, but now is indifferent to the presence of other bulls.

USES

The great service rendered to man by the Reindeer of Lapland is well known, and the realization that we had in America a Lapland of our own, led long ago to a plan for establishing the Caribou as a range animal in Alaska. Naturally enough, the first idea was to domesticate the native species. But the Reverend Sheldon Jackson, Senator H. M. Teller, and the Hon. A. C. Durborrow, who took the whole problem in hand, were more wisely practical, in that they availed themselves of the long domestication of the Reindeer in Europe, and imported their stock from Norway and Lapland. These have prospered and multiplied.[15]

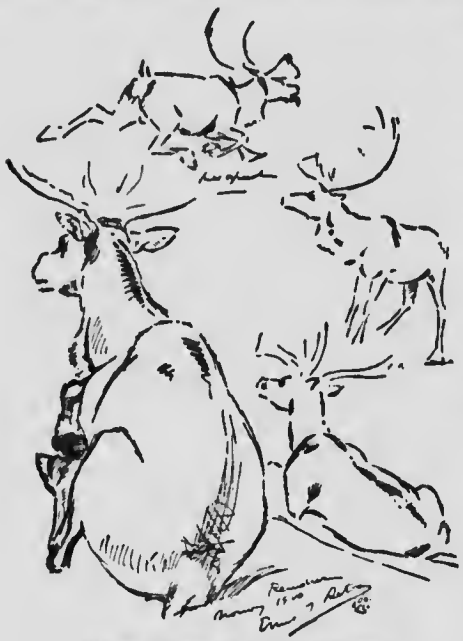


FIG. 91—Sketches of Norway Reindeer.

There are now several thousand of them domesticated in Alaska. The project is an assured success, and the time is in sight when the great northland will support a population of Reindeer and supply Reindeer staples in exchange for those of the south.

A similar scheme is now being successfully furthered in Labrador by Dr. Wilfred T. Grenfell.

The Reindeer has always been an important animal to our race. The dawn of human history is known as "The Reindeer Age," because, at that time, the Reindeer was the

[15] Rep. Intro. Domestic Reindeer, Alaska. S. Jackson, U. S. Senate, 1896.

PLATE XIII.—SCATOLOGY OF THE DEER.

Pellets all natural size. 100 to 200 at each place.

*Wapiti.*—1-7; 1 and 2 spring pellets; 3, summer, all green grass; 4 and 5 autumn, dry grass and twigs; 6, winter, nearly all woody fibre; 7, gravel and sand, doubtless swallowed medicinally.
*Mule-blacktail.*—8-11, 8-8, Buck; 9, 10, adult, probably doe; 11, fawn.
*Whitetail.*—12, not distinguishable from those of Blacktail, and sometimes as large as those of Wapiti.
*Caribou.*—Group 14, Athabaska River, October 30, 1907
*Moose.*—Group 15-15; though sometimes confluent in green grass season, these are typical and easily known.

most numerous large animal in Europe, and the chief support of man. The bone-caves and lake-beds of southern Europe abound in Reindeer remains. The Cave-man who hunted the Reindeer, though a naked savage, had a wonderful feeling for art. He was the inventor of etching and has left us many pictures of contemporary life, etched on bone, slate, and ivory, with that most primitive of gravers, a sharp-pointed flint.

These pictures are the earliest-known efforts in art. The most ancient monuments of Egypt, Assyria, and China were probably built thousands of years after the Stoneman had accidentally buried these etchings in the midden-heaps of his camp.

They are priceless and unimpeachable records of life at the time, in the one universal writing. They are, moreover, fair in drawing, good in composition, and masterly in character. No one needs to be told that the man who drew these animals had been familiar with them from his youth up.

Many species, from birds and snakes to elephants and men, are represented, but the best of the drawings always are those of the Reindeer. Among these, the palm is given to the Kesserloch etching on a piece of Reindeer antler. The reproduction on the next page is full size.

At first sight one may be disposed to question the drawing of the hind-legs and the incurved line of the belly. But a reference to the habits of the living animal shows that these parts are correctly represented. During the rut, the bull Reindeer are so devoted to the present engagements that they even neglect to eat, and the late fall sees them spent in strength, worn out, and emaciated. They are then so weak that they are easily destroyed by Wolves and other enemies. From these they seek refuge in the bogs and marshes, where their own natural gifts are guarantee of safety, until the frost makes firm ground of all, by which time the stag has regained his vigour.

The full-sized antlers and the long beard show that this was the season in the Cave-man's drawing. The pinched-up belly, the tottering hind-legs, and the truthful rendering of the

marsh all go to show that he was depicting something that he had seen with his own eyes, and that his Reindeer, indeed, was much the same as ours to-day, though he and the beasts he chased are reckoned with the species that lived in Europe ten thousand years ago.

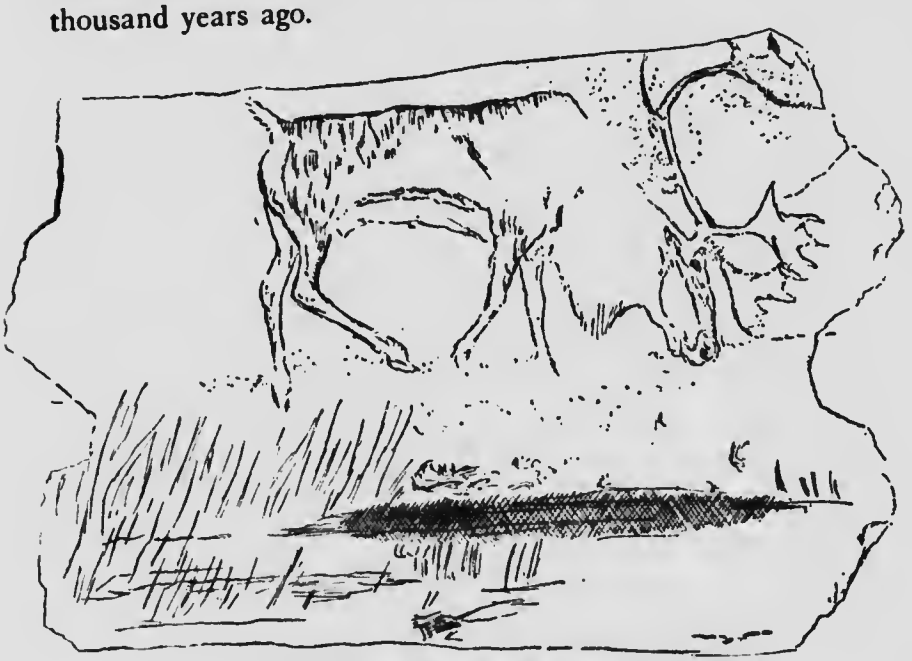


FIG. 92—Prehistoric drawing of Reindeer from Kesserloch Cave, Switzerland.
(From Prof. Albert Hein's reproduction in Lartet and Christy's Reliquiæ Aquitanicæ.)
(Size of Original.)

PLATE XIV.—ANTELOPE SIGHTING DANGER.
(*Antilocapra americana* (Ord.))

## VI.

## The Common Prongbuck, Antelope or Pronghorned Antelope of America, Cabrit or Cabrie.

*Antilocapra americana* (Ord).

(*Antilocapra*, name compounded by Ord, in 1818, out of *L. antilope*, an antelope, and *capra*, a goat; *americana*, of America.)

*Antelope americana* ORD, 1815, Guthrie's Geogr 2nd Am. ed., II, p. 292 (descr. on p. 308).

*Antilocapra americana*, ORD, 1818, Journ. de Phys., LXXXVII, p. 149.

TYPE LOCALITY.—On the Plains and the highlands of the Missouri.

FRENCH CANADIAN, *le Cabrit*.

CREE, *Ah-pi-chee-ah-tik'* (small caribou).

YANKTON SIOUX, *Tah-chah-chus-cheen'-ah* (small deer).

OGALLALA SIOUX, *Tah-hern-cha-san'-la*.

The word Cabrit or Cabrie used by the half-breeds of the North-west may be, as Richardson suggests,[1] a Basque corruption of the Spanish *cabra*, a goat. The fact that the English fur-traders and the earliest Spanish explorers call it "Goat" helps this idea. But Dr. Coues thinks[2] Cabra, Cabbrie, Caberey, etc., may be a native word adapted.

The names *Le Squenoton* and *Squinaton*, recorded by Dobbs and his anonymous predecessor,[3] probably do not belong to this species.

[1] F. B. A., 1829, I, p. 262.

[2] "It occurs in early annals of the N. W. under circumstances which lead me to believe it an entirely different word [from Latin Capra] of Indian origin."—Henry's Journ., 1897, p. 191. E. C.

[3] Quoted by Richardson, F. B. A., 1829, I, p. 262.

The Family *Antilocapridæ* is unique.[4] It combines peculiarities of the giraffes, the goats, the Antelope, and the Deer. It consists of a single genus, *Antilocapra* (Ord, 1818), and this consists of one species, found only in North America. Therefore the characteristics of the animal are the characteristics of the genus and of the Family.

The American Antelope is a ruminant, which, like the giraffe, has two hoofs on each foot; like the goat, it has a gall-bladder and a system of smell-glands; like the Deer, it has 4 teats and a coat of hair, with an undercoat of wool; like the goat, it has hollow horns on a bony core, yet, as in the Deer, these horns are branched, and are shed each year.

SIZE AND WEIGHT

The largest buck Antelope in the Zoological Park, New York,[5] stands 37½ inches (952 mm.) at the shoulder; has a head and body length of 47¾ inches (1,213 mm.); tail, 3½ inches (89 mm.). A fair-sized buck stands 36 inches (914 mm.) at the shoulder—the top of the head rising a foot higher—and weighs about 100 pounds. A four-months'-old buck which I weighed in Jackson's Hole in October, 1898, was 60 pounds, and stood 28 inches at the shoulder. A large one killed by E. S. Dodge, of Oracle, Ariz., weighed 125 pounds.[6] The females are smaller and lighter.

COLOUR

The colour of the adult *male* Antelope is a rich tan, varied with pure white patches, as shown, that is to say, the sides of face, nape of neck, base of ears, 2 bars on throat, breast, belly, rump, and inside of limbs are white. The upper part of the muzzle, the patch under each ear, the eyes, horns, hoofs, and sometimes the mane, are black.

The *female* is similar in colour, but the black areas are less, and those under the ears are often lacking. Dr. W. T. Hornaday has a large male head also without these black

[4] As these pages are in press, M. W. Lyon, Jr., of U. S. Nat. Mus., gives excellent reasons for reducing this Family to a subfamily of Bovidæ, with which it agrees in all important parts of its structure. See Proc. U. S. Nat. Mus., No. 1619, Vol. XXXIV, Aug. 11, 1908.

[5] W. T. Hornaday, Am. Nat. Hist., 1904, p. 117.

[6] Recreation Magazine, October, 1898, p. 307.

FIG. 03—An Antelope pose.

FIG 05—Antelope poses.

FIG. 04—Antelope poses.

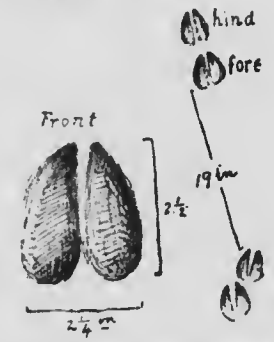




FIG. 06—Tracks of large Antelope.

side-patches. Occasionally specimens are seen with a distortion of the usual pattern on the throat, as though the stencil had been jarred when the work was half done.

The young are at first grayish brown, darkening on the face, paling on the rump, and with faint suggestions of the adult colours and pattern, but are never spotted as in the Deer Family. They assume the adult colours toward the end of summer.

RACES

Merriam has recently described[7] the Mexican Antelope as a new sub-species, *mexicana*, but this name is possibly antedated by Hamilton Smith's *palmata;*[8] this is a pale race.

DISCOVERY

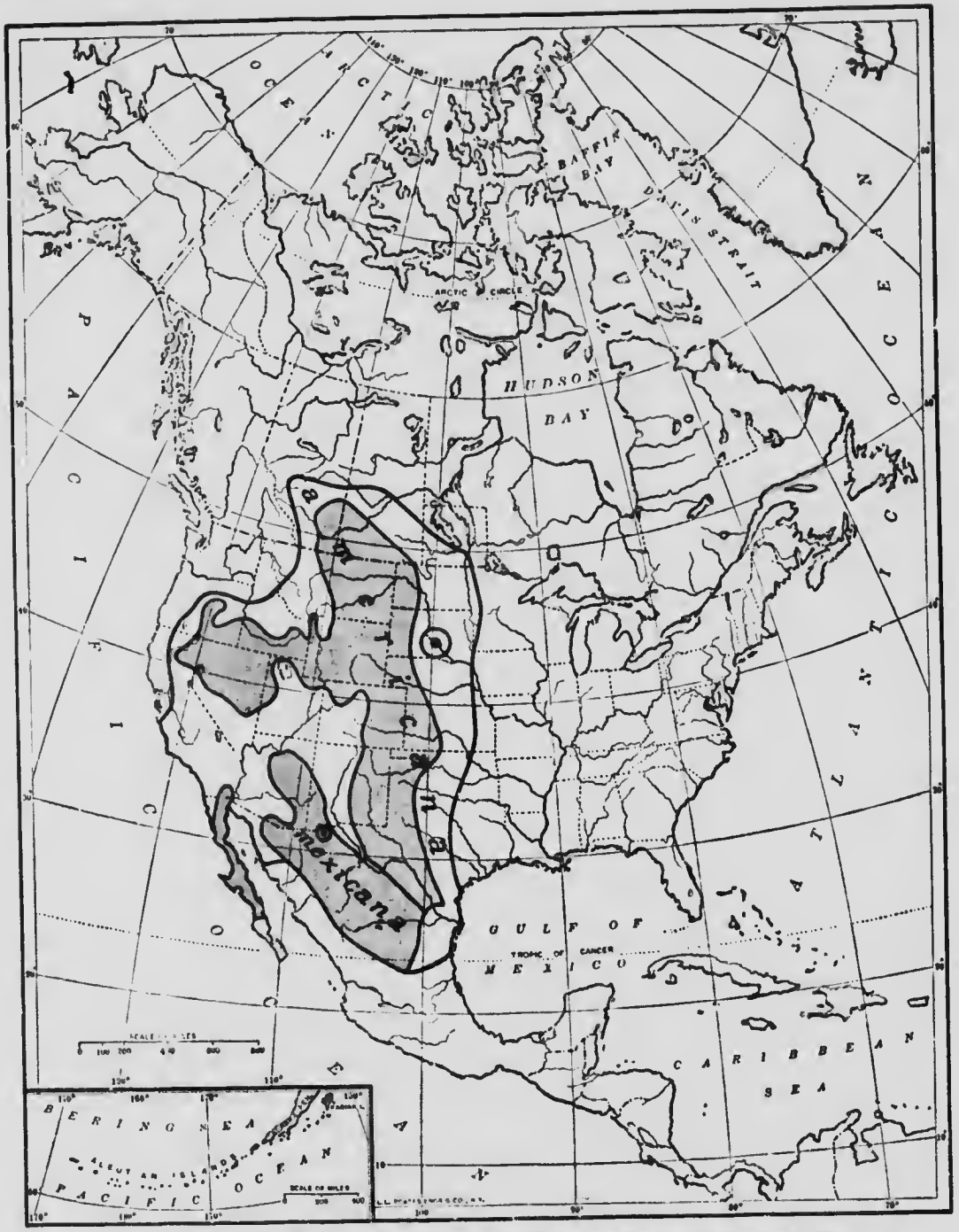
In that eventful *anno domini* 1535, when Jacques Cartier ascended the St. Lawrence to be the white discoverer of Hochelaga (Montreal), Francisco Vasquez de Coronado also landed in Mexico and became a pioneer and an empire-builder of world-wide fame. Five years later he set forth on his memorable march northward as far, we now believe, as Kansas, discovering and possessing in the name of the Cross and the King. Without doubt he was the first white man to see the Antelope. Charles F. Lummis writes me that:

"Coronado's expedition unquestionably saw Antelope; but there is no name and no definite description of them in his record. The nearest he comes to it is on the Buffalo plains, where Castañeda speaks of 'siervos, remendados de blanco' (the stags patched with white). Herrera mentions them under their proper name of *Berrendos* (Decade, II, p. 288, 1601). I do not recall any mention of them in Gomara."

G. H. Gould calls my attention to the fact that near Zuni, Coronado saw what he calls goats. Undoubtedly they were Antelope.

In 1651 Hernandez described[9] this animal. He calls it Teuthlalmaçame or Temamaçame; evidently these were the native Aztec names, and in the same paragraph he uses the

[7] Proc. Biol. Soc., Wash., April 5, 1901, p. 31.
[8] Griff. Cuvier, 1827, V, p. 323.
[9] Nov. Hist., 1651, pp. 324–5.




**MAP 9—RANGE OF THE PRONGHORNED ANTELOPE AND ITS TWO RACES.**

***Antilocapra americana* (Ord.)**

Founded on the records of many early travellers and on my personal observations, with assistance from the maps published by Dr. C. Hart Merriam, 1901, Dr. W. T. Hornaday, 1904, and some material in the possession of the Biological Survey, U. S. Dept. of Agriculture. The outer line shows the primitive range; the tint shows the range in 1900, probably shrunken still more to-day (1909).

name "Berendos," by which it is yet known in Mexico. But it did not receive any scientific appellation until one hundred and sixty-four years later.

## Life-history.

RANGE

Map 9 shows the Antelope to be by choice a creature of the high and open plains, though in California and Texas it was originally found down nearly to sea level. Its preference is the flat country, yet it is often found on rolling or hilly lands, and occasionally in small parks or forest openings; its prime requisite being that its feet rest on hard, dry ground.

IN MANITOBA

Formerly the Antelope abounded on the high prairies of south-western Manitoba, as attested by several old records:

In the fall of 1801 A. Henry built a trading post at the mouth of Pembina River, near the present St. Vincent. Here he lived, traded, and scribbled for several years. His journal shows that Buffalo were abundant about the fort. The only mention he makes of Antelope is this:[10]

"November 15: An Indian brought me a large Cabbri which had four inches of fat on the rump."

In 1806 Henry was travelling from Portage la Prairie, Manitoba, W. S. W., through the Brandon Hills, and says:[11]

"July 14. From the summits of these high barren hills we had delightful views. In some low spots were clusters of poplars; to the north we could see the Assiniboine, north of which we could trace the course of Rapid River [Little Saskatchewan], which comes from Fort Dauphin Mountain [Riding Mountain]. Herds of Cabbrie or Jumping Deer were always in sight."

He continued his journey S. S. W. across the Plains of the Souris into what is now Dakota, finding abundance of Buffalo, and records next day from near the Boundary, at a point 14 miles south of Boss Hill, on the west bank of the Souris, close

[10] A. Henry's Journal, 1897, p. 191.

[11] *Ibid.*, p. 305.

to Butte de Sable:[11] "Cabrie were in sight almost every moment, but so shy that we could not get a shot."

The following day he wrote:[12]

"July 16: We saw numbers of Cabbrie of two different kinds, some [the bucks] almost as large as fallow Deer and others [the does] much smaller, red and white spotted; the latter had young, and did not appear so shy as those we had seen before. The young ones, sighting us, would run up to us within a few yards, while the dams would come on behind them with more caution, until their curiosity was satisfied."

These are all the very early mentions I can find of this animal in our limits.

Antelope were never found along the low Red River, were rare even on the White Horse Plain, where, however, Captain John Schott of Athabaska Landing—then a boy of 14—tells me he killed two in the spring of 1855. This is the only evidence I can find of Antelope anywhere near Winnipeg. In 1852 Schott was with a number of Buffalo hunters on the Big Plain, near the site of Carberry, and there saw several bands of Antelope. But nowhere north of the Assiniboine were they plentiful as on the high prairies west of Pembina Mountain.

In 1858 Professor H. Y. Hind, travelling from the United States Boundary on the west bank of the Souris, due north across the Plains of the Pipestone, records[14] for a point apparently 10 or 12 miles north of the Boundary:

"July 4: We saw some herds of Cabri, and McKay succeeded in killing a female." But his narration shows that they were very rare in the region.

In 1874 Dr. E. Coues saw "a few Antelopes" along the Souris River, near the Boundary.[15]

J. T. Brondgeest, of Whitewater, Man., tells me that he first came to Whitewater in 1879, and settled down in the fall

[11] *Ibid.*, p. 306.
[12] *Loc. cit.*, p. 310–11.
[14] Assin. & Sask. Expl. Exped., 1859, p. 46.
[15] Birds Dak. & Mont., July 29, 1878, Bull. U. S. Geol. Surv., No. 3, Vol. IV, p. 547.

of 1880, and that in those days there were plenty of Antelope about. But the last he saw was killed by his father in 1881.

In 1882, when I traversed that whole region, I neither saw nor heard of any Antelope, nor can I learn that they have ever been seen since.

HOME LOCALITY

My own experience with this animal has been chiefly on the Plains of the Canadian River and in western Wyoming. I was there much struck by the smallness of the home locality that seemed to satisfy each band. A level stretch of open prairie two miles across seemed ample range for a herd of twenty throughout a whole season. If there was water on it they seemed satisfied to stay indefinitely. All the records I can find are of similar import. Thus:

Dr. E. L. Munson, U.S. Army, says:[10] "For some weeks a band of several hundred were in a large pasture 4 miles square, several miles from Havre, Montana."

Dr. C. A. Canfield (of California) says:[11] "Any particular band of Antelope does not leave the locality where they grow up, and never range more than a few miles in different directions."

W. N. Byers, of Denver, Col., tells me that for several years in Middle Park, Col., he used to see one particularly large buck Antelope near the road within a mile of the same place. He supposed it was there on account of a salt-lick near.

It is a common remark that the Antelope when hunted runs in a circle. A little reflection will show that this is true of all animals, and that the circle is always around the region that the creature knows, namely, its own home locality; in this case but 3 or 4 miles across.

During summer the bands are scattered, but the range of the individual is even smaller. I have seen an old Antelope that made her summer home on the flat top of a butte that was less than 200 acres in extent. The males seem to be less local at this time than the females, and, like bull Moose, commonly wander in twos.

[10] Forest and Stream, February, 1897, p. 164.

[11] Caton, Antelope and Deer of America, 1877, p. 43.

But all this permanent residence of one spot seems to be in regions where the winter is mild and the snow light. In the northern part of the range a different habit prevails. At the first heavy snow the Antelope of the Upper Jackson's Hole travel 150 miles southward to the Red Desert. Those on the prairies of the Saskatchewan move into the coulées and brakes, 100 miles southward and westward. Those of the Plains near the Rockies go toward the foot-hills, and those on the open country about the Black Hills flock thither from all points of the compass. MIGRATION

Edwin Carter tells me that the Antelope used to winter in vast numbers about Colorado Springs, and were common in the surrounding country all the rest of the year.

As noted later, Major James B. Pond told me that during a blizzard in the winter of 1868–9 he saw the Antelope crowded in every sheltered valley along the railway line from Cheyenne to Denver.

At Medicine Hat, Alberta, I was informed that a snow-storm in winter would concentrate the antelope in coulées and places of shelter. But these are temporary congregations, and, according to Dr. E. L. Munson, a few days of fine weather causes them to scatter again. He also remarks[18] that he "found Antelope rare during the summer along the Sun River and the Teton, but reasonably plenty in winter."

Richardson says:[19] "Some of them remain the whole year on the South Branch of that river [Saskatchewan], but they are merely summer visitors to the North Branch [about 200 miles away]. They come every year to the neighbourhood of Carlton-house, when the snow has mostly gone, * * * and they retire to the southward again in the autumn as soon as the snow begins to fall." Then he adds an item which affords interesting light on the relentless process of developing a migratory instinct. "Almost every year [he says] a small herd lingers on a piece of rising ground not far from Carlton-house, until the snow has become too deep on the Plains to permit them to travel over them. Few, or none of that herd, however,

[18] *Loc. cit.*

[19] F. B. A., 1829, I, p. 263.

survive until the spring, as they are persecuted by the Wolves during the whole winter."

From this we may conclude that the Antelope is a creature of small home locality, and a permanent resident there when climate and food-supply permit, as is the case in the southern part of its range. But in the colder, snowier regions it is driven to journey in search of better conditions; and though these movements are as often northward as southward, they are seasonal and somewhat regular, so that they are true migrations.

A curious stampede that took place during one of these movements is thus narrated[20] by H. W. Skinner, Chicago:

"Early in the spring of 1890 a party consisting of two trappers and three prospectors, besides myself, were going up the western side of the Green River, in Wyoming, as rapidly as the melting of the snow would allow us to proceed. The wild animals were going up the river valley at the same time. Large bands of Antelope travelled parallel with us, and being unmolested (as for a number of days not a shot was fired), they would dash by within a hundred yards of us. We sometimes stopped for two or three days at a time, waiting for the snow to melt sufficiently to allow us to go ahead. While making one of these stops we camped on a gentle slope facing the south-west. The snow had disappeared from the slope, but was still quite deep in the valley through which we were obliged to pass. As we lay quietly in our blankets one noon, taking turns at crawling under the wagon to get out of the intense heat of the sun, there suddenly came over the crest of the ridge north-east of us (the crest being not more than fifty yards distant) a band of Antelope numbering about 50. Being badly frightened by something, they dashed over the ridge, and were among us before we could spring to our feet. Probably half of the band ran directly through the camp. All tried to sheer off to the right, but the momentum and panic of the leaders were so great that they did not change their course quickly enough to avoid running over us. I do not know that any member of

[20] Letter, April 3, 1901.

the party was actually struck by an Antelope. Some of the camp utensils were, as I remember the accompanying clatter, and a rifle that had been leaning against the wagon was knocked over and the stock broken. The entire affair was over in a very few seconds, of course. None of us recovered from our astonishment until the Antelope were far away."

NUMBERS

The accompanying map (p. 213) shows a surprisingly slight shrinkage in the range of the species—a shrinkage which, unfortunately, does not correspond with the actual reduction of its numbers.

The ancient territory of the Pronghorns covered about 2,000,000 square miles; and a safe estimate, founded on the reports of travellers, would be 10 Antelope to every square mile. The present range covers about 1,000,000 square miles. But who will say that there are 10,000,000 Antelope left? If it be shown that there are 100,000 wild Antelope alive to-day I shall be agreeably surprised. At least half of them must be in Mexico.

These estimates are founded on many ancient and modern accounts, viewed in the light of my own experience.

During early days in New Mexico (about 1892) we could usually reckon on seeing a band of a dozen or 20 Antelope on the open plains every 10 miles or so during the fall. The region that I knew, and rode in daily, was some 60 miles long by 5 wide. In this were 5 well-known bands of Antelope, each keeping its own home locality and each numbering about 20. This would give 100 Antelope to 300 square miles. But all the "old-timers" agreed that there were *no Antelope* in the country now. "Just an odd one here and there, and nothing to compare with the herds of the days gone by," they said.

In those early times bands of 2,000 or 3,000 were seen commonly on the plains of California.[21]

Charles H. Stonebridge, of New York, tells me that in the August of 1875, while crossing Wyoming, he saw daily from

[21] J. C. Hoxie, J. S. Drury, S. F. Dickenson, and many other Californian pioneers in conversation at Bakersfield, Cal., October 3, 1899.

500 to 3,000 Antelope in bands numbering 100 or 200 each. In April, 1879, they were just as plentiful in the same region, also in western Nebraska and in Utah.

Similar testimony is borne by many travellers for the open country east of the Rockies.

In the Dakota Badlands, during the early '80's, they were still abundant. Howard Eaton tells me that in 1884 he saw there as many as 8,000 and 9,000 in a day. Even as late as 1896 they abounded in Montana. Dr. Edward L. Munson, of the U. S. Army, gives credence to the report that in the great blizzard of December of that year "40,000 Antelope took shelter in the coulées along Milk River alone in Montana, near his post, Fort Assiniboin," and that between Havre and Glasgow (125 miles) a band of them might be seen every half mile.[22] These probably were the Antelope population of a region a couple of hundred miles across concentrated in the sheltered valley.

Had they been the entire population of that north end of the range, it would give about one Antelope to the square mile, but we have evidence of many other bands in the country, at least doubling the number; yet we know that Antelope were far from abundant then—in the old-time sense.

W. N. Byers, of Denver, tells me that in 1868 he witnessed a Ute "surround" of Antelope in North Park, Col., where 4,400 Antelope were killed. As the entire Park is 5,000 square miles, only a small part of it could have been driven, and, furthermore, many of those started escaped. We are safe, however, in putting the numbers as high as 3 Antelope per square mile. But the Park was not an ideal place for the species. The snows were too deep for a high rate of population. In the Yellowstone Park proper (3,000 square miles, about one-third of it Antelope country) there were, according to official estimate, in 1896, 1,000 Antelope—that is, 3 to every square mile. Yet hunters considered them very scarce, and said that it would take 10 times as many (that is, 30 to the square mile) to make really "Antelope country."

[22] Forest and Stream, January 2, 1897, p. 7.

Major J. B. Pond once gave me an important item: "In the winter of 1868–9 I travelled on the railroad newly opened between Denver and Cheyenne. All the Antelope had left the open plains, and were now sheltering among the foothills. For 10 or 12 miles in Cache le Poudre valley and all the way west of the train, about ¾ to ½ mile away, was one long band of Antelope, 20 to 40 rods wide, practically continuous and huddled together for warmth. Their numbers changed the colour of the country. That winter many wagon loads were brought to Denver and sold, 3 or 4 carcasses for 2 bits (25 cents), that being the smallest coin in use."

If there is no error in these figures, it meant 2,000,000 Antelope. This great concourse came from the Plains north and east. They would not have come from the west, because it was rugged mountainous country; nor from the south, because of the storms; and it is extremely unlikely that they came from a greater distance than 200 miles. Reckoned by area, therefore, they represented about the fiftieth part of the Antelope population of America. If even we halved the estimated figures to avoid error, it would still give over 40,000,000 as the aggregate of Antelope on the range. At this time they must have outnumbered the Buffalo.

From these various facts it will be seen that in many regions the species probably exceeded 10 to the square mile. Though there were vast areas which fell far below this, these were offset by the greater density elsewhere. Therefore, in estimating their pristine population at 10 to a square mile, I have been reasonably conservative.

I hope I have been equally so in putting the 1900 population at 100,000. Since then their numbers have probably decreased further. In some regions, I am told, there is a slight increase, but in others a sad diminution. A. A. Anderson estimated that in 1905 there was not more than a quarter of the Antelope in Wyoming that there were in 1900.

It is fortunate that the nation has awakened to the fact that game is worth preserving, and that a national effort is needed to preserve it. All the States now have game laws for

the protection of Antelope. Some of them have even declared a close season for a term of years. It is probable, therefore, that we may yet keep the Pronghorn from going the way of the wild pigeon and the Buffalo.

HORNS

The horns are perhaps the most remarkable feature of this remarkable animal. Though true horns like those of a cow or goat, they are yet branched in shape, and shed each year like the antlers of a Deer. This last fact was first announced by Rufus B. Sage, who wrote, about 1841, of the Antelope:[23] "The male, however, is equipped with hook-shaped antlers, ebony coloured, and 6 or 8 inches in length, which he sheds annually in the months of November and December." Dr. C. A. Canfield, of Monterey, Cal., made the discovery independently in 1858.[24]

FIG. 97—Diagram of buck Antelope's horns in his four successive autumns.

The black part is the new horn coming inside.

Judge Caton investigated[25] the growth of horns in detail. His observations show that the male Antelope has, at birth, a little bump over each eye. At four months old (that is, at the end of September) this breaks through the skin as a small and somewhat movable horn. In January, usually when about an inch long, this is dropped or pushed off by the new horn growing below it, on the top of the bony core, which also grows rapidly, so that in a couple of months the whole horn is about 3 inches long. The next year the shedding takes place earlier, but the bony core (now much bigger, of course) remains. The prong is developed above the bony core.

Old bucks shed in October—that is, immediately after the rut. They have an advantage over members of the Deer tribe in one particular—a Deer is hornless for some time after

[23] Rocky Mt. Life, 1857, p. 56.

[24] Pub. in Proc. Smith. Inst., 1866. See Caton, Antelope and Deer of America, 1877, p. 26.

[25] Antelope and Deer of America, 1877, pp. 25–35.

shedding the antler, but an Antelope's new horn is already well sprouted before the old one is dropped. The outlines shown in Fig. 97 may be considered as diagrammatic expression of the horn development. Actual horns in series like those of the Wapiti (p. 57) are not at hand.

It is well known that true horn is theoretically a mass of consolidated hairs, but the whole process of hair-growth, the consolidation into horn, and the actual shedding (as with the hair of the coat) are all visibly demonstrated in the horn of this unique animal.

It seems that the larger and lustier the individual the sooner his weapons are shed. W. R. McFadden, of Denver, tells me that early in the fall of 1894, while shooting on the Elkhead River of Colorado, he fired at a buck Antelope that had unusually large fine horns. It ran some 20 yards and fell dead. On coming up he was disappointed to find that it had for horns only a pair of miserable little spikes. The puzzle was explained when he found both of its other horns, a large pair, lying on the ground where it fell. Evidently it had been at the point of shedding these when shot at.

The female yearling shows little points of horn. These never exceed 2 or 3 inches in length.

Horns of the normal type are shown in the first figure in Plate XIV, and the number of variations from this is small. The largest pair that I can find on record[28] (I have not seen them) are in the possession of E. S. Dodge, of Arcadia Ranch, Ariz., who shot the creature near Oracle, Ariz., October 22, 1897. These are given as follows:

| | INCHES |
|---|---|
| Length of left horn around curve | 17¼ |
| Length of right horn around curve | 17⅜ |
| Spread of horns at tip | 6½ |
| Spread at widest part | 15 |
| Girth of left horn at base | 6½ |
| Girth of right horn at base | 6¼ |
| Girth of horn at largest place | 10½ |

[28] Recreation, October, 1898.

These horns are of exceptional size. As Dr. W. T. Hornaday remarks:[27] "Any measuring 12 inches may fairly be considered large."

The only "freak" type that is often seen is that known as the "droopers." An example is shown in Fig. 98. Such disfigurements are probably the result of accident in early life. But obviously the buck with "droopers" once will always have them, as the fundamental horn cores themselves are abnormal.

FIG. 98—Antelope with drooping horns.
From photograph in Recreation, June, 1897, by W. H. R., who got them at Laramie, Wyoming, in 1893.

Long ago Darwin confessed himself puzzled[28] by the form of the Spring-bok's horn, inasmuch as the in-curve of the points apparently rendered them useless for attack. It seems as though a simple straight spike would be much more effective. The in-curved point and its half-way snag seem like buttons on the rapier, like efforts to disarm the well-armed knight while leaving him in possession of his weapons. But many observations made on the Antelope in the Washington Zoo Park, while I was painting their portraits, showed me how true it is that not the smallest detail in nature is without distinct purpose, for which it has been carefully adapted through ages of experiment. I learned that the prong—so far from being a button on the rapier—is a hilt that protects the bare flesh farther up, as described later (see p. 244). In short, the recurved point enables the buck to strike his adversary in the throat, where the skin is thinnest.

THE DISCOGRAPH

Another remarkable detail of the Antelope's anatomy is the white area on each buttock. This seems at first like the rest of his spots—a mere patch of white coat; but it is found

[27] Am. Nat. Hist., 1904, p. 217. [28] Descent of Man, Vol. II., p. 239.

PLATE XV.—ANTELOPE IN NATIONAL ZOOLOGICAL PARK WITH DISCS CLOSED.
(Photograph by G. G. Seton.)

PLATE XVI.—THE SAME ANTELOPE WITH DISCS HALF SPREAD.
(Photograph by G. G. Seton.)

PLATE XVII.—SKETCH OF A YOUNG ANTELOPE "LAYING LOW."

to be specialized for an important service. It is composed of hair graded from short in the centre, to long at the front edges. Under the skin of the part is a circular muscle by means of which the hair can, in a moment, be raised and spread radially into two great blooming twin chrysanthemums, more or less flattened at the centre. When this is done in the bright sunlight they shine like tin pans, giving flashes of light that can be seen farther than the animal itself, affording a conspicuous identification mark that must be of great service to the species.

Many years ago, while riding across the upland prairies of the Yellowstone, I noticed certain white specks in the far distance. They showed and disappeared several times, and began moving southward. Then, in another direction, I discovered other white flecks, which also seemed to flash and disappear. A glass showed them to be Antelope, but without wholly explaining the flashing or the moving, which ultimately united the two bands. I made a note of the fact, but did not understand it until the opportunity came to study Antelope in the Washington Zoo. I had been quietly watching the grazing herd on the hillside for some time; in fact, I was sketching, which affords an admirable opportunity for watching animals a long time minutely. I was so quiet that they seemed to have forgotten me, when, contrary to rules, a dog chanced into the Park. The wild Antelope has a habit of raising its head every few minutes while grazing, in order to keep a sharp lookout for danger, and these captives maintained the tradition of their race. The first that did so saw the dog. It uttered no sound, but gazed at the wolfish-looking intruder, and all the long white hairs of the rump-patch were raised with a jerk that made the patch flash in the sun. Each grazing Antelope saw the flash, repeated it instantly, and raised his head to gaze in the direction where the first was looking. At the same time I noticed on the wind a peculiar musky smell—a smell that certainly came from the Antelope– and was no doubt an additional warning.

Some time later I had opportunity to make a careful dissection of the Antelope's rump-patch, and the keystone to the arch of facts was supplied. My specimen, taken in Jackson's

Hole, was a male under six months old, so that all the proportions, and indeed the character, were much less developed than in the adult. (Fig. 99.)

The fresh skin was laid flat on a board, and then the pattern and mechanism of the rump-patch were clearly seen. The hairs at the upper part of the patch (A) were about 4 inches long, grading to the centre (B), and the lower parts, where they were under 2 inches long, all snowy white and normally lying down flat, pointing toward the rear. At the point (B), among the roots of the hair, was a gland secreting a fluid having a strong musky smell. On the under side of the skin was a broad sheet of muscular fibres, which were thickest around B; they have power to change the direction of the hair, so that all below B stands out, and all above is directed forward.

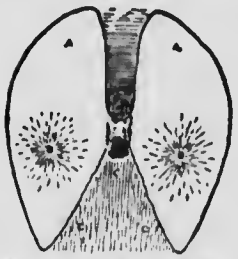


FIG. 99—Skin of crupper-discs.

At AA the hair was about four inches long; at and below BB less than two inches; at CCC, between the two patches, it was one-quarter inch long.

It seems, therefore, that as soon as an Antelope sees some strange persons or threatening object, this muscle acts, and the rump-patch is instantly changed into a great double disk of white that shines afar like a patch of snow. Further, in the middle of each disk is exposed a brown spot (the musk-gland), from which a quantity of the musk odour is set free, and its message is read by those who have noses to read.

Of all animals man has the poorest nose. He has virtually lost the sense of smell, while, among the animals next in the scale, scent is their best faculty. Yet even man can distinguish this danger-scent for 20 or 30 yards down the wind, and there is every reason to believe that another Antelope can detect it a mile away.

Observations on captive animals have thus afforded the key to those made on the Plains. I know now that the flashing flecks seen on the Yellowstone uplands were the interchanging signals of the two bands, the smaller of which, on getting the musky message, "Friends," had laid aside their fears and joined their kindred. This, it will be seen, is simply a helio-

graph. Man flatters himself that he was the first inventor of flash communication, but he is wrong—the Antelope used it thousands of generations before it was dreamed of by mankind.

The bristling mane of the species is erected under excitement at the same time with the disks.

GLANDS

Many animals are furnished with glands that produce a strong-smelling stuff that serves in some cases as a defence, but mostly as a method of intercommunication. A peccary has a scent-gland on its back, a Deer has one in each foot and on the hock; a goat has several about the head. The Antelope has every one of these various smellers, each tainting the adjoining air in a way of its own, and doubtless for a purpose that none other could answer.

There are numerous theories as to the purpose of the glandular system. Judge Caton thinks that these many pungent odours help to protect the Antelope from flies and mosquitoes, but it seems more likely that their chief service is for intercommunication.

The glands on the jaw seem related to the sexual system, as they are largest in the buck and most active in rutting time; those on the rump, as seen, have a place in the heliographic system; and the purpose of the other though not yet understood, is almost certainly to serve in conveying the news.

How can they do so? As possible answer to this, rather than as ascertained fact, I suggest that an Antelope passes along a certain plain, eating at one place, drinking at another, lying down in a third, being pursued by a Wolf for half a mile, when the Wolf gives up the unequal race, and the Antelope escapes at his ease. A second Antelope comes along. For him the foot-scent from the interdigital glands marks the course taken by his fellow as clearly as the track in the snow would do for us. Its strength tells him somewhat of the time elapsed since it was made, and its individuality shows whether his predecessor was a stranger or a personal friend just as surely as a dog can tell his master's track. Again, the hock-scent exuded on the plants or ground where the first animal

laid down informs the second one of the action. At the place where the Wolf was sighted the sudden diffusion of the rump-musk on the surrounding sage-brush will be perceptible to the newcomer for hours afterward; and the cause of it will be made clear when the Wolf trail is detected. This may sound a far-fetched tale of Sherlock Holmes among the Beasts, but not so, if we remember that in these animals their sight faculty is at least as good as ours; that their scent faculty is of still greater value to them; and finally, if all this had been recorded in the snow, we also could have read it with absolute precision.

The uniform of the species is itself an important means of intercommunication. Its conspicuous colouring labels the creature afar that this is surely an Antelope, for information of friend or foe. Thus one realizes that it is useless to follow, and the other that it is needless to flee.

It is interesting to note that the Antelope's tail does not count in its code of expression, although in the Whitetailed Deer—which is not furnished with the discograph—the tail is greatly developed and specialized as a means of communication. Parallel cases are the Wapiti, whose tail is inert, but whose crupper-patch is very active, and the Moose, whose tail is a dummy, or sleeping member of the firm, but whose hip on each side is furnished with an erectible patch that seems to serve the purpose of expression.

VOICE

The sound oftenest heard from the Antelope is a querulous, grunting bleat, uttered by the mother when she is calling to the kid. The adult has also a sort of shrill whistle or snort—used as an alarm and a short bark of curiosity. The kid utters a bleat or squeak, but most of their signalling is done by appeals to the eye and nose.

EYE

The eye of the Antelope is of marvellous beauty and magnitude, "larger than that of any other quadruped of its size," as Caton says[29]—and there is every evidence that it is as keen as it is beautiful. This is readily understood in relation to the

[29] Antelope and Deer of America, 1877, p. 24.

fact that it is a creature of the open, where its eyes are more often serviceable to it than its ears, or even than its nose, and that the majority of its signals, unlike those of woodland animals, are dependent upon vision for their success.

In obvious relation to the full expressive eye is the interesting habit recorded by Judge Caton:[30]

"Our Antelope [he says] has the faculty of weeping when in affliction. I first observed this in a specimen which had been taken wild when adult, and still retained all his natural fear of man. I had placed him in a close cage in the evening, intending to familiarize him with my presence, and divest him of his fears when he saw me by convincing him that I would not hurt him. When I approached him the next morning he seemed struck with terror, and made frantic efforts to break out, which he soon found was impossible. His great black eye glistened in affright. I spoke softly and kindly, while he stood trembling as I introduced my hand and placed it on his shoulder. Despair now seemed to possess him, and he dropped on his knees, bowed his head on the ground, and burst into a copious flood of tears, which coursed down his cheeks and wet the floor! My sensibilities were touched, my sympathies were awakened, and I liberated him from that cage as quickly as I could tear the slats from one of the sides. Whether he appreciated this or not I cannot say, but his great fear seemed to leave him as soon as he was liberated; he ran but a little way and not at full speed, when he stopped and began to pick the grass."

FEET

The Prongbuck is the only horned ruminant in North America that has but two hoofs on each foot. Nature's economic plan has been to remove all parts that cease to be of use, and so save the expense of growing and maintaining them. Thus man is losing his back or wisdom teeth, since civilized diet is rendering them superfluous. Ancestors of the Antelope had four hoofs to the foot, like the Deer or the pig, but the back pair on each have been dropped. At an earlier period the common ancestor of the Antelope and Deer had *five*

[30] Antelope and Deer of America, 1877, p. 46.

well-developed toes on each extremity, but it seems that while this makes an admirable foot for wading in treacherous swamps, it is, for mechanical reasons, *a slow foot;* the fewer the toes the greater the speed. The Deer living in swamps could not afford to dispense with the useful little hind or mud-hoofs, and retain them still for bog use, though much modified from the original equal-toed type, more nearly shown in the pig. But the Antelope, living on the hard, dry uplands, had no use for bog-trotters, and exchanged them for a higher rate of speed, so that it now has only two toes on each foot. The Horse Family went yet further. They shunned the very neighbourhood of swamps; all their life was spent on the firm, dry, level country; speed and sound feet were their holds on existence; and these they maintained at their highest pitch by adopting a foot with a single hoof-clad toe.

SPEED

Coronado and his contemporaries, when they discovered the Antelope, were too busy adding to the spiritual Kingdom of their Masters, in consideration of the material plunder thereof, to bestow a second thought on this wonderful wild thing. It remained for Lewis and Clark,[31] two hundred and seventy years later, to give the world detailed information about the Pronghorn of the Plains.

They comment with wonder on its great strength and its great weakness—that is, on its speed, which has given it first place for swiftness among the four-foots of America, and its inordinate curiosity, that has so often rendered its speed of no avail.

Concerning its gait, Audubon and Bachman say:[32] "Their walk is a slow and somewhat pompous gait, their trot elegant and graceful, and their gallop or "run" light and inconceivably swift; they pass along, up or down hills or along the level plain, with the same apparent ease, while so rapidly do their legs perform their graceful movements in propelling their bodies over the ground that, like the spokes of a fast-turning wheel,

[31] Journal. Biddle edition, 1814, Vol. I, p. 122 et seq. [32] Quad. N. A., Vol. II, p. 198.

we can hardly see them, but, instead, observe a gauzy or film-like appearance where they should be visible."

Hornaday says:[33] "In running it has three very distinct gaits. When fleeing from danger it carries its head low like a running sheep, and gallops by long leaps; when showing off it holds its head as high as possible and trots. * * * Occasionally it gallops with high head, by stiff-legged leaps like the Mule-deer."

Why does the Antelope occasionally make these high, but slightly progressive, bounds? Undoubtedly for the same reason as the Jack-rabbit makes a "spy hop." They are to give it a momentary high outlook whence it can scan the surroundings and look for danger.

I have gathered many observations on the speed of certain quadrupeds and have arrived at a scale, which, however, I submit with much hesitation. Of course we have no actual gauge on the speed of the wild creatures, and must reach it by various devices and comparisons, eliminating guesses. The estimates of hunters, etc., are always too high; besides, it is a misleading fact that of two animals going at the same rate the smaller always *appears* to be going the faster.

It is safe to say that the horse, the ancient standard of speed, still holds its own. There seems no good reason for supposing that any creature on legs—two, three, or four—ever went for any distance faster than a blood race-horse. Salvator's mile in 1 minute 35½ seconds is the fastest pace reliably recorded for anything afoot.[34]

On the uplands of Mexico, in 1892 and 1893, I several times saw my hunting comrade, William Allen, on his favourite horse "Spider," ride into a bunch of Antelope going their best and with everything in their favour. "Spider" was locally known as a racer, although only a quarter-blood.

On the Little Missouri I saw some first-class greyhounds

[33] Am. Nat. Hist., 1904, p. 117.

[34] My authority is Samuel W. Taylor, Editor of the Rider and Driver, New York; the record is Salvator, 4,110, Monmouth Park, N J., U. S. A., August 28, 1890.

overtake a Mule-deer on the level, but fail utterly when it came to a buck Antelope. These same dogs could catch a Coyote in a very short race.

Captain R. B. Marcy says:[35] "We have had several good opportunities since we have been upon the plains of witnessing the relative speed of the different animals found here, and our observations have confirmed the opinion I have before advanced. For example, the greyhounds have, upon several different occasions, run down and captured the Deer and the Prairie-rabbits, which are also considered very fleet; but although they have had very many races with the Antelope under favourable circumstances, yet they have never, in one instance, been able to overtake them; on the contrary, the longer the chase has continued the greater has been the distance between them. The *Cervus virginianus* (our Red-deer) has generally been considered the fleetest animal upon the continent after the horse, but the *Antilocapra americana*, or Pronghorned Antelope of the plains, is very much swifter."

Greyhounds have doubtless caught many Antelope in open chase, but one greyhound cannot catch a full-grown, unwounded buck Antelope by fair running.[36] As Governor St. John, of Kansas, said to Buffalo Jones after much experience, "It takes a mighty good greyhound to catch a mighty poor Antelope."[37]

I have often heard railroad men tell of races between trains and Antelope. When running at the ordinary rate of 25 or 30 miles an hour the engine could not pass these fleet coursers, but when the engineers put on all speed, so as to run at a 35-mile rate, the train forged ahead—and in a mile or so the Antelope turned aside and gave it up, disgusted to find that at last there was something on the plains that could outrun them.

[35] Exped. Red River, 1854, p. 62.

[36] Since this was written Dr. G. B. Grinnell tells me that in 1873 "Gibbon," a phenomenal greyhound belonging to General Stanley, did on 22 occasions, in fair race, catch unwounded Antelope, some of which were bucks. And Colonel W. P. Evans, 11th Inf. U. S. A., writes me, November 28, 907, that Colonel Gardiner had a bitch greyhound, which he saw catch a fine buck Antelope in 1878, near Fort Dodge, Kan. She had several others to her credit, but was undoubtedly a very unusual hound.

[37] Buff. Jones Advt., 1899, p. 194.

PLATE XVIII.—LEAVING THE GREYHOUNDS BEHIND.
(Drawing originally published in *Recreation*).

I have computed the speed of many other animals by counting their bounds to the minute and then afterward measuring those bounds in the snow. On others I have made a number of comparative observations from railways, trains, and motor-cars going at a known speed. Above all, I have always kept in mind the fact, when on record, that such can catch so-and-so, in a fair race. The mineralogists make a scale of hardness, on units, each of which can scratch the one below it, and be scratched by the one above. I have acted on this plan in making my scale of swiftness, only for "scratch" I read "catch."

In general, I have found that the wild animals are less swift than is commonly supposed, and that their strong point is the quickness with which they can get up speed. Their "muzzle velocity" is indeed a matter of life and death; for most predaceous creatures, especially the cats, give up the chase at once if they fail on the first dash. Furthermore, I have been continually impressed by the smallness of difference in their speed. The few seconds that one animal saves in making its mile is evidently of vital importance. The scale I have attempted is founded on the animal's best rate for a mile. A rate that is representative has been chosen, rather than the phenomenal or the highest record of each species.

Thus the best horse record for a mile is at the rate of over 36 miles an hour. I prefer, however, to set the horse at 34 miles an hour, as many horses attain this rate.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Race-horse | Best speed for a mile is at the rate of | | | | 34 | miles pe: | hour |
| Pronghorned Antelope | " | " | " | " | 32 | " | " |
| Greyhound | " | " | " | " | 30 | " | " |
| Texan Jack-rabbit | " | " | " | " | 28 | " | " |
| Common Fox | " | " | " | " | 26 | " | " |
| Northern Coyote | " | " | " | " | 24 | " | " |
| Foxhound | " | " | " | " | 22 | " | " |
| American Grey-wolf | " | " | " | " | 20 | " | " |

In this connection it is interesting to note that the best speed of a man for 100 yards is 9⅘ seconds, which is at the rate of 21½ miles an hour. A man's best speed for a mile is 4

minutes 12¾ seconds, or at the rate of 14 miles an hour. An ordinary runner makes a mile in 5 minutes (*i. e.*, at the rate of 12 miles an hour), so that what actually counts in the race is, as usual, the *trifle more speed* that each animal can command.

All travellers and hunters agree that the Antelope can cover an astounding distance in a single leap, but none of them tell us what they mean by "astounding," whether 15 feet or 50, and this still remains to be ascertained. Judge Caton, however, points out[38] that their leaping power is almost restricted to the horizontal. They are so essentially creatures of the open plains, and so unaccustomed to high jumping, that a four-foot fence was found enough to confine them.

CURIOSITY

This animal is credited with uncontrollable curiosity. In the old days of Lewis and Clark the recognized method of "tolling" Antelope within shot was to wave a handkerchief on a stick in their plain view, the gunner himself remaining concealed, and usually, after much doubt and many circlings, the herd :ntured within range.

In early days, we are told by many travellers, any unusual object was enough to attract the Antelope. But in later times they learned wisdom. On the plains of New Mexico, I never could "toll" Antelope, nor did I hear of any one in that country who had succeeded recently. In fact, the local hunters maintained that it was "played out"—the Antelope were too wary now to be taken in.

Colonel Roosevelt makes a similar observation for the Antelope of the Little Missouri region:

"In the old days [he says[39]], it was often possible to lure them toward the hunter by waving a red handkerchief to and fro on a stick, or even by lying on one's back and kicking the legs. Nowadays, however, there are very few localities indced in which they are sufficiently unsophisticated to make it worth while trying these time-honoured tricks of the long-vanished trappers and hunters."

[38] Antelope and Deer of America, 1877, pp. 47–48.
[39] Deer Family, 1903, p. 106.

FOODS

The Antelope is a creature of the dry plains, the land of grass, cactus, and sage, and its food is by long habit confined to these species of plants. Judge Caton could not induce his captive specimens to touch twigs, browse, or leaves. They would eat grain and fresh bread, but rejected fruit and acorns. "They are fond of common salt [he says[40]], and should have it always by them when in parks; and if soda be mixed with it, no doubt, it would be better for them, for their native plains generally abound with crude or sulphate of sodium, and long use may make this better for them than in the form of the chloride; at least it is worth the trial by those who have pet Antelopes."

DRINK

Once every day during the hours of sunheat the Antelope cautiously wend their way to some familiar pond, spring or stream. There they drink copiously, for they seem to need much water. Nevertheless, those who are familiar with the arid region of the continent will see at a glance that the map (p. 213) includes as Antelope range vast areas that are without water during the greater part of the year. How, then, do the Antelope live there? The answer is simple: These regions are provided with vegetation that has the power of storing up water for its own use—that can, during the few showers of winter, lay up enough moisture to carry it over the whole year; and chief among these provident plants are the great bulging cactuses. Each is a living tank charged with fluid so precious that it must perforce wear a bodyguard of poisonous bayonets to keep back the horde of wayfarers so ready to slake their thirst at the cactus's expense. In these the Antelope finds its desert springs. T. S. Vandyke, who first called my attention to this fact, says:

"On the arid plains of Lerdo, in Mexico, where I hunted in 1884, the Deer and Antelope *do not drink*. The proof is conclusive to my mind. I know that the only water for 40 miles was a little pool less than 200 feet across, that was only a quarter of a mile from my camp. Whitetail, Mule-deer, and

[40] *Loc. cit.*, p. 42.

Antelope abounded in all that region, yet the mud on the banks never showed a sign of one coming there to drink. It seems that the fleshy leaves of the abundant cactus supply them both with food and drink."

E. H. Wuerpel, the well-known artist of St. Louis, writes me similarly (March 30, 1901):

"When I lived in Mexico, six years ago, Antelope were still abundant on the upland plains as far south as Coahuila. There is no water in the region they inhabit, but they find the cactus leaves supply enough moisture."

But what about the spines that are supposed to be the sufficient defence of these vegetable cisterns? Wuerpel writes further: "While crossing the region with oxen, we used to burn the spines off the cactus and feed it to the cattle, and they suffered no inconvenience for lack of water, although without it for perhaps two days at a time."

But how do the Antelope utilize them without the kindly help of the fire-maker? Some interesting light on this point has been supplied me by G. B. Winton, of Nashville, Tenn., who points out that not only cactus leaves, roots, and fruit are eaten, but also those of numerous other species of desert plants that store up water in their tissues. Many of these are nearly spineless; "others have the tufts of spines so wide apart that a goat or a Deer may insert his muzzle between and get a good bite, though a cow could not; others have soft spines, especially where the leaf is new."

Thus the desert plants afford both food and drink to the desert creatures.

DOMESTICATION

If captured when fully adult, Antelope are usually irreclaimable. But, taken when a few days old, they are the most tameable of our horned creatures.

They are, however, extremely delicate at this age, and difficult to bring up, though J. H. G. Bray, of Medicine Hat, tells me that he has had good success with them, and reared many Antelope kids by feeding them on cow's milk, one-third water, and a little sugar, giving them many feedings a day.

Even when fully grown they are not hardy and rarely live long in confinement. Fatal enteritis seems to be the usual cause of death.

ENEMIES

The worst enemies of the wild Antelope are, first, repeating rifles; and next, sheep, which destroy their winter range. But Coyotes, Wolves, and eagles kill many, especially kids.

The adult Antelope is rarely attacked by eagles. The only case I ever heard of first-hand was related by Harry J. Wells, of Clayton, New Mexico. Coyotes are to be feared chiefly when so hard pressed by hunger that they organize a hunt with a system of relays, and thus run down the quarry that is so much swifter than themselves. But they kill numbers of the little ones before they are able to follow the mother.

On its extreme northern range the Antelope has another dreaded enemy whose occasional ravages are thus commented on by Dr. E. L. Munson.[41] "Mr. Parotti has been in this country as hunter and guide for nearly twenty years. He tells me that the fearful winter of 1893, when the thermometer registered 61 degrees below in this post [Fort Assiniboin, Mont.], killed off four-fifths of the Antelope—that they starved to death by thousands on account of the deep snow. He found, after that winter, what he estimated were 900 carcasses where the Antelope had drifted into a deep ravine and evidently had no strength to get out. Before that time Antelope were plenty through here, but that winter killed nearly all off. While they were shot by thousands, the number so destroyed was only an insignificant fraction of the total."

DISEASE

Domesticated Antelope in parks are very subject to fatal enteritis, as stated above, a consequence no doubt of improper food. But the wild Antelope also have visitations of deadly disorders. Concerning the most destructive of those on record, Dr. J. A. Allen says:[42]

"During the summer of 1873 a fatal epidemic raged among the Pronghorns over nearly the whole area between the Yellow-

[41] Forest and Stream, March 27, 1897, p. 244.
[42] Nat. Hist. Mont. & Dakota, Proc. Bos. Soc. Nat. Hist., June, 1874, p. 40.

stone and Missouri Rivers, destroying apparently three-fourths to nine-tenths of them. The greatest fatality seems to have occurred in July, judging from the size of the fawns found dead, and hence not long after we crossed this portion of the country. From the head of Heart River to the Missouri we found their carcasses, on our return, thickly scattered along our line of march, including those of both sexes and all ages, fawns being often found lying within a few yards of their dams. On our way out Antelope were almost constantly in sight, but on our return they were only rarely met with, ten dead ones being seen to each living one. The epidemic seems not to have extended beyond the Yellowstone, where they seemed more numerous on our return than on our way out, and where no dead ones were observed.

"The previous year they are reported to have ranged over this section of the country, in autumn, in very large numbers, bands of two or three hundred being sometimes met with by the Yellowstone Expedition of 1872, on its return eastward. Four were captured by the men as the frightened animals attempted to run through the train.

"Epidemics similar to that affecting the Pronghorns are well known to occasionally affect Deer, Rabbits, and Field-mice."

LIFE

During the winter the Antelope live in mixed bands of all ages and sizes. Nowadays these bands are commonly 10 to 50 in number, but in earlier days, I am told, several hundred, even thousands, would run together.

Early in the spring the usual inevitable disposition to scatter manifests itself. The separation of the sexes seems to be due to an instinctive dislike of each other, as the time approaches for the young to be born. It becomes yet stronger as the hour draws near. At that time each female strives to be utterly alone. She avoids even the few remaining companions of her own sex, and retires to some secluded spot.

YOUNG

Parturition takes place in late May or early June, on the Yellowstone, but may be earlier farther south. The fawns or kids are commonly 2 in number. Their mother hides them close together for several days, visiting them at frequent inter-

vals, ceaselessly scanning air and plain for signs of danger, and never going far away, except, perhaps, when forced to seek water—a necessary absence which she cuts as short as possible. At all times the squeak of a kid will bring her back at reckless speed, with blazing eye and bristling hair, ready to fight to the death any ordinary foe, or (if it be one too strong to fight) to intercept and mislead him, by every device the mother wit can bring to bear. There are not many creatures native to the plains that she will not face in such a case. As Colonel Roosevelt says:[43] "A doe will fight most gallantly for her fawn, and is an overmatch for a single Coyote, but of course she can do little against a large Wolf."

Audubon and Bachman say:[44] "Sometimes, however, the Wolves [Coyotes] discover and attack the young when they are too feeble to escape, and the mother then displays the most devoted courage in their defence. She rushes on them, butting and striking with her short horns, and sometimes tosses a Wolf heels over head; she also uses her forefeet, with which she deals severe blows, and if the Wolves are not in strong force or desperate with hunger, puts them to flight, and then seeks with her young a safer pasturage, or some almost inaccessible rocky hillside."

It seems likely that few Antelope kids are killed by their natural enemies, except such as are surprised during the brief absences of the devoted mother.

This is a danger inseparable from polygamy. If the Antelope had developed monogamy, the young would have two adults to protect them; at least one would likely be near at all times, and the superior prowess of the buck might even have eliminated the chief danger of their young lives.

Audubon, during his visit to the far West in 1843, had many opportunities of observing the young after they were old enough to follow the mother. This they do, he says, when they are a fortnight old, and he describes with happy enthusiasm the nursing of a kid at this age:[45]

[43] Deer Family, 1903, p. 111.
[44] *Ibid.*, p. 199.
[45] Q. N. A., 1849, Vol. II, p. 197.

"We had the gratification of seeing an old female, in a flock of eight or ten Antelope, suckling its young. The little beauty performed this operation precisely in the manner of our common lambs, almost kneeling down, bending its head upward, its rump elevated, it thumped the bag of its mother from time to time, and reminded us of far distant scenes where peaceful flocks feed and repose under the safeguard of our race."

The kids, though strong enough to follow the mother, are yet ready, at her signal, to hide when danger threatens, and the marvellous way in which they "play dead" is most inspiring.

On June 13, 1897, I rode to the top of Junction Butte, in Yellowstone Park. As my head rose above the level I caught sight of a female Antelope walking along, followed by a smaller animal, that turned out to be her kid. Very soon the mother saw me and communicated her alarm to the young one, which dropped at once to the ground. Just how she ordered him to hide I cannot tell. I am satisfied that he did not see the danger. She may have grunted, but I am inclined to think that the danger signal was a flash of her crupper-disks. As soon as he had dropped she ran off to one side, uttering the loud, grunting bleat of the species. Evidently she was trying to decoy me away, but I rode straight to where the young one had dropped, and found him crouching flat on the bare ground, and yet so well-concealed by his protective colour and his stillness, that had I not marked him down, I never should have found him. I rode around him and spent some twenty minutes making the sketch, which, finished afterward, appears herewith. During this time he gave no sign of life. Even a fly crawling over his eye and nose did not make him forget that his duty was to "lay low" at whatever cost (Plate XVII).

This young one I took to be two weeks old. His colours were quite unlike those of the adult, being soft, unspotted shades of gray and brown that matched him with the ground, helping him to hide; they constituted, indeed, a *protective* colouration, in contrast to the *directive* livery of the old one—a livery which he does not assume until he is able to save himself by running.

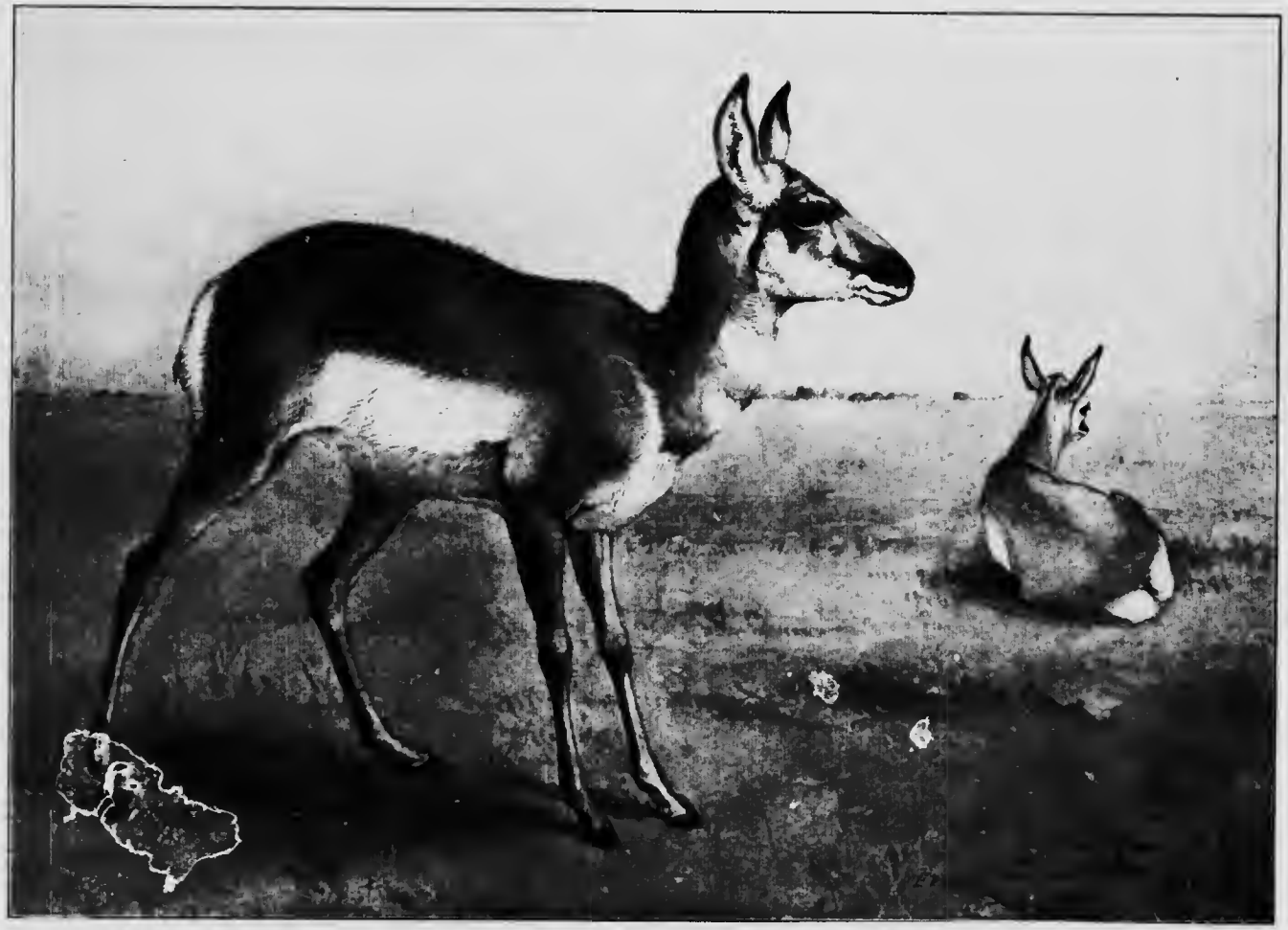


PLATE XIX.—YOUNG ANTELOPE, FROM LIFE.

(*Antilocapra americana* (Ord.).)

September, 1885.

On the preceding day I had ridden alongside the Yellowstone, in the Park, with E. Hofer. Three Antelope were in sight. By imitating the squeak of a young one, Hofer brought an old one up near, and shortly afterward we found two of the young close together. They were well grown—much larger than the one seen the day after; yet they crouched in the sage while the mother circled 200 yards away, uttering her alarm bleat. When we got within a few feet of them, they jumped up and ran away swiftly, but crouched again when out of sight over the next ridge. I took them to be about three weeks old. In this case the mother's alarm cry may have been the sufficient order to hide.

As soon as the young can follow, there is a disposition on the part of the mothers to form little bands. In early July two or three of the old ones with their kids may often be seen together. They unite for the sake of company and mutual protection, so that this is truly a social gathering.

By the end of July the kids on the Yellowstone are about half grown and have now assumed the livery of the old ones. Early in August the young bucks begin to join the bands of their mothers and little brothers.

SEPTEMBER

By September older bucks drift in, and the Antelope band shows all ages, sizes, and sexes mingled together in a huge happy family. As this is too soon for the sexual passions to play their firebrand part, we have in this bright month of September an ideal scene that is probably unique among our horned ruminants.

Many old hunters have described it to me. W. R. McFadden, of Denver, in particular, has given me full details, including those of a game that he witnessed about the middle of September, 1882, in the head of Middle Park, Colo.

PLAY

He had crawled out after a band of Antelope on the plain. There was a fine big buck, and only one. McFadden got out to a Buffalo wallow, and rising up to shoot saw the buck playing with seven or eight kids. They were careering about, he was leading. They would chase him, and caper and prance around him. After about half an hour the little ones got tired

and rested. But the buck was still fresh, and he set out racing by himself as though bent on using up all his surplus energies. Rushing at full gallop round and round the bushes, here and there, anywhere, to keep going, and yet close to the band, he must have run ten minutes, all alone, at full speed, while the hunter watched, and still seemed fresh as ever.

On another occasion McFadden saw a dozen kids and two or three big bucks at play in the same way.

As September passes the band increases, the merry games relax not; and the good fellowship existing is exemplified when Fox or Coyote menace any of the young. Each one seems now to act for the good of the entire herd. A mid-September incident of Antelope hunting in Jackson's Hole recurs to me: I had crawled through brush and sage for half a mile after a mixed band of 40. I was within 300 yards and, in cover of a certain clump of sage, expecting to get within 100 yards, before selecting my specimen, when a loud "kau" afar to my right called my attention to the fact that I was in plain view of a young sentinel buck whose head showed above the sage 200 yards to my left. In an instant every crupper-disk was flashing and the band lined up. The next moment I knew they would be going. I turned my sights on the nearest—it was the sentinel—and now—he is among the specimens on view in the National Museum.

MATING

This ideal family gathering is broken up at length, not by any outside enemy, but by the annual mating (one cannot call it pairing) season. Toward the end of September the kids of the year are weaned, and about the same time the procreative instinct is aroused in the bucks. At first the feeling is one merely of fevered unrest without definite purpose; sudden impulses drive them to expend their energies in aimless exercise. The Honourable T. Roosevelt writes:[46]

"Of all the game the Prongbuck seems to me the most excitable during the rut. The males run the does much as do

[46] Deer Family, 1903, pp. 109–110.

the bucks of the Mule and Whitetail Deer. If there are no does present I have sometimes watched a buck run to and fro by himself. The first time I saw this I was greatly interested, and could form no idea of what the buck was doing. He was by a creek bed in a slight depression or shallow valley, and was grazing uneasily. After a little while he suddenly started and ran just as hard as he could, off in a straight direction, nearly away from me. I thought that somehow or other he had discovered my presence; but he suddenly wheeled and came back to the original place, still running at his utmost speed. Then he halted, moved about with the white hairs on his rump outspread, and again dashed off at full speed, halted, wheeled, and came back. Two or three times he did this, and let me get up very close to him before he discovered me. I was too much interested in what he was doing to desire to shoot him."

The passion of the bucks takes very definite form when, later, the females manifest signs of response, and the battles that ensue show all the savagery and greed that is characteristic of the extremely polygamous creature that the Antelope is. Canfield says[47] of his domesticated Antelope: "He was the most salacious animal I have ever seen."

"In September [says Roosevelt[48]], sometimes not earlier than October, the big bucks begin to gather the does into harems. Each buck is then constantly on the watch to protect his harem from outsiders, and steal another doe, if he can get a chance. I have seen a comparatively young buck who had appropriated a doe, hustle her hastily out of the country as soon as he saw another Antelope in the neighbourhood, while, on the other hand, a big buck, already with a good herd of does, will do his best to appropriate any other that comes in sight."

FIGHTING

Roosevelt does not think these buck duels very serious affairs, but Audubon says[49] "they fight with great courage and even a degree of ferocity. * * * They strike with the

[47] Caton. Antelope and Deer of America, 1877, p. 45.
[48] Deer Family, 1903, p. 110.
[49] Q. N. A., 1849, Vol. II, p. 197.

horns, they wheel and bound with prodigious activity and rapidity, giving and receiving severe wounds."

In the Washington Zoo I repeatedly saw their manner of fighting, and was made to realize how exactly each detail of the apparently harmless horn had a purpose, offensive or defensive, for which it was highly specialized. Two bucks were having one of their periodical struggles for the mastery. They approached each other with noses to the ground, and after fencing for an opening, closed with a clash. As they thrust and parried, the purpose of the prong was clear. It served the Antelope exactly as the guard on the bowie-knife or the sword serves a man; for countless thrusts that would have slipped up the horn and reached the head, were caught with admirable adroitness in this fork.

And the in-turned harmless looking points? I had to watch long before I saw how dangerous they might be when skilfully used. After several minutes of fencing, one of the bucks got under his rival's guard, and making a sudden lunge, which the other failed to catch in the fork, he brought his in-turned left point to bear on the unprotected throat of his opponent, who saved himself from injury by rearing quickly and throwing himself backward. Such a move, however, it seemed to me, could scarcely have foiled a dangerous thrust if the two animals had been fighting a deadly duel.

I find, further, that in their fights the wild Antelope are usually struck in this way. W. R. McFadden tells me that he has seen two bucks badly ripped by a rival's horn, one in the throat, the other in the side of the neck close to the throat.

I recall a scene, the sequel of an Antelope duel on the Bighorn Basin many years ago, in which evidently the defeated buck took the most serious possible view of the situation. It was in the October of 1898. I was riding across the Bighorn Basin (Wyoming) with Mrs. Seton and A. A. Anderson, when we noticed near the horizon some bright white specks. They were moving about, appearing and disappearing. Then two of them seemed to dart erratically over the plain, keeping always

PLATE XX.—ANTELOPE APPROACHING TO ATTACK.
(From a photograph by Mrs. G. G. Seton.)

PLATE XXI.—HEADS OF YOUNG BUCKS.

an equal distance apart. Soon these left the others and careered about like twin meteors, this way and that, then our way; at first in changing line, but later directly toward us. Their wonderful speed soon ate up the intervening mile or two, and we now saw clearly that they were Antelope, one in pursuit of the other. High over their heads a golden eagle was sailing.

On they came. The half mile shrank to a couple of hundred yards, and we saw that they were bucks,—the hind one the larger—dashing straight toward us. As they yet neared we could see the smaller one making desperate efforts to avoid the savage lunges of the big one's horns, and barely maintaining the scant six feet that were between him and his foe.

We reined up to watch, for it now was clear that the smaller buck had been defeated in battle, and was trying to save his life by flight. But his heaving flanks and gaping, dribbling mouth showed that he could not hold out much longer. Straight on he came toward us, the deadliest foes of his race, the ones he fears the most.

SANCTUARY

He was clearly between two deaths—which should he choose? He seemed not to hesitate—the 200 yards shrank to 100, the 100 to 50—then the pursuer slacked his speed, seeing that it would be folly to come farther. The fugitive kept on until he dashed right in among our startled horses. The eagle alighted on a rock 200 yards away.

The victorious buck veered off, shaking his sharp, black horns, and circling at a safe distance around our cavalcade to intercept his victim when he should come out the other side. But the victim did not come out. He felt that he was saved, and he stayed with us. The other buck, seeing that he was balked, gave up the attempt, and turning back, sailed across the plain, till he became a white speck that rejoined the other specks—no doubt the does that had caused the duel.

The vanquished buck with us stood for a time panting, lolling his tongue, and showing every sign of dire distress. It would have been easy to lasso him, but none of us had any desire to do him harm. In a very short time he regained his

wind, and having seen his foe away to a safe distance, he left our company and went off in the opposite direction. The eagle realizing now that there would be no pickings for him, rose in haste and soared to a safe distance.

This incident suggests a number of psychological problems which will be hard to solve if we accept certain old-time theories of animal creation, but which will solve themselves if we admit the Antelope to be a fellow-creature, with feelings somewhat akin to our own. Had one of us been in the place of the vanquished buck, we should probably have done just as he did.

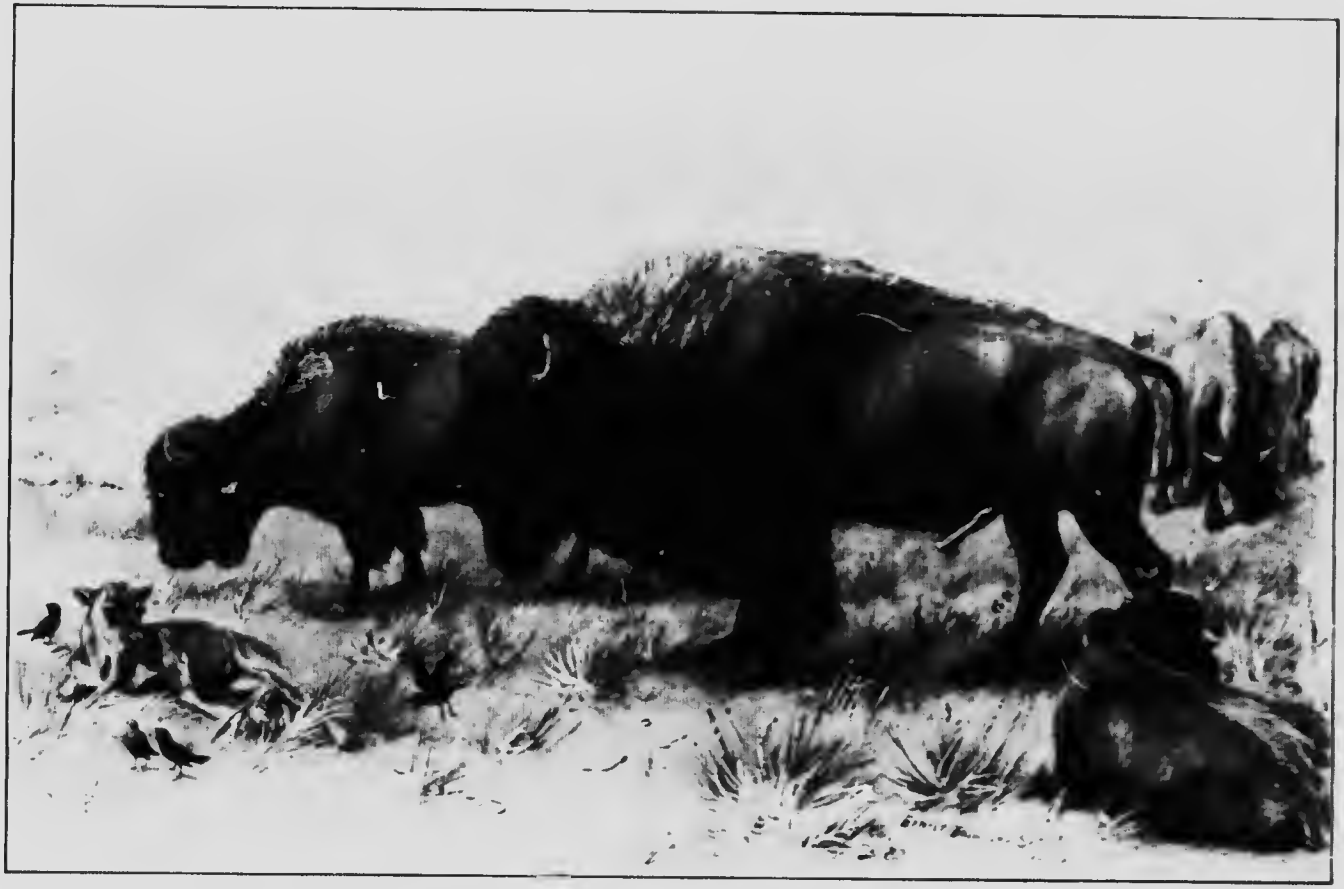


PLATE XXII.—A BUFFALO HERD IN THE EARLY FALL.

(*Bison bison* (Linn.).)

## VII.

## The American Bison or Buffalo.

*Bison bison* (Linnæus).

(Gr. *Bison*, the shaggy, hump-backed, wild Ox of Europe; the true Bison.)

*Bos bison* LINN., 1758. Syst. Nat., ed. I, p. 72.
*Bison bison* JORDAN, 1888. Man. Vert., U. S., 5th Ed., p. 337.
TYPE LOCALITY.—Mountains of south-eastern United States.

FRENCH CANADIAN, *le Bison*.
CREE & OJIB., *Mush-kwe-tay'-pej-ee-kee* (prairie horned-beast).
CHIPEWYAN, *Ed-jer'-ay*.
YANKTON SIOUX, *Tah-tank-ka Coh-wah'-pee*.
OGALLALA SIOUX, *Tah-tank'-kah* (bull), *Ptay* (cow).

The Family *Bovidæ* comprises large animals (cattle) of the style of the common ox. They have hollow horns on persistent bony cores, which grow larger each year, and are never shed; 4 hoofs on each foot, the hinder 2 smaller and higher than the front 2; feed on herbage; have no upper incisors; a complex stomach, with 4 distinct compartments, and chew the cud.

The genus *Bison* (H. Smith, 1827) has, in addition to all the Family characters: Curved cylindrical horns; a high hump on the shoulders, due to great prolongation of the spines

of the vertebræ; a short tail; long woolly hair, especially on the head and fore parts.

$$\text{Teeth: Inc. } \frac{0-0}{4-4}\text{; can. } \frac{0-0}{0-0}\text{; prem. } \frac{3-3}{3-3}\text{; mol. } \frac{3-3}{3-3} = 32$$

The American Buffalo, in addition to the Family and generic characteristics, has peculiarities of size and colour indicated by the following:

SIZE

A large bull shot by Dr. W. T. Hornaday in Montana, December 6, 1886, measured:[1]

| | | |
|---|---|---|
| Height at shoulders | 5 ft. 8 in. | (1,727 mm.) |
| Length of head and body to insertion of tail | 10 " 2 " | (3,100 mm.) |
| Depth of chest | 3 " 10 " | (1,169 mm.) |
| Girth behind forelegs | 8 " 4 " | (2,542 mm.) |
| Circumference of muzzle behind nostrils | 2 " 2 " | ( 661 mm.) |
| Length of tail vertebræ | 1 " 3 " | ( 381 mm.) |
| Length of hair on shoulders | 6½ " | ( 165 mm.) |
| Length of hair on forehead | 1 " 4 " | ( 407 mm.) |
| Length of chin beard | 11½ " | ( 292 mm.) |

This was a typical Buffalo bull, but specimens of over 6 feet (1,830 mm.) at the withers have been recorded.

An adult cow measured at the same time was 4 feet 10 inches at the shoulders (1,474 mm.).

HEAD

It is customary to speak of the enormous head of the Buffalo bull as a thing out of proportion to his bulk; but the Buffalo head, divested of its wool, is of the same proportion as that of the horse, ox, or dog. That is to say that, at the shoulder, the animal is 2½ heads high, and that the body from the shoulder point to the croup is about 2½ heads.

According to Montague Brown (in "Encyclopedia of Sport"), the largest recorded horns of this animal are 21 inches long with a girth of 15 inches; but August Gottschalk, of Bozeman, Mont., has sent me statements, fully and legally attested,

[1] Ext. Am. Bison, 1889, p. 405.

that he has a mounted head of which the left horn is 22 inches long, and 16⅜ inches in girth at the base, the widest spread of the horns being 35 inches from tip to tip. He sends me also a photograph of the head of a grand old bull having a spread of 33½ inches across the horns, the right having a length of 20¼ inches and a girth of 16½ inches. I have not seen either of these.

Hornaday gives 11½ inches as the length of the beard of the above-mentioned bull that he mounted for the National Museum. E. Carter, of Breckenridge, Colo., tells me that the longest beard he ever measured was 12 inches.

The ordinary process of grazing tends to keep the beard of wild individuals worn down short. I have no doubt that the length given is exceeded in stalled specimens.

WEIGHT

About 1,800 pounds is considered average weight for a bull, but Hornaday tells me that he weighed two living bulls at 2,190 pounds and 1,990 pounds respectively.

According to Audubon and Bachman,[2] fat cows weigh about 1,200 pounds; though Henry says,[3] seldom over 700 or 800 pounds. The lesser weight seems to be nearer the average, but I have seen cows that stood as high and looked as heavy as ordinary bulls.

COLOUR

The bull has the head, tail, legs, lower parts of neck, and shoulders dark brown, shaded into lighter brown on the upper parts of the body, palest on the shoulders and hump; toward spring, all the upper parts of the body bleach into a dull brownish-yellow, beside which the head looks black.

The cow is similar, but darker in the body colour.

At birth the calf is dull reddish-yellow, paler on the legs and under parts; at six months it is more like the mother; at two years it is everywhere of a deep, glossy, blackish brown; after this it again grows paler with age.

There were several well-known freaks and colour-varieties of the Buffalo "robe," as the shaggy hide of the animal was

[2] Q. N. A., 1849, Vol. II, p. 44. [3] Henry's Journal, 1897, Vol. I, p. 171.

called. The "beaver robe" was a rich brown with very fine fur, of these not more than one in ten thousand was found; the "black robe," oftenest seen in the Mountain Buffalo, was less rare. The "buckskin robe," of a yellow tinge, a sort of half albine, had little value. There were also the "blue robe," which was slatey, and the "white or pied robe." This last was the rarest. One or two in a lifetime was the utmost that any hunter secured. The Indians treasured them as "great medicine." Long writes[1] of one which J. Dougherty saw in an Indian hut, "a Bison head very well prepared, which had a white star on the front. The owner valued it highly, calling it his great medicine; he could not be tempted to part with it, "for," said he, "the herds come every season into the vicinity to seek their white-faced companion." A magnificent and historical robe of pure white was the special medicine and personal adornment of the great Cheyenne Chief Roman-nose. He wore it in his last fight, when he charged fearlessly at the head of his band to fall in the leaden hail of Forsyth's troops entrenched on Beecher Island. (Republican River, Sept. 17, 1868.)

Covering, as it does, so many diverse faunal areas, one might naturally expect the Buffalo to split up into several corresponding races; and it is generally recognized that, in a measure, it did so.

The far north produced the huge Wood Buffalo (*B. B. athabascæ*, Rhoads); the Rockies the small dark Mountain Buffalo; the Plains the paler medium-sized Plains Buffalo. It is probable, too, that the extinct Alleghanian Buffalo had distinctive characteristics, but there is no available evidence to prove this.

HISTORY

The Bison, or Buffalo, the largest and, at one time, the most important of all America's big game, was first discovered by the explorers of the sixteenth century.

In 1521 Cortez, the Spanish Conqueror of Mexico, reached Montezuma's capital, the City of Mexico, where, in the men-

[1] Exp. Rocky Mts., 1823, Vol. I, p. 471.

agerie, he saw the first American Bison to be viewed by European eyes. The menagerie and the beast are thus described[5] by Antonio de Solis (Conquest of Mexico, 1684):

"In the second Square of the same House were the Wild Beasts, which were either presents to Montezuma, or taken by his Hunters, in strong Cages of Timber, ranged in good Order, and under Cover; Lions, Tygers, Bears, and all others of the savage Kind which New-Spain produced; among which the greatest Rarity was the Mexican Bull: a wonderful composition of divers Animals. It has crooked Shoulders, with a Bunch on its Back like a Camel: its Flanks dry, its Tail large, and its Neck covered with Hair like a Lion. It is cloven-footed, its Head armed like that of a Bull, which it resembles in Fierceness, with no less Strength and Agility."

But this was at least three hundred miles from the natural range of the Bison, which, as a wild animal, had yet to be discovered. This discovery took place nine years later, and again the honour fell to a Spaniard. In 1530, Alva Nuñez Cabeza de Vaca was wrecked on the Gulf Coast. Travelling inland to what is now south-eastern Texas, he met with the Bison on its native range. So far as I know this was the first meeting of the wild American Buffalo and the gun-bearing white man. Cabeza's remarks are brief but clear:[6]

"Cattle come as far as this. I have seen them three times, and eaten of their meat. I think they are about the size of those in Spain. They have small horns like those of Morocco, and the hair long and flocky, like that of the Merino. Some are light brown (*pardillas*), and others black. To my judgment, the flesh is finer and sweeter than that of this country [Spain]. The Indians make blankets of those that are not full grown, and of the larger they make shoes and bucklers. They come as far as the seacoast of Florida [now Texas] and in a direction from the north, and range over a district of more than 400 leagues. In the whole extent of plain over which they roam, the people, who live bordering upon it, de-

[5] Quoted by Hornaday, Ext. Am. Bison, 1889, p. 373.
[6] Davis's Spanish Conquest of New Mexico, 1869, p. 67.

scend and kill them for food; and thus a great many skins are scattered throughout the country."

Coronado was the next explorer who penetrated the region inhabited by the Buffalo, which he traversed from the west, entering by way of Arizona and New Mexico, in 1540. He crossed the southern part of the "Panhandle" of Texas, reached the edge of what is now Indian Territory, and returned through the same region. It was in the year 1542 that he reached the Buffalo country, and traversed the plains that were "full of crooked-backed Oxen, as the mountain Serena in Spain is of sheep." One of his followers, Castaneda, gives a description of the animal, and adds: "We were much surprised at sometimes meeting innumerable herds of bulls without a single cow, and other herds of cows without bulls.[7]

FIG. 100—Earliest known picture of American Buffalo.
From Gomara's Historia de las Indias Saragossa, 1552-1553. Folio.
In New York Public Library (Lenox Building).

The earliest discovery of the Bison in eastern North America, or indeed anywhere north of Coronado's route, was made somewhere near Washington, District of Columbia, in 1612, by an Englishman, Sir Samuel Argoll, afterward Deputy-Governor of Virginia, who says:[8]

"I set my men to the felling of Timber, for the building of a Frigat, which I had left half finished at Point Comfort, the 19th of March; and returned myself with the ship into Pembrook [Potomac] River and so discovered to the head of it, which is about 65 leagues into the Land, and navigable for any ship. And then marching into the Countrie, I found great stores of Cattle as big as Kine, of which the Indians

[7] *Loc. cit.*, pp. 206–7.

[8] Purchas Pilgr., 1625, Vol. IV, p. 1765.

that were my guides killed a couple, which we found to be very good and wholesome meat, and are very easy to be killed, in regard they are heavy, slow, and not so wild as other Beasts of the wilderness."

"It is to be regretted [says Hornaday [9]] that the narrative of the explorer affords no clew to the precise locality of this interesting discovery; but, since it is doubtful that the mariners journeyed very far on foot from the head of navigation of the Potomac, it seems highly probable that the first American Bison seen by Europeans, other than the Spaniards, was found within 15 miles, or even less, of the capitol of the United States, and possibly within the District of Columbia itself."

From this time onward, the region of the Buffalo was more often visited, and the explorers gave frequent descriptions of the great beast and of its vast numbers.[10]

The earliest figure that I can find was that given by Gomara in 1553. It is here reproduced, full size (p. 252). Evidently it was drawn from the imaginative description of the discoverer. While corresponding line for line with the text, which corresponds line for line with the animal, it presents in the language of the times, a monstrous beast indeed.

## Life-history.

RANGE

The accompanying map (p. 255), showing the original range of the Buffalo, has been compiled chiefly from maps by Drs. Allen and Hornaday, with later information accumulated from other sources.

IN MANITOBA

When Alexander Henry II came to Red River, in 1799, he found the Buffalo swarming all along the Red River Valley.

Alexander Ross says[11] "all this part of the country was overrun by the wild Buffalo, even as late at 1810."

[9] Exterm. Am. Bison, 1889, p. 375.

[10] These facts are largely drawn from the two standard sources: Dr. W. T. Hornaday's Extermination of the American Bison (1889), and Dr. J. A. Allen's American Bisons (1876).

[11] Red River Settlement, 1856, p. 15.

In 1812 the first brigade of Scotch families arrived to found Red River colony. Strange to say, this was the first year when the Buffalo did not graze over the site of modern Winnipeg.

In 1817 Buffalo were "far off" from Red River.[12]

In 1818, according to tradition, a large band came for the last time within a day's ride of Fort Garry.

In 1819 they could still kill some Buffalo in the country adjacent to Fort Pembina.[13]

In 1821 Buffalo were scarce at Pembina.[14]

In 1826 Buffalo were not found apparently until 150 or 200 miles beyond Pembina.[15]

In 1849 the hunters went 250 miles from Pembina in the direction of Cheyenne River before finding the Buffalo herds.[16]

In 1852 the end of the Buffalo was evidently not far distant.[17]

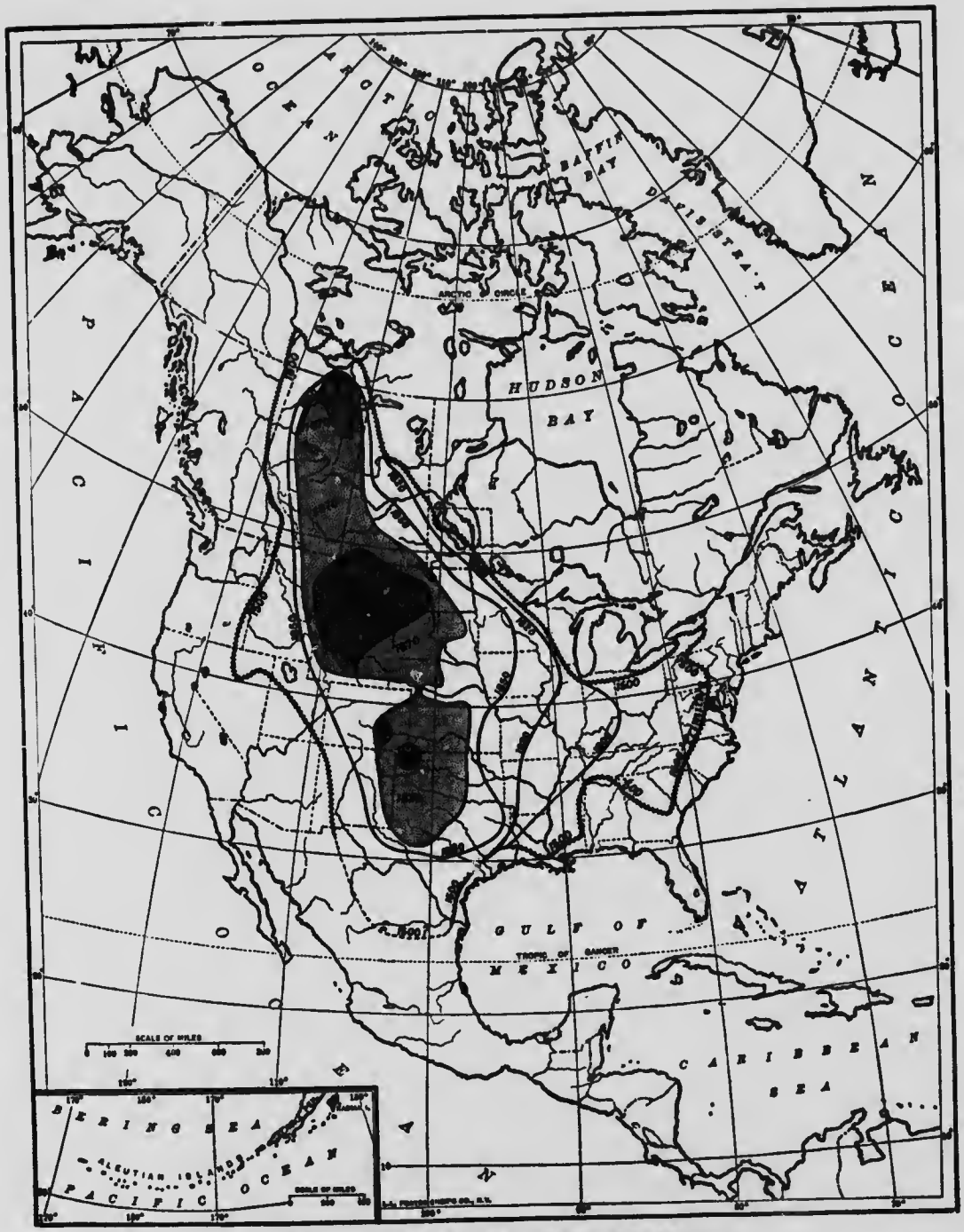
Nevertheless, there were at that time many Buffalo still roaming the Big Plain where Carberry now stands. Captain John Schott, of Athabaska Landing, tells me that in 1852, when he was a boy eleven years old, he went with a party of Buffalo hunters (Saint Pierre Pierrot, Louison Bonnot, and Pierre Pierrot) in search of Buffalo westward of Winnipeg. They found plenty of them on the Big Plain, and camped in the sandhills to the south where there was a good place to herd the horses and also high hills from which to see the Buffalo. Little John's job was to watch the horse herd from some sandhill, and if they strayed too far he would go on his pony to round them up.

The more recent skulls that strewed the Big Plain in 1882 for the most part dated chiefly from that hunt of thirty years before.

In the winter of 1856–7, according to H. Y. Hind, the Buffalo were very numerous on the banks of the Souris.[18]

In 1858 Hind found abundance of fresh Buffalo signs along the International Boundary, near Souris River.[19] He

[12] Ross, Red River Settl., 1856, p. 47.
[13] *Ibid.*, p. 50.
[14] *Ibid.*, p. 58.
[15] *Ibid.*, p. 99.
[16] *Ibid.*, p. 255.
[17] *Ibid.*, p. 267.
[18] Ass. & Sask. Expl. Exped., 1859, p. 43.
[19] *Ibid.*, pp. 44–45.




**MAP 10—RANGE OF THE AMERICAN BUFFALO.**

***Bison bison*** **(Linn.).**

Compiled chiefly from the works and maps of Dr. J. A. Allen and Dr. W. T. Hornaday. With many original records in the north. The black spots, on Yellowstone Park and near Lake Athabasca, represent the herds existing in 1909.

saw no Buffalo there, but records that there were great herds of these animals still on the summer range of the Coteau du Missouri, 50 miles to the south-west.[20] The fear of the Sioux, he says, kept most hunters out of that country.

At Two Creeks, Hind saw and shot the first Buffalo—a bull—on July 9, 1858. Next morning, as he journeyed toward Fort Ellice, he saw 3 more. Thirty miles west of the fort, he says, "Buffalo were numerous."[21]

The last Buffalo band seen in Manitoba by John Schott was in 1861, when an immense herd was discovered in Grand Valley. They completely covered the site of the present town of Brandon.

In 1867 a trader, J. L. Lagare, went on a journey from Winnipeg toward Wood Mountain. He told me in conversation that he saw the first Buffalo at Oak Lake; and during the winter of 1867–8 he and his partner lived on Buffalo killed on the Souris Plains, although they were then scarce, and only small bunches were to be seen. The great herd kept farther west, about Cypress Hills.

In 1874 Dr. E. Coues passed along the International Boundary without seeing any Buffalo till he got to Frenchmen's River, Montana, about Long. 107° 20′, or 200 miles west of Manitoba.[22]

In 1875 a few stragglers were said to be on the Big Plain.

In 1879, about November 7, Dr. F. W. Shaw, of Carberry, tells me that, as he was going to Rapid City from the Big Plain, he saw the tracks of 3 Buffalo at a place about 4 miles north of Grand Valley. They had been travelling northward, and a few hours before had been seen by a Mr. McFadden, while they were crossing the Assiniboine.

In 1882, C. C. Helliwell, of Brandon, saw 8 in the Souris region.

In the fall of 1883, according to A. S. Barton, of Boissevain, an old Buffalo bull crossed the Souris Plain from the south-

[20] *Ibid.*, p. 46.
[21] *Ibid.*, p. 46.
[22] Birds, 49th Parallel, Bull. U. S. Geol. Sur. Ter., 1878. Bull. 3, Vol. IV, art. XXV, p. 547.


**MAP 11—FOREST, PLAINS AND PRAIRIES OF NORTH AMERICA (EXCLUSIVE OF MEXICO),**
**After C. S. Sargent's Map No. 1, Tenth Census of United States, Dep. Int., 1880, with corrections in Canada from the Atlas recently published by the Department of the Interior of Canada (1906).**

Showing coniferous forest in dark tint, deciduous forest in pale tint, prairies in dotted tint, and treeless plains in white tint.

east, going north-westerly toward Plum Creek. It was pursued by the Gales on the Antlers of the Souris, but was never overtaken. When last seen it was going toward Moose Mountain.

About this time an old bull, probably the same, was seen near the site of the present town of Souris. My informant, H. W. O. Boger, says he saw it in daylight at 300 yards as it crossed his farm. It was trotting and went off north-west. A lot of the boys went after it, but never got it. This was the last seen in the region. It was recorded in all the current newspapers.

In 1882, when first I went to live in Western Manitoba, the prairie everywhere was dotted with old Buffalo skulls. Many had horns on them, but none had hair. Their condition and local tradition agree in fixing 1860 to 1865 as the epoch when the last Buffalo were killed on the Big Plain.

In the long slough east of Carberry I have found many Buffalo bones; and on August 13, 1899, I found a complete Buffalo skeleton the No doubt, all the large bogs throughout Manitoba con skeletons of Buffalo that have been mired and engulfed.

ENVIRONMENT

Although Map 10 gives so vast an area as the range of the Bison in days gone by, it is not to be supposed that the species was equally abundant in all parts. We know, in fact, that it was comparatively rare in most of the wooded country.

The true Buffalo range was that part of the region which was without trees and yet was provided with water, as will be seen on comparison of the Buffalo map with the Forest and Plains Map of America. We find that in the East the Buffalo followed the deciduous forests, and yet appeared to avoid coniferous woods. A study of the conditions prepares me for a future find of Buffalo bones on the north side of Lake Erie.

In all this wooded country, however, its numbers were small, the true home of the species being the open region of the great Mississippi River Valley, where the land was unforested and yet well watered. On this only was it ever found in herds of millions.

ANCIENT NUMBERS

The early explorers who describe the Buffalo bands do not give us anything more exact than superlative expressions, such as "countless herds," "incredible numbers," "teeming myriads," "the world over robe," etc.

To gain a more precise idea as to the numbers of this species, it is necessary to attempt an estimate, as follows:

The total area inhabited by the Buffalo was about 3,000,000 square miles. Of this area open plains constituted about one-half. According to figures supplied me by A. F. Potter, of the Forest Service, the ranges of North and South Dakota, Montana, Wyoming, Nebraska, Kansas, Colorado, Texas, and Oklahoma (a total of about 750,000 square miles, or half of the plains) carried at the time of the last census (1900) about 24,000,000 head of cattle and horses and about 6,000,000 head of sheep. This means that, when fully stocked, these plains might sustain a number of Buffalo at least equal to the number of cattle and horses. But the Buffalo had to divide their heritage with numerous herds of Mustang, Antelope, and Wapiti. On the other hand, a Buffalo could find a living where a range animal would starve. Moreover, many of the richest bottom lands are now fenced in, and we have taken no account of the 6,000,000 sheep. On the whole, it seems that we are safe in placing the number of Buffalo formerly living on the entire Plains area as about 40,000,000.

The range of the species on the prairies was a third as large as that on the Plains, but it was vastly more fertile; indeed, the stockmen reckon one acre of prairie as equal in fertility to four acres of the Plains. Doubtless, therefore, the prairies sustained nearly as many head as the Plains; we may safely set their population at 30,000,000.

The forest region of the Buffalo area supported a relatively sparse population. For its 1,000,000 square miles we cannot allow more than 5,000,000 Buffalo.

Summing up these totals, we arrive at the conclusion that the primitive number of Buffalo was about 75,000,000.

Let us consider the question from another standpoint: There were 1,500,000 square miles of the Plains; it takes

30 acres of such range to support an ordinary range beast, which needs as much as, or more than, a Bu lo. There were as many of the latter as the food could sustain; therefore the Plains had 30,000,000, but take off one-third to allow for the herds of other creatures, and we have 20,000,000 as the number of the Plains Buffalo. On the prairies and in the woods 10 acres a head is the usual range allowance; but doubling this to allow for Deer, etc., it would give us a population of 45,000,000, or a total of 65,000,000 Buffalo.

Again: Col. C. J. Jones estimated[23] the Buffalo in 1870 at 14,000,000. They were then occupying less than one-third of their range and were not nearly so crowded as in ancient times; their original total, therefore, must have been at least 50,000,000.

Yet again: All the evidence available goes to show that the Buffalo herds travelled from 100 to 400 miles in search of food; and that these herds broke speedily to find sustenance, and therefore that the herds never went more than 300 or 400 miles from their home-region. Hornaday estimates[24] at 4,000,000 a herd which Colonel Dodge saw[25] travelling on the Arkansas in May, 1871. If this herd had been gathered from the extreme distance from which they are known to congregate, it would represent an area of 200,000 square miles. There would be room enough to repeat this about 15 times on their range, and thus yield a population of about 60,000,000 as the sum of the Buffalo in primitive days, when their whole range was stocked as fully as the food-supply would permit. From these facts it will appear very safe to put the primitive Buffalo population at 50,000,000 to 60,000,000.

In 1800 there were practically no Buffalo east of the Mississippi. Their range had shrunken by one-eighth; their numbers doubtless shrunk in even greater degree; 40,000,000 head would be a fair estimate at that time.

The Duke of Bedford's herd of Buffalo at Woburn Abbey

[23] Forty years of Adv., 1899, p. 255.
[24] Ext. Am. Bison, 1889, p. 391.
[25] Plains of Gt. West., p. 120.

PLATE XXIII. BUFFALO HERD.

Drawing made in 1832.

was begun in 1896 with 7 animals, and had increased to 25 in 1905 notwithstanding a loss of 11 by deaths. That is to say, it had increased 20 per cent. each year, and in six years had doubled. A similar rate of increase is seen in the Corbin herd. These figures represent, no doubt, an abnormal rate of increase, as the animals are constantly protected and never suffer for lack of food.

The total of Buffalo in captivity in 1889 was 256; since then they have added as nearly as possible 10 per cent. per annum in spite of many disadvantages, such as isolated animals, over-feeding, over-production of males, etc. If, therefore, we set the rate of increase in the wild herds at 5 per cent., as long as they are within the limit set by food-supply, we shall probably be near the facts. In early days the Buffalo held their own well against the Indians with their primitive weapons. But, in the full splendour of the Buffalo days, say about 1830, the Indians, aided now by horses and armed with rifles, killed, as will be seen later, at the rate of over 2,000,000 each year. Allen estimates[26] the destruction by Indians at 2,000 000 annually in the early 40's. Baird puts it[27] at 3,500,000 in the 50's on the Missouri alone. Other means of destruction added at least half as many more to the number, so that 3,000,000 a year may have been reached as a total of loss in the 30's. To stand such drain with their slow rate of increase, the herds would have had to be at least ten times as numerous as they were. But they could not stand it, and they were plainly diminishing. Therefore, they must have fallen below 40,000,000 even as early as the beginning of the nineteenth century. Nevertheless, they could not have been much less than that or they would have vanished far faster than they did.

MIGRATIONS

All observers agree that the Buffalo in great herds visited parts of the country where at other times they had been unknown, and they remained for a time until impelled to another change of residence. The questions arise: Were these regular movements up and down certain routes? Was the change

[26] Hist. Am. Bison, Dep. Int., 1877, p. 562.

[27] *Ibid.*, p. 562.

made under stress of weather or famine, or both? In other words, Was the Buffalo truly migratory?

To this question Catlin gives an emphatic "No."

"These animals [he writes[28]] are, truly speaking, gregarious but not migratory. They graze in immense and almost incredible numbers at times, and roam about and over vast tracts of country, from East to West, and from West to East, as often as from North to South."

There is, furthermore, abundant proof that the herds were found summer and winter over most of the animal's natural range. This is all the evidence I can find for the non-migratory theory.

On the other hand, all records, even those of Catlin, refer to the coming and going of the Buffalo, not perfectly regular, but quite seasonal, while most records speak especially of summer and winter ranges, as regions where herds were to be found at set times.

Colonel Dodge tells[29] of a herd estimated at 4,000,000 that he saw on the Arkansas in May, 1871, *moving northward*. At Beaver Creek, 100 miles south of Glendive, Jas. McNaney says[30] that the Buffalo began to arrive *from the north* in the middle of October, 1882; that about the first of December an immense herd came; that by Christmas all had *gone southward;* but that a few days later another great herd came *from the north* and *followed* the rest.

The half-breeds and old hunters along the Red River have often told me of the northward coming of the Buffalo in spring, and of their southward migration in the fall.

Hornaday, after a very full investigation of the subject, writes:[31]

"It was a fixed habit with the great Buffalo herds to move southward from 200 to 400 miles at the approach of the winter.

* * * * * * *

At the approach of winter the whole great system of herds which range from the Peace River to the Indian Terri-

[28] N. Am. Ind., 1866, Vol. I, p. 248.
[29] Plains of Gt. West, p. 120, *et seq.*
[30] Hornaday's Ext. Am. Bison, 1889, p. 421.
[31] Ext. Am. Bison, 1889, p. 420.

tory moved south a few hundred miles, and wintered under more favourable circumstances than each band would have experienced at its farthest north. Thus it happened that nearly the whole of the great range south of the Saskatchewan was occupied by Buffaloes even in winter."

"The movement north began with the return of mild weather in the early spring. Undoubtedly, this northward migration was to escape the heat of their southern winter range rather than to find better pasture; for as a grazing country for cattle all the year round, Texas is hardly surpassed, except where it is overstocked. It was with the Buffaloes a matter of choice rather than necessity which sent them on their annual pilgrimage northward."[32]

Colonel R. I. Dodge's many valuable observations on the migratory habits of the southern Buffaloes tend to the same conclusions:

"Early in the spring [he says[33]], as soon as the dry and apparently desert prairie had begun to change its coat of dingy brown to one of the palest green, the horizon would begin to be dotted with Buffalo, single or in groups of two or three, forerunners of the coming herd.

"Thicker and thicker and in larger groups they came, until by the time the grass is well up, the whole vast landscape appears a mass of Buffalo, some individuals feeding, others standing, others lying down, but the herd moving slowly, moving constantly to the northward. * * * Some years, as in 1871, the Buffalo appeared to move northward in one immense column, oftentimes from 20 to 50 miles in width, and of unknown depth from front to rear. Other years the northward journey was made in several parallel columns, moving at the same rate, and with their numerous flankers covering a width of a hundred or more miles.

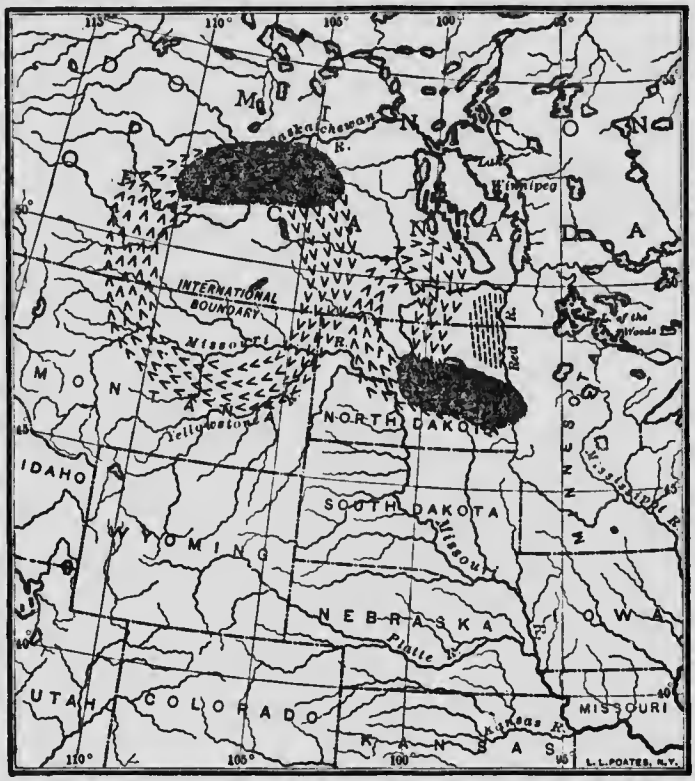
"The line of march of this great spring migration was not always the same, though it was confined within certain limits. I am informed by old frontiersmen that it has not within twenty-five years crossed the Arkansas River east of Great Bend, north-

[32] *Loc. cit.*, p. 424.

[33] Our Wild Indians, p. 283, *et seq.*

west of Big Sand Creek. The most favoured routes crossed the Arkansas at the mouth of Walnut Creek, Pawnee Fort, Mulberry Creek, the Cimarron Crossing, and Big Sand Creek.

"As the great herd proceeds northward it is constantly depleted, numbers wandering off to the right and left, until




MAP 12—Buffalo migration according to Professor Hind's record.

The dark area in each case marks the winter range. The arrow-heads show direction of migration. Their ancient route along Red River is marked with straight dotted lines.

finally it is scattered in small herds far and wide over the vast feeding grounds, where they pass the summer.

"When the food in one locality fails they go to another, and towards fall, when the grass of the higher prairie becomes parched by the heat and drought, they gradually work their way back to the south, concentrating on the rich pastures of

Texas and the Indian Territory, whence, the same instinct acting on all, they are ready to start together on the northward march as soon as spring starts the grass."

To this Hornaday adds:[34] "The herds which wintered on the Montana ranges always went north in the early spring, usually in March, so that, during the time the hunters were hauling in the hides taken on the winter hunt, the ranges were entirely deserted. It is equally certain, however, that a few small bands remained in certain portions of Montana throughout the summer. But the main body crossed the International Boundary, and spent the summer on the Plains of Saskatchewan, where they were hunted by the half-breeds from the Red River Settlement and the Indians of the Plains. It is my belief that in this movement nearly all the Buffaloes of Montana and Dakota participated, and that the herds which spent the summer in Dakota, where they were annually hunted by the Red River half-breeds, came up from Kansas, Colorado, and Nebraska."

Hind, the leader of the famous exploring expedition to the Canadian Northwest in 1859, has left some valuable records[35] as to the Buffalo movements, from which I have compiled the accompanying map (No. 12). It is remarkable that the Saskatchewan herd should have wintered in its coldest region. Probably the explanation is that this happened to comprise the best feeding grounds.

A. Henry's record given below shows that, in 1800, the stream of migration both northward and southward, moved parallel with and close to the Red River. The change to the route near Turtle Mountain began about 1812, when the first settlers came to Lord Selkirk's land grant, and it was directly caused by the increase of hunters in the neighbourhood.

There is only one sure way to determine the question of migration, and that is by a series of observations made during a number of years at one point where the Buffalo abounded. Twenty years ago we should have said, "Too late for that," but now the discovery of Alexander Henry's precious old

[34] Ext. Am. Bison, 1889, p. 425. [35] Ass. & Sask. Expl. Exped., 1859, p. 106.

"Journal in Red River Valley" has shed some light on the Buffalo and most other bygone creatures of that now famous land of grain.

Henry's observations[36] were made at Park River Post, a fort which he built on the Red River at a point 35 miles south of the International Boundary. The Buffalo lived in that region the year round, though less numerous there than higher up the river. I have collected all his remarks on their migration:

"18 September, 1800. Immense herds moving southward slowly.[37]

"7 November. Great herd of cows going at full speed southward.[38]

"1 January, 1801. Buffalo in great abundance; the plains entirely covered; all were moving in a body from north to south.[39]

"14 January. Country covered with Buffalo moving northward.[40]

"15 January. The plains were still covered with Buffalo moving slowly northward."[41]

During January, 1803, he found the country from Park River to Riding Mountain crowded with Buffalo.[42]

"15 November, 1805. Terrible snow storm, Buffalo passing northward in as great numbers as I ever saw them."[43]

This last is the only record in Henry's "Journal" that contradicts the idea of regular migration, but the writer expressly says that it was during a blizzard. In Manitoba blizzards come always from a northerly point. The Buffalo always faced the storm, hence, perhaps, this irregular movement.

I conclude with Hornaday that the Buffalo did migrate from 300 to 400 miles northward in spring, and as far southward again in autumn, but that the regularity of this movement was often much obscured by temporary changes of direction to meet changes of weather, to visit well-known pastures, to

[36] Alex. Henry's Journal, 1799–1814, pub. 1897. [37] *Ibid.*, p. 99. [38] *Ibid.*, p. 136.
[39] *Ibid.*, p. 162. [40] *Ibid.*, p. 166. [41] *Ibid.*, p. 166.
[42] *Ibid.*, p. 208. [43] *Ibid.*, p. 273.

seek good crossings of rivers or mountains, or to avoid hostile camps and places of evil memories. Furthermore, there were scattered individuals to be found in all parts of the range at all seasons.

Theoretically, the Buffalo must have been migratory. Although it covered a vast region it continued of one species, whereas, it would probably have split up into several distinct species had not it been continually mixed as a result of migrations.

NATURAL ENEMIES

The chief natural enemies of the Buffalo herds, taking in inverse order of importance, were blizzards, Wolves, prairie fires, bogs, the Indian, and rivers. Epidemic disease seems to have been unknown among them.

BLIZZARDS

Hitherto, the blizzard has been entirely ignored as a destroyer of Bison. My attention was first called to ` by Romanzo N. Bunn, of Chicago. He brings forward evidence to show that the last great herd inhabiting the country north of the region between Yankton and Devil's Lake, and between the Big Sioux River and Missouri, was destroyed by the blizzard of 1871–2. He states that in the 70's hundreds of thousands of Buffalo crossed the Missouri River, going northward, and that they never returned, nor were they accounted for by the hunters. Senator D. L. Pettigrew, of Flandreau, Dakota, informed him that after the terrible winter of 1871–2, he found herds of Buffalo lying dead in the hollows, evidently buried where they had sought shelter.

Concerning his own experiences, Bunn writes me:

"After months spent in prospecting throughout the Northwest during 1880, I reached a point a few miles to the westward of the Big Sioux River, and settled upon government lands in Kingsbury County, present State of South Dakota. There I noted with astonishment the enormous number of Buffalo skeletons lying bleaching upon the prairies. The adult skeletons were, at that time, in a perfect state of preservation, showing, for the most part, no signs of having been disturbed

since the death of the animal. Reasoning that, if they had been killed by hunters, I should find broken limbs, skulls with bullet-holes in them, and marks of rifle-balls on the bones, I searched often and diligently for these signs, but I found none. True, a stray shoulder-blade, older in appearance than the rest, had a spear-head sticking through it, as evidence that an Indian had killed this animal many years before; but, on the newer-looking and complete skeletons, no mark of violence was to be observed. Evidently, they had not been killed by hunters. They lay stretched out on the prairie, large animals and small, on upland and lowland, usually singly, though one day I found fifty in a bunch, lying in a ravine. These seemed mainly small or young animals. I observed that just to the north was one of the highest hills in the locality, the situation being such that, within an hour after a big blizzard had gotten up full steam, this ravine would probably be ten feet deep with snow.

"I pondered much upon this subject, for there were at least 200 of these skeletons on my own half-section. By the time the next season opened, however, I had ceased to wonder how they died, for the cause became evident.

"The winter of 1880–1 is still known to the early settlers of Dakota as the 'blizzard winter,' and the storm of October 15, 1880, as the 'October blizzard.' The morning of that day, following a rainy night, opened with a fast-falling snow-storm and a gale from the north. You could not see a house twenty feet away. To venture from shelter during the next two days was to endanger your life. Although early in the season and the temperature not very low, the soft wet snow would weigh down your clothing in a few moments, so you could scarcely bear the burden. When it cleared, on the morning of the 17th, the entire aspect of the landscape seemed changed. The prairie at this point is quite rolling, and cut by many dry water-courses, although there is not a living stream in the country, and not a tree in sight. On that morning the whole country had been brought to practically a dead level. The quantity of snow was almost beyond belief. Everywhere it entirely hid

the prairie grass, lying a foot deep even on the highest ridges. Wide ravines, 20 feet deep, were full to the top, and these held much snow as late as the following May.

"Cattle belonging to various settlers had drifted away during the storm, and, in spite of the fact that it was early in the season and the cattle in good condition, many were lost. For example, a pair of heavy, strong work oxen had passed over the brow of a hill and were standing on their feet in the drift, dead. Their backs were on a level with the surface of the snow, their noses elevated in an effort to prevent smothering, the large horns disclosing their location.

"In such a blizzard, no escape was possible for even the hardy Buffalo. They would have been buried in the sheltering hollows where they sought repose and would there have shared the fate of the old oxen. Large clusters of bones found in such spots indicate that this had indeed happened, that their deadliest enemy was the snow.

"To repeat, the great herds that went north in 1870–1 never returned. There is no evidence that any large numbers of them were killed by hunters, red or white, and there is, therefore, but one reasonable explanation of their disappearance. They were exterminated by the blizzards of 1872.

"Further, I believe that, at all times, the Dakota blizzard has taken heavier toll of the Buffalo than even the Dakota Indian did."

No one who has seen the Northern blizzard will question its terrible power. I have lived through several and agree with Bunn that a winter with a long succession of these snow-siroccos might in certain circumstances destroy every Bison on the range before spring. But blizzards *did not happen every winter*, and they were restricted to a certain limited treeless area lying far north and of heavy snow-fall. So that I doubt whether, upon the whole, the destruction by blizzards was comparable with that of other agencies which were of more regular occurrence and covered a large part, or all, of the Buffalo range.

WOLVES

Every Buffalo band was followed by Wolves that picked off the young, the weak, and the wounded, and thus kept the herds up to a good physical standard. But the numbers killed by Wolves was not great.

PRAIRIE FIRES

Prairie fires not only destroyed the food of the Buffalo, but were the source of direct danger to the animal, as we realize in reading this extract from Henry's "Journal":[44]

"November 25, 1804. Plains burned in every direction and blind Buffalo seen every moment wandering about. The poor beasts have all the hair singed off; even the skin in many places is shrivelled up and terribly burned, and their eyes are swollen and closed fast. It was really pitiful to see them staggering about, sometimes running afoul of a large stone, and other times tumbling down hill and falling into creeks, not yet frozen over. In one spot we found a whole herd lying dead. The fire having passed only yesterday, these animals were still good and fresh, and many of them exceedingly fat. Our road was the summit of the Hair Hills [Pembina Mt.], where the open ground is uneven and intercepted by many small creeks running eastward. The country is stony and barren. At sunset we arrived at the Indian camp, having made an extraordinary day's ride, and seen an incredible number of dead and dying, blind, lame, singed, and roasted Buffalo. The fire raged all night toward the S. W."

Hind, in 1859, made similar observations:[45]

"Blind Buffalo [he says] are frequently found accompanying herds, and sometimes they are met with alone. Their eyes have been destroyed by prairie fires; but their quickened sense of hearing, and smell, and their increased alertness enable them to guard against danger, and makes it more difficult to approach them in quiet weather than those possessing sight. The hunters think that blind Buffalo frequently give the alarm when they are stealthily approaching a herd in an undulating country. When galloping over stony ground, blind Buffalo

[44] A. Henry's Journal, p. 253.
[45] Ass. & Sask. Expl. Exped., 1859, p. 107.

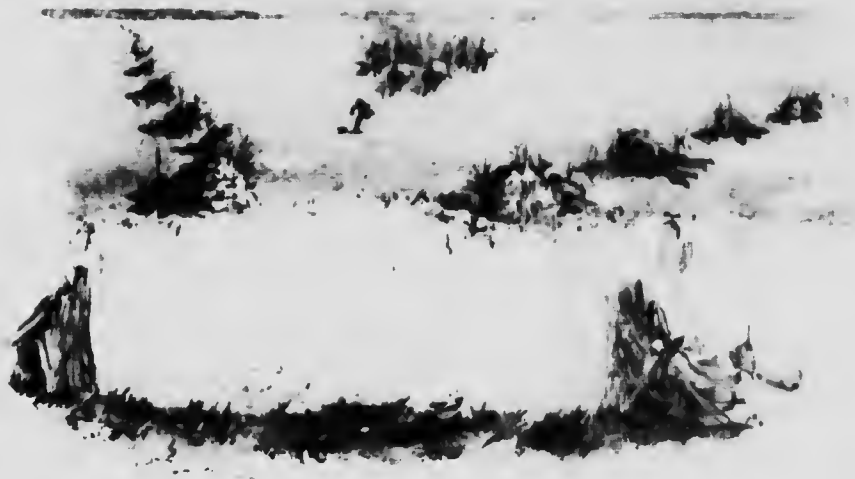


PLATE XXIV.—LEADING THE BUFFALO INTO THE POUND

PLATE XXV.—HEAD OF BUFFALO COW
By Ernest Thompson Seton.

frequently fall, but when quietly feeding they avoid the stones and boulders with wonderful skill."

BOGS

The obstinate adherence to one course that characterized the Buffalo often led many to their death in the treacherous bogs. Hornaday says[46] that, in the summer of 1867, "over 2,000 Buffalo out of a herd of about 4,000, lost their lives in the quicksand of the Platte River, near Plum Creek, while attempting to cross. * * * It was a common thing for the voyagers on the Missouri River to see the Buffalo hopelessly mired in the quicksands or dead along the shore." I doubt not that every great bog and quicksand in the Central Northwest will prove on drainage a Buffalo bone-yard containing countless bones that date from earlier days.

INDIANS

The primitive Indian was from be the greatest enemy of the Buffalo. Armed with bow and arrow or lance, and without the aid of the horse he could scarcely count solely on the Buffalo for his live meat. In winter, when snow was deep, he could pursue the animal on snow-shoes and slay them easily enough. But there was rarely sufficient snow for this; all the circumstances precluded the possibility of great destruction of Buffalo life by the Indians. Moreover, the opportunities for such slaughter were confined to the north. On rare occasions the tribe could unite and form a Buffalo pound. But there was usually a deficiency of small game to make this great effort not worth the while; and I doubt not that, before the coming of the horse and the rifle, the Red man did little harm to the great Bison herds. These two principal aids arrived together on the Buffalo range, about the close of the eighteenth century, and they marked the beginning of the epoch of extirpatory slaughter by man.

RIVERS

Far the worst destroyer of the Buffalo in ancient days was treacherous ice in the spring. All winter the Buffalo herds of the colder range were accustomed fearlessly to cross

[46] Ext. N. Am. Bison, 1889, p. 421.

and recross the ice-bound rivers. Springtime comes with the impulse to wander farther north; the herds are more compacted now; they slowly travel on their route; river after river is crossed at first. But a change sets in; the ice grows rotten; to all appearance it is the same, but it will no longer bear the widely extended herd; the van goes crashing through to death, and thousands more are pushed in by the oncoming herd behind.

The records of early travellers, we now realize, have much on this subject. But the best I can find is still from the garrulous and ever-delightful Henry:[47]

"March 28, 1801.—It [the ice on Red River] continued to drift on the 31st, bearing great numbers of dead Buffalo from above, which must have been drowned in attempting to cross while the ice was weak. * * *

"Wednesday, April 1st. The river clear of ice, but drowned Buffalo continue to drift by, entire herds. Several are lodged on the banks near the fort. The women cut up some of the fattest for their own use; the flesh appeared to be fresh and good. It is really astonishing what vast numbers have perished. They formed one continuous line in the current for two days and nights. One of my men found a herd that had fallen through the ice in Park River, and all had been drowned; they were sticking in the ice which had not yet moved in that part."

"When they [The Mandans on the Missouri] collect the driftwood, great numbers of drowned Buffalo that have perished in attempting to cross above when the ice was getting bad float down; those animals the natives are very careful to haul on shore, as they prefer such flesh to that killed in any other way."[48]

April 7th. The women continue to cut up drowned Buffalo to make tallow.

April 18th. Rain; drowned Buffalo still drifting down the River, but not in such vast numbers as before, many having lodged on the banks and along the beach.

[47] A. Henry's Journal, 1897, p. 174.

[48] *Ibid.*, p. 341.

April 25th. Drowned Buffalo drift down River day and night.

"May 1st, 1801. The stench from the vast numbers of drowned Buffalo along the river was intolerable."[49]

"2d. Two hunters arrived * * * from Grandes Fourches. * * * They tell me the number of Buffalo lying along the beach and on the banks above passes all imagination. They form one continuous line and emit a horrible stench. I am informed that every spring it is about the same."[50]

The distance was 35 miles and a Buffalo every 10 yards on each side would be within the terms of the description. This would total over 20,000 carcasses.

Dr. E. Coues, commenting on this in a footnote, says:[51]

"This account is not exaggerated. John McDonnell's Journal, when he was describing Qu'Appelle River, states May 18, 1793. "Observing a good many carcasses of Buffalo in the river and along the banks, I was taken up the whole day in counting them, and, to my surprise, found I had numbered when we put up at night 7,360, drowned and mired along the river and in it. It is true, in one or two places, I went on shore and walked from one carcass to another, where they lay from three to five files deep. (Masson I, 1889, p. 294.)"

For generations the dwellers on the Missouri River were familiar with the yearly flood that bore countless Buffalo hulks to be packed away in the Mississippi mud, that in some far geological day will be the rock, all stored and storied with unnumbered bones. Now we know that all the northern rivers made their death-trap every spring; and, since their sum of length must have been not less than 20,000 miles, we can form an estimate of the prodigious slaughter that was caused by rotten ice. Clearly, the destruction by Nature's own means was so great that the Buffalo can have done no more than barely hold its own in the fight; and when the rifle also came upon the scene, its doom was sealed.

[49] *Ibid.*, p. 177. [50] *Ibid.*, p. 177. [51] *Ibid.*, p. 174

LIFE-HISTORY

It was during the migrations alone that the very large herds were seen. Bands of a few thousand were found at all seasons, but the millions came together only on some great general impulse.

Let us follow one of the herds moving northward to its summer home from the sheltered bottom-lands along the Missouri, in Central Dakota, where it had wintered.

Before there is yet any visible spring in the land the spirit of unrest comes on the animals. It may be that the final touch is given by a warm, sunny day. Some old cow, with a bunch of from 50 to 100 followers, turns her nose northward. Their grunting spreads an epidemic of unrest, and from every valley a long, black string pours forth. As they top the uplands, others and yet others come to view. The general move is northward, but their disposition is to condense into one herd. As night comes down, black and chill, they leave the exposed ridges and shelter in the hollows. Cold weather and more snow may follow, but the impulse to travel possesses them now. Once it is given command, it changes not in force or direction till the remembered pastures are reached. Rivers may cross their path. These, if frozen, are unnoticed; if open, they are swum; if covered with rotten ice, the ice is broken eventually by the weight of the herd, and many are drowned, but the rest swim through and continue their march. An onset of hunters may swerve them for a time, but it does not change their main trend.

For three or four weeks this continues, and the blackening horde comes swarming down the long level prairies of the Red River Valley. Now they are nearing their familiar summer haunts, and the bands which united originally to form the herd, begin to quit that main body. Again some old leader cow sets the example; and, stringing after her, come many cows and yearlings, mostly relatives by blood. Finally come a dozen bulls, mostly relatives by marriage.

COW LEADS THE CLAN

In a broad sense, it will be seen that this small local herd is a family, or rather, a clan. Their leader is always an old cow—there is abundance of evidence for this—doubtless she is

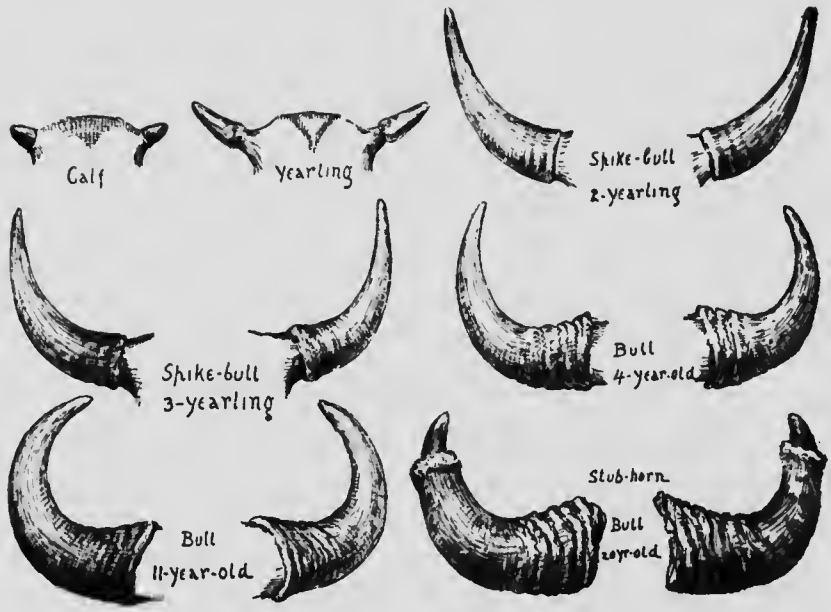



FIG. 101—Series of Buffalo horns.
Redrawn from Extermination of the American Bison, by W. T. Hornaday.

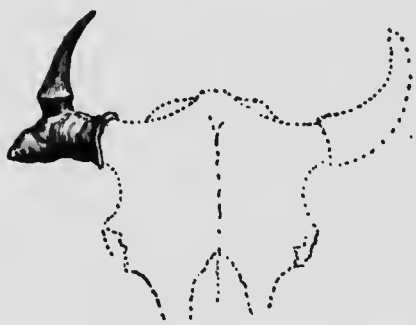


FIG. 102—Freak horn from Saskatchewan.
collection of James Hargraves, of Medicine Hat.

FIG. 103—Freak Buffalo horn found on the Black Plateau.
Collected in 1895 by Frank H. Mayer.
Drawn from photograph in Outdoor Life.

the grandmother of many of them. As Long says,[52] "Cows are often seen accompanied by the calves of three seasons." The males remain with the females and take an active interest in the young. Animals know and stay with their personal acquaintances; they resent the approach of strangers; migrants work back to their birthplace; whenever a local band of Buffalo was wiped out, their pasturage remained vacant for years, so it is unlikely that this group is finally scattered during the annual herding. The evidence derived from common range cattle sustains this idea; for, in spite of the annual round-ups which correspond to the annual herding of the Buffalo, we usually find the same little bunch of cattle (easily distinguishable by their marks) on the same feeding-ground season after season. Finally, the Bison is polygamous, or probably promiscuous, so that those living together are sure to be much interrelated, that is, they form a clan.

The blood-and-clan feeling of the group, therefore, I think well established; but, because it has been questioned, I was glad, long after the above was written, to find the following penned by an undoubted authority, Buffalo Jones:[53]

"Each small group is of the same strain of blood. There is no animal in the world more clannish than the Buffalo. The male calf follows the mother until two years old, when he is driven out of the herd, and the parental tie is then entirely broken. The female calf fares better, as she is permitted to stay with her mother's family for life, unless by some accident she becomes separated from the group.

"The resemblance of each individual of a family is very striking, while the difference between families is as apparent to the practised eye as is the Caucasian from the Mongolian race of people.

"These groups are as quickly separated from the great herd after a stampede as is a company of soldiers from its regiment at the close of 'dress parade.' The several animals know each other by scent and sound; they grunt similarly to a hog, but in a much stronger tone, and are quickly recognized by every

[52] Exped. Rocky Mts., 1823, p. 473.

[53] Buff. Jones Advt., 1899, p. 234.

member of the family. When separated by a stampede or other cause, they never rest until they are all together again.

"A pathetic sight was sometimes witnessed when the mother of one of these families was killed at the first shot. They were so devoted to her, they would linger and wait until the last one could be easily slain."

So far as I can learn a band does not further disintegrate. It rambles about, in a radius of perhaps 10 miles from its favourite drinking place; and, wherever it goes, it is followed by one or two ever watchful Gray-wolves.

GESTATION

Some time in April usually, though possibly as early as January and as late as August, the full-grown cow has finished her 9½ months' gestation.[44] True to a universal instinct, she slinks off by herself to some slight hollow, for such there are even on the levellest prairie, and there is born the calf, or on some rare occasions twin calves.

THE CALF

The labour is remarkably short and easy. Dr. Frank Baker writes that normally it occupies from 25 to 45 minutes. A recent case in the National Zoological Park was timed by the head keeper, Blackburne, who says that "the calf had been cleaned and was nursing 26 minutes after the cow stopped eating hay and lay down." Thus, in less than an hour the mother is able and ready to meet any enemy that may come to injure her young. Chief among these are the Gray or Buffalo-wolves. From one or two of these she is very well able to guard her calf, but half-a-dozen give a serious aspect to the situation, even though she stand with the little one under her body. Usually, however, help is at hand. Her loud angry snort or threatening bellow will quickly bring the bulls to her aid. And the effectiveness of their response may be judged by the following incident related[45] by an army surgeon to Colonel Dodge:

"He was one evening returning to camp after a day's hunt, when his attention was attracted by the curious action

[44] Dr. W. T. Hornaday tells me of a case in which the gestation was prolonged to ten months and three weeks.

[45] Plains of the Great West, p. 125.

of a little knot of 6 or 8 Buffalo. Approaching sufficiently near to see clearly, he discovered that this little knot were all bulls, standing in a close circle with their heads outwards, while in a concentric circle at some 12 or 15 paces distant, sat, licking their chops in impatient expectancy, at least a dozen large Gray-wolves (excepting man, the most dangerous enemy of the Buffalo).

THE FATHER

"The doctor determined to watch the performance. After a few moments the knot broke up, and, still keeping in a compact mass, started on a trot for the main herd, some half a mile off. To his very great astonishment, the doctor now saw that the central and controlling figure of this mass was a poor little calf, so newly born as scarcely to be able to walk. After going 50 to 100 paces the calf lay down, the bulls disposed themselves in a circle as before, and the Wolves who had trotted along on each side of their retreating supper, sat down and licked their chops again; and so, though the doctor did not see the finale, it being late and the camp distant, he had no doubt that the noble fathers did their whole duty by their offspring, and carried it safely to the herd."

Frémont records a similar incident that he observed on the Platte River in 1842. In this case, however, the Wolves were too numerous for the would-be rescuer and the affair had a tragic end:

"July 4. While we were at breakfast [he says[56]], a Buffalo calf broke through the camp, followed by a couple of Wolves. In its fright it had probably mistaken us for a band of Buffalo. The Wolves were obliged to make a circuit around the camp, so that the calf got a little to start, and strained every nerve to reach a large herd at the foot of the hills, about 2 miles distant; but first one, and then another, and another Wolf joined in the chase, until his pursuers amounted to 20 or 30, and they ran him down before he could reach his friends. There were a few Bulls near the place, and one of them attacked the Wolves and tried to rescue him; but was driven off immediately, and the little animal fell an easy prey, half devoured before he was

[56] Frémont's Epl. Exped., 1845, p. 22.

dead. We watched the chase with the interest always felt for the weak; and had there been a saddled horse at hand, he would have fared better."

THE MOTHER

In both cases the mother seemed to be missing. Some observers think her negligent of her duties. There is, indeed, great individual variation in this respect; but, ordinarily, she is the best protector the little one can have and is afraid of nothing when the calf is threatened. Yet many times she acts in a dumb, cowed way, especially when the assailant of the youngster is a man.

James K. Darnell, of Breckenridge, related to me that in the early 70's, when he was cow-punching on the Plains, the Buffalo were very plentiful. He often amused himself by roping the calves. When one was caught he would jump off, remove the lasso, and hold it with his hands. The mother would stand at a distance of 100 yards gazing anxiously, neither cow nor calf making any sound. As soon as he let the calf go, the mother seeing it was free, knew it would take care of itself, and turning tail, went off at full gallop, without even looking behind.

Had the calf by bellowing made it clear to his mother that he was in peril of his life, I fancy it would have made a profound change in her demeanor.

In proof of this is an experience recorded in Buffalo Jones's Adventures,[87] while on his last expedition to capture Buffalo alive. It shows that the cow Buffalo is no respecter of persons when once her dull wit has grasped the idea that they are unworthy of respect:

When the last calf was lassoed its mother rushed furiously to the rescue. After the horseman had vainly tried to drive her off, Colonel Jones very unwillingly drew his revolver and shot her dead.

Nor does the maternal instinct suffer when the animal is tamed and taught a less distrust of man, as Jones expressly says:[88]

[87] Adv. Buffalo Jones, 1899, p. 135.

[88] *Ibid.*, p. 235.

"Sometimes when I now lasso a calf of those in domestication and attempt to lead it away, the mother will quickly place herself in front of her baby and thrust a horn under and often through the loop of the rope, and hold the horse and rider perfectly solid, while, if the rope is slackened, she in some instances will free the calf entirely."

Thus we have seen that the mother, and all the possible fathers and uncles, are ready to do their duty in protecting the calf. Now comes Buffalo Jones to attest that the aunts also are quick to respond, so that the ideal of family feeling is complete in the Buffalo, thus setting him in high and honourable contrast to most other polygamous animals; offering, indeed, some refutation to the dictum that such a marriage arrangement is a foredoomed failure.

"Often [says Colonel Jones [59]] have I so crippled a calf that it was impossible for it to follow the herd, and its pitiful bleating would hold the family until I could kill all desired. Should the calf be wounded in the fore or hind parts, the old cow would actually support the parts so crippled, and it would walk away on the normal parts by such aid."

Once the calf is strong on its feet, and that means when three or four days old, its life is with the herd, and it is effectually guarded. Ordinarily, when the old ones lie down for the night, they may be scattered, but the near appearance of a Gray-wolf is enough to make them rearrange their places, condensing their band—the bulls, as a matter of course, now taking the outside.

"In pursuing a large herd of Buffaloes [says Catlin [60]], at the season when their calves are but a few weeks old, I have often been exceedingly amused with the curious manœuvres of these shy little things. Amidst the thundering confusion of a throng of several hundreds or several thousands of these animals, there will be many of the calves that lose sight of their dams; and being left behind by the throng, and the swift passing hunters, they endeavour to secrete themselves, when they are exceedingly put to it on a level prairie, where nought

[59] *Ibid.*, 235.

[60] N. A. Indians, 1866, Vol. I, p. 255.

can be seen but the short grass of six or eight inches in height, save an occasional bunch of wild sage a few inches higher, to which the poor, affrighted things will run, and dropping on their knees, will push their noses under it, and into the grass, where they will stand for hours with their eyes shut, imagining themselves securely hid, whilst they are standing up quite straight upon their hind feet and can easily be seen at several miles' distance. It is a familiar amusement for us, accustomed to these scenes, to retreat back over the ground where we have just escorted the herd, and approach these little trembling things, which stubbornly maintain their positions, with their noses pushed under the grass, and their eyes strained upon us, as we dismount from our horses and are passing around them. From this fixed position they are sure not to move, until hands are laid upon them, and then for the shins of a novice we can extend our sympathy; or if he can preserve the skin on his bones from the furious butting of its head, we know how to congratulate him on his signal success and good luck. In these desperate struggles for a moment the little thing is conquered, and makes no further resistance. And I have often, in concurrence with a known custom of the country, held my hands over the eyes of the calf, and breathed a few strong breaths into its nostrils; after which I have, with my hunting companions, rode several miles into our encampment, with the little prisoner busily following the heels of my horse the whole way, as closely and affectionately as its instinct would attach it to the company of its dam."

Alex. Henry mentions expressly [61] that the mothers come back in search of their young after the hunt is over.

In the early spring the life of the herds is pleasant. Weather is bright and warm; insect pests are unknown. Before the snow is quite gone, the crocus or sandflower is greening the plains again, and in a week changing their colour with its teeming bloom; a hundred others follow in quick succession with their rich and succulent growth. The Buffalo grow

[61] *Loc. cit.*, p. 177.

fatter every day. All the early morning they graze. Toward ten o'clock they lie down and chew their cud; about noon the old cow will arise and march toward the water with the band behind her. She does not go far among the many deep-worn Buffalo trails before finding one which is headed her way. She follows it; the others come stringing along single file behind her. The only exception to the single rank is made by the young calves, which run and frisk along beside their mothers. It may be miles to the watering place, but the herd marches steadily and with purpose. After all have drunk their fill, they may lie down again in the neighbourhood, or maybe they will wander back to some prairie swell, on whose northern side the sun is a little less warm or the western breeze a little stronger, and there they scatter and lie down for a two hours' rest, till the herd is reminded of its own growing hunger perhaps by some young "spike-horn" rising to resume the quest for food. Or, maybe, the final ounce of push that moves the landslide is supplied even by some little calf, who, desiring drink, uses vigorous means to make his mother take the posture needful to serve him.

FIG. 104—Cattalo cow in herd of Buffalo Jones.
From pen-and-ink sketch by Ernest Thompson Seton.
(Courtesy of the United States National Museum.)

FIG. 105—The big bull collected by W. T. Hornaday.
From pen-and-ink sketch by Ernest Thompson Seton.
(Courtesy of the United States National Museum.)

I remember once watching a young calf that besought his mother for food by pushing her neck as she lay. She brushed him away with a swing of her head. He tried farther back,

where, indeed, he could smell the refreshment that he needed; but it was effectively barricaded from him. Again he rubbed and leaned against his mother's neck in mute appeal; again she mutely said, "Don't bother me," and flung him afar with a swing of her massive woolly jowl.

Then did that small calf rise to the emergency in a way that filled me with glee; for, standing just beyond the sweep of mother's impatient horns, he backed and charged again and again, butting and pounding, with his tiny budding "nubbins" of horns, against her flank—her only tender spot—until she could stand it no longer and leaped to her feet. Now, of course, the object he had in view was easily within his reach; and springing into place, but well forward out of reach of her first impatient but half-hearted kick, he tugged away. The mother's love was stirred in response, and her forgiveness of him was complete—it arrived, indeed, before his punishment, so that it came not at all.

FIG. 106—Cattalo yearling in herd of Buffalo Jones.
From pen sketch by Ernest Thompson Seton.
(Courtesy of the United States National Museum.)

Another glimpse of the family life (or at least, the Indian opinion of it) is afforded by the following from the pen of C. E. Denny. Referring to the rare and beautiful "Beaver robe" already mentioned, he says:[42]

"The robe was nearly always of a cow, very fine and very light. Many explanations were given by the hunters for this peculiar coat, and the right one was no doubt that given by Montana Indians—that it was caused by the constant licking of many animals in the herd, to which some motherless calf belonged, it having become the pet of the band, the animals testifying their liking in that manner."

COW-BIRDS

In all this pastoral scene, there is a flock of small black birds, "cowbirds" or "buffalo-birds" they are called. They haunt the Buffalo as negroes do a Mississippi raft-house,

[42] Forest and Stream, May 8, 1897, p. 362.

sometimes on it, sometimes on the nearest land, but always moving when it moved, and recognizing it as headquarters.

The cowbird (*Molothrus ater*) is a well-known member of the Starling family. It is peculiar in this—it never mates, makes a nest, or brings up its own young. Free love is its habit; and, when the female is ready to lay, she searches for the nest of some small bird, and in it abandons her offspring to a foundling's chances with a strange foster-mother. Then—back she hikes to the merry group that lives and revels around the Buffalo herd. Sometimes the cowbirds walk sedately behind their grazing monster; sometimes they flit over snapping at flies; often they sit in a line along the ridge-pole of his spine. Their attachment to the Buffalo was so close that an Indian myth tells of their nesting in the wool between the horns of the big bull—rather a fearsome home-site, one would think, during a combat of the bull with some huge rival. But there are some foundations for the myth. First, they do not nest elsewhere; furthermore, I am told by "old timers" that skulls of Buffalo, still clad in their black shock of hair, were often used by little birds as nesting-places.

One more incident: In the park at Silver Heights, near Winnipeg, is a herd of a dozen Buffalo. All summer they are followed by the usual flock of cowbirds, which fly southward when cold weather arrives. But when the autumn of 1900 came, one stayed when the others left. All through that Manitoba winter it remained with the Buffalo, especially with the biggest bull of the herd. Its food was of the Buffalo's food; by day it flitted near or warmed its toes in the wool of the animal's back; by night, it snuggled on a sort of hollow it had made in the wool just behind his horns. The Buffalo was protector of the bird against famine, frost, and the attacks of both animal and human foes; for he was so fierce that none dared go near him, even to inspect more closely the cowbird that had committed itself to his charge. This incident is attested by Dr. S. J. Thompson, the veterinary of the Province, by George Grieve, the taxidermist, and by T. A. Prescott, the keeper.

PLATE XXVI.—LIFE STUDIES BY E. T. SETON.

1. Study of an old cow. 2. Young cows. 3. Buffalo cow (Jardin des Plantes, March 25, 1892.) 4. Old cow.

PLATE XXVII.—BUFFALO BULL TEARING UP THE GROUND.

The 4 act in wallowing

From a photograph by R. L. Walker, of Carnegie, Pennsylvania.

Grieve tells me that he thinks the bird was wounded and unable to fly when its kinsfolk went south, and so made the best of the situation; and not so very bad it proved, for it was fat and fit in the spring.

As the summer grows warm the Buffalo shed their coats in great broad flakes or wads of mothy-looking felt, till the hinder half of their bodies becomes positively naked. And now the mosquito millions are turned loose. I suppose that even a rhinoceros would be annoyed by these long-beaked stingers of the lush wet prairies, and the Buffalo, with their naked rears, are driven to accept any promise of relief. Standing on a high knoll in a strong wind is said to be "good medicine" for the flies. But such a combination is not always available, and, besides, it prevents feeding. A much more convenient protection is a supplementary coat of mud.

THE WALLOW

Catlin's description of the Buffalo habit of "doping for flies" is old, but worthy of repetition, for he saw it in its highest development and on numberless occasions:

"In the heat of summer [he says[a]] these huge animals, which, no doubt, suffer very much with the great profusion of their long and shaggy hair or fur, often graze on the low grounds in the prairies, where there is a little stagnant water lying amongst the grass, and the ground underneath being saturated with it, is soft, into which the enormous bull, lowered down upon one knee, will plunge his horns, and at last his head, driving up the earth, and soon making an excavation in the ground, into which the water filters from amongst the grass, forming for him in a few moments a cool and comfortable bath, into which he plunges like a hog in his mire.

"In this *delectable* laver he throws himself flat upon his side, and forcing himself violently around, with his horns and his huge hump on his shoulders, presented to the sides, he ploughs up the ground by his rotary motion, sinking himself deeper and deeper in the ground, continually enlarging his pool, in which he at length becomes nearly immersed. And

[a] N. A. Indians, Vol. I, p. 249–50.

the water and mud about him mixed into a complete mortar, which changes his colour, and drips in streams from every part of him as he rises up upon his feet a hideous monster of mud and ugliness, too frightful and too eccentric to be described."

This practice seems to have been much more popular with the bulls than with the cows—a fact which seems to prove that the flies alone were not the cause of it. The bulls were more heavily clad with wool on the fore parts and suffered more, therefore, from the heat. Also they gathered more of the prickly seeds that are an active irritant of the skin. Chief among these on the northern Plains is the "spear grass" or "wild oats" (*Stipa spartea*). In July it seeds abundantly. Each seed is like an [illegible], with a sharp corkscrew point and a long barley awn, but set everywhere with fine bristles pointing backward. When this contrivance touches the wool of a Buffalo, its barbs at once cling, and by a complete hygroscopic mechanism, first carefully studied by Miller Christy,[64] it revolves seven or eight times in an hour, boring through the wool and finally reaching the skin. Every prairie man remembers the sharp prick of the spear-grass—first its corkscrew penetrates his clothing; then it attacks his person. Every sheep-owner, too, can testify that it keeps on boring, even through the skin, till an angry, irritating sore is produced. This aggressive plant was, no doubt, one of the plagues that drove the Buffalo to the wallows. A proof of this, as Christy points out, is seen in the fact that the old wallows are rimmed about with an unusually thick and vigorous growth of spear-grass. The newer generation calls them "fairy-rings."

RUBBING

The wallow was not the only offset. Rubbing places were in great demand. It is well known that the posts of all the first telegraph-lines across the Plains were thrown down, again and again, by the Buffalo rubbing against them. Even when the poles were protected by sharp spikes, the big brutes were not deterred from availing themselves of these delightfully convenient scratching posts—they were, indeed, attracted rather

[64] On the power of penetrating the bodies of animals possessed by the seed of *Stipa spartea*. Read before the Linnæan Society, London, February 21, 1884.

than repelled by the additional tang thus given. Further, as every settler on the Plains of the Souris knows, the boulders there are smooth and have a hollow worn around them, by the scrubbing and trampling of Buffalo for generations, availing themselves of the chance for a vigorous rub. Old travellers along the Red River tell of all the trees being rubbed smooth, like those in a farmyard. There is, indeed, little doubt that the Buffalo have helped to extend the prairies and to reduce the woodland country by rubbing down the trees.

SANITATION

In sanitation the Buffalo is very low, its excretions being left anywhere. Such is the rule among creatures that have nothing of the nature of a nest or home-point.

AMUSEMENT

The only approach to social amusement that I have ever heard of was that described to me by Charles Norris, a cowboy of New Mexico, who, in 1886, watched a band of Buffalo at their watering-place. After drinking very heavily, he says, they played about like calves, and a number of them amused themselves by jumping off a steep bank into the water four feet below, running round to climb the bank at a low place, and repeating the performance many times.

MATING

The Buffalo bull is so exemplary in his behaviour toward the calf that some observers believed the species to be monogamous. Thus Audubon and Bachman say:[65]

"The Bison bulls generally select a mate from among a herd of cows and do not leave their chosen one until she is about to calf.

"When two or more males fancy the same female, furious battles ensue, and the conqueror leads off the fair cause of the contest, in triumph.

* * * * * * *

"It frequently happens that a bull leads off a cow, and remains with her, separated during the season from all others, either male or female."

[65] Quad. N. A., Vol. II, pp. 37–38.

Others maintain that there is no mating and that the species is promiscuous. Yet others assert that extreme polygamy is the rule—that the strongest bull drives the rest out and holds the herd as his harem.

COMBATS

That great battles take place there can be no doubt. The annual ferment, the disturber of so much animal peace, sets in during July—earlier in the south, later in the north—and continues about two months. Catlin's picture is that of a man who had seen it many times·

"The '*running season*,' which is in August and September [he says[66]], is the time when they congregate into such masses, in some places, as literally to blacken the prairies for miles together. It is no uncommon thing at this season, at these gatherings, to see several thousands in a mass, eddying and wheeling about under a cloud of dust, which is raised by the bulls, as they are pawing in the dirt, or engaged in desperate combats, as they constantly are, plunging and butting at each other in the most furious manner. In these scenes the males are continually following the females, and the whole mass are in a constant motion; and all bellowing (or 'roaring') in deep and hollow sounds; which, mingled all together, appear, at the distance of a mile or two, like the sound of distant thunder."

Frémont's description is given even more detailed:[67]

"July 7, 1842.—In the course of the afternoon, dust rising among the hills at a particular place attracted our attention; and, riding up, we found a band of 18 or 20 Buffalo bulls engaged in a desperate fight. Though butting and goring were bestowed liberally, and without distinction, yet their efforts were evidently directed against one—a huge, gaunt old bull, very lean, while his adversaries were all fat and in good order. He appeared very weak, and had already received some wounds, and, while we were looking on, was several times knocked down and badly hurt, and a very few moments would have put an end to him. Of course we took the side of the weaker party, and attacked the herd; but they were so

[66] N. A. Indians, Vol. I, p. 249.

[67] Expl. Exped., 1845, p. 26.

blind with rage that they fought on, utterly regardless of our presence, although on foot and on horseback we were firing in open view within twenty yards of them. But this did not last long. In a very few seconds we created a commotion among them. One or two, which were knocked over by the balls, jumped up, ran off into the hills; and they began to retreat slowly along a broad ravine to the river, fighting furiously as they went. By the time they had reached the bottom we had pretty well dispersed them, and the old bull hobbled off to lie down somewhere."

The question arises, Who was that old bull? I suspect that he was the great-grandfather of many of those who were ill-treating him, and further, that he ill-treated his own great-grandfather in precisely the same way.

POLITICS

There is on Antelope Island, in Salt Lake, a herd of Buffalo which numbered 28 in 1905. Friends in Salt Lake City have given me an idea of what has been going on in that herd, ever since they were turned loose and left free to resume their tribal life, a dozen years ago. The strongest bull takes possession of all the best things—the wallow, the choice food, the shady spot in summer, the sheltered nook in winter, and the majority of the cows. He would take all, if he had the wit, and the cows accepted his view of the matter. The lesser bulls keep out of his way and take what they can get of his leavings. From time to time, some growing lusty young fellow tries a bout with the "boss" and usually gets the worst of it. But a time comes, soon or late, when the "boss is licked." He is driven out of the herd and far away from it, forbidden to return at the peril of his life, and the new king reigns in his stead, to tyrannize over the cows and the lesser bulls as he did before. The reign of each "boss" is usually two or three years. I have no doubt that this explains the clan-life of the Buffalo. It is a well-known fact that any solitary Buffalo seen on the plains was always an outcast old bull—doubtless one that had been originally

driven out of the herd, and, becoming indifferent to the other sex, remained more or less solitary from choice.

OLD BULLS

These old bulls are rarely molested by hunters, human or brute. They are too tough for one to eat or for the other to kill. But sometimes the Wolves, when hard pressed by hunger, will unite in a large band and attack even an old bull, if no better prey be in sight. Catlin was witness of several of these terrific encounters and has left this description:[68]

"During my travels in these regions I have several times come across such a gang of these animals [Wolves] surrounding an old or a wounded bull, where it would seem, from appearances, that they had been for several days in attendance, and at intervals desperately engaged in the effort to take his life. But a short time since, as one of my hunting companions and myself were returning to our encampment with our horses loaded with meat, we discovered, at a distance, a huge bull encircled with a gang of white Wolves. We rode up as near as we could without driving them away, and, being within pistol shot, we had a remarkably good view, where I sat for a few moments and made a sketch in my note book, after which we rode up and gave the signal for them to disperse, which they instantly did, withdrawing themselves to the distance of fifty or sixty rods, when we found, to our great surprise, that the animal had made desperate resistance until his eyes were entirely eaten out of his head, the grizzle of his nose was mostly gone, his tongue was half eaten off, and the skin and flesh of his legs torn almost literally into strings. In this tattered and torn condition the poor old veteran stood bracing up in the midst of his devourers, who had ceased hostilities for a few minutes, to enjoy a sort of parley, recovering strength and preparing to resume the attack in a few moments again. In this group some were reclining to gain breath, whilst others were sneaking about and licking their chops in anxiety for a renewal of the attack; and others, less lucky, had been crushed to death by the feet or the horns of the bull. I rode nearer to the pitiable object

[68] N. A. Indians, Vol. I, pp. 257–8.

PLATE XXVIII.—A VERY HIGH-HUMPED OLD BULL.

PLATE XXIX.—THE OLD BULL'S LAST FIGHT.

as he stood bleeding and trembling before me, and said to him, "Now is your time, old fellow, and you had better be off." Though blind and nearly destroyed, there seemed evidently to be a recognition of a friend in me, as he straightened up, and, trembling with excitement, dashed off at full speed upon the prairie, in a straight line. We turned our horses and resumed our march, and when we had advanced a mile or more, we looked back and on our left, where we saw again the ill-fated animal surrounded by his tormentors, to whose insatiable voracity he unquestionably soon fell a victim."

AUTUMN

During August and September the herd has consisted of all ages and sexes intermixed. As September wanes, the males lose interest in their partners, and now for the first time we find the clan divided, the males in one herd, the females in another. Their lives go on as before, but they meet and pass without mixing. The bulls are at this time poor in flesh and subdued in spirit, but the rich pasturage to which they most assiduously devote themselves begins to improve their condition. By October the good fare shows in all. Their new growing coats are sleek, their bodies reinvigorated, their tempers more sociable, and, when late November frosts send forth the word to move, it is usual to find the clan reunited, moving as before with the old great-grandmother in advance; the young ones scattered through it, the father and grandfather behind; and the dethroned great-great-great-grandfather roaming alone in the offing.

AGE

These solitaries were probably far over twenty years of age. Domestic bulls continue to breed till considerably over a dozen years old. These were past breeding, and the Buffalo seems to have been longer lived than the ordinary bovine. The Hon. R. F. Pettigrew, of South Dakota, tells me that a Buffalo bull calf that he caught in 1882 was still living in Buffalo City Zoo in 1902, and by its continued vigour gave every promise of a much more extended life. The cows seem equally long-lived. Charles Payne tells me of one that was still

breeding and vigorous in her twenty-ninth year. Colonel Jones says:[69] "The natural life of the Buffalo is much longer than is that of the domestic cattle. I frequently saw animals so old their horns had decayed and dropped off, which indicated that they live to a patriarchal age. I saw a Buffalo cow in the Zoological Garden in Paris which was thirty-one years old, and I am sure I have seen wild ones from ten to fifteen years older." And since the cow begins to breed at three years and has a calf each spring (or every other spring) for about thirty years, the diminution of the Buffalo as a wild race cannot be, as some have claimed, due to infecundity.

EXTERMINATION

The extermination of the Buffalo has been so fully and admirably treated by Dr. W. T. Hornaday in his volume of that name (1889), that I can do little more than condense his account, acknowledge my indebtedness, and add a few later facts.

About the beginning of the nineteenth century the Buffalo were cleared out of all the country east of the Mississippi.

In 1832, according to Catlin,[70] 150,000 to 200,000 robes were marketed each year, which meant a slaughter of 2,000,000 or perhaps 3,000,000 Buffalo by the Indians. The destruction was already so great that Catlin prophesied the extinction of the Buffalo "within *eight* or *ten* years." The drain was obviously more than the natural increase, and already the vast herds were shrinking visibly. About 1834 or 1835 they began to diminish very rapidly on the western slope of the Rockies, as Frémont records. But the eastern slope was the great Buffalo range. Concerning these two areas this famous explorer writes:[71]

"The extraordinary abundance of the Buffalo on the east side of the Rocky Mountains, and their extraordinary diminution, will be made clearly evident from the following statement: At any time between the years 1824 and 1836 a traveller might start from any given point south or north in the Rocky Mountain range, journeying by the most direct route to the Missouri River, and during the whole distance his road would be always

[69] Buff. Jones's Advt., 1890, pp. 235–6.
[70] N. A. Indians, Vol. I, p. 263.
[71] Expl. Exped., 1845, pp. 144–5.

among large bands of Buffalo, which would never be out of his view until he arrived almost within sight of the abodes of civilization.

"At this time [1842] the Buffalo occupy but a very limited space, principally along the eastern base of the Rocky Mountains, sometimes extending at their southern extremity to a considerable distance into the Plains between the Platte and Arkansas Rivers, and along the eastern frontier of New Mexico, as far south as Texas."

Frémont reckoned the annual market of Buffalo robes as 90,000;[73] but robes were collected only during the four winter months, and not more than a third of those killed at the season were skinned, while half of the robes were used at home and never sent to market. Therefore, 90,000 robes represented a slaughter of about 1,920,000 Buffalo. But the rate of killing was so much higher in summer that we may calculate the annual kill at 2,000,000 or 2,500,000 a year during these palmy Buffalo days. The Buffalo Indians had been decreased by small-pox, but the white consumers more than made up the shortage. Naturally, therefore, the herds shrunk fast.

In 1842 Frémont found distress among the Indians along the Platte on account of failure of the Buffalo.[73] In 1852 the Buffalo was so far from the Red River country that Ross considered hunting it a thing of the past. In 1867 the Union Pacific Railway reached Cheyenne, penetrating the heart of the Buffalo country. It carried unnumbered destroyers with it and split the remaining Buffalo into halves. Thenceforth it was customary to speak of the "south herd" and the "north herd," each of which appeared to recognize a boundary in those sinister lines of steel.

THE SLAUGHTER

In 1871 the Santa Fé Railway crossed Kansas, the favourite summer ground of the southern herd, now reduced to about 4,000,000, according to Hornaday.[74] Then began the great slaughter by the white skin-hunters. Taking as a basis

[73] *Loc. cit.*, p. 145.

[73] Expl. Exped., 1845, p. 145.

[74] Ext. Am. Bison, 1889, p. 504.

the railway statistics of shipments and Colonel Dodge's observations, Dr. Hornaday has calculated the slaughter of the herd as follows:[75]

| | |
|---|---|
| 1872 | 1,491,489 |
| 1873 | 1,508,658 |
| 1874 | 158,583 |
| Total | 3,158,730 |
| Killed by the Indians during the same period | 390,000 |
| Settlers and Indians | 150,000 |
| Total | 3,698,730[76] |

These are the lowest estimates that I know of. Colonel Jones's figures are about double these. That was practically the end of the southern herd. A few scattered bands lingered in out-of-the-way places, but were relentlessly hunted down. The last considerable herd that I can learn about was in 1886, described to me seven years afterward by Charles Norris, cowboy, of Clayton, N. M., whose narrative is full of interesting detail. The date seemed to me very late for so large a herd, but cross-examination did not make him change it.

THE LAST OF THE SOUTH HERD

The last big bunch of Buffalo he ever saw was in the "Panhandle" of Texas. He came on them in May of 1886. He was driving a bunch of horses from Coldwater to Buffalo Springs; and, when thirty-five miles east of Buffalo Springs, he saw the herd about three miles off, and knew at once they were Buffalo, because they were all of one colour. He left the horses with the other man, as all he needed was a guide to this place. Next day, on returning, Norris saw the Buffalo again about fifteen miles farther east, and rode in among them. Some were lying down and some were grazing. They seemed about 200 in number; 6 only were little calves. As soon as they saw him they bunched like cattle and kept on "milling" around. Then one bull made a lead to stampede, but none followed him, so he

[75] *Ibid.*, p. 499.

[76] *Ibid.*, p. 501.


PLATE XXX.—GOING TO WATER.

came back to the bunch. Another bull then started from the bunch and tried to lead off. He ran about 100 yards, but none followed him at all, so he also returned to the bunch. Then one in the bunch that seemed a third larger than any other there led out and all following him, strung out in a semicircle. Norris tried to cut across to the middle of it; but instead of running right away, part of them hung back and it seemed as if they were going to surround him. He thought it wiser then to fall back and get out of the ring. Then they strung off after the big leader. Norris galloped behind trying to rope a calf, but the mother turned on him. He had no gun, and his horse was tired, so he gave it up. He noticed that in running they "pawed" with one side low, and after a while changed to the other. After they went off he rode on fifteen miles south-east to camp. A. N. Cranmer was in charge of the camp, which was by a small lake. He said: "This is the only water in this region and they will be certain to come in here before three days." So the men waited and on the second day, the whole herd appeared. Now they had a good chance to count them. There were 186. They drank very heavily and then played about like calves. A number of them amused themselves by jumping off a bluff into the water, four feet below them, then running around up a low place to jump off again. As soon as they had seen all they wished the men fired, killing a cow and a bull. They then set about roping some calves. Norris caught one and Cranmer caught two. They had to kill the mother of the last, as she showed fight. The herd went off and these men saw no more of it. One of the calves died and Norris gave his to Cranmer's little boy, who sold it to Goodnight, and the other was traded to a passing stranger from Kansas for a span of colts. In the November of the same year, on the same trail, Norris saw 12 head of Buffalo, but has never seen one since.

The very last individuals that I have knowledge of were found in 1889. The account of them I got from W. Allen, cowboy, also of Clayton, New Mexico, four years after the event. I give it in full.

About August 20, while out with a party hunting mustangs, in the neutral strip about twelve miles north-east of Buffalo Springs, the riders saw four animals, which they supposed were mustangs, as they were rolling in the dust. They were about three miles away, on the south side of a little knoll. The hunters rode around on the north side and got within seventy-five yards, to learn that these were four Buffalo.

They took alarm at once and started off westward, closely pursued by the hunters for about three miles, and then met another man driving a bunch of mustangs. The two bunches, mustangs and Buffalo, joined, and the men chased them for two miles, when they parted, the mustangs turning to the left, keeping up the X I T fence, and the Buffalo going to the right. Allen chased these about five miles farther and right into two of his own party. The Buffalo circled from them south and west three miles back, then right back to the X I T fence again. He fired four shots into a cow. She quit the bunch and went two miles to a lake, while he chased the three right through the X I T fence and left them. The men then returned to the cow at the lake; she ran into the deepest water, and stood at bay. After resting a short time she came out of the water and they shot her. A photographer, who was with the camp, took the pictures of the party with the skin and meat in view. That was the last Buffalo Allen ever saw. He learned that the three were killed later on.

This ended the last stragglers of the southern herd.

THE NORTH HERD

The great northern herd was still in existence after the bulk of the southern was wiped out. A colder winter and the presence of hostile Indians, which kept away white hunters, were their chief protections. Hornaday calculates[77] the northern herd at about 1,500,000 in 1870, but most authors put it much higher. The Indians, he reckons, were then slaughtering them at the rate of 375,000 a year.

In 1876 the United States troops pacified or drove the hostile Indians out of the Missouri country, opening the way

[77] Ext. Am. Bison, 1889, pp. 504–5.

for the skin hunters. In 1878 the last great herd went south from the Saskatchewan, and the few scattered bands left behind were killed off by the Indians in 1879. In 1880 the Northern Pacific Railway opened a way into the central country of the last herd, and the southern story was repeated.

Condensing Dr. Hornaday's account[78] we find that:

| | | | | |
|---|---|---|---|---|
| In 1881 | hunters | shipped | out | 50,000 |
| In 1882 | " | " | " | 200,000 |
| In 1883 | " | " | " | 40,000 |
| In 1884 | " | " | " | 300 |
| In 1885 | " | " | " | 0 |
| | Total | | | 290,300 |

This was the end of the northern herd. The remnant, numbering perhaps 200 or 300, was scattered in droves among the Badlands between the Missouri and the Yellowstone. One of these bands, numbering 40 or 50, took refuge in the rough country along the Big Porcupine River, where 28 of them were killed in 1886 by Dr. Hornaday, who collected and afterwards mounted them for the United States National Museum.

The rest of these in the United States were soon picked off by cowboys and hunters.

IN CANADA

But a few small bands lingered on the Upper Saskatchewan for several years.

James M. Macoun tells me that in 1888 (early July) he saw the meat of 8 Buffalo bulls that were killed between Methy Portage and Lac la Biche. They were the last seen there.

In 1889, according to the Reverend J. A. McLaughlin, missionary of Victoria north of the Saskatchewan, and W. Hine, a band of 11 was found in Hand Hills, 500 miles west of Manitoba. Five were killed by Indian acquaintances of McLaughlin. He saw part of the spoils, including a head, which sold at Winnipeg for $120. The other 6 were not accounted for.

[78] *Ibid.*, p. 513.

The only wild Buffalo now left are those preserved in the Yellowstone Park, and the herd of Wood-buffalo that finds a refuge in the woods and on the Plains of Great Slave River.

DOMESTICATION

So far as I can learn the earliest systematic effort to domesticate the Buffalo took place in Manitoba. In 1877 some Indians returning to Winnipeg from the west brought with them 5 Buffalo calves (1 bull and 4 heifers). The[illegible] became the property of James McKay, and were allowed [illegible] n about the outskirts of the town until 1882, when the he[illegible]ow numbering 23, came into the possession of S. L. Bedson, by whose courtesy I was enabled to examine the herd at Stoney Mountain and gather full information.

The account, which I partly reproduce, appeared in the May, 1886, edition of my "Mammals of Manitoba."

THE BEDSON HERD

At the present time (January, 1885) the herd numbers 41; of these, 9 are half-breeds with the common cattle; 6 are three-quarter bred; and the rest pure Buffalo. The object of domesticating these beasts is to provide an animal better suited to the requirements of the North-west than the common animal, which is, of course, unable to bear the winter without a certain amount of housing and feeding.

These Buffalo receive no care beyond what is necessary to prevent them wandering away or being stolen. They live on the open prairie summer and winter, subsisting on the wild grass, even when they have to dig for it through one or more feet of snow. Nor is it a bare existence that they so maintain; for when I saw them late in January they were finding grass enough, not merely to feed, but to fatten them. When a blizzard comes on they lie down close together with their backs to the wind, and allow the snow to drift over them, so that under the combined protection of the snow and their own woolly coats they are perfectly comfortable. In January, 1884, one of the cows calved on the open prairie, and though at the time the thermometer registered 38 degrees below zero, neither cow nor calf appeared to suffer the slightest inconvenience.

In 1888 this herd had increased to 58, not counting 25 half-breeds. In November of the same year they were bought by Colonel C. J. Jones (Buffalo Jones), of Kansas, and added to the 57 already in his possession.

From these, at least in part, have been supplied most of the herds now in captivity.

Colonel Jones has made many experiments and believes in a hybrid form between the Buffalo and common cattle. This "Cattalo," as he calls it, is especially suited as a range animal for the far north. It has the advantages of being exceedingly hardy, fearless of blizzards, able to paw and root through the snow for grass when ordinary cattle would starve, and, above all, produces a robe which, very superior even to that of a Buffalo, is worth as much as an entire ordinary steer.

Alaska and Canada are the countries for which these experiments have an especial interest.

THE ALLARD HERD

The Canadian Government soon realized that a mistake had been made in letting these Buffalo go, but an opportunity to retrieve has recently arisen.

Charles Allard, a Montana ranchman, had secured a few [illegible]lo and kept them at the Flathead Reservation until 1888, [illegible]hey numbered 35 head, and in 1907 their own increase [illegible]he added Pablo herd raised their numbers to 628. The whole herd was offered for sale and secured by the Canadian Government. A stroke of good business which pleased all good Canadians and did not entirely displease all good Americans who wish well for the Buffalo, because now it was realized that this remnant would be properly cared for and have a chance to increase.

BUFFALO WOOL COMPANY

The Red River was the scene of another attempt to turn the Buffalo to commercial account.

In 1822 there was founded at Fort Garry a joint stock company called the "Buffalo Wool Company."[79]

[79] See Ross, Red R. Settlement, 1856, W. 69–72.

The partners proposed to gather the Buffalo wool and use it as a substitute for that of the sheep. Undoubtedly the wool in question will make a good, servicable cloth, but the difficulty of getting the raw material in quantity and, above all, the mad mismanagement of the enterprise, ended all in a disastrous collapse.

Ross informs us (p. 72) that a yard of the cloth fetching 4*s* and 6*d* [$1.08] in England cost £2 10*s* [$12.00] to make on Red River.

CENSUS

How many Buffalo, both wild and domesticated, all told are now living? This is a question put by all who are interested in the subject. For a clear expression of their numbers, their decline, and the rescue of the survivors, I shall set the various figures in column:

| | | |
|---|---|---|
| Estimate of the Buffalo in primitive days | | 60,000,000 |
| " " " | 1800 | 40,000,000 |
| " " " | 1850 | 20,000,000 |
| Dr. W. T. Hornaday's estimate | 1870 | 5,500,000[80] |
| Miller Christy's census (of which 200 were in captivity) | 1888 | 1,300[81] |
| Dr. W. T. Hornaday's census (wild 635; captive in America 256; in Yellowstone Park 200) | 1889 | 1,091[82] |
| About 1895 they probably reached a minimum of | | 800 |
| Mark Sullivan's census in | 1900 | 1,024[83] |
| S. P. Langley's census Feb. 6, | 1902 | 1,394[84] |
| Dr. Frank Baker's census | 1903 | 1,753[85] |
| " " | 1905 | 1,697[86] |
| Dr. W. T. Hornaday's census | 1908 | 2,047[87] |

[80] Ext. Am. Bison, p. 504.
[81] "The Last of the Buffaloes," London Field, November 10, 1888, p. 697.
[82] Ext. Am. Bison, 1889, p. 525.
[83] "The Buffalo Still Lives," Boston Evening Transcript, October 10, 1900.
[84] Am. Bison in U. S. and Canada, U. S. Dept. Int., 57th Congress, 1st Sess., Senate Doc. No. 445, pp. 38–39.
[85] Stat. Am. Bison, 1905, Nat. Zool. Park, Smithsonian Institution.
[86] Stat. Am. Bison, 1906, Nat. Zool. Park, Smithsonian Institution.
[87] Rep. Am. Bison Soc., 1908, p. 74.

PLATE XXXI.—THROUGH THE MIST.
Drawn by Ernest Thompson Seton, 1892.

The apparent diminution in 1905 was due to the continued hunting of the wild ones in north-west Canada.

In 1903 Dr Baker estimated these latter at 600; in 1905 at 400. My own estimate, after a month on their range in 1907, is 300. They seem to be doomed, unless the Government takes vigorous steps to save them. But the captives in America and Europe have increased from the original stock of 200 in 1888 to 1,722 in 1908, and there is every prospect that they will continue as they have begun.

THE BUFFALO

Many able pens have recorded the service that this imposing creature rendered man. It needs no telling here. He fed a quarter of a million and clothed twice as many human beings. But these services are ended. As a wild animal the Buffalo is gone! The great herds will never again be seen roaming the Plains.

Who is there of the present generation that does not feel profound regret at this thought, and ask himself, "Oh, why was I born too late?" What would I not give to have seen the Buffalo days and people in their romantic prime? Much of the hungry regret that Sir Walter Scott felt over the departed glories of feudal life, is felt by every boy and young man of our country now, when he hears of the Buffalo days and the stirring times of the bygone wildest West. Why was this extermination allowed? Why did not the Government act? This and a hundred other saddest "might-have-beens" spring forth from hearts that truly feel they lost a wonderful something when butchers, drawn from the human dregs of border towns, were turned loose to wipe out the great herds that meant so much to all who love the wilds and the primitive in life.

There is but one answer, *It was absolutely inevitable.* The Buffalo ranged the Plains that were needed by the outcrowded human swarms of Europe. Producing Buffalo was not the best use to which those Plains could be put. The Buffalo, possessed of vast size and strength, of an obstinate, impetuous disposition that would stampede in a given line and keep that line to the utter destruction of all obstacles or of himself, was

incompatible with any degree of possession by white men and with the higher productivity of the soil. Therefore, he had to go. He may still exist in small herds in our parks and forest reserves. He may even achieve success as a domestic animal, filling the gaps where the old-time cattle fail. But the Buffalo of the wild Plains is gone forever; and we who see those times in the glamour of romance can only bow the head and sadly say, "It had to be. He served his time, but now his time is past."

But he leaves behind him a lasting monument. Who that knows the West has not seen the game-trail grow into an Indian trail; the Indian trail into a pack-trail; the pack-trail into a white man's road, that in turn is the pilot of the iron horse? The reason is simple—it is the easiest and shortest way through the hills that can be selected by long experience and thorough knowledge of the country. This idea, proclaimed by Hamlin Garland years ago, has been worked out for the Buffalo by A. B. Hulbert in his "Historic Highways of America."[88] He points out that the Buffalo first planned the route through the Alleghanies by which the white man entered and possessed the Mississippi Valley.

"It is very wonderful [he says] that the Buffalo's instinct should have found the very best courses across a continent upon whose thousand rivers such great black forests were thickly strung. Yet it did, and the tripod of the white man has proven it, and human intercourse will move constantly on paths first marked by the Buffalo. It is interesting that he found the strategic passageways through the mountains; it is also interesting that the Buffalo marked out the most practical paths between the heads of our rivers, paths that are closely followed to-day by the Pennsylvania, Baltimore and Ohio, Chesapeake and Ohio, Cleveland Terminal and Valley, Wabash, and other great railroads.

"A rare instance of this: The Baltimore and Ohio Railroad between Grafton and Parkersburg (W. Va.) has followed the

[88] Prospectus to Hist. Highways Amer., Vol. I, Part II. Paths of the Gr Game Animals, 1902.

trail steadily throughout its course, and when it came to a more difficult point than usual, the railway was compelled to tunnel at the strategic point of least elevation, and in two instances the trail runs exactly over the tunnel! This same thing occurs now in the building of a new railway."

But the white-man was not the first to follow the Buffalo's paths. Professor Mooney has proved to us that the Sioux Indians were a race of the Atlantic coast; that they migrated through the Alleghanies to the Mississippi Valley, and on—and yet farther on—they went. Doing what? We know to-day from their traditions, from their life, and from their route, they were *following the Buffalo*. They followed them over the mountains, by the paths the Buffalos themselves had made. They have followed them long and far. Will they still keep on, and—as many of their bravest wished to do—seek the herds no more on the vast Missourian Plains, but over the borderland, in those perfect hunting-grounds where the mosquito, the small-pox, and the white man are unknown; and where alone the Buffalo bands will ever again be seen darkening the offing and "making the earth one robe?"

FIG. 107—A story of the plains.

# RODENTS
# ORDER GLIRES

PLATE XXXII.—RED-SQUIRREL (ABOUT ⅔ LIFE SIZE).

(*Sciurus hudsonicus* Erxl.)

Connecticut, 1906.

## VIII.

## The Common Red-squirrel, or Chickaree.

*Sciurus hudsonicus* Erxleben.

(L. *Sciurus*, a squirrel, from Greek *skia*, a shadow, and *oura*, tail, because it sits in the shadow of its tail; *hudsonicus*, because it was first described from one found at Hudson's Straits.)

*Sciurus vulgaris hudsonicus* Erxleben, 1777, Syst. reg. an. I, p. 416.

*Sciurus hudsonicus* Allen, 1894, Bull. Am. Mus. Nat. Hist. VI, p. 325.

Type Locality.—Hudson's Straits.

French Canadian, *l'Écureil rouge, ou de la Baie d'Hudson.*

Ojib., Saut., Musk. and Cree, *Ad-jee-dah-mo,'* said by Animeekong to mean "head downwards," which is another way of saying "tail in air."

Chipewyan, *Klee'-ay.*

Yankton Sioux, *Kee-hch-chah.*

Ogallala Sioux, *Zeé-cha.*

The Family *Sciuridæ* may be recognized among Canadian Mammals, as rodents with short ears, and bushy tails (usually long): lower grinders, 4 on each side.

The genus *Sciurus* (Linnæus, 1758) comprises small rodents of tree-climbing habits; they have large and very bushy tails, moderate ears, no cheek-pouches, four fingers and a knob-like thumb on the fore-feet, and five nearly equal toes on the hind. The teeth are:

$$\text{Inc. } \frac{1-1}{1-1};\ \text{prem. } \frac{2-2}{1-1} \text{ or } \frac{1-1}{1-1};\ \text{mol. } \frac{3-3}{3-3} = 20 \text{ or } 22$$

In addition to these generic characters the Red-squirrel has:

Length, about 12 inches (305 mm.); tail, 5 inches (127 mm.); hind-foot, $1\frac{7}{8}$ inches (48 mm.). In Manitoba, Carberry specimens are largest; Lake of the Woods, smallest. SIZE

COLOUR

*In summer* the typical Red-squirrel is a sort of olive pepper-and-salt above, becoming redder on the legs, feet, tail, and ears; and darker and more olive, on the head between the eyes; pure white on the lips, chin, throat, ring around eye, under parts of body and inner parts of limbs; with a black stripe extending along the side of the body between the dark upper colour and the white below. Near the end of the tail is a broad tapering band of black, and the tail is finished with a border of yellowish or grayish colour.

*In winter* it loses the black stripe along each side, but adds a broad red band down the back and tail, and a speckling of dark gray over the white below.

Sexes alike.

In any part of its region, or in any of its coats, it is known at once as a *red squirrel*, with a white breast.

Its nearest relatives are:

The Douglas Squirrel (*S. douglasi* Bachman) which is readily distinguished by its eartufts and by its orange or buff under parts.

Frémont Squirrel (*S. fremonti* Aud. and Bach.) which is characterized by white-edged tail, a yellowish rufous backband, gray upper parts, and white breast speckled with gray.

The following races are recognized:

*hudsonicus* Erxl., the typical form.

*gymnicus* Bangs. Smallest of all the races, hind-foot small, colour dark, tail dark with red or orange fringe; breast, peppered gray in winter.

*loquax* Bangs, a large form, very red above and always pure white below.

*minnesota* Allen, largest of all, hind-foot large and a pale form, most obviously differing from *hudsonicus* in having under side of tail all gray instead of rusty red.

*dakotensis* Allen, a large and very pale form, quite the palest of all and white below.

*baileyi* Allen, a very large, more olive and darker above than the type washed with fulvous below.


## MAP 13—RANGE OF THE NORTH AMERICAN RED-SQUIRRELS.

This map is founded chiefly on Dr. J. A. Allen's Revision of the Chickarees (1898), with assistance from the records by O. Bangs, R. Macfarlane, E. W. Nelson, Audubon and Bachman, S. N. Rhoads, G. S. Miller, C. Hart Merriam, W. H. Osgood, E. A. Preble, E. T. Seton.

It must be considered diagrammatic and provisional. The facts are not yet available to make an absolute map of distribution. For the sake of clearness the ranges are shown as though quite separate; they doubtless overlap.

**The three species are:**

***Sciurus hudsonicus* Erxl., with 10 geographical races.**

***Sciurus douglasi* Bach., with 5 geographical races.**

***Sciurus fremonti* Aud. & Bach., with 4 geographical races.**

*ventorum* Allen, a large form like the foregoing, but darker, more olive, and grayer below.

*richardsoni* Bach, a large form still darker than *ventorum;* with much black, especially on the tail, which is nearly all black above.

*streatori* Allen, a large form much like *richardsoni*, but is more olivaceous above in summer, and has a very short tail, of which only the last third is black.

*vancouverensis* Allen, like *streatori*, but much smaller, and tinged brownish below.

*petulans* Osgood, like *vancouverensis*, but paler.

Specimens from Ingolf, Kenora, Norway House, and eastern and northern Manitoba are true *hudsonicus*. Those from Carberry and Winnipeg begin to show a gradation toward the larger pale form called *minnesota*.

## Life-history.

RANGE OF SPECIES

The Red-squirrel is found in Manitoba, from Lake of the Woods to Fort Ellice, and from Turtle Mountain to Berens River. Its range in America is set forth on page 309.

ENVIRONMENT

Its special environment is the coniferous woods. It is, indeed, the only true Squirrel in Canada, east of the Plains, that is happy in the fir and pine forest region.

It is also the only true Squirrel in Eastern Canada that makes and harbours in holes under ground. There is nothing so safe as Mother Earth, and it is doubtless due to this subterranean habit that the Red-squirrel survives and flourishes, while the Gray and Fox-squirrels vanish with the vanishing woods.

INDIVIDUAL RANGE

The home range of each individual is, I should say, less than ten acres. At Duff's Lake, near Carberry, is a grove of oaks that cannot cover much more than twenty acres, and it is yet range enough for a number of Red-squirrels to live in year after year. This grove is quite isolated; the Squirrels, to get

to it originally, may have had to cross half-a-mile of bare prairie. But the Red-squirrel knows so well how to use a hole in the ground that it can make these open journeys safely, when a more strictly arboreal animal would surely come to grief.

In a grove of thirty or forty oak trees, east of Carberry, Willie Brodie and I, on November 26, 1882, ran down and captured a Red-squirrel, that might easily have escaped to thicker woods farther away, but this small grove was evidently the home region that it knew, and here it would stay. In Ontario I have known one of the species to take up its abode in a barnyard, and never leave this all winter to go even fifty rods away. Many a one passes its whole life in an orchard of from four to five acres. A family of Red-squirrels that I watched for some months at Tappan, New York, never, so far as I could learn, went a quarter of a mile from the central home trees. In the woods about my Connecticut home is the Red-squirrel family elsewhere referred to as the "Singers." These I watch each summer, but I have never seen them one hundred yards from the home tree. If they ventured so far they would be trespassing on the occupant rights of the next Squirrel family, and be forced to fight or run away. I have, however, observed another family in northern New York that habitually travel along the fence between a corn-crib and a woods over a quarter of a mile off.

At his country home (Woodstock, N. Y.) Paul Doherty has, he tells me, a pair of Red-squirrels which are very easy to observe, as both are albinos. Their nest for two or three years has been in a hollow apple tree. They are usually seen within fifty feet of this. Only once in four months did he see them farther away; they were then at the next house, eighty feet from their nesting tree.

As sidelight I cite the case of a Fox-squirrel, a creature larger and more active than the Red-squirrel, therefore needing a larger stretch of woodland, and yet the evidence goes to show that the home range of the Fox-squirrel is small. Of half a dozen that I turned loose in Wyndygoul Park, in the spring of 1901, but one was seen as far off as a half mile from

the original spot, and two that died some weeks after, were found within fifty yards of the place where they got their liberty. The others disappeared.

From these various facts I conclude that in a district of abundant food a Red-squirrel may pass its life on a few acres. In a region of scarcer food it must range farther, but if driven half a mile from home it may be an utter stranger to the locality. The cases noted in the chapter on swimming are exceptional.

HOW ABUNDANT

This species is never seen in vast numbers like the Gray-squirrel of the East.

When the authorities of Bronx Park, N. Y., decided to thin out the Red-squirrels for the sake of the song birds and the Gray-squirrels, they killed 60 of them in the 200 acres of woodland, leaving about a dozen. The woods had been well stocked with Red-squirrels, from which we may infer that a Squirrel to every three acres is abundance.

I found it more numerous at Kenora than anywhere else in the country, and there I doubt if they would average one Squirrel to every three acres of pinewoods. In the western part of Manitoba it is much less abundant. Possibly a pair of Red-squirrels to every square mile of the country is the highest average we can allow. Where there are neither cone-bearers nor oaks there are no Squirrels.

I see no difference in the number during recent times. It seems as numerous now as twenty years ago.

SOCIABILITY

Red-squirrels will play together, chasing each other among the trees, but I never saw two of them unite to defeat an enemy or to undertake some work too heavy for single effort. One may give the alarm call on finding a lurking foe, but it seems to utter it as a menace to the foe not as a warning to its friends. I have, I believe, seen both parents (near Toronto) gathering cedar bark for the nest; and, of course, the young are often seen in late summer following the mother, but these two cases, being family affairs, do not prove true sociability.

Sociable animals do things which are of no direct benefit to themselves, but helpful to others of their species, exclusive of their young and mates. In this highest sense according to present evidence the Red-squirrel, though slightly gregarious, is not sociable.

VOICE

In voice, the Red-squirrel of Manitoba does not differ from the common Red-squirrel of Ontario and Connecticut (*var. loquax*) so far as I can see. The prolonged chatter, the repeated coughing and scolding, and the deep whining that precedes the chatter, are common to both forms.

In my woods is a Red-squirrel, apparently a female, that is a *singer*. She seems to amuse herself by uttering all the Squirrel notes in rapid succession, going over the list a number of times, and in various combinations, until her performance has lasted ten or fifteen minutes. This is doubtless an unusual individual, but she illustrates the musical habit that we know now to be common to many, and may yet be found in all of the Mouse and Squirrel families.

MATING

The mating of the Red-squirrel in Manitoba takes place late in March or early in April. About Toronto I found the male showing signs, internal and external, of sexual activity as early as February 6.

PAIRING

I have no conclusive evidence to show whether the sexes truly pair or simply consort for the time being. I have, however, seen two adults at work building a nest, and this is strong evidence, since it is the rule for the male among polygamous animals to shirk all family responsibilities.

The two albino Squirrels already noted at Woodstock, N. Y., were seen together all summer and autumn.

William Brewster and several other naturalists are of the opinion that the Red-squirrel pairs, and the following evidence has bearing on the question:

On the afternoon of July 19, 1905, at Cos Cob, Conn., I heard a continuous whining *churr-churr* from a Red-squirrel in the trees under the window, and I saw, about ten feet off, a

small Red male with very red tail and black side stripes, trying by personal violence to possess a large dull-coloured female. She "*churred*," struggled, and scrambled from bough to bough for several minutes, but he kept his hold. At length she uttered the loud call chatter. An answer came from a hemlock some fifty yards away; another large Squirrel rushed in and put the small villain to flight.

I consider this incident important, as it showed first, sexual feeling outside the true breeding season; next that the third Squirrel (almost surely a male) still felt a band of attachment for this female; which argues in favour of permanent mating.

I was further led to ask, Does not fear imply the possession of imagination?

NESTING

The home nest is usually in a hollow tree or stump. The majority of those I examined were in the abandoned holes of the flicker—a bird that provides more homes and safe retreats for animated nature than any other agency in our country. In the district around Kenora, that is, the pine forest, the Red-squirrels build many outside nests. These are a mass of bark strips and roots in the thick top of some bushy tree. One of these that I examined near Ingolf in September, 1904, was about nine feet from the ground in a small jack-pine that stood in a thicket. It was eighteen inches across, fourteen inches high, made on a solid platform of sticks, warmly built of frayed bark. Evidently the roof was watertight, as inside all was warm and dry in spite of recent heavy rains. The chamber was about six inches across and four inches high in the centre. It had but one door; this was on the south and so draped with fibrous material as to be virtually self-closing and quite concealed. W. R. Hine tells me he has once or twice found the litter in these "drays." About Carberry, where hollow oaks and flicker holes abound, these outside nests are rarely seen.

On the other hand, in the far north, where the timber is small, many such are made, doubtless for permanent homes. W. H. Osgood, writing of the Red-squirrel on the Yukon, says:[1]

[1] N. A. Fauna, 1900, No. 19, p. 27.

"Evidences of its activity are to be found all through the spruce forest. Its globular nests of grass, moss, bark and refuse are common and are usually situated near the trunk of some slender spruce, ten or twenty feet from the ground. Sometimes several will be found in the same tree, and a half dozen or more are very often to be seen at the same time."

Apparently the young are born about the first of May. A home nest which I found at Carberry, June 24, 1882, was twenty feet up in an abandoned flicker's hole in a poplar stub. YOUNG

It contained 5 young. They were then blind, naked, and helpless and had no sign of aural orifice. They measured each about 4½ inches long, including the tail, which was 1½ inches. While I was up the stub the mother dashed up and down the far side, running over my hands and arms, in her great distress for their safety, quite reckless for herself.

I put the young back, intending to come again and watch their development. But the mother had other plans for them. She removed them at once, and I did not discover their new abode.

I saw nothing of the male on this, or indeed on any other, family occasion, and so far as I know, he does not usually help in caring for the young.

On the morning of May 4, 1906, at Cos Cob, I found an old female Red-squirrel in a rat-trap alive. She was evidently in milk. On letting her go she ran up a near tree, in the thick top of which I at once heard a great chattering and crooning as of two or more Squirrels. I suppose mother and family or possibly the mates were rejoicing over their reunion after the long separation of perhaps three or four hours.

During boyhood days near Lindsay, Ontario, I once felled a dead hollow tree in which was a Red-squirrel's nest. The mother and one of the young were killed by the fall, but the remaining five little ones, still blind and furless, though now late in June, were taken to the old cat with the idea that she would give them a merciful end, and turn them to account. But the cat had very young kittens at the time, her

heart was tender, and she received the orphans kindly. She suckled them with her own brood for some days. They died one by one, but it was not the fault of cat or kittens. So far as we could see her behaviour towards them throughout was of the gentlest and most motherly description.

In a box which I set up in a thick hemlock near my house in Connecticut, the Squirrel elsewhere described as the "singer," rears her brood each year. In June I often see the little ones following the old one in a sort of procession through the trees. This is no doubt their training. The mother knows and teaches them all the leaps and bridges, as well as the harvest trees in their overhead world.

On June 1, 1905, in Wyndygoul Park, a Red-squirrel, apparently a young of this year, but already two-thirds grown, was climbing under the eaves of the house, and seemed to be catching and eating insects. It lost its hold several times on the smooth woodwork, and once it fell with a heavy flop to the brick terrace eight feet below. It seemed hurt and rubbed its head with both paws in a comical way for a few moments, then ran off to its proper home in the trees.

It was interesting to note that it *rubbed* its head. Had the hurt been elsewhere it would have *licked* it. In either case the treatment must be considered an instinctive application of massage to the bruised place.

My journal at Cos Cob, Conn., for June 11, 1905, has the following: Small Red-squirrels now running alone, they are very red and have very big tails. Again, on June 15, I find this: The young Red-squirrels of the Singer family are very red in colour and fearless in behaviour. They sometimes follow the old ones and sometimes run alone.

I think they are not weaned till late in August; at least certain of them are not. The following notes show that some broods are very late.

August 24, 1888, at Lorne Park, near Toronto, Ontario, a family of half-grown Red-squirrels was found in a stub to-day; the mother carried them off one by one to a distant tree, where she hid them high up from view.

Camp, forty miles east from Kippewa, Quebec, on September 10, 1905. To-day our guide, Fred Reeves, saw a Red-squirrel carrying a young one in her mouth. She held it by the belly, its legs and tail curled about her neck. It was about one-third grown.

By October the family seems to have broken up spontaneously. I believe that one brood each year is all the Red-squirrel produces.

NOCTURNAL

The true Squirrels are supposed to be strictly diurnal. I never heard of a Red-squirrel bestirring itself by night, and I am much puzzled by this note in my journal:

Caughnawanna, forty miles east of Kippewa, Quebec, September 28, 1905. After dusk, I heard in a fir tree the unmistakable "*snick, snick, snick*" with occasional "*snicker*" of a Red-squirrel. This was repeated at intervals all night until 10.30 P. M., when I went to sleep. At 4.30 when I arose it was still to be heard. It certainly was not the voice of any bird or of any other quadruped that I know. Is the Red-squirrel nocturnal or desirous of posing as a nightingale? or was it some note of the Flying-squirrel?

TAIL

Like all the tribe this species has a very tender tail. If suddenly lifted by the tail when alive, the skin is likely to strip off, leaving the raw, bony structure. This is a serious handicap, as is proved by the fact that a tailless Squirrel rarely survives. The loss seems to limit its jumping power, and when it falls it suffers a heavy jar, from which the tail would have saved it.

Yet it is a remarkable fact that half of the Squirrels I collected about Kenora in 1886 had some injury in the tail—either it was lacking a few joints, or it had an abnormal bump on the end. I do not know whether these were caused by battle, disease, or climate.

At St. Johnsbury, Vt., a friend of mine (Charles H. Horton) had two or three large trout in a fountain basin on the lawn. A Red-squirrel that lived in the adjoining grove came

at times to drink here. One day, having satisfied his thirst, he faced about. A distant cat aroused his ire. He scolded as he sat on the edge of the basin and lashed his long brush over it in true Red-squirrel style, till one of the trout leaped from the water and seized the tail. Of course it stripped off, leaving the raw bone. The wrathy Squirrel, rushing up the nearest tree, had the unique experience of seeing the trout play games with his tail in the water below. He chattered and scolded furiously for about five minutes, then went off. The injury seemed slight; the naked part dried up and dropped off. The animal was not obviously crippled, and yet, as usual, the tailless one disappeared. Robbed of his rudder for the long flying leap, and of the parachute to break his fall, he was crippled in the struggle for life and could not long survive.

Francis Dickie, of Carberry, Man., writes me that on March 20, 1905, he found a Red-squirrel dead under a tree. "The tail was gone, except half an inch of stub, which looked as if chewed off, and not cut with a knife."

POWERS

How far can the Red-squirrel leap on the level? Not more than five feet, I should say, after measuring many bounds recorded in the snow, where they were running to escape from dogs and hunters. The wonderful leaps of fifteen or twenty feet from tree to tree that one hears of, are made on a descending leap, in which they are greatly aided by the kiting action of the flat spread body and tail.

SWIMMING

The Red-squirrel of New England is known to be a strong and fearless swimmer. It does not hesitate to make for land a mile away across the water. Dr. Merriam has some interesting notes on the swimming of this species as observed in the Adirondacks.

"The Red-squirrel [he says[2]] is a good swimmer, swimming rapidly and with much of the head, back, and tail out of the water. On August 18, 1874, I was paddling silently down a sluggish stream in the heart of the Adirondacks, when a slight

[2] Mam. Adir., 1884, pp. 216–7.

FIG. 108—Right hind-paw.
(Natural size.)

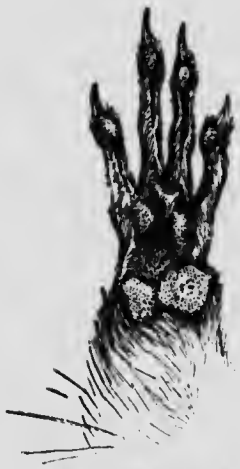


FIG. 109—Right fore-paw.
(Twice natural size.)

FIG. 110—Track of left hind-paw.
(Natural size.)

FIG. 11.—Showing the four nerve bristles on under side, with tufts of same on fore-legs, cheeks, etc.

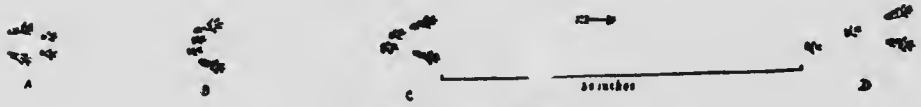



FIG. 112—Tracks in snow.

Details of Red-squirrel.

noise on the shore arrested my attention. A Squirrel soon appeared at the water's edge, but turned back upon perceiving the boat. The stream, which was about twenty feet (approximately six metres) in width, here flowed through an extensive marsh, the nearest tree being more than 100 yards (nearly 100 metres) away. Surprised at seeing a Squirrel in such a place, I stopped the boat, holding fast to a few bushes on the opposite bank, and after remaining motionless a few moments had the satisfaction of seeing him return, climb out on a little bush, and swim across. Again, June 28, 1878, while rowing on Brantingham Lake, in Lewis County, I saw a Red-squirrel swimming about midway between 'the point' and the main shore opposite [one mile]. He was moving toward the point, and, as I reached him, climbed up on the oar, ran over my back and legs, then along the gunwale, jumping ahead from the bow in the direction toward which he was swimming when first seen. On overtaking him he again came aboard and jumped ahead as before. This was done a number of times, the Squirrel gained each time two or three boat's length, till he finally succeeded in reaching the shore. I have repeatedly been told by hunters and guides that they occasionally meet these Squirrels swimming various lakes and rivers in the Wilderness, and James Higby tells that in June, 1877, he saw as many as 50 crossing Big Moose Lake (one and a half miles), and that they were all headed the same way—to the north.

"I am informed by A. K. Fisher that at the southern end at Lake George, in early autumn, it is sometimes an everyday occurrence to see Red-squirrels swimming across the lake, from west to east [about two miles]—never in the opposite direction. The chestnut grows abundantly on the eastern side of the lake, but it is comparatively scarce on the western, and these extensive migrations always take place in years when the yield of chestnuts is large.

"A few Squirrels are occasionally seen crossing the lake when the nut-crop is only moderate. In September Mrs. Fisher was angling between Diamond Island and the west shore when a Red-squirrel swam to the boat and was lifted in

by the tail. After resting a few minutes it ran out on an oar, jumped into the water and swam to the island (which is half a mile from the west shore), and thence, doubtless, to the chestnut groves on the eastern side of the lake."

"Mr. Winslow C. Watson, in his History of Essex County, says: 'The autumn of 1851 afforded one of these periodical invasions of Essex County. It is well-authenticated that the Red-squirrel was constantly seen in the widest parts [about 7 miles] of the lake (Lake Champlain), far out from land, swimming towards the shore, as if familiar with the service; their heads above the water, and their bushy tails erect and expanded, and apparently spread to the breeze. Reaching land, they stopped for a moment, and relieving their active and vigorous little bodies from the water by an energetic shake or two, they bounded into the woods, as light and free as if they had made no extraordinary effort.'"

MIGRATION

These observations bring up the question of migration. I have little faith in the migration of Squirrels. In autumn the young are full grown; all the Squirrel population is bustling about preparing for the winter. They seem so much more numerous than in summer that one often hears the remark that "the Squirrels have come"—but among Red-squirrels, at least, it is not in any sense due to a regular migration.

The evidence of the above paragraph from Dr. Merriam's book is so strong, however, that we must admit for the Red-squirrel of the Adirondack at least, and doubtless some other peculiar localities, a certain amount of migration when driven by scarcity of food. I have seen nothing of the kind in Manitoba, Ontario, or Connecticut.

FOOD

In the summer the Red-squirrel feeds on almost any kind of nuts and seeds. Berries also are added, but not at all to the extent that the Black and Gray-squirrels use them. The Red is a little unaccountable in some of its tastes. I have known one tear open vast quantities of apples to get at the seeds without eating any of the pulp, though it does sometimes eat the

latter. On June 23, 1906, a Red-squirrel stole an apple from our porch breakfast table and carried it up a tree. Later it fell from the crotch where he had lodged it. He had eaten over one-fifth of it; the remainder weighed four and a half ounces. He had not reached the seeds. Several apples had been stolen thus.

CARNIVOROUS

Most of the Rodentia will eat flesh, some are largely carnivorous; probably all are meat-eaters at times, but the Red-squirrel enjoys the ill-repute of being the most carnivorous of its genus.

Its attacks on fledgling birds and birds' eggs are notorious. About noon on June 26, 1905, at Cos Cob, I heard the shrill squealing of a young flicker and the angry *churr churr* of an old one varied by a loud *clape*. On going to the place I found a Red-squirrel on the ground with a fledgling flicker. He was deliberately eating the flesh off its shoulders in spite of its squeals and the very poor defense of the mother. When he saw me he ran up a tree and scolded from a safe place. The little reprobate was soaked and red with blood to the very eyes.

In June of 1906 at least three robins' nests in my garden were rifled of their new-hatched young by Red-squirrels, and in one or two cases the eggs were taken. Nevertheless, there is remarkable individuality shown among the Squirrels in this particular. A family of five lived in a grove of six or seven small trees near my house. In this grove a yellow-throated vireo reared her young under the Squirrels' very noses. They must have seen the birds, yet did them no harm.

William Brewster has described to me a similar case in which he saw the Squirrels leap daily over a robin's nest, but offer no harm to the eggs or callow young. These, however, must, I fear, be called the exceptions. The normal Red-squirrel of New England and Ontario is a little cut-throat ruffian—a terror to small birds, especially to the robin.

Its brother in Manitoba has a similar reputation, though I never saw one actually robbing a nest.

In the Selkirk Mountains, August 17, 1899, I watched the Squirrels of the region eating eagerly the worms that infested

a sort of gall that formed on the spruce trees (*P. alba*). Crossbills also were eating them at that time.

In the autumn the showering abundance of nuts and seeds gives the Red-squirrel a chance to feast, to fatten, and also to lay up store for times of famine ahead; all of which it attends to with admirable assiduity. In the country about Kenora, the principal autumn (and therefore winter and spring) food of the Squirrel is seeds of the jack-pine. But about Carberry the spruce and oaks supply its staples of support.

IN THE WINTER

The Red-squirrel has three principal sources of winter food supply in Manitoba.

1st. *Stores of food and nuts* that it has laid up in hollow trees or in underground vaults during the previous season, and over which it exercises the surveillance of a jealous ownership.

So far as I have been able to observe, the Red-squirrel never buries separate nuts here and there in the ground, after the manner of the Fox-squirrel, nor does it store up any useless husks, but first prepares the food carefully, and stores it in one or two places, usually a hollow log or tree. About Winnipeg, where hollow trees are scarce, I found evidence of its storing this food underground, and farther north, according to Sabine and Richardson:[3]

"These animals * * * are found wherever the white spruce fir grows, living upon its seeds, and passing the winter in holes at the roots of trees, coming out occasionally for food, and to sport in fine weather among the branches."

Osgood says[4] that on the Yukon "little excavations in the moss show where the Chickarees have been digging for roots; and spruce cones tucked away in these and other out-of-the-way places are further evidence of their sagacity. The ground is often strewn for some distance with the scales of spruce cones which they have stripped. Near Lake Marsh I found one such place twenty feet square which was covered six inches deep with scales."

[3] Franklin's Land Journey, 1823, p. 665
[4] N. A. Fauna, No. 19, p. 27, 1900.

CONES

Before the crop is quite ripe the Red-squirrel may be seen industriously cutting off pine-cones, fir-cones, etc., till the tree is despoiled and the ground below littered over with the crop. There they lie until the harvester finds time to open each, and carry the valuable part to one of its storehouses. And here it may be remarked that the Red-squirrel knows the best way of getting at each kind of food. It never opens an acorn as it would a hickory nut, or a pine-cone as a chestnut burr. It never strikes a butternut on the thick end, or makes the mistake of chisseling into a nut that does not repay the trouble. Sound-*looking* nuts picked up at a Squirrel's laboratory are invariably found to be empty.

FIG. 113—Red-squirrels in life.

The workshop where the Squirrel thus prepares its food is much marked by heaps of the hulls, rubbish and rejected nuts, but these are never left near the actual store.

The habit of cutting off the chestnuts before they are ripe is very marked among the Connecticut Squirrels, and is at times somewhat puzzling. The nuts would be much better if left a fortnight longer, and by throwing them to the ground all are brought within reach of many rivals. The explanation lies in the fact that the Red-squirrel has been evolved to prey on the

seeds of conifers. If these are left to ripen fully they take unto themselves wings and fly away, whereas by cutting the cone just before it opens the Squirrel makes sure of the prize.

In contrast with the storage habits of the Red-squirrel I quote my notes on the Fox-squirrel: "On the first of August, 1903, I watched for an hour the Fox-squirrels in City Park, Madison, Wis. A large male that seemed master of those near came forward as I offered him some peanuts. The first three he ate, the rest he buried. His procedure was the same each time: seizing the nut in his teeth, then in his paws, he turned it two or three times in his mouth and appeared to be licking it—why? I could not guess unless it was to mark it with the smell of his ownership. This trick is also practised by the Eskimo[1] of Davis Strait, as well as by sailors and small boys of our own race.

Then the Squirrel ran along the ground in a jerky, erratic way, selecting a place to bury his treasure. Having decided on the spot, always in the open, away from any landmark, he scratched a hole about three inches deep, thrust the nut into the bottom of it and replaced the earth, packing it down with his front paws, until it was levelled. If approached by another Squirrel during the operation, he drove him away. If another Squirrel approached the place two or three minutes afterward, the owner of the treasure still showed fight, but in five or ten minutes he seemed to lose the sense of ownership, and other Squirrels might run over the place without provoking hostilities. This Squirrel made ten holes during the hour I watched. After that he seemed to be weary. The question arises, How does the Squirrel profit by these "hides"? It seems to me incredible that he should remember each separate place. Rather, I should say, he has a general guidance from memory of locality and a particular guidance from smell.

[1] "The fortunate person licked each article with his tongue, on receiving it, as a finish to the bargain, and an act of appropriation. They in no instance omitted this strange practice, however small the article." Franklin's First Journey, 1823, p. 17. It is well known that once a cow, sheep, or dog has licked its own little foundling, the feeling of kinship and possession is established. Maybe human kissing had a cognate origin.—E. T. S.

I never saw a Squirrel dig without finding the buried treasure, though I have often seen him smell without digging.

This is the habit of the Fox-squirrel and its cousin, the Gray, but not apparently of the Red-squirrel or any of its near kindred.

In the region of the two former it is probable that 9 nut trees out of 10 owe their planting to some Squirrel.

At Wyndygoul Park a number of Red and Gray-squirrels have learned to eat from a tray of stuff put out daily in cold weather. The Grays sit down and eat their food where they find it. The Reds carry it away to eat. The Grays lose interest when their bellies are full. The Reds carry away everything, storing what they cannot eat.

*The second food supply* in winter is mushrooms, chiefly of the genus *Russula*. If these were to be stored in the same way as the other provisions they would doubtless rot long before they could be of service. The Squirrel stores them in the only available way, that is, in the forked branches of the trees. Here they are safe from the snow that would bury them, from the Deer and Field-mouse that would steal them, and instead of rotting, they dry up and remain in good order until needed.

I have seen Red-squirrels storing up these mushrooms in the Sandhills south of Chaska Lake, Manitoba, in the Selkirk Mountains, on the Ottawa, and on the upper Yellowstone River. The Squirrel's sense of private ownership in a mushroom-stored tree is not so clear as its feeling regarding a hoard of nuts it has gathered.

During early winter in Manitoba I have once or twice seen a Red-squirrel dig down through the snow to some mushroom, still standing where it grew, and there make a meal of it.

While camped at Caughnawanna, on September 14, 1905, I was witness of a comic display of frugality and temper on the part of a Red-squirrel. A heavy footfall on the leaves had held me still to listen. Then appeared a Chickaree labouring hard to drag an enormous mushroom. Presently it caught in a branch, and the savage jerk he gave to free it resulted in the "handle" coming off. The Squirrel chattered and scolded, then seized the disc, but again had the misfortune to break

it, and now exploded in wrathful sputterings. Eventually, however, he went off with the largest piece and came back for the fragments one by one.

FIG. 114—Mushroom eaten by Red-squirrel, Bitter-root Mts., Idaho, September 6, 1902 (Natural size)

The scene was an exact reproduction of one described by Dr. Merriam in 1884.[6]

*The third principal food supply* is the thinnest greenish outer bark of the Quaking Aspen or Poplar. This it does not store up, but gathers as it is needed in time of famine, just as do the other herbivorous animals.

[6] Mam. Ad., 1884, p. 214.

FOOD IN SPRING

The Red-squirrel's chief food in spring is presumably the same as in winter, namely, stores carried over from the year before, eked out with poplar bark. As a matter of fact these stores are laid up for spring as much as for winter. Many times during the spring time I have seen Red-squirrels licking eagerly the twigs of a sweet birch (*B. lenta*) opposite my window. I could not see that they got anything; they certainly were not removing the bark. It has, however, a new variation of diet at this season, for now the sapsucker comes from the south and taps numerous trees, maple, aspen, etc., to feed on the coagulated syrup, and on the insects caught therein. The Red-squirrel makes the most of the chance, and following the sapsucker, steals the product of its labour; sap and insects both are acceptable. Thus the Squirrel becomes for a season a sort of parasite on the hard-working woodpecker.

A most interesting case of odd companionship has been put on record[7] by T. A. Gentry. It may be of the same class as this.

ODD COMPANIONSHIP

"In the hollow of an oak-tree, not far from Germantown [says he], lives an individual of the common Chickaree Squirrel (*Sciurus hudsonicus*) with a specimen of this little owl [saw-whet or Acadian] as his sole company. They occupy the same hole together in perfect harmony and mutual good-will. It is not an accidental temporary association, for the bird and the Squirrel have repeatedly been observed to enter the same hole together, as if they had always shared the apartment. But what benefit can either derive from the other?"

The only explanation that I can suggest is that the Squirrel went there to feed on the Mice and small birds that the owl often stores in one corner of its house. I expect the owl was not benefited at all. Similar cases are mentioned in the Fox and Badger chapters.

HABITS IN WINTER

This species does not hibernate, so far as my observation goes. I have seen them abroad during very cold weather, even 20 degrees and 30 degrees below zero; and throughout the

[7] Coues's Birds of the Northwest, 1874, p. 317.

winter about Carberry. I recollect especially one day in December, 1884, seeing the Squirrels chasing each other about in a grove of oaks and having the merriest game of tag, though the thermometer registered that day 35 degrees below zero.

I think it possible that farther north, where the winter is severe, this vigorous little creature may consent to sleep during

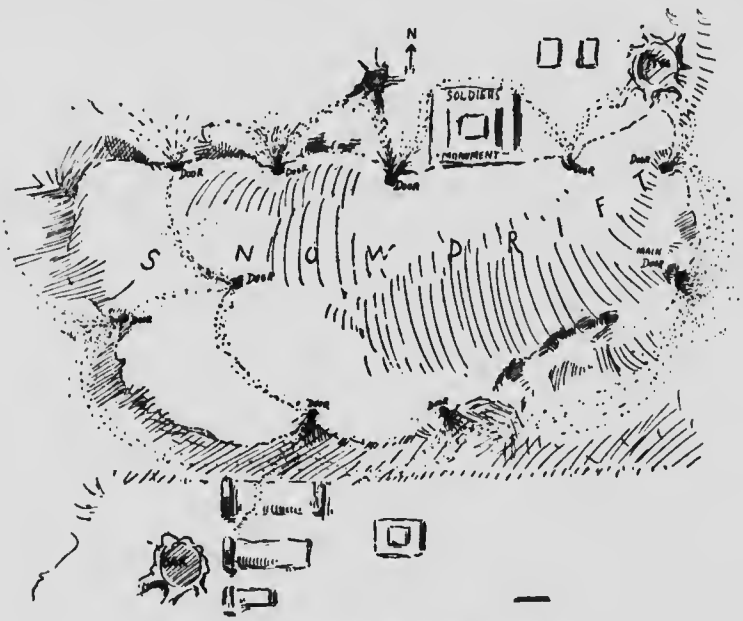



FIG. 115—The Red-squirrel's playground, in a snowdrift.

the worst of the storms, for the habit is deeply rooted in the family. But this must be only for a short time, and it is ever ready to resume active life on the slightest encouragement from the weather.

E. W. Nelson says[8] that in Alaska "the most intense cold of the northern winter does not keep them in their nests more than a day or two at a time."

During the winter in northern New York State I found a trail along a fence showing in the snow where some Squirrels had a regular road from a barn full of corn to a little woods a

[8] Nat. Hist. Alaska, 1887, p. 281.

quarter of a mile away. This woods turned out to be first, a cemetery, second, the happy home of a family of Red-squirrels. Besides a number of holes in trees and in the earth, I found these Squirrels had a snow-drift playground. They had made a perfect labyrinth of galleries in a drift that was twenty feet long and six feet wide. This had ten entrances leading to chambers and passages innumerable, and in very cold days they evidently played tag here instead of in the tree tops. Around the entrances I found the remains of nuts and pine-cones, so maybe somewhere in the snow-drift was a feasting place—their winter palace was banquet hall as well as gymnasium; but I could not examine it fully without destroying it, so left it alone (Fig. 115).

FIG. 116—Opening of a Red-squirrel's snow-tunnel.

This carousal of the Squirrels lay between the graves of a family that had died of small-pox and of some soldiers killed in the Civil War, but doubtless the Squirrels found it the merriest place on earth.

Every winter at Cos Cob I find dozens of tunnels driven under the snow as close as possible to the ground. These are of two or three inch calibre and at the bottom show plainly the foot-marks of some animal of Squirrel size, labouring hard to force the passage. Though I never caught the miner in the act, I have at length traced them to the Red-squirrel. The remains of cones, etc., in and around showed what it sought with so much labour.

ENEMIES

The principal enemy of this animal in primitive regions is the Pine Marten; indeed, we may consider that next to the Mice the Red-squirrel is the Marten's principal food. Quick though the Squirrel may be, the Marten can follow just as fast. Up the tree and down and from branch to branch, pursuing to the topmost twigs, turning when it turns, climbing where it climbs, leaping where it leaps, the Marten surely runs it down, and revels in its blood. The Squirrel has but two

ways of escaping; the first is by getting into a hole that is a snug fit for itself and therefore impossible for the foe—not by any means a safe resource, as the Marten may tear the entrance a trifle wider, and then take the prey at leisure. The other is the flying leap from the branches of one tree to another. The Marten can leap quite as far as the Red-squirrel—that is, four or five feet on the level—but its greater weight forces it to leap from a point farther back, where the boughs are thicker, and this difference is often the salvation of the hunted one. A Squirrel knows all the fa leaps that are found in its home woods. If it sticks to them it may escape. But one that loses its head and allows itself to be driven into strange territory, is certainly lost.

It has another foe to contend with, probably the worst of all—that is the *paralysis of fear*. The very sight of the relentless, blood-thirsty Marten on its trail will sometimes rob it of all power, and render it an easy prey.

The Weasels also are among the foes of the Squirrel. They have not the activity of the Marten, but they can follow the Squirrel into any hole, and their pertinacity makes up for their inferior agility in the trees.

We must also reckon among its enemies most of the large hawks and owls. According to Fisher's Report,[9] the marsh hawk, Cooper's goshawk, redtail, redshoulder, broad-wing and barred owl have been taken with parts of Red-squirrel in their stomachs. To these we may safely add the great horned owl, for it is known to kill Fox-squirrels; doubtless, therefore, the Red-squirrel also is on the list.

Strange to say, we must include the sparrow-hawk, as the following record will show:

Portage la Prairie, April 16, 1886.—A male sparrow-hawk was brought to me. In its stomach was a young Red-squirrel and a song-sparrow, an extraordinary meal for so small a bird. Possibly the sparrow-hawk was seeking for a home when it discovered the Squirrel's nest with the young one, and yielded to temptation.

[9] Fisher's Hawks and Owls of U. S., 1893.

COMMENSALISM AND PARASITES

The Common Deermouse of Manitoba is found in the same region and has the same foods as the Red-squirrel, so I suspect it will be found tapping the Red-squirrel's hoards, just as the Field-mouse often quarters itself on the storehouse of the Yellow Gopher.

The *cuterebra*, which is fully described on page 410, is known to attack most small rodents. I never saw a case among Red-squirrels, but W. R. Hine tells me that he has seen several about London, Ontario, and one or two among specimens taken near Winnipeg. In these cases the larva of the bot was found in the scrotum of the Squirrel.

In the fall of 1888, near Toronto, I saw a Red-squirrel rubbing his anus very hard on a tree as he chattered at me. On collecting him, I found the anal glands and the surrounding region much swollen. Whether this was some disease or a sexual condition or the result of an attack of *cuterebra*, I could not make out. I have seen it several times since and always in late summer or early fall. Two well-marked cases were September 11, 1905, at a place forty miles east of Kippewa, Quebec, and September 22, 1902, Bitterroot Mountains, Idaho.

Wyndygoul, August 13, 1905.—To-day I watched a large female Red-squirrel (evidently in milk) energetically scratching her head with both paws. Sometimes she scratched and nibbled at her body and tail, but the head seemed the chief seat of the irritation. Occasionally I saw her mandibles moving as though eating the victim of the hunt. At times she stopped to seize and devour a hemlock cone, and several times she rubbed her face and neck vigorously on the hemlock limbs.

A curious sort of parasitism is found among animals which build an elaborate nest, and I have several observations to show that the Red-squirrel is no exception.

I found an abandoned nest of the species late in September and sent the whole thing to Professor E. B. Southwick, who thus reported: "After a careful examination of the Squirrel's nest I find among the lining:

"(a) The leg of a thorax and larva-skin of beetle, I think,

those of the 'meal worm,' no doubt attracted there by the bits of grain, on which it feeds in the larval state.

"(b) The pupa case of fly. As there was a lot of Squirrel excrement in the nest it is possible that the fly larva fed upon it, as I could see no signs of any other animal matter that it could develop on.

"(c) The pupa case of wasp. This came from the small nest which you say hung a foot above the bed and was not included in the Squirrel's boarders."

This is a study in "commensalism"—as the Squirrel had at least two tenants to share his bed and board and a "squatter" in the shape of a wasp whose sovereignty was not to be disputed—in fact, commensalism with "squatter sovereignty" hanging over it—not so unlike some other local habitats or homes we have seen.

On July 9, 1906, I found that the nest already mentioned as that of the Singer, was deserted. I sent it complete for analysis to Professor Southwick. I believed that the increase of the parasites had forced the Squirrel to leave it, but this idea was not sustained by the report, which is as follows:

"The nest was composed of leaves of *Quercus rubra, alba* and *castanea* (*Castanea resea* var. *Americana*).

"Leave and fibre of *Tilia americana* [the nearest tree was 200 yards away].

"Leaves of *Juglans cinerea* [the nearest was 100 yards away].

"Fibre of *Vitis labruska* and probably of *Asclepius* (species ?) [the nearest was 300 yards away].

"The lower part of the nest was composed of a mass of decaying leaf mould and vegetable matter, excrement, etc., and in this I found the following remnants:

"The pupa case of two species of *Diptera;* the imago developing in the excrement; a very minute fly (*Diptera*) of an unknown species, bred in the fermenting mass and common to such places; the remnants of wing-cases of two species of *Coleoptera*, probably of the wood-boring kind.

"Two larvæ of some wood-boring *Coleoptera* which will have to be developed so as to determine the variety; parts of wing-case of cockroach, common in woods in moist places.

"I could not find any parasitic animals that would cause the Squirrels to forsake their nest, and if such is the case they migrate with them or leave the nest when the host has disappeared."

In the spring of 1908 I noticed that there were no Squirrels about this nesting box. On May 13 I climbed up and found the reason; it was crammed to the roof with dung pellets, a disgusting mass, which left no room for a nest.

SANITATION

The pollution of the nest with excrement is a black mark against the Red-squirrel, and shows that it has not yet attained the rudiments of sanitation. In this department the lowest animals are those that void their dung wherever they happen to be, even in their nests. But the sanctity of the home is essential to uplift, and the next step is seen in those that leave the nest, but void the waste anywhere near. Flying-squirrels and Ground-squirrels illustrate this. A new advance is marked by those which have special places for the product. Of this class are the Field-mice with their open midden-heaps. The highest types are represented by the cats, which bury their dung with scrupulous care each time, and the Pocket-gophers, which construct underground cesspools, on the earth-closet principle. The Deer, having no home place or nest, need no sanitation, and have not developed at all in this direction. But the Red-squirrel is inexcusable. It has a home and does not trouble to keep it clean.

GOVERNMENT

Though unacquainted with the first principle of sanitation, the species has developed some of the fundamentals of government. It will fight bravely for its food tree, for its territory, for its nest and, as we have seen, for its mate. Caught trespassing, however, on the dominion of the neighbour, it will act in a cowardly manner that contrasts sharply with the behaviour when defending its own.

This may mean that when at home it can count on support, and abroad it fears an increase of foes, not that it is a conscience-made coward.

WHAT AGE DO THEY ATTAIN?

Applying the rule, that the age of an animal is about four times the period of growth, the Squirrel should be old at six years. In captivity, when guarded from all dangers, it might last eight or ten years. I have no direct evidence. However, I knew a Gray-squirrel that lived captive for eight years and was fully grown when first caught.

MENTALITY

The Red-squirrel is a veritable Puck of the Pines—an embodiment of merriment, birdlike activity and saucy roguery. One may live for years near a wood that is the home of Weasel, Skunk, and Hare without ever suspecting their presence, for these sly creatures are silent and nocturnal. But the merry Chickaree is a being of the sunlight, and as boisterous as it is vigorous in work and play.

It is well-known to all the world that shares its range, and the map (p. 309) shows how very wide a range it is. In various forms it covers North America, broadly speaking, wherever the pine trees grow.

The rodents are very low in the scale of intelligence, but the Red-squirrel ranks high in its class. It is gifted with a burning curiosity, which, tempered by prudence and aided by agility, is an excellent start on the road to knowledge. It is an inveterate scold, and will follow a foe for the fun of abusing him at a safe distance. When cornered in a hole it fights desperately till the last, and will drive its powerful "buck teeth" right through the incautious hand that grasps it, as I have several times discovered to my cost. It considers itself very superior to its larger cousin, the Gray-squirrel, and I take the Red-squirrel's view of the case. Whenever their interests clash it is the Red-squirrel that wins—in the end, not, I suspect, by any actual battle, but by its vigour, pluck, and pertinacious aggressiveness, which enable it to wear out and drive the other away; although I

need hardly say that the story of its emasculating its rival is an ancient, picturesque, and sanguinary myth.

There is evidence, however, that the contest is no foregone issue.

On the 2d of January, 1905, I climbed up to the box mentioned in the chapter on young. I expected to find the owner at home, as the Red-squirrels were daily to be seen. The box was crammed with leaves and bark strips. A bunch in the centre seemed to move. A finger thrust proved that a warm, furry creature was within, another poke, and out leaped, not the *prima donna*, but a fat Gray-squirrel, the sole occupant of the nest. If the two kinds are at war, and the Red is the stronger, why was the Gray-squirrel there?

VALUE

Should we preserve the Red-squirrels in view of the fact that they destroy a certain amount of grain, fruit, and song-birds every year? These are serious charges, and I cannot refute them in detail; but I know that my grounds abound now, as they have for years, with grain, fruit, song-birds. and Red-squirrels, showing that these are not incompatible. They are near some sort of balance. It may prove a wise thing to keep the Chickaree numbers down since their natural foe, the Marten, is gone from New England, but I am far from joining with those who would welcome its extinction. Indeed, I should wofully miss the noisy little rascals if I did not see them at their daily play, and I hope that the Red-squirrels will frequent my grounds at least as long as I do.

PLATE XXXIII.—EASTERN CHIPMUNK (½ LIFE SIZE).

(*Tamias striatus* (Linn.).)

Connecticut, September 25, 1906.

## IX.

## Common Chipmunk, Big or Eastern Chipmunk, Chipping Squirrel, Striped Ground-squirrel or Hackee.

*Tamias striatus griseus* Mearns.

(Gr. *Tamias*. a steward, one who stores and looks after provisions; L. *striatus*, striped; L. *griseus*, gray.)

*Sciurus striatus* Linn, 1758, Syst. Nat., X ed. 1, p. 64.
*Tamias striatus* Baird, 1857, 11th Smiths. Rep., p. 55.
Type Locality.—South-eastern United States.

*Tamias striatus griseus* Mearns, 1891, Bull. Am. Mus. N. Hist., III, p. 231.
Type Locality.—Fort Snelling, Minn.

French Canadian, *le Suisse.*
Cree and Ojib., *Ah-gwin-gwis'.*
Saut. and Muskego, *Ah-ging-goos'.*
Yankton Sioux, *Ah-tah-chah.*
Ogallala Sioux, *Hayt-kah'-lah.*

The genus *Tamias* (Illiger, 1811) comprises small Squirrels, living on the ground; they have well-developed cheek pouches, and along the back a series of black stripes on brown or gray ground.

The teeth are:

$$\text{Inc. } \frac{1-1}{1-1}\text{; prem. } \frac{1-1}{1-1}\text{; mol. } \frac{3-3}{3-3} = 20$$

In addition to these generic characters the Common or Eastern Chipmunk of Manitoba has the following:

Length, about 9½ inches (241 mm.); tail, 3¼ inches (82 mm.); hind-foot, 1⅜ inches (35 mm.). SIZE

COLOUR On the nape, shoulders, back, and upper surface of the tail it is a dark pepper-and-salt, tinged with chestnut on the head and changing to clear orange brown on rump, thighs, and root of tail. On its back it has five stripes, which are so deep a brown as to pass for black. The central one, the thinnest, beginning at the crown, between the ears, as a deep chestnut, becomes black just behind the shoulders and fades in the pale chestnut of the rump; the other four are in pairs on each side, from shoulder to hip, separated by a strip of pale buffy-white. The eye is in a dark streak with a whitish one above and another below. The cheek is fawn colour with a dark streak across it, and fading into white on the throat.

The flanks generally, the feet, and under side of the tail are pale fawn colour; inside the legs and all below, pure white. The tail has a black fringe or border with white tips.

The female is similar.

In its native surroundings its black stripes, rich colours, and lively habits identify it easily.

The four races of *striatus* may be briefly characterized thus:

*striatus* Linn., the typical form, with a general chestnut tinge, especially on the flanks.

*griseus* Mearns, a larger, paler, and grayer form.

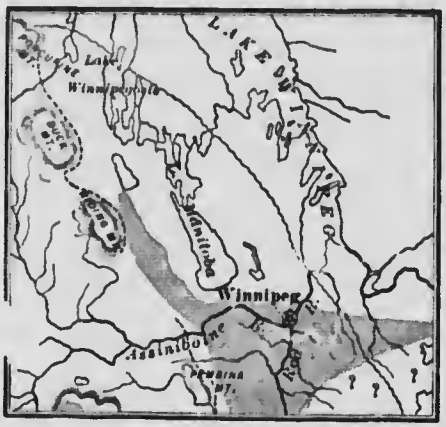
*lysteri* Rich., like *striatus*, but larger and paler, with rump and thighs yellowish red, instead of chestnut.

*venustus* Bangs, a large bright-coloured form, with shortened stripes.

## Life-history.

RANGE Its distribution in Manitoba is that of an eastern species that is spreading north-westward. It is abundant about Ingolf; also, I am told, at Kenora. Dr. E. Coues collected 4 specimens at Pembina; and I found it plentiful along the Red River down at least to lower Fort Garry. I have a specimen

taken at Morden by D. Nicholson, who tells me that it is not rare there. I have seen several specimens that were taken at Portage la Prairie, where it is common. I found it ranging west of Portage la Prairie for about twenty miles, but never got it at Carberry. On the west side of Turtle Mountain, V. Bailey found it common in August, 1887.[1] North-westerly, following the line of the old lake shore from Morden, I traced it up to Dauphin, where it seems to be abundant. J. J. G Rosser tells me that it is plentiful at Winnipegosis and on all high ground of Red Deer Point. This represents its north-western limit as at present known. In Manitoba I have never found it beyond the limit of the old Agassiz Lake bed (see Maps 14 and 15).




MAP 14—Distribution of the Eastern Chipmunk in Manitoba.

ENVIRONMENT

Log-heaps, stone-piles, broken rocky ridges, wooded banks, and ramshackle outbuildings, in dry, sunny places near woodlands, are the chosen places of the Chipmunk. We look for it in vain on open prairie, in gloomy unbroken forests, or in swamps. Though but slightly arboreal, it is at home in the woods, and is usually very local in distribution. A great many will gather at some very attractive spot, while the region around, though appearing to answer their needs, may be without Chipmunks. Sun, food, and a dry, sheltering labyrinth near the ground are the essentials of Chipmunk happiness.

HOME RANGE

The home range of each individual is undoubtedly very small. On one occasion in late June, I followed two Chipmunks that left the hole nearly together and set out as though with an object. They travelled to a small knoll covered with oaks, some fifty paces away. At another time (June 15, 1905) I saw a Chipmunk make repeated journeys between a small

[1] Rep. Orn. and Mam. Dep. Agr., 1888, p. 437.


**MAP 15—RANGE OF THE COMMON CHIPMUNK AND ITS FOUR RACES.**

***Tamias striatus* (Linn.).**

This map is founded chiefly on records by John Richardson, Audubon & Bachman, J. A. Allen, D. G. Elliott, E. A. Mearns, G. S. Miller, O. Bangs, E. A. Preble, S. N. Rhoads, E. T. Seton.
Further investigation will modify it considerably on the north and west. The lines demarking the races are provisional.

grain storehouse and its den, about fifty yards away, down hill, through the woods. Both these cases were at Cos Cob, Conn.

In order to mark an individual Chipmunk for better observation in this regard, I caught a female that lived by our porch. Then I placed the cage-trap that held her in a bowl of deep blue-purple dye. The Chipmunk did not like it at first, and splashed in such vigorous protest that everything within three feet looked very blue. But she found it not so bad as it looked, and soon was sitting contentedly with only her head above the purple sea. To help her pass the time and evidence my good feeling, I offered some bread. This she accepted in a proper spirit and fell to eating, but held it so low that it was speedily dyed an intense purple, which, however, apparently detracted nothing from her relish.

When taken out and dried in the sun, her back colour was hardly changed, but her breast, throat, and feet were of a most distinctive imperial hue. I took her to the woods to a place about 150 yards from her home and set her at liberty. This was July 14. A Chipmunk frequented our porch all that summer, though I never saw it in clear light close at hand. On September 25 I saw one there singing its full song. A cage-trap quickly brought it within reach and I learned that it was my purple Chipmunk, though there was not a trace of the dye excepting on the bare skin of nose and feet. These were now of a bright blue.

This and the opinions of other naturalists comprise all the evidence I have on the home range of the individual Chipmunk, and it leads me to believe that though the animal may go 100 or 200 yards away on occasion, it ordinarily spends its entire life within the narrow compass of two or three acres.

NON-MIGRATORY

Furthermore, so far as I have seen, the species does nothing in the way of migration. Dr. Merriam, on the other hand, states his belief that the Adirondack Chipmunks *are* migratory:

In June, he says,[3] "the species attains its maximum in numbers, the young and old together inhabiting all parts of

[3] Mam. Ad., 1884, p. 234.

the woodland. Foreseeing that the nut crop will fail (this being the even year), they commonly emigrate in July and do not again appear till September or October of the ensuing year.

"Briefly, then (leaving out of consideration the small number of resident individuals, and the migrants that sometimes pass through on their way to distant parts), we find Chipmunks reach the Adirondack region during September and October of the odd years (nut years), remaining till the following July. They then depart and are not seen again till the autumn of the next year. Hence they are here about ten months and absent about fourteen months, the period of greatest abundance being in June of the even years (when there are no nuts)."

I do not find in this *conclusive* proof that the species is migratory. I cannot learn that any one ever *saw* a migration of Chipmunks. Nor are they known to appear in unusual numbers elsewhere in the season in question. One or other of these facts seems to me necessary to support the theory of migration.[3]

At Cos Cob, Conn., the Chipmunks had abounded up to the autumn of 1907. The nut crop was a failure that year. In the spring of 1908 a melancholy change had come over the woods. There was no spring chorus and only three Chipmunks were discovered after a thorough investigation covering weeks. All three were at places where they could live on corn put out for the ducks. In June there seemed to be a slight increase in the number of adult Chipmunks, which added a perplexity to the problem. But I am still inclined to think that the increased numbers of Chipmunks in the Adirondacks during nut years is, that the plentiful food supply permits actual increase, and in famine years they die. They *seem* most abundant in June of the nutless years, because the scarcity of food compels them to be out and stirring all the time, and so they are much in evidence.

[3] Since the above was written John Burroughs writes me that in the summer of 1908 the Chipmunks appeared at Roxbury, N. Y., in extraordinary numbers. So the question remains open.

When autumn came the ground was pebbled over with hundreds of bushels of acorns, chestnuts and hickory nuts, but there were no Chipmunk hordes. There seemed to be a slight increase in their number, but less than reproductive increase would have explained. Four times in the third week of October did I hear a solitary Chipmunk strive to raise the chorus as he perched on some stump, but in each case there was but one voice. The merry host of a year before was no longer in the woods.

The only migration I have seen among them is like that of the flowers—the summer, above ground; the winter, below.

There is, in this connection, nevertheless, another curious circumstance that I have noted *each year* at Cos Cob, Conn. It is the practical disappearance in July of the otherwise abundant Chipmunks. I do not know of any satisfactory explanation, for when August comes they seem as numerous as ever.

ABUNDANCE

The greatest abundance of this species that I ever saw in the North-west was at Ingolf, which is on the Canadian Pacific Railway just east of the Manitoban line. During a visit there in 1904 I found both this species and *Eutamias neglectus* in numbers about the railroad siding, where long lines of grain cars, jolted at start or stop, had made the place a delectable forage ground for the ever-growing hordes of Chipmunks that found an ideal residence among the tumbled rocks composing the railroad dump. Among these they had excavated, or found, endless labyrinths which doubtless afforded them security from many enemies.

The railway is an important agent in the distribution of several animals, forming, as it does, a plain sunny opening in the forest, a continuous sheltering bank on the prairie, a means of crossing rivers, and a long chain of food supplies through the waste from grain cars.

During the two days at Ingolf I saw perhaps 25 of the large species, but the residents told me that they were now far from their usual number; on warm days earlier in the month

ten times as many might have been seen. Already (September 16), apparently, some of them had retired for the season.

Along the wooded banks of the Red River and Assiniboine River, the tangled brushy banks afford to the Chipmunks good concealment as well as plenty of nut and seed supplies. Here, though they are less abundant than at Ingolf, I found them so generally distributed that it would be safe to estimate their number at a pair for every fifty yards along the river front.

At Cos Cob, Conn., the species abounds. Along the drive which passes through the woods for 700 yards, I found 7 or perhaps 8 pairs. This would give about 1 pair to each acre. A favourite hollow just back of the house, however, has as many as the entire drive, although it is less than half an acre in extent.

One pair to the acre is over 1,000 Chipmunks to the square mile, and this I should say is well within their numbers in all the half-cultivated parts of their range in years of abundance. But in places of high cultivation like Ohio, and south-western Manitoba, or of no cultivation at all, like northern Ontario and north-eastern Manitoba, I should divide the figures by 100, and on this basis reckon up the Chipmunk population of their entire range at not less than 20,000,000 in years of abundance, and in years of disaster, reduce it to a quarter as many.

SOCIABILITY

The Chipmunk is quite sociable as well as gregarious. Not only do they associate in numbers where the surroundings are attractive, but they unite in several efforts, notably the spring chorus described later, and, as Kennicott remarks,[4] "sometimes, though not always, several pairs occupy the same burrow in winter, the store of food being common property."

Some interesting observations on their sociability are thus supplied by John Burroughs.[5]

"One March morning after a light fall of snow I saw where one had come up out of his hole, which was in the side of our path to the vineyard, and after a moment's survey of the surroundings had started off on his travels. I followed the

[4] Quad. Ill., 1857, p. 72. [5] Squ and Furbearers, 1900, pp. 23–24.

track to see where he had gone. He had passed through my wood pile, then under the beehives, then around the study and under some spruces, and along the slope to the hole of a friend of his, about sixty yards from his own. Apparently he had gone in here, and then his friend had come forth with him. for there were two tracks leading from this doorway. Then I followed them to a third humble entrance, not far off, where the tracks were so numerous that I lost the trail. It was pleasing to see the evidence of their morning sociability written there upon the new snow."

SPRING COMING

In Manitoba the common species appears above ground about the first or second week of April, that is, as soon as warm weather has surely set in. The regularity with which the Chipmunks appear, with the first soft wind of spring, sets me wondering sometimes whether there is not something more than mere verbiage in the phrase, "vernal influence." Snug in their deep, dark abode, far beyond reach of sun or frost, they cannot be reached or touched by mere temperature, nor can it be that they appear at a set time, as some of our winter-sleepers are said to do. No! They must come forth on the very day when first the very spring is in the land. A Chipmunk announces its return to sunlight in a manner worthy of a bird. Mounted on some log or root it reiterates a loud chirpy "*chuck-chuck-chuck*." Other Chipmunks run from their holes, for they awaken almost in a body, they run forth into the sunlight, and, seeking some perch, add their "*chuck-chuck-chuck*" to the spring salute. So the glad news spreads from point to point, from stone-pile and log-heap, to brush-heap and fence, summoning all the race to come forth and take part in the national rejoicing.

This jubilant method of receiving the spring-time I have seen only in the eastern part of America, for the good reason that I never happened to be in the forest regions of Manitoba when the event should take place, but I am told by many that in our province the Big Chipmunk fully maintains the tradition of its family.

In the wooded parts of Minnesota the coming forth of the Chipmunks is a recognized event among the young Indians and is celebrated, Dr. Charles Eastman informs me, by a special hunt. As soon as the bright, warm days of spring arrive to make it possible the boys go forth between sunrise and nine o'clock to some well-known Chipmunk haunt, where one of their number, who is adept in imitating the creatures' notes, begins the chorus by a loud chirping. The Chipmunks pop out of their holes on all sides. "Sometimes as many as 50 will come together and hold a social reunion."[6] Then, seeking some high perch, they join in the spring music with a concentrated energy that seems to make them heedless of danger, and soon they fall in numbers to the blunt-headed arrows of the little Indians.

VOICE

They are active from this time on, and their sunny morning chorus is not by any means confined to that original outburst.

On April 29, 1905, at Cos Cob, Conn., I heard a Chipmunk in full song. He kept it up for eleven minutes without ceasing, and uttered 130 chirps to the minute. He got no reply, though he worked very hard and seemed tired toward the last. I made the sketch of him which appears as the upper figure in Plate XXXIII.

On May 28, 1905, at Cos Cob, I heard a Chipmunk singing; he kept it up for three minutes, uttering three chirps to the second.

On June 11, 1905, at the same place, I saw a Chipmunk uttering the "*chuck-chuck*" chorus at the rate of fifteen chirps to ten seconds; five or six of his kind were in sight, but only one joined in; it was 100 feet away. When I drew near they changed to the much higher danger note and dived below. Early in September, 1906, at Cos Cob, I timed a singing Chipmunk. It kept on for six minutes, uttering at the fastest 170 chirps to the minute. While most of these uttered the deep musical "*chuck*," others used as the unit of the song a high chirp exactly like the alarm note. I never heard one making this sound while up a tree. I believe both sexes sing.

[6] Indian Boyhood, by Charles Eastman, 1902, p. 92.

Besides the loud "*chuck-chuck*" song it has several other notes, one in particular being a trilled whistle of several different notes that it utters when alarmed. This usually accompanies the final rush that it makes into a place of safety; possibly it is uttered in defiance of its pursuer, or it may be like the nervous squeal of a child just escaping being caught in a game.

MATING

There is much mystery about the mating of the Chipmunks. Unquestionably they have a season of excitement during the autumn. Rhoads thinks[7] that this may be the mating season, as the Tree and Flying-squirrels are known to mate in late autumn or early winter, according to latitude. I certainly saw the small Chipmunk of the High Sierra rutting in late September. Then, again, the Chipmunk of the Northern States will come out, like the proverbial Woodchuck, in February and race about like mad. This E. W. Nelson thinks[8] must be their rut. But these same proofs are found in a greater degree during the excitement of the early spring, with the additional evidence of the sexual organs being in a high state of functional activity. The visiting Chipmunks described by Burroughs may have been seeking mates. As late as May 5 a male Chipmunk caught for examination (Cos Cob, 1906) showed by the condition of the organs that this was its season of procreation.

On May 6 I found at the same place a female dead in a rat trap, apparently a week or ten days after the birth of her brood. Another female caught that day for examination was obviously at the point of becoming a mother.

As early as May 21, at Cos Cob, Conn., the young, already half grown, have been seen, and on September 27, 1906, I saw two, about half grown, follow an old one for some fifty feet from the den. On October 8 I captured for examination a female that was, or recently had been, suckling young. On October 14 I saw a half-grown Chipmunk playing about the door of its parental home.

[7] Mam. Penn., N. J., 1903, p. 62.

[8] *Ibid.*

In Pennsylvania, during late October, S. N. Rhoads collected[9] some two-thirds grown Chipmunks which could not have been born much earlier than late July.

How are we to reconcile all this evidence? Is it not possible that the species has several ruts in the year, and those females that are impregnated in the fall have a protracted gestation, as has been observed in certain other mammals that hibernate? It seems probable at least that two broods are produced each year.

Nevertheless, the principal season of sexual ardor is that of early spring. Though the others are open to question, there can be no doubt in the case of the spring-time revel. So that, beginning with the general awakening, the first month of their vernal life is given up to love, music, and feasting. It was for this merry month of carnival that the abundant supplies were laid up the year before. Food is now scarce everywhere, there is snow in the woods, there may even be more snow storms, and the Chipmunks' joy might seem likely to precede disaster had they not provided against the possibility of evil days. For a month or more their chief dependence will be this garnered product of the year gone by.

BREEDING

Whether they pair or not I cannot say; most naturalists believe that they do. I have usually found two old Chipmunks in each hole except when the young were very small; then the mother alone is seen about. The time of gestation, judging from analogy, should be about a month, but I have no direct evidence, and the fact of hibernation might greatly prolong the period in those females that were newly pregnant when entering on their winter sleep.

Rhoads thinks[10] "it is not unlikely that the female Chipmunk during parturition, and for some time after the birth of her young, does not leave the burrow, but either lives on the food she has stored there, or is fed by her male partner."

The following note bears on their habits at this season: On May 29, 1905, I caught the Chipmunk that lives in the

[9] *Ibid.*

[10] *Ibid.*

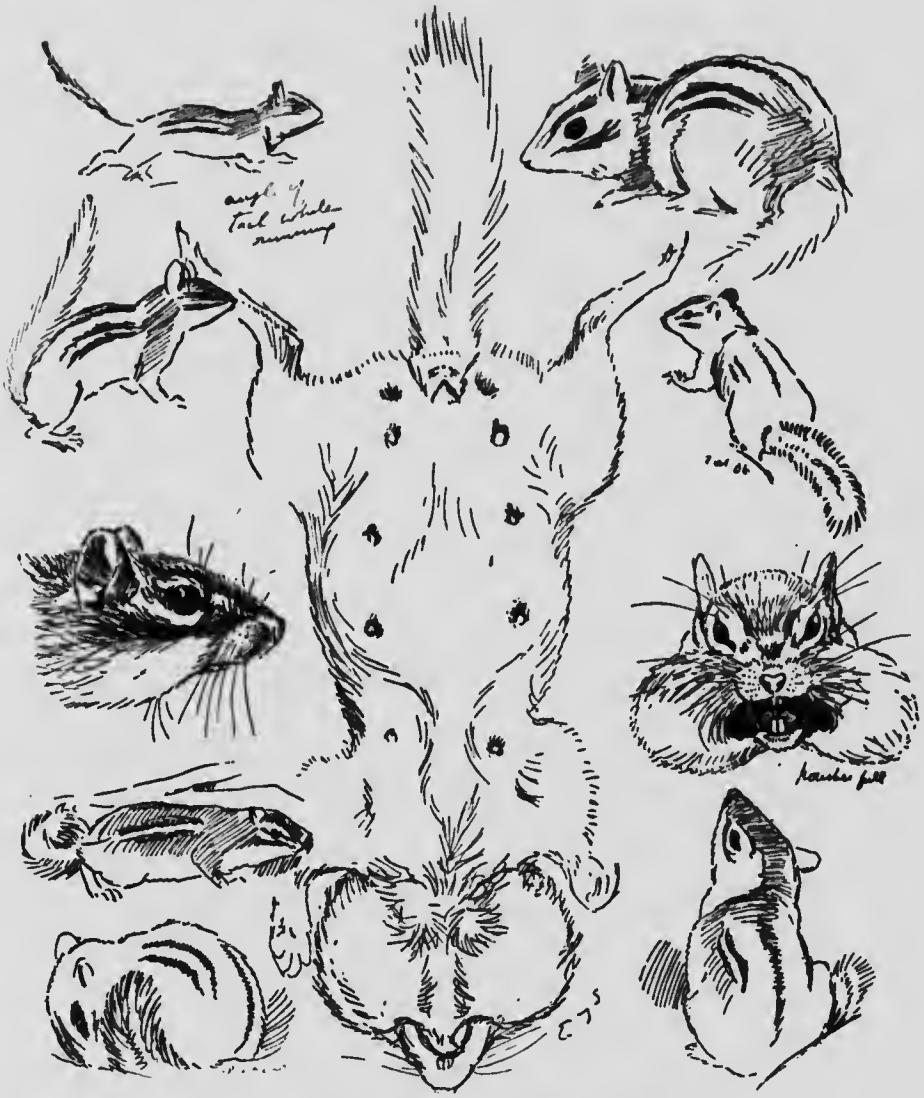


FIG. 117—Poses, etc., of Common Chipmunk (*T. striatus*).

The central figure is to show two musk glands on each side of the anus.

bank west of the house. It proved to be a female, she had the usual teats, but only four in 'commission.' I caught her again in the afternoon in the same place. Each time on being released she took refuge in a hole remote from the nest hole, once twenty-five feet away, once fifty feet away. I have never seen more than one old one about this hole.

DEN

I am not aware that any one has ever watched a Chipmunk actually at work burrowing, but circumstantial evidence shows that it adopts an ingenious method of concealing the entrance. Beginning at any convenient point in the selected bank, it drives a long crooked tunnel with an outlet in some thicket or sunny bank. All the earth is carried out and left as a mound at the entrance; when the burrow is finished this over-conspicuous hole is permanently closed up. Thus there is little outward sign of the real doorway to the home. The calibre of the burrow is one and a half to two inches. I do not believe that the Chipmunk brings earth out in its cheek pouches; these are reserved exclusively for food.

A curious instance of pertinacity on the part of the species took place at my home, Cos Cob, Conn. A Chipmunk had decided to make a doorway in the middle of the drive. Accordingly the tunnel appeared, bored from below. I filled it up with coarse gravel, and packed it tight for at least a foot down into the burrow. Two days later it was reopened *from below*. Again it was rammed full of hard gravel, to be opened again, and within forty-eight hours. Sixteen times during one month did I stop up this hole, and as often it was reopened from below. What became of the bushels of gravel I could not find out, but a general depression at that part of the drive began to show. At the end of five weeks' struggle I went away from home, for a rest, the Chipmunk triumphantly completing its earthworks. That was in 1903, and he held it peacefully throughout 1904.

In 1905 I renewed the attempt. For thirty successive days in the month of May I closed the hole once, or sometimes twice, in a day, and as often it was opened from below. Twice only

was it opened from the outside, and in each case I saw the animal outside when I closed the hole. From this I argue that he had but one doorway, and whatever he did with the earth, it was not brought out of that doorway. Possibly in this case it was stowed in some rock cranny under the drive, which was founded on large stones. In July, though no longer persecuted, this Chipmunk abandoned the hole, perhaps because of the various annoyances, though it must be remembered that July is the season when all the Chipmunks seem to disappear. In August he reopened it, and dwelt there till snowfall said "bedtime." In 1906 I renewed the battle, but desisted at the end of summer. That Chipmunk holds the fort to-day, September, 1906, and has the satisfaction of giving a jolt to every carriage that too rudely passes his door. The species is known to be wonderfully tenacious of its holdings. Where you find a Chipmunk this year you are likely to find one next year, probably the same Chipmunk. This is a marked contrast with the habits of the Woodchuck.

One of the dens was opened[1] in November, by Kennicott who found that it had for storage "four or five enlarged chambers, in different parts of the burrow, which was complicated and consisted of several windings and intersecting passages situated not over a foot below the surface. The entrance to the burrow was under a log, and the passages extended several feet on every side. A large nest of leaves and grass was placed above the surface, under the rotten log. Only one of the inhabitants was found, but he was quite active."

YOUNG

The young number 4 or 5, and are, as usual with the group, blind, helpless, naked, and almost shapeless little pink pillules of vitality. The nest prepared for them is deep in the ground and is approached by a network of burrows. So far as I know the female alone cares for the young. By June they are sufficiently grown to venture outdoors, and when half grown they will follow the mother forty or fifty feet from the door. In August most of the young Chipmunks are fully grown and

[1] Quad. Ill., 1857, p. 72.

able to shift for themselves. Possibly the 3 or 4 individuals often found in the winter den are the family of that year.

Evidence of this is given by Rhoads who says:[11] "That many Chipmunks enter and appear to be at home in the same burrow in the late fall, is evidenced by my having trapped at the mouth of a single burrow, between the 15th and 25th of October, on the mountain three miles above Round Island, Clinton County, Pa., 7 full-grown Chipmunks, of which 1 was an adult female, 2 an adult male, 1 a young female and 4 young males. Three of the young males and the young female were so nearly alike in size that I think them the offspring of the old pair, and that it was likely they all were expecting to hibernate, with the exception of the fourth young male, in this retreat. Of course this is only circumstantial evidence, but it is probable, as the 4 young were hardly able to hew out among those rocky fastnesses a retreat for themselves that year."

HABITS

The Chipmunk has the vivacity as well as the voice of a bird, combined with something of the Squirrel and even of the rat in its disposition, but in an exterior so attractive that one readily forgets the evil strain that betrays its low relationship.

Its combined nervousness and curiosity are admirably pictured thus by Merriam:"

"He is partial to brush-heaps, wood-piles, stone walls, rail fences, accumulations of old rubbish, and other places that afford him a pretty certain escape, and at the same time enable him to see what is transpiring outside. For, though by no means wary, he delights in these loosely sheltered hiding places, where he can whisk in and out at will, peep unobserved at passers-by, and dart back when prudence demands. If suddenly surprised he utters a sharp *chip'-per'-r-r-r*, and makes a quick dash for his retreat, which is no sooner reached than, simultaneously with the disappearance of his tail out pops his head, his keen dark eyes gazing intently at the source of alarm. If not pursued farther he is very apt to advance toward the supposed enemy, betraying his excitement by a series of nerv-

[11] Mam. Penn. and N. J., 1903, p. 62.

ous starts and precipitous retreats, till finally, making a bold rush, he dashes by the object of his dread, and in another instant is peering out from a hole beneath the roots of a neighbouring tree.

'Though a very inquisitive creature, this habit does not seem to be attributable to curiosity alone, but rather to the same reckless foolhardiness that prompts the small boy to cross and recross the road in front of a swiftly advancing carriage or locomotive.'

Although ... home among tangled underbrush and log heaps, the ... is a poor climber compared with the Red-squirrel. It seldom goes far from the ground, and never for sport ... climbs for food or for refuge.

In garden ... point, ... nicott says:[14]

He informs me that he once observed a number of Chipmunks ... bing the bushes of the prickly ash (*Xanthoxylum ... nericanum*) to obtain the berries, which they were carrying ... their burrows in considerable quantities. At another time, he saw one repeatedly climb a hickory and cut off the unripe nuts, which were brought to the ground, and, while yet covered with the green pericarp, placed ... hole at the root of ... tree which, however, was not its burrow; and he was told that the same individual was noticed to carry nuts in this manner for some days. Though this species is not generally climb trees, except when pursued, I am inclined to think it does so voluntarily more frequently than is supposed."

Merriam records having seen Chipmunks gathering beech nuts at a height of sixty feet up the trees, and W. Brewster writes me: "I saw one in Concord last June (1904) climb an elm fifty feet in height to the very topmost slender spray, where it remained several minutes eating elm seeds. I have never before known a Chipmunk essay such a feat of tree climbing."

I have several times seen the same thing at lesser heights, and commonly found the individuals immature. If, when pursued, they cannot find a hole, they commonly scramble up a tree, but are then far from being at home, and soon make up

[14] Quad. Ill., 1857, p. 71.

their minds to come down, especially if their inspection shows that no dog is about. In spite of sticks and shouts they descend till almost within reach, then with a final rush they reach the ground and usually some safe refuge that they had decided on while up aloft.

SWIMMING

An exciting chase of a Chipmunk by a Brown Weasel is described by J. W. Curran, of Montreal, in "Forest and Stream" for June 2, 1900. It happened at Lake Couchiching, Ont., in July, 1899. The Chipmunk took to the water, closely followed by the Weasel. After a chase of 100 yards the former drew away from his foe and escaped.

FOOD

The food of the Chipmunk is chiefly seeds, berries, and nuts, but insects, flesh, and birds' eggs also enter into its summer bill of fare.

Kennicott says:[15] "Like the true Squirrels, the Chipmunks are properly nut-eaters, though they feed rather more on the seeds of small plants than their arboreal relatives; nor do they subsist upon the buds of trees." But several naturalists have testified that the Chipmunk does not confine itself to vegetable diet. A. J. Cook, of Lansing, Mich., states[16] that a Chipmunk was observed nibbling at a snake that had been recently killed. He could hardly be driven away, and soon returned to his feast when his tormentors had withdrawn to a short distance. A still more remarkable incident is recorded[17] by Alexander Wilson, the Ornithologist. It shows that the Chipmunk is as omnivorous as any of its omnivorous tribe, and can on occasion play the part of a little tiger in its own little world.

"My venerable friend, Mr. William Bartram, informs me that he saw one of these birds [spotted sandpiper] defend her young for a considerable time from the repeated attacks of a Ground-squirrel. The scene of action was the river shore. The parent had thrown herself with her two young behind her

[15] Quad. Ill., 1857, p. 71.
[16] Am. Nat., March, 1870, p. 58.
[17] Am. Orn., Vol. II, pp. 342–3.

between them and the land; and at every attempt of the Squirrel to seize them by a circuitous sweep, raised both her wings in an almost perpendicular position, assuming the most formidable appearance she was capable of, and rushed forward on the Squirrel, who, intimidated by her boldness of manner, instantly retreated; but presently returning, was met as before, in front and on flank, by the daring and affectionate bird, who with her wings and whole plumage bristling up, seemed swelled to twice her usual size. The young crowded together behind her, apparently sensible of their perilous situation, moving backward and forward as she advanced or retreated. This interesting scene lasted for at least ten minutes; the strength of the poor parent began evidently to flag, and the attacks of the Squirrel became more daring and frequent, when my good friend, like one of those celestial agents, who, in Homer's time, so often decided the palm of victory, stepped forward from his retreat, drove the assailant back to his hole, and rescued the innocent from destruction."

Let us hope that this was a Chipmunk of unusual depravity; nevertheless we can find others of his tribe that are equally abandoned. Brewster writes me: "While collecting at Crooked Lake, Mich., in May, 1888, I shot at a wood thrush and broke its wing. As it fluttered off over the ground a Chipmunk pursued and caught it. When I reached the spot the Chipmunk had killed the bird and eaten most of its brains. I had to kick at the Chipmunk to make it give up the thrush. Afterward as I held the bird dangling in my hand the Chipmunk approached and jumped up, trying to snatch it from me."

Furthermore, we find in Audubon and Bachman's Quadrupeds[18] this paragraph:

"A lady in the vicinity of Boston said to us, 'We had in our garden a nest of young robins (*Turdus migratorius*), and one afternoon as I was walking in the garden I happened to pass very close to the tree on which the nest was placed; my attention was attracted by a noise which I thought proceeded from it, and on looking up I saw a Ground-squirrel tearing

[18] Q. N. A., 1849, Vol. I, p. 69.

at the nest, and actually devouring one of the young ones. I called to the gardener, who came, accompanied by a dog, and shook the tree violently, when the animal fell to the earth, and was in an instant secured by the dog.'"

In the train of this we are not surprised to find Rhoads' statement[19] that "they not only eat insects, snakes, mice, birds, eggs, and various species of shelled snails, but have been known to devour each other when wounded or caught in a trap."

STORAGE

All summer long, May, June, July, August, September, and October, in Connecticut, I have observed the Chipmunks carry home great bulging pouchfulls of food. Sundry of my notes taken at Cos Cob in 1905 run as follows:

May 28, Chipmunk on bank west of the house popped into hole with full cheeks and out again in half a minute with cheeks empty.

June 8. All summer, so far, I have seen the Chipmunks carrying food in the cheeks, and have heard them in full song. I saw an old one at the brook drinking like a little pig.

June 15. Saw a Chipmunk carrying home two pouches full of stuff, from a place over 150 feet away. The young are now out, but rarely with their mother.

October 9. Chipmunks hard at work. Saw one carrying acorns from our lawn down to a place fifty yards away. He made four trips in ten minutes while I watched, and *kept right on*. He took several acorns in his pouches each time, so that his head seemed enormous. It was about 1 P. M.

October 27. Chipmunks very numerous and busy storing food; often singing. These little animals seem to have a premonition of storms and a dislike to face them. Whenever they were exceptionally busy we found it meant a falling barometer, and during a three-days' storm they never appeared, subsisting comfortably, no doubt, on the "hay made while the sun shone."

The name *Tamias* (the steward) was given to this bright little creature because of its admirable foresight in laying up

[19] Mam. Penn. and N. J., 1903, p. 63.

provision for times of storm and scarcity, and it is in its preparation for the dread season that the Chipmunk is chiefly noted. In the bright actinic days of autumn, when nuts and acorns are showering down in the groves, the Chipmunk is toiling from sunrise till sunset to take advantage of the opportunity; filling its granaries to insure itself against starvation that comes stalking through these same woods, and not so very far ahead. The soundest nuts and seeds are its choice. Never is it known to defile its warehouse with flesh, insects, carrion or any of the perishable things that it does not hesitate to eat if they fall in its way while abroad. Its principal stores are hidden in chambers carefully prepared underground in connection with its home den. The ample cheek-pouches with which the species is provided, enable it to take as much as a dozen hazel nuts to its hole at a single journey.

Bachman found[20] that they could carry four hickory nuts at a time. I learned by experiment on a dead specimen that four acorns of the white oak were as much as each pocket could comfortably hold.

Audubon and Bachman caught one with no fewer than sixteen chinquapin nuts (*Castanea pumila*) stowed away in its cheek-pouches, and they add: "We have a specimen now lying before us, sent from Pennsylvania in alcohol, which contains at least one and a half table-spoonfuls of bush trefoil (*Hedysarum cannabinum*) in its widely distended sacks." (*Ibid.*, p. 69.)

As the calibre of its hole is about two inches, it is not surprising that the Chipmunk often returns home with cheeks so distended that it must turn its head sideways to enter at all. The method of filling the pouches is admirably described by the talented naturalist cited above.

"Some years ago [he says[21]] I watched one of these animals whilst laying up its winter store. As there were no nuts to be found near, I furnished a supply. After scattering some hickory nuts on the ground near the burrow, the work of carrying in was immediately commenced. It soon became aware

[20] Quad. N. A., 1849, Vol. I, p. 70. [21] Ibid.

that I was a friend, and approached almost to my feet for my gifts. It would take a nut from its paws and dexterously *bite off the sharp point from each end*, and then pass it to its cheek pouch, using its paws to shove it in, then one would be placed on the opposite side, then again one along with the first, and finally, having taken one between its front teeth, it would go into the burrow. After remaining there for five or ten minutes it would reappear for another load."

The Gray-squirrel stores its food in numberless places, sometimes a single nut in each. Usually these are found in the ground, where it could not utilize the food during frosty weather. Maybe this points to a southern origin for the species. The Red-squirrel, a creature of more northern range and yet rarely hibernating, stores its food in one or two large storehouses where it can find it, when most it is needed, no matter how hard the frost or deep the snow. The Chipmunk seems to do both ways, or to compromise between them.

"In addition to their storehouses," Dr. Merriam observes,[22] "they frequently, like the Gray-squirrel, make little caches, burying here and there beneath the leaves the contents of their cheek pouches."

Mr. Ira Sayles thus graphically describes[23] this habit:

"I lately noticed in my garden a bright-eyed Chipmunk, *Sciurus striatus*, advancing along a line directly toward me. He came briskly forward, without deviating a hair's breadth to the right or the left, until within two feet of me; then turned square toward my left—his right—and went about three feet or less. Here he paused a moment and gave a sharp look all around him, as if to detect any lurking spy on his movements. (His distended cheeks revealed his business—he had been out foraging.) He now put his nose to the ground, and, aiding this member with both forepaws, thrust his head and shoulders down through the dry leaves and soft muck, half burying himself in an instant.

"At first I thought him after the bulb of an *Erythronium*, that grew directly in front of his face and about three inches from

[22] Mam. Adir., 1884, pp. 235–6.

[23] Am. Nat., June, 1870, p. 249.

it. I was the more confirmed in this supposition by the shaking of the plant. Presently, however, he became comparatively quiet. In this state he remained, possibly half a minute. He then commenced a vigorous action, as if digging deeper; but I noticed that he did not get deeper; on the contrary, he was gradually backing out. I was surprised that, in all his apparent hard work (he worked like a man on a wager), he threw back no dirt. But this vigorous labour could not last long. He was very soon completely above ground, and then became manifest the object of his earnest work; he was refilling the hole he had made, and repacking the dirt and leaves he had disturbed. Nor was he content with simply refilling and repacking the hole. With his two little hand-like feet he patted the surface, and so exactly *replaced the leaves* that, when he had completed the task, my eye could detect not the slightest difference between the surface he had so cunningly manipulated and that surrounding it. Having completed his task, he raised himself into a sitting posture, looked with a very satisfied air, and then silently dodged off into a bush-heap, some ten feet distant. Here he ventured to stop and set up a triumphant 'chip, chip, chip.'

"It was now my turn to dig, in order to discover the little miser's treasures. I gently removed enough of the leaves and fine muck to expose his hoard—half a pint of buttercup seeds, *Ranunculus acris*."

I think, however, that Kennicott was right in holding the view that these little caches are for temporary use; long before winter all the Chipmunk's stores are doubtless contained in one or two granaries. The Illinois naturalist thus comments:[24]

"The quantity of nuts, acorns, and seeds sometimes collected by these industrious little fellows is astonishing. They are frequently stored temporarily under logs, and in shallow holes under roots of trees, and afterward removed to the burrow at a more leisure season. I have known lazy people to watch the Chipmunks in nutting time, and finding where they carried their stores, dig them out, saying they could

[24] Quad. Ill., 1857, p. 72.

thus get nuts faster than by picking them up themselves. In a burrow dug open in November I found over half a bushel of hickory nuts and acorns."

Another opened in January by Audubon and Bachman is thus described:[28]

"There was about a gill of wheat and buckwheat in the nest; but in the galleries we afterward dug out, we obtained about a quart of the beaked hazel nuts (*Corylus rostrata*), nearly a peck of acorns, some grains of Indian corn, about two quarts of buckwheat, and a very small quantity of grass seeds. The late Dr. John Wright, of Troy, in an interesting communication on the habits of several of our quadrupeds, informs us, in reference to the species, that 'it is a most provident little creature, continuing to add to its winter store, if food is abundant, until driven in by the severity of the frost. Indeed, it seems not to know when it has enough, if we may judge by the surplus left in the spring, being sometimes a peck of corn or nuts for a single Squirrel.'"

Evidently these two famous naturalists overlooked the fact, already noted, that spring is the time of the hard pinch.

In Manitoba the serious gathering of supplies is confined, I think, to August and September, though they lose no opportunity, while the weather continues warm, working from sunrise till sunset, or even a little later, but never by night.

DIURNAL

So far as I have been able to observe the Chipmunk is strictly diurnal. Audubon depicts the barn owl—most nocturnal of its tribe—with a Chipmunk in its claws; doubtless he had some good reason for this, but I do not know what it was.

ENEMIES

Among the Chipmunk's enemies are cats, Foxes, Weasels, hawks, and snakes, but the smaller Weasels are probably the most destructive of its foes. It has only one means of escape from these bloodthirsty little fiends, and that is retreating into some side gallery of the burrow, and then plugging with earth the passage behind it. I never saw this done, but I have often

[28] Quad. N. A., 1849, p. 70.

found the burrows of small rodents so plugged when I was after them. I am satisfied that it was done by themselves, and that it is a deliberate attempt to baffle an enemy by hiding from him. It is very certain that if not foiled by some such expedient a Weasel on entering the labyrinth of a colo[illegible]uld easily follow his bent—hunting down and killing e[illegible] ember of the community before he moved to fresh fields of carnage.

That he does so at times is attested by the following from the pen of Bachman:[28]

"We once observed one pursue a Chipping Squirrel into its burrow; after an interval of ten minutes it reappeared, licking its mouth, and stroking its fur with its head by the aid of its long neck. We watched it as it pursued its way through a buckwheat field, in which many roots and stumps were yet remaining, evidently in quest of additional victims. On the following day we were impelled by curiosity to open the burrow we had seen it enter. There we found an old female Ground-squirrel and five young, half grown, lying dead, with the marks of the Weasel's teeth in their skulls."

I have not seen a case of the parasitic cuterebra or warble in the species, yet I should be surprised to find it immune when most of its relatives are afflicted by this pest.

HABITS IN AUTUMN

Toward the end of October in Southern Ontario and Connecticut, and in September in Manitoba, the Chipmunks vary their labours of storing food by a musical outburst that closely resembles the chorus of spring. When the morning is bright and warm some lusty fellow gets up on a perch and begins to "*chuck-chuck-chuck.*" If psychologically well timed, his invitation at once provokes abundant and rapturous response. Every Chipmunk mounts his perch, and they make the woods ring for several minutes with their united voices.

We must remember that the winter is a period of perpetual sleep to them; they are practically dead from October to March. This autumn outburst of song then is but a *few ac-*

[28] Q. N. A., 1849, Vol. I, p. 72.

*tive days* before their mating season in March. I wonder, therefore, whether the performance has not in it something of erotic impulse.

There is yet another mystery about the Chipmunk. Animals which hibernate become enormously fat just before their retirement. This is a supposed essential of the procedure and yet the Chipmunk does not. Of forty specimens secured by Rhoads[27] at Greenwood Lake, N. J., in the last of October "no really fat one was found among them, though the acorns, which they were busily harvesting and storing away, were abundant." One might argue from this that their torpor is not very profound. Kennicott and Bachman made observations that lead to this same conclusion. Of those that the latter unearthed in January under five inches of snow, he says:[28] "They were not dormant, and seemed ready to bite when taken in the hand; but they were not very active, and appeared somewhat sluggish and benumbed, which we conjectured was owing to their being exposed to sudden cold from our having opened their burrow."

My own observations at Toronto would prove the lethargy complete, and this raises the question as to whether the latitude is not a factor in the case.

HIBERNATION

The Woodchuck goes down sharp on time with little regard to weather, but the Chipmunk's autumnal disappearance seems prompted solely by the frost. If that comes in September it makes its final bow the day before; if the cold holds off till December, the Chipmunk postpones its departure correspondingly.

In my notes made during several years in Toronto I find odd Chipmunk records all through October and this final entry for November 1, 1889: "To-day the cat brought in a newly killed Chipmunk, showing that they yet come above ground, although there has been a good deal of frost; the weather is now mild."

[27] Mam. Penna. and N. J., 1903, p. 62.

[28] Q. N. A., 1849, Vol. I, p. 70.

A captive specimen which I kept (also at Toronto) was active all winter when in a warm room; but as soon as exposed to a temperature near freezing point, he curled up in his sleeping place and took no further interest in the affairs of life.

Many observations testify that a spell of bright warm weather in mid-winter will tempt the Chipmunks forth, and if, as happens in the Southern States, the winter should pass without sharp or continuous frost, the Chipmunks probably do not find it worth while to go into the long sleep at all.

## X.

## Little Chipmunk, or Long-tailed Chipmunk.

*Eutamias quadrivittatus neglectus* (Allen).

(Gr. *Eu*, well or good; *tamias* [see ante], because this new genus is even more specialized than the older *Tamias*—though along the same lines. *L. quadrivittatus*, from *quadri*, the combined form of *quattuor*, four, and *vitta*, a band, hence 4-banded, which is unfortunate, as it has 5 bands like its kin; L. *neglectus* overlooked.)

*Sciurus quadrivittatus* SAY, 1823. Long's Exp. Rky. Mts., II, p. 45.

*Eutamias quadrivittatus* MILLER and REHN, 1901, N. A. Ld. Mam., Proc. Bos. Soc. Nat. Hist., Vol. XXX, No. 1, p. 43.

TYPE LOCALITY.—Near Cañon City, Colorado.

*Tamias quadrivittatus neglectus* ALLEN, 1890. Bull. Am. Mus. N. H., III, p. 106, June.

*Eutamias quadrivittatus neglectus* MILLER and REHN, 1901, N. A. Ld. Mam., Proc. Bost. Soc. Nat. Hist., Vol. XXX, No. 1, p. 44.

TYPE LOCALITY.—Eastern shore of Lake Superior, Ont.

FRENCH CANADIAN, *le petit Suisse*.
CHIPEWYAN, *Thal-coo'-zay*.
CREE, "*Ches-se-cow-e-pis-kus*" Russell.

The genus *Eutamias* (Trouessart, 1880) comprises Chipmunks that differ most visibly from those of the genus *Tamias*

in being much smaller and paler, with longer tails and 2 more premolars.

The teeth are:

$$\text{Inc.}\ \frac{1-1}{1-1};\ \text{prem.}\ \frac{2-2}{1-1};\ \text{mol.}\ \frac{3-3}{3-3} = 22$$

The Little Chipmunk has, in addition to the generic characters, the following:

SIZE Length, about 8 inches (203 mm.); tail, 4 inches (102 mm.); hind-foot, 1¼ inches (32 mm.).

FIG. 118—Little Chipmunk (*Eutamias neglectus*).
Carberry, Manitoba, 1884.

COLOUR In general, above it is a brownish gray, much darker on the crown, faintly peppered with darker brown on crown, back and haunches, and becoming clear orange-buff on the shoulders, sides and flanks; on the chin, throat, lower jaw and under parts generally it is white. There are five black stripes on the body, the central one longest; it begins on the crown and continues

to the tail; between the two outer black stripes on each side is a white stripe which dims on the neck, but reappears at the ear, and continues to the eye. On each side of the head are three dark-brown stripes—over the eye, through the eye, and under the

FIG. 119—Tracks of the Little Chipmunk, with intervals of about ten inches.

eye. The tail is dull orange below, and above orange overlaid with black hairs. It has a black edging or border, which is broadened toward the end, and is tipped all round with yellow or buff.

When seen alive its quick movements and noisy 'chirrup' attract attention; its warm fawn-colour and black stripes mark it for a Chipmunk, while its smaller size, its freedom from chestnut tint, and its tail held upright, distinguish it from *striatus* and complete the identification.

The following races are recognized:

*quadrivittatus* Say, the typical form, much paler and grayer than the above described.

*neglectus* Allen, a bright-coloured form, tinged yellow on hinder parts.

*borealis* Allen, smaller and yellower than *quadrivittatus*, but not so bright as *neglectus*; gray on rump.

*gracilis* Allen, a larger, slenderer, and more intensely coloured race than *quadrivittatus*, with the black marks replaced by reddish brown.

*luteiventris* Allen, above brighter coloured than *quadrivittatus* and below buffy.

*felix* Rhoads, a darker race than the typical.

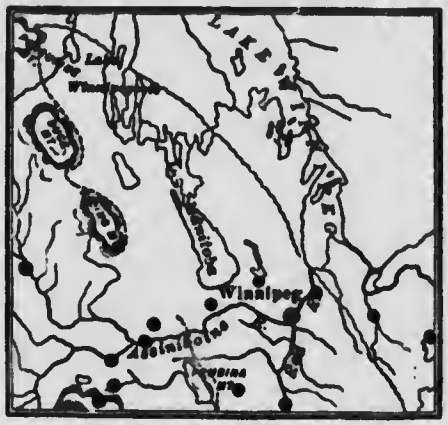
*affinis* Allen, a larger race; gray, especially on rump.

## LIFE-HISTORY.

RANGE

The distribution of this species is that of a western animal that is working eastward. It is the common and abundant Little Chipmunk of all the wooded region and river valleys

south of the Assiniboine and west of the Red River. It is plentiful at Wonoona, Manitoba; I did not find it north of Carberry or the immediate Valley of the Assiniboine, or beyond Fort Ellice. East of Winnipeg I noted it all along the Canadian Pacific Railway as far as Ingolf, where it is very abundant. Preble found it reported rather common at Oxford House, Keewatin, and saw one at Pine Lake in the same district.[1] Dr. Bell records[2] it from Nelson and Churchill Rivers, and G. S. Miller found it at Nepigon and Peninsula Harbour, Ontario.[3] Thus we may look for this Chipmunk in all parts of our Province, and I am puzzled to account for its scarcity in the country just north of the Assiniboine. Probably the explanation lies in faulty observation (Maps 16 and 17).




MAP 16—Distribution of the Little Chipmunk in Manitoba. The spots are actual records, but the whole Province is within its accredited range.

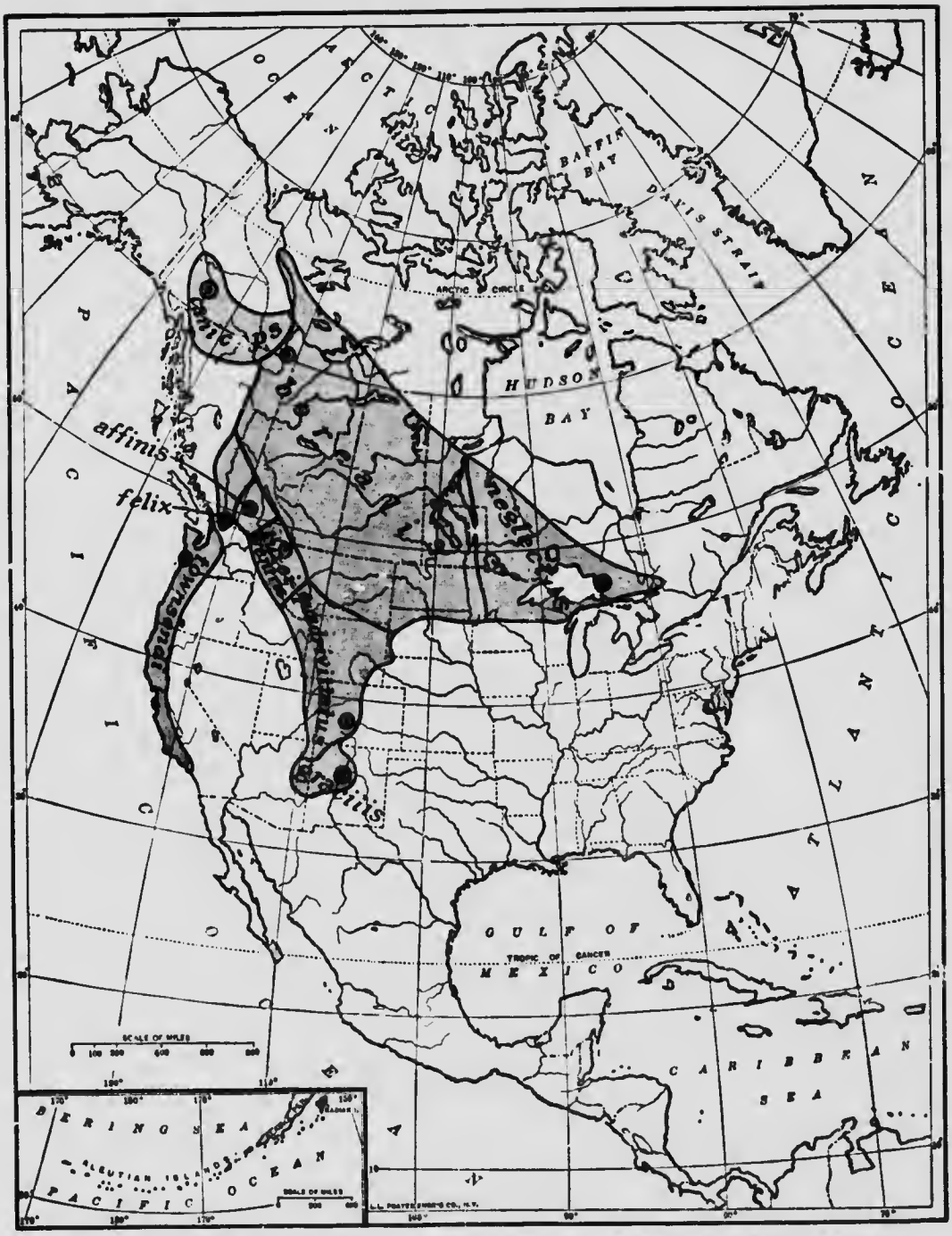
ENVIRONMENT

This species is found in the same surroundings as the large Chipmunk. Possibly it is more of a ground animal, as I never saw one up a tree.

HOME-RANGE

The home-range of the individual must be very small. I found a pair living in a little isolated thicket about twenty yards in diameter. I can readily believe that, given food enough, they would not leave this at any time. The case noted later of an individual going a quarter of a mile in search of special food was, I believe, very exceptional. Ordinarily this Chipmunk will, like its larger cousin, pass its whole life in the narrow bounds of one or two acres.

[1] N. A. Fauna, 1902, No. 22, p. 45.
[2] Rep. Prog. Can. Geol. Surv., 1882–3–4, App. II, p. 48 DD (1885).
[3] N. A. Fauna, 1902, No. 22, p. 46.




**MAP 17—RANGE OF THE SMALL CHIPMUNKS FOUND IN BRITISH NORTH AMERICA.**

This map is founded chiefly on records by G. S. Miller, Jr., D. G. Elliott, S. N. Rhoads, J. A. Allen, E. Coues, R. Kennicott, V. Bailey, E. A. Preble, W. H. Osgood, R. Macfarlane, E. T. Seton.

It must be considered diagrammatic and provisional. It treats of all the species hitherto found in British North America. There are, however, many others to the South of the International Boundary, some of which may prove sub-species of these.

**The species are:**

***Eutamias quadrivittatus* (Say), with its 8 races.**

***Eutamias townsendi* (Bachman), found along the Pacific coast in several races, one of which enters British Columbia.**

NON-MIGRATORY

There is, moreover, nothing of the nature of a migration among these Chipmunks. This individual fixity has had the usual result of splitting up the group into a great number of different forms, corresponding with the life conditions of each locality.

If Chipmunks were given to travel, the races which abound in the south and west would have been swamped, except where they were the simultaneous product of a large region. But strange to say, the Chipmunk as a species seems less able to transport itself from place to place than are many trees and plants.

ABUNDANCE

This creature is very local in distribution. It may seem rare in a given region, then suddenly we come on some place of exceptionally favourable conditions and find the Chipmunks in numbers. At the old sawmill mentioned later, there were hundreds of these bright little creatures. One could have seen 50 in ten minutes when the place was a wilderness of ramshackle buildings and lumber piles. I dare say that the acre in which the mill stood held not less than 1,000 Chipmunks. But this was in the early 80's. In 1892 the mill was gone, and the Chipmunks with it; still I thought the species more generally abundant about Carberry than in 1883.

In Turtle Mountain, as I learn from A. S. Barton, it is very abundant in some years and scarce in others; whether this is due to epidemics, as with the Rabbits, or to famine, as with many species, is yet to be ascertained.

SPRING ADVENT

In spring the Little Chipmunk appears about the same time as the larger one, that is, during the first week of April. At Touchwood Hills in 1902 the first one was seen on April 13. But its evident dependence on temperature is shown by the fact that in the mild season of 1905 this species appeared above ground at Boissevain, Man., during February, and was therefore dormant but little more than two months that winter.

It seems hardier than *striatus*, for in the Rocky Mountains of Wyoming and Colorado I often saw it running over the snow

after winter had begun. On one occasion, 9,000 feet above the sea, near Breckenridge, Colo. (in 1899), as late as October 31, I saw one sitting up and eating under the shelter of a log during a driving snowstorm.

MATING

I have no information relative to its breeding habits. While observing a nearly related Chipmunk in the High Sierra of California I found evidence that its mating season is in September, although the young are not born till the following spring. So far as known, this is not the case with the present species. It is believed to mate in April and produce some time late in May.

HABITS

The habits and actions of these bright little creatures have been happily described by my friend and fellow-traveller, Miller Christy:

"Without exception [he says[1]] the Chipmunk is in its form and movements the very prettiest little animal I ever set eyes on. In it the fear of man seems to be entirely absent; it seems to run away merely for fun, but for all that, you would almost as easily catch a flash of lightning! It is incessantly upon the move, climbing about and over everything as if exploring, and always carrying its long tail bolt upright in such a ridiculous manner that it becomes by far the most conspicuous part of the whole animal. You may see one of these tails, with a Chipmunk attached to it, dodging round a piece of wood and eyeing you keenly, without the slightest appearance of fear, as if roguishly trying to tempt you to catch it. But try! In a moment, with a shrill, derisive bird-like little whistle, the tail is gone—you hardly know where, till you see it again a moment later, going through exactly the same antics along with several other tails.

"Among the sandhills, a few miles from Carberry, stands an old sawmill, which is usually deserted during the summer months. Round this mill Chipmunks swarm. Their holes run under its floor, and the creatures themselves are constantly

[1] Nat. Hist. Journal and School Reporter, York, Eng., May 15, 1885, pp. 67–74.

to be seen scaling the walls and scampering over the roof. One day when I was at the mill, I found that they had entered by a broken window, had licked clean some unwashed plates left on a bench, and had even taken samples of the eatables left in the cupboard. I went on another day to the mill in order to try and catch some Chipmunks alive. This I found a very easy thing to do with a figure-4 box-trap. The animals seemed perfectly unsuspecting. Whilst I was setting one of these a Chipmunk extracted my small store of bait from the paper in which it was wrapped, and consumed a considerable portion of it. As the little thief scampered off at my approach, with every appearance of laughing at me, he dropped the bread and I secured it; but I had no sooner done this than on looking round found that another Chipmunk was sitting upright on the top of the trap I had just set, nibbling at my bait, which he held in his forepaws, and eyeing me sharply, but otherwise manifesting a coolness and deliberateness of procedure that completely staggered me."

"On October 23 [at Peninsula Harbor, Ont.], I found an adult female in a nest built of feathers and soft vegetable fibres, at the end of a tunnel under a clump of bearberry. The tunnel was about two feet long and terminated a foot or more beneath the surface in a chamber about the size of a cocoanut. This chamber was completely filled by the nest, which contained, in addition to its occupant, a small store of seeds of various weeds and wild fruits." (*Miller*, p. 31).

Edwin Hollis records[5] that "a specimen taken at Touchwood Hills, April 13, 1902, had barley in its cheek-pouches and was quite a quarter mile from the nearest barley field or granary, so evidently had a winter store."

In August and September the little Chipmunk emulates its cousin in labouring for the rainy days to come. As late as September 26 at Fort Resolution I saw one carrying home great bulging pouchfuls of skunk-grass seeds. About the end of the month, it finally plugs its doorway against the cold, the wet and the Least Weasel, and curls up for its six months' sleep.

[5] Zoologist, August 15, 1902, p. 297.

## XI.

## Franklin Ground-squirrel, Spermophile or Citellus; Scrubgopher, Whistling Gopher, Gray-cheeked Spermophile, Gray Ground-squirrel or Bushy-tailed Ground-squirrel.

*Citellus franklini* (Sabine).

(*Citellus* the Latin name of the Ziesel or Souslik of Russia, the type of the present genus; *franklini*, in honor of Sir John Franklin, commander of the Overland Expedition, 1819–1822, on which Dr. John Richardson discovered this species at Cumberland House. He sent the first specimen to Sir Joseph Sabine, who named it.)

*Arctomys franklinii* SABINE, 1822, Trans. Linn. Soc., XIII, p. 587.

*Citellus franklini* ELLIOT, 1905. Check List Mam. N. A. Field Mus. Pub. 105, Zool. ser., Vol. VI, p. 105.

TYPE LOCALITY.—Near Cumberland House, Sask.

FRENCH CAN., *la Citelle ou l'E'cureuil de Franklin.*
SAUTEAU, *Me-sed'-jee-dah-mo'* (big squirrel).
YANKTON SIOUX, *Ho-tang.*

The genus *Citellus* (Oken, 1816) comprises squirrel-like animals that live on the ground, with tail more or less bushy and usually long, outer ear various, from almost none to large, well-developed cheek-pouches; 5 nearly equal toes on hind-foot; 4 fingers and a knob-like thumb in front. Teeth:

$$\text{Inc.}\ \frac{1-1}{1-1};\ \text{prem.}\ \frac{2-2}{1-1};\ \text{mol.}\ \frac{3-3}{3-3} = 22$$

In addition to the generic characters, the Franklin Ground-squirrel has the following:

SIZE Length, 14 inches (355 mm.); tail, 4½ inches (114 mm.); hind-foot, 2 inches (51 mm.).

PLATE XXXIV. FRANKLIN GROUND-SQUIRREL (ABOUT $\frac{1}{3}$ THE SIZE).

(*Citellus franklini* (Sabine).)

Carberry, Manitoba, 1892.

From drawing made by E. T. Seton for Bailey, Bull. 4, 1893, U. S. Biological Survey, Dep. Agr.

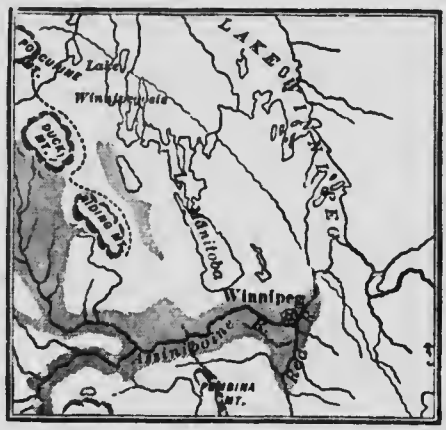
COLOUR

All above yellowish brown, becoming dark slatey or bluish gray on the head, and paler on the sides, everywhere finely peppered with black, which on the rump faintly suggests bars. Eyelids, lips, and throat, edge of ear and all below, dull yellowish white. Tail, gray and peppered on both sides, bordered and tipped with white; at the end is a sub-terminal band of black; each hair is in about seven sections, which are alternately black and white.

Female similar.

When seen in its native surroundings this Ground-squirrel with its bushy tail looks much like an ordinary Gray-squirrel.

The species has not split up into any well-marked races.




MAP 18—Distribution of Franklin Ground-squirrel in Manitoba (provisional).

### LIFE-HISTORY.

It is generally distributed throughout the Alleghanian region of Manitoba, but is rare on the east side of Lakes Manitoba and Winnipegosis, and I found no trace of it in the thick forests of Riding and Duck Mountains. The map (No. 18) shows its distribution in the province as I saw it. Doubtless this will be greatly modified by further observations. For range see Map 19.

ENVIRONMENT

It is essentially a ground animal, frequenting the edges of thick, dry undergrowth near woodlands or along hedges. It is equally strange in dense forests and on open prairies. Its chief region with us is the poplar country from Pembina to Pelly.

Kennicott says:[1] "I have known this Spermophile to take refuge in a hollow tree, crowding up the hole like a Gray Rabbit. Mr. F. C. Sherman, of Chicago, informs me that

[1] Quad. Ill., 1857, p. 80.


**MAP 19—RANGE OF THE FRANKLIN AND RICHARDSON GROUND-SQUIRRELS.**

*Citellus franklini* (Sabine) and *C. richardsoni* (Sabine).

Founded on Bailey's maps in the Reports of the Biological Survey, U. S. Department of Agriculture, and the Maps in Doc. 132, Senate 1907, with additional records by E. T. Seton.

The crosses (x) near Georgian Bay and in New Jersey are localities where the Franklin Ground-squirrel has been introduced.

he twice saw one, when pursued, climb five or six feet up the trellis work and vines at the side of a house," but these are exceptional cases.

HOME-RANGE

The home-locality of each individual is probably less than 100 yards across. The only evidence I have, aside from probabilities, is the fact that one or two are often found inhabiting a little thicket of less than a quarter of an acre, and they can usually be found within a very few yards of the same place.

ABUNDANCE

In 1882, we, in Manitoba, reckoned this the rarest of the Ground-squirrels; since then it has increased, especially about Pembina, Winnipeg, Portage la Prairie, Brandon, Minnedosa, and Dauphin, while the Striped Ground-squirrel has decreased, so that now this is much the more numerous of the two.

I should consider this species abundant if there were three pairs to every hundred yards square of scrub, and this is said to be under the probable population of the wooded borderland along the Red and Assiniboine Rivers. At a place in Kansas (Auburn), where it was "very common," Professor L. L. Dyche, says:[2] "On an average I think there could not have been less than one Squirrel for each rod of fence."

SOCIABILITY

In Illinois, says Kennicott,[1] "it is usually found living alone or in pairs, and I have never observed a number of burrows scattered over a small prairie knoll like the semi-villages of the Striped Spermophile. This is perhaps owing to their small numbers; for the species appears to be naturally gregarious, and, at times, large companies live together, burrowing within a few feet of each other, and several pairs even entering the same hole."

SPRING ADVENT

In its spring appearance it is later even than the Striped species, and observers generally agree that it is about three weeks behind the Yellow Ground-squirrel. In Manitoba therefore it may be looked for ordinarily about the first of May.

[1] Pr. Grd. Sq., 1893, U. S. Dep. Agr., Bull. 4, p. 53.
[2] Quad. Ill., 1857, p. 79.

VOICE

Most of the Ground-squirrels are noted for the great variety of the sounds they produce, but this is the musician of the family. It utters the same calls as the others, but expresses them in a fine, clear whistle. Its ordinary note heard in the brushwood is in a high degree musical, resembling the voice of some of our fine bird-singers, and has won for the species the names of 'Whistling Gopher' and 'Musical Ground-squirrel.'

Both sexes are supposed to make these sounds, but the point is not settled.

DEN

The den is made in a low, brushy bank; in style it is "usually deeper than that of the Striped Spermophile, but otherwise similar to it" (*Kennicott*[4]). Jillson says[5] that "when not frightened into their holes they generally plug them up with dirt, but always leave them open when out." This habit has not been recorded by any other observer.

Dr. C. E. McChesney, of Fort Sisseton, N. D., credits[6] the species with nesting in a hollow tree.

MATING

The slight evidence at hand would set the mating season about the middle or third week of May, fully a month later than with the Yellow Ground-squirrel.

Kennicott is of the opinion that the species pairs, but that the male early abandons the female and leads a solitary, roving life during the summer. Edwin Hollis says[7] of those that he saw at Touchwood Hills, Sask.: "Pairs of old ones and family seem to live together."

BREEDING

At Carberry, June 15, 1892, I got a female that carried 6 well-developed unborn young. A female in the New York Zoological Park produced 4 young on June 8, 1905. When I examined them on June 20, they were still blind, helpless, and nearly naked. Only the slightest beginning of hair was to be

[4] Quad. Ill., 1857, p. 80.
[5] Herrick's Mam. Minn., 1892, p. 168
[6] Mam. Ft. Sisseton, Dak., 1878, p. 216.
[7] Collecting Small Mam. in N. W. T. Canada. Zoologist, August 15, 1902, p. 297

seen, but the colour that the coat was to be, was clearly shown in the tinting of the skin. One of them was 3¾ inches long, of which the tail was ¾ of an inch, the others were similar.

In number they vary from 4 to 7. They are suckled for five or six weeks, and about the first of August, when about a third grown, they begin to come out of the holes and forage for themselves.

There is but one litter each season.

SPEED

This is the most active of the Ground-squirrels; even a terrier has little chance to catch it in its favourite undergrowth. It seems to know this very well, and will voice its shrill defiance again and again at the dog in pursuit.

MENTALITY

I once put a Scrub Ground-squirrel into a cage with a Yellow Ground-squirrel that had been there for some time. At first it seemed afraid of its big cousin, but soon plucked up courage enough to attack and defeat him. It frequently uttered its loud musical whistle, while the Yellow one did nothing but chatter his teeth.

DRINKS

The next day I offered this individual some water. It drank greedily and noisily, but not copiously. Thus it differs from its two relatives in that it needs a supply of water. Perhaps this fact will be found important in its distribution.

FOOD

The flesh-eating propensities of the group to which it belongs are well known, and the Gray Ground-squirrel offers no exception to the family habit. It is less carnivorous than the Striped species, yet loses no chance to eat a meal of flesh. The one from which I made the drawing gnawed its way out of the cage one night and ate the head off a newly mounted prairie-chicken before escaping for good.

"One observed by Dr. Hoy did not eat Mice, though it killed them when placed in its cage. Its food is generally similar to that of the Striped Spermophile, stores being also found in its burrow. It gnaws hard substances more than the

Striped Spermophile, and while the latter will not gnaw out of a box, this readily does so. Caged specimens cut open hazelnuts also." (*Kennicott.*[9])

Bailey says[9] in his Ground-squirrel Report: "At Pembina, N. D., I found several young Mice [*Peromyscus bairdi*] in the stomach of one of these Spermophiles, and at Ortonville, Minn., I shot one in the act of eating a freshly killed wood phœbe (*Contopus virens*). It had evidently just caught the bird, though it is difficult to understand how." Speaking of the omnivorous habit of the species, Prof. C. L. Herrick says:[10] "During the summer it feeds upon wild fruits, such as strawberries, but has well-marked carnivorous propensities. During a few days' encampment on Lake Traverse several of these animals became so domestic as to partake freely of fish from our table so long as no suspiciously hasty motions were executed by the human participants."

L. Bruner, of Lincoln, Neb., testifies[11] that in his State "it is carnivorous, at least when in captivity, as I can testify from experience with one I had caged during the greater part of one summer. After having been in a cage for about a month, I turned in a Mouse one day, in order to have a 'happy family' in my menagerie. Imagine my horror then to see Mr. Squirrel pounce upon the Mouse, kill and eat it in such a manner as to indicate that it was not the first Mouse thus eaten. The bones were held in the fore-feet and striped clean, after which they were dropped. The time occupied for the entire task of killing and eating the Mouse was not more than five minutes."

Finally Herrick quotes Jillson as authority for the statement: "If a pair takes up its abode near small chickens and turkeys they soon thin them out."[12]

In Manitoba, also, this charge has been made against the Scrub-gopher. Indeed, it seems to be the only one of our rodents that is an habitual depredator of the chicken-yard.

[9] Quad. Ill., 1857, p. 81. [9] U. S. Dep. Agr., 1893, Bull. 4, p. 56.
[10] Mam. Minn., 1892, p. 167.
[11] Bailey's Prairie Ground-squirrels, 1893, Bull. 4, p. 52.
[12] Mam. Minn., 1892, p. 168.

In a very limited sense the species appears to be migratory. Kennicott, whose opportunities for studying it were unusual, says[13] that in Illinois "this Spermophile exhibits a remarkable disposition to migrate from one field to another. Not only do the males lead a wandering life in summer, but pairs appear frequently to change their quarters, leaving their winter burrow to breed in another, and then, perhaps, hibernating in a third, at some distance from this. In several instances a company of a dozen or more have been observed to appear in a locality where none were seen the previous summer, and then to disappear after remaining there a year or only a few weeks. In the early part of summer 20 or 30 of these animals suddenly made their appearance, and burrowed in an old embankment, within three or four rods of my father's house. They seemed to have lost the shyness exhibited when leading a solitary life, and were not alarmed at the near approach of man. They even came about the kitchen door to pick up crumbs, and disputed with the chickens for their food. MIGRATION

* * * * * * *

"A war of extermination was commenced. Several were shot, while others were killed with clubs, whereupon the survivors left in a body, as suddenly as they had come, and were never seen again, nor could they be found upon any part of the farm."

In Manitoba the principal enemy of the Gray Ground-squirrel is the red-tailed hawk. On July 9, 1884, I saw two of these hawks fighting over some prize. While they were so busied I secured the booty, a fine specimen of this Ground-squirrel, and was glad to get it, as it was considered rare in the region at that time. ENEMIES

Late in September the Scrub Ground-squirrel takes its last look at the sun, then barricades its doorway with earth against Weasels, wet and frost, and sleeps until a half year later, when the white crane comes again and trumpets a resurrection to the under-world that slept as dead. FALL

[13] Quad. Ill., 1857, pp. 79–80.

## XII.

## Yellow Ground-squirrel, Yellow Gopher, Flickertail, Richardson Ground-squirrel, Citellus or Spermophile.

*Citellus richardsoni* (Sabine).

(L. *Citellus*, see ante; *richardsoni*, in honour of Sir John Richardson, who discovered the species at Carlton House in 1820.)

*Arctomys richardsonii* SABINE, 1822, Trans. Linn. Soc., XIII, p. 589.

*Citellus richardsoni* ELLIOT, 1905, Check List Mam. N. A. Field Mus. Pub., 105, Zool. Ser., Vol. VI, p. 111.

TYPE LOCALITY.—Carlton House, Sask.

FRENCH CANADIAN, *la Citelle ou l'Écureuil de Richardson.*

CREE AND OJIB. *Me-sed'-jee-dah-mo'* (big squirrel).

OGALLALA SIOUX, *Tash-nah-hay-ho'-tah.*

In addition to the generic characters set forth under the previous species the Yellow Ground-squirrel has the following:

SIZE Length, about 12 inches (305 mm.); tail, 3½ inches (89 mm.); hind-foot, 1¾ inches (44 mm.).

WEIGHT The weight of a large male I found to be 13 ounces, the female is smaller and not so heavy.

COLOUR A Carberry specimen, a male taken August 4, doubtless typical, is in general of a warm yellowish buff, deepening along the cheeks, shoulders, flanks, and thighs to a strong yellow. On the crown and back it is thickly peppered with brownish black, giving the effect of a gray mantle. On the rump these markings faintly suggest cross pencilling. The tail above is

PLATE XXXV.—THE RICHARDSON GROUND-SQUIRREL (ABOUT ⅔ LIFE SIZE).

(*Citellus richardsoni* (Sabine).)

Carberry, Manitoba, 1892.

From drawing made by E. T. Seton, for Bailey, Bull. 4, 1893. U. S. Biological Survey, Dep. Agr.

brown, peppered like the back; below, clear pale sienna; finished with a blackish edging, which again has a broad tipping of pale yellow. My specimens taken at Turtle Mountain late in April are much paler in general colour, nearly white below.

The sexes are alike.

When seen alive it is like a pale yellow Squirrel with a rather short tail, that it jerks and shakes upward every few seconds when watching an intruder. From this it gets its name, Flickertail.

It has no recognized races.

## Life-history.

RANGE

The Richardson Ground-squirrel is a characteristic inhabitant of the Saskatchewan Campestrian faunal area (Map 19). In Manitoba it is found on all the true prairies of the second steppe, as shown on Map 20; but it enters also the upper part of the Red River Valley proper, along the east slope of the Pembina Mountain. At Morden I found it abundant, also thence north-eastward as far as Myrtle. It extends in small numbers northward to Russell and the Gilbert Plains, on the west of Riding Mountain.


Map 20—Distribution of the Richardson Ground-squirrel in Manitoba.

ENVIRONMENT

This is strictly a prairie animal. It is never seen in or near the woods; its favourite localities are high rolling lands of stiff or gravelly clay, but prairie ridges of any kind are acceptable locations. It is as fond of cultivated fields as its striped relative is of the virgin prairie. Its burrows are so deep that the plough does them no harm but what it can repair in

a few minutes, and the growing crop at the door affords bountiful forage; thus it fits in very comfortably with agricultural surroundings, and has greatly increased with the spread of farming.

In the Souris country, where there is abundance of wheat on rolling clay lands, it finds an ideal home, and is very plentiful.

ABUNDANCE

This is by far the most abundant of the Ground-squirrels. At Whitewater on April 29, 1904, I examined an interesting colony of the species. In its centre of population I marked off a space 10 yards by 20, then counted the burrows in it. There were 50. This, I should think, meant at least 25 adult Ground-squirrels in the space of less than one twenty-fourth of an acre. The colony straggled along for a mile or more, the population thinning out on the level fields to four or five holes per acre, and of course with none at all in the wet places. But taking all together, I calculated the Ground-squirrel population at not less than 10 per acre, or, say 5,000 to the square mile. That 10 per acre is not too high is shown in a case observed on the Saskatchewan by James M. Macoun. A farmer there killed 300 of these Ground-squirrels on his field of less than 10 acres, and yet it made no obvious difference in their numbers.

E. T. Judd tells[1] of a square mile in North Dakota on which 4,000 Ground-squirrels were killed in one season.

In a two-acre field of wheat at Carberry, July 5, 1892, I counted 16 Ground-squirrels sitting up. I could not see those that were down on all-fours feeding, but it is safe to estimate them at double this number. There were at least 48 Ground-squirrels in that field, or 25 to the acre, and along the bank of Pollworth's slough, north of Carberry, in the early 80's I have often seen as many as 50 Ground-squirrels within an acre and there captured 20 in one hour with two traps. Even halving the lowest of these figures, we should have a Ground-squirrel population of 20,000,000 on the prairies of Manitoba alone.

That these estimates are not excessive is shown by the bounty records. At Carberry, in the year 1890, with bounties

[1] Bailey's Rep. Prairie Ground-squirrels, U. S. Dep. Agr., 1893, Bull. No. 4, p. 65.

at three cents per tail, $1,180 was paid out. This represented 40,000 Ground-squirrels killed in the municipality of North Cypress (about 400 square miles), and yet it made no obvious difference in their numbers.

Coues has given us a bright pen-picture of this creature along the Boundary Line. "It is one of the most abundant animals of our country [he says[1]], occurring by hundreds of thousands over as many square miles of territory, almost to the exclusion of other forms of mammalian life. Millions of acres of ground are honeycombed with its burrows. * * * I never saw any animal—not even Buffalo—in such profusion. I have ridden for days and weeks where they were continuously as numerous as prairie-dogs are in their populous villages. Their numbers to the square mile are vastly greater than I ever ascertained those of *S. beecheyi*, the pest of California, to be, under the most favourable conditions."

Such facts and figures show also how hopeless it is for man to fight these armies by actual onslaught; there is not money enough in the country to carry on such a warfare with success. The wiser plan is to work with other forces, those of nature and of careful science, and the credit of finding the way belongs to the Biological Survey of the United States Department of Agriculture. The Ground-squirrel had increased rapidly in numbers with the cultivation of the country throughout its range until about 1894, when it became a serious burden to the farmers. Then was invented the scientific method of poisoning that has given us the upper hand once more and made it easy to deal with the problem. (See end of this chapter.) Since then the Ground-squirrel numbers have fallen below the danger point, though constant vigilance is still the price of good crops, as indeed it is of most good things.

SPRING APPEARANCE

This species appears above ground very regularly each year about the middle of April without regard to the weather. Late snowstorms sometimes set in after its reappearance, and the Ground-squirrel becomes unenviably visible as it runs over

[1] Am. Nat., IX, 1875, pp. 148–154. Quoted in Bailey's Report.

the white, but this does not make it return to its winter sleep. On April 27, 1892, in Manitoba, an unprecedented snow storm occurred and covered the ground a foot deep. Next day the Ground-squirrels were seen in thousands running about. So far from becoming scarce under the trying weather, they seemed rather to have increased, at least they became unusually prominent.

In the mild season of 1905, however, A. S. Barton writes me, these winter-sleepers came out during February in the country about Boissevain.

Having broken their sleep, they need food, but the natural supplies have not yet begun to grow, and starvation might be their lot had they not been careful to lay up a store the year before, when there was abundance in the land.

Thus April is the season for which chiefly they gathered the crop of the summer gone by, and the month is given over to love and feasting, without care for the food of to-morrow.

A number of specimens examined at the end of the month (April 27 and 28) had their stomachs filled with the first appearing grass.

HOME REGION

The home-region of each individual is doubtless very small; it probably never ventures a hundred yards from its own door.

SOCIABILITY

This is the most sociable of our three Ground-squirrels, as it commonly nests in straggling colonies, the members of which doubtless profit by each other's presence in learning of approaching danger, yet I never saw them indulge in any sort of game or social pursuit, or attempt to combine their efforts for a common cause. Nevertheless, as Coues says,[1] "Their gregarious instinct is rarely in abeyance. A few thousand will occupy a tract as thickly as the prairie-dogs do, and then none but stragglers may be seen for a whole day's journey.

* * * * * * *

"There is one very curious point in the socialism of these animals. Every now and then, in odd out-of-the-way places,

[1] Am. Nat., IX, 1875, pp. 148–154.

where there may not be another Gopher, for miles perhaps, we come upon a solitary individual guarding a well-used burrow, all alone in his glory. The several such animals I have shot all proved to be males; and what is singular, these old fellows are always larger than the average (some would weigh twice as much), peculiarly sleek and light-coloured, and enormously fat. The earlier ones I got I suspected to be a different species, so peculiar were they in many respects. I suppose they are surly old bachelors who have foresworn society for a life of indolent ease, though if I had found them oftener among their kind I should have taken them for the Turks of the harem."

INTER-COMMUNICATION

The species utters a husky alarm whistle as soon as it scents danger, and the end of the tail is raised at each whistle; thus we have directive sounds and marks combined. Old plainsmen say that a Prairie-dog's voice is tied to its tail, because every time it lifts one it lifts the other, and when one stops the other does. This is equally true of the present species.

MATING

It is not known whether this rodent pairs, is polygamous, polyandrous, or promiscuous. The mating season is about the middle of April or before that. Francis Dickie writes me from Carberry that on April 21, 1905, he killed 11 Yellow-gophers; of these 6 were females, and 4 pregnant; the embryos very small except in one case, where they were each half an inch long.

Three females taken April 29 showed embryos from the size of No. 4 shot (3-16 of an inch) to that of a bean (7-16 of an inch).

As the gestation of the rat is 21 days, and that of the rabbit 30 days, it is likely that the Ground-squirrel's period is between the two; therefore the first of these embryos was in the second week of development and the last within ten days of birth.

NESTING

At Whitewater on April 29, 1904, I examined the nest and burrow of a Yellow Ground-squirrel. This one was selected because I saw an old one run into it with a mouthful of grass. After four hours of hard work by myself and my assistant, E. W. Darbey, we dug out and made careful measurement of the labyrinth, plans of which are given in Fig. 120. We did not see anything more of the owner, so doubtless she escaped by some passage to another burrow, probably plugging the gallery behind her, as we missed it. This is the usual experience in digging after a burrowing animal. The grass she was carrying was found scattered along the outer gallery.

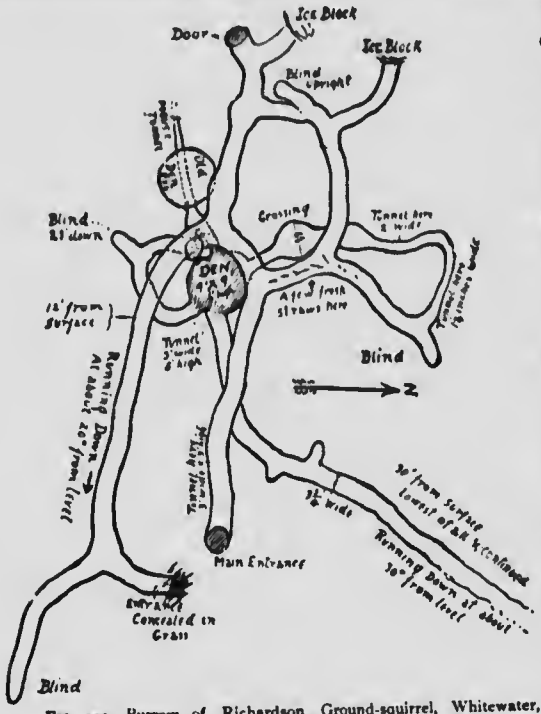



FIG. 120—Burrow of Richardson Ground-squirrel, Whitewater, Manitoba, April 29, 1904. (Plan).

The small room marked "old den" had no connection with the burrow, so far as we could learn. It may have been an ancient chamber abandoned long ago, as it was full of hoar frost and had no sign of occupancy. Two or three of the galleries were too small for the Squirrel to have made and were probably the work of Mice. I am inclined to think that at least one species of Mouse is a parasite or commensal of these Ground-squirrels, inhabiting the small off-shoot galleries. These they make from the tunnels of their host and, tapping the store rooms, steal the provisions laid up by the larger rodent. In this case we found a colony of *Microtus drummondi* not far from the burrow.

The chamber was 9 by 9 inches by 6 inches high, the lining was of grass and oat hulls, about two inches thick, and reaching well up the walls. I examined it carefully and found no dung of owners or Mice, and no insects; it was thoroughly clean, but not dry or warm. I do not think it was in use this year.

We found no nest in this. Evidently it was too early for the family. (See Fig. 120.)

The burrow of the Yellow Ground-squirrel can always be distinguished from those of the other two by its size, having a calibre of about three inches, by the ever-increasing mound at the door, and by the fact that it rarely goes straight down, but is usually on a side bank and goes in at an angle; evidently, from the nature of the ou[illegible] it reaches a considerable depth.

The young are born about the middle of May. Prenatal counting in eight cases showed the number to be 11, 7, 7, 7, 6, 6, 6, 6. YOUNG

About the end of June the young are one-third grown and big enough to come out of the holes and make the acquaintance of the sunlight. They now look much like their parents, differing chiefly in being smaller.

At the entrance to each den from one to ten of the Squirrels may be noted any bright day in late summer, and the scene in the colony is of the liveliest description. Birds and beasts of prey make the place a regular forage ground, and the farm boys come with trap and snare to earn a little bounty money. The growth of the young is rapid, and by September they are not to be distinguished from the old ones in activity or appearance.

But one litter is raised each year.

When the thermometer is at 70 or 80 degrees the Ground-squirrel is in its glory, but it has no liking for very hot weather. Whenever the temperature rises to or near the 90's the Ground-squirrel hides below. It is, moreover, strictly diurnal; I never saw one above ground before sunrise or after sunset. TEMPERAMENT

Although a winner in the ordinary struggle for existence, this animal has not the spirit of either of its cousins. Once I

kept all three species together in a cage; the Yellow Ground-squirrel, although the largest, was bullied by both of its relatives. It chattered its teeth angrily at them for a time, but finally submitted.

SPEED

This creature is a poor runner. The farmer's boy can easily outrun it if he finds it far from its hole, and then it has to save its life by dodging—a hopeless shift, indeed, if the boy's usual four-footed colleague happens to be at hand. But it is rarely caught far from home. I doubt if it ever goes voluntarily fifty yards from a burrow. I have known individuals go over a hundred yards to a favourite food, but they do so under special provisions against surprise, as the following note illustrates:

Carberry, July 5, 1892. As the sun lowered it fast lengthened the shadows and brought into prominence the smallest depressions on the prairie; it revealed also on a long bank by the twenty-acre wheatfield a perfect labyrinth of Ground-squirrel runs (p. 389) leading from all parts of the near prairie for 100 yards or more into the grain. The runs had no common plan beyond convergence at the crop, but each main run appeared to have on it a sort of refuge burrow at every ten or fifteen yards. These refuges differed from the residential burrows in being small, inconspicuous, half-hidden in the run, and without mounds. The Ground-squirrels would dodge from one to another, twinkling in out of sight at the slightest alarm. If two happened into the same burrow there was mischief brewed at once, and the weaker had to make a dash across country in search of some more hospitable retreat.

In August they may be seen all day running down their holes with pouches full of grain and other supplies. Sometimes these supplies are not food, but bedding.

FOOD

In food-habits it is much less carnivorous than the other two species, and yet is omnivorous. Primarily its diet is roots, leaves, and seeds of prairie plants.

Bailey says in this connection:[1] "Roots of plants are eaten and a great many seeds, especially those of pig-weeds (*Chenopodium album* and *boscianum*) and wild sunflowers, which are abundant and form a considerable part of the diet. They also eat grasshoppers and many other insects."

Dr. Coues tells of the manner in which these little apostates of an herbivorous race would crowd joyfully around the

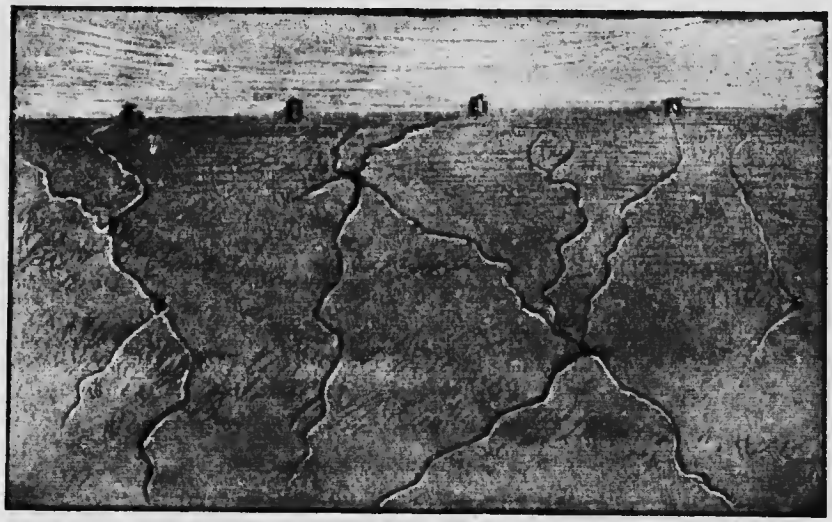


FIG. 121—Runs of Richardson Ground-squirrel leading to a grain-field, Carberry, Man. An asylum burrow is seen every 10 or 15 yards. The space shown is 30 yards each way.

carcass of a fallen Buffalo, as near and often as they dared, in view of the many stronger creatures there assembled.

But the coming of the plough put a new complexion on their lives. The farmer killed the Buffalo and the prairie herbage. Very properly, then, the farmer is a lawful prey, and this Ground-squirrel easily heads the list of the four-footed pests with which the agriculturist has to contend in Manitoba.

In 1889 a law was passed providing a bounty of three cents to be paid for every Gopher tail delivered. The only tangible result was a depleted treasury. The Ground-squirrels continued to exact their tribute of many bushels per acre. Bailey

[1] Rep. Pr. Gr. Sq., 1893, p. 61.

considers that the loss in ripe grain eaten, stored away, or destroyed in autumn is small compared with that which they cause by digging up the seed after it is sown in the spring, as each kernel taken then deducts many fold from the crop.

But they are mischievous throughout the season. R. C. Cooper writes Bailey concerning the species in North Dakota: "It is present in great numbers and very destructive to small grain, doing most damage after the grain begins to head out and shade the ground fully; they then pull down the grain and cut off the upper part of the stalk for many rods around their holes, seemingly to let sunlight strike the ground; they do not like damp places."[5]

STORAGE

It seems to be the habit of the species to carry food home in its cheek pouches for immediate consumption as well as for winter stores. On May 23, 1884, I captured a Ground-squirrel from a very righteous hawk that had caught him raiding a grain-field, and had lynched him on the spot. This was a very large specimen, a male; it weighed 13 ounces. Its cheek pouches contained 240 grains of wheat and nearly 1,000 grains of wild buckwheat, which is a noxious weed. Another, taken July 26, had in its cheek pouches 162 grains of oats. Bailey records one that had in its cheek pouches 269 grains of oats.[6]

The ripening crops in August afford the Ground-squirrel a chance that it never neglects. Load after load of the golden grain is garnered into its own bin, some six feet underground. In October the store is untouched and the owner sound asleep. I have but one personal observation in support of this. On October 27, 1884, I followed a Badger track in about two inches of snow that had fallen the night before. The Badger had come to a Ground-squirrel's hole and, guided no doubt by scent, dug straight down about six feet. The evidence showed that he had found and devoured the owners. Clearly they had omitted to plug the doorway and had paid the extreme penalty of their neglect, for there was the nicely made bed torn open. But also I saw there the storehouse containing about

[5] *Loc. cit.*, p. 64.

[6] *Loc. cit.*, p. 61.

two quarts of wheat, all of it *sprouted*. Evidently the Badger was not interested in wheat, as it was lying in piles, and apparently there was as much in sight as the little bin would have held.

The storehouses examined at Whitewater, April 9, 1904, were empty.

NEVER DRINKS

So far as known this animal is independent of water. It finds the moisture of its vegetable food sufficient.

ENEMIES

Every beast of prey from Bear to Weasel, all of the hawks and some of the owls, prey on the Yellow Ground-squirrel, and its only recourse is a speedy retreat to Mother Earth, not by any means a bad one, as is shown by results.

Professor John Macoun tells me that twenty miles southwest of Saskatoon, Sask., July 29, 1906, he saw one of these Ground-squirrels sitting upon its mound as a Long-tailed Weasel came loping over the prairie. The Squirrel dived below; the Weasel went after it, but came out almost at once; evidently the Squirrel had fooled him.

But it has enemies that are even more dangerous. Five specimens collected May 2, 1884, were carefully examined. All were infested with wire-like worms in the stomach, alimentary canal, and scrotum. Nearly all spring specimens after this were found to be similarly infested.

The cuterebra or warble, too, is said to prey on this species, though I have not seen a case.

Since the appearance of the burrowing owl in Manitoba (about 1895) this Ground-squirrel has a new dependant; for its burrows are just such as are needed by the owl for nesting places, and unquestionably the baby Ground-squirrels are of just the right size, shape, and flavour to provide a delicious meal for the ungrateful bird.

TRAPPING

In trapping these dull-witted creatures but little subtlety is needed. If you walk gently toward a Ground-squirrel sitting at his front door, he gives a short, husky whistle about every ten seconds, jerks up his tail-end in time to his music, then takes the sub-soil plunge as you get nearer, going at thirty

or forty feet if you rush at him, but waiting till you are within ten if you go slowly. Now the ready trap is set at the door in plain view; neither bait nor covering is needed. In a minute, if all be still, the Ground-squirrel reappears, popping his head out cautiously once or twice, then boldly leaping out when he sees you at a safe distance. If he chances to overleap the trap this time or step too lightly to spring it, a clod thrown at him sends him skurrying back in such heedless haste as is sure to land him in the disaster you had planned.

When a snare is used it is set round the rim of the hole. The trapper now lies down some ten feet away, and jerks the noose as soon as the victim's head appears above the grass. If, however, it be near sunset when he goes down below, you need not expect to see him out again that day.

I have many times driven a Ground-squirrel gently into his hole, then sat down to wait beside it. His short whistle is invariably heard within once or twice, then his nose reappears, only to drop back when he sees you. But he returns, and if you are still he gets bolder, popping back and forth, probably, and though you be but three feet from the mouth he will dodge out and scuttle away to the next burrow. It looks like a piece of daredevil bravado, for in many cases there was reason to suppose he was owner of the hole he was leaving and was not driven forth by any inhospitable relative. It is often a help in bringing him out if you whistle softly.

AUTUMN

Toward mid September, as the days grow short and the mornings chilly, the Ground-squirrel comes out less often. By the end of the month, or at latest the middle of October, it says good-bye to the light upper world and sinks, like the flowers, into the slumber that is to last until spring. For half of each year, half of its life is spent in a sleep so deep that it is a temporary death.

SERVICES TO MAN

The work that the various Ground-squirrels do for man as tillers of the soil is not to be forgotten, but it is small when compared with that done by the Pocket-gopher, and is more than offset by their destruction to standing grain.

The fur of this animal is used sometimes for cloak linings, but it is thin and poor. The leather has a possible application in the manufacture of 'kid' gloves, but the skin is not usually considered of any commercial value.

HOW TO EXTERMINATE

The safe and successful method of exterminating this pest of the farm is by poisoning with crude bisulphide of carbon, as recommended by the United States Biological Survey (Prairie Ground-squirrel Report, 1893, p. 26). Two tablespoonfuls of this on a bunch of rags or waste should be thrust into the top or highest part of the burrow of the Ground-squirrel, and the hole closed up. It gives off a poisonous gas which is heavier than air. This follows down along the burrow and kills the occupants, who are thus dispatched and buried out of sight by a single operation.

As this bisulphide is a poisonous, inflammable, and explosive substance it should be handled with care.

## XIII.

## Striped Ground-squirrel, Striped-gopher, Thirteen-striped Spermophile or Citellus, Hood Spermophile or Leopard Spermophile.

*Citellus tridecemlineatus* (Mitchill).

(L. *Citellus*, see ante; L. *tridecemlineatus*, from *tredecim*, thirteen, *lineatus*, lines or stripes.)

*Sciurus tridecemlineatus* Mitchill, 1821, Med. Repos., N. S., VI (XXI), p. 248.

*Citellus tredecimlineatus* Elliott, 1905, Check List Mam., N. A. Field Mus. Pub. 105, Zool. Series VI, p. 104.

Type Locality.—Central Minnesota.

French Canadian, *la Citelle ou l'Ecureuil à treize raies.*

Ojib. and Saut., *Sha-sha'-ba Wa-ba-coosh'.*

Yankton Sioux, *Tah-sen-a A-das-ka.*

Ogallala Sioux, *Tash-nah-hay'-ah-lah.*

In addition to the generic characters given on page 372, the Striped Spermophile has the following:

SIZE Length, about 11 inches (279 mm.); tail, 3½ inches (89 mm.); hind-foot, 1⅜ inches (35 mm.); ears, very small and low. Female smaller.

COLOUR All above, dark or blackish brown (which varies greatly in depth), with 7 long stripes of dull yellowish white, between which are 6 more or less broken rows of spots, similar in colour to the stripes; the stripes are much broken up on crown and haunches; there are traces of chestnut on the flanks and in the

PLATE XXXVI.—THIRTEEN-STRIPED GROUND-SQUIRREL (LIFE SIZE).
(*Citellus tridecemlineatus* (Mitchill)).
From specimen taken at Carberry, Manitoba.


**MAP 21—RANGE OF THE STRIPED GROUND-SQUIRREL AND ITS SEVEN RACES.**

*Citellus tridecemlineatus* (Mitchill).

Founded on Vernon Bailey's maps in the U. S. Biol. Survey, with other records by J. A. Allen, C. Hart Merriam, E. T. Seton, *et al.* The boundaries between the races are approximate.

dark stripes; all below dull buff, nearly white on the chin; the tail is yellowish brown or sienna, with a fringe of coarse hairs that are black but have yellowish white tips. April specimens from Winnipeg are very pale and brown. The female is similar.

When seen on the prairie, its stripes, general olive tone and short ears readily distinguish it even if it chance to be near the haunts of the Chipmunks. Its style of uniform is indeed unique; the only approach to it is seen in the Rio Grande Ground-squirrel, which has rows of *white* spots and is otherwise different.

Seven races are recognized:

*tridecemlineatus* Mitchill, the typical form.
*pallidus* Allen, smaller and paler.
*olivaceus* Allen, like *pallidus*, but darker.
*parvus* Allen, very small.
*alleni* Merriam, smaller, darker and more olive than type.
*texensis* Merriam, like type, but smaller and redder.
*badius* Bangs, very large and red.

Specimens from Turtle Mountain, Man., show an approach to *pallidus*.

### Life-history.

RANGE. The Striped Ground-squirrel is found on all the dry prairies of Manitoba, from Lytleton to Duck Mountain, from Pembina to Selkirk, and from Brokenhead to Fort Ellice, but it is less strictly a prairie species than its yellow congener, and is often seen in the partly wooded country. At Dauphin I was shown specimens taken there by H. C. Nead, and learned from many that the species abounds on Gilbert Plains and northward as far as Fork River. A few are to be found even farther, along the neighbouring Gravel Ridge east of Duck

Mountain. Sir John Richardson records[1] that the species was "in considerable numbers" at Carleton House, but not found beyond north latitude 55°.

The favourite surrounding of the Striped Ground-squirrel is dry virgin prairie on a light soil. ENVIRONMENT

It is, or was, particularly abundant on the Big Plain around Carberry, Man. By abundant is not meant its numbers equalled those of the Yellow Ground-squirrel; of that I have seen 50 within an acre, but of the Striped species 50 in a 10-mile drive would represent its greatest abundance in my experience. At Grinnell, Iowa, it is much more plentiful. J. H. Houghton counted 25 during a walk of a quarter of a mile;[2] I never heard of a place in Manitoba where it attained such numbers. It is, however, more numerous than it seems, as its colour enables it to hide so easily, and I should estimate our present population of Striped-gophers at not less than 250,000. NUMBERS

It has greatly decreased during the last twenty years. In 1882 one could see 30 or 40 a day without difficulty. One day in the spring of 1884 I caught 13, all males, in our half-acre garden. In 1892 it had become so rare that I seldom saw more than 2 or 3 in a half day's tramping, and reports from all regions under the plough, show that the Striped Ground-squirrel is disappearing. In my notes for June 7, 1892, I find this:

The natives say that the large Ground-squirrels kill the Striped species. I have seen no signs of actual encounter except in cages, where the small ones were usually victorious, but it is quite evident that the former are overrunning the country. The farmers complain greatly of their ravages. * * * I have no doubt that the chief enemy of the smaller species is the plough. This Squirrel's home is the virgin sod; its burrows are so superficial and small that they are destroyed at once by the plough, whereas the large and deep burrows of *richardsoni* are affected at the entrance only by the overturning

[1] F. B. A., Vol. I, 1829, pp. 177–8.
[2] Bailey's Rep. Pr. Gr. Sq., Bull. 4, U. S. Dep. Agr., 1893, p. 37.

shear, and are easily cleared again by their owner. This is supported by the fact that wherever you find a tract of dry virgin prairie left, you are sure to find it populated still by the Striped species, while the Yellow alone is found in the ploughed fields.

SOCIABILITY

Speaking of its habits in Illinois, Kennicott says:[3] "It is naturally gregarious, and though never observed living in such great companies as the Prairie-dog, twenty, or sometimes even fifty or a hundred, may be found within the area of an acre, two burrows being frequently within a few feet of each other, though one is never inhabited by more than a pair." This does not agree with my own observations. I should rather call it a solitary species, for I never saw one heeding another, except in the breeding season, and those I kept in captivity took no notice of each other except to fight. In one sense the species may be slightly gregarious, but I should say not at all sociable.

SPRING ADVENT

The Striped Ground-squirrel is usually two weeks behind the Yellow one in its spring appearance; it is rarely seen in numbers until the end of April, but around Carberry begins to appear about April 20.

In the backward season of 1904 it had not appeared in force when I went East on May 1. Again, in the very early season of 1905 Francis Dickie wrote me from Carberry that the first Striped-gopher was noticed April 1. At MacDonald, J.S. Charleson noted its first appearance on March 27.

MATING

The mating season sets in at once and the males may be seen chasing the females from burrow to burrow over the prairie. Kennicott says that in Illinois they pair, but the male deserts the female just before the young are born, and leads a solitary roving life all summer, "digging a temporary burrow or occupying a deserted one for a few days wherever he may take up his abode."[4]

[3] Quad. Ill., 1857, pp. 75–6.

[4] *Loc. cit.*, p. 76.

The burrows of the Striped Spermophile are distinguished from those of the Yellow species by their smaller size (of barely two-inch calibre instead of three), also they are on the level ground. They usually go straight down for six or seven inches, sometimes much farther, and rarely have any earth mound visible at the door. Apparently the animal is at pains to hide the entrance, so gets rid of the earth-pile by scattering it. Bailey remarks:[6] "Though many of the burrows open on smooth, bare ground, with nothing to conceal them, the entrances are more commonly hidden by a bunch of grass, and sometimes a dried weed, a piece of pape., or an old rag is drawn over the entrance."

DENS, ETC.

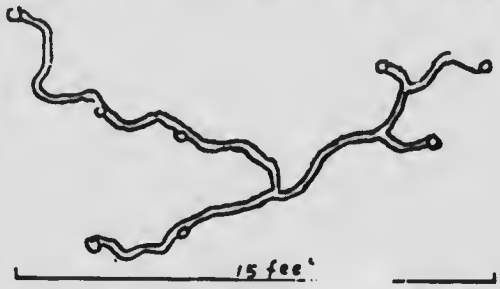



FIG. 122—Striped Spermophile's [illegible] anitoba, 1882.

Burrow 2 or 3 inches below surface; *entrances were open* is important doorways to the home den.

The fact that *all the* with the plugging of the

They are of at least two kinds.

First, a labyrinth of many galleries with many entrances. This is close under the sod, rarely more than three or four inches down. I take it to be a mere playground and refuge; doubtless, also, it serves to mislead such enemies as might be in search of the Ground-squirrel's nest. (Fig. 122).

Second, the nesting burrow. This also is a labyrinth, but deeper than the first kind, and it has a large, comfortable chamber about nine inches in diameter, with many approaches, and more than one entrance. This chamber is about six inches down, and is lined with fine, dry grass.

At Carberry, September 8, 1904, I dug out the Ground-squirrel nest from which I made the diagram shown in Fig. 123. I did not see the rightful occupant, but suppose from its size and character that it was the work of a Striped-gopher. In one place, as marked, was found a salamander (*Ambystoma tigrinum*). It was not dormant but very sluggish. Several

[6] Rep. Pr. Grd. Sq., 1893, p. 33.

times have I found this species thus utilizing the burrows of the Ground-squirrels for its own winter den. These galleries were much plugged with soft earth and not easy to trace. Most were one and one-half to one and three-fourths inches wide, and about three inches down, but never more than six inches from the surface.


FIG. 123—Burrow of Striped Ground-squirrel.
Drawn by E. T. Seton, Carberry, Manitoba. Sept. 8, 1904.

I have also seen another burrow that is attributed to this species. It goes down nearly straight for a dozen feet. It may possibly be the winter den, but I never found the bottom or the animal that made it. The natives say it is a well, but I think they are mistaken.

In 1882 I published certain drawings of the prairie in section. They were the four faces of one square hole. The extent to which the burrowing rodents had recently interfered with the surface deposits was very plain, but later studies showed that most of these results were traceable to the Pocket-gopher (*Thomomys*), so that, although the present species is an important secondary worker, the subject is treated in the chapter devoted to *Thomomys*.

On May 21, 1884, I dissected 3 female Striped-gophers that had been shot in the garden, and found in each 9 well-developed young, evidently within a few days of birth. On May 24 I saw several of this species carrying bedding into their dens. On May 26 I opened 2 more and found 7 and 8 young. Other observers have noted young up to 14; thus they range from 7 to 14 in number, 9 being about the average. YOUNG

It is a remarkable fact that among the rodents, at least, prenatal counting shows more young than actual observation of the litter in the nest. Does this mean the death of one or two at each birth?

Evidently they are born about June 1. I found this note in my Carberry Journal for May 27, 1884: "The Striped-gopher in the cage brought forth her young yesterday or the day before, but she has utterly neglected them (they are since dead). They are perfectly naked, blind, helpless, and apparently toothless. There is not even an opening for the ears. Their skin is bright pink, and shows no signs of hair or of the mature markings. The total length of one is 2¼ inches; of this the tail is ⅜ of an inch. The sex is pronounced and the whiskers show.

"Dr. Hoy, who observed them in confinement, says that they have no hair on the body before they are twenty days old, and that the eyes do not open till the thirtieth day. They continue to require the nourishment and care of the mother for a much longer period than most rodents." (*Kennicott.*)[6]

A nest found near Carberry in June was of fine grass a couple of inches below the sod, and contained 8 young Gophers, half grown but showing all mature markings.

About the first week in July they are big enough to come out of the den; they are half grown in the middle of the month, but do not yet go far from home and mother. They are fully grown by September, and before the winter comes the family feeling is entirely gone. Probably the young do not even winter together.

Only one brood is raised each season.

[6] Quad. Ill., 1857, pp. 75–6.

VOICE

This Ground-squirrel has a much greater variety of whistles and bird-like chirps than the Yellow species, though it is inferior vocally to the Scrub-gopher. Its short, sharp whistle of alarm, and its prolonged quavering defiance, uttered from the safe underworld, are well known to every farm boy who snares Ground-squirrels for pocket money. When held by a trap it bites its adversary savagely, and utters a sort of angry snarling.

"During the breeding season these Spermophiles are quiet and shy, but in June and July, when the half-grown young begin to make their appearance above ground, their voices are most frequently heard. The parent and her young at this time are constantly calling back and forth." (*V. Bailey.*)[1]

CLIMBING

I was greatly surprised to find that this creature could readily climb a low bushy tree, and twice saw one do it as noted in the food paragraphs, page 405.

SPEED

Its speed is about the same as that of the Yellow Ground-squirrel, but mentally it is decidedly superior.

MENTALITY

If you find a Striped-gopher sitting by its burrow and walk straight toward it, it waits until you are within perhaps ten feet, then dives with a little defiant "chirrup" into its underground safety. If you walk so far as to pass within eight or ten feet and do not look at it, it seems to watch your eye and remains perfectly still while you pass. If you step or turn toward it, it dives at once. The Yellow Ground-squirrel, on the other hand, no matter how approached, always runs into its hole with nervous haste, as soon as it sees a foe anywhere near.

When I kept the two species together in a cage, the Striped one bullied its larger brother mercilessly, and lost no opportunity of impressing it with the superiority of mind over matter.

If a Striped Ground-squirrel on the prairie be followed, not too fast, it will play with the observer, leading him

[1] Rep. Pr. Grd. Sq., 1893, p. 33.

about in various directions, without seeking a hole. I remember once (July 16, 1892) following one for a hundred yards or more in a very crooked course, then, so far from hieing earthward at last, it took to a field of standing wheat and eluded me in that, giving the usual chuckle of defiance as it disappeared.

If, however, it be hotly pursued, it makes for its earthworks shelter. The faint signs of runways that we see in the grass are no doubt very big, plain fingerboards to it—the Gopher who runs may read them. Its course, though erratic to us, is always directed accurately by these road blazes to a haven, and when at length it stops and looks at the pursuer he may be sure that it is now at the door of its den, and on a nearer approach will dive with the usual twitter of derision.

But possessed of an uncontrollable curiosity it is sure to peep out again if all be still, and it is easily taken then in a noose laid over the hole where it first disappeared.

HABIT

This animal has a habit of sitting bolt upright on a mound; it makes itself as tall as possible to look around; its paws are pressed in close to its breast, and at a distance it looks like a picket-pin or a stake driven into the ground. At such times the uninitiated often take the Squirrel for a surveyor's landmark until a nearer approach causes the supposed stake to dive into the mound.

DIURNAL

It is strictly diurnal, and so partial to warmth that it is not often seen above ground before the sun is in full force—that is, nine or ten in the morning—and long before sunset it retires for the night. On dull or cloudy days it is scarcely seen at all. Those that I kept in cages were put into a stupor by a temperature several degrees above freezing point, which however, did not affect the Yellow Ground-squirrel in the least. The latter may often be seen running web-footed and chill-footed over the snow-drifts in spring time, but I never knew the Striped one guilty of such indiscretion.

The present species rises from its winter's sleep nearly

two weeks later than the Yellow Gopher, and retires in autumn about as much earlier, thereby losing a good month of active life.

TENACIOUS OF LIFE

Although very sensitive to cold the Striped-gophers are very tenacious of life, and it frequently happens that individuals trapped, crushed, or mangled and thrown aside for dead, have revived and escaped.

FOOD

Belonging to an order of herbivores, we expect to find this animal eating all things that grow above and below the ground—grass, herbage, seeds, berries, roots, and grain; but the creature is quite omnivorous and habitually includes all garbage as well as herbage in its diet. I have known it to eat greasy house-scraps at which a Rabbit would have wabbled its nose in holy horror, as well as offal, insects, feathers, raw meat, small birds, mice, and its fallen comrades.

The best available light on its food habits is found in Vernon Bailey's Report on the Ground-squirrels,[8] from which chiefly I compile the following records of its insect, bird, and reptile-eating propensities:

INSECT EATING

"They feed especially upon such insects as grasshoppers, beetles, caterpillars, and ants." (V. B.)

"I have seen it catch and consume the cabbage butterfly repeatedly, and have also watched it digging for cut-worms." (J. N. Houghton, of Grinnell, Iowa.)

At Ames, Iowa, Professor F. E. L. Beal "saw a Striped Spermophile with a large hairy caterpillar in its mouth."

The results of the examination of 22 stomachs of this Spermophile, made at Ames, Iowa, are given by Prof. C. P. Gillette. "The animals from which the stomachs were taken were killed on various parts of the College farm, and at intervals from April 19 to August 2. As a result of this examination it was found that insects formed 46 per cent. of the stomach contents, with an average number of 13 cut-worms and web-worms

[8] U. S. Dept. Agr., 1893, Bull. 4, pp. 38–45.

in each. 'The web-worms in these stomachs were, in the great majority of cases, the larvæ of *Crambus exsiccatus*, which is very injurious to corn and grass in Iowa, its work in corn being very often mistaken for that of cut-worms.' In conclusion it is stated that 'the insects which the Squirrels feed on are almost exclusively injurious species, chief among which seem to be cut-worms, web-worms, and grasshoppers. As grass, clover, and other green stuff has been abundant wherever the Squirrels were taken, and as their stomachs were often gorged with insects that must have given them trouble to catch, it would seem that they prefer the latter food.' "[9]

The only available record of the Ground-squirrel eating reptiles is contributed by Bailey: "I once shot a Spermophile [he says[10]] as it was sitting up eating something that it held in its paws. On picking it up a partly devoured lizard (*Eumeces fasciatus*) was found, and several joints of the lizard's tail were in the Spermophile's cheek pouches."

The step from reptile to bird is greater to the layman than it is to the naturalist or the Gopher. H. G. Smith, of Denver, writes:[11] "I have found the feathers of the shore-lark (*Otocoris alpestris arenicola*) about the entrance to the burrows on one or two occasions, but whether killed by the Squirrel or not I do not know. * * * The shore-lark evidently regards them as enemies, for I have often seen them try to drive the Spermophiles from the locality of their nests, and have found the eggs of the species, as well as those of the lark-bunting (*Calamospiza melanocorys*), destroyed, as I suppose, by this Spermophile."

In the July of 1883 Miller Christy and I saw a Striped-gopher climb twice up a low, bushy spruce tree in pursuit of a vesper sparrow that was perched on top. Again in 1887 Christy wrote me from Shoal Lake: "May 18, I saw a kingbird chasing a Gopher (Striped) along the ground for some yards till it got into its hole. The bird kept at the business for (I should think) half a minute."

[9] Bull. Iowa Exp. Station, 1889, No. 6, p. 242.
[10] *Loc. cit.*, p. 39.
[11] *Loc. cit.*, p. 38.

This seems to show that the kingbird recognized in the Ground-squirrel an enemy—one who was a habitual destroyer of small birds and their eggs.

AS MOUSE-HUNTER

Those that I kept in cages invariably preferred raw meat to any vegetable food I could offer them. Professor F. E. L. Beal states[12] "that at Ames, Story County, Iowa, he once saw one carrying a Field-mouse.

In a letter dated Lincoln, Neb., June 19, 1888, Professor L. Bruner says:[13] "I saw a Gopher catch and kill a Field-mouse, which is something I have never seen them do before. I do not know what caused the Gopher to do so, for as soon as I approached it, it dropped the Mouse and ran into its hole. The Mouse was badly bitten."

"Dr. Hoy has shown that this animal feeds upon Mice and insects when in captivity, and he further informs me that he has examined burrows in which the numbers of the skins of Meadow-mice found sufficiently proved the appetite exhibited by his caged specimens, to be natural. Those observed in captivity killed and devoured Mice in the same manner as the Weasel, showing themselves to be adepts in this mode of procuring food. One would spring upon a Mouse savagely uttering a low snarl, and despatch it by biting its neck, after which the top of the skull was taken off, the brains licked out, and the blood sucked, the body not being devoured when there was an abundant supply." (*Kennicott.*)[14]

Thus the long, slender weasel-like body of the species is not misfitting its character. This is, indeed, the Weasel of the Family, and we wonder how the small ground-birds could raise a brood at all in the early days, when this bloodthirsty little creature abounded on the plains and daily ransacked its home acre for the defenseless eggs or young of prairie birds.

CANNIBAL

Nor does this sanguinary little rodent balk at the climax of a carnivorous life. As I have seen many times in cages, and as is attested by nearly all observers, it does not hesitate on

[12] *Loc. cit.*, p. 39. [13] *Loc. cit.*, p. 37. [14] Quad. Ill., 1857, p. 78.

occasion to kill and eat wife or brother, mother or child, when other opportunity is lacking to glut its appetite for the living flesh and blood. Thus in spite of the strictly herbivorous teeth with which it is endowed it is a logical presentation of flesh-eating pushed to the unbridled conclusion.

Vernon Bailey gives[15] this summary of his studies on its food habits:

"Eighty stomachs and eleven cheek pouches were collected and their contents carefully examined. Since the stomachs were taken from specimens collected at various dates, ranging from May 19 to August 31, and over an extent of country including Minnesota, the Dakotas, Montana, Wyoming, Kansas, and Texas, it may be reasonably inferred that the average summer diet of the species is represented. Following is a list of the food components found in the stomachs:

| ANIMAL | VEGETABLE |
|---|---|
| Grasshoppers | Oats |
| Crickets | Wheat |
| Caterpillars (larvæ of Lepidoptera) | Pig-weed (*Chenopodium*) |
| Beetles | Bindweed seeds (*Polygonum*) |
| Ants | Wild sunflower seeds (*Helianthus*) |
| A small cocoon | Night shade berries (*Solanum*) |
| Insects' eggs | Cactus fruit (*Opuntia*) |
| Spermophile hairs | Roots |
| Feathers of small birds | Herbage" |

STORAGE

A surprising and delightful discretion is displayed by this animal in its selection of food for storage. *It never attempts to store food that will spoil.*

On this point Bailey writes:[16] "The following tables show that the contents of the cheek pouches differ widely from those of the stomachs, many things being eaten that are never stowed away in the pouches. For instance, more than half of the

[15] Rep. Pr. Grd. Squirrels U. S. Dep. Agr., 1893, Bull. 4, p. 43.
[16] *Loc. cit.*, p. 45.

stomach contents consisted of insects, while no insects were found in the cheek pouches, the latter invariably containing nothing but seeds. This is what might have been expected, as the food laid up for winter is carried in the cheek pouches."

Though storage is highly developed in the Ground-squirrel the reason for it is not quite clear. The capacious cheek pouches with which it is provided are in daily use *all through the season*. In illustration of this and of their size and the owner's tastes I quote from my Journal:

"Carberry, Man., July 25, 1892. Collected a female Ground-squirrel that had in her cheek pouches 34 grains of wild oats (*Stipa spartea*)."

Concerning the storage of food, Kennicott states:[17] "This is done in spring and summer, as well as in autumn. Considerable stores of grain, seeds, roots, etc., are found thus collected in large side-chambers, excavated for their reception, in the burrow. Corn, wheat, and oats are stored up, when taken from the newly planted fields in the spring, with buckwheat and winter wheat later in the season, as well as heads of grain taken from the edges of the field in harvest time. I have seen more than a quart of crab-apples taken from the burrow of one which had carried them several rods from a tree. George and Frank Kennicott inform me that they observed one, the burrow of which was near a lone burr-oak, on the prairie, to carry great quantities of acorns into his hole; and another was killed by them, the cheek pouches of which were crammed with the dry ovaries of a prairie plant, the seeds of which were exceedingly minute. From this it would appear that the Striped Spermophile at all seasons carries portable articles of food to its burrow to be eaten. He certainly takes no food from the time he first becomes torpid, in autumn, until he again becomes active."

For what reason, then, does it store up all this food? We are forced to believe that it is done, not for winter use, but for the times during its active six months, when food is too scarce

[17] Quad. Ill., 1857, p. 77.

or the weather too bad for it to forage successfully—that is, during the cold, wet spells in summer, unseasonable rains in autumn, and, above all, in early spring time. Confirmation of this is found in the following from my Carberry Journal of 1882. "May 2, I ploughed up the storehouse of a Striped-gopher. It contained two pints of wheat and one of buck-wheat in separate piles."

The species is, moreover, obliged to lay up more than it needs, to offset the pilferings of the parasitic Mice mentioned later.

NEVER DRINKS

So far as known, however, it never drinks. As with many small rodents, the moisture of the vegetable food is sufficient for its needs, so that the story of the well or burrow running down to water is a myth. I kept a number of the Ground-squirrels of both kinds in a cage all summer, but they never paid any attention to the water supplied them, so we ceased providing it. A very hot spell continued for a week, and it was suggested that the Ground-squirrels might now enjoy a drink. A saucerful was put in. Four would not touch it, two sniffed at it, wetting their whiskers slightly, then licked the whiskers dry, but could scarcely be said to have drunk.

ENEMIES

Like the preceding, this animal is the accepted prey of all creatures, great and small, which prey. As Dr. Coues has pointed out in good set zoological terms, the proper function of the whole order Rodentia is to turn grass into meat for the sustenance of their betters. I have taken Striped-gophers from each and all of the large Hawks which nest in our Province.

Among the quadrupeds the Badger chiefly makes a special study of Ground-squirrel as diet. I have in many places seen the shelter burrows ripped open for twenty or thirty yards, showing where the Badger pursued the Squirrel by demolishing its rooftree, and usually there was some evidence to show that he had been successful.

Cats kill a great many Gophers, but do not thrive on them; in fact, many hundreds of Cats have died from feeding on

Ground-squirrels. The reason apparently is that the Squirrel is infested by abdominal and intestinal worms, which are taken by way of the Cat's stomach into its system, and there work their havoc.

PARASITES

These worms I have found in most Ground-squirrels, both Yellow and Striped, in the spring and early summer. The *Ixodes*, or tick, that infests Rabbits, I have not yet found on these species, but confidently look for it. Another remarkable insect parasite is the *Cuterebra*, commonly called a "bot or a warble." My attention was first directed to this in the August of 1882. On the 5th of that month I wrote as follows: "Got a male Striped-gopher, apparently in good health, but the scrotum was entirely occupied by a large grub about one inch long and half an inch wide. It resembled a butterfly cocoon. The head projected outward toward the animal's rear. The testicles were either undeveloped or consumed, as there was no sign of them. The grub, when cut out, progressed over a board about as fast as an earthworm would, point first, *i. e.*, the end that was inwards. It was of a light olive, thickly sprinkled with fine black spots. I am told that the Ground-squirrels have been found with their hindquarters paralyzed by one of these grubs." Dr. A. S. Packard says[18] of this:

FIG. 124—The larva of Cuterebra, secured Aug. 5, 1882, at Carberry, Man. (Natural size.)

"The larvæ (of Cuterebra) live in subcutaneous bots beneath the skin of various animals. One species (the *C. emasculator* of Fitch) lives in the scrotum of the Squirrel, which it is known to emasculate. Mr. S. S. Rathvon has reared *C. buccata* Fabr. from the body of a Striped Squirrel, the larvæ having emerged from the region of the kidneys. Other species live in the Opossum and different species of Field-mice."

A Honduras species that attacks man is thus described by Dr. T. L. Leconte. They are "usually found beneath the skin of the shoulders, breasts, arms, buttocks, and thighs, and were

[18] Guide, Study of Insects, p. 405.

suspected to have been introduced when the persons were bathing." Apparently these parasites caused no pain either at the time of laying or during development.

Say records[10] a case wherein the original sting of the egg-laying was irritating and the larva caused a painful tumor as it developed under the man's skin. Apparently it was five or six weeks in growing, and caused acute pain when it moved, probably because it was touching a nerve. The victim killed the parasite with a poultice of rum and tobacco ashes—two poisons of recognized and frightful virulence—then removed it with the forceps. After this he quickly recovered.

This fly is very active in its attacks on the Ground-squirrel during late summer. In 1884 I made a careful investigation of its ravages. The following are the items from my Journal at Carberry:

July 26, 1884. Found a young Squirrel of the year with the larva of a cuterebra in the skin of its cheek; it had expanded so as to fill the cheek pouch. This was the earliest observed.

August 3. Caught 5 Striped-gophers to-day, of these 2 had had the "warbles," but they were gone, and the places nearly healed; 1, a female, was carrying a larva under the skin, between her hind legs, of all uncomfortable places.

August 5. Collected 1 male; it had 1 larva.

August 6. Collected 3 Striped-gophers, all had a larva, although 2 were females.

August 8. Out of the 5 Striped-gophers taken to-day, 4 had the parasites, and 2 of these were females.

August 12. Of 2 specimens, 1 only had larva, and it had 2, 1 in each hind-leg.

August 14. Of 3 specimens taken, 2 had larvæ, 1 of these was a female.

August 18. Captured a large male Striped-gopher; it had 1 larva, this in its scrotum. It was fully developed and soon it crawled out of its cradle to be promptly devoured by its recent host, amid the applause of the spectators.

[10] *Loc. cit.*

August 20. Fired at a Marsh Hawk that was carrying a Striped-gopher. This was dropped; it proved a male. In its scrotum was 1 fully developed larva, which presently crawled out and escaped.

August 25. Out of 4 specimens collected to-day but 1 had a larva. This host was a female.

August 30. Out of 2 specimens to-day 1 had had a larva, now escaped; the host was a female.

September 4. Collected 1 female Striped-gopher. She had 2 larvæ still in her belly skin.

September 11. Collected 2 males, the last of the season—neither had any larvæ. The season is doubtless over for parasites as well as for host.

This record shows that the cuterebra infests males and females indiscriminately, but it generally, though not always, attacks the lower abdominal region, and is frequently housed in the scrotum of the male. But does it emasculate the host? It is usually credited with doing so. In my 1882 account of this parasite I stated so, because the scrotum seemed quite empty after the grub was removed. In view of the fact that the testicles are reduced almost to nothing after the breeding season, possibly withdrawn into the body, I do not at present consider it proven that the cuterebra really emasculates the Striped-gopher or its larger cousin.

Among the parasites of the Striped-gopher we must reckon the Mice, which pilfer from its stores. I have no good observation on this, but in the case of the Yellow Ground-squirrel I think that the robber Mouse is *Microtus drummondi*.

LAST DAYS ON EARTH

During August and early September the Striped-gophers may be seen running into their holes with full loads of bedding and provender. There is some reason for believing that the wandering father returns in time to do his share of these preparations. Kennicott takes this view, and refers[20] to the "winter burrow, in which the pair hibernate and the female brings

[20] Quad. Ill., 1857, p. 76.

forth her young." During cold days now they do not show themselves at all. About the middle of September they bid good-by to the sunlight, plug up the doorway, and curl up for their seven months' sleep below the line of the frost.

"Whether they remain dormant all of the six or seven months which are spent underground is difficult to determine [says Bailey[21]], but it seems probable that they do not. Large stores of grain and nuts are carried into the holes in autumn and stored close to their nests. Whether these are eaten during the winter or saved for use in the spring, when grain and seeds are scarce, remains to be ascertained."

HIBERNATION

The only investigation of the hibernation of this Spermophile, so far as I know, is by the late Dr. P. R. Hoy, of Racine, Wis.

He states:[22] "The following are the results of many observations and experiments on the Striped-gopher (*Spermophilus tridecemlineatus*) during active life as well as when under the profound stupor of hibernation. During activity the Gopher's pulse is 200, respiration 50, temperature 105.

"On the 2d of October, having procured a Red-squirrel (*Sciurus hudsonicus*) and a Gopher, animals of nearly equal size, the one active during the coldest weather, while the other is a characteristic hibernator, I cut out a part of the gluteal muscles of each, and after dividing and bruising, so as thoroughly to break up every part, I took fifty grains of each and placed in a test tube, into which I put two ounces of cold water. After freely agitating, the mixture was left to digest for eight hours, at the expiration of which time I carefully decanted and renewed the water, agitated and left twelve hours, then filtered and rolled the residuum on blotting paper in order to remove all excess of moisture. When weighed they stood: Gopher, 50–15; Squirrel, 50–10. These experiments were repeated with substantially the same results. Gluteal muscles of the Squirrel contained 20 per cent. of albumen, soluble in cold water, while

[21] Rep. Pr. Grd.-Sq., 1893, pp. 34–5.

[22] Proc. Am. Ass. Adv. Sci., August, 1875, pp. 148–9, quoted in Bailey's Rep., pp. 35–6.

the same muscles of the Striped-gopher treated in like manner, at the same time, yielded 30 per cent.

"As it is well known that the flesh of reptiles is rich in albumen, I procured several marsh frogs and subjected the gluteal muscles to like analysis, which resulted in 40 per cent. of loss. The following will convey to the eye these results:

Per cent. of soluble albumen: Frog, 40; Gopher, 30; Squirrel, 20.

"On the 15th of December, the Gopher being thoroughly torpid, temperature of the room 45, Gopher rolled up like a ball, no visible evidence of life, I opened the abdomen and inserted the bulb of a thermometer, which indicated 58 degrees. I next turned back the sternum in such a manner as to expose the heart and lungs. The remarkable congested condition of these organs first attracted my attention. In fact, it would appear as if the blood had all collected within the thorax. The pulsation of the heart was reduced to four each minute, the auricles would slowly and imperfectly contract, followed immediately by the ventricles. These slow pulsations of the heart occupied four seconds. There was no visible respiration, the lungs remaining almost entirely passive. The heart continued to pulsate without perceptible change for fifteen minutes, and then when raised from its position it continued to pulsate for some time, being almost reptilian in this respect. During hibernation the circulation is so feeble that when a limb is amputated but a few drops of blood will slowly ooze from the fresh wound. The stomach and bowels empty, and the body was enclosed in a thick adipose layer. I was not able to excite the least motion or contraction of the muscles in any way, even by pinching or cutting nerves, showing the most perfect condition of anæsthesia possible.

"During hibernation the Gopher is not able to endure more than 6 degrees or 8 degrees of frost. The manifestations of life are so feebly performed that a few degrees below freezing is sufficient to convert apparent death into reality. On the 10th of April, at which time the first Gopher appears above ground, I repeated the experiment of the previous autumn. Body

emaciated, hair dry and lifeless, flesh perceptibly less moist than it was in the fall. On subjecting the gluteal muscles to like treatment as in October I was surprised to find only 18 per cent. of loss instead of the 30, as exhibited in the previous autumn.

"The large amount of soluble albumen found in the flesh of the Striped-gopher in the fall, and the lesser amount found after its protracted hibernation, go far to prove that albumen somehow fits the animal for its long sleep. Is it not probable that albumen is a stored-up magazine of elaborated nutrition, to be used when no food can be assimilated by the digestive organ?"

RELATION TO MAN

Although the farmers generally wage war on the Ground-squirrels as enemies to the crops, the case is not so clear as they seem to think. There is so much to be said on the other side that it is usually nearly a balance. Kennicott, after long study of the matter, wrote:[23] "There can be no doubt that Meadow-mice and insects are largely eaten by these animals whenever they can be obtained; and the high probability is that their good offices in the destruction of these, far more than counter-balances their occasional injury to the corn-fields. I doubt their being so very injurious in long-cultivated farms."

From all accounts Indian corn is the cereal to which it is most destructive. In Manitoba it does no harm to this crop for most excellent reasons; it certainly works mischief in gardens, but it is often blamed for the doings of its two larger relatives. On the other hand, as shown, it destroys enormous numbers of noxious seeds, insects, and mice, and it would be well if the bounty law against it were repealed. Such laws are now generally discredited in America, and its numbers in our country are too small to constitute a danger even if it were as much a grain-eater as some would have us believe.

[23] Quad. Ill., 1857, p. 78.

## XIV.

## The Canada Woodchuck or Wood-shock, Ground-hog, Thickwood Badger or Canada Marmot.

*Marmota monax canadensis* (Erxleben).

(*Marmota*, the Ital. name is *Marmotta*, from L. *mur*. (stem of *mus*, a mouse or rat) and *mont* (stem of *mons*, a mountain), hence a 'mountain rat'; *monax*, a monk, given because it is usually seen living a simple, secluded life, in a cell, fat, sleek, alone, and contented. L. *canadensis*, of Canada.)

*Mus monax* LINN, 1758, Syst. Nat., X ed. I, p. 60.
*Marmota monax* ELLIOTT, 1905, Check list N. A. Mam., F. M., pub. 105, Zool. Ser. VI, p. 119.
TYPE LOCALITY.—Maryland.

*Glis canadensis* ERX., 1777. Syst. reg. an. I, p. 363.
*Marmota monax canadensis* ELLIOT, 1905, Check List N. A. Mam. Field Mus., pub. 105, Zool. Ser. VI, p. 120.
TYPE LOCALITY.—Hudson Bay.

FRENCH CANADIAN, *le Siffleur; la Marmotte du Canada.*
CREE, *Wee-nusk'*; also *Wee'-nee Suk'-ah-tip* (on Athabaska).
OJIB. SAUT. & MUSK., *Ah-kuk'-wah-djees.*
CHIPEWYAN, *Thel'-lee-cho* (big Ground-squirrel).
YANKTON SIOUX, *Hob-cush-a.*

Richardson derives 'Wood-shock' from the Cree '*Otchoek*,' sometimes written '*Wejack*,' but applies the name to the 'Fisher.'[1] 'Thickwood Badger' was given in the North-west to distinguish the animal from the true or prairie Badger. 'Siffleur' or 'Whistler' is from its note; and it is. of course, a true 'Marmot.'

[1] F. B. A., 1829, I, p. 53.

The Genus *Marmota* (Frisch., 1775) comprises large rodents that have: form, stout; tail, short and bushy; ears, very short; thumb on front paws, a mere knob, with a nail, the other four fingers with claws; 5 well-developed toes on hind-feet; very small cheek pouches.

$$\text{Teeth: Inc. } \frac{1-1}{1-1}\text{; prem. } \frac{2-2}{1-1}\text{; mol. } \frac{3-3}{3-3} = 22$$

In addition to the generic characters the Canada Woodchuck has:

Total length, about 24 inches (610 mm.); tail, 5½ inches (140 mm.); hind-foot, 3 inches (76 mm.). SIZE

Weight of adult, 9 to 10 lbs. I have seen an adult female that weighed only 3 lbs.

Above, yellowish brown, with pepper-and-salt effect made by the white tipping to the long blackish hairs; head, dark brown, becoming *whitish on the cheeks and sides of muzzle;* paws, nearly black; below generally, brown, but tinged strongly with orange, especially on the legs. Tail, blackish brown, with some white tipping to the long hairs. In Minnesota specimens, the black of the crown reaches far below the eyes; in New England specimens it does not. COLOUR

The near neighbours of *monax* may be thus distinguished from it:

*M. caligatus* Eschscholtz, is a much larger and in general of whitish gray, with black feet and crown; the warm tints confined to the tail and rear.

*M. flaviventer* Aud. and Bach., is much like *monax* but yellower below; its whole face is blackish brown, becoming abruptly white on chin and lips; its throat very dark chestnut, sharp against the white of the chin.

*M. dacota* Merriam, is larger and of a general golden colour, with black crown and face and brown tail; its white chin recalls *flaviventer.*

The following races of *monax* are recognized:

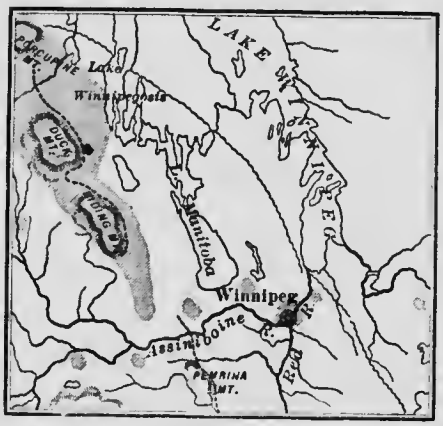
*monax* Linn. This, the typical form, is rather larger and much redder than *canadensis*.
*canadensis* Erx., as herein described.
*ignavus* Bangs, like *canadensis*, but darker, and with shorter, broader skull.

Black freaks or melanisms are common among Woodchucks. I have seen two from near Toronto, Ont., two from St. Johnsbury, Vt., one from St. Louis, Mo. I have also seen a single albino or white freak from St. Johnsbury, Vt. These Vermont specimens are in the Fairbanks' Museum.

## Life-history.

RANGE

The map shows that most of Manitoba is within the range of the Canada Woodchuck; and yet it seems to be rare in most of the Province.




Map 22—Distribution of the Woodchuck in Manitoba, so far as ascertained

D. Nicholson tells me that during twenty-five years' experience he has seen several about Morden, and had four brought to his taxidermist shop. Hine saw two that were taken near Winnipeg, but considers them very rare in that locality. About Ingolf I was told that Woodchucks were found, but were far from common. G. H. Measham says that at Big Ridge, near Shoal Lake, they are occasionally taken, and at McGregor they are not uncommon. C. C. Helliwell heard of one killed on the Souris, north of Turtle Mountain, in 1900.


**MAP 23—RANGE OF THE WOODCHUCKS OF NORTH AMERICA.**

This map is founded chiefly on the published chart of the U. S. Biological Survey (Doc. 132, Senate, 1907) and on the records by R. MacFarlane, J. Fannin, E. W. Nelson, W. H. Osgood, E. A. Preble, C. Hart Merriam, J. A. Allen, D. G. Elliot, S. N. Rhoads, O. Bangs, Audubon and Bachman, C. H. Townsend, E. T. Seton, *et al.*

It must be considered diagrammatic and provisional. All the North American species and races are entered.

***Marmota monax*** **(Linn.), with 3 races,** ***Marmota caligata*** **(Esch.),** ***Marmota olympus*** **(Merriam),** ***Marmota flaviventer*** **(Aud. & Bach), with 2 races.** ***Marmota dacota*** **(Merriam),**

There is in Calder's collection a Woodchuck that came from Brandon Hills. Darbey writes me that he has never known the species near Winnipeg, but has seen two skins that were taken on Riding Mountain, and in 1890 he killed a large Woodchuck near Fort Elice. At Carberry I secured a specimen in the spruce woods, June, 1884, and I knew of two others that were killed at the same place. H. C. Nead, the taxidermist at Dauphin, tells me that it is found in that region, but is rare. J. J. G. Rosser considers it not uncommon about Winnipegosis and quite plentiful in Duck and Porcupine Mountains, especially about Pelly.

ENVIRONMENT

This is a forest animal, but prefers the edges of sunny openings rather than the gloomy depths, and at all times is found in high, dry situations. Wooded clay banks and gravelly ridges are much to its taste, and its distribution in Manitoba will be found dependent on their presence.

POPULATION

During my early days in Ontario, Woodchucks were considered common, but I do not think that there were 20 on our hundred-acre farm.

Walter L. Hahn states[2] that in Porter County, Indiana (400 square miles), where Woodchucks are very abundant, about 1,400 had been killed each year for the five years ending 1905, without appreciably reducing their numbers.

In Lewis Co., N. Y., 33 were captured in one large meadow during a single season by Drs. Merriam and Bagg.[3] In Manitoba I doubt if the entire Woodchuck population is more than a few thousands.

INDIVIDUAL RANGE

The home-range of the individual is very limited in one sense. The tracks and the destruction around the doorway of a Woodchuck's den show clearly that ordinarily it does not go more than 100 yards from home. But a time comes when it needs a change, and it sets out to seek its fortune elsewhere,

[2] Mam. Kankakee Valley, Proc. U. S. N. M., 1907, p. 458.
[3] Mam. Adir., 1884, p. 249.

going perhaps a mile or more, before it finds a location that suits its taste and is without an occupant of its own tribe.

MIGRATION

This is the only migration known among the Woodchucks; it may occur at any time of the day or night, or at any season except in winter.

In the grounds about my house the species is well represented, but I never see a Woodchuck two years in succession at the same hole. A new den each year seems to be their plan of life—an annual, doubtless a spring, moving.

BURROW AND DEN

As will be seen, the existence of the Woodchuck depends on its den or burrow. This is either in the woods or on the rolling pastures, but by preference on the border land between. Two principal types are described[4] by Merriam; "the first slopes at a moderate angle from the surface, and has a mound of dirt near its entrance; the other is more or less vertical for several feet * * * immediately below the surface, and no loose earth can be found in its neighbourhood."

These two I have often examined. The difference is that, that with the earth pile was dug from the surface down; that without earth pile was dug from another burrow up to the surface.

The best descriptions of Woodchuck burrows that I know of are by W. H. Fisher, of Cincinnati, Ohio. My own observations, as far as they go, corroborate those of Fisher; therefore I shall give a digest of his admirable paper.[5]

In all, he investigated 9 burrows between September 20 and October 10, though not all in the same year. One of the simplest styles is shown in Excavation I (Fig. 125), the most complex in H. He does not say whether these were the work of families or of solitary males, of recent make or old.

The longest was H; it gave a total length, including all galleries, of 47 feet, 11½ inches. The shortest was I; its total length was 6 feet, 8¼ inches. The deepest point reached by any

[4] Mam. Adir., 1884, p. 246.

[5] Investigations of the Burrows of the American Marmot (*Arctomys monax*), by William Hubbell Fisher, Cincinnati, Ohio, U. S. A. From the journal of the Cincinnati Society of Natural History, July–October, 1893. Vol. XVI, pp. 105–123. Plates VI to X.

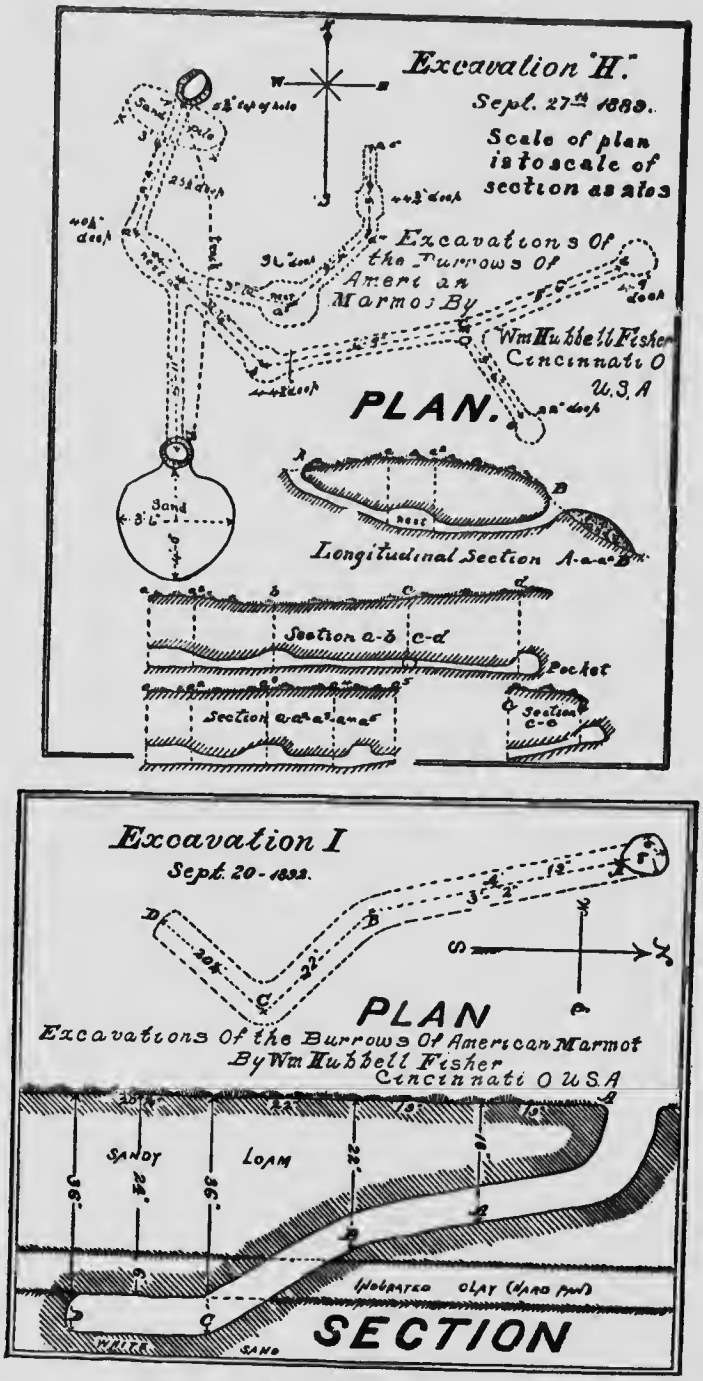



FIG. 125—Plans of Woodchuck burrows.

Reproduced from W. H. Fisher's paper in Journal of Cincinnati Society of Natural History 1893. H was the most complex, I the simplest one found.

was 49 inches down. The burrows at the entrance were usually about 1 foot by 6 inches, but sometimes much larger; in one case very near to 24 inches one way. But always they are speedily narrowed to a diameter of 6 or 7 by 4 or 5 inches. Most had two, some three, entrances; a few had but one. Most had indications of at least one earth pile at the doors. A few had no earth pile, though there were signs of its former existence in the increased vegetation. One only had earth piles at all doorways, of which, however, it had but two. Some had a doorway concealed under some shrubs and in bushes; in each case this seemed to be the original door by way of which all the earth was carried out.

The largest pile was 4 feet 9 inches by 4 feet 11 inches by 9 inches high. These mounds were evidently used as posts of observation.

I have long held the theory that many animals will plug their burrows behind them to elude pursuit; Hubbell's observations on this point are conclusive. He thus relates his first investigation:

"One afternoon, the farmer, while ploughing over a field, high and level, in which corn had been raised, and from which the plough-share threw up the nests of Jumping-mice, informed me that a Woodchuck had a few minutes previous gone down into a hole by a stump, standing far out in the field. I summoned our faithful Joe, and each of us, armed with a shovel, proceeded to the stump. Here we began to dig, following down the hole. The latter ran under the stump, ramified a little, and then ran horizontally some two feet below the surface for about five feet, and then descended rapidly nearly two feet more in an additional length of some three and a half feet. Not a sign did we see of our much-sought-for Woodchuck."[6]

* * * * * * *

"The next day * * * I found at the side of the ditch and on a level with the passage, which was about two feet below the surface, a new hole. Aha! Here it was the Chuck

[6] *Loc. cit.*, p. 106.

had hidden. But how was it that we saw no traces of this hole when digging? When we left the ditch the place where this hole was was a part of one continuous wall of sand, without break or check to indicate that any hole was here."[7]

More evidence was secured in another hole that he followed September 30: "At 12 o'clock [he says], just one-half hour after the digging began, we came upon a live, robust Marmot, ready to do and die in his own defense. After reaching him, we watched him while a party was sent for a canvas bag. Meantime the fellow gave us a specimen of his ability by filling up the hole in front of him and thus disappearing from view. The time occupied in this operation was one minute."[8]

Conclusive evidence was furnished by an individual that he dug out on October 10. This one was watched again and again plugging the hole behind him when exposed by the diggers. In half a minute he could completely close it with earth so hard packed as almost to defy discovery of the tunnel. In this we see the explanation of so many Woodchucks escaping underground even from enemies that were able to follow them.

NEST

Most of the burrows opened by Hubbell had one enlarged nesting chamber more or less lined. A few had none; one only, the largest and longest (see H in Fig. 125), had six. This is the home nest of the individual and the nursery of the young.

SANITATION

As soon as an animal develops an elaborate home it must develop sanitation or suffer from disease.

Some creatures that fear neither weather nor foes, go forth into the air to drop their dung. There are many times when the Woodchuck cannot well do this, and to meet the difficulty it has invented a dry earth closet. Merriam points out that the main gallery of the Woodchuck's burrow commonly terminates in a little pocket, where its excrement is found buried.

From time to time this is removed, and "the mounds in front of the large holes frequently, if not generally, contain

[7] *Loc. cit.*, p. 107.

[8] *Loc. cit.*, p. 115.

accumulations of the animal's excrement, and in one case I removed fully half a bushel from a single mound."[9]

These midden-heaps of the Woodchuck are likely to furnish much light on the history of the individual, just as the midden-heaps of the Paleoliths are our principal histories of their makers. Every scrap of bone or undigested food will tell a little story to those who can read such things.

In a nest of the long burrow, Fisher found the skull of a Woodchuck.

"This find appeared to contradict the assertion by a farmer that Marmots would never live in a burrow where a Marmot had died."[10]

MATING

All the evidence at hand goes to show that the Woodchuck pairs. It is the testimony of nearly all observers that one or else two old Woodchucks (never more) are found in each home den. Usually two are seen in early spring, and when the allurements of the love season are over, the male—in most cases—goes forth to other scenes, though probably *not* to another mate. This is an inferior but popular style of monogamy. Pleasant variations of it are occasionally seen. Some Woodchuck fathers actually seem to stay, or return home, and divide with the mother the care of the young.

The mating ceremonies are believed to take place about the middle of March, that is, as soon as the waning of winter sets the Woodchucks free to assume active life; and the tracks on the snow—if there be any at this time—show that the males make many and long journeys from home are indeed greatly concerned on some special and important business on hand—what can it be, if not the all-important business of perpetuating their race?

There is, however, some evidence that the pairing takes place in the fall. First, it is often the recurrent sex-instinct that quenches the mother love, and drives the young forth to begin life for themselves; and the young Woodchucks do quit home in late summer and go forth to seek their fortunes else-

[9] Mam. Adir., 1884, p. 246.

[10] *Loc. cit.*, p. 115.

where. Second, the species is a profound hibernator, and many, if not most, hibernators, copulate in the autumn. This, indeed, seems to be a rule among hibernators whose gestation exceeds six weeks.

YOUNG

The young are born in the underground nest, about the end of April. They number from 2 to 8, but are usually 4 or 5, and like most rodents, are at birth very undeveloped, and exceedingly small.

As they do not usually come out of the den till mid-June, it is probable that they are blind till a month old, and not strong enough to venture forth till six or seven weeks after birth.

At this time, if at all, the father comes back to his family. I have heard of several cases; the most detailed was described to me by Robert M. Harrison, of Grand Rapids, Mich. He says, that on July 6, 1905, at a farm three miles west of the city he saw and captured at one hole 2 old Woodchucks and 5 young ones. He saw 8 young ones late in the afternoon; the smaller old one was with them. He several times saw the mother come out and look around, then utter a sort of growl that brought the young out.

One day at five o'clock in the morning he saw both parents with the 8 young out together feeding. The mother came out first and called; the father came out, then went back and brought out all the young ones. When they found that he was near, the mother—that is, the smaller parent—uttered a low groan, that sent the family down below. They often chattered, but he never heard them whistle.

The young begin to eat solid food as soon as they are old enough to come forth and find it. They do not usually go far from the burrow at this time, but Audubon and Bachman record[11] a case which also gives interesting light on the devotion of the mother:

"Whilst hunting one day (says a good friend of ours, when we were last in Canada), I came across a Woodchuck * * * with a litter of 6 or 7 young by her side. I leaped from my horse,

[11] Quad. N. A., 1849. Vol. I, p. 21.

feeling confident that I could capture at least one or two of them, but I was mistaken; for the dam, which seemed to anticipate my evil designs, ran round and round the whole of her young 'Chucks,' urging them toward a hole beneath a rock, with so much quickness, energy I may call it, that ere I could lay hands on even one of her progeny, she had them all in the hole, into which she then pitched herself, and left me gazing in front of her well-secured retreat, thus baffling all my exertions."

By the end of August the young Woodchucks are nearly full grown, large enough to think themselves able to care for themselves, and the family breaks up. At least, the larger number scatter to burrow on their own account.

Audubon and Bachman mention that "when the young are a few months old, they prepare for a separation, and dig a number of holes in the vicinity of their early domicile, some of which are only a few feet deep, and are never occupied. These numerous burrows have given rise to the impression that this species lives in communities, which we think is not strictly the case."[11]

AUTUMN

Throughout the autumn, old and young are busied storing up food, not in warehouses or vaults that robbers might rifle, but in their own skins, as fat, that will keep them doubly warm till absorbed. Their winter nests also are warmly lined and placed far below reach of the frost.

About the last of September they retire for the season, and all investigations hitherto have proved that sleeping in each winter den there is either a solitary very young one or very old one, or else a pair—possibly the pair of last season, reunited as soon as it was the pleasure of the lady to reunite.

Exceptional weather may sometimes make the Woodchuck come forth again after its retirement, but the rule is otherwise. The Woodchuck is one of the country folks' 'Seven-sleepers.' Its torpor is indeed profound. Concerning its hibernation Audubon and Bachman write:[12]

"We are gratified in being able to communicate the following facts, related to us by the Hon. Daniel Wadsworth, of

[11] *Loc. cit.*, p. 23.

[12] *Loc. cit.*, pp. 20–21.

Hartford, Conn. 'I kept,' said he to us, 'a fine Woodchuck in captivity in this house for upward of two years. It was brought to me by a country lad, and was then large, rather wild, and somewhat cross and mischievous; being placed in the kitchen, it soon found a retreat, in which it remained concealed the greater part of its time every day. During several nights it attempted to escape by gnawing the door and window-sills; gradually it became more quiet, and suffered itself to be approached by the inmates of the kitchen, these being the cook, a fine dog, and a cat; so that ere many months had elapsed it would lie on the floor near the fire, in company with the dog, and would take food from the hand of the cook. I now began to take a particular interest in its welfare, and had a large box made for its use, and filled with hay, to which it became habituated, and always retired when inclined to repose. Winter coming on, the box was placed in a warm corner, and the Woodchuck went into it, arranged its bed with care and became torpid. Some six weeks having passed without its appearing, or having received any food, I had it taken out of the box, and brought into the parlour—it was inanimate, and as round as a ball, its nose being buried, as it were, in the lower part of its abdomen, and covered by its tail—it was rolled over the carpet many times, but without affecting any apparent change in its lethargic condition, and being desirous to push the experiment as far as in my power, I laid it close to the fire, and having ordered my dog to lie down by it, placed the Woodchuck in the dog's lap. In about half an hour my pet slowly unrolled itself, raised its nose from the carpet, looked around for a few minutes, and then slowly crawled away from the dog, moving about the room as if in search of its own bed! I took it up and had it carried down stairs and placed again in its box, where it went to sleep, as soundly as ever, until spring made its appearance. That season advancing, and the trees showing their leaves, the Woodchuck became as brisk and gentle as could be desired, and was frequently brought into the parlour. The succeeding winter this animal evinced the same disposition, and never appeared to suffer by its long sleep.'"

The Woodchuck sleeps in complete torpor for weeks. But a popular superstition has it that each year, on the 2d of February, he comes out into the day. If he then *sees his shadow on the snow* he retires for another six weeks' slumber. If, on the other hand, no shadow is visible, he continues more or less active until spring. WOODCHUCK DAY

This superstition seemingly originated among the Negroes of the Eastern Middle States, and has this much of truth for foundation: The Woodchuck sometimes comes out as early as the first week in February. If at that time the sun shines brightly on the snow, it means frosty weather, and probably a late spring. On the other hand, *no snow* and low hanging rainclouds, are evidence of an open winter, and that fosters an early activity on the part of the Woodchuck.

The spring awakening of the Woodchuck seems to have little to do with any of the essentials by which it is supposed to be guided, namely, weather and food. Merriam says:[14] "The remarkable circumstance has already been noticed that the Woodchuck often retires to winter quarters, when surrounded by an abundance of food, and during the continuance of fine warm weather; but still more surprising is the fact that he generally emerges from his hole and tunnels to the surface while the ground is buried in snow to the depth of several feet, and when no green thing is to be found upon which he can feed. He not only comes to the surface, but makes long journeys in various directions over the snow covered land, and is apt to continue these apparently aimless pilgrimages night after night until the fast-melting snow enables him to reach the much-coveted grass, which has been kept fresh and green in places by its heavy covering." SPRING TIME

Of course this is where its great store of fat is of service. Doubtless this is absorbed during the weeks of scarcity in the early spring.

The warm, bright days with greening grass come on, the cold and the snow are gone, and the Woodchuck now sits at

[14] Mam. Adir., 1884, p. 242.

the door of its cell, enjoying to the full the good things of life, and *possibly* giving expression to it in a way that is worthy of happy, higher beings. Well-fed, unafraid, revelling in the warm sun, stretched prone or rearing back against a bank, its limp limbs drooped in joyous sloth, it rejoices in the good things of life, and yields, we believe, but have not yet shown, to the subtle sensuous thrill which stirs the hidden springs of song. True, I never heard from a Woodchuck any sound but the shrill, rattling whistle of alarm, which bids the foe keep off, or warns its distant neighbour of the foe, and the low growl or whine of mother and young, or the sound of menace made by its grating teeth. But we have a hint of what may yet be learned when we approach the philosophical "red monk" of the fields in a way that at length will win its confidence and open the secrets of its pleasant life.

THE SONG OF THE WOOD-CHUCK

The article that gives the hint is from the pen of Dr. A. Kellogg. "For the last forty years [he writes[18]] the fact of the common Maryland Marmot, or Woodchuck, being able to sing like a canary bird, but in a softer, sweeter note, has been quite familiar to myself and others, who could be brought forward as witnesses." He then speaks of a very young Woodchuck which he raised, and goes on to say: "It had a seat in the little high chair at the children's table full oft. Its earnest and restless concupiscent purr as it scented sweet cake and fragrant viands was wonderful. At length it became as familiar as the family cat, and finally burrowed under the doorstep. My impression is now, and always has been, that it was a female. I used to watch the pet very closely to see how it sang, as children are apt to do. There was a slight moving of nostrils and lips, and consequently whiskers, with an air unmistakable happy or serene enjoyment. I question much if this is altogether unknown to others, *always excepting naturalists*."

ALL HOURS

At one time I considered the exemplary Woodchuck strictly a creature of daylight, sunlight preferred. But many

[18] Singing Maryland Marmot, Am. Nat., June, 1872, pp. 365–6. Quoted by Merriam.

recent observers have discovered evidence that in warm weather the Woodchucks come out by night, especially by moonlight, and are partial to a twilight ramble.

ON THE GROUND

The Woodchuck is but a slow creature. If surprised in the open it knows that its only hope is to get back to its den, and this it proceeds to do with vigorous bounds; but at its best it will be overtaken by dog or boy if far from home. From the latter it may escape by dodging—but the travelling Woodchuck found by a dog is quickly gathered to its fathers.

Nevertheless the creature can climb. This is a perennial subject of discussion in the sporting magazines. And yet every naturalist who has written fully on the Woodchuck within a hundred years, has discovered and announced that the Woodchuck can, and does occasionally, climb a tree. It does not go up with the bewildering quickness of a Squirrel, r t even with the steady certainty of a Coon, nor is it so sure of itself as the logy Porcupine, but up it certainly does go, as scores of observers have testified.

The Rev. C. A. Richmond, of Albany, N. Y., writes me on December 31, 1901: "In October, 1892, I was out with an old hunter after deer. We were in the thick woods about the headwaters of the Alleghany River, in McKean County, Pa. We were on our way home and had nearly reached a small clearing, when we saw the hound give chase to an animal, which, after running a few yards, climbed up a tree and crawled out upon a small branch.

"As we came under the tree we saw the Woodchuck, for it was an ordinary everyday Woodchuck, clutching the branch for dear life, and the dog giving tongue and leaping furiously in the air. The Woodchuck was evidently not at home, and in a few moments fell to the ground and was instantly dispatched by the hound. It was a full-grown male, unusually dark in colour. The tree was a soft maple, the trunk about fourteen inches in diameter, perpendicular, and of the average roughness. The branch was perhaps six inches in thickness.


FIG. 126—Woodchuck. (*M. monax canadensis.*)

Upper part is series of tracks made at Cos Cob, Conn. *a* is track of right fore-foot; *b* of right-hind. The series *d* shows track in walking; *e* and *f* show tracks speeding.

*g* is right fore and *h* right-hind of a small female (natural size). *i* is the same individual taken on Athabaska River, May 28, 1907.

"The old hunter and I sat down on a log and discussed this Woodchuck question in all its many phases. The incident did not surprise him, as it did me."

I have never seen a Woodchuck up a tree, but I have seen one run along the top of a high rail fence in Muskoka, and am satisfied that Merriam very correctly summarized the case so long ago as 1881:

"Woodchucks [says he[16]], when molested, and particularly during their youthful days, often climb up ten or twelve feet in shrubbery and young trees that abound in low branches, and not infrequently scramble up the trunks of large trees, which have partially fallen or slant sufficiently to insure them against slipping. Occasionally, especially when hard pressed by a fast-approaching enemy, they ascend large erect trees whose lowest branches are some distance from the ground. But, in order to do this, they must take advantage of the impetus of a rush, for they cannot start slowly upon the trunk of an upright tree and climb more than a few feet without falling. Neither can they stop and go on again before reaching a branch or other resting place."

SWIMMING

In the water, from all accounts, the Woodchuck is far from being at home. It can swim, but poorly; and wisely eschews the element wherein it is at such a disadvantage.

So far as I know, it does not even drink; but, like the Rabbit, satisfies its bodily need for liquid with the juices of food-plants, aided, no doubt, by their sprinkling with rain or dew.

FOOD

Grass and clover are believed to be its favourite foods, but it will eat almost anything that a pig will eat. I never caught one feeding on flesh, but suspect that, like most rodents, it adds an occasional meat variant to its diet.

Long after the above was written the following instance was related to me by Ernest O. Leighly, of Hartville, Ohio:

Last spring he was near an old mill-dam on Henlines's farm, at Bolivar, Tuscarora County, Ohio, when he came on a

[16] F. & S., July 7, 1881, p. 453.

mother quail with a large brood. They scattered and hid at her order and she tried to lead him away, but he stood still, and at length found two sitting on the bare ground before him. He picked one up; it struggled for a time, but became quiet in his hand. He waited half an hour. The mother had flown away down the valley and now came cautiously back. He was quite still. The mother gave a low call once or twice, then gradually the young reappeared and heads popped up here and there from the leaves, and soon they all ran to her, and were led away. When she was out of sight he quietly set down the one he had in his hand. It ran after the mother, but he moved slightly and this scared the chick. It scrambled up a bank, found a Ground-hog's hole and ran in there. A moment later the Ground-hog came out licking his lips and looking for the rest of the quail.

This incident is not conclusive, but is suspicious. We must, however, admit that it is unfair in any case to judge of a race by its degenerates.

USE TO MAN

The flesh of the Woodchuck is excellent eating if properly prepared. Its pelt is not to be desired as fur, but the leather and the skin are in demand for mit-facings and whip-lashes.

In boyhood days we used to prepare the leather thus: Wrap up the raw, fresh pelt with plenty of hardwood ashes on its flesh side. After two or three days the hair slips off, or can be scraped off. Soak the skin then for a week in soft soap, and work thoroughly till it dries soft. Failing the soap, a strong brine of salt and alum will serve.

When Woodchucks are over-numerous they become a nuisance, not only by destroying the crops near their dens, but by digging holes that endanger the legs of the horses and necks of the riders. In such cases a skilful trapper can soon thin them out, or an expert rifleman may clear the farm in a week of two; or finally—and most drastic—by putting the poisonous bisulphide gas down each den, one can mercifully and effectually, send the occupants to a sleep from which they do

not awake. This plan was invented by the United States Biological Survey, and has proved most effectual.

But it is rarely that such measures must be resorted to, and when in reasonable numbers the harmless philosophic Woodchuck must commend itself to all who are interested in picturesque wild life.

THE WOODCHUCK'S FOES

My own experiences with the species in Manitoba have been but few. I knew it much better in Ontario and the Eastern States, where it continues in numbers, despite the efforts of farmers who do not appreciate the æsthetic beauties of its philosophic life—who are so bigoted, indeed, that they would rather kill one than lose a horse or an acre of clover.

In my early days about Lindsay, Ontario, the Woodchuck was the largest wild animal that entered into the lives of us boys. In the grain fields, still dotted with stumps, it found a homeland very much to its taste. With some great stump to stand guard over its doorway, its roots for posts to block all ruthless digging foes, its top to furnish a sunning place and observatory, each fat, contented Woodchuck lived—the happy lord of the small domain about its door. At times, though rarely, the long rifle of the grown-ups would end the career of some rack-renting Chuck that wasted by overtaxing its little manor; or perhaps the Fox, who prowled early, snapped up the Woodchuck that prowled late. But upon the whole it had little to fear from any but the boys and their ever-present auxiliary, the house dog. Many times, as I now recall with over-long delayed remorse, we played a boyish, fiendish part. That same old dog, by cutting off some Chuck afield from its fortress, would drive it into a treacherous hollow log or burrow just begun. Here it needs must turn to fight—for the Woodchuck, though wisely ready ever to retreat if possible, will *never surrender*. No, it is a fighter, and fight it will, with the courage of a hero, both dogs and boys innumerable; whistling its shrill alarm, desperately grating its teeth till their splinters fly, seizing on anything, dog or stick, that comes in reach; defying all, till the brutal twisting-stick

entangled in its fur gives it the unexpected jerk that throws it on the mercy of foes that know no mercy; a scuffle then—a crunching of bones—and the Red Monk's life has ended in a tragedy.

But these were individual cases. The race is far indeed from ending. In those, that now I call my Woodchuck days, the Bear, the Deer, the Beaver, the Wolf, and even the Porcupine were gone, but the Woodchuck throve, as still it does. Without the cunning, the speed, the strength, the armament, or the prowess of any of these, it still has a secret better than all that gifts it with power to hold its own. The secret of its life and the sum of its wisdom is this—keep close to the ground. In time of fear it flies to Mother Earth. This, indeed, is wisdom, for our wise men tell us all flesh is earthborn Anteus-like, that nations die as surely as they quit the soil. Here man himself might learn a lesson; while others pass away, the Woodchuck's race yet lives and thrives and holds its ancient range.

## XV.

## Northern or Canadian Flying-squirrel.

*Sciuropterus sabrinus* (Shaw).

(Gr. *Skiouros*, a squirrel; *pteron* a wing; L. *sabrinus*, of Severn River.)

*Sciurus sabrinus* SHAW, 1801, Gen. Zool., II, p. 157.
*Sciuropterus sabrinus* BANGS, 1896, Proc. Biol. Soc. Wash., X, p. 162.

TYPE LOCALITY.—Severn River, Keewatin, Canada.

FRENCH CANADIAN, *l'Asapan; le Polatouche; l'Ecureuil volant.*
CREE, *Sha-ka-skan'-da-way-o.*
OJIB. & SAUT., *Sha-ka-skan'-da-way* ( = flying downward).
CHIPEWYAN, ? *Thee-chin Nok-ky'-ay.*
YANKTON SIOUX, *Poh-kahn.*
OGALLALA SIOUX, *Psin'-cha.*

The genus *Sciuropterus* (F. Cuvier, 1825) comprises nocturnal squirrel-like animals, with large eyes and ears, clad in very soft velvety fur, with tail flattened, and with a *flying membrane between the legs* on each side, supported and enlarged by a spur developed from the pisiform bone; the teeth are:

$$\text{Inc. } \frac{1-1}{1-1}; \text{ prem. } \frac{2-2}{1-1}; \text{ mol. } \frac{3-3}{3-3} = 22$$

In addition to the generic characters the Canadian Flying-squirrel has:

SIZE Length, 12 inches (305 mm.); tail, 6 inches (152 mm.); hind-foot, 1½ inches (38 mm.).

COLOUR Its general colour above is soft fawn-brown, much broken with the lead-coloured under-fur showing through, especially on the upper side of the wings. Toward the edge of these flaps

the colour becomes a very dark blackish brown, which forms a band and ends sharply against the white of the under sides.

The under parts of the animal are white, but *next the body the fur is a dull leaden gray.* The under side of the tail is more or less tinged with fawn colour, and there is a blackish ring around each eye.

In winter it is much browner above and tinged with yellow beneath.

Female similar.

When seen alive it looks like a buff and slate-coloured Squirrel with very solid, flat tail, and white or creamy breast.

From its near relatives in America it may be distinguished thus:

*sabrinus* Shaw, is about 12 inches long, of which the tail is 6; it has hind-foot 1½. *Fur on breast white, but ashy at roots.*[1]

*volans* Linn., is much smaller, having, l., 9 in; t., 4; hft., 1¼. *Fur on under parts pure white to roots.*

*alpinus* Rich., somewhat like *sabrinus*, but larger and grayer. Size, l., 12 in.; t., 5; hft., 1½.

*yukonensis* Osgood, largest of all with very long tail; it is darker than the others, and tinged fulvous on under parts. Size, l., 14; t., 7; hft., 1⅝.

The following races of *sabrinus* are recognized:

*sabrinus* Shaw, the typical form.

*macrotis* Mearns, smaller, with longer ears and redder fur.

*silus* Bangs, smaller and much darker than *sabrinus*.

*makkovikensis* Sornborger, a large and very dark form.

### Life-history.

RANGE

The type was described from Severn River. My specimens, taken at Rat Portage (now Kenora), Winnipeg, Morden, and Carberry, are true *sabrinus*, as doubtless are all within

[1] While this was in press E. A. Preble's N. A. Fauna, No. 27, appeared; in that the author claims that in the Mackenzie Region *alpinus* grades into *sabrinus*, p. 57.


**MAP 24—RANGE OF THE NORTH AMERICAN FLYING-SQUIRRELS.**

This map is founded chiefly on the records by J. A. Allen, Audubon and Bachman, C. Hart Merriam, John Richardson, S. N. Rhoads, C. H. Townsend, John Tannin, A. P. Low, O. Bangs, W. H. Osgood, V. Bailey, Edward A. Preble.
It must be considered diagrammatic and provisional. All the North American species are entered.

*Sciuropterus sabrinus* (Shaw), with 4 races,
*Sciuropterus volans* (Linn.), with 2 races,
*Sciuropterus alpinus* (Richardson), with 10 races,
*Sciuropterus yukonensis* Osgood.

Manitoba. The species is reported plentiful at all of the above-named places, except Morden.

Rosser writes that it is common at Lake Winnipegosis.

Russell obtained a single specimen at Grand Rapids where it is very rare.[2] Preble got several hunter's skins from Norway House.[3] Professor Robert Bell says:[4] "It is common around Norway House. Occurs about Oxford House and Nelson River House on the Churchill River."

Audubon and Bachman say:[5] "We found this interesting Flying-squirrel in abundance at Quebec, and many of them were offered for sale in the markets of that city during our sojourn there. It appears, indeed, to take the place of the common small Flying-squirrel of the United States (*P. volucella*) in lower Canada, where we did not observe the latter east of Montreal."

It is recorded for New Brunswick,[6] Nova Scotia,[7] Prince Edward's Island,[8] Big Island on Mackenzie River, Fort Liard, Isle à la Crosse, and Lac du Brochet. I got a specimen at Fort Resolution in 1907.

Thus the northern Flying-squirrel is a species of the true Canadian zone east of the Rockies. It is to be looked for in all the wooded parts of Manitoba, though apparently most abundant in the heavily timbered part of the south and west.

ENVIRONMENT

I have never seen or heard of Flying-squirrels away from large timber whose hollow trunks or woodpecker holes afford its favourite nesting place. It is so strictly dependent on the woodpeckers for its tenements that it will not be found where no woodpeckers are.

[2] Explor. Far. North, 1898, p. [illegible]
[3] N. A. Fauna, No. 22, 190[illegible] 44
[4] Rep. Prog. Can. Geol. Surv. 1882-3-4, A[illegible] II [illegible]
[5] Quad. N. A., 1849, Vol. III, p. 203
[6] A. L. Adams, Field and Forest Rambles, 187[illegible]
[7] J. B. Gilpin, Trans. Inst. Nat. Hist. Nova Scotia, 1869, Vol. II, p. [illegible]
[8] C. B. Bagster, Pr. Ed. Id., 18[illegible] p. 88
[9] Mamog. Rodentia—Sciuridæ. A. Allen, 1877, p. 662.
[10] R. MacFarlane, M[illegible] N. W. T. Proc. U. S. N. M., 1905, p. 749.

I have no direct evidence on the home-range of this species, but analogy with other Squirrels and the absence of any migratory habit lead me to believe that the Flying-squirrel is content with a domain of two or three acres. HOME-RANGE

In my Connecticut home woods I have more than once found three Flying-squirrel (*volans*) nests within a radius of fifty yards. This instance sheds some light on the creature's abundance—three families within two acres; and therefore I should say that here the Flying-squirrel is more abundant than the Red-squirrel, and yet is rarely seen. Its secretive nocturnal habits lead many to believe that it is not found in their locality, even though it may be the most numerous of its group. ABUNDANCE

I never knew of more than one family together in the nesting time, but in December, 1882, I found 9 adults living in one stub at Carberry. They were so close together that a rifle ball fired by my companion at the stub below their hole killed 4 and wounded another of the 9. They were undoubtedly profiting by each other's company for warmth, therefore this animal is somewhat sociable. The kindred species is well known to nest in colonies where some specially favourable spot is discovered. SOCIABILITY

The voice of this species is said to be like that of *volans*, which is a prolonged squeak not unlike the complaint of a red-eyed [illegible] whose nest is threatened. VOICE

My observations on *volans* tend to show that that species pairs, and that the male takes an active interest in the young. I have not been able to watch *sabrinus* at the season of reproduction, but analogy prepares one to believe that in domestic matters it is as good as its near relative. MATING

The usual nesting place is a deserted hole, but any hollow tree will serve. NESTING

The young number from 3 to 6 and are born [illegible] last of April.

A female Flying-squirrel taken at Winnipeg by E. W. Darbey, on April 21st, contained 6 young ready for birth; 4 young found in a nest May 15th, are but little larger than the foregoing, each was 4¼ inches long, tail 1½, eyes not opened. They were probably three weeks or a month old. Dr. Merriam says[11] "June 18th, 1883, Dr. A. K. Fisher and the writer found the nest of a Northern Flying-squirrel at West Pond near Big Moose Lake. It was in the last year's nest of a three-toed woodpecker (*Picoides arcticus*) in a tamarack (*Larix americana*) and the entrance hole faced the east, about ten feet above the ground. On cutting down the tree the nest was found to contain three nursing young, not yet one-third grown; they were estimated to be about a month old. They were fed on condensed milk diluted with water, until we left the woods, and afterward on fresh milk and vegetables. One of them grew very rapidly, attaining nearly two-thirds the size of his parents by the 10th of July, when it was accidentally killed. They were all perfectly tame and acted much like the young of the common Flying-squirrel."

The devotion of the Flying-squirrel mother is touchingly set forth by Audubon and Bachman[12] in their account of a family of this species.

"This brood was procured as follows: A piece of partially cleared wood having been set on fire, the labourers saw the Flying-squirrel start from a hollow stump with a young one in her mouth and watched the place where she deposited it, in another stump at a little distance. The mother returned to her nest and took away another and another in succession until all were removed, when the woodcutters went to the abode now occupied by the affectionate animal, and caught her already singed by the flame of the fire, and her five young unscathed."

These with their mother were kept in confinement about four months and carefully observed.

Nursing was performed thus: "The younglings stood on the ground floor of the cage, whilst the mother hung her body

[11] Mam. Adir., 1884, p. 207. [12] Quad. N. A., 1849, Vol. III, p. 204.

downwards, and secured herself from falling by clinging to the perch immediately above her head by her forefeet. This was observed every day, and some days as frequently as eight or ten times." [Nevertheless we must not suppose that this is the normal attitude of all Canadian Flying-squirrels while nursing.]

"After some time a pair of the young were given away to a friend. The three remaining ones, as well as the mother, were killed in the following manner:

"The cage containing them was hung near the window, and one night during the darkness a rat or rats (*Mus decumanus*) caught hold of the three young through the bars and ate off all their flesh, leaving the skins almost entire, and the heads remaining inside the bars. The mother had her thigh broken and her flesh eaten from the bone, and yet this good parent was so affectionately attached to her brood that, when she was found in this pitiable condition in the morning, she was clinging to her offspring and trying to nurse them as if they had still been alive."

ENEMIES

Owls, Foxes, Martens, and Weasels are also to be numbered among the enemies of this gentle creature.

J. S. Charleson writes me that in January, 1905, T. S. Kittson shot a barred owl in Riding Mountain, Manitoba, and found in its stomach a Flying-squirrel.

Professor Macoun tells me that in British Columbia he once found the body of a Flying-squirrel in a trout.

HARDINESS

The hardiness of this merry night-prowler is such that, although it ranges north-west as far as the Arctic circle, it is not known to hibernate at any time.

As Merriam says:[11] "The mercury may indicate a temperature many degrees below zero, or snow may be falling in quantities sufficient to obstruct the vision, without seeming in any way to dishearten this merry adventurer. The last rays of the departing sun have scarcely disappeared from the western

[11] Mam. Adir., 1884, pp. 206–7.

horizon before the sombre shades that mark the approach of winter night commence to gather about the snowclad forest. Whether bright stars sparkle and shine through a frosty atmosphere, or heavy, leaden clouds overhang the scene, makes little difference to the Northern Flying-squirrel. He emerges from his warm nest, takes a hasty survey of the surroundings lest some wily owl should lurk hard by, glides silently to a neighbouring tree, and starts forthwith upon his nightly tour in quest of food and sport.

"Prompted either by hunger or curiosity, or by a combination of the two, he examines every unusual object with scrupulous care, and as one result is always getting into traps set for valuable fur—and this whether they are baited with mammal, bird, or fish. Indeed, the nature of the bait seems to be a matter of the most trivial consequence, as it often consists of Red and Flying-squirrels that have previously been taken in the trap. Even in this case another is as likely to be the next thing caught as any animal in the wilderness. Hence it happens that the trapper comes to look upon him as an unmitigated nuisance."

FOOD

Nuts are doubtless the favourite food of this bright-eyed night-prowler, but these are scarce in northern Manitoba, and spruce seeds probably are its mainstay. Moreover, there is every reason (except direct evidence) to believe that the Northern Flying-squirrel, like its relative, will eat bark, buds, fruit, seeds, nuts, insects, birds, or meat; is, indeed, perfectly omnivorous.

The following curious incident from the pen of "Prowler"[1] refers to the present species in New Brunswick:

"An odd experience befell Mr. Hunter during his return from a hunting trip to the settlement last fall. One evening he left a candle burning on the table in the Forty-Nine-Mile Camp while he went out to the hovel to look after the horses. To his surprise, when he returned to the camp the candle was not only extinguished, but could nowhere be found! Mr.

[1] Frank H. Risteen in Forest and Stream.

Hunter is not entirely free from the influence of these wild, weird legends peculiar to the backwoods of the Miramichi, especially those that relate to a fabulous monster known as the 'Dungarvon Hooper.' He lit another candle, however, and went out to attend to his team. When he came back he found that the second candle had vanished as mysteriously as the first! This was a severe blow to Mr. Hunter's peace of mind, but he pulled himself together and examined the camp thoroughly to see if some practical joker was not concealed about the premises. Finding no traces of anything in human form, he placed his third and last candle on the table, stood his axe within easy reach, and awaited developments. In a few minutes a Flying-squirrel hopped in the door, boldly mounted the table, and knocked down the candle, thus extinguishing the flame. He started for the door with his booty when Mr. Hunter took a hand and put the little rascal to flight."

SPEED, ETC. The few of this species that I have observed in daylight were far inferior to a Red-squirrel in activity. Audubon and Bachman mention[15] that at Quebec they heard of one that was caught alive by a soldier, who saw it in the Plains of Abraham and ran it down. But it is scarcely fair to judge the swiftness of a night animal by its speed in the dazzling day.

FLIGHT Its flight is like that of the common Flying-squirrel, but more extended. A Squirrel will shoot from a tree at an angle of about 30 degrees to the perpendicular trunk, but the angle increases as he goes downward. When he is twenty-five feet down, he is about the same distance from the trunk. Then he goes horizontally and at last a little upward, landing about as far from the starting point as he is below it.

AMUSEMENTS I have no record of this Flying-squirrel indulging in sociable amusements, but Audubon and Bachman[16] give an interesting description of a social gathering of the southern species that will at least show us what to look for in the present species.

[15] N. A. Quad., 1849, Vol. III, p. 203. [16] Quad. N. A., 1849, Vol. I, p. 218.

It was a calm evening in early autumn near Philadelphia as the naturalist sat in an ancient grove. About sunset the Flying-squirrels began to appear, until not less than 200 were in sight, sailing and coasting in air from tree to tree, scores at a time crossing and recrossing in all directions, apparently for the joy of flight rather than in an endless game of catch. When it was too dark for further observation the naturalist left them, but the party was still at its height.

SWIMMER

Unlike the day Squirrels, this species is apparently a poor swimmer. Merriam tells of individuals found drowned in sap buckets even, and so many specimens have been found drowned in cisterns and wells that one is forced to believe that it has bartered its power in the water, and to some extent its activity on land and in the trees, for its very limited mastery of the air. This no doubt accounts in part for the fact that in North America the Flying-squirrel is practically confined to the mainland.

PLATE XXXVII.—FAMILY OF BEAVERS.

(*Castor canadensis* Kuhl.)

The pair in the water are having a friendly nibbling match.

## XVI.

## Canadian Beaver.

*Castor canadensis* Kuhl.

(L. *castor*, a beaver; L. *canadensis*, of Canada.)

*Castor canadensis* KUHL, 1820. Beiträge Z. Zool., p. 64.
TYPE LOCALITY.—Hudson's Bay.

FRENCH CANADIAN, *le Castor.*
CREE, *Ah-misk'.*
MUSKEGO, *Ah-mik-kuk.*
OJIB, *Ah-mik'.*
CHIPEWYAN, *Tsa.*
YANKTON SIOUX, *Tcha-pa.*
OGALLALA SIOUX, *Chan-pah'.*

The Family *Castoridæ* contains but one genus, *Castor* (Linnaeus, 1758); the animals in this are very large rodents of aquatic habits. They have a massive skull of general squirrel-type; short ears; 5 toes on each foot; the hind-foot webbed; the claw of second toe on hind-foot is double (possibly for use as a comb and louse-trap); tail broad, flat horizontally, and scaly; the incisors of a deep orange colour.

$$\text{Teeth: Inc. } \frac{1-1}{1-1}\text{; prem. } \frac{1-1}{1-1}\text{; mol. } \frac{3-3}{3-3} = 20$$

In addition to these generic characters, the Canadian Beaver has: Length, 43 inches (1,092 mm.); tail, 16 inches (406 mm.), of which the scaly part is 9 inches (229 mm.) long and 4½ inches (115 mm.) wide; hind-foot, 7 inches (177 mm.).

WEIGHT

A male which I got near Great Slave River, July 11, 1907, weighed 30 pounds; this was considered of fair size. But I saw one weighed at 54 pounds; this was taken at Brokenhead, Manitoba, in 1886; and although Bachman gives[1] 61

[1] Quad. N. A., 1849, Vol. I, p. 353.

pounds as a maximum, W. R. Hine tells me that he weighed a 68-pound Beaver that came from Port Arthur.

COLOUR

The general colour is a deep, dark chestnut, darker on the ears, paler and grayer below; the cheeks pale brown, in contrast with the crown; the region above and at each side of the tail, cinnamon rufous or bright chestnut.

When alive the Beaver looks like a huge Muskrat, but the broad, flattened tail is a distinctive mark at all ages.

Both black and white freaks are found. The black pelts are worth about double the common ones; the white have no especial value.

The Canadian Beaver differs chiefly from that of Europe in being much larger and in having shorter nasal bones; these in the European measure *considerably more than one-third* the distance between the incisors and the occipital crest, and in the Canadian *about one-third*.

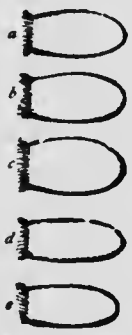


FIG. 127—These diagrams (except *a*) are from the descriptions and do *not* agree well with actual specimens.

The following races of *canadensis* are recognized:

*canadensis* Kuhl, the typical form, and smallest (*a*).

*carolinensis* Rhoads, larger than the type, with broader tail (*b*).

*frondator* Mearns, larger and paler than the type, with scaly part of tail shorter than twice the width (*c*).

*pacificus* Rhoads, largest and darkest of all, with scaly part of tail longer than twice the width (*d*).

*texensis* Bailey, very large and pale, with scaly part of tail longer than twice the width (*e*).

## LIFE-HISTORY.

Map 25 (page 449) shows that the Beaver ranged over all temperate America wherever there was wood and water. The outline may stand as its present habitat, but there are great blanks where it has been exterminated. The Mississippi


**MAP 25—RANGE OF THE AMERICAN BEAVER WITH ITS FIVE RACES.**

*Castor canadensis* Kuhl.

Founded chiefly on records by S. Hearne, J. Richardson, L. H. Morgan, Audubon and Bachman, R. Bell, D. G. Elliot, H. Y. Hind. S. N Rhoads, J. Fannin, E. W. Nelson, O. Bangs, E. A. Mearns, E. A. Preble, V. Bailey, F. M. Chapman, and E. T. Seton.
This map must be considered provisional and diagrammatic; the north boundary only is well established.

drainage is practically without Beaver to-day except at the headwaters of the streams that come from the north and west.

An interesting note on northern distribution is contributed by Dr. R. Bell, of Ottawa:

"On the west side of Hudson's Bay [says he[1]] the northern limit of the Beaver is rather south of the mouth of the Churchill River. A party of natives, who had found a family of Beavers some distance up the North River, between the Churchill and the Seal Rivers, related the circumstances as unusual for that latitude." The exact place is shown on the map by a cross a little west of the mouth of the Churchill River.

IN MANITOBA

One hundred years ago the Beaver abounded in every willow-fringed stream in Manitoba.

Alexander Henry's fur returns on Red River show the following account of Beaver skins.[2] (I give the modern names of the places):

| | | TOTALS |
|---|---|---|
| 1800–01 | Reed or Roseau River, 832; Park River, 643 | 1475 |
| 1801–02 | Grand Forks, 410; Pembina Mountain, 200; Scratching River, 130; Pembina River, 629 . . . . . | 1369 |
| 1802–03 | Pembina River, 550; Turtle River, 337; Red Lake, 85; Pembina Mountain, 30; Long Prairie, 150; Bear's Head, 254; Lake Manitoba, 116; Portage la Prairie, 229 . | 1751 |
| 1803–04 | Portage la Prairie, 219; Lake Manitoba, 131; Long Prairie, 100; Netley Creek, 520; The Forks (*i. e.*, Winnipeg), 356; Pembina Mountain, 182; Park River, 147; Pembina River, 211 . . . . . | 1866 |
| 1804–05 | Portage la Prairie, 294; Dog Lake, 648; Long Prairie, 184; Netley Creek, 350; White Mud River, 150; Pembina Mountain, 121; Salt River, 160; Pembina River, 829 | 2736 |

[1] Observ. Hudson's Bay, etc., Geol. Sur. Can., 1884., p. 49, App. 11.

[2] Alexander Henry's Journal, 1897, pp. 184, 198, 221, 245, 259, 281, 422, 440.

| | | |
|---|---|---|
| 1805–06 | Portage la Prairie, 116; Dog Lake, 103; Fort Wasp Mountain (?), 284; Grand Forks, 342; Pembina River, 776 . . | 1621 |
| 1806–07 | Portage la Prairie, 47; Middle Creek, 72; Sandhill River, Minn., 500; Pembina River, 565 | 1184 |
| 1807–08 | Netley Creek, 54; Pembina Mountain, 53; Grand Forks, 150; Pembina River, 339 | 596 |

An average of 1,587 a year for eight years from a region that was probably about 40,000 square miles, or about 1 to each 25 square miles, which is very low, even though there were several rival traders in the country collecting each an equal amount of fur. Henry abandoned the region on August 8, 1808, giving as a reason "the country being almost destitute of Beaver and other fur,"[4] etc.

In the early 80's Professor Macoun found Beaver very numerous in the Red Deer River country near Fort Pelly. In 1883 I found a few in Duck Mountain; in 1886 they were very scarce everywhere, even about such famous Beaver ranges as Lake of the Woods and the northern country generally. In the south-western parts of the Province they were unknown.

At the present time, owing to good game laws, they are on the increase.

NUMBERS

The average annual total of Beaver skins brought out by the American fur companies and the Hudson's Bay Company for the period between 1860 and 1870, when the fur trade was at its height, is, in round numbers, 153,000. But the natives used as many good pelts as they sold and seldom saved the skins of those taken in summer, though they killed for food the whole year round. So that 500,000 per annum is more likely to represent the aggregate destruction by man. This was at least doubled by other agencies, and the total annual death rate would reach not less than 1,000,000.

This evidently was more than they could stand, for their numbers steadily dwindled. A creature breeding as fast as a

[4] Henry's Journal, p. 256.

Beaver is supposed to add 20 per cent. per annum to its population, therefore 1,000,000, being somewhat over 20 per cent., would leave us about 5,000,000 as the possible original population.

Approaching the question in another way: In the late 50's L. H. Morgan explored thoroughly a Beaver country on the south-west shore of Lake Superior, immediately west of Marquette. It was 6 by 8 miles. In his map[5] of this he shows 63 dams and 39 lodges. Each lodge was estimated to represent 7 Beaver, that is, 273 in all, or 5⅔ to the square mile. But he mentions that only a portion of the lodges are shown on the map. A reading of the text leads us to believe that the number was double those marked, so that the ratio may have been 10 to the square mile.

From all accounts they were much more numerous in British America and in the Rockies, where, according to Prevost,[6] one trapper sometimes took 500 Beaver in the year. But they were much less abundant in the Plains country and Mississippi Valley proper, therefore 3 to the square mile is a reasonable estimate. The entire Beaver range is about 6,000,000 square miles, so that 18,000,000 might have been the total population. With these figures in view one is safe in setting the original Beaver population at not less than 10,000,000 in years of abundance.[6½]

The Hudson's Bay Company still draws 30,000 to 50,000 Beaver skins per annum from its territories, while rival traders secure at least a third as many. The destruction from various other causes will easily bring the total to 100,000 per annum, and since the species is able to stand it, I believe this drain to be not more than 20 per cent. of the present numbers, or about 500,000.

[5] In The American Beaver and His Works, 1868, a standard volume which must be the starting-point for all Beaver studies, p. 82.

[6] Quoted by Aud. & Bach., Quad. N. A., 1849, Vol. I, p. 354.

[6½] Dr. T. S. Palmer tells me that in the Algonquin Park, which is nearly 2,000 square miles, the Beaver population is estimated at 100,000, or 50 to the square mile. This represents maximum abundance. If there is no error in the figure, it means that my estimate of the primitive Beaver population in North America should be multiplied at least by 5. E. T. S.

ENVIRONMENT

Sluggish streams and small lakes with clay banks that are well-wooded with aspen and willow are the favourite haunts of the Beaver. Streams that run in rocky beds, or that dry up in summer, and large rock-bound lakes are equally shunned.

HOME-RANGE

The individual range is very small for so large an animal. When the pair have found and settled in a place that suits them they do not travel half a mile from home. When, on the other hand, an unmated Beaver is seeking a partner or a good location, he may wander for a dozen miles.

At Big Dam Lake, 40 miles east of Kippewa, Quebec, on September 21, 1905, I saw much Beaver work and learned from Mittigwab, the Indian guide, that all of this was the work of one old male Beaver that had lived here alone for two or three years. He wanders as much as 15 miles up stream from the Lake and 1½ miles from water, in search of company, especially in early spring when the ice first breaks up.

But his quest of a mate has been unsuccessful so far (1905), in spite of much advertising, for his mud-pies, with a dash of informational castor, were on every corner and point for at least 100 miles of shore.[7]

THE DAM

The dam is the most famous if not the most remarkable of the Beaver's undertakings. It is a vast structure of sticks, stones and roots, mud and sod laid across a running stream to back up the water, ensure the Beavers depth enough to protect them from their enemies all summer, and preclude all danger of its freezing to the bottom in winter. Morgan describes[8] two kinds, the open stick dam, faced with mud on the up-stream side and through the top of which the water trickles all along; and the solid-bank dam which is of earth and has an overflow at one place, where it is reinforced with sticks. I take it that the latter is simply a very old dam in which the sticks have rotted away from the main structure, and which the grass and growing stuff have solidified into a green bank.

[7] While this is in press I learn that his efforts have been rewarded, and he is now the happy patriarch of a large community.

[8] *Loc. cit.*, pp. 84–5.

The process of building, as nearly as I can tell from having seen many dams in all stages of growth, is as follows:

The Beaver and his wife first decide on the stream they propose to make into a pond—and it is always a small one, sometimes a mere spring. Morgan says[1] there is no instance known of a dam made across a stream having a greater depth than two feet at the site of the structure when the water is at its lowest level.

Next they select a place where the bed is hard clay or gravel, neither rock nor bog being desirable, and then begin

FIG. 128—Section of dam showing mud face up stream.

the dam by cutting and laying quantities of brushwood lengthwise in the deepest part of the stream bed, butts against the current. Each stick as it is laid is partly covered near the thick end with mud, stones, or clay to hold it down and the process carried on until the wall is raised, and would in sections be somewhat as shown in Fig. 128. But very rarely is a log used, and never a stake. By this time the original bed of the stream is blocked and the water flooding the shore calls for a still wider dam. At both wings it is spread, and here we see why the curvature against the stream is usually given.

The force of the current, especially at high water, is such that a new formation not *up* stream is surely swept away, thus the only correct plan is forced on the Beaver. Exceptions occur, but there is generally an obvious explanation. Some log, root, stump, or hillock was there to suggest a different line and offer assistance in making it safe.

Night by night the Beaver family works on the dam, piling up sticks and burying them in mud that is full of fibrous roots, or anchoring them down with stones of one to six pounds

[1] *Ibid.*, p. 105.

weight. The mud is got in the handiest way, the nearest place, that is, by diving to the bottom of the pond just above the dam. This has a tendency to enlarge the pond, so that in most cases it is widest and deepest just above the dam.

Thus it is seen that interlacing branches are the Beavers' safeguard against a washout, just as they are of human engineers who are forced to use wildwood material.

PERPETUAL VIGILANCE

The labour of the Beaver knows no end, no dam is ever finished or beyond need of repairs. Morgan remarks[10] that "dams begin to decay as soon as they are deserted by the Beavers and quickly thereafter disappear," which is surprising, considering their solidity, but evidently true, for the eastern part of America abounds in beaver-meadows, that is, beaver-pond bottoms, yet it is very rarely indeed that one sees traces of the dams that made them.

Two of my observations in contradiction of popular belief I was glad to have confirmed by Morgan:

1st. Among the scores of dams examined I never saw anything of the nature of a stake; that is to say, the Beavers do not drive stakes.

2d. Beavers rarely use logs. But once have I seen a log used. Morgan also mentions a case;[11] it was 1 out of 63, and that he considered accidental, possibly even that the tree fell on the dam, as it was a tree that had been blown down, not felled by Beavers.

It is easy to see how by perpetual work through generations the Beavers must in time turn the stick dam into the bank dam. For the sticks tend to decay and disappear except where replaced to fortify the overflow, and the rest of the dam must settle into a solid grass-grown mass.

The best opportunity I ever had to study Beaver work was in the Yellowstone Park in 1897. On Lost Creek, not far from Yancey's, where I stayed some months, was a family of Beavers with their usual contrivances to make a great pond of a very little stream. It was from this colony that Ellwood

[10] Am. Beaver, pp. 123–4.

[11] *Ibid.*, p. 110.

Hofer took the 3 Beavers sent to the National Zoo, and as nearly as we knew there were 4 more left in the pond. After spending two days with compass and measuring rod I produced the accompanying plans [12] of the Beaver's system of interior navigation (Fig. 129). The source of all the water was a spring or springs in the marsh above. This resulted in a tiny rill about 18 inches wide and averaging 3 inches deep across, and yet was so managed by this industrious family as to result in 13 ponds, the largest of which is 6 or 7 feet deep, 250 yards long, 80 yards wide, and covering about 3 acres.

This is made by the great or central dam, which is doubtless the oldest; for the aspens opposite were evidently the first to be cut away, the willows in the pond it makes are dead, the house is in its pond, and, finally, the fact of its superior size is some guarantee of its seniority. This dam is built largely of stone where it reaches the talus of the cliff, and entirely of mud and sticks where it runs into the marsh. During the first night of my visit the Beavers added a charred pole, 18 feet long and 5 inches thick—the only pole I saw used there. This dam is 301 feet long, 15 feet wide at base, 4½ feet high in the deepest place, measured to the bed of the stream just below the face; it contains between 100 and 200 tons of material. Such a structure must have taken years of labour and generations of Beavers to produce. Twenty-four yards below this is the second dam, most happily, if unwittingly, placed to relieve the pressure on the first.

Morgan describes [13] in detail dams which were 488 feet and 551 feet long.

The highest dam he had knowledge of is "about 35 feet long, 12 feet in vertical height, and with a slope of interlaced poles on its lower face upward of 20 feet in length." [14]

The largest dam, that is, the one which he is "well assured is not surpassed in magnitude by any other Beaver dam in North America," [15] is 260 feet 10 inches long, 6 feet 2 inches

[12] These I published in Recreation Mag., October, 1897, pp. 286-9.
[13] Am. Beaver, pp. 129 and 122. [14] *Ibid.*, p. 119. [15] *Ibid.*, pp. 99 and 97.

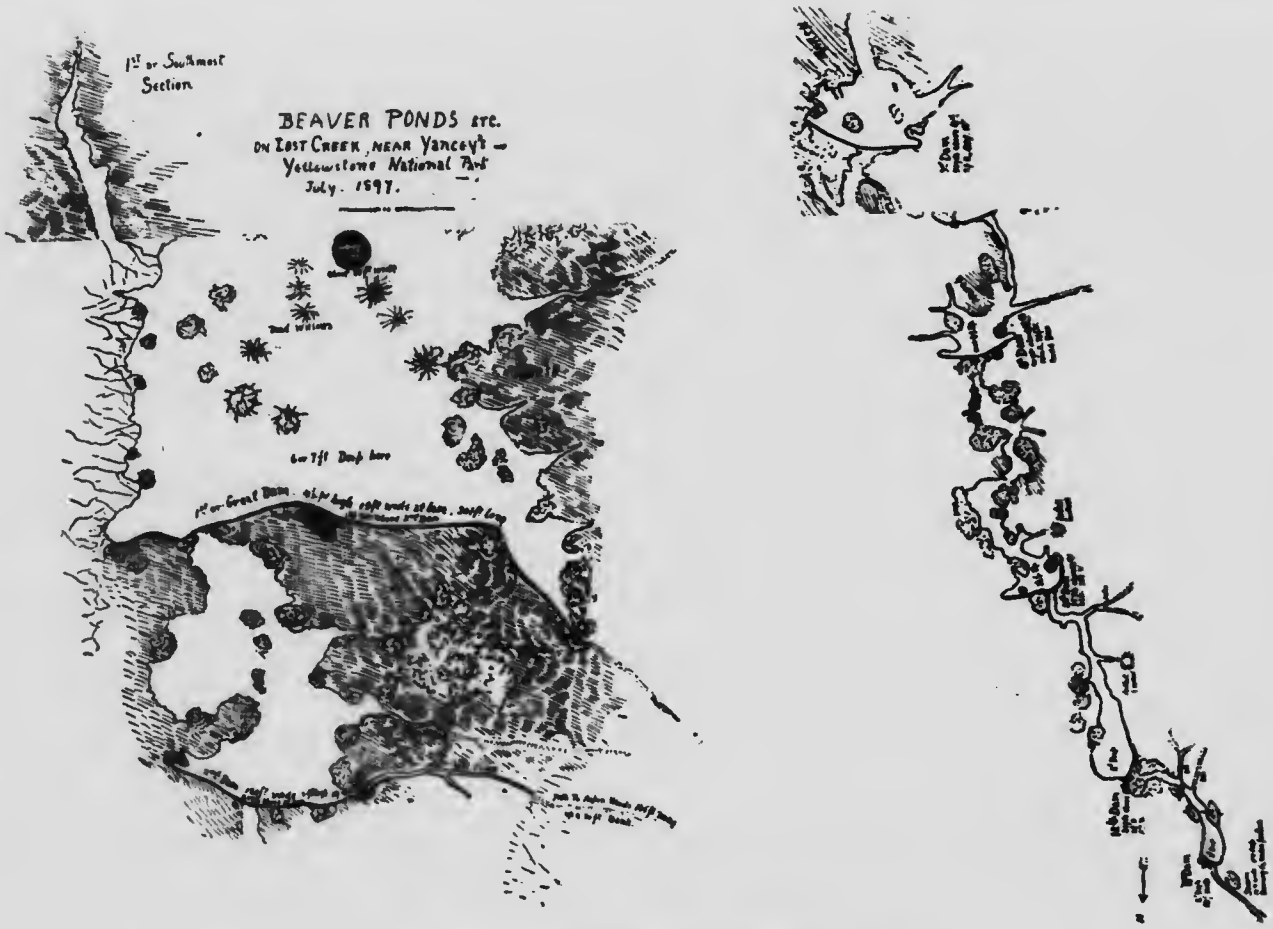
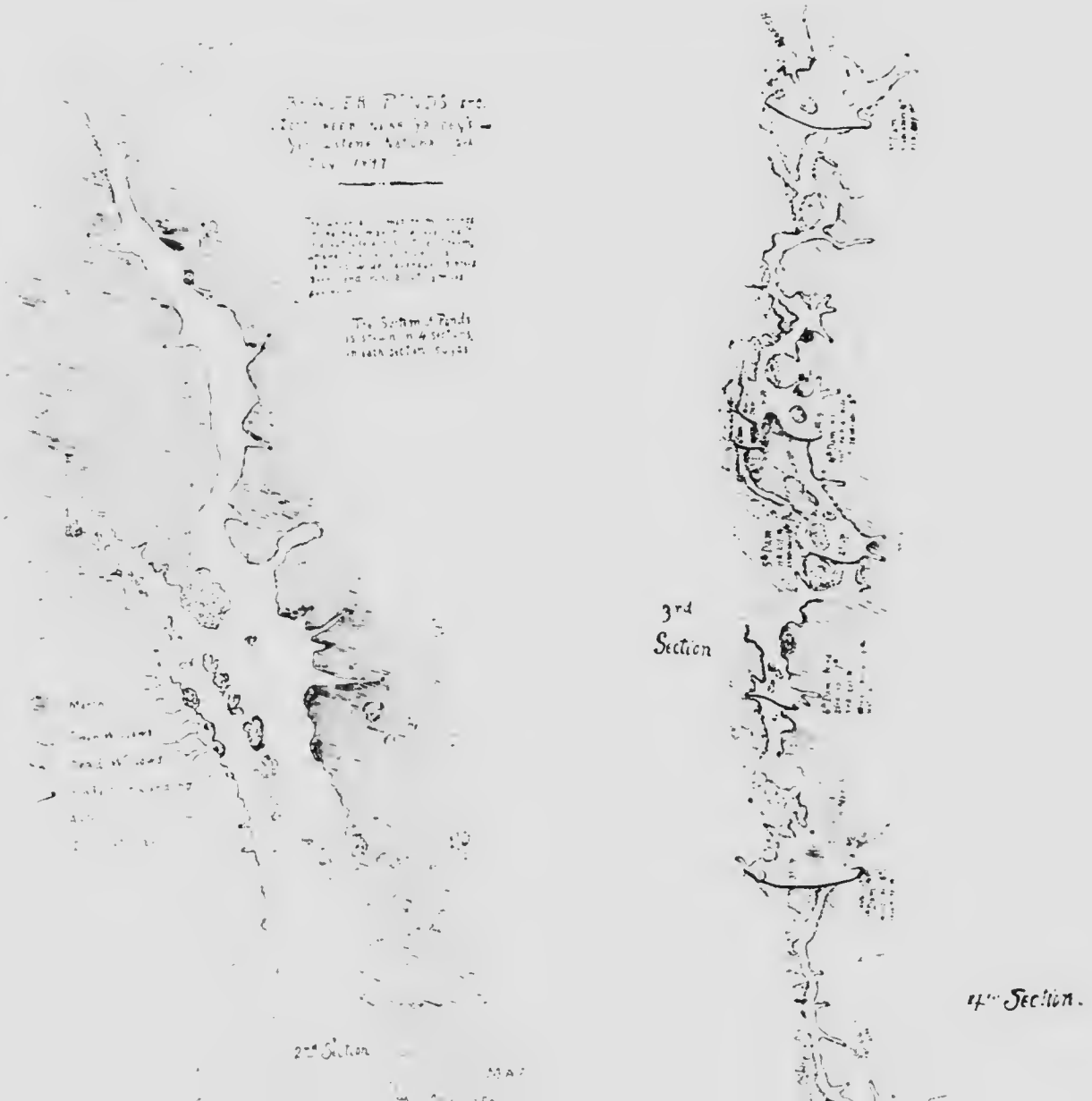



FIG. 129—The Yancey Beaver Ponds, Yellowstone Park.
Drawn from survey made on the ground by Ernest Thompson Seton, July, 1897.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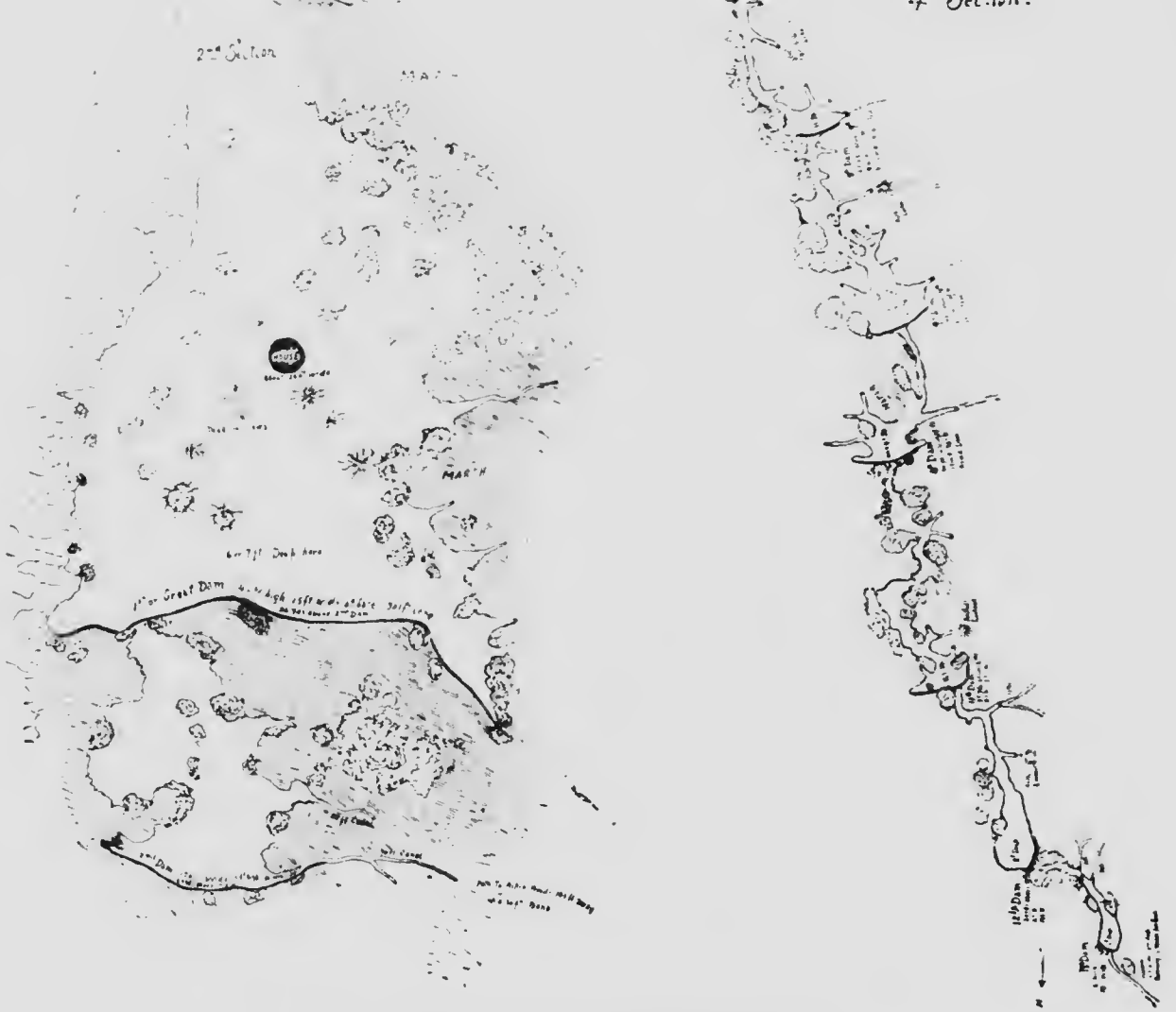



FIG. 129—The Yancey Beaver Ponds, Yellowstone Park.
Drawn from survey made on the ground by Ernest Thompson Seton, July, 1897

high, 18 feet wide at base; holding the water above it at 5 feet higher than in the pool below.

This dam must have contained about 250 tons of material.

The dam which makes Beaver Lake in Yellowstone Park I believe is the longest ever recorded. I saw it from a distance, but had no opportunity of measuring it. General S. B. M. Young writes me that it is about 700 feet from end to end.

LANDING PLACES

Reference to the plan (Fig. 129) shows a great many little docks or landing places. These are short canals with raised mud or sod wharfs at the end; these are either lookouts or sunning places. Usually there are paths leading away from them farther afield. They are found chiefly on the western side, as there is no food on the eastern bank.

The dock seems to be the small beginning out of which grew what some consider the Beaver's most wonderful achievement—the canal.

THE CANALS

The canals are quite as interesting as the dam; Morgan considers them even stronger evidence of intelligence. He says:[16] "In the excavation of artificial canals as a means for transporting their wood by water to their lodges, we discover, as it seems to me, the highest act of intelligence and knowledge performed by Beavers. Remarkable as the dam may well be considered, from its structure and objects, it scarcely surpasses, if it may be said to equal, these waterways, here called canals, which are excavated through the lowlands bordering their ponds for the purpose of reaching the hardwood, and of affording a channel for its transportation to their lodges. To conceive and execute such a design presupposes a more complicated and extended process of reasoning than that required for the construction of a dam; and, although a much simpler work to perform, when the thought was fully developed, it was far less to have been expected from a mute animal." Many canals in all stages of growth are shown on the plan (Fig. 129), but the largest and most interesting is the 70-footer, leading

[16] *Ibid.*, p. 191.

westward from the second pond. It is the highway to the feeding grounds; is about 18 inches deep up to the fork, beyond which it is but 12 inches deep. It is clean cut with sharp, hard edges, and has a most artificial look. It ends abruptly at the foot of the bank, and then the path, sharply defined, continues on to the woods, 145 feet farther on and 30 feet higher up.

Morgan describes and illustrates three good examples of canals found near Marquette, Mich. These are 365 feet, 523 feet, and 579 feet long, respectively. All are 2 to 3 feet wide and have throughout about 18 inches of water. All lead from the residential pond to the feeding grounds (*a*, *b* and *c*, Fig. 131).

(*a*) The first of these,[17] 365 feet long, reaches to the foot of a hill and then forks as shown. These forks are the remarkable feature of this; "their construction along the base of the high ground gives them a frontage upon the canal of 215 feet of hardwood lands, thus affording to them along this extended line the great advantages of water transport for their cuttings."[18]

(*b*) The other two are remarkable, not only on account of their length, but because also of their locks. These are best illustrated in the 523-footer.[19] Each lock is a low dam making a foot rise in water level; over these the logs are dragged. While the main canal is supplied with water from the pond, the locks are fed with rain water gathered by the 142-foot dam next the swamp.

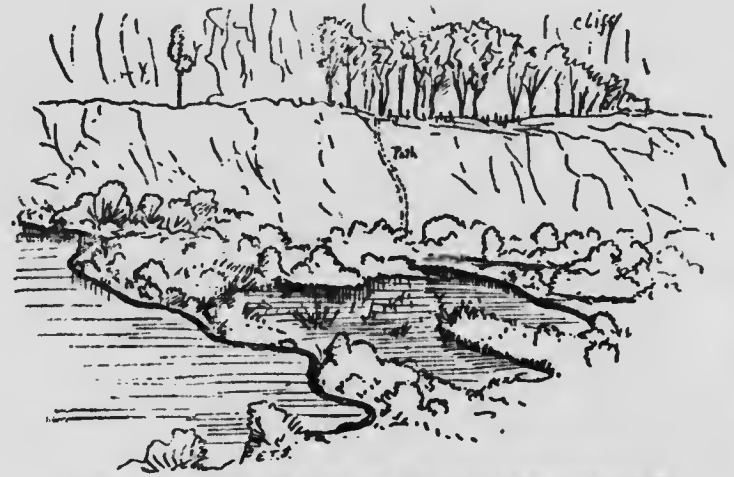
The 579-foot canal[20] has the same general plan as the other, with two locks, but it adds an important feature, namely, a wing-dam set at such an angle into the river that it deflects water enough to keep the canal well filled.

The longest canal I ever examined was a very old one at Gal Pond, near Wanakena, St. Lawrence County, Adirondacks, N. Y., August 4, 1908. It was 654 feet long, nearly 4 feet wide, and led from the pond to a grove of poplar and yellow birch. Although abandoned for fully fifty years it was very well marked and showed many Beaver cuttings.

[17] Am., Beaver, p. 197.
[18] *Ibid.*, p. 198.
[19] *Ibid.*, p. 196.
[20] *Ibid.*, p. 200.

Looking up the valley from the north.

The main pond with house, and on the bank beyond, the remains of the aspen woods.



First and second ponds from the east side. The present feeding grounds opposite.

View from the aspen woods (present feeding grounds, 1897), the 70-foot canal in foreground.

FIG. 130—Views of the Yancey Beaver Ponds, Yellowstone Park, 1897.

A second use for the canals is pointed out by Morgan. He found them cut across the neck of long points on the river, and even across long islands in the pond, "for the obvious purpose of saving distance in going around."[21]

In brief, then, these canals are among the most wonderful of all the Beaver's wonderful undertakings. They are the obvious result of a plan adhered to from the beginning. They are made at a cost of enormous labour extending over years, and are kept in repair only by unremitting attention and toil.

They are unquestionably made for the convenience of reaching the feeding-ground without a dangerous overland journey and to assist in the transportation of the heavier sticks used when storing winter food. That is to say, the canals are made for precisely the same reason as those made by man, for the easy transportation of passengers and freight.

BURROWS

The Beaver burrow or den is an older institution probably than either the lodge or the dam. It is made in a bank near deep water, and is very simple in plan; it has a single entrance, which is below water line under some tree, root, or overhanging bank; it has a diameter of a foot or eighteen inches, a length of a dozen feet, and leads to a chamber just above the water line under a root or stump or clump of bushes, which strengthens and guards the roof, that is here made thin enough to admit air.

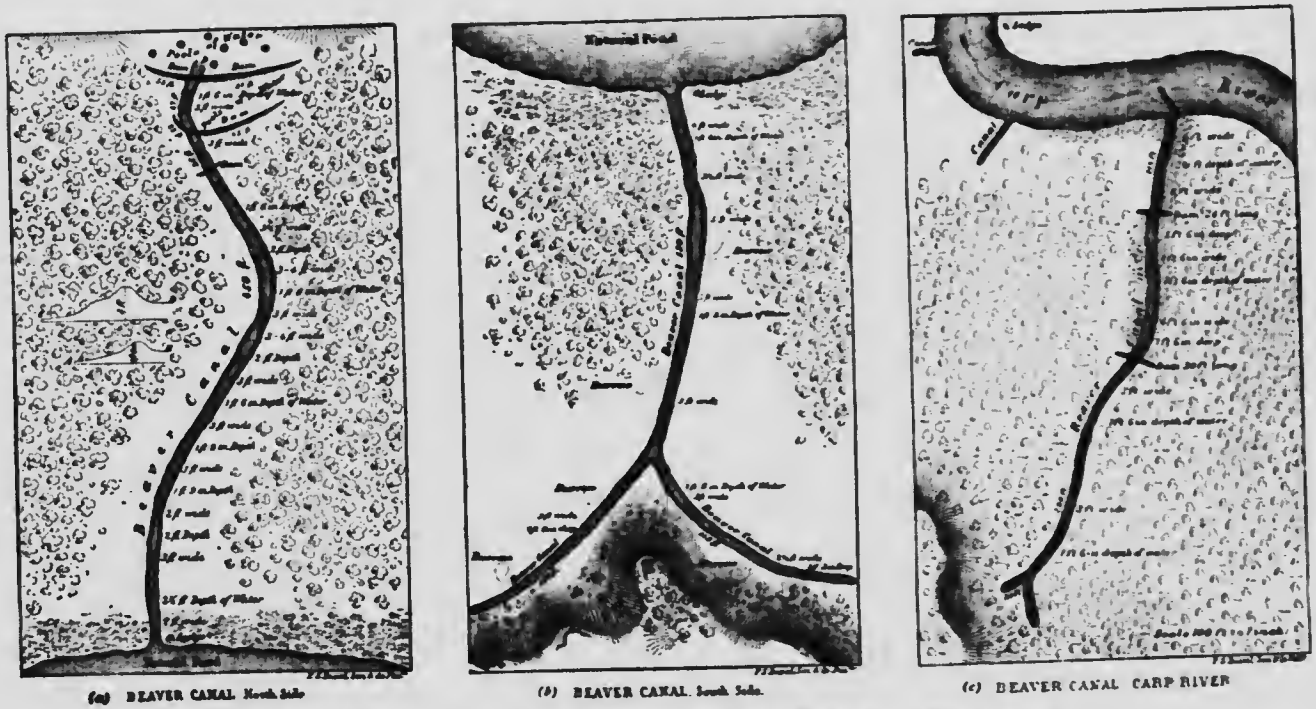
A good typical example is shown (Fig. 132, p. 462); this is the uppermost burrow seen on *b*, Fig. 131.

BANK BEAVER

In streams which have always plenty of water, and which therefore need not and indeed cannot be dammed, the Beaver elaborates the bank den or 'wash'[22] somewhat. On the Yellowstone, Morgan saw a number of these in 1862. "The entrances or passageways often extend back twenty feet into the bank and each communicates with one or more under-

[21] *Ibid.*, p. 202.

[22] "Wash," a corruption of the Ojibwa *O-washe'*, Am. Beaver, p. 165.



(a) BEAVER CANAL. North Side. (b) BEAVER CANAL. South Side. (c) BEAVER CANAL CARP RIVER

FIG. 131—Three remarkable Beaver Canals, reproduced from Morgan's American Beaver.
They are as follows: (*a*), 365 feet long; (*b*), 523 feet long; (*c*), 279 feet long.


FIG. 132—Plan of a Beaver burrow.
(From Morgan.)


FIG. 133—Ground-plan of a bank-lodge.
(From Morgan.)

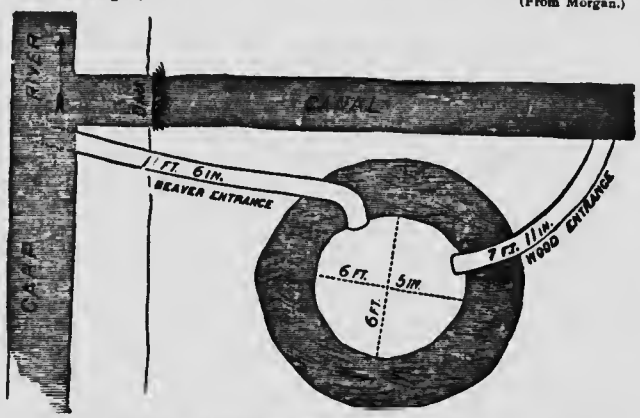



FIG. 134—Ground-plan of a more elaborate bank-lodge, showing the nearly straight wood entrance in dead water, and the Beaver entrance in the running stream.
(From Morgan.)

ground chambers, which are always found near the surface."[23] The individuals that live in these are called 'Bank Beavers.' I saw numerous examples of their work on the Nyarling River, Mackenzie District, in June, 1907.

In many cases their entrance is protected with a mass of sticks, which also is winter food. This pile is called a 'false lodge.'

FALSE LODGE

A higher development of the false lodge is seen when it is made by a lake. Then there is no annual freshet to carry away the pile, so it grows yearly.

VENTILATION

Over the chamber in the bank is a thin place made to admit air. In the course of time this ventilator may give way,

[23] *Ibid.*, p. 159.

leaving the chamber dangerously exposed, and then the Beaver is seen, with true constructive ingenuity, repairing the ventilator with a pile of interlacing sticks.

Then, as Morgan remarks:[24] "It is but a step from such a surface pile of sticks to a lodge with its chamber above ground, with the previous burrow as its entrance from the pond." A case which is precisely paralleled by the bank house of the Muskrat.

BANK LODGE

The next step is the bank lodge, which has a complete roofing of sticks around. Plans of two good examples are shown in Figs. 133 and 134.[25]

From the bank lodge the step is easy to the island lodge, and when the island is a mere upturned root or hummock, we reach the final and most specialized dwelling of the Beaver, the moated lodge in the pond.

The great pond in the Lost Creek Series at Yancey's, Yellowstone Park, contained but one lodge; this was enormous. It looked 25 feet through and 5 feet high, but having no boat I could make no measurements. It is usual for Beavers to have several burrows as well as a lodge, but one side of this pond was rock, the other side level marsh, so these may have had no burrows, at least I saw no signs of them.

LODGE

A typical lodge is a rounded mass of sticks, and occasionally stones; it is 20 feet across the base and 3 to 5 feet high, cemented with mud except on the outside, which is covered with naked sticks.

It contains one circular chamber, which is about 2 feet high and 6 feet across. As a rule the lodge has a single chamber, and when two or more are found side by side there is no connection between them. They are, indeed, separate lodges accidentally touching.

There are usually two entrances, rarely more; one abrupt, often winding, is the ordinary runway; and the other, quite

[24] *Ibid.*, p. 165.

[25] *Ibid.*, 153.

straight, is for bringing in wood. They are 2 or 3 feet below water level on the outside, but open above water line inside—they are 1½ to 2 feet wide and 5 to 10 feet long. They are finished with mud, which is plastered smooth like the doorway of an adobé house. The floor is about 4 inches above water level, and covered with a solidified mass of mud and small

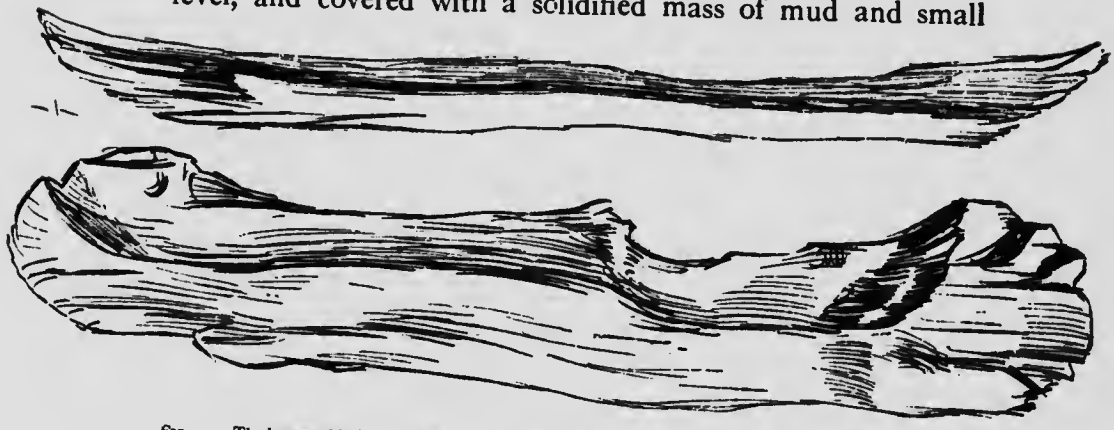


FIG. 135—The largest chip I saw at the Yancey Ponds (life size): many were 6 by 1 inch, but most were shorter.

twigs. There is more or less dry grass or wood shavings for bedding. The only air is what comes through the walls or is accidentally brought in the fur of the inhabitants or incidentally in their lungs.

FOOD

Closely connected with the building instinct is the food instinct of this animal. Its favourite diet in Canada is the bark of the poplar or quaking aspen, but it also eats the young bark and twigs of most of the hardwoods and in summer they add many kinds of vegetation, even berries, pond-lily roots, and marsh grass, and in winter the wood itself; but never is known to eat any part of coniferous trees, although it cuts them down for building material.[26]

FELLING TREES

The cutting down of trees is one of the most amazing performances of the Beavers, so of course it has been much exaggerated in early accounts. Thus the statement that the

[26] *Ibid.*, p. 184.

Beaver is so skilful that it can always throw the tree toward the stream is quite misleading. It cuts first the trees on the margin and they always lean toward the stream, so must fall streamward. But later, when cutting farther afield, the trees as often go wrong as right. The work of felling is usually done by the pair with assistance at times from their grown-up children.

Two Beavers can cut down a three-inch sapling in three minutes and a six-inch tree in an hour or two. Three are the most that have been seen working on the same tree at once.

"With this number [says Morgan[27]] two nights at most would give ample time to fell a tree a foot in diameter." A party of surveyors in the Beaver country near Marquette "counted nineteen tree-falls which they heard in a single night between the hours of seven and twelve o'clock."[28]

The same observer gives the following interesting description of the felling:[28]

"When but two are engaged they work by turns, and alternately stand on the watch, as is the well-known practice of many animals while feeding or at work. When the tree begins to crackle, they desist from cutting, which they afterward continue with caution until it begins to fall, when they plunge into the pond, usually, and wait concealed for a time, as if fearful that the crashing noise of the tree-fall might attract some enemy to the place. The next movement is to cut off the limbs, such as are from two to five and six inches in diameter, and reduce them to a proper length to be moved to the water and transported thence to the vicinity of their lodges, where they are sunk in a pile as their store of winter provisions. Upon this work the whole family engage with the most persevering industry, and follow it up night after night, until the work is accomplished. The greatest number of Beavers ever seen thus engaged by any of my informants was 9, while the usual number is much less."

Similar testimony is given by Long in his "Expedition to the Rocky Mountains."

[27] Am. Beaver, p. 220. [28] *Ibid.*, p. 221. [28] *Ibid.*, pp. 172–3.

"Three Beavers [he says [30]] were seen cutting down a large cottonwood tree; when they had made considerable progress, one of them retired to a short distance and took his station in the water, looking steadfastly at the top of the tree. As soon as he perceived the top begin to move towards its fall, he gave notice of the danger to his companions, who were still

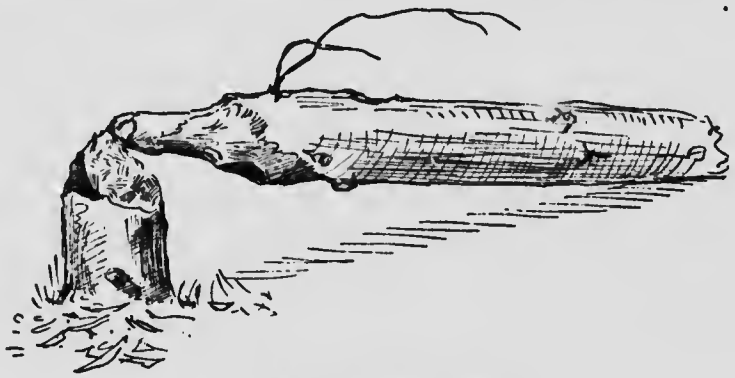


FIG. 136—A 5-inch aspen just fallen.

at work gnawing at its base, by slapping his tail upon the surface of the water, and they immediately ran from the tree out of harm's way."

Many times the tree goes the wrong way. This I have often seen, and frequently it has happened that some Beaver made a miscalculation and was killed by the fall of his own tree.

The largest trunk I have ever seen cut down by Beavers was 14 inches in diameter, a poplar, but we have records of cottonwoods 20 and 24 inches, 30 inches,[31] nearly 3 feet.[32] These, however, are exceptional; 3 to 8 inches is the usual run. At one Beaver cutting I counted 116 poplar stumps. There were six such places near the dam, but the largest stump of any was but 8 inches through.

As an adjunct of work the Beavers sometimes raise a platform of mud around a tree. This enables them to reach up higher to a thinner place and cut it down more easily.

[30] Long's Exped., 1823, Vol. I, p. 464. This passage apparently by T. Say.
[31] Morgan, Am. Beaver, p. 177. [32] Lewis and Clark, Longman's ed., p. 146.

STORAGE

Like most of the rodents which do not hibernate, the Beavers store up food for winter. All through the autumn they labour; the suitable trees next the bank are first attacked; if they fall into the water they are allowed to lie there, as it is easy to cut their branches later under the ice. If they fall on the land all the branches are cut off into pieces of a size possible to handle, that is to say, "when 5 inches in diameter they are usually about a foot long, when 4 inches in diameter they are about a foot and a half long, and when 3 inches in diameter are about 2 feet long. Poles from 1 to 2 inches in diameter are often found 8, 10, or 12 feet in length, and also cut up into short lengths from a few feet to a few inches long." [33] They are brought to the lodge to be stored in two different ways. The heavier timbers are sunken in the bottom of the pond. How they are sunken is often discussed. I have heard men who should have known better say that the Beaver sucks all the air out of them to make them sink, or that the Beavers charm them and at your touch the charm is broken, they float up. The fact is that most green woods are nearly as heavy as water. If waterlogged they are heavier. The Beaver carries the green stick down to the bottom and partly buries it in the mud; very little holds it. In a week or so it is waterlogged and lies there even if uncovered. If any one pulls at a piece of poplar, for example, just after it is sunken, it floats and will not stay down without weighting. These things I saw and proved to my own satisfaction on the Nyarling River, near Great Slave Lake, in June, 1907.

The smaller branches are stored in a different way. In the water above Beaver lodges that are situated in a current is a pile of brushwood moored to the bottom and apparently not used for food. This Morgan considers is a safe storage place for the smaller twigs that might be carried away by the stream.[34]

When utilizing these hoards the Beaver takes the piece into the lodge, eats the bark off and later adds the useless stick to the roof-tree or to the dam.

[33] Am. Beaver, pp. 178–9.

[34] *Ibid.*, p. 188.

IN WORKING

While at work the fore-paws are used to hold sticks that are being cut up by the teeth, also to carry mud and stones. They push, pull, dig, and grapple with them—they use them, indeed, as hands.

Long sticks are carried in the teeth, with the end over the Beaver's back if on land. Small logs are rolled by one or more Beavers pushing with their hands, their shoulders, their hips or their whole broadside.

INTERCOMMUNICATION

Being essentially sociable, the Beaver has many methods of communicating ideas. The first of these is the vocal. Young Beavers wail like a crying child. Older ones hiss in menace or utter a querulous "churr." When two meet in the pond I have several times seen them nibble each other's cheeks, at the same time uttering a chattering noise; I suppose it is a friendly salutation.

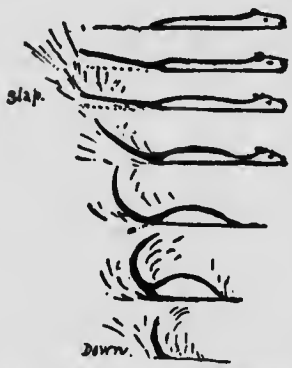


FIG. 137—Succession of altitudes in diving.

Another important means is the "splash" signal. While watching the Beavers at Yancey's I learned that at once, on discovering danger, each Beaver gives a great slap with its tail and dives; this is understood by all and repeated by all as they dive.

Among the hunters on the Nyarling River I found that it is considered the sign of a mortal wound if the Beaver dives without slapping. The sound of it on a quiet evening is very far-reaching; it is in fact two sounds, one a loud "slap" as of a paddle, followed at once by a deep hollow plunge, as though a ten-ton boulder had been dropped in the water.

MUD-PIES

But there is another way which may be called the mud-pie telephone. The Beaver has, like birds, a cloaca or one orifice, urinal, genital, and anal combined; each (male or female) has close to this two pairs of glands. The large ones

FIG. 138—Feet of adult male Beaver (left side), taken near Fort Resolution, M. T., July 11, 1907.

Eleven-twelfths of life size. The figure in the right upper corner is the split nail of the second toe on hind-foot; it is twice natural size.

are the 'barkstones' or castoreum glands, secreting castor corresponding, according to Dr. W. W. Ely,[35] to the preputial glands, and the smaller, the oil-stone, secreting a lubricant.

The castor is a yellowish substance, commonly described as "strong smelling." Its odour certainly is peculiar, but it seems to me very faint. These two secretions are given off at will by the animal, usually while voiding urine or excrement, and are a most important though ill-comprehended method of intercommunication.

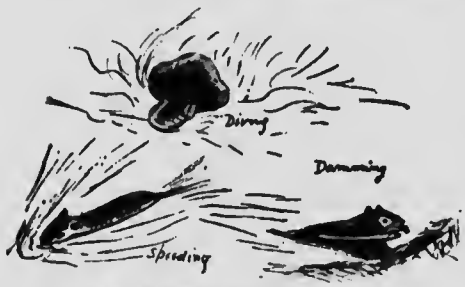



FIG. 139—Life sketches of Beavers at work.

A trapper named Prevost called the attention of Audubon and Bachman[36] to a peculiar habit of the Beaver. "He said that when two Beaver lodges are in the vicinity of each other the animals proceed from one of them at night to a certain spot, deposit their castoreum, and then return to their lodge. The Beavers in the other lodge scenting this, repair to the same spot, cover it over with earth, and then make a similar deposit on the top. This operation is repeated by each party alternately until quite a mound is raised, sometimes to the height of four or five feet."

Whatever the reason there can be no doubt that the smell of castoreum has a wonderful fascination for the Beaver, and is used almost universally by the trappers as a lure or charm to decoy the fur-bearer to its fate.

Nor is this infatuation confined to Beavers, for most mammals respond to its dangerous attractions; and mixed with various other substances to intensify it or make it more easy to handle, it forms a part of every trapper's stock in trade.

This probably is the broad, underlying idea: the product of the gland varies with the age, sex, and condition of the individual. The next Beaver that passes can get light on these

[35] Am. Beaver, p. 301.

[36] Quad. N. A., 1849, Vol. I, p. 353.

things by study of the castor left in the little pile of mud; thus it serves as a means of spreading intelligence; in particular about sexual matters, hence its power.

The old Beaver already mentioned as being on Big Dam Lake, east of Kippewa, left his castorized mud-pies on every promontory for miles, and thus proclaimed to all who understood what a very solitary miserable life was his, and how earnestly he did strive and pray to find a mate.

PLAY

We should expect such a sociable creature to show considerable advancement in development of play, and even here it seems the "castor" takes a prominent place. Morgan says:[27]

"Occasionally they indulge themselves at play, for which a formal preparation is made. After selecting a suitable place upon dry ground near the pond or stream, they void their castoreum here and there upon the grass, and, in the musky atmosphere thus created, spend some hours at play or basking in the sun. The trappers call these playgrounds 'Musk Bogs.' Two or three of them are often seen at play in the water—diving, swimming around, and ducking each other."

LIFE OF A BEAVER

The Beaver is a strict monogamist. The mating season is February, and the pair make then and there a contract for life. Gestation lasts about three months; toward the end of that time the mother separates herself from her mate, that is, I suppose, compels him to move out and keep away, while she prepares for the brood in the old lodge by making a warm nest of dry grass, so at least say the trappers, but it is not very clear how the mother keeps the grass dry when she must swim under water with it. Harry V. Radford believes that the bedding is always of finely shredded wood.

NEST

Here the young are born in the month of May; their eyes are open from the first.

YOUNG

They number 2 to 5. According to Morgan,[28] one William Bass "found . . young Beavers in a fœtal state in one female,

[27] Am. Beaver, p. 223.

[28] *Ibid.*, p. 221.

and 8 young Beaver born also in a single lodge. He had also found 6 young ones a number of times and all the numbers below this down to a single young Beaver."

At a month the young begin to eat solid food, and go abroad with the mother; and at six weeks are weaned; but they continue with their mother for a year longer at least.

At 2 years they are old enough to mate, but are not fully grown till 2½ years old. They live for 12 to 15 years.

FATHER

What little evidence there is goes to show that the male is a model parent. Naturally his duties are small, since he is not called on to nurse, feed, lead, or defend the young, but some fathers are considered models when they refrain from doing bodily harm to their offspring, and are especially admired if they keep away altogether while the young are helpless in the nest.

YELLOW-STONE PARK

The Beavers near Yancey's, in Yellowstone Park, have, like most wild things there, realized the blessed peace of the Park. They came out soon after sundown while I watched them from a hide. I saw 4 swimming about at the same time. But only the biggest one seemed interested in repairing the dam, and he worked "like a Beaver" the whole time, never passing the dam without adding something, and if he had nothing else would dive to the bottom for a handful of mud, and pound it into the dam wherever he fancied the water was running over. It never seemed to occur to him that the water must go over somewhere; so the work of stopping the supposed leak goes on indefinitely and the dam grows bigger.

In menageries where they have given the Beaver the privilege of running water there is much complaint that in their insensate mania for stopping the overflow they block drains, etc., oblivious of the fact that but for benign and periodic human interference on their behalf, they would speedily bring on themselves a death by drowning.

OUTCASTS

Just as among Buffalo and Moose we have the lone bull that is more or less of an outcast, so in the Beaver world we

have individuals, old males, that are outcasts or degenerates, either from choice or necessity. Many strange theories are brought forth by trappers and Indians to explain these. This much only is certain, they are outcasts and they are failures.

"It is a curious fact [says Prevost, the trapper[39]] that among the Beavers there are some that are lazy and will not work at all, either to assist in building lodges or dams, or to cut down wood for their winter stock. The industrious ones beat these idle fellows, and drive them away, sometimes cutting off part of their tails and otherwise injuring them. These 'Paresseux' [idlers] are more easily caught in traps than the others, and the trapper rarely misses one of them. They only dig a hole from the water running obliquely toward the surface of the ground twenty-five or thirty feet, from which they emerge, when hungry, to obtain food, returning to the same hole with the wood they procure, to eat the bark.

"They never form dams, and are sometimes to the number of 5 or 7 together; all are males. It is not at all improbable that these unfortunate fellows have, as is the case with the males of many species of animals, been engaged in fighting with others of their sex, and after having been conquered and driven away from the lodge, have become idlers from a kind of necessity. The working Beavers, on the contrary, associate, male, females, and young together."

Near Kippewa, however, I knew of a solitary he-Beaver that did build a large dam in 1904.

Morgan offers an explanation which at least puts the "sluggards" on a higher plane. "These "outcasts" [says he[40]] are probably such Beavers as, having lost their mates, refused afterward to pair, and led thenceforth solitary lives in burrows.

ENEMIES

In the far north the Wolverine is credited with being the most formidable enemy of the Beaver, but it is difficult to see

[39] Quoted by Audubon and Bachman, Q. N. A., Vol. I, p. 352.
[40] Am. Beaver, pp. 136–7.

how it can harm them, living as they do in the water, where it is not especially at home. Doubtless the only chance is when the Beaver is ashore for material. The Fisher, the Bear, the Wolf, and the Lynx are also to be reckoned with at such a time, while the Otter is ever ready to satisfy its hunger with Beaver meat if no fish are at hand.

The Muskrat is considered, at least by the Beaver, to be an enemy. It enters the Beaver pond as a sort of parasite and works mischief there, as elsewhere, by piercing the dam with its tunnel. The trappers generally maintain that a Beaver recognizes the Muskrat as a mischief-maker and kills it when the chance occurs.

The coat of the Beaver seems to be infested with a troublesome parasite; the captive specimens in Zoos may often be seen nibbling each other for a quarter of an hour at a time, apparently to give and get the joy of scratching on places not easily reached by the Beaver himself.

In the plan of the Lost Creek or Yancey's Pond it will be seen that many of the short pathways end at ant-hills; these hills are the work of a small and wholly black ant that raises its mound a foot or so above the marsh. The Beavers may have sought these hillocks as lookout places, but there was evidence of their staying a long time, and I wonder if they did not go there for what is known in the west as a "dry wash"; that is, to let the ants pick off the parasites. Possibly, as noted already, the curious split or double nail on the second toe of the hind-foot is an adaptation for combating fur-lice.

In this connection I may record an observation on the Beaver's method of dealing with another minor pest.

The patriarch and chief toiler in the big pond near Yancey's, while attending strictly to business, was again and again pursued by the Brewer blackbirds that nested in the nearby swamp. They were very resentful birds, ready to annoy any creature that came near their home ground. Without regard to law or order, again and again they united in a noisy mob to tease the old Beaver as he calmly swam across

the pond. But the latter has found a simple way of dispersing the mob, that I would commend to the notice of our city authorities. When tired of the annoyance he gives a flirt with his tail that sends up a shower of spray on his tormentors and drenches them so thoroughly they are glad to go back to the bushes and mind their own business.

INTELLIGENCE

The intelligence of the Beaver has been much discussed. There was a time when it was considered on a par with that of man, and tales marvellous and preposterous were told in verification. A reaction set in and it became generally accepted that the Beaver, being in the Rabbit and Porcupine class, was of no heavier mental calibre than they. Now, thanks to such observers as Hearne and Morgan, we are reaching the true line and find it as usual in the middle of the road.

While of a low, general mentality, the Beaver has a wonderfully developed instinct for the building of dams and waterways. A quickness to take advantage of little things and a ready adaptability to change of surrounding that in this special department puts it in the highest class of low animal intelligence. A case parallel with that of the ants indeed; which, though so low in organization, have acquired extraordinarily complex instincts, whose history affords one of the most wonderful "fairy tales of science."

SPEED, ETC.

On the land the Beaver is but a poor traveller and in the water it is not one of the swift swimmers. It seems to me to go no faster than a dog, and two miles an hour is, I should think, its fast speed. But its diving power is remarkable.

On Yellowstone Lake, August 5, 1897, I saw a Beaver a good quarter mile from shore; it dived and was seen no more. The water was like a mirror, so we should have seen it had it reappeared short of the land.

The trappers generally credit the Beaver with power to swim a quarter of a mile without coming up to breathe, which implies that it can go fully 5 minutes without breathing.

In swimming the Beaver relies on its hind-feet as paddles, the tail is used chiefly as a rudder, the fore feet are little employed.

SANITATION

Like all creatures that live in colonies and have elaborate homes, the Beaver has progressed well along the lines of sanitation. At all times the lodges are found scrupulously clean; for the owner invariably steps out of doors when prompted to void its ordure; the product is like a lot of fine chips and wood fibre of light colour. Curiously enough the dam is a favourite place for the deposit, perhaps on the principle that every little helps.

DISEASE

Like others of our beasts, this species has its years of increase and decrease, and also is subject to diseases that are as yet not understood. Tanner says[41] of the Beaver on Upper Red River about 1800:

"Some kind of distemper was prevailing among the animals which destroyed them in vast numbers. I found them dead and dying in the water, on the ice, and on the land; sometimes I found one that, having cut a tree half down, had died at its roots; sometimes one who had drawn a stick of timber half way to his lodge was lying dead by his burden. Many of them which I opened were red and bloody about the heart. Those in large rivers and running water suffered less; almost all of those that lived in ponds and stagnant water died. Since that year the Beaver have never been so plentiful in the country of Red River and Hudson Bay as they used formerly to be."

POPULAR ERRORS ABOUT BEAVERS

In correction of several ancient errors it is well to remember that:

The Beaver cannot and does not drive stakes.

It never plasters the lodge with mud outside. All lodges are finished outside with sticks.

It does not use its tail as a trowel.

It does not suck the air out of sticks to make them stay down.

[41] Quoted by Dr. E. Coues in Henry's Journal, p. 256.

It does not cut or carry large logs or use them in the dam.

When caught in a steel trap it does not deliberately amputate the foot, but twists about and pulls until it is torn off.

USES

This animal has always been a staple of food and raiment to the natives of America. Its wonderful coat of fur is prime for half of the year, it is backed by a very strong skin, and is one of the peltries most highly prized. Trapping is carried on chiefly by means of the steel traps, but I do not here propose to detail the methods. Already they are too successful, and the harmless Beaver has disappeared from half its range and become comparatively scarce in the rest.

At one time, the last quarter of the eighteenth century, about 150,000 skins were exported annually by the American Companies, besides which the Hudson's Bay Company marketed about 50,000 per annum.

In 1891 the American supply had dwindled to 11,693 and the Hudson's Bay Company's was 57,260, really a bad year for the Company, as in 1887 its export had been 102,745, and in 1871 had reached 174,461.

In 1905, the latest year for which I have complete figures, the Hudson's Bay Company's returns were 54,119.

At the London Annual Fur Sales held at Lampson's, March, 1906, 8,414 Beaver were sold. The highest price reached was 62 shillings ($14.88) each, for 41 first-class black skins; 30 shillings ($7.20) to 35 shillings ($8.40) were ruling prices for first-class skins, from which they graded down to about 15 shillings ($3.60) for thirds.

As a food supply the Beaver takes a prominent place. The flesh is good and the tail is considered a delicacy. In taste it is like "calf's head" with marrow dressing, is decidedly rich and heavy, but I thought it delicious eating. In a vast portion of the Mackenzie Valley the Beaver serves the Indians as the Buffalo did those of the Plains. It is their staff of life, it feeds and clothes them, as well as supplies the necessary peltry to barter with traders for other things desired. These tribes are very naturally known as the "Beaver Indians."

RESTORATION

But the tremendous slaughter of modern times and methods have told on the Beaver, the rapid shrinkage of the species in point of numbers has led, first, to laws restricting the killing, next to attempts at restocking depleted regions.

The success of the latter is most encouraging. The Algonquin Park, in Ontario, is a famous illustration of this. So well have the protected Beavers prospered there that now their overflow is restocking the surrounding country.

In Monroe County, Pennsylvania, the species has reappeared and will probably continue to increase, as the colony is jealously guarded.[42]

In the Adirondacks, once famous as Beaver country, then practically bereft of them, the good work of restoration goes on. Harry V. Radford took upon himself the onus of the enterprise. He sends me the following outline:

"In 1904, at my request, the first Beaver appropriation bill ($500) was introduced in the New York Legislature. It became available the same year. That fall the Commission purchased 7 Beavers, 6 of which were successfully liberated the following spring. This year (1906) I obtained a second Beaver appropriation ($1,000) from the Legislature, and the liberations will soon be resumed. A number of private citizens are co-operating with the State and liberating Beaver on their estates in the Adirondacks. The Adirondack Beaver supply is rapidly multiplying, and there are at present perhaps 50, as against 6 or 8 of five years ago. Unquestionably, the Beaver restocking project is a complete success."[43]

Similar good news comes from western Quebec and many parts of the eastern country showing that men have fully awakened to the value and service of this remarkable fur-bearer, especially in the northern part of its range.

There can be no doubt that the Beaver did more to open up Canada than any other creature or product. It was the

[42] Rhoads, Mam. Penn. & N. Jersey, 1903, pp. 70–2.

[43] In 1908 Radford estimated their number at 150. See N. Y. S. F. F. & G. Com., 12th Annual Rep., p. 417.

pursuit of the Beaver that lured on the early explorers and that brought here the original colonists. It was Beaver fur that bought for white men the manufactures of Europe that were needed to make life tolerable when first our people took to the woods, and it is fitting indeed that this creature, the symbol of energy, peace, and industry, should be the emblem of the country for which it did so much.

## XVII.

## The Common House-mouse.

*Mus musculus* Linn.

(L. *Mus*, a mouse; L. *musculus*, diminutive of *mus*.)

*Mus musculus* Linn., 1758, Syst. Nat. X ed., I, p. 62.
Type Locality.—Sweden.

French Canadian, *la Souris domestique*.

The Family *Muridæ*, or Mice, are small rodents with more or less naked tails covered with scaly skin, but not flattened above; not more than 3 grinders in lower jaw.

The genus *Mus* (Linnæus, 1758) contains the Old-World Mice and Rats, which are typical rodents, small in size, with large ears, small eyes, tail nearly as long as the body, naked or nearly so, tapering from base to tip, and covered with scales more or less in rings; no cheek pouches. Colour, dull black or grayish brown. But the teeth are the most important feature of this group.

The formula is:

$$\text{Inc.}\ \frac{1-1}{1-1};\ \text{mol.}\ \frac{3-3}{3-3} = 16$$

The upper molars have tubercles in series of 3 across the crown of the tooth, instead of 2 in a series, as with the American Mice.

The pattern will be better understood by means of the outlines in Fig. 140, which, however, are purely diagrammatic, varying in details, not only with each species, but with each individual and epoch in the life of that individual.

The Common House-mouse has, in addition to the generic characters, the following:

SIZE Length, 7 inches (178 mm.); tail, $3\frac{1}{2}$ inches (89 mm.); hind-foot, $\frac{11}{16}$ inch (18 mm.); ear, $\frac{1}{2}$ inch long (13 mm.).

The long, sharp nose also is a marked feature.

The general colour is "mouse colour," that is, grayish brown above, shaded on the under parts into ashy, more or less tinged with yellowish. COLOUR

When compared with other Mice found in Manitoba, its gray colour above and below without a sharp edge to it anywhere, and the absence of pure white combined with its large ears and its long, tapering naked tail, will be four sufficiently distinctive.

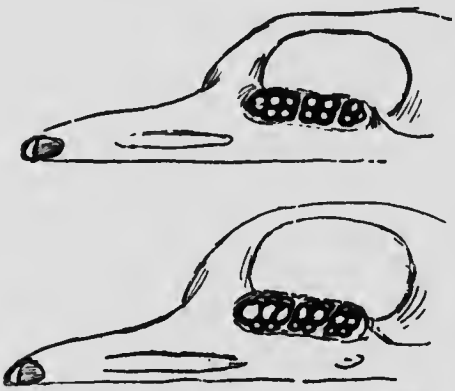


FIG. 140—Upper diagram, left upper molars of genus *Peromyscus*.
Lower diagram, left upper molars of genus *Mus*.
(Greatly enlarged.)

## LIFE-HISTORY.

This species ranges over the whole of the civilized world as a parasite or commensal of mankind. Its first appearance about Carberry, Man., was in the fall of 1886, when I got some specimens out of a stack. RANGE, ETC.

Its chosen environment is a hole in the wall of a well-stocked pantry.

It is not known whether the male parent takes any interest in the young, or, indeed, whether or not the species pairs. MATING

It breeds without ceasing the whole year round. The period of gestation is probably 25 days. The young number 5 or 6; they are weaned at about 2 weeks, and produce very soon, probably at the age of 2½ months. So that in one year a pair of Mice could easily become 1,000, even allowing for considerable destruction by their enemies.

Among the unexpected foes of this animal is the cuterebra or warble-fly.

At Winnipeg, August 25, 1902, I was shown a Common Mouse infested with three of the large warbles or skin-grubs. The miserable little creature was nearly dead from exhaus-

tion and, indeed, died shortly after capture. On going to the house (of W. J. Ptolemy) I was able to examine and preserve the specimen; the parasites were still alive and very large. (See Fig. 141.)

SINGING MICE

Most persons are surprised to hear of singing Mice. The first I met with was in my New York residence. Out of the black darkness of a cupboard at midnight came a prolonged squeaking, thrilling, and churring, suggestive of a canary's song, but of thinner and weaker quality. There could be no question that it was a 'singing Mouse.' Many such cases are on record. Some have been explained as the squeaking of a Mouse in pain from some internal disease, particularly of the vocal apparatus, but others have not, and there seems good reason for believing that House-mice, and indeed all Mice, will at times express their sense of well-being, in a series of complicated sounds that correspond in every way with the singing of birds.

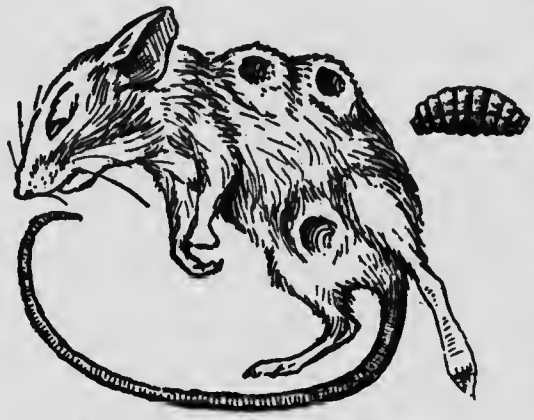


FIG. 141—The diseased Mouse and one of its parasites. Both life size.

So far as known the Common Rat (*Mus norvegicus*) has not yet established itself in Manitoba.

## XVIII.

## Grasshopper-mouse, Calling-mouse, Short-tailed Deer-mouse, or Missouri Mole-mouse.

*Onychomys leucogaster* (Wied).

(Gr. *Onychomys*, from *Onychos*, a claw, and *mys*, a mouse, hence 'claw-mouse,' because its claws are so large compared with those of other Mice; Gr. *leucogaster*, from *leucos*, white, and *gaster*, belly.)

*Hypudæus leucogaster* WIED, 1841, Reise, Nord. Amer., II, p. 99.

*Onychomys leucogaster* BAIRD, 1857, Mam. N. A., p. 459.

TYPE LOCALITY.—Clark, Clark County, South Dakota.

The genus *Onychomys* (Baird, 1857) comprises Mice which have the general form of *Microtus* combined with the colours of *Peromyscus*, the soles of the feet are densely furred and have only 4 (instead of 6) tubercles; the tail is less than half the head and body. The front claws and feet are highly developed for digging.

The teeth are: Inc. $\frac{1-1}{1-1}$; mol. $\frac{3-3}{3-3} = 16$

In addition to these generic characters the Grasshopper-mouse has:

SIZE Length, about 6¼ inches (160 mm.); tail, 1⅝ inches (45 mm.); hind-foot, ⅞ inches (23 mm.).

COLOUR All above soft grayish-brown, sprinkled over with fine black hairs; on the sides and rump this shades into orange and buff, and ends abruptly against the creamy white of all the under parts; the colour is darkest on the lower back, but there is no dorsal band, as in *Peromyscus;* feet, white; tail, gray-brown above, white below, except on *tip, which is all white.*

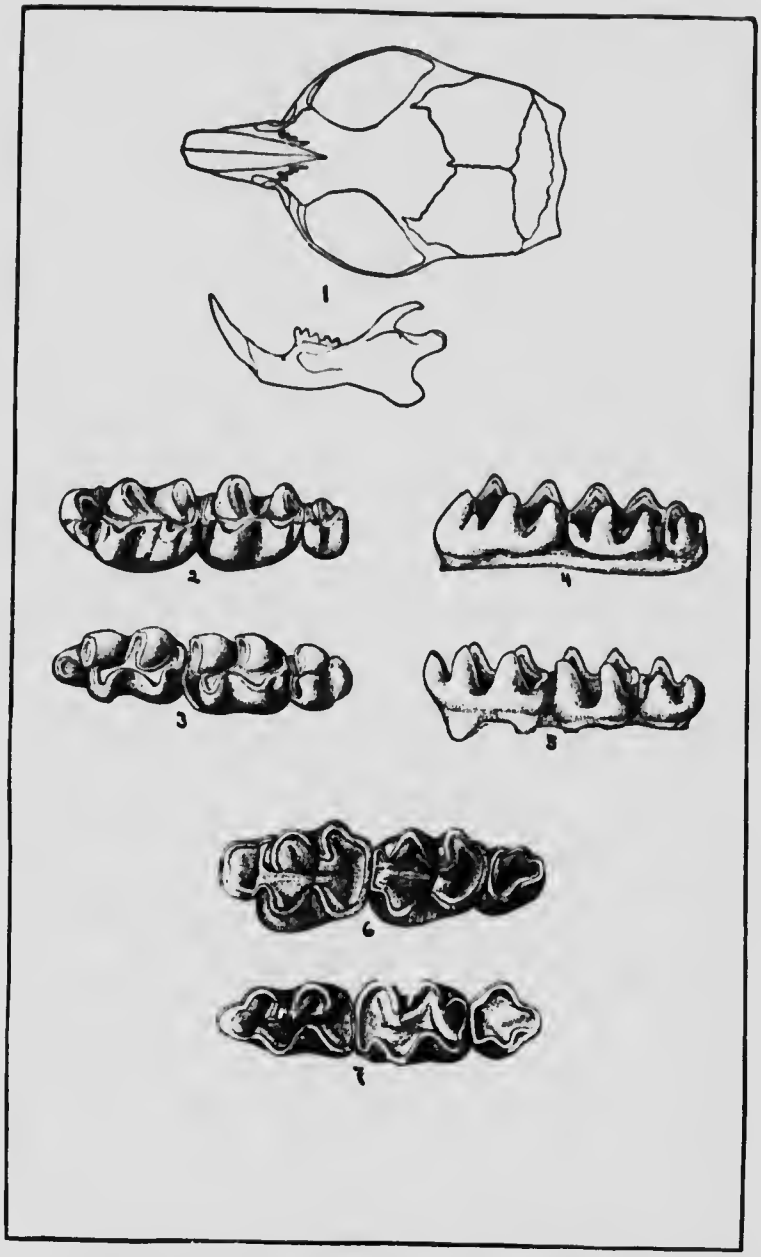



FIG. 142—Skull and teeth of *Onychomys leucogaster* (Wied).

1 to 5 of young; 6 and 7 of adult; 1, skull and left under jaw from outside, twice natural size. Other figures 10 times natural size. From Merriam, N. A. Fauna, 2, 1889, Biol. Survey, U. S. Dept. Agr.

The whiskers and ring around eyes, blackish. The *white of the cheeks meeting on the muzzle* is a marked colour feature.

When seen alive it looks like a bob-tailed Deer-mouse, or a White-footed Meadow-mouse.

Six races of this widespread species are recognized:

*leucogaster* Wied, the typical form.
*brevicaudus* Merriam, smaller, with shorter tail and longer ears.
*longipes* Merriam, a very large race, with long, slender tail.
*albescens* Merriam, a very pale race.
*melanophrys* Merriam, like *leucogaster*, but ears smaller, toes more furred, and black ring around eye accentuated.
*pallescens* Merriam, a very large pale race, with long slender extremities.

Some of these may be entitled to full specific rank.

## Life-history.

RANGE

This appears to be a species of the eastern edge of the plains, from Texas to Manitoba, the type locality being Fort Clark, Dakota. Dr. Coues found it[1] in Red River Valley along the 49th parallel. Vernon Bailey reports[2] it at Bottineau, on the west slope of Turtle Mountain. At Carberry, on the first of June, 1884, I captured a supposed example. As it is a species of the Missouri River region, I should expect to find it in all the dry portions of the second prairie steppe of Manitoba. About Indian Head, Sask., it is abundant, as is proved by records and specimens in the Geological Survey Museum at Ottawa. The 4 which I examined are among these, although in the young or gray pelage they are clearly true *leucogaster*.

[1] Field Notes, 49th Parallel, U. S. Geol. Surv. Bull., 3, Vol. IV, 1878, p. 546.
[2] Rep. Orn. Mam. U. S. Dep. Agr., 1888, p. 443.

POPULATION

At Clayton, New Mexico, I found its kinsman *arcticeps*, so abundant that I estimate its numbers at not less than 50 to the acre in a favourite locality, though I suspect that this was a colony, and there may have been great areas without any of the kind. This may help to furnish a little light on the numbers of the present species.

ENVIRONMENT

Its chosen surroundings are dry, sunny hillocks on edges of thickets in open country. In Minnesota, Bailey found it common on hills and prairies living "in holes on the top of Indian mounds, in sides of banks, and in holes under débris among brush."[3]

HOME-RANGE

I have no evidence to show the home-range of the individual.

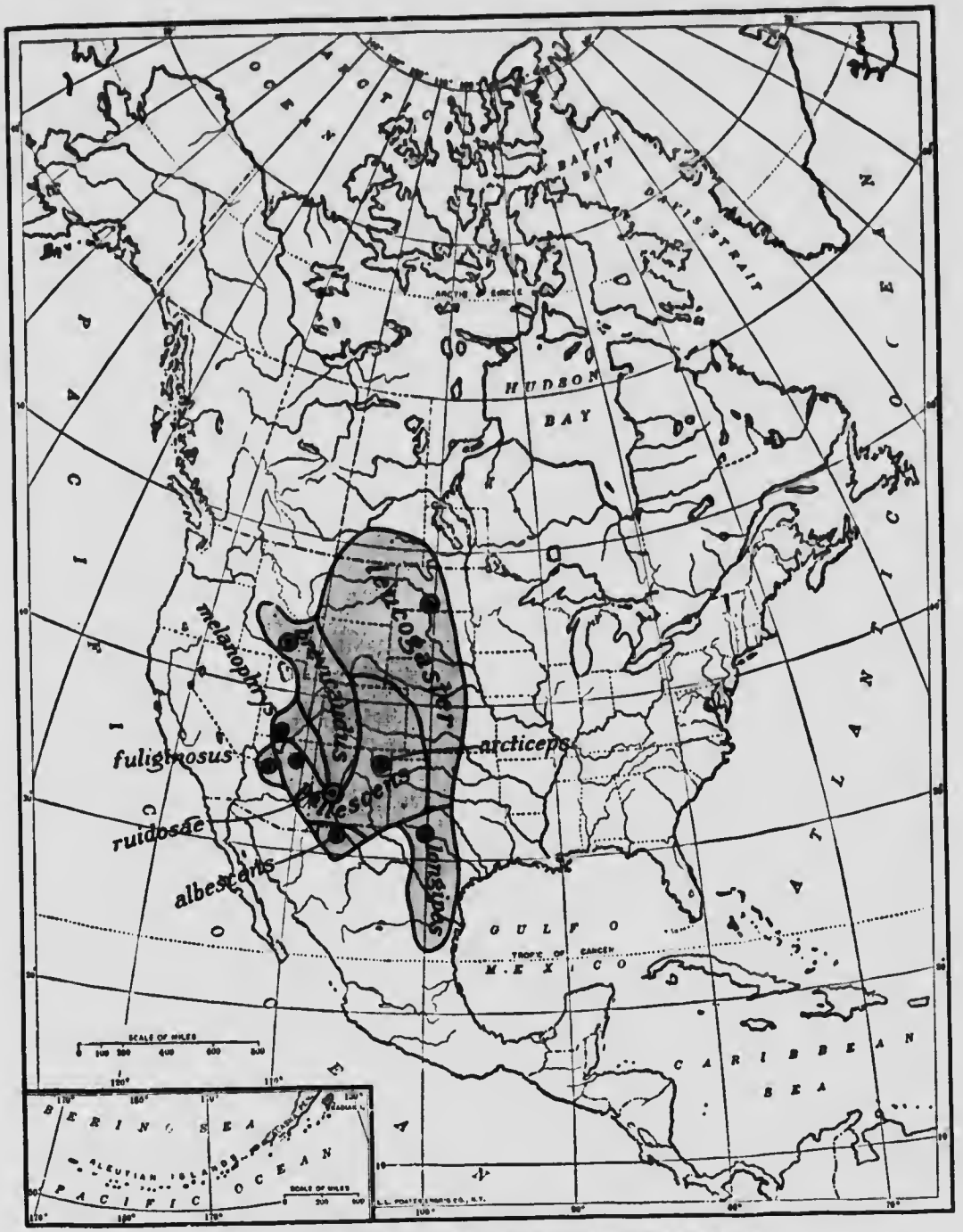
VOICE

The species seems unusually gifted, for its family, in the matter of voice. In my Yellowstone journal I find this note for June 28, 1897: "Yancey's, Yellowstone Park. To-day, as I was sitting on an open sandy bank near the Yellowstone, I heard a prolonged, plaintive, squeaking call, repeated at intervals of four or five seconds. It seemed to come from a part of this bank, about thirty feet from where I sat. The calling ceased when I went to the place, but I found the bank honeycombed with mouse-holes of *microtine* style, and of about two-inch calibre. All about was open, sparsely grassed country. The sound was like that of a Calling-hare, but much higher pitched, and there was no Calling-hare ground within many miles; it certainly came from these holes. I have not yet found the cause of this crying, but doubtless it is the unknown habit of a well-known creature."

The answer to my riddle I found in V. Bailey's notes[4] on a Grasshopper-mouse that he kept in captivity. "He settled one thing for me: that a squeaking cry which I heard at evenings at Brown's Valley and once or twice at Duck Lake was made by this species. He has made the same sound several times. It is something like the cry of the Flying-squirrel."

[3] *Loc. cit.*, p. 442.

[4] *Ibid.*




**MAP 26—RANGE OF THE LARGE GRASSHOPPER-MICE.**

Founded chiefly on papers by D. G. Elliot, C. Hart Merriam E. A. Mearns, V. Bailey, E. R. Warren, G. S. Miller, S. N. Rhoads. The map is provisional and diagrammatic, especially in the South.

**The species are:**

*Onychomys leucogaster* (Wied.), the common species of the plains with 6 races,
*Onychomys ruidosae* Stone and Rehn,
*Onychomys arcticeps* Rhoads,
*Onychomys fuliginosus* Merriam.

BREEDING

Its mating and breeding habits are entirely unknown.

BURROWS

The powerful fore-feet and claws of this creature proclaim it a digger. Wherever I have met with it, and that was chiefly in New Mexico along the Canadian River, I found it frequenting little hillocks that were more or less honeycombed with tunnels which were 1½ to 2-inch calibre. In these complicated burrows I always found other inhabitants, especially the Kangaroo-mice (*Perodipus*). Whether the *Onychomys* was intruding itself on the *Perodipus* or the *Perodipus* on the *Onychomys* I could not determine.

HABITS

It is strictly a ground and underground species, of nocturnal habits, and is probably unable to climb at all. Bailey says in the article cited: "One which I kept in confinement was not full-grown when caught. From the first he did not show the least fear. He took food from my fingers when first offered and never attempted to bite. If not disturbed or very hungry he sleeps all day, and when waked up, gapes, stretches, and blinks some time before he gets fully awake, but is then lively for a time, though he does not seem to like the light, and if it is bright, keeps winking. In the evening he becomes lively and tries to get out, jumping and scratching at the sides of his cage and biting the wires of the front, but he never gnaws, and though he has been a week in a thin cigar-box, there is not a tooth mark on it. Sometimes he becomes crazy in his efforts to get out nights and jumps about with all his might, but usually, unless hungry, he is quiet and intelligent." "Though the weather was cool, they would not keep more than six hours without the hair loosening over the belly * * * probably insect food caused this tendency to early decomposition."

NON-HIBERNANT

Those that I saw in New Mexico were active all winter, but I have no evidence on this point for the species in Manitoba. The probabilities are that it does not hibernate, but stores up food and continues alert under the grass and snow.

FOOD

The food habits of the captive specimen kept by Vernon Bailey are the main evidence we have on this subject. It would eat any kind of meat and most kinds of insects: it was fond of cheese, cake, and cream. When hungry it would descend to seeds and grass and frogs. When Mice and birds were thrown in, it sprang on them with the ferocity of a professed carnivore; evidently it reckoned them on its list of lawful prey. But its chief and choicest food was insects, crickets preferred. Its appetite for these seemed insatiable. On September 22, in 4 hours it ate 30 large insects, chiefly grasshoppers and crickets; September 25 it ate 53 large insects, as before, in 12 hours and apparently would have eaten more if it had had them. From this it will be seen that it is well worthy of the name Grasshopper-mouse.

"The only insects offered to him which he would not eat were ants, and a few in his box made him almost crazy."

EXCREMENT

As a result of such food-habits, the excrement of this species is easily known by the remains of insects that it contains.

TRAPPING

These simple creatures are easily caught in any kind of a trap with almost any kind of a bait.

In New Mexico, where I collected a number of *arcticeps* in 1893, I usually found that the trapped ones had their eyes eaten out by their sorrowing relatives before I could get around in the morning.

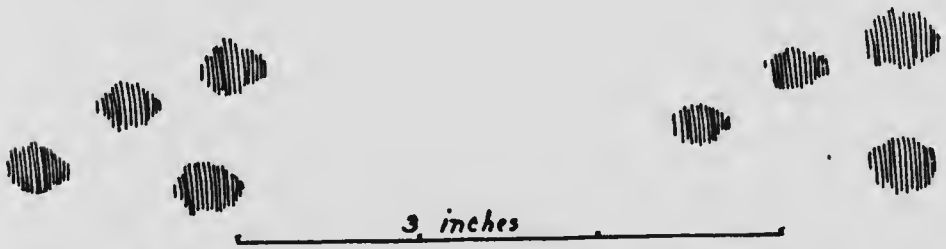



FIG. 143—Tracks of Grasshopper-mouse or Calling-mouse, going towards right. Sketched in Yellowstone Park, August 1, 1897. (Life size.)

## XIX.

## The Arctic Deermouse, Tree-mouse, or Wood-mouse.

*Peromyscus maniculatus arcticus* (Mearns).

(Gr. *Pera*, a pouch; *mys*, a mouse; L. *maniculatus*, 'with little gloves,' on account of its white paws; L. *arcticus*, expressing the far north habitat of the present form.)

*Hesperomys maniculatus* WAGNER, 1845, Wiegmann's Arch. f. Naturg., XI, Bd. I, p. 148.

*Peromyscus maniculatus* BANGS, 1898, Am. Nat., XXXII, p. 496, July, 1898.

TYPE LOCALITY.—The Moravian Settlements on the north-east coast of Labrador. Probably Nain.

*Hesperomys leucopus arcticus* MEARNS, 1890, Bull. Am. Mus. Nat. Hist., II, p. 285.

*Peromyscus maniculatus arcticus* Wilfred H. OSGOOD, in MSS. 1908, considers this the type form of the group.

TYPE LOCALITY.—Fort Simpson, Mackenzie River at the junction of the Liard River.

FRENCH CANADIAN, *la Souris à pàtte blanche du Canada.*

CREE, *Appecoosesh*[1] or *Appèk-kusis*[2] (according to Sir John Richardson).

*Ah-pik'-wa-seès* (according to the French Cree half-breeds on Athabaska River. Compare *Ah-pik-wa-jeès*, their name for Bat.

YANKTON SIOUX, *Yis-pay-na.*

[1] F. B. A., 1829, Vol. I, p. 142.

[2] Arctic Search Exped., 1851, Vol. II, p. 387

The genus *Peromyscus* (Gloger, 1841) comprises Mice of about the size of a House-mouse, but distinguished by their cheek pouches and peculiar upper molars, etc. (See Fig. 144.)

They have large prominent eyes and ears, soft fur which is gray or brown above and white below; long tail, usually bi-coloured.

$$\text{Teeth: Inc. } \frac{1-1}{1-1}\text{; mol. } \frac{3-3}{3-3} = 16$$

The immensely complicated synonomy of the group *Peromyscus maniculatus* is much less complicated than the relationships of the many subspecies that are supposed to belong to it. In the present state of our knowledge it is impossible to offer a satisfactory digest of the facts.

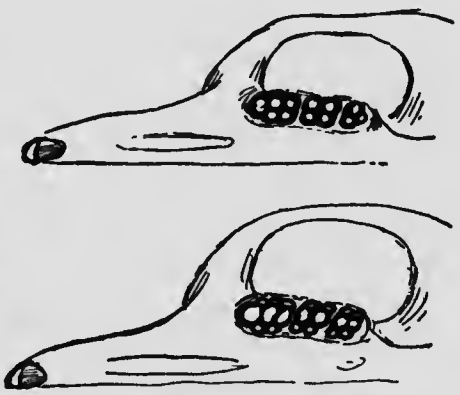


Fig. 144—Upper diagram, left upper molars of genus *Peromyscus*.
Lower diagram, left upper molars of genus *Mus*.
(Both greatly enlarged.)

Temperate North America, in general, is inhabitated by a widespread, highly plastic, long-tailed, white-footed Wood-mouse, called *maniculatus*. This is split up into many intergradient forms, of which three find a meeting ground in Manitoba.

These, according to W. H. Osgood, to whom I am indebted for essential aid in treating the present species, are *arcticus*, *nebrascensis*, and *bairdi*.

In addition to the generic characters a fairly typical specimen of *arcticus* taken at Winnipegosis, August, 30, 1904, has the following:

Length, 7¼ inches (184 mm.); tail, 3¼ inches (82 mm.); SIZE hind-foot, ⅞ inch (21 mm.).

COLOUR

Above, grayish fawn colour, clearest or strongest on cheeks and rump, with a broad (over ½ inch) band along spine from snout to hips, of darker gray sprinkled with blackish hairs; under-fur everywhere plumbeous, which is the colour also of hind legs on outer side. All below, pure white; tail, bicoloured sharply, pure white below, brownish black above; a slight tuft on end.

FIG. 145—Head of Deermouse showing the cheek pouches distended. Altogether the pouches contain 14 of the seeds also an equal bulk of ship-biscuit. Athabaska River, May, 1907

Sexes alike; young, slatey above, and until nearly full grown. Our three races may be thus characterized:

*arcticus*, as above; differs from the typical *maniculatus* chiefly in its much shorter tail. It is a woodland form. Size: 7¼; 3¼; ⅞ inches.

*bairdi* is smaller, much more slender than *arcticus*, and darker, having always a very dark or nearly black band down the back. It is a prairie form. Size: 5¼; 2; ¾ inches.

*nebrascensis* differs from *arcticus* in being much paler, the buffy or yellow is very pure, especially on the hindquarters, and is greatly extended so that it covers nearly all the body, leaving little or no dark dorsal band. It is a Plains form. Size 6¼; 2 1/16; 1⅛ inches.

When alive *nebrascensis* strikes one as a *golden-brown mouse; bairdi* as a *black mouse; arcticus* as a *gray mouse.*

At Carberry I got specimens that were related to all three, but also some that were nearly true *bairdi*. Specimens from Kenora, Ingolf, Winnipeg, and Winnipegosis are almost typical *arcticus*.[3]

## LIFE-HISTORY.

RANGE

The northern Deermouse (*arcticus*) is generally distributed in north-eastern Manitoba, and is the dominant form in the Province. Its range is shown on Map No. 27.

[3] While this volume was in press Osgood's monograph of the genus *Peromyscus* appeared. This work makes it seem probable that true *maniculatus* is the form in north-eastern Manitoba.


**MAP 27—RANGE OF THE NORTHERN D..ERMOUSE.**

***Peromyscus maniculatus* (Wagner) and its Northern Races.**

This map is founded chiefly on W. H. Osgood's admirable map in N. A. Fauna No. 28 (published while my article was in press). While following this as a whole, I have simplified it and added the type localities. Except in Canada, the areas of intergradation are not indicated where shown they are dotted. Some 35 races of *maniculatus* are recognized by Osgood.

Those entering Canada are as follows:

*maniculatus*
*arcticus*
*gracilis*
*abietorum*
*bairdi*
*nebrascensis*
*artemisiae*
*oreas*
*austerus*
*keeni*
*hylaeus*
*algidus*
*macrorhinus*
*saturatus*
*hollisteri*
*eremus*
*argentatus*

ENVIRONMENT

Its favourite surroundings are in or near timber or buildings; any dry place where it can climb above ground seems to please it, and every settler's home and barn has a population of these Mice, except, perhaps, in some of the older regions where the imported House-mouse of Europe has arrived and driven the natives farther back.

HOME-RANGE

I have no positive evidence on the extent of its individual wanderings, but it is not known to migrate, so probably its life may be spent within one hundred feet of its den.

ABUNDANCE

It is much less abundant than the Meadow-mouse, but I have commonly seen half-a-dozen killed every week in our one-roomed shanty without visibly reducing the numbers. I suppose that every barn near the woods has at least two pairs about it, and that every group of farm-buildings in Manitoba has a dozen pairs among its permanent population.

SOCIABILITY

Although many of this species are sometimes found together in a small locality, they are attracted by favourable conditions, not by each other's company. So far as I have seen, they do not nest in colonies, move in bodies, unite their efforts in any enterprise, or otherwise profit by each other's company, so can scarcely be called sociable. One pair in each burrow or nest is the rule.

INTER-COMMUNICATION

The well-marked livery and long tail of the species are no doubt directive marks of importance. Its senses of smell, hearing, and touch are acute and play an obscure but obvious part. The continuous whiskering of strange objects is suggestive of a highly developed system of whisker-touch, but the species seems to neglect no means of conveying its impressions to its kin.

The peculiar signalling of Deermice is a subject to which my attention has been called by M. A. Walton, the Hermit.[2] He considers that drumming with the feet is the chief means employed by the New England species. I have often seen the performance.

[2] A Hermit's Wild Friends, 1905, p. 122.

The Mouse beats on any near object, with the palm of one paw, so rapidly that it makes a drum-roll suggesting the call of the downy woodpecker, but extremely short and soft. I believe the Arctic Deermouse uses the same means of communicating with its fellows.

Vocal power also is well developed in the species. It has the usual variety of squeaks, and almost certainly a prolonged song like that attributed to *bairdi*, indeed, to all our animals in the Mouse and Squirrel groups. VOICE

The tracks of the Deermouse are commonly to be seen on the snow. They show the pairing of the feet that are char- TRACKS

FIG. 146—Tracks of Deermouse. (Running to left.) Note tail mark and pairing of front or smaller feet.

acteristic of climbing animals. Sometimes they resemble the tracks of a sparrow, but the furrow left by the tail will distinguish these (Fig. 146).

This beautiful little creature is an expert climber, and its ideal nesting site is in some hollow log or tree well up from the ground. In the woods this means usually a woodpecker hole or some hollow heart that is reached only by a very small opening. I once found one in a deserted wren's nest in a stump. Around buildings it will use any kind of a cranny, high or low, and will often make a nest in some movable box or bundle within a few hours after it has been set down. The nest itself is an ambitious structure from three to eight inches in diameter, globular, completely roofed in, and entered by a self-closing doorway on one side. It is composed of straw, bark, and various native cottony plants, is very warm, and, like everything about this dainty little animal, shows a keen appreciation of the creature comforts of life. NEST

This elaborate construction is amply justified by the facts that the nest is not a mere nursery. It is the home of the family the whole year round, and must be proof against rain, frost, and flood, as well as hidden from innumerable enemies.

STORE-ROOM

Not far from the home-den, and usually connected with it, is the storeroom filled with various seeds and grasses (never roots), for the Deermouse does not hibernate even in the coldest weather, and therefore lays up in times of plenty a store of food to last it through the evil days ahead.

MATING

All the evidence at hand goes to show that the Deermouse pairs; that usually the male helps his partner to prepare the nest and care for the young, but that there are cases in which the male abandons the female as soon as the joys of the mating season are banished by the responsibilities.

Pairing takes place in late winter, and the two together construct the nest.

GESTATION

Gestation I find to be 23 days in the White-footed Deermouse of Connecticut; it is probably the same in this species. The earliest brood comes about April 1, in Manitoba, and is succeeded by another every sixty days till snow time; thus a pair may have 4 litters in a season.

The young are usually 4 or 5 in number, but 3 are often seen, especially for the first brood of a young mother; I once found 7 embryos in a mature female, though she had but 6 teats.

When the nest is disturbed so that the mother runs out, she commonly carries off some or even all of her brood attached to her teats. This, however, is not her regular mode of carrying them about, but is rather due to the fact that the young when very small attached themselves firmly to the teat, almost in marsupial style, and the mother has not time to disengage herself if suddenly driven forth. Most of the Deermice carry their young in the mouth, one at a time, when they move them, just as a cat does her kittens.

Near Hamilton, Montana, on the evening of September 4, 1902, I found in one of our horse panniers a Deermouse

(*artemisiæ*) with a family of 4 young. They were about ten days old, I should guess. One of them clung to her teat and was dragged about by her mother as she dodged among our packages. Eventually she ran off with it into the bushes. I put the others into the hole where she hid, and in due time she returned and cared for them.

The young are blind till about two weeks old. As soon as they are able to take care of themselves, that is when two-thirds grown and about a month old, they quit the parental nest, and, obedient to a necessary instinct, scatter to live, for a time at least, a solitary life, leaving the parents free to set about the production of a new brood. Analogy would indicate that at the age of three or four months they begin to reproduce.

NOCTURNAL

The large black eyes, long whiskers, and expansive ears all tell a story of adaptation to a life of dim light. The Deermouse is nocturnal. Very rarely, indeed, can one camp in the woods of Manitoba without finding signs next morning that Deermice have been about the camp, running over the sleepers, tickling their faces with their cold feet, and picking up such scraps as are left in reach. But one never sees the Deermouse while the sun is high, unless it has been disturbed in its retreat.

In this it differs from the Meadow-mice. They come out at all times, but are screened in their tunnel runways, while the Deermouse seems to go where it will in the woods, high and low, unrammelled by a customary route and without any semblance of the runway habit, even when the ground is covered with snow.

FOOD

This Deermouse is essentially a nut-and-seed eater when compared with the grass-eating Meadow-mice. As already recognized, is has highly developed the habit of storing up food for the winter. As the species does not hibernate, and cannot flourish on such coarse provender as will satisfy the Meadow-mice, it needs a great store of the finest food-stuffs as well as a warm winter nest.

Richardson writes[3] concerning the food habits of the form that he found of general distribution in the north: "It has a habit of making hoards of grain or little pieces of fat, which I believe is unknown to the European domestic Mouse; and what is most singular, these hoards are not formed in the animal's retreats, but generally in a shoe left at the bedside, the pocket of a coat, a night-cap, a bag hung against the wall, or some similar place. It not infrequently happened that we found barley, which had been brought from a distant apartment and introduced into a drawer, through so small a chink that it was impossible for the Mouse to gain access to its store. The quantity laid up in a single night nearly equalling the bulk of the Mouse renders it possible that several individuals unite in their efforts to form it."

ECONOMIC VALUE

In its native woods it is a harmless or even beneficial species, destroying many noxious weeds and insects; but in storehouses, where sometimes it takes up its abode, it does a good deal of mischief by gnawing holes in bags to get at the supplies. However, its numbers are never very great, so that the loss it causes is always very small.

ENEMIES

The owls, the smaller Weasels, the Short-tailed Shrew, the Striped-gopher, the Lynx, the Fox, and the hawks are perhaps the worst enemies of this species, and are here given in order of virulence. From the owls, Lynx, Fox, and hawks its escape is indoors or even underground, and to baffle the others I suppose it can at best slam the door in their faces by plugging the hole behind it. No doubt when the ogre goes off with its babies it rejoices in its own escape, forgets its sorrow, and speedily consoles itself with a new family.

[3] F. B. A., 1829, I, pp. 142–3.


PLATE XXXVIII.—PRAIRIE DEERMOUSE (LIFE SIZE).

(*Peromyscus bairdi* (Hoy and Kennicott).)

From life, Carberry, Man., July, 1884.

(*Peromyscus bairdi* (Hoy and Kennicott).)
From life, Carberry, Man., July, 1884.

## XIX a.

## Prairie Deermouse, Baird Mouse, or White-footed Prairie-mouse.

*Peromyscus maniculatus bairdi* (Hoy and Kennicott).
(*bairdi*, in honor of S. F. Baird.)

*Mus bairdii* Hoy and Kennicott, 1857, Pat. Off. Rep. for 1856, p. 92.
*Peromyscus maniculatus bairdi* Osgood, in MSS.
Type Locality.—Northern Illinois.

On p. 492 this race is compared with *arcticus* and sufficiently characterized for identification.

### Life-history.

RANGE

This is a species of general distribution in the Upper Mississippi Valley, and faunally south-western Manitoba is a part of that region.

I collected five specimens at Carberry. Professor C. L. Herrick says[1] the species is of "reasonably frequent occurrence in the south-eastern part of Minnesota." V. Bailey found it[2] "common on the high prairie in the town of Traverse on the Dakota side of the valley," and also at Pembina, and caught a supposed specimen at Bottineau, on the west slope of Turtle Mountain.

It is essentially an animal of high, dry prairies, and is the complement of the common Deermouse. They are closely related and much alike, but one is a robust forest form, and the other a slender prairie species.

HOME-RANGE

I have no evidence on the home-range of the individual, but analogy would argue that it cannot be more than 100 yards radius.

[1] Mam. Minn., 1892, p. 190.
Rep. Orn. U. S. Dep. Agr., 1888, p. 442.

ABUNDANCE

The species is not common in the parts of Manitoba where I lived and trapped. During several years at Carberry I collected only five specimens. I should say indeed that the south-western prairies of the Province are the north-eastern fringe of its range. At Pembina it began to be more plentiful. V. Bailey not only found it common on the prairies there, in the summer of 1887, but adds that[3] "it seems to be about the only Mouse of economic importance. It lives near the grain fields and cuts down a small quantity near the edges. It cuts some grasses on dry ground for the seeds, but is not numerous enough to be of great importance."

SOCIABILITY

Like *arcticus*, it is neither sociable nor gregarious; usually one pair of adults is all that are found in one burrow.

Bailey observed[4] that it lived in the same holes with the Grasshopper-mouse, but this may have been a sort of parasitism on the part of the latter, as in New Mexico I found it similarly sharing the quarters of *Perodipus*.

VOICE, ETC.

Captive specimens kept by Kennicott had a soft, clear voice and used it but seldom.[5] It is not known whether the creature drums with its toes as a means of inter-communication, but seemingly it has the song habit discovered already among other members of the group.

SINGING

The only evidence I have of this is an article contributed to the American Naturalist by W. O. Hiskey, of Minneapolis, Minn. He writes as follows:[6]

"A communication in the *Naturalist* some time ago, in regard to 'Musical Mice,' prepared me for a phenomenon which recently came under my observation, which otherwise would have astonished me beyond conception. I was sitting, a few evenings since, not far from a half-opened closet door, when I was startled by a sound from the closet of such marvellous beauty that I at once asked my wife how Bobbie Burns (our canary) had found his way into the closet, and what could start him to singing such a queer and sweet song in the dark?

[3] *Loc. cit.* [4] *Loc. cit.* [5] Quad. Ill., 1857, p. 95.
[6] Am. Nat., May, 1871, p. 171.

I procured a light and found it to be a *mouse!* He had filled an overshoe from a basket of popcorn which had been popped and placed in the closet in the morning. Whether this rare collection of food inspired him with song, I know not, but I had not the heart to disturb his corn, hoping to hear from him again. Last night his song renewed. I approached him with a subduced light and with great caution, and had the pleasure of seeing him sitting among his corn singing his beautiful solo. I observed him without interruption for ten minutes, not over four feet from him. His song was not a *chirp*, but a continuous song of musical tone, a kind of *to-wit-to-wee-woo-woo-wee-woo*, quite varied in pitch. While I observed him I took for granted that he was a common House-mouse (*Mus musculus*), but when he sprang from the shoe to make his escape, he appeared like a Prairie-mouse [*Peromyscus bairdi*], a species I had not, however, observed in-doors. I have thus far failed to secure this little rodent musician, but I shall continue to do all I can in the way of popcorn to entertain him, and if his marvellous voice gives him the pre-eminence in mousedom which he deserves, by the aid of natural selection, I shall presently have a chorus of Mice."[7]

Before accepting all musical Mice as artists inspired to flights in the musical art, by a combination of talent, æsthetic impulse, and holy joy, we should remember that not a few cases have been explained away as mere outcries from continued pain, and in some cases from diseased or defective breathing apparatus.

MATING

Again I must refer to Kennicott, who knew this Mouse well and studied it minutely—captive and free. The species pairs. "In spring," he says,[8] "I have always found the old male living with the female and young; but during the summer I have sometimes observed the male leading a solitary life, and the females and young in burrows by themselves."

BURROWS

"Not having on the prairies the shelter found by its timber-loving cousins, in old stumps and trees, this species

[7] See also Am. Nat., 1889, p. 481.

[8] *Loc. cit.*

digs and burrows. These are rather simple, with few or no side passages, and often with but one entrance, the depth and extent being variable, but never great. * * * In cultivated fields the burrows are frequently dug at 'the roots of fruit trees.'"

NESTING

Out on the prairie it nests in any chance shelter afforded by a wisp of grass or straw, an overhanging bank, an overturned sod, or even a den underground, especially among the roots

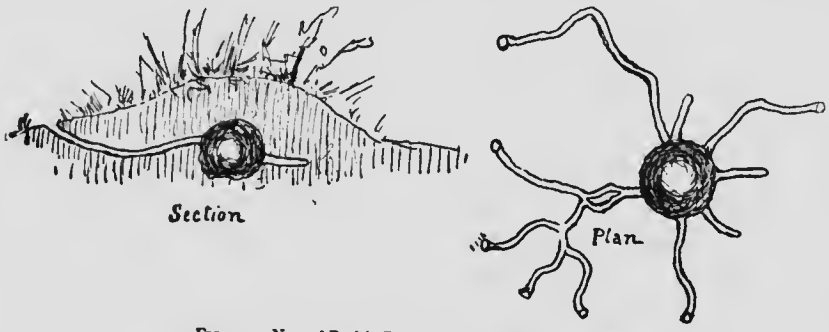



FIG. 147—Nest of Prairie Deermouse, Carberry, Man., 1882.
Seven doors of entry; three blind tunnels.

in a scrubby bank. These underground homes are dug by the Mouse itself and are very simple affairs, readily distinguished from the tunnels of the Striped Ground-squirrel by the shortness, simplicity, and size. The Ground-squirrel makes a tunnel about 1¾ inches in diameter, that of the Mouse is but 1 inch.

In the summer of 1882 I saw and caught a Deermouse on a little prairie knoll near my shanty. It proves to have been *bairdi*. In October I dug open this knoll and found the nest of which the plan is here shown. It was about six inches from the surface. The chamber was lined with soft, dry grass, but was quite empty. As the tunnels were too small for the Striped Ground-squirrel, and *bairdi* the only Mouse ever seen about that spot, I assume this to have been the den of the latter species. It is shown in the accompanying illustration (Fig. 147).

BREEDING

The young, as with *arcticus*, are produced in a succession of three or four broods between snow and snow.

YOUNG

They number 5 or 6, 5 being the usual litter of an adult mother. In their growth and development they present no very obvious difference to the young of *arcticus*.

Some of these Mice were kept captive by Kennicott, who says: "I placed a female with 5 young, but a few days old, in a cage, and observing that 6 of the mother's mammæ had been sucked, I placed another, taken from a younger litter, with her, which, to my surprise, she adopted; and several weeks afterward, they having in the meanwhile taken a journey of many miles, I heard that this interesting little family, including the changeling, were all alive and well. This old female constructed the usual globular nest of the cotton and grass placed in the cage; and, upon looking into this, I found the young attached to her teats in every instance, except when I examined immediately after she had been out to eat, and before they had resumed their accustomed places. It is only when they are quite small, however, that the young remain so constantly attached to the mammæ."

This pleasant picture, unfortunately, is clouded by the disagreeable thought that these Mice are cannibal even to the extent of eating their own young when not furnished with flesh meat.

As soon as they are able to take care of themselves, that is when about a month or six weeks old, the young scatter from the home-nest, leaving mother and father (?) to live for a time each the life of a young recluse.

STRICTLY NOCTURNAL

The Baird Mouse is strictly nocturnal, and, indeed, is in all its habits an ordinary Deermouse that has adapted itself to prairie life.

FOOD

Its food is briefly every kind of seed and nut found on the prairies, doubtless also insects, birds' eggs, and flesh, when obtainable, and failing all these, it can live on herbage and leaves.

The carnivorous record given by Kennicott is rather gruesome.

"On one occasion [he says[9]] I captured a pair with young, and placed them all in a cage well supplied with various kinds of vegetables and grain. The next day several of the young were killed and eaten, and in two or three days they had all disappeared. Shortly afterwards the male, which had been slightly injured, was found dead, and partly devoured by his rapacious spouse. After this I fed my specimens with meat as well as grain, which they ate, and, as long as they were supplied with it, they lived together harmless; but no sooner was this withheld, than the old ones, both male and female, devoured their young. Though all are more or less carnivorous, they are not generally so bloodthirsty as to devour each other of their young when not supplied with flesh."

Bailey says of those that he observed near Pembina:[10] "I think it eats the seed of pennycress (*Thlaspi arvense*), which has become so thick that in some fields nothing else can grow." Besides this he found these Mice cutting down grain and grass for the seeds.

ECONOMIC VALUE

Thus it is shown to do a little mischief to the crops by cutting them down and about an equal amount of good by destroying a troublesome weed.

STORAGE

It has the storage habit well developed, as it does not hibernate, but, like others of its family, is active in all seasons and weathers. Kennicott points out that it collects seeds, but never roots. A mouse nest with a store of roots is likely to be that of a *Microtus* but not of a *Peromyscus*.

[9] Quad. Ill., 1857, p. 94.
[10] Rep. Orn. U. S. Dep. Agr. (for 1887), 1888, p. 442.

## XIX b.

### Nebraska Deermouse.

*Peromyscus maniculatus nebrascensis* (Mearns).

(L. *nebrascensis*, of Nebraska.)

*Hesperomys leucopus nebrascensis* Mearns, 1890, Bull. Am. Mus. Nat. Hist., II, pp. 285 and 287.
*Peromyscus maniculatus nebrascensis* Osgood, in MSS.
Type Locality.—Calf Creek, central Montana.

On page 492 this race is compared with *arcticus* and *bairdi* and sufficiently characterized for identification.

As my Manitoba specimens are not typical of this form, and my notes but brief and inconclusive, I shall pass it with the general statement that in habits it is a Deermouse that has taken to life in the open and semi-arid Plains.

## XX.

## Canadian Red-backed Vole, Red Wood-vole, or Gapper Mouse, Long-eared Ground-mouse.

*Evotomys gapperi* (Vigors).

(*Evotomys*, from Gr. *ev*, well; *otos*, ear; *mys*, mouse, a name given to the genus by Dr. E. Coues in 1874, on account of the 'well-developed ears' when compared with *Microtus; gapperi* in honour of Anthony Gapper, who collected the first specimen known to science. He found it on his brother's farm near Lake Simcoe and sent it to Vigors, who described and named it in 1830.)

*Arvicola gapperi* VIGORS, 1830, Zool. Journ., V, p. 204.
*Evotomys gapperi* MERRIAM, 1891, N A. Fauna, No. 5, p. 119.
TYPE LOCALITY.—Near Lake Simcoe, Ontario.

FRENCH CANADIAN, *le Campagnol rouge.*

The genus *Evotomys* (Coues, 1874) comprises Meadow-mice much like those in the genus *Microtus*, but readily distinguished by their *large ears*, longer tails, and *red back*. (See Plate XXXIX, Fig. *a*.)

The tooth formula is as in *Microtus*, though there are many minor differences in the teeth.

The Gapper Mouse, in addition to its generic characters, has the following:

SIZE Length, 5¾ inches (146 mm.); tail, 1½ inches (38 mm.); hind-foot, ¾ inch (19 mm.).

COLOUR General colour of the body a buffy or pale ochraceous; the broad band along the back from crown to tail, chestnut, streaked with black hairs; under parts, pale buff; feet, gray; tail, brownish above, gray buff below, tip black. In summer, darker.

Usually the male has on each flank a gland marked by a pale patch of fur.

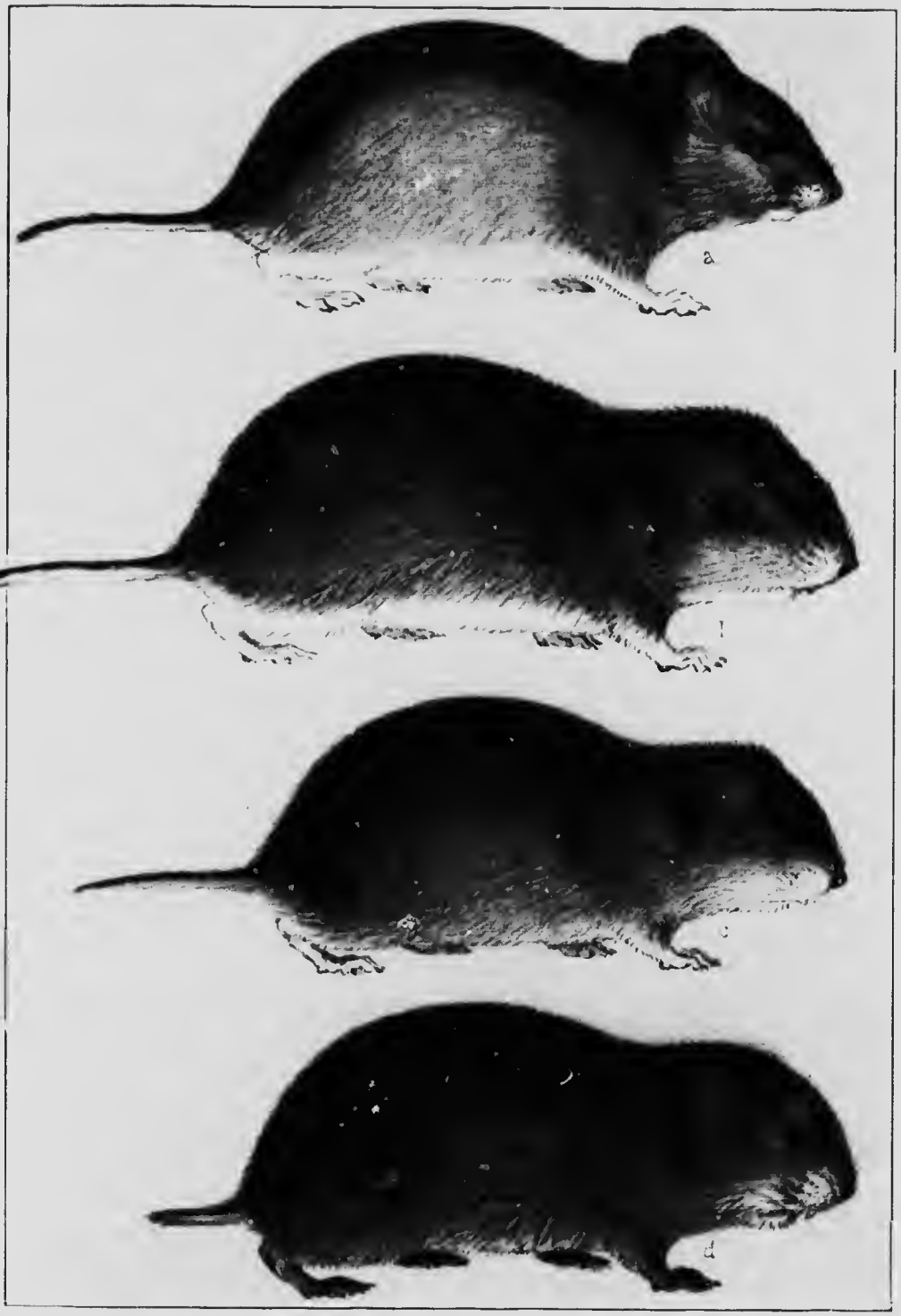



PLATE XXXIX.—VOLES.

*a. Evotomys gapperi athabascæ* Preble. *b. Microtus pennsylvanicus drummondi* (Bach.).
*c. Microtus minor* (Merriam). *d. Synaptomys borealis* (Rich.).

From specimens in collection of Biol. Survey.
(All are life size.)


**MAP 28—RANGE OF RED-BACKED VOLES OF THE GENUS *Evotomys*.**
**(All North American species included.)**

This map is diagrammatic. Actual records are spotted for *gapperi* only.
These are chiefly from Vernon Bailey's "Revision" of the Genus, with others by E. A. Preble, D. G. Elliot, S. N. Rhoads, O. Bangs, C. Hart Merriam, E. R. Warren, G. S. Miller, E. T. Seton.

**The following are entered:**

*Evotomys gapperi* (Vigors) and its 8 races,
*Evotomys caurinus* Bailey,
*Evotomys wrangeli* Bailey,
*Evotomys dawsoni* Merriam with its 2 races,
*Evotomys orca* Merriam,
*Evotomys brevicaudus* Merriam,
*Evotomys carolinensis* Merriam,
*Evotomys ungava* Bailey,
*Evotomys idahoensis* Merriam,
*Evotomys mazama* Merriam,
*Evotomys obscurus* Merriam,
*Evotomys californicus* Merriam,
*Evotomys occidentalis* Merriam,
*Evotomys nivarius* Bailey,
*Evotomys proteus* Bangs.

This species is dichromatic, that is, it appears in two colourations, one the normal, as above, the other the dark "freak," much grayer in general and the back stripe sooty, instead of red.

The slender form, long tail, rufous-tipped ears and bright colours of the animal will distinguish it from the neighbouring species.

The following races are recognized:

*gapperi* Vigors, the typical form.
*ochraceus* Miller, larger and duller-coloured.
*rhoadsi* Stone, like *gapperi*, but darker-coloured, with shorter tail and larger hind-foot.
*athabascæ* Preble; size of *gapperi*, with lower parts lighter and face grayer.
*loringi* Bailey, a very small, bright-coloured form.
*galei* Merriam, like *gapperi*, but paler, and with longer tail.
*saturatus* Rhoads, larger, and longer-tailed than *gapperi*.

## Life-history.

RANGE

The Gapper Mouse, originally described from Yonge Street, north of Toronto, Ont., has been found in graded forms across the Continent to British Columbia. I got specimens at Kenora, Winnipeg, and Carberry. E. A. Preble also found it[1] "rather common throughout the region between Norway House and Hudson's Bay." Kennicott took a few along Red River.[2] Coues, in his Monograph of Muridæ, records[3] it from Minnesota. Agassiz brought three specimens from Lake Superior.[4] Bailey records[5] others from various parts in Minnesota and Dakota, including Pembina. Thus all of Manitoba falls within the proper range of this Mouse.

[1] N. A. Fauna, No. 22, 1902, pp. 50–1.
[2] Quad. Ill., Pat. Off. Rep. (for 1857), 1858, p. 89.
[3] Monogr. Rod. Muridæ, U. S. Geol. Sur. Ter., 1877, p. 145.
[4] *Ibid.*
[5] Rep. Orn. U. S. Dep. Agr. (for 1887), 1888, p. 444.

The specimens from Portland, N. D., prove to be of the well-marked sub-species,[6] *loringi*. Pembina and Carberry specimens are, according to Bailey, intermediate between *loringi* and the type. Kenora and Norway House specimens, on the other hand, are true *gapperi*, so that we may consider the habits of all the Manitoba Red-backed Voles under one head.

ENVIRONMENT

This species is a Meadow-mouse that has taken to the woods, abandoning at the same time the mud-coloured hue of *Microtus* for the rich chestnut-reddish that harmonizes admirably with the dead leaves that carpet its home-land. In Keewatin Preble found[7] that "Mossy spruce woods seemed to be their favourite habitat, but we also frequently trapped them in deciduous or mixed woods, and occasionally in willow thickets or swamps."

HOME-RANGE

The only evidences I have on the home-range of the species are those of analogy among its kindred, probabilities, and the fact that I have found it living in very small isolated clumps of timber, all of which tends to prove a very small home locality for each individual, less, I imagine, than one hundred feet across. Evidence pointing to a very different conclusion, however, is cited in the paragraph on drink.

ABUNDANCE

This animal is much less abundant than the Common Meadow-mouse or *Microtus*. Even in the most favoured localities its number cannot be one-tenth of those of the Meadow-mouse. Along the heavily timbered bottomlands at Breckenridge, Minn., Kennicott found it[8] more numerous than any other mammal in an equal area, except *Microtus austerus*, in northern Illinois. He considered it rare at Latitude 50 degrees on the Red River, and at Carberry I did not see more than three or four each year. Since it is a woodland species, it is decreasing with the clearing of the forests.

[6] Proc. Biol. Soc., Washington, May 13, 1897, p. 125.
[7] N. A. Fauna, No. 22, 1902, p. 51.
[8] Quad. Ill., Pat. Off. Rep. (for 1857), 1858, p. 90.

SOCIABILITY

Though often found in numbers together, the Mice of this group are not, strictly speaking, sociable, since they do not seem to combine their efforts for a common purpose or profit by each other's society.

COMMUNICATING, ETC.

It is a remarkably s ent species. Kennicott says[9] that he did not at any time hear this Mouse utter sounds, as the *Microtus austerus* does, whenever several are feeding together, nor did it make any cry when caught.

BURROWS

It does not make the over-ground, under-grass runways, so characteristic of the true Meadow-mice. Continual use may occasionally give visible shape to the pathway near its nest, but ordinarily it scampers about on the floor of the forest as freely as a tiny Deer.

NEST

From all accounts the nest is usually placed in a superficial burrow. Though it is sometimes found on the top of the ground, under or in logs, stumps, or moss. Kennicott found one "in the rotten stub of a tree several feet from the ground."[10] Usually it is lined with grass and other soft material.

BREEDING

Regarding the mating, we know little beyond the fact that it attends to these duties at the earliest opportunity, with assiduity that is worthy of the indefatigable and fecund family to which it belongs.

Nothing is known of the period of gestation for this, or, so far as I can learn, for any other of our Meadow-mice. Millais gives[11] the gestation of the British species (*E. glareolus*) at 28 days.

The evidence is that it breeds as soon as the snow is well gone in spring, though why it should wait is not obvious, as it is active all winter under the snow, and just as warm probably as later.

YOUNG

The species is very prolific. Kennicott[12] found 8 young in a nest, and within several rods of this a family of 5 or 6,

[9] *Ibid.*, p. 89.
[10] *Ibid.*, p. 89.
[11] Mam. Gr. Br. & Ire., Vol. II, 1905, p. 246.
[12] *Ibid.*, p. 90.

probably a month or two older, which he concluded to be an earlier litter of the same parent.

Merriam records:[13] "I have shot females each containing 4 young as early as the 3rd of April and as late as the 4th of October. I have also taken a female early in June that was nursing her second brood. Hence it is clear that several litters are produced each season." To this I may add that at Carberry, September 22, 1884, I caught a Red-backed Vole within a few days of bringing forth young. It is quite likely that the young of the early litters are hard at work contributing to the population before their first winter.

HABITS

This Mouse differs from the rest of the ground Mice in several important particulars. Its habits are rather like those of the Deermice. It climbs about logs and up low stumps with facility, and is sometimes seen living in old buildings, and, although a wildwood species, it often takes up its abode with civilized man, just as the Deermouse habitually does, and just as the Meadow-mouse does not.

DIURNAL

Most of its kin are nocturnal, but this species is largely if not chiefly diurnal. Kennicott[14] "was particularly struck with their diurnal habits. Not only were they active during the day, but they appeared to seclude themselves strictly after dark. I caught them readily in traps, in the day, but never at night, nor were they seen in the evening, as would have been the case had they been crepuscular." Merriam considers this Mouse both diurnal and nocturnal. He says:[15] "I have shot it at noonday scampering over the leaves in the deep woods, and dodging in and out between the rocks of a lake shore. I have also seen it after dark in shanties and log houses, and have caught many during the night in traps."

FOOD

In food habits it is omnivorous, like its kin, but is a cleaner feeder than most and shows little of the carnivorous propensity.

[13] Mam. Adir., 1884. p. 272.
[14] Quad. Ill., 1858, p. 89.
[15] Mam. Adir., 1884, p. 271.

Merriam says[16] it feeds "upon beechnuts and a variety of seeds, berries, and roots, and also, at certain times in the winter season, upon the bark of shrubs and trees. The beech, maple, ash, and bass suffer most severely from its attacks and in the order named. The bark is generally removed in irregular areas from the large roots just above the ground, but sometimes saplings and even trees a foot or more in diameter are completely girdled to the height of three or four feet."

Like all of its order that do not hibernate, it lays up stores of roots and nuts and seeds for winter consumption.

DRINK

A curious case which seems to show that these Mice are in the habit of travelling a long way for water is thus recorded by Kennicott: "Though I collected several specimens of this species, together with a great number of *Zapus hudsonius* drowned in a hole a half mile from the woods, I saw none on the prairie at any other time; whence it is inferred that they are generally confined to the woods."[17]

ON THE GROUND

Although, as we have seen, it can and does climb a little, it is at home only on the ground. When at its fastest pace it goes at a steady trot, not bounding like a Deermouse. This difference of progress is exactly paralleled among small birds, and for the same reasons. The Shore-lark and such ground birds are *steppers;* the sparrows and tree birds are *hoppers.* I have no drawing of the trail to illustrate this species, but it undoubtedly is much like that of the *Microtus*, which see.

ENEMIES

Its enemies are all living creatures; for those that do not eat it, eat its food, or destroy its shelter, and so crowd it out.

RELATION TO MAN

As this is a woodland species disappearing with the forest, it has but little bearing on agriculture. The only mischief it embarks in is the girdling of forest trees, and this has never yet been observed on a scale large enough to be serious. Merriam remarks that its flesh "is tender and well-flavoured," which statement the lovers of wild meat may construe into a gentle hint.

[16] *Ibid.*

[17] Quad., Ill., 1858, p. 90.

## XX a.

## Prairie Red-backed Vole.

*Evotomys gapperi loringi* Bailey.

(*loringi*, in honour of J. Alden Loring, who collected the type specimen at Portland, North Dakota, November 22, 1895.)

*Evotomys gapperi loringi* BAILEY, 1897, Proc. Biol. Soc. Wash., May 13, 1897, p. 125.

TYPE LOCALITY.—Portland, North Dakota.

This race of the Gapper Mouse differs from the typical form chiefly in its smaller, slenderer skull, and in being much smaller and brighter coloured. It is, indeed, the smallest known *Evotomys* in North America.

The average of 18 adults from the type locality gave the following measurements:

Length, $4\frac{7}{8}$ inches (123 mm.); tail, $1\frac{1}{4}$ inches (31.5 mm.); SIZE hind-foot, $\frac{11}{16}$ inch (17.9 mm.); the tail being about $\frac{1}{4}$ of total length.

"*Full winter pelage:* Dorsal stripe sharply defined, extend- COLOUR ing from anterior base of ears back between ears to rump, pale reddish hazel, scarcely darkened with black hairs and frosted from the presence of a white subterminal zone. In some specimens with the maximum of white the back is fairly hoary, in others the chestnut predominates and conceals the white zone. Face, sides, and rump, bright grayish ash, more or less washed with buffy; belly pure white or rarely creamy white; ears pale chestnut; feet pure white; tail sharply bicolor, whitish below, blackish brown above; pencil black above, a few white hairs below. Adult males with large whitish or light grayish spots over the side glands. *Summer pelage:* Dorsal stripe dark, rich chestnut; sides and face pale bister, more or less suffused with yellowish; belly thinly washed with white or whitish; feet

dusky; tail darker and less sharply bicolor; ears brownish; side spots in old males sooty gray. *Young* slightly darker than adults." (*Bailey.*[1])

Carberry and Pembina specimens prove to be intermediate but nearer *loringi* than *gapperi;* Turtle Mountain examples should be true *loringi.*

### Life-history.

This is a prairie race; it is found in the wooded valleys of western Minnesota, eastern South Dakota, eastern North Dakota and south-western Manitoba, as shown on Map 28.

As there is no reason to suppose its habits are different from those of true *gapperi*, the preceding chapter may be considered as applying to both.

[1] Revision, genus *Evotomys.* Proc. Biol. Soc. Wash., May 13, 1897, pp. 125–6.

## XXI.

### Drummond Vole, Common Meadow-mouse, Vole or Ground-mouse of Manitoba, Marsh-mouse or Brown Vole.

*Microtus pennsylvanicus drummondi* (Aud. and Bach.).

(Gr. *Micros*, small; *otus*, ear; *drummondi*, in honour of Thomas Drummond, of Forfar, Scotland, who accompanied Sir John Franklin on his 1825 Expedition as naturalist, and collected the type of this sub-species.)

*Mus pennsylvanica* ORD., 1815, Guthrie Geog., 2nd Amer. ed., II, p. 292.

*Microtus pennsylvanicus* RHOADS, 1895, Amer. Nat. XXIX, p. 940.

TYPE LOCALITY.—Meadows below Philadelphia, Penna.

*Arvicola drummondii* AUD. and BACH., 1854, Quad. N. A., III, p. 166.

*Microtus drummondi* TROUESSART, 1897, Cat. Mam., Pt. III, p. 563.

TYPE LOCALITY.—Probably near Jasper House, Alta.

FRENCH CANADIAN, *le Campagnol de Drummond.*

CREE, *Wah-wah-be-gah-nōt'-see.* (Applied to all Mice.) Tweedell gives it "*Wah-be-gah-nōt'-see.*"

SAUTEAU, *Wah-be-gah-nōt'-see.*

OJIB., *Ah-me'-ko Wah-wah-be-gah-nōt'-see* (= Beaver-mouse.) When Aneemeekong was asked for a fuller explanation of the name he replied, "know nothing, act like children, and steal."

CHIPEWYAN, *Kloon'-ay.*

The sub-family *Microtinæ* includes all our Short-tailed Meadow-mice or Voles, the Lemmings, and the Muskrats. All have the same dental formula:

$$\text{Inc. } \frac{1-1}{1-1};\ \text{mol. } \frac{3-3}{3-3} = 16$$

It comprises 7 genera. Their external characters as here set forth will answer for a key:

*Microtus* Schrank, 1798. The common Meadow-mice or Voles in a coat of dark brown, with pepper-and-salt effect on back, but paler and grayer below; tail 1½ to 2½ times as long as hind-foot. Molars not rooted, but from persistent pulp.

*Phenacomys* Merriam, 1889. Is like *Microtus*. When adult it has molars with prong-like roots and with reëntrant angles deeper on inner than on outer side; unfortunately these, though important, are characters of little use to the field naturalist. Hind-foot, 6-tuberculate, the outer tubercle large and prominent, while in *Microtus* it is nearly obsolete.

*Synaptomys* Baird, 1857. Much like a *Microtus*, with a *very short tail*, shorter than hind-foot, and with *upper incisors grooved* on outer edge; in *Microtus* they are smooth.

*Lemmus* Link, 1795. Like a *Microtus*, with soft, woolly fur, and *very short tail*, shorter than hind-foot; the thumb has a *flat strap-like nail*; the outer *ear is well developed*.

*Dicrostonyx* Gloger, 1841. Like *Microtus*, but with *tail a mere stub*, much shorter than the hind-foot. Outer *ear rudimentary*. The *thumb apparently wanting or a mere rudiment* with a pin-point nail; the two middle claws of the front feet develop enormously and become two snow

shovels for winter use; the winter coat is white. These animals are found only in the Arctic regions.

*Evotomys* Coues, 1874. Like *Microtus*, but with *red back* and *well-developed ears*.

*Fiber* F. Cuvier, 1800. The Muskrats are known at once by their great size, brown fur and *flat, blade-like, scaly* tail. Otherwise a Muskrat is merely a magnified *Microtus*.

About 70 North American species and races of the genus *Microtus* appear in the latest lists. Their minute differences, individual variations, and endless intergradations are a puzzle to most naturalists. It is impossible to identify them without elaborate study of many specimens—skull and skins. One can only hope and believe that this present repellent multiplication of names will give place to a simplified comprehensible system that shall be a help to the study of the animal itself.

I feel something like desperation when endeavouring to identify any of the genus by a book or even by labelled specimens. Especially when I seek as heretofore to be guided by external characters. They prove most unreliable. Fortunately there is another means, the safest of all, the characters presented by the teeth; and in this department the Meadow-mice are most happily placed. They may be coarse-furred, coarse feeders, with coarse, blunt muzzles, but they are possessed of the most exquisite little carved ivories in the way of molars that any of our creatures can boast. The teeth of the Deermice look very coarse and bumpy beside these; their white enamelled lines and curves in high relief are inlaid with brown dentine intaglio constituting at once a thing of beauty to please the naturalist's eye, a graven record of the animal's development, and the safest of all labels.

Vernon Bailey has made a special study of the group.[1] I reproduce his diagnoses.

[1] Revision, Microtus, N. A. Fauna, No. 17, 1900.

"First of the genus *Microtus*:[2] Lower incisors, with roots extending far behind and on outer side of molar series; upper incisors, not grooved; molars, rootless, with outer and inner re-entrant angles approximately equal. Palate, with median ridge, distinct lateral pits, complete lateral bridges (not ter-

FIG. 148—Meadow-mouse *Microtus pennsylvanicus* (Ord.).
From Toronto specimen, by Ernest Thompson Seton, 1888.
(Cut from Bailey's Am. Voles, Fauna 17, U. S. Biological Survey.)

minating in posterior shelf in any American species). Tail, as long as or longer than hind-foot, terete; claw of thumb, pointed, not strap-shaped."

"Second, of the sub-genus *Microtus*:[3] Plantar tubercles, 6; lateral glands on hips in adult males;[4] mammæ, normally 8, 4 inguinal, and 4 pectoral;[5] ears, usually overtopping fur; *m*1 normally with 5 closed triangles;[6] *m*3 with 3 transverse loops and no triangles; *m*2 with 4 closed sections, and in most Eastern

[2] *Ibid.*, p. 10.
[3] *Ibid.*, p. 13.
[4] "In front of hips in *xanthognathus* and probably in *chrotorrhinus*."
[5] "Four in the *mexicanus* group, a pair of inguinal and a pair of pectoral."
[6] "With only four closed triangles in most of the Alaska species."

species an additional posterior inner loop; *m*3 with 3 closed triangles (except in *chrotorrhinus* and *abbreviatus* groups)."

Third, of the species *pennsylvanicus*,[7] of which *drummondi*, and most likely all shown on the map, are local forms.

GENERAL CHARACTER

"MICROTUS PENNSYLVANICUS.—Size, medium; tail, at least twice as long as hind-foot; fur, long, overlaid with coarse hairs; ears, moderate, conspicuous above fur in summer, almost concealed in winter pelage; colours, dusky gray or brownish; skull, long, well arched, and rather smooth; middle, upper molar, with four triangles and a posterior loop.

COLOUR

"*Summer pelage*: Upper parts, dull chestnut brown, varying to bright yellowish chestnut, darkened along the back with coarse black hairs; belly, dusky gray or tinged with cinnamon; feet, brownish; tail, dusky above, slightly paler below. *Winter pelage*: Duller and grayer throughout; tail, indistinctly bi-colour. *Young*: Blackish.

CRANIAL CHARACTERS

"Skull, long, usually not angular or much ridged; incisors, projecting well in front of nasals; incisive foramina, long, occupying two-thirds of the space between the molars and incisors; bullæ, moderately large and well rounded; molar series, long; *m*2 with 4 closed triangles and a posterior loop; *m*3 with an anterior crescent, 3 closed triangles, and a posterior loop with two inner lobes; *m*1 with 5 closed triangles, anterior trefoil, 4 outer and 5 inner salient angles; *m*3 with 3 long inner and 3 short salient angles.


FIG. 149.—Molar enamel pattern of Microtus pennsylvanicus (x5)
From Bailey, Fauna 17, Biological Survey, U. S. Dept. Agr.

MEASUREMENTS

Average of 5 adults from Washington, D. C.: Total length, 171 (6¾ inches); tail vertebræ, 46 (1⅛ inches); hind-foot, 21.2 (⅞ inches); skull (No. 30321, ♀ ad., from Washington, D. C.), basal length, 27.4 (1 1/16 inches); nasals, 8.3 (11/32 inches); zygomatic breadth, 17.2 (11/16 inches); mastoid breadth, 12.7 (½ inch); alveolar length of upper molars series, 7.2 (5/16 inch).

To this Bailey adds for *drummondi*:[8]

[7] *Ibid.*, p. 17.

[8] *Ibid.*, pp. 22–23.

GENERAL CHARACTERS "Similar to *Microtus pennsylvanicus*, but much smaller, with slenderer feet and tail, and paler colour.

COLOUR "*Summer pelage:* Upper parts, yellowish bister with numerous dark-brown or black-tipped hairs; sides of nose and hairs in front of ears more decidedly yellowish; belly, white or rarely tinged with buffy, sometimes dusky during the molt; feet, silvery gray; tail, bicolour, blackish above, whitish below. *Winter pelage:* Paler than in summer, yellow on ears and nose more conspicuous. *Young:* Paler and not so sooty as young *pennsylvanicus*.

FIG. 150—Right hind-foot.
*a* of *M. drummondi*.
*b* of *M. minor*.
(life size)

CRANIAL CHARACTERS Skull, not much arched and rather flat-topped, slender but sharply ridged in adults; audital bullæ, large and smoothly rounded; palate, flattened in immature specimens, becoming higher with deep lateral pits in adults; dentition, as in *pennsylvanicus*. Except for the larger bullæ and a few characters of minor weight, the skull of *drummondi* is a miniature of the skull of *pennsylvanicus*.

MEASUREMENTS "Average of 6 adult males and females from Muskeg Creek, Alberta: Total length, 145 (5$\frac{11}{12}$ inches); tail vertebræ, 39 (1$\frac{17}{32}$ inches); hind-foot, 17.8 ($\frac{11}{16}$ inch); largest specimen from Muskeg Creek: 160; 41; 18 (6$\frac{5}{16}$; 1$\frac{5}{8}$; $\frac{11}{16}$ inches); skull (No. 81487, ♀ ad. same locality), basal length, 23 ($\frac{29}{32}$ inch); nasals, 6 ($\frac{1}{4}$ inch); zygomatic breadth, 14 ($\frac{9}{16}$ inch); mastoid breadth, 11 ($\frac{7}{16}$ inch); alveolar length of upper molar series, 6 ($\frac{1}{4}$ inch)."

The following races are recognized:

*pennsylvanicus* Ord. The typical form.
*drummondi* Aud. and Bach. Much smaller, slenderer, and paler than the type.
*nigrans* Rhoads. Larger and darker.
*acadicus* Bangs. Smaller and paler than the type.
*modestus* Baird. Size of type, but paler, yellower, and with shorter tail.
*fontigenus* Bangs. Smaller than type, with short, wide skull.

*labradorius* Bailey. Much like *drummondi*, but skull flatter.

*aztecus* Allen, like the type, but more buffy in colour, and with shorter tail and larger hind-foot.

*enixus* Bangs. Slightly larger than the type and of darker colours.

*terrænovæ* Bangs. Slightly larger than the type, with decidedly larger hind-foot and more yellowish colours.

*breweri* Baird. A little larger than the type, with paler, grayer colours.

*nesophilus* Bailey. Size of the type, but skull shorter and wider, and colours darker.

For the ordinary field naturalist a simpler, ruder method of identification may be better. The Drummond Vole, then, is the only dark-brown Manitoban Meadow-mouse whose total length is about 7 inches, of which the tail is one-quarter. The only species much like it there are *minor*, which is easily told by its paler, grayer back, buffy under parts, and smaller size; and *Synaptomys*, known by its bob-tail and grooved incisors. See Plate XXXIX, Figures *b*, *c*, and *d*.

## Life-history.

RANGE

On Map 29 the probable range of the race *drummondi* is set forth. The spots being the actual records. The other forms are entered in theoretical outline. In Manitoba I found *drummondi* generally abundant, and got specimens from Whitewater Lake, Carberry, Poplar Point, Winnipeg, Kenora (Rat Portage), and Lake Winnipegosis, while Preble found it[1] abundant at Norway House, so no doubt it will be found in every sedgy part of Manitoba.

ENVIRONMENT

I have usually found this species in coarse, rank grass, on the edges of marshes, but it often leaves the marshes and swarms into the grain fields when the crops are ripe.

[1] N. A. Fauna, No. 22, 1902, p. 51.

If we make for our six common Mice a ladder to show their chosen elevations, we shall put the *Peromyscus arcticus* at the top, far above the ground, next the *P. bairdi*, next the *Evotomys*, very near the ground, next *Microtus minor*, a little below, and lowest of all, much of the time below the surface, we find the present the most subterranean of the group.

HOME-RANGE

The home-range of the individual is probably less than 50 feet across. I have seen an isolated hollow of that size which was obviously the whole world of a dozen or more of these Mice.

ABUN-DANCE

This is generally considered the most abundant quadruped in Manitoba; even in the years when the Rabbits are multiplied to millions, they fall far below the ordinary numbers of this species. In a year of plenty it is common to hear of half a dozen under each grain stook, or of a bushel being killed at each threshing. I have heard of over a thousand in one oat stack. I have seen over 1,000 (by guess) in a field of 10 acres. I suppose that, reckoned with its kinsman and complement, *M. minor*, the two together in their year of apogee populate the whole of Manitoba at the rate of 10,000 to the square mile. Merriam estimates[10] that in the Adirondacks during off years they number not less than 5,000 on a 200-acre farm, which would be over 15,000 to the square mile, and I have no reason to suppose them less abundant in Manitoba. To exceed these numbers we must descend from the ranks of quadrupeds and search among insects.

This abundance is more or less periodic. The reasons for the abnormal increase are as little known as the causes of its disappearance. The analogous case of the Varying Hare would lead us to attribute the destruction to some epidemic disease.

The Mouse millions are doubtless, as elsewhere noted, the boats especially designed to bring food over from the Mainland

[10] Mam. Adir., 1884, p. 274.


**MAP 29—RANGE OF THE LARGE MEADOW-MICE.**
***pennsylvanicus* group.**

This map is diagrammatic. Actual records of *drummondi* only are spotted. These are chiefly from Vernon Bailey's "Revision," and papers by G. S. Miller, E. A. Preble, W. H. Osgood, O. Bangs, S. N. Rhoads, F. Hollis, E. T. Seton, W. H. Dall, *et al.*

**The species are:**

*Microtus pennsylvanicus* (Ord.) with its 6 races,
*Microtus drummondi* (Aud. and Bach.),
*Microtus aztecus* (Allen),
*Microtus enixus* Bangs,
*Microtus terraenovae* (Bangs),
*Microtus breweri* (Baird),
*Microtus nesophilus* Bailey.

of Grass to the Island of Carnivores. Indeed, the flesh-eaters, in Canada at least, are far more dependent on the Muridæ than they are even on the great ruminants. These may furnish an occasional meal, but the Mice are the ever-present and reliable hunger-stay, and without them our carnivorous birds and beasts would speedily cease to exist.

What the archæan rocks are in geology, then, our rodents are in the mammal kingdom. Near the bottom of the system-


FIG. 151—Midden-heap of *Microtus drummondi*, with 2 back doors contributory. The pile contained about 10,000 pellets. Whitewater, Manitoba, April 29, 1904

atic scale, and not only great in aggregate bulk among formations, but also the raw material of which most others are made.

SOCIABILITY

This species commonly lives in crowded colonies, the members of which, to a considerable extent, profit by each other's labours and presence. Their tunnels, runways, midden-heaps, and stores are apparently common property. The species is therefore sociable as well as gregarious.

This Mouse often squeaks. Though to our dull ears a mouse-squeak is a mouse-squeak, I doubt not that variations of the sound convey various crude ideas to others of the kind. They sometimes chatter the teeth to express anger, and I think they stamp with the foot to call attention, as do many of the rodents. The smell-glands on the hips of old males may serve some purpose of intercommunication, but they have not yet been worked out. INTERCOMMUNICATION

The burrows of the species are about ½ inches in diameter, fairly round, and sinuous with the half-sunken runways that zigzag over the ground among the rank grass. They branch without plan or method apparently, forming an inconsequent network. The following note from my journal, April 2, 1904, refers to a colony of *Microtus drummondi* examined near Westbourne, Manitoba: BURROWS

FIG. 152—Midden-heap of *Microtus pennsylvanicus* contributory. The pile was 6 x 4 inches and pellets; each pellet was ¼ x ⅛ inch. Sketched back doors about 2,000 east of Kippewa, Quebec, September 25, 1905. (View )

"In a little damp hollow, not far from the town, I found a colony of Field-mice. The hollow, about 10 yards by 20, was covered with coarse, rank sedge, rather sharply divided from the close-cropped grass on the dry prairie about. It sloped to the north-east, where, 20 yards away, ran the stream.

The whole area of the hollow was cut up with runs, so many and so devious that I made no attempt to map them. SANITATION Some of the runs were underground and those were about 1¼ inches in diameter. In the middle of the marsh was a curious midden-heap chiefly of dung pellets; each pellet was ¼ inch

long by $\frac{5}{8}$ to $\frac{1}{2}$ inches thick. The pile itself was 7 inches by 5 wide and 3 high, and contained by computation 10,000 pellets. Several thousand times that winter, then, had these exemplary little beasts put themselves to the inconvenience of stepping out of the back door, to avoid soiling their nests. It was at a place where two back doors or minor tunnels opened out (see Fig. 151). This habit of voiding dung at a certain place is a beginning of civilization. Three specimens from this colony were identified by Dr. Merriam as *M. drummondi*.

NESTS

*M. pennsylvanicus* (that used to be *Arvicola riparius*) is the eastern form of *drummondi* and the same in its way of life. Merriam writes thus of its habits in the Adirondacks:[11]

"In early spring its nests are generally made just beneath the surface, but, after the grass has attained a little height, they are usually placed in slight depressions directly on the ground." This agrees with my own observation on the present species.

It has the habit, also, of making a number of winter nests under the snow. These are usually of chewed grass and straw, very warm and cosy. In these it nurses the young.

MATING

Its mating habits are quite unknown. It may be promiscuous.

YOUNG

To breed like Rabbits is an old measure of fecundity, but those who established the standard were not fully acquainted with the Microtinæ. These Mice can marry, multiply, and raise to independent age a whole family before the Rabbits get much beyond the period of gestation. They begin in the early spring, or even late winter, and seldom stop before snowfall; meanwhile, the young of the first broods are at work assisting in the noble work of multiplying the race, supplying fresh toilers for the task of converting a world of vegetable matter into a world of sublimated flesh and blood, for the service and sustenance of the vast tribes of mouse-parasites known as birds and beasts of prey.

[11] Mam. Adir., 1884, p. 275.

The number of the young varies from 4 to 8, and it is more than likely that one pair may produce 6 broods in the season between April and November 1st.

On the ground this species usually trots; it rarely springs like the tree Mice. It can, however, climb. Those which I kept in cages climbed about on the wires as readily as Deer-mice. SPEED AND GAIT

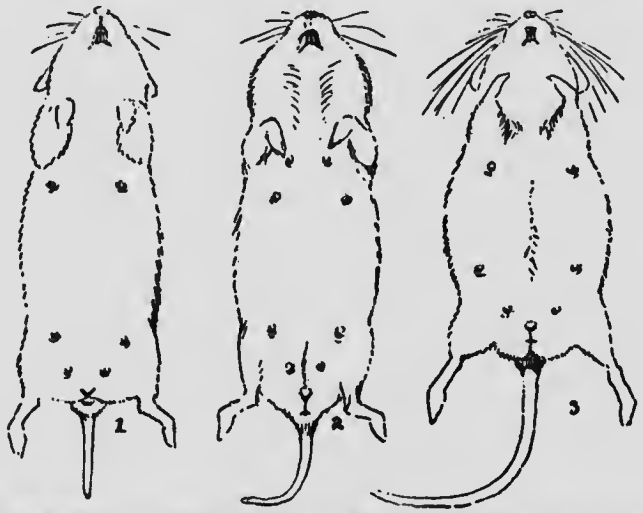


FIG. 153—Mastology of: 1. *Evotomys athabascæ;* 2. *Microtus drummondi;* 3. *Peromyscus arcticus,* (All half life size.)

They were active chiefly at evening, but were ready to get up and stir themselves at any time. Doubtless, as with most animals, including man, their ideal time is the 'cool of the evening.' During summer in the far north diurnalism is of course obligatory. NOT DIURNAL

I do not know of any peculiar feature in the food habits of this species. Its staples are wild grasses. Like its kind, it is content with grain, grass, or garbage, and will readily eat flesh or insects. FOOD

Recent researches, however, by A. F. Shull,[12] at Ann Arbor, show that, while the Mole-shrew habitually preys on snails, the

[12] Am. Nat., Aug., 1907, pp. 495–522.

Meadow-mouse (*M. pennsylvanicus*) will die of starvation rather than touch them. Rhoads maintains that[13] in autumn it rarely eats grain, lives chiefly on grasses, and does little harm when kept down to normal numbers.

STORAGE

This animal does not hibernate, therefore it must lay up a large store of food for the winter. This it does with assiduity and success, even when it has to steal the raw material from some hibernator.

PARASITISM

At sundry times and divers places I have seen evidence that this Mouse takes advantage of the winter sleep of the Richardson Ground-squirrel to tap its storehouse and steal its garnered supplies. This is immoral, yet some individuals go so far as to make their home in a small calibre gallery off the main tunnel of the Ground-squirrel, commonly near the food room, it which they make a small private door, and thus they manage to live in its house, to some extent under its protection, and feed on the fruits of its labours. This is a pronounced case of parasitism. It is only fair to say that it was not absolutely proven against *Microtus drummondi*, but I know that Mice were doing this, and I found no other species in the neighbourhood.

ENEMIES

An animal which multiplies itself by six every six weeks would, in six years, possess the earth and more than fill its possession, if something were not done about it. The Voles are very near such a rate of increase. Fortunately, there are numberless able reducers of the Vole population, eager to do their very excellent best, but they do not any more than strike a balance. If they relax their efforts or fail in the least the Mouse millions break forth in devastating hordes.

Kennicott's[14] chapter on the Meadow-mouse and its foes is full of interesting points. It does not refer to any one species, but it fits them all; and since it had the ill-luck to be buried in a Patent Office Report where few can find who want to use it,

[13] Mam. Penn., 1903, p. 99.

[14] Quad. Ill., Pat. Off. Rep. (for 1856), 1857, p. 86.

and most who find it do not wish to read it, I reproduce a part: "One of their greatest enemies in this vicinity [West Northfield, Ill.] is the northern shrike, or butcher-bird (*Lan. s borealis*), the food of which consists almost wholly of *arvicolæ* and a few Prairie White-footed Mice (*Mus bairdii*), during his sojourn with us, in his spring and fall migrations. This bird takes his stand, day after day, upon the same tree or fence-stake, and from this post surveys the surrounding fields, in which no Mouse may now show himself with safety. The result of the shrike's watchfulness and prowess may be seen, in part, in the bodies of the numerous Mice, fastened in the branches of bushes or on fences, sometimes partly eaten, sometimes having only the brains taken out, but oftener entire. Considering what he has devoured, besides these, the large numbers destroyed by the shrike may be readily supposed. The Southern shrike (*Lanius ludovicianus*), which breeds largely in the prairie districts throughout this State, is also an enemy to be dreaded by the Meadow-mice. Though feeding more upon insects than its larger cousin, and being, perhaps, a less successful mouser, its destruction of *arvicolæ* in summer is well known, and has gained for it the name of 'mouse-bird' in central Illinois. This bird not only pounces upon them when they are moving about, but finds the nests on the surface, and digs out the inmates with its bill and claws. A domesticated brown sandhill crane (*Grus canadensis*), which I kept for several years, spent much time in hunting about the fields for the nests of Meadow-mice. He became expert in finding them, and when they were situated upon or near the surface he would dig them out with his long and powerful beak, and after first killing all the inmates, proceed to swallow them whole, with much apparent relish. In spring I have seen him thus destroy several families of old and young *arvicolæ* in a day. Cranes are carnivorous, and large feeders, and if all are as good mouse-catchers as my pet, they must destroy great quantities on the prairie. The owls also devour them to some [illegible] in the timber especially; while the short-eared owl [illegible] *yotus cassinii* of Brewer), which is strictly a prairie

bird here, feeds largely upon them. This owl is diurnal, and may be seen flying low over the surface in search of Meadow-mice, in broad day, both in winter and summer. The hawks all prey upon them, too, from the little sparrow-hawk to the great red-tailed buzzard. The marsh-hawk lives mostly upon them in this region, and is observed sweeping along close to the ground hunting for them in every field. Dr. Hoy informs me that near Racine he observed, in autumn, a flock of black-hawks (*Archibuteo sancti-johannis*), 20 or 30 in number, to frequent a high knoll to which numerous Meadow-mice had been driven by the inundation of the surrounding lowlands. This they visited morning and evening for over a month, during which time they appeared to feed upon nothing else than Meadow-mice. One of them, shot late in autumn, was exceedingly fat, and had the remains of 4 full-grown *arvicolæ* in his stomach. Dr. Hoy estimated the number destroyed by the flock in six weeks at over 8,000. He says that they form the chief food of this hawk in the West, and that it should be regarded as a friend to the farmer, the more so as it does not make predatory descents on the farm-yard. *Arvicolæ* are the legitimate food of the prairie rattlesnake or massassauga (*Crotalphorus tergeminus*). In many specimens of this snake examined I have not found one the stomach of which did not contain the remains of Meadow-mice. The rattlesnake can readily enter their burrows, and is certainly more or less nocturnal; so that the *arvicolæ*, when out at night, fall an easy prey to this voracious reptile, which, though noted for its ability to endure wonderful fasts, even of a year or more, in captivity, is, nevertheless, a huge feeder naturally. I have taken the partly digested bodies of 5 adult *arvicolæ*, with the remains of 2 small garter-snakes, and some bird's feathers, from the stomach of a rattlesnake, and have repeatedly found the remains of several Mice, in various stages of digestion, in the stomach of one of them, showing that they had been caught at different times. And I would here remark that I have little faith in the opinion popular among farmers that rattlesnakes eat only at long intervals from choice. Observation indicates the con-

trary. Meadow-mice are also devoured by the common large-striped or garter-snake (*Eutænia sirtalis*), and are undoubtedly eaten by another garter-snake (*Eutænia radix*), which is our most abundant reptile on the prairies. They are also found in the stomachs of the milk-snake (*Ophibolus eximius*) and of the large fox-snake (*Scotophis vulpinus*). All the larger snakes probably prey upon them in other localities. The most abundant species of *arvicolæ* in this region are inhabitants of the prairie, and have less to fear from the small timber-loving carnivorous mammals than those living in the woods. Minks, Skunks, and Weasels, however, when inhabiting the prairie, devour many, Foxes also eat them, and Prairie-wolves dig open their burrows and feed largely upon them. Badgers, no doubt, also destroy many. As stated, in noticing the Striped Spermophile, that animal makes many a meal upon them, as well, perhaps, as Franklin's Spermophile. Domestic cats hunt them eagerly, eating them in preference to House-mice. It is to be observed that the flesh of the *arvicolæ* is sweet and delicate, without the disagreeable flavour of the House-mice, being, in fact, quite palatable. Judging from the astonishingly savage and carnivorous propensities exhibited by some specimens, in confinement, it is highly probable that, where abundant, they may frequently devour each other. After the annual fires have burned the grass on the prairies, numerous nests of the *arvicolæ* may be found on the ground, the inmates of which, unable to escape, have often been killed, furnishing a feast to the many Hawks, Owls, etc., which flock to these grand barbecues."

In Touchwood Hills, Sask., Edwin Hollis found this Vole much subject to the attacks of cuterebra or warble.

NON-HIBERNANT

The Mice of this group do not hibernate. Throughout the intensest cold of the north-western winter the Drummond Vole is as active as ever, quite contented so long as it can keep out of sight, in the various runways that form its village deep among the herbage under a snowdrift.

RELATION TO MAN

As Rhoads has pointed out,[15] the proper home of the species is sedgy or other waste land, where it does no harm directly and much good indirectly, because it supplies the staple food to countless beasts and birds of prey that are of service to man either commercially or as sources of æsthetic pleasure.

But when, owing to the operation of obscure causes, the Field-mice are so unduly multiplied as to be forced out of their natural habitat, into regions where their interests clash with those of man, then they are universally considered and cursed as a nuisance. Not only do they consume the growing crops in summer, but in winter their legions are quartered on the grain in stacks, and engaged in driving tunnels under the snow in the orchards and nurseries where, without leaving their safe-hiding, they bark and kill the saplings by the thousand.

Every creature, then, that helps to hold in check the Meadow-mouse hordes should be reckoned a friend to man, for in its years of outbreak this little devastator is at least the most abundant foe that the Manitoba farmer has to deal with in the world of claws and fur.

Its life-history is little known, but the glimpses we have of it gives promise of a wonderful fairy tale of science, in store for him who will fully and carefully investigate the ways of this *Microtus*. Its village with many streets is apparently a communistic society. The storehouses are believed to be common property. The frequent midden-heaps are a fairly good solution of the sanitary question. This species is not known to mate; probably the sexes live in promiscuity, and in winter the young are guaranteed a living by the common storehouses. This is a condition of affairs fulfilling the ideal of some socialists; but we are forced to remember also they are the lowest rank of mammal intelligence, they are the spoiled of all spoilers; that their population is periodically swept away by obscure causes or by disease, and that, but for their enormous fecundity, they could not long continue in existence.

[15] Mam. Penna., N. J., 1903, pp. 98–9.

## XXII.

## Little Vole or Field-mouse, Least Upland Vole, or Gray-vole.

*Microtus minor* (Merriam).

(Gr. *Microtus*, see ante; L. *minor*, because so much smaller than its nea[illegible].)

*Arvicola austerus minor* MERRIAM, 1888, Am. Nat. XXII, p. 600.

*Microtus minor* BAILEY, 1900, N. A. Fauna, No. 17, p. 75.

TYPE LOCALITY.—Bottineau, Turtle Mt., N. Dakota.

FRENCH CANADIAN, *le petit Campagnol.*

No special Indian names.

This Field-mouse belongs to the sub-genus *Pedomys* (Baird, 1857), which is thus characterized by Bailey:[1]

"Characters of the sub-genus *Pedomys:* Plantar tubercles, 5; side glands, obscure or wanting, rarely discernible; mammæ 6, inguinal 2–2, pectoral 1–1; ears, medium; fur, long and coarse. *Skull*, high and narrow; molars, with wide reentrant angles; *m*3 with 2 closed triangles; *m*1 with 3 closed and 2 open triangles; *m*2 with anterior pair of triangles confluent; *m*3 with 3 transverse loops, the middle loop sometimes constricted, or even divided into 2 triangles."

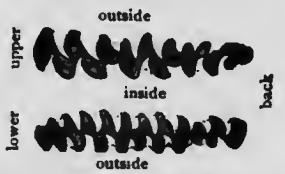



FIG. 154—Molar enamel-pattern of *Microtus* (*Pedomys*) *austerus* (25). To illustrate the subgenus. (From Bailey, Fauna 17, Biol. Surv., U. S. Dep. Agr.)

In addition to the generic (see p. 480) and sub-generic characters the Least Vole has:

Length, 5⅛ inches (130 mm.); tail, 1⅜ inches (35 mm.); SIZE hind-foot, ⅝ inches (16.5 mm.).

[1] N. A. Fauna, No. 17, 1900, p. 73.

COLOUR

"*Winter pelage:* Upper parts uniform clear peppery gray, from a combination of black and whitish-tipped hairs; belly, washed with soiled white or pale buffy; tail, sharply bicolour, dusky above, buffy below; feet, gray. *Summer pelage:* With a mixture of fulvous above, belly with thinner wash of light-tipped hairs over dark under-fur.

"*Young* slightly darker than adult, with less peppery appearance of fur."[2]

It most resembles *drummondi* of the species in our limits, but *drummondi* is large, with white breast and chestnut back that is peppered with black hairs, and *minor*, small with buff breast and gray back peppered with whitish hairs. Besides which the sub-generic characters will aid in diagnosing the two. (See Plate XXXIX, figure *c*.)

## Life-history.

RANGE

This Vole ranges in the northern part of the prairie region from north-eastern North Dakota to Edmonton, Alberta, and south-eastward to Minneapolis, Minn. I found it common about Carberry.

The actual records are shown on Map 30.

ENVIRONMENT

It frequents dry uplands, the open fields along fences, and is especially well pleased with the shelter of stacks and stooks.

ABUNDANCE

In Manitoba it is common, and at threshing time we could usually count on finding two or three dozen of this species at the bottom of each stack. The number, however, varies greatly; in 1884 I find, according to my notes, I saw but one in the four weeks before September 2d.

HOME-RANGE, ETC.

In the size of the individual range, population, voice, etc., it appears to be much like *M. drummondi*.

MATING

Nothing is known of its mating habits. Possible sidelight is afforded by the habits of its near kinsman *austerus*, con-

[2] *Ibid.*, p. 76.


**MAP 30—RANGE OF THE LITTLE VOLE AND ITS NEAR KIN.**

(The subgenus *Pedomys*.)

This map is diagrammatic. Only *Microtus minor* is fully indicated; of this the spots are actual records, chiefly from V. Bailey's "Revision" of the American Voles.

**The species are:**

***Microtus minor*** **(Merriam),** ***Microtus austerus*** **(Le Conte),** ***Microtus ludovicianus*** **Bailey,** ***Microtus haydeni*** **(Baird).**

cerning which Kennicott writes:[3] It pairs, "but two pairs never occupy the same hole," and further, "in summer the old males do not live with the females and young, but are generally with the females in spring, although an old male has been found in November with a female and her suckling young."

BREEDING AND YOUNG

As late as October 23 (1884), while drawing in the last of the oats, I found the nest of this species with 5 new-born young. It was a mass of frayed oat blades and grass, placed in a hollow on the surface of the ground and in the stubble.

Bailey found that in Minnesota its preferred home-site was in some little dry mound or tussock.[4]

The following from my Journal shows that they have young also as early as April, if, as I believe, the note belongs to the present species: Carberry, July 2, 1902. Robert McCullough tells me that while harrowing, late last April, he disturbed a common Field-mouse that made off, carrying a young one in its mouth, but, finding the burden too heavy for a rapid escape, it suddenly dropped the little one, and, after hastily rooting the earth over it with its nose, left it. But presently finding that the man was not disposed to be troublesome, regained courage, and, cautiously returning, recovered and carried off the little one in its mouth. McCullough stood within eight feet and saw everything very clearly. He has often seen this Mouse go off with the young hanging on behind, but this was the only time when he saw the young carried in the old one's mouth.

This species at times carries its young attached to the teats, as do many others, probably all of the Family.

HABITS, ETC.

I kept two or three Little Voles in a box for several weeks in the autumn of 1882, and made the following notes:

Carberry, Man., December 16th. The Field-mice kept since the threshing live and thrive. The most noticeable thing about them is their fondness for building. When in the bare

[3] Quad. Ill., 1857, pp. 99 and 98.
[4] Rep. Orn. Dep. Agr. (for 1887) 1888; p. 445.

box the pair gnawed a lot of chips off the sides, then arranging them in a circle to one side, they demurely ensconced themselves in the middle and made very much believe it was a nest. Then I gave them some straw and bits of wool; these were greedily seized on and added to the nest. In a couple of days the stronger Mouse killed its mate, ate the head, and, presently, utilized the body as building material. This was not self-preservation, it was crime. A Flying-squirrel put in the same box died mysteriously, and the next day his tail was worked into the Field-mouse's nest. The tail of a Prairie-wolf was put in, and by degrees it was dragged over to form a roof.

FOOD

In Minnesota, Bailey found this Vole feeding largely on the bulbs of the wild onion and purple blazing-star (*Allium striatum* and *Liatris graminifolia*).[5]

PARASITES

E. Hollis tells me that in the country about Touchwood Hills, Sask., in late July and early August, 1901, he found the Least Voles infected with bots (*Cuterebra*), very few being without them, and sometimes there were as many as 3 in an individual. All were in the skin of the belly; the other Voles of the region were similarly attacked.

IN GENERAL

This Mouse differs from its larger cousin (or maybe brother) in size and habitat, also it seems to make fewer runways, for the good reason that it does not need them in its more open home-land, but in all other respects, so far as I know, it is a miniature of *drummondi*. They lead the same lives, wear similar coats, squeak the same squeaks, eat the same food, multiply just as fast, and live on heedless and happy, undaunted and unreduced, in spite of exactly the same magnificent appalling array of gifted, rapacious, ever-active, and implacable foes; and the anathemas so plentifully poured forth already on *drummondi* in all probability belong just as truly here.

[5] *Loc. cit.*

## XXIII.

## Muskrat, Musquash, Ondatra or Mudcat.

*Fiber zibethicus* (Linnæus).

(L. *Fiber*, a beaver; L. *zibethicus*, adapted from the root of 'zibet' or 'civet,' the Musk-cat of the Old World, applied to the Muskrat on account of its odour.)

*Castor zibethicus* Linn., 1766, Syst. Nat., XII, ed. I, p. 79.
*Fiber zibethicus* Cuv., 1817, Reg. anim. I, p. 192.
Type Locality.—Eastern Canada.

French Canadian, *l'Ondatra*, or *le Rat musqué*.
Cree, *Was-usk'*, *Wah-chusk* or *Wat-susk"*.
Saut., *Wah-sesk'*.
Ojib., *Wah-jusk'*.
Chipewyan, *Dthen*.
Yankton Sioux, *Tsink-pay*.
Ogallala Sioux, *Sink-pay'-lah*.

The genus *Fiber* (Cuvier, 1800) comprises animals which in anatomy are simply immense Meadow-mice, with naked tails flattened on the sides. The Muskrat is the type of the genus. The teeth are as in *Microtus*.

SIZE The Muskrat is: In length, 21 inches (532 mm.); tail, 10 inches (254 mm.); hind-foot, 3½ inches (89 mm.).

WEIGHT Of 8 Muskrats captured at Carberry in the fall of 1886, the largest, a male, weighed 2 pounds 4 ounces. The smallest, also a male, weighed 1 pound 5¾ ounces; a large female weighed 2 pounds 3 ounces. The average of 6 males was 1 pound 10 ounces.

COLOUR In general, above, chestnut brown, darkest on the crown and back, becoming much paler and grayer on the belly and cheeks, and nearly white on the chin and throat and inner side of legs; the feet are covered with close, hard, shiny hair of silvery brown.


**MAP 31—RANGE OF THE MUSKRATS.**

Founded on records by J. Richardson, Audubon and Bachman, D. G. Elliot, Hart Merriam, E. A. Mearns, E. A. Preble, R. MacFarlane, E. W. Nelson, E. [illegible] Warren, Vernon Bailey, J. Fannin, O. Bangs, R. Bell, W. H. Osgood and E. T. Seton.
The map must be considered provisional and diagrammatical.

**The following are recognized:**

*Fiber zibethicus* (Linn), with its 6 races,
*Fiber spatulatus* Osgood. Yukon Muskrat,
*Fiber occipitalis* Elliott. Oregon Muskrat,
*Fiber obscurus* Bangs. Dusky, or Newfoundland Muskrat,
*Fiber macrodon* Merriam. Large-toothed Muskrat.

When seen alive, its size, flat naked tail, aquatic habits, and the dark crown with buffy cheeks will identify it.

Freaks of colour are often seen; melanisms or black-coated Muskrats are not rare; they bring two or three times the price of ordinary ones. White freaks or albinisms are occasionally met with; they are of no commercial value.

The following geographical races are recognized:

*zibethicus* Linn., the typical form.
*pallidus* Mearns, a smaller paler race.
*rivalicius* Bangs, smaller than the type, duller and darker.
*aquilonius* Bangs, smaller than the type, blacker, with smaller hind-foot.
*ripensis* Bailey, a smaller race, pale, with white spot over each nostril and a dusky chin-stripe.
*hudsonius* Preble, a small race, paler than the type and with small molars.
*spatulatus* Osgood, a small dark race, with spatula-shaped nasals. Preble reduces this to a race.

Carberry specimens are intermediate between *hudsonius* and *zibethicus*.

## Life-history.

RANGE AND ENVIRONMENT

The Muskrat is an inhabitant of every part of Manitoba. Except when seeking a new home it is never found away from water. Its special environment is marshy ponds and the banks of slow-running, sunny streams.

INDIVIDUAL RANGE

The home-locality of each individual is less than 200 yards across. If further from home than that, he is in foreign parts; doubtless travelling to seek his fortune. A Muskrat will live and thrive and be happy in a little pondy marsh that is even smaller than this, and never wish to leave it until it dries up. Near Carberry is an isolated pond only 50 feet across that has long been the sufficient home of at least one pair of these animals.

At my home in Connecticut is a lake with 2 Muskrat families at points 200 yards apart. When one family was killed no other Rats were seen in that part of the lake till new tenants came; all evidence went to show that these Muskrats did not go more than 100 yards from home, and rarely that. At another point is a pond about 50 yards long and 10 yards wide. A pair has nested in one end, and though the parents are seen daily, they are never observed at the other end.

In an Iowa prairie pond about 40 yards by 60, surrounded by dry, open country, I saw 8 good-sized rat-houses; one of them seemed to be double, it was so large. In a pond about 30 by 40 yards I saw 3 large rat-houses. In another isolated round pond, 10 yards across and quite alone in a dry region, was one large rat-house. This was on November 28, 1905.

Near Washington, Minn. (November 30, 1905), I saw 15 large rat-houses and some smaller beginnings in a pond but 30 by 100 yards. The number of houses to the acre seemed to increase as we went northward.

POPULATION

The pine forest is as unattractive to Muskrats as the dry, open prairie. Their ideal surroundings are found in the great belt of broken poplar woods, marshes, and ponds that extend from Roseau River, across the Province to Dawson Bay, for a width of 70 to 100 miles. In the pine forest region I should estimate the Rat population at not more than 10 to the square mile. In the prairie region there are ponds and sloughs enough to multiply this by 10, and in the great poplar belt, where 100 Muskrat families are often found in a 50-acre marsh, there may easily be 10 to the acre. But this is only in the ponds; allowing for the great stretches of dry land and averaging the ponds, I should put the Rat population of Manitoba at not less than 500,000 in years of fair abundance.

SOCIABILITY

The Muskrat is more sociable than the Rabbit, but less so than the Beaver. Several will join their efforts to produce the rat-house or lodge, and they are always careful to announce

to each other the discovery of danger by the loud alarm splash, that the uninitiated think could be made by nothing less than a Moose jumping into the water. I have several times heard of Muskrats uniting also to fight some common enemy, but never saw one of these affairs.

COMMUNICATION

Besides the danger splash already noted, this animal can use its voice. A low squeaking, made by suckling the back of one's hand, gives a passable imitation of the Muskrat's friendly call to its mate, and is sometimes used by the Indians to decoy the swimmer within shot. They also squeal very loudly and snarl among themselves. But the anal glands that secrete the well-known musky smell of the animal also serve as a means of communication, for it is left with the dung at the various landing places, and I doubt not serves the animals as a sort of rude news office, as described in the Gray-wolf chapter, for each Rat on arriving can tell by the smell whether or not any of his acquaintances have called there recently.

MATING

The mating season is said to be mid-April. Desperate fights now take place among the males, if their loud snarling, splashing, and squealing at night are evidence. In these battles the combatants tails are often mangled, or, according to some trappers, even cut off.

Apparently the species pairs. I find many naturalists who believe it to be monogamous. The general rule is that the males of polygamous animals do not concern themselves with the young, whereas among monogamous animals the male divides all labour with the female, including the building and keeping up of the home, and this the male Muskrat certainly does. I have again and again seen two adult Muskrats swimming and working together in spring and early summer. In fact, it is the rule for a pair to be seen continually about each home den.

The following observation made at my home by Mrs. Mary Vanderburgh gives a glimpse of the family life that is scarcely compatible with polygamy:

"May 17, 1905. To-day as I approached the bridge on the main drive in Wyndygoul Park I saw a Muskrat on the opposite bank busy collecting grass, and as I stood quietly to watch, he rushed down the bank, apparently in a great hurry, with the grass protruding from either side of his mouth, and swam vigorously across the pool to the near shore where I stood; he

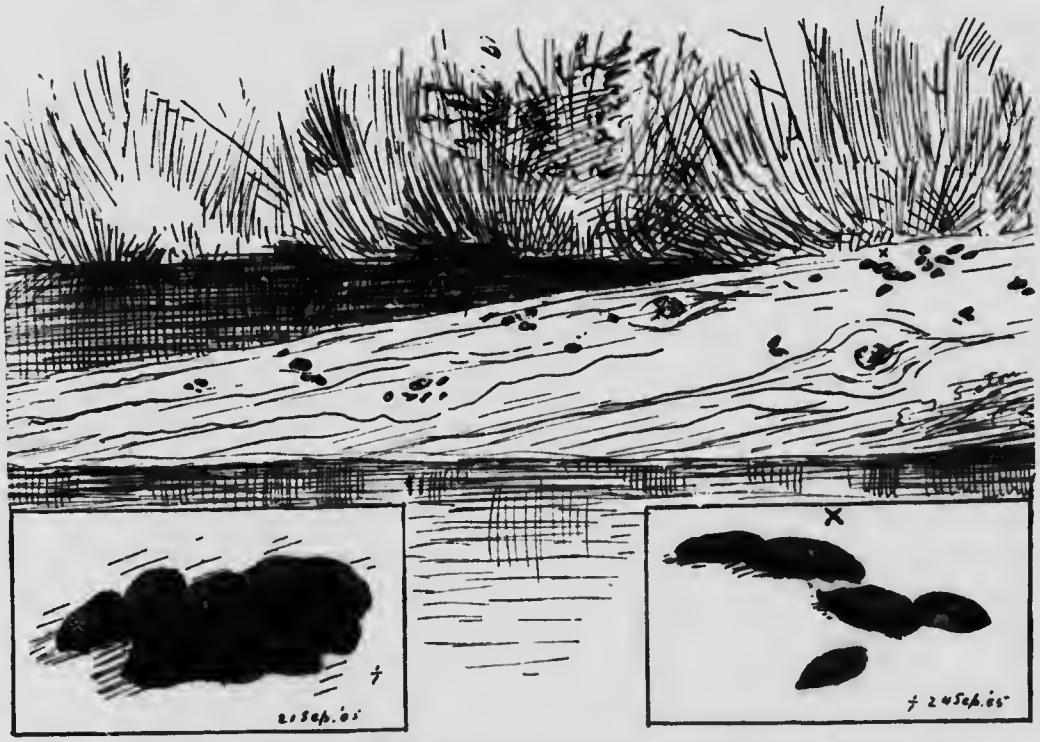


FIG. 155—Log that was a favourite landing place and news-depot of the Muskrats on a small stream 40 miles east of Kippewa, Que. With illustrations of their scatology (natural size).

was quickly followed by another, also with a load of grass. Both swam straight under the bank near where I was and dived. They soon reappeared and again set out for more grass, bringing it back in their mouths as before. This they did 4 times, and seemed to be working very hard. The fourth time, the first to reach the shore disappeared with its burden under the bank as before, but his companion suddenly turned to the right and dived into the waterway at another

place with his grass, and I did not see him again, although the other reappeared and swam across the pool toward the grassy bank, but this time upon reaching there it seemed to hesitate, and then swam to a small outlet and disappeared in the bank; neither of them appearing again, although I waited for some time.

"Twice when these two animals met in mid-stream, but going in opposite directions, the one who had deposited his burden stopped and nibbled the face and side of the other, but the worker did not turn aside nor diminish the energy with which it made for the other shore. The pair were evidently associated, and, I think, were mates."

Finally, Miles Spencer, of Fort George, H. B., writing[1] from personal experience backed by many inquiries among the Indians, says that the female is assisted by the male in rearing the young. Since such model paternalism is incompatible with polygamy, polyandry, or promiscuity, we must believe that the monogamy of the Muskrat is fairly well established.

NESTING

When the water near the shore is shallow it digs a canal from the deeper water along the bottom. This is like a railway cutting, open at the top until the rise of the ground makes it easier for the Muskrat to take the plunge, that is, to carry the canal on as a tunnel, after which it ascends obliquely to a chamber above the water level near the surface. The evolution of this canal is suggested in these notes from my journal. In late May, at Cos Cob, John Crawford surprised a Muskrat in the small pond while away from its hole in the bank. He stood over the hole, and though the water was but 6 inches deep at the time, it plunged into the mud and leaves at the bottom, and by tunnelling in that stirred up such a cloud that it escaped unseen into the hole. This I also saw the next day. I think its real object in getting into the mud was to swim as deep as possible, but it was at the same time beginning a canal.

[1] A. P. Low, Expl. James Bay, Can. Geol. Sur., 1888, App. III, p. 78 J.

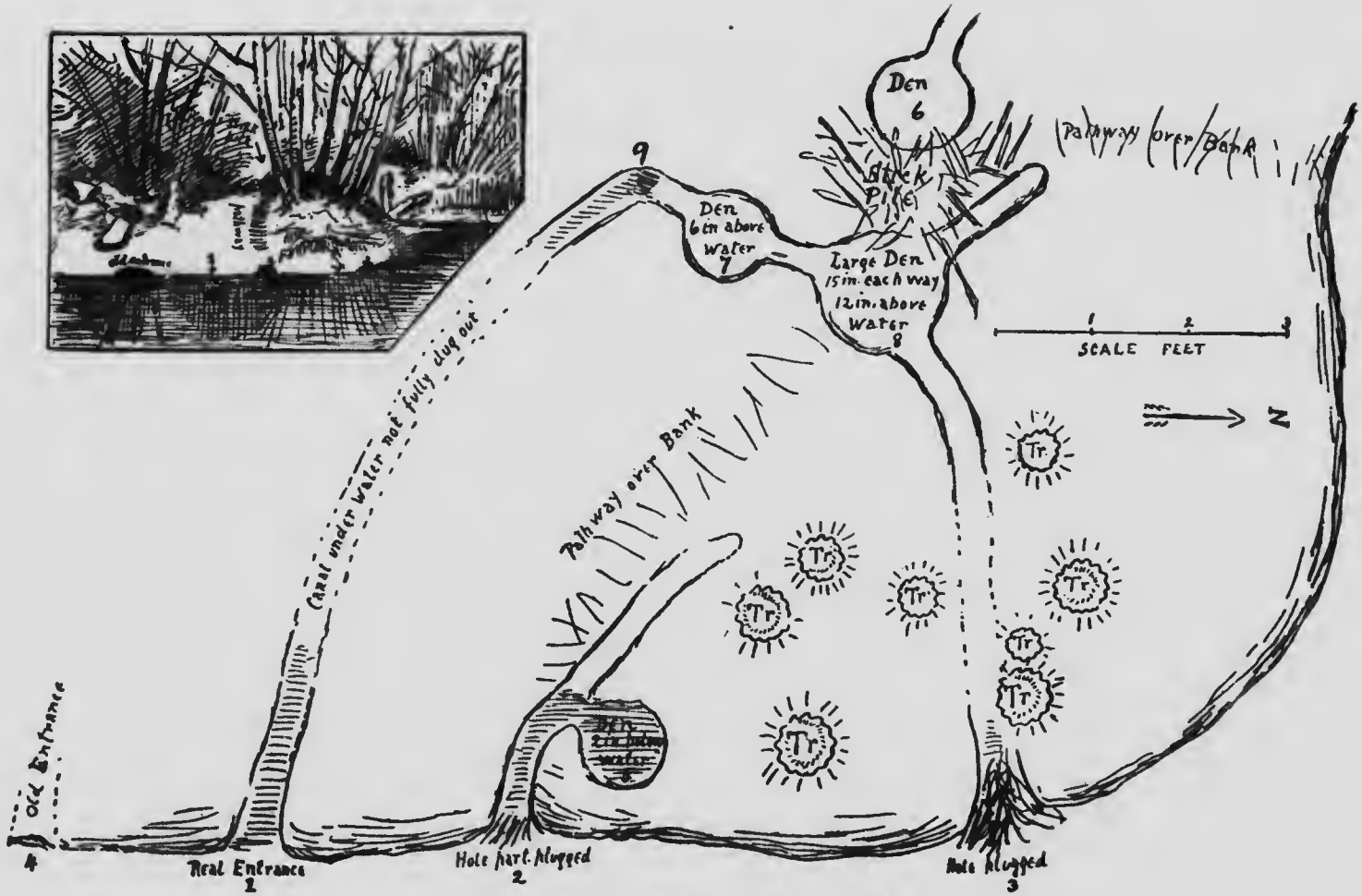



FIG. 156—Sketch and plan of a Muskrat den at Cos Cob, Conn., July, 1905.

DEN

The diagram in Fig. 156 represents a Muskrat's home that I examined at Cos Cob, Conn., in July, 1905. It was under a clump of young ash trees and presents all the usual characteristics of the bank dens. Nos. 2 and 3 were holes at water level. They were plugged up with grass and sticks as when exposed by the water lowering; 1, the real entrance, was deep under water and was made later; 5 was a den with about

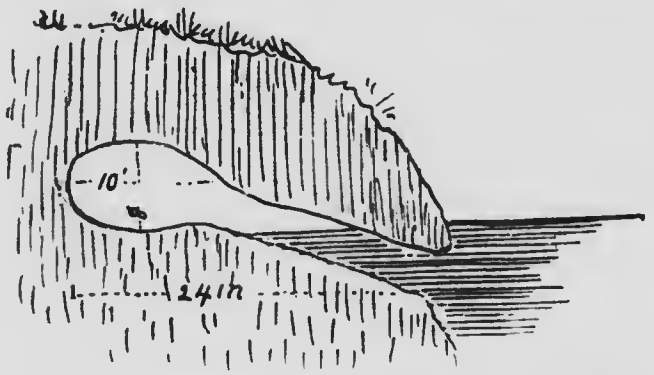



FIG. 157—Section of the simplest style of den made by Muskrat, Cos Cob, Conn., 1906.

2 inches of water in it, 6, a small den not connected with the others; 7, a small den at a lower level than the main den; at 9 is a plunge hole from the den into deep water; 8 was the main den, nearly round, 15 inches each way, smoothed with great labour in gnawing off thick roots. It was very near the surface and had a ventilator under the stick pile, as also had 6. The pathways were evidently made by the Muskrats in carrying up these sticks.

The main den had quantities of green grass and stalks in the corners; among these jewel-weed was prominent. This was fresh cut, and may have been either food or bedding, probably both.

This den illustrates the style of all those I have examined on banks. They have one main entrance under water, sometimes other smaller entrances. The tunnel leads up to a commodious den, which is open to the air at one small place, and covered outside with a pile of sticks and grass.

The main features of this agree perfectly with those of the nest made in a rat-house. The stick pile over the roof shows how easily one grades into the other.

There was no dung anywhere in the dens; all was sweet and clean.

HOUSE BUILDING

The Muskrat begins in July to get ready for the winter either by repairing the old home or beginning a new one. George H. Measham of Woonona, Man., says he has known a pair to keep the same site for years.

When a new nest is to be made, they select a place in the weeds or rushes where there is about two feet of water, and begin to drag to one spot the vegetation and mud for ten feet around. In this way a little island of rubbish is gradually piled up, and the water around is deepened and cleared of rushes, etc. As the island rises above the water level, less mud and more reeds are used—this is probably unintentional—and now it is made a little wider and becomes like a low haycock on a small base of mud and trash. As soon as it is a few inches above water, the builder begins to dig a tunnel under the level through the rushes onto the surface of the mud island and into the thin haycock.

This now answers for a house, although the roof is so open that the Muskrat can see out. But the process of building goes on; each day a few more bundles of reeds are dragged onto the pile. It grows until by August it is perhaps 3 or 4 feet high, but the mass of stuff piling on keeps crushing down the roof of the centre chamber and its gallery. The builders offset this by tearing off the encroaching ceiling as it gets too low. In time the subsidence ceases, the floor of the chamber is now covered with the reeds shredded in heightening the vault. The chamber is enlarged, additional entrances are made, the channel to each is deepened, and the Muskrat's house, after a slow growth during perhaps four months, is ready for winter.

I cannot say that I have followed one house through all these stages, but I have seen nests so obviously presenting each, that I consider the process demonstrated.

The ordinary house has but one chamber, but I have seen examples with more, doubtless the product of two families uniting their efforts, although each family lives by itself, having separate rooms and doorways. In September, 1904, I examined a large rat-house on Lake Winnipegosis, and made the accompanying diagrams. (Fig. 158.)

RAFTS

This house was probably the joint home of two families. Each of these large houses is surrounded by a number of rat-rafts which are like outlying fortresses of the great central

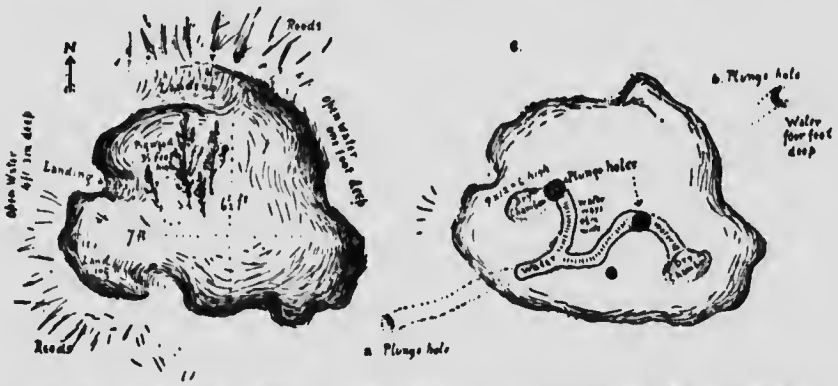



FIG. 158—A large rat-house sketched at Lake Winnipegosis in Sept., 1904. As seen from above, and in plan.

camp; these are merely floating bunches of reeds, with anchorage of a few growing reeds. Their first purpose seems to be furnishing the members with landing places where they can feed comfortably; but when the ice forms they answer a new need—they afford breathing places; for the reed raft makes it easy to keep the ice open there, and also conceals the Musk-rat that is using the place.

In the winter, if the occupants be frightened out of the big citadel, they will usually be found in a few minutes scattered at the various breathing raft-holes.

In very deep water we find a type of nest that is both house and raft. Its foundation instead of being a mud island is a floating mass of reeds. It answers well for the fall and winter, but usually becomes water-logged and sinks from sight in the spring.

The lodges are resting places and sleeping places, as well as the nurseries for the young. They are truly the homes of these animals.

The inborn home-feeling that the Muskrat has for its raft—that is, its house beginning—is shown in this incident. During my early days in the Souris Plains (May, 1882) I once fired at a Muskrat sitting on a large raft. It dived off into the water, but returned to clamber onto the floating reeds. I walked gently near, then waded out to find it was the same Muskrat—stone dead. It had come back to its raft to die.

A higher development of these outlying posts is thus described by Dr. John Rae:[1]

EATING-HUTS

"The house-building habits of the Muskrat, in nearly every part of British North America, are well known, but there is one plan to which it sometimes resorts under certain circumstances which appears to show great intelligence in enabling it to get its food more readily. The Muskrat, when about to build its house, selects a pond or swamp of good, pure water, on the bottom of which grow the plants which constitute its winter supply of food. If the pond or swamp is of considerable extent, and the house a large one containing many Rats, they, when the water begins to freeze in early winter, keep several holes open in the ice in different directions, and at a distance from the house, and build a little hut of mud and weeds (just large enough to hold one Rat comfortably) over each hole, which—especially when covered with snow—prevents it freezing up. These huts enable the Rats to extend their feeding-ground to all parts of the pond, which could not be reached at all, or with difficulty, from the house if they had to swim home every time with a mouthful of food to eat it. With these little shelters they are saved a great amount of labour and are enabled to reach all the food in the pond. I remember, when on a snow-shoe journey, one of my men went very quietly up to one of these miniature mud-huts and knocked it

[1] Birds and Mam., H. B. Co. Ter., Linn., Soc. Journ. Zool., XX, Pt. X, 1888, pp. 142-3.

over with his axe, disclosing a live Rat with some of the food it had been eating. The practice of building these little eating-huts is by no means common, and does not seem to be resorted to when the pond is of moderate dimensions, and all parts of it can be reached from the house without difficulty."

YOUNG

The period of gestation is probably about 30 days. In Manitoba the young are born in mid-May. They number 4 to 9 and are naked, blind, and helpless. They are suckled until three weeks or a month old. In Connecticut they begin to venture out first about the middle of May. They are now one-third grown and clad in fur of a peculiar leaden hue, quite different from that of the parents. In Manitoba there are commonly said to be 3 litters during the year, the first litter of the year having young themselves early in the autumn.

An interesting illustration of the young one's fearlessness is furnished me by Dr. Gordon Bell. In late September, 1901, at Lake Manitoba, he saw a young Muskrat about as "big as a goose-egg" and probably one-fifth grown, on a rat-house, eating a green rush. He picked it up, and it sat on his hand, still eating. Presently he set it down again on its house, where it continued feeding without fear or loss of time.

This species does not usually lay up a supply of food in the sense that the Beaver does, yet the rat-raft and rat-house both are closely connected with the quest of food. In the winter it is obvious that the house is much eaten away from the inside. While the roof is frozen this makes no difference, but in the spring, when the frost gives, the top of the enlarged chamber is apt to fall in.

The filling up and digging is now resumed, for in many cases the rat-house is the home of the young brood.

JETTIES

Muskrats frequently make jetties or landing places. These are little banks of mud along the marshy shore, a few inches above the water. From the shallows near by the animal gathers mud and weeds to make the jetty; this also serves to deepen and clear the water, so that the owner can plunge in

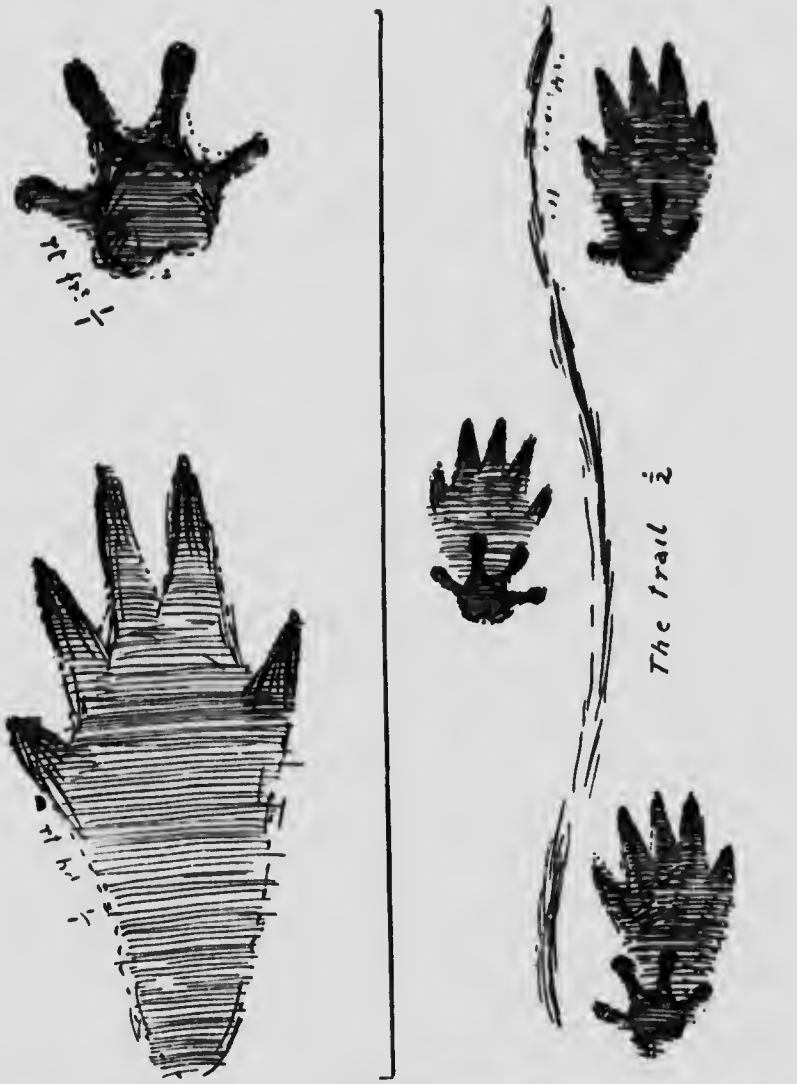



FIG. 159—Tracks of Muskrat. Those on left are fore and hind prints, life size. Those on right show the series as in the trail with the tail mark, half life size.

to safety. Besides those constructed by themselves, the Rats select and use ready-made landing places, such as roots and stones by the water's edge.

They commonly leave their dung on these jetties. This marks them clearly, and probably serves for a record, as already noted (see Fig. 155).

In voiding its dung the animal prefers to have its body dry and its tail in the water. One which I kept in captivity was so particular about this that it invariably turned its tail end into the little water trough, keeping that in a very unfragrant condition, although the water was changed more than once each day. The origin of this custom was no doubt in the necessity for keeping the house clean. This they could be sure of doing if each time, each Muskrat took the trouble to drop its tail over the threshold into the canal, which thus formed at once waterway, moat, and trunk-sewer for the inhabitants.

MIGRATION

In September, and sometimes later, an erratic migration takes place. At this season they travel overland for a considerable distance, as far as a mile or two from the water. They are then likely to be found in various odd places. I have seen them in outhouses, in wheat-fields, and on the open prairie at such times. When thus discovered they commonly show fight, even going out of the way to attack the disturber of their peace.

PUGNACITY

I once knew a migrant and militant Muskrat hold three horses and a mower at bay, when the field of grain was all cut except the short central swathe in which the wanderer had taken refuge.

On another occasion, while travelling over the prairies with oxen, they swerved aside from the trail and I caught a glimpse of something leaping at the nose of the near ox. I jumped from the wagon, the cattle ran away, leaving me to face—a big Muskrat. It had disputed the trail with the oxen, and now came straight at me. Leaping for my leg, it fixed its teeth in my trousers and held on till it was killed. This

was near Rapid City, October 2, 1883. Again at Carberry, September 5, 1892, George Scollan brought me a Muskrat that was on the trail leading into Kennedy's Plain. It had claimed the right of way from him, and believed that right was might.

Another of these fighting adventurers is reported by Dr. F. J. Cadham, of Winnipeg. In October, 1903, while driving on the open prairie seven miles west of the city, he saw a Muskrat travelling. He jumped out and gave chase, but it turned at once to face him, and fought till killed.

Yet another from Germantown is thus described by Arthur C. Emlen:[3] "In the blizzard of 1899 a boy I know had a curious adventure with a Muskrat. He was coming home late one night when he saw some dark object run across the lane in front of him; before he knew it the Muskrat ran up his leg. No sooner was it thrown off than it started up the other leg. After quite a fight the boy managed to kill the Muskrat with his umbrella. I saw both the Rat and the umbrella afterward; there was not much left of either. The strange part of this story is that it took place on a hill not very near any Muskrat haunts, so that the boy could not have been trespassing on the Muskrat's grounds."

Most naturalists can contribute instances of the Muskrat's ferocity, but in none that have come under my notice was the animal in the water. In each case it was surprised on land, and, finding itself at a desperate disadvantage, it manifested the courage of desperation

SPEED

On the land the Muskrat is slow; a man can easily catch one. But the water is its proper element; here it swims and dives almost like an Otter. I have often run along on the thin, clear ice, over a Muskrat that was swimming just below, and found it was going at what I should call 3 miles an hour, and could dive and swim about one hundred yards without coming up for breath. From observations made while walking

[3] Letter, Oct. 7, 1900, A. C. Emlen, Awbury, Germantown, Pa.

parallel with a swimming Muskrat, I should say that its ordinary rate is not above a mile an hour.

FOOD

The food of the species is chiefly vegetable matter. The bleached ends of long reeds, lilies, stalks, and roots of flags are staples. But there is not the least doubt that it will eat clams, fish, insects, and even young birds, when it can catch them in the water.

Richardson, writing at Churchill River (103° W. Long.), in 1848, says[4] of one Muskrat food:

"The *Acorus calamus* is another of the indigenous plants that enter into the native pharmacopœia, and is used as a remedy in colic. About the size of a small pea of the root, dried before the fire or in the sun, is a dose for an adult, and the pain is said to be removed soon after it is masticated and swallowed. When administered to children, the root is rasped, and the filings swallowed in a glass of water, or of weak tea with sugar. A drop of the juice of the recent root is dropped into inflamed eyes, and the remedy is said to be an effectual though a painful one. I have never seen it tried. The Cree name for the plant is *watchuske mitsu in*, or 'that which the Muskrat eats.'"

STORAGE

Although not usually credited with storing up food for winter, the Muskrats do so at times. All through the summer, from at least the first of June, they may be seen carrying great bundles of green stuff into their dens. If intended for bedding, it seems to show very poor judgment on the part of the Rats, but it ends well, for they commonly eat these piles when they have need of them. This is indeed one kind of storage, but the species is known to carry out the idea on a much higher plane, as shown in the following by Dr. Charles A. Eastman:[5] "When our people [Sioux] were gathering the wild rice [Minnesota] they always watched for another plant that grows in the muddy bottom of lakes and ponds. It is a white bulb about the size of an ordinary onion. This is stored away by

[4] Arctic Search. Exp. (of 1848), 1851, Vol. I., pp. 82–3.
[5] Indian Boyhood, 1902, pp. 239–40.

the Muskrats in their houses by the waterside, and there is often a bushel or more of the *psinchinchah* to be found within. It seems as if everybody were good to the wild Indian, at least we thought so then."

ENEMIES

The Muskrat has many enemies. Hawks, owls, Weasels, Otters, Foxes, Wolves, and many others consider it their lawful prey, and the pike and pickerel take it at a disadvantage on the water, but the Mink is almost the worst of its natural foes. The Mink abounds wherever the Muskrat does. It frequents the same places, it is aquatic, and can follow the Muskrat into its house, no matter how long or how crooked is the underwater trail to the door. E. W. Deming, the animal painter, tells me that when he lived on the Green River of Illinois in the '80's, he spent much time each winter catching Mink and Muskrat. He became very familiar with their habits, and learned that the former feeds regularly on the latter. He once dug out a Mink, and found within its den the remains of 10 Muskrats. Apparently the Rat has but one advantage, and that is it can *out-dive* the Mink. It is moreover, a desperate fighter when at bay, it never surrenders, and, as Charles G. D. Roberts points out, a strong, old Muskrat might even defeat a small Mink in one of the narrow underwater ways.

There is yet another and still more dangerous enemy, that is, a severe winter following a dry fall. The ponds are then so shallow that they freeze to the bottom, the Rats are either forced out to be at a helpless disadvantage among birds and beasts of prey, or are sealed in so that they prey on each other. It takes years for the species to recover from such a dire experience.

PARASITES

The Muskrat is remarkably free from parasites. A sort of fur-lice is found on most individuals, but not to an inconvenient extent. I do not know of any disease that it is subject to.

FLESH

The flesh of this animal is eaten at all times by the Indians. In the fall and the winter it is not unpalatable,

indeed it somewhat resembles duck, but in the spring it is so impregnated with musk as to be quite unfit for food.

When they are to be eaten, Muskrats are commonly shot, but the trap and the spear only are used when it is taken for fur.

SPEAR

The rat-spear is a 3-foot rod of half or $\frac{3}{8}$ inch iron, very slightly barbed near the tip and set in a long handle. The hunter either approaches the rat-house gently and drives the spear through house and all, impaling one or sometimes two of the occupants, or he taps the house, causing them to skim away under the ice. If this is new and clear, he can drive the spear through ice and Rat. A hatchet is then used to enlarge the hole and kill the victim after it is pulled out.

I have seen the spear driven through $4\frac{3}{4}$ inches of new, hard ice and into a Muskrat which was thus secured.

FUR

The fur of the creature is of good quality and on a strong skin. Notwithstanding its low market value, it is one of the most important staples in Manitoba, for a skilful trapper can catch 50 to 100 in a day during the times of plenty.

This peltry is always in demand. At Winnipeg, March 26, 1904, it was thus quoted: Prime winter, 3 cents to 12 cents; prime spring, 6 cents to 20 cents. The black Muskrats are of higher value. But the abundance of the species and the certainty of the catch is sufficient to offset these low values, and there is no falling off in the business. As early as 1822, the Hudson's Bay Company exported 150,000 Muskrat skins annually. Since then the numbers have steadily increased, and during 1905, 3,466,429 were marketed in London.

At the London Annual Fur Sales, held at Lampson's, March, 1906, there were sold 1,074,550 Muskrat and 11,655 black Muskrat. The highest price paid for common Muskrat was 21*d* (42c.) each for 2,200 first-class skins, but 10*d* (20c.) and 12*d* (24c.) were more usual prices, and down to 6*d* (12c.) for third-class skins (shot and damaged). Black Muskrat brought as high as 43*d* (86c.) for 430 skins first-class and second-class mixed, and from that down to 10*d* (20c.) for skin, with 20*d* (40c.) and 30*d* (60c.) for fair prices.

The Muskrat is much disliked by all dam-owners, including Beavers, because it has a trick of digging through the earth embankments. But in Manitoba there is no count against it; it is an important asset to the Province, and the game guardians are right in protecting it according to present law.

CURIOUS CASE

The following is a remarkable case: During the fall of 1905 a trapper, Nelson Crane, living on the Oquago Creek, an affluent of the Delaware River, Pennsylvania, was surprised to see along the margin of the river the unmistakable track of a hoofed animal whose feet were smaller than those of the smallest African gazelle, each track being less than the tip of a little finger; the stride was 2 inches, the straddle a little over an inch. At many places very clear impressions were seen, and left not the slightest doubt of it being a tiny, hoofed quadruped of unknown species.

One day, on going to a trap set for Mink, Crane found the undoubted track of the 'pigmy Deer,' and in the trap, to his amazement, one of the legs of the animal with the hoofs. There was just enough of the leg to show that it was nothing more than an abnormal Muskrat, the central toes of each foot having enormously developed short claws which covered the point of the toe and were indeed hoofs. The trapper sent the foot to the Harrisburg State Museum. Through the kindness of the curator, Professor H. A. Surface, I have been able to examine and make the accompanying drawing of this curiosity (Fig. 160).

FIG. 160—The foot with the tiny hoofs (life size).

The animal itself has never been seen.

## XXIV.

## Bog-lemming, Lemming-vole, Lemming-mouse, Bob-tailed Meadow-mouse or Bog-mouse.

*Synaptomys borealis* (Richardson).

(Gr. *synaptis*, joined together; *mys*, mouse, because it joins the Meadow-mice with the Lemmings; L. *borealis*, of the north.

*Arvicola borealis* RICHARDSON, 1828, Zool. Jo[illegible] III, No. 12, 1828, p. 517.

*Synaptomys borealis* PREBLE, 1908, N. A. Fauna, No. 27, p. 183.

TYPE LOCALITY.—Ft. Franklin, Great Bear Lake.

The genus *Synaptomys* (Baird, 1857) comprises Field-mice which look much like the ordinary Field-mice (*Microtus*), because both are on such a small scale, but if they were enlarged to the size of a Deer, we should find them as different as Caribou and Elk. Aside from the very different skulls and other points which require dissection to show, the Lemming-mouse has the coarse brown coat, the *grooved upper incisors*, and a *little bob tail* sticking barely *half an inch beyond the fur*, while the Vole has a fine brown coat, smooth teeth, and tail over an inch beyond the fur.

They have the same tooth formula, but the teeth themselves present many differences of detail.

SIZE In addition to the generic characters, this Bog-lemming has: Length, 5⅛ inches (130 mm); tail, 1 inch (25 mm.); hind-foot, ¾ inch (18 mm.).

COLOUR In colour and outward appearance this animal is somewhat like *Microtus drummondi*, but it is much redder above and darker below, without white; the feet are dark brown; it has a chestnut spot under the ear. A Fort Franklin male specimen[1] before me has on each hip a white tuft of hair that

[1] No. 133,905, U. S. Biological Survey Coll.


**MAP 32—RANGE OF THE BOG-LEMMINGS.**

*Synaptomys borealis* (Richardson).

(All the North American species are included.)

This map is diagrammatic and provisional. Actual records of *borealis* and *dalli* only are spotted. These are from Preble's Reports (Faunas 22 and 27), W. H. Osgood (Faunas 21 and 24), and Richardson.

In general the map is founded on records by J. Richardson, E. A. Preble, W. H. Osgood, C. Hart Merriam, J. A. Allen, S. N. Rhoads, O. Bangs, W. H. Dall, G. S. Miller, Jr., and D. G. Elliot.

*Synaptomys cooperi* Baird,
*Synaptomys fatuus* Bangs,
*Synaptomys sphagnicola* Preble,

*Synaptomys innuitus* (True), with its 2 races,
*Synaptomys wrangeli* Merriam,
*Synaptomys andersoni* Allen,

*Synaptomys borealis* (Richardson), with 2 races,
*Synaptomys chapmani* Allen.

marks a smell-gland. These peculiarities of colour, with its very short tail, make a sufficient label for field-work. (See *d* in Plate XXXIX.)

Two races are recognized:

*borealis* RICH., the typical form as above.
*dalli* MERRIAM, lighter coloured and redder.

## LIFE-HISTORY.

RANGE

Richardson found the species in abundance at Great Bear Lake.[2] Preble secured specimens near Fort Rae[3] at Echimamish River and at Norway House.[4] It is almost certainly therefore a species ranging in northern Manitoba.

HABIT

The Bog-lemmings frequent the cold sphagnum bogs of the far north. They are shy, secretive and nocturnal. Hitherto their habits have escaped almost all observation.

One of Preble's Echimamish River specimens, taken June 25th, contained 6 embryos.

[2] F. B. A., 1829, 1, p. 127.
[3] Proc. Bi. Soc. Wash., Aug. 6, 1902, p. 181.
[4] N. A. F. No. 22, 1902, p. 54.

PLATE XL.—POCKET-GOPHER ♀ (½ LIFE SIZE).

(*Thomomys talpoides* (Rich.).)

Carberry, Man., 1892.

From drawing made for Report, U. S. Biological Survey, Dept. Agr. (1892) 1893.

## XXV.

## Northern Pocket-gopher, Gray-gopher, Mole-gopher, Mole, Pocket-mouse or Gaufre.

*Thomomys talpoides* (Richardson).

(Gr. *thomos*, a heap, and *mys*, a mouse; L. *talpa*, a mole, and Gr. *eidos*, appearance, latinized into *oides*.)

*Cricetus talpoides*, RICHARDSON, 1828, Zool. Jour., III, p. 518.
*Thomomys talpoides* BAIRD, 1857, Mam. N. A., p. 403.
TYPE LOCALITY.—Plains of Lower Saskatchewan.

FRENCH CANADIAN, *le Gaufre gris*.
CREE? *Ootaw-chee-gæshees'* (according to Richardson[1]).
OJIB., *Po-tach'-i-ping-gu'a-shi*, *i. e.*, 'blowing up the soil.'
YANKTON SIOUX, *Mah-hee-ah-cha'*.
OGALLALA SIOUX, *Wah-hin-hay'-yah*.

Gopher is from the French *gaufre*, a honeycomb, given because this creature honeycombs the ground.

FIG 161.—Right fore-paw and hind-foot of *T. fossor* ♀, being now life size. Colo., 10 Sept., '01. E. T. S.

The Family *Geomyidæ* are rodents about the size of a rat, they live the life of a Mole, digging and dwelling in underground galleries; their fur is soft and fine, but dull gray or brown, without conspicuous markings; their eyes and ears are very small; their front feet are enormously developed for digging, their thumb is a mere knob with a nail; their tails are short, nearly naked, and, as Dr. Merriam points out, are developed as organs of touch, very serviceable when running

[1] F. B. A., 1829, I, p. 204.

backward in the burrow; in each cheek is an enormous fur-lined pocket or pouch, that opens in front outside of the mouth.

The genus *Thomomys* (Wied., 1839) answers to the foregoing, and has also the front upper teeth *without* a central groove. Dentition:

$$\text{Inc. } \frac{1-1}{1-1};\ \text{prem. } \frac{1-1}{1-1};\ \text{mol. } \frac{3-3}{3-3} = 20$$

GENERAL CHARACTERS

In addition to all the Family and generic characters, the Gray Pocket-gopher has the tail less than half the length of the head and body; the female has 6 pairs of teats, 2 under the fore-legs, 2 on the chest, and 2 on the lower belly. The species has also marked peculiarities of size and colour.

SIZE

This is one of the largest members of the genus. A male taken at Carberry, Man., October 31, 1886, measured total length from snout to tail tip, 9⅝ inches (244 mm.); head and body, 7 inches (178 mm.); tail, 2⅞ inches (73 mm.). The hind-foot is about 1¼ inches (32 mm.).

The females are smaller.

COLOUR

The colour is a dark grayish, becoming browner on the back, and pale slatey below; nearly white on chin, throat, feet, and tail. It is difficult to describe the colour exactly, especially as there is a good deal of individual variation, but *talpoides* may be distinguished from its nearest neighbours by its greater size and darker colours.

Two races are recognized:

*talpoides* Richardson, the typical form.
*rufescens* Wied., redder in colour.

## Life-history.

RANGE

Map 33 shows the range of the Family *Geomyidæ* to which the Pocket-gopher belongs. The various species are found in the whole of the region west of the Mississippi Valley, as far as the Pacific Coast, south well into Mexico and north at least as far as the Saskatchewan; thus they are found throughout a region of about 2,000,000 square miles.


**MAP 33—RANGE OF THE POCKET-GOPHERS.**

Founded chiefly on U. S. Biological Survey maps by Dr. C. Hart Merriam and Vernon Bailey in N. A. Fauna, No. 8, with assistance from maps in Doc. 132, Senate, 1907, and records by E. T. Seton.

The map includes all of the Family that come north of the Mexican Boundary. It is diagrammatic—as many of the groups overlap. The western area contains 47 different species of *Thomomys* not yet sufficiently known for mapping. *Geomys bursarius* Shaw, comes very near, but does not quite reach Manitoba.

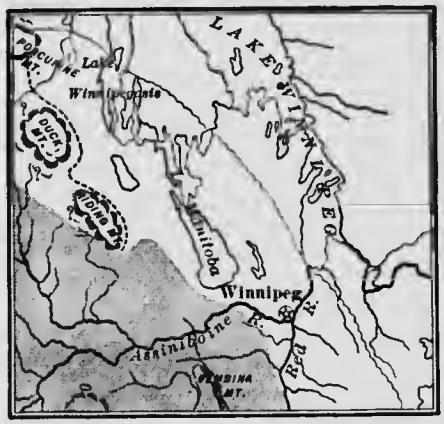
**The northmost area is the range of *Thomomys talpoides*, with its 2 races.**

IN MANITOBA

The present is the only one inhabiting in Manitoba. It abounds in the south-western section of the Province, that is, all the prairie region except the low, wet part of the Red River Valley. (Map 34.)

ENVIRONMENT

The members of this group find congenial surroundings on level prairies, low bottom-lands, high uplands, and among sandy dunes. They abound on the plains and lowlands of Dakota, Minnesota, Wyoming, and Montana, as well as in all the aspen forests. On the Yellowstone I found them even on the tops of the high mountains: for example, Mount Sepulchre (nearly 9,000 feet). All through the Clearwater region on the Bitter-root Mountains in Idaho they are numerous, from the highest levels to the lowest flats, wherever there is soil enough to dig in. On the White River Plateau of the Colorado at least one species is plentiful, from the uppermost peaks to the lowest slopes of the quaking aspens. In California they exist in vast numbers, from sea level at San Francisco to above timber line on the High Sierra, in all situations where there is soil enough or even gravel enough to afford them cover. I even found that an old dead crater, near Mount Tallac and almost as high, was the scene of unnumbered eruptions of Pocket-gopher origin.




MAP 34—Range of the Pocket-gopher in Manitoba.

There are doubtless large arid or annually flooded areas that they do not inhabit, but, it may be stated in general, that they are to be seen in every part of the great West where there is soil enough to burrow in, and rain enough to produce a crop of annual plants.

In Manitoba *talpoides* finds its choicest home-lands on the rich, rolling, open country of the Assiniboine, and rarely ventures far into the woods.

NUMBERS

On all the prairies of western Manitoba this species is in maximum numbers. After walking over much of the region and estimating by results the number of Gophers, I set the population at 5 to 10 per acre. The estimate is sustained by the following facts supplied me by Louis J. Ohnimus, Superintendent of the Golden Gate Park, San Francisco. In that famous park, one species of *Thomomys* (*T. bottæ*) is common and very troublesome. Ohnimus wrote me in 1899 as follows:

"From 100 to 300 Gophers are killed every year in the park. About 100 to 150 acres are covered in the killing. The trapping is generally carried on for three or four months of each year. The Gophers are decreasing in number under this drain."

From this it might be inferred that 2 or 3 Pocket-gophers to the acre was the probable population, but I saw the area in question at the time, and it showed so little Gopher work that evidently the trapping had been succeeding for some time, and the Gopher population was very far below the average.

In the Golden Gate Park they merely injure the lawns and gardens by throwing up lines of hills over night, but I have seen vast areas in the Sierra, Colorado, Wyoming, Dakota, and Manitoba where walking was most laborious, on account of the number and extreme activity of the Gophers, where indeed a man sank several inches and a horse nearly a foot at each step. I should think therefore that 5 to 10 Gophers per acre was well within their numbers where they abound.

But they do not abound in all parts of the range, therefore I should take a fifth of the lowest figure for an estimate, and allow for this range of 2,000,000 square miles a total Gopher population of 1,000,000,000. *Talpoides* is found in about one-tenth of this range, and therefore should be represented by 100,000,000 individuals. Probably its numbers do not fall far below this.

SOLITARY

The *talpoides* seems to be a solitary animal. I usually found that, after trapping one, the mound upheaval ceased in that tunnel for a time. An exception to this was observable in late May

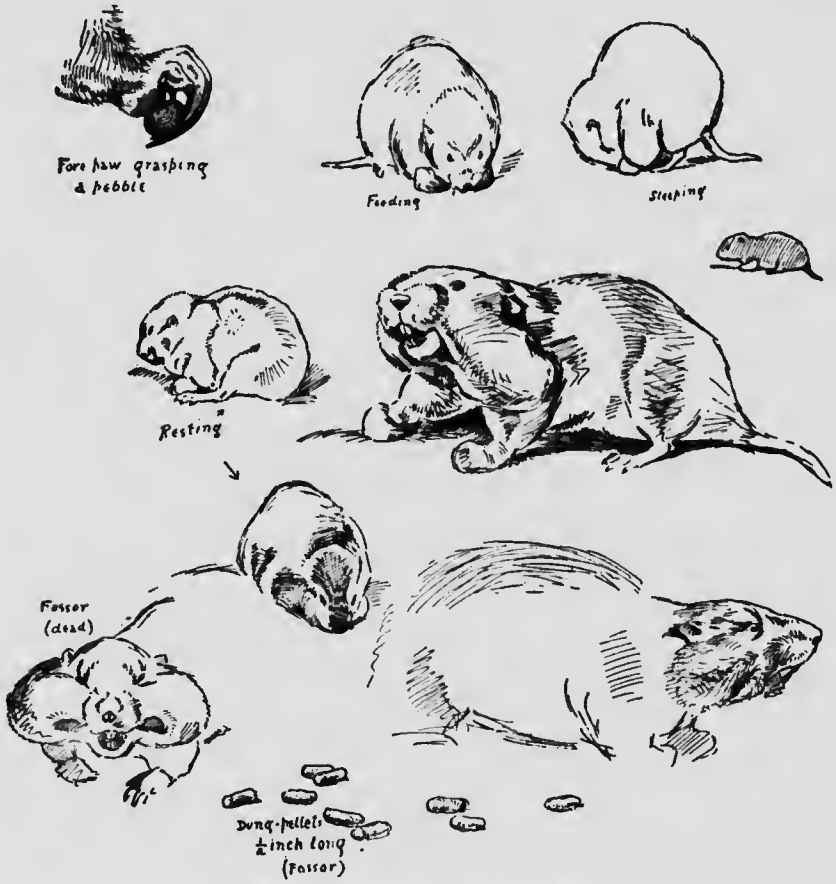



FIG. 162—Life studies of *Thomomys talpoides*.

and early June, when I commonly got two, a male and a female, before the signs of activity ceased in that particular labyrinth.

Being neither sociable nor gregarious, the Gopher has not developed many methods of intercommunication.

SOUNDS

Ordinarily it is silent. When taken alive it hisses, grinds its teeth, and sometimes utters a low snarling.

I have never seen the nest of *talpoides*, but I took 5 well-developed unborn young from a female on June 29, 1892. They were certainly within two weeks of birth. A female taken alive August 1st was evidently nursing. On September 8, 1884, I captured 2 half-grown young, and again saw others that month. YOUNG

Louis J. Ohnimus informs me that *bottæ*, which abounds in Golden Gate Park, breeds in the fall and winter, and has 5 to 6 in the litter. In the autumn the young apparently scatter and begin their solitary life by burrowing for themselves. At this time the size of the Gopher may be fairly estimated by the calibre of its tunnel and by the number of mounds it throws up.

The food of the Pocket-gopher is chiefly if not exclusively vegetable; roots, grain, grass, and the leaves of various plants are staples. FOOD AND STORAGE

In Manitoba during the spring of the year I have several times ploughed out its storehouses and found the grain in them —amounting to three or four pints—not mixed, but each kind in a separate pile.

In Minnesota, Herrick says[3] "the main runway was provided with blind alleys at intervals, each of which was somewhat expanded at the end. Here a store of grass roots is accumulated in quantities varying from a pint to nearly half a peck. The amount seems to be intentionally limited, so that the slight heating shall stimulate the roots to fresh growth, thus providing fresh supplies for the winter. Larger chambers are constructed for the tubers of helianthus, etc."

In Colorado I dug out a food store of the *fossor* species. The plants in it were cut in sections about two inches long, that is, to fit the cheek-pouches of the animal, and stowed on the outside of the bed-lining. This food consisted chiefly of the leaves and hollow stems of a large composite plant, a specimen of which is shown in Fig. 163. It was very abundant at this time September) in all the hollows, but not immediately

[3] Mam. Minn., Herrick, 1892, p. 229.

over the nest. Evidently the Gopher had gone abroad to gather this food.

I have several times found roots in the pouches of the Gopher; one purpose of its burrowing, indeed, is to get a choice variety of these. I personally have never known it to destroy root crops, though I have heard of such things elsewhere.

My captive specimens always refused drink.

HABITS

The Gopher leads the life of a Mole, living in a burrow which is about 3 inches wide and ramified indefinitely near the surface. It throws up a mound every few feet, but in some cases a gallery is run for 20 or 30 feet without a mound appearing.

Fig. 163.
(See page 567.)

Its method of burrowing, as observed in captive specimens, is to loosen the earth with the powerful front claws, as it stands with hind-feet advanced and wide spread, then throw it backward between the hind-legs, to be further passed on by the hind-feet; and when a sufficient pile is ready, the Gopher turns round and pushes with its broad head and powerful front-feet, forcing the pile ahead of it to the first side gallery, up that and out, usually without exposing itself. The *earth* is always moved thus, *not in the enormous cheek pouches*, as some believe. In all my experience I have never known these to serve for anything but provender bags. In one or two cases I have found a little earth in the pouches, but obviously it came from some roots that the creature was carrying home.

In August, 1892, I caught a Gopher and kept it captive for some days while I sketched the attitudes that appear in Fig. 162, p. 566. I also got some new notes on its habits.

On being offered grass it was careful to cram its cheek pouches before eating. To make this easy it cut the

grass in lengths with its teeth, then transferred it to the pouches by the use of both paws, as well as teeth and lips. In doing this its movements were so quick as to make observation difficult.

One of the most curious characteristics of its fore-paws is their perfect prehensileness. This is attained, not by a true digital prehensility, but by the long claws working against

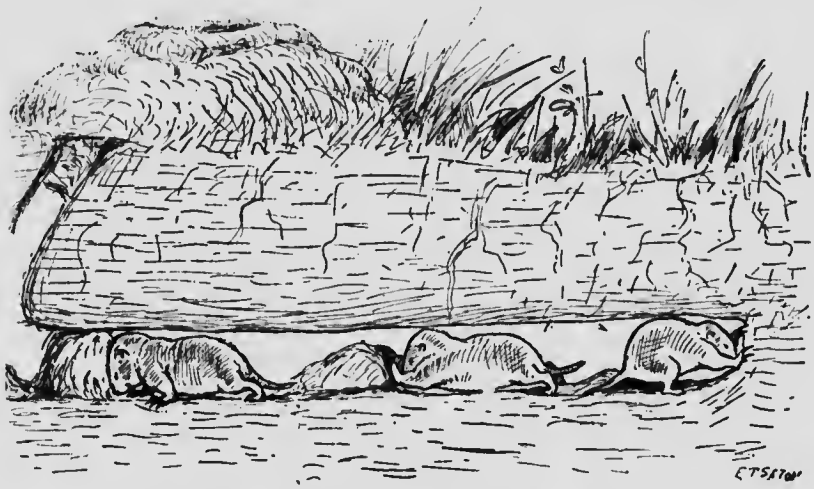


Fig. 164—Attitudes in burrowing; the same animal in different positions.

the large pad or cushion of the pisiform region, as is the case with the sloth and some other animals. This power seems of use only in the handling of food, while foraging, eating, or filling their pouches. The animal seemed as incapable of climbing as a dog or a sheep.

My notes on another captive are thus recorded:

Carberry, Man., July 29, 1892. In the morning I investigated a Pocket-gopher's labyrinth. The part that I opened is shown in Fig. 165. This was about 9 inches below the surface and each gallery, about 3 inches in diameter. It was continued north-west for about 50 feet farther with fresh mounds at various points all along. I set the trap in a hole near the north end, and in the evening found the Gopher caught by the

hind-leg. It was not vicious, and when taken out and put on the ground it made but little effort to escape, either by digging or by running. It refused water, but ate grass readily. Its fur showed the usual two or three cracks across the back. Its movements were rather slow.

When walking its fore-feet rested on the outer edge with the claws turned inward, in the manner of the great ant-eater.

July 30, 1892. In the evening I noticed that the Pocket-gophers begin work at 6 P. M., that is, as soon as the heat of the

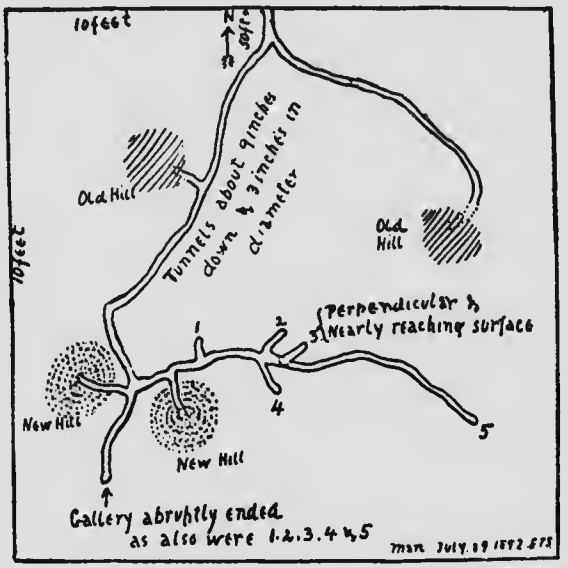



FIG. 165—Burrow of *T. talpoides;* about 30 feet are shown; it was continued at least 50 feet farther, with many mounds.

day is over. My second captive specimen is apparently thriving in its box.

August 1, 1892. This morning, after four days captivity, the Pocket-gopher died. The labyrinth in which I caught it, and which I had partly opened, showed fresh hills to-day. I therefore dug open about 20 feet more, but discovered neither nest nor another occupant. The captive may have been preparing for a family, for it gathered into one corner all available material for making a bed.

Most of the Gophers rest while the sun is high. In Colorado I have heard *fossor* digging under my bed in camp at night and in the early morning. Fresh mounds are found at dawn over the tunnels of all the species I have observed, namely, *talpoides*, *fossor*, *monticola*, and *bottæ*. NOCTURNAL

Of course it matters little to this child of the dark world whether the other world be bright or not when he works, and yet there is little doubt that at night his upheavals are less likely to catch the eyes of watchful foes.

This does not mean that the Gopher never toils by day. Early morning and late evening are favorite times with *talpoides* in Manitoba. Indeed, it is always ready to toil except in the hours of extreme heat, and I have known a continued temperature of 90 degrees in the shade to stop all upheavals for some days.

Frequently, possibly every night, the Gopher quits the burrow and sallies forth into the open air, foraging for grain and foods not attainable underground. These it crams hastily into its pouches, then retires to its burrow to consume them. The cover of night is essential to these expeditions; they are seldom made in broad daylight, though they may be undertaken in twilight or by the light of the moon.

In Fisher's report on "Food of Hawks and Owls"[1] I find 12 cases cited in which hawks had preyed on Pocket-gophers, and only 8 in which owls had done so; but there were a vast number of hawk observations and comparatively few for the owls.

On May 5, 1887, my friend, Miller Christy, wrote me from Western Manitoba: "To-day I found a nest of horned owls in a poplar tree on the open prairie. Besides the two fledgling birds, it contained the remains of 20 Pocket-gophers in various stages of decay." The horned owl is a night feeder. I have never taken a Gopher from a hawk.

In California, the food of the barn owl, according to Clark

[1] Bull. 3, Div. Orn. & Mam. U. S. Dep. Agr., 1893.

P. Streator,[1] is almost exclusively Pocket-gophers the whole year round. As the barn owl is strictly nocturnal in its feeding habits, this is a good evidence that the Californian Gopher also is a nocturnal species.

There is one time when the Gopher is very apt to become the prey of day-feeders. And that is at noon, when, as later described, the digger opens its burrow to let in the sun, and may thus be surprised by a watchful foe.

ENEMIES

Obviously the chief enemies of the Pocket-gopher are owls; but we must add to these hawks, Badgers, Weasels, Coyotes, Foxes, and, in some regions, snakes, which enter the tunnels if they chance to find them open. The care with which the Gopher will plug the burrow as often as one exposes an entrance is probably an instinctive precaution against such marauders. If the burrow be persistently opened for two or three days the Gopher abandons it.

I have seen patches of 50 to 100 square yards on the damp creek bottom that had plenty of old, but no recent, signs of Gopher-work. These I could not account for, unless it was that Weasels had killed off their mining population.

PARASITES

In Manitoba and New Mexico I have several times found Gophers with an interesting kind of companion or semi-parasite. Amphibians of the genus *Ambystoma* commonly take refuge for the winter in the Gopher tunnels.

The common toad, also, will avail himself of the easy digging furnished by the new Gopher mound, when the time comes to bury himself for the season.

BURROWS

The burrows of this famous burrower are of two kinds, forage and residential. I have never investigated fully one of the latter made by the Manitoba species, but have opened many of its forage burrows. These are usually 2 to 3 inches in diameter and 4 to 8 inches from the surface. Figs. 165 and 166 show typical examples.

[1] *Ibid.*, p. 134.

But in Colorado on the White River Plateau in September, 1901, I spent three days investigating the complicated home of an allied species, *T. fossor*. The notes in my journal run thus:


FIG. 166—Burrow of *talpoides*. Carberry, Man., May 27, 1884.

Pagoda Peak, Colorado, September 9, 1901. In the afternoon we dug out the labyrinth of a Pocket-gopher. The species abounds in every part of the country we passed through. It keeps the ground soft even at 10,000 feet elevation.

The burrow was on a slope with an eastern exposure. We dug out 125 feet of it, most being about 4 inches from the surface in the friable soil, but near the nest it dipped down through hard-pan vertically 24 inches from the surface, as shown in Fig. 167.

The central chamber had a 3-inch lining of finely chewed grass; it was 12 inches long, 9 wide, 7 high, and perfectly clean. DEN

Special places, or pockets, were provided for the dung. There were great quantities of this, fully three pints, some of it being very old and mouldy. At only one place did we find any of it in the main gallery. The form taken by the pellets is, of course, regulated by the intestine, and shows the affinities of the animal. The dung of Rabbits is round, of Mice and Squirrels double-conical or oval, that of the present species, cylindrical. (See Plate of Scatology, facing page 654.) DUNG

At several places were piles of earth pellets, a gill or so in each. These were compact and rounded, of various sizes, MUD PELLETS

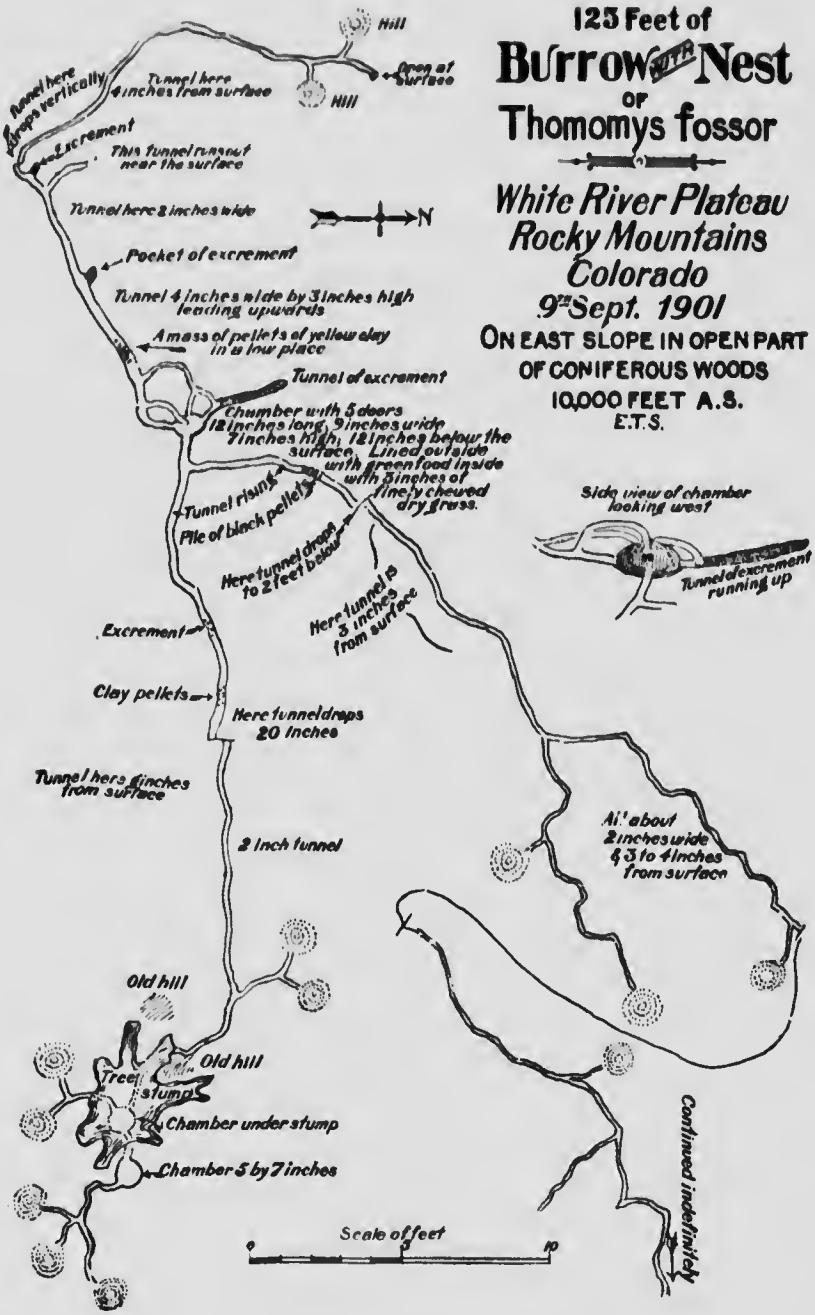



FIG. 167—Typical residential burrow of a *Thomomys*.

and looked like worm castings. Some were of black mould, some of yellow clay, the two kinds being in separate piles. The only explanation that I can suggest for these is that, in going out to forage during wet weather, the animal's fur becomes soiled, and the mud is afterwards cleaned off and accidentally rolled into these pellets, before the Gopher re-enters the nest; another indication of its cleanliness.

This animal, in common with all that make elaborate homes, has progressed well in sanitation.

AIRING

A common habit observed in *talpoides*, *fossor* and *monticola* is, as mentioned already, that of leaving the burrow open an hour or two on sunny mornings, apparently for air or sunlight. Possibly the Gopher lies below the open hole to enjoy the warmth. No doubt the passing of the miner along the snug-fitting tunnel while one door is open, draws in fresh air enough to last for some time.

It plugs the ventilator up again about noon. This general move to close the air-hole gives the appearance of a midday period of activity at tunnelling.

On September 10 I caught a female Pocket-gopher in a burrow connected with the above, and continued the examination and measuring of the galleries.

On September 11 we continued our investigations, but saw nothing of the owner, so either it escaped by one of the side galleries or it was the female caught yesterday. This morning, however, fresh hills appeared near the trench we opened.

There were no mounds near the chamber or its galleries. The few marked on the plan were new ones, but the whole surface bore evidence of having been disturbed early this season. In the spring, no doubt, the plot was dotted with numerous hills, since levelled by the weather, etc.

This investigation has kept two of us hard at work for nearly three days with shovels, rule, and tape-lines.

No doubt the residential burrows of *talpoides* will be found much like this.

SHAFTS

There is yet one other type of burrow that I attribute to *talpoides*. The only one of these which I investigated was while digging a well on the Big Plain in Manitoba in 1882. It went down spirally 15 feet, then it left the line of the well. Old residents told me that such were commonly found, and were understood to be made by the Pocket-gopher seeking water. I did not see the animal that made it and do not believe that Gophers seek water, but the tunnel was of the same size as those made by *talpoides*, and the only other possible makers were the Sperr iophiles (*richardsoni* and *tredecemlineatus*).

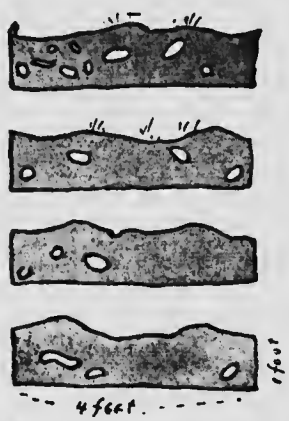



FIG. 168—Prairie sections made at Carberry, Man., in 1882, to illustrate the number of Gopher burrows near the surface. Most of these were plugged with lighter coloured subsoil.

Whatever the exp'anation of the deep shafts, they are not as important as the ordinary tunnels. These are 4 to 10 inches down and about 3 inches wide, as illustrated in the sections made in Manitoba, 1882. (See Fig. 168) These tunnels are connected by frequent side galleries with the surface, and although along the cut banks of the creeks in California I saw a great many holes, apparently made by these rodents, down 3 or 4 feet, we must believe that the special realm of the Pocket-gopher's activity is—like the farmer's fortune—in the soil within a foot of the surface.

INDUSTRY

The Gray Pocket-gophers work not only morning, evening and night; they are active during a larger part of the year than most burrowing rodents. Of course that activity is varied with the season. I have many observations to show that *talpoides* is most energetic in the spring-time. J. B. Goff assures me that this is true also of the Colorado species. Through the summer the Gophers continue their work with little relaxation in the hottest weather, and in Manitoba *talpoides* works away, pushing its great black mounds through the snow long after the frost of winter has stopped the plough.

During the coldest weather it never appears outside, and yet evidently continues its labours. We have proof of this in the remarkable clay-castings or tunnel-plugs that it leaves under the snow. In the spring, after the snow and ice have melted, these clay casts are found in curious serpentine labyrinths over the grass of the hollows. They are no doubt the material that would have formed hills had the snow not compelled the Gopher to dispose of the stuff in a different way. SNOW-TUNNELS

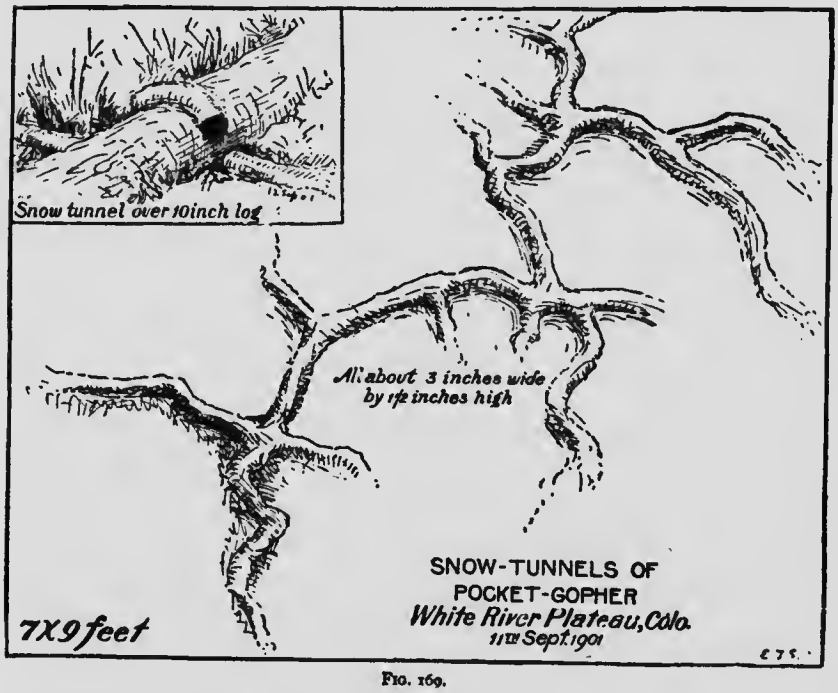



FIG. 169.

Fig. 169 shows a snow-tunnel plug by *fossor*. I saw hundreds of these in each day's ride through the mountains of Colorado; they were seen chiefly in upland hollows where the snow had been deep. This, though it had been exposed to the weather for five months, was 1½ inches high and about 3 inches wide. I imagine that when first uncovered by the melting of the snow, it was at least 3 inches high. It is far

from being an unusual one, and was drawn because it happened to be near my camp. During the day I passed many that were larger and more complicated.

In a corner of the same drawing is shown a curious case where the Gopher had carried his snow-tunnel and earth-plug over a log 10 inches in diameter.

NON-HIBERNANT

It is clear that the Pocket-gophers do not hibernate. The species that I have observed do not get fat in the fall; *fossor* and *talpoides* I know lay up a store of food for the winter, and as early as April 12 (1883), at Carberry, I took one from a white owl. Evidently it was abroad foraging, though there was yet plenty of snow on the ground.

There is every reason to believe that *talpoides* and its kin continue active the whole year round, which means that they never cease to dig.

EARTHWORMS NOT NATIVE IN WEST

In his well-known book on "The Formation of Vegetable Mould through the Action of Worms," Darwin begins with this statement: "Earthworms are distributed throughout the world," and later gives much detailed evidence in support of it. I was therefore greatly surprised on going to Manitoba, in 1882, to find that the common earthworm was there quite unknown.

I was not aware at the time that in 1828 Richardson wrote[5] of the Mole-gopher, "It cannot, like the English Mole, feed on earthworms, for none exist in those latitudes. . . . I was told by a gentleman who has for forty years superintended the cultivation of considerable pieces of ground on the banks of the Saskatchewan, that during the whole of that period he never saw an earthworm turned up."

In November of 1882 I recorded the absence of earthworms from Manitoba in my paper on the Gophers, published by the Manitoba Department of Agriculture in the spring of 1883.[6] The following remarks appear therein:

[5] F. B. A., 1829, I, p. 204.

[6] Agr. Rep. Man. for 1882, pub. Winnipeg, 1883, pp. 169–172.

"Doubtless all the hearers of this paper are familiar with the outlines of Darwin's theory that the worms are the makers of the black loam. Now, an earthworm is a creature altogether unknown in this part of the world . . . so the presence of from 10 to 20 inches of the best black loam would seem to stagger the worm theory; but perhaps the Gophers are a perfect substitute for worms." GOPHERS MAKE THE LOAM

In 1883 I was visited by Miller Christy, and together we investigated a considerable section of Manitoba without finding any earthworms, and satisfied ourselves that they were not native to the region.

The following year Christy published in *Nature*[7] a paper "On the Absence of Earthworms from the Prairies of the Canadian North-west," in which he gives many facts showing that earthworms are not native to Manitoba, and says:

"Further, Mr. Leo Rogers, son of Mr. Thomas Rogers, of Manchester, who has spent several years with the engineers of the Canadian Pacific Railway, has informed me that earthworms are unknown between Winnipeg and the Rockies."

In the Winnipeg reprint[8] of this article the editor adds these remarks:

"In *Nature* of February 28, 1884, Mr. T. E. Wilcox, of Vancouver Barracks, Washington Territory, says: 'Miller Christy writes on the absence of earthworms from the prairies of the north-west. I can confirm his statements, and extend them to cover the prairies of Kansas, the Indian Territory, and Idaho and Washington Territories.

* * * * * * *

"'At Boise City, Idaho, some enthusiastic disciples of Isaak Walton imported and successfully reared the coveted bait in soil suited to the habitat of the *Lumbricidæ*.'"

* * * * * * *

"In *Nature*, March 27, 1884, Dr. Hy. F. Walker, of New York City, wrote in reference to Christy's paper, 'The obser-

[7] Nature, Jan. 3, 1884. [8] Rep. Dep. Agr. Man. (for 1883), 1884, p. 349.

vation there made is correct as to the absence of earthworms in the region mentioned.'

* * * * * * *

"For years I have been accustomed to go to Muskoka, in the Canadian dominion, for shooting and fishing. This section is a wooded wilderness with numerous lakes and streams. It is still Governmental wild land, and in part unsurveyed for settlement. The frontier settlers there tell me that, until a place has been inhabited for five years, it is useless to search for the earthworm."

Following my article a year later, Professor Robert Bell, of the Canadian Geological Survey, read, before the Royal Society of Canada, on May 23, 1883, a paper called[9] "The Causes of the Fertility of the Land in the Canadian North-west Territories," in which are these paragraphs:

"As far as I am aware, earthworms are not found in the North-west. If they exist at all it will be in the woods, or in the older cultivated lands into which they have been introduced from abroad, as I have never seen them or heard of them in the unbroken prairie."

* * * * * * *

"The formation of the vegetable mould in these regions must, therefore, be due to some other agency than that of worms, and this I believe to be principally the Moles, which live in vast numbers throughout the region in question, and although apparently insignificant animals, accomplish more in the way of soil-making than the earthworms of England."

* * * * * * *

"If the fertility of tens of millions of acres of land in the North-west, and consequently their value, has been mainly due to the work of Moles, these apparently insignificant little creatures may be regarded as the most important of the native animals of the country."

[9] Rep. Dep. Agr., Man., for 1883, pub. 1884, p. 346 and p. 348.

Since 1882 I have made personal investigations in parts of Saskatchewan, Alberta, South-eastern British Columbia, Dakota, Wyoming, Montana, Idaho, Colorado, New Mexico, Arizona, and the mountains and dry parts of California, and made numberless inquiries covering the western part of the Mississippi drainage, as well as all the adjoining mountains, without hearing of any earthworms excepting in localities where they were introduced.[10]

Further, I am satisfied that, excluding the narrow humid belt along the Pacific Coast, earthworms are not native to any part of America south of the Great Slave Lake or west of the immediate Mississippi Valley. Probably the true earthworm is not native to any part of North America.

LOAM ABUNDANT

According to Darwin, there should be no vegetable mould in this vast continental region. There exists, nevertheless, a fine stratum of humus in all parts of it where there is moisture enough to produce annual vegetation. The black loam in Manitoba is from one foot to two feet thick, an amount probably not exceeded over any large area elsewhere in the world. This is not a solid bed of decayed vegetation, but is thoroughly mixed with the upper formation.

LOAM IS GOPHER MADE

There is no doubt, then, that, in the absence of earthworms, this mixing is done, as already stated, by a number of species of burrowing animals, but by far the most important of these are the *Geomyidæ* or Pocket-gophers.

We have already noted the vastness of the area inhabited by the Pocket-gophers, their ubiquity in that area, the greatness of their numbers, and the assiduity of their labours; let us now look at the results in detail, and, finally, in mass.

NUMBER OF MOUNDS

In Fig. 170 is shown the work of *T. monticola*, on a plot 16 by 32 feet, found on the west side of Lake Tahoe, in California, September 23, 1899. In this the black spots show where some animal had laid open the Gopher's burrow, but there was nothing to say whether it was done from

[10] They have recently appeared in many highly cultivated parts of Manitoba.

above by some enemy, or from below by the Gopher itself. The dotted spaces represent very old hills, either of last spring or of the year before. Those faintly outlined are recent hills, and the heavy-lined hills were about a day old. A sample hill

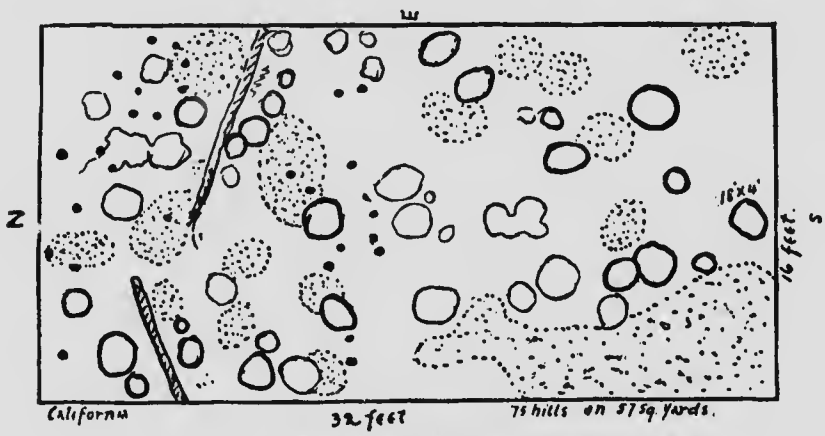



FIG. 170—Work of *monticola*, near Lake Tahoe, California, Sept. 23, 1899.

SIZE OF MOUNDS

is seen in the middle of the right or south side. It was 18 inches wide, 4 inches high, and contained about a third of a bushel of earth. This is probably an average hill, but in Manitoba I have seen others 10 inches high and 4 to 5 feet across, thrown up from a single burrow, and containing 7 or 8 bushels of loam.

On April 29, 1904, at Whitewater, Manitoba, E. W. Darbey and I staked off 20 yards square in the middle of a large Gopher tract, then carefully counted the hills—there were 78. We then measured in a bushel measure a number of the mounds, and found that an average one was a good half bushel, a large one 2 bushels. Altogether they represented about 40 bushels of earth. All these had been made apparently this season.

In the Sierra, September 23, 1899, I saw 10 large hills thrown up in one day from one tunnel; many extensive areas had had the surface wholly turned that year. I noted some, of course, with little gopher-work, but very few with none.

At Carberry, Man., September 8, 1904, on a space 5 yards long and 1 yard wide I counted 7 new mounds less than 24 hours old; an average one was 18 inches wide and 3 inches deep.

In another Sierra valley, September 24, 1899, I saw 15 fair-sized hills thrown up within twenty-four hours, apparently by a

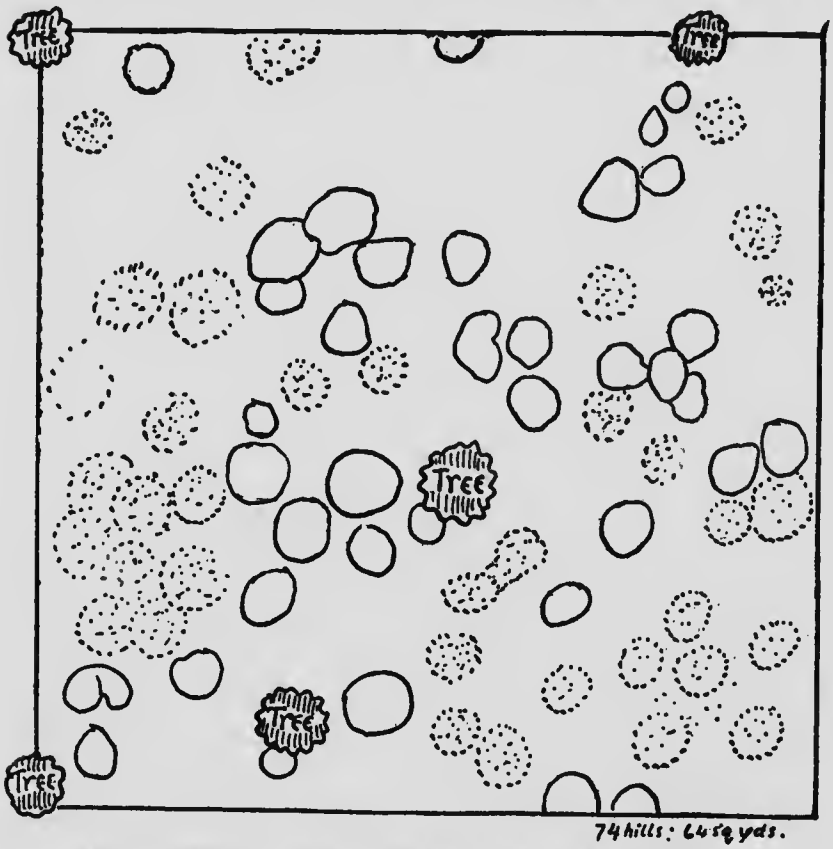



FIG. 171—Gopher work in Colorado, on a space 24 feet square, September 16, 1901.

single Gopher, and scattered with them were 32, so recent, that only one inch of their exterior was dry. All were within a radius of 15 feet. The aggregate of these 47 hills thrown up in two days was not less than 25 bushels of earth. At another camp in the Sierra that same month I examined many large

areas and concluded that these animals completely ploughed the surface of the country, that is, turn it all over, at least once in two years.

An even better illustration I observed on the South Williams River of Colorado, September 16, 1901. Under the shade of some scattering aspens where we were camped I measured off a space 24 feet square and carefully plotted the Gopher-mounds on it (Fig. 170). The firm outlines are around the hills that were less than a week old, the dotted lines mark hills about a month old, but the whole surface had evidently been turned this summer; the ground was so soft that the horses sank six to ten inches in walking across it.

This was a fair sample of the flats and hollows throughout the White River region, except where it was rock or very hard clay.

The Californian example (Fig. 170) shows about 75 hills on its area of 57 square yards; at this rate there would be 6,000 hills to the acre. An average hill among these was 18 inches across and 4 inches high, as nearly as possible one-third of a bushel, therefore 2,000 bushels per acre were upheaved within two or three months by the Pocket-gophers, enough to cover the whole area evenly to the depth of one inch.

In the Colorado example (Fig. 171), with 74 hills to 64 square yards, the result appears slightly lower, but it should be remembered that in this case the hills over a month old were not counted, as heavy rains had melted them to a general level. Those remaining would, if levelled off, cover the ground to a depth of one-half an inch; this was one month's work for the Gophers.

In the other cases cited, 4 to 5 bushels were thrown up in one night by a single Gopher. In the second Sierra case the 47 hills or 25 bushels thrown up would equal 1,500 bushels per acre, or if levelled, about one-half inch over the entire surface in *two days*.

These figures show possibilities rather than general probabilities.

TIRELESS INDUSTRY

But as already seen, these animals are more or less active the year round, and even halving the lowest estimate of their numbers to cover sparsely populated regions, and again halving the estimate of their work to allow for periods of comparative idleness, we shall still have an even upheaval of between two and three inches per annum.

In Colorado I made a number of observations that seem to more than justify this conclusion. For example:

September 22, 1901. Camp on Wilson's Flat-top, Colorado. Here, as elsewhere noted, the whole country is upheaved by Pocket-gophers. Aspen logs with the bark on, rot in three years,[11] if set in the ground, and in five above ground; and yet I found here many fallen trunks eight inches in diameter that were completely sunk, buried out of sight, by the labours of these miners *before the wood was at all rotted*. This would mean an upheaval in that place of at least eight inches in less than five years.

RESULTS

Darwin concluded that the earthworms in five years bring up soil enough to cover the ground one inch thick, and that, therefore, the result of its labour is of vast importance. I reckon that the Pocket-gopher does this much in five months. It does not do it in the same way or so effectively, because the earthworm actually digests the substance of its castings, but it is evident that the Gopher's method answers the purpose of fully disintegrating and mixing the dead vegetation with the soil to produce a rich and fertile black loam.

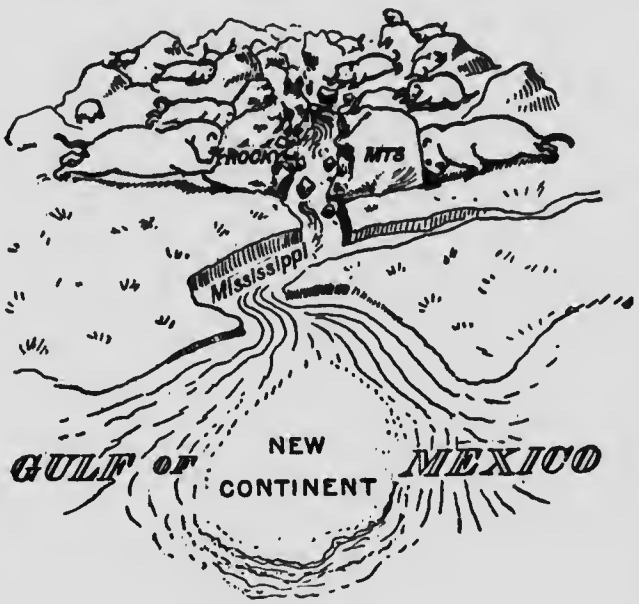
From these observations we may form some idea of the work done toward tilling and draining the ground by this continental army of rodents, and it is possible that they cause still greater changes by bringing such vast quantities of soil under the influence of the sun and wind.

Their aggregate power as active geological agents must be immense, and when we stand on the banks of the Mississippi

[11] "Pieces of wood, 2½ inches square, were buried to the depth of 1 inch in the ground, and decayed in the following order: Lime, American birch, alder, and aspen in 3 years, etc. etc." J. H. Balfour, Manual of Botany, 1855, London and Glasgow, p. 45.

and watch that turbid river bearing its 400,000,000,000 of tons of mud per annum to the sea,[13] for the manufacture of new continents, we should realize that a great many thousand million tons of that flood-born silt is simply the *débris* from the workshop of the *Geomyidæ*.

[13] Humphrey & Abbott, Delta Survey.



## XXVI.

### Jumping-mouse.

*Zapus hudsonius* (Zimmerman).

(*Zap.us*, proposed by Coues in 1875, from the Greek *za*, an intensive particle, and *pous*, a foot, hence 'remarkable foot.' Latin *hudsonius*, of the Hudson's Bay Territory.)

*Dipus hudsonius* ZIMM., 1780, Geog. Gesch. Men. U. Vier Thiere II, p. 358.

*Zapus hudsonius* COUES, 1875, Bull. U. S. Geol. Sur. Ter. 2d Ser., No. 5, p. 253.

TYPE LOCALITY.—Hudson's Bay.

FRENCH CANADIAN, *la Gerbille du Canada.*
CREE, *Kwa-kwash'-kan-ah'-be-gah-not'-see.*
OJIB. & SAUT., *Kwash-kwash-kwut-tah'-be-gah-not'-see.*

The *Family Dipodidæ*, of which the African Jerboas are typical representatives, consists of small mouse-like Rodents, whose hind-legs are enormously developed for leaping, and whose tails are very long, usually tufted.

It includes the Jerboas, the Jumping-hares, and the Jumping-mice.

FIG. 172—Skull of *Zapus hudsonius.*
(One and one-half times natural size.)
Showing minute premolars. Cut from Preble's Revision of Zapus, N. A. Fauna, No. 15, Biological Survey, U. S. Department of Agriculture.

The genus *Zapus* (Coues, 1875), in addition to the Family characters, has the tail slender, tapering, untufted, and very long (about 5 inches), exceeding the head and body together; on front paw, 4 fingers and a knob-like thumb, 5 toes on hind-feet; ears, very small; small cheek pouches; all

resemble *Zapus hudsonius* in their peculiar style of colouration. Teeth:

$$\text{Inc. } \frac{1-1}{1-1}\text{; prem. } \frac{1-1}{0-0}\text{; mol. } \frac{3-3}{3-3} = 18$$

The species *insignis* has no premolars, therefore but 16 teeth in all; it is type of the sub-genus *Napæozapus*.

SIZE

The Hudsonian Jumping-mouse is further distinguished by: Total length, about 8¼ inches, rarely over 8½ (210 mm., rarely over 215 mm.); hind foot, 1⅛ inches (28 mm.); tail, about 5 inches (127 mm.)—of course this is its most variable proportion, ranging from 4 to 5½ inches (102 to 140 mm.).

The females are smaller; I have found them but 7¼ inches (184 mm.) in total length.

COLOUR

The under-fur of all the upper parts is lead colour, overlaid on the cheeks and sides with a strong ochre yellow, and on the crown and back with blackish and ochre mixed; all below is pure white. The effect is of a yellow Mouse, with a sharply marked brown band down its back, and a white breast.

In autumn the back band is less marked and the yellow brighter.

When seen alive it is easily identified by its yellow colour and *extraordinarily long tail*, and, if in motion, by its flying leaps.

The following races are recognized:

*hudsonius* Zimm., the typical form.
*campestris* Preble, large and bright-coloured.
*ladas* Bangs, larger and darker, with larger hind-foot.
*alascensis* Merriam, larger and darker, with longer skull.
*americanus* Barton, very small.

## Life-history.

RANGE

The true *Zapus hudsonius* of Zimmerman, described in 1780 from a Hudson Bay specimen, is a species widespread in


**MAP 35—RANGE OF THE AMERICAN JUMPING-MICE.**

**(Exclusive of *Z. insignis*.)**

Founded chiefly on E. A. Preble's Revision in N. A. Fauna, No. 15, 1899. The map must be considered provisional and diagrammatic. Some of the western forms will doubtless be reduced to sub-specific rank.

**The following are recognized:**

*Zapus hudsonius* (Zimm.) with its 5 races,
*Zapus tenellus* Merriam,
*Zapus princeps* Allen, with 3 races,
*Zapus major* Preble,
*Zapus nevadensis* Preble,
*Zapus trinotatus* Rhoads, with 3 races,
*Zapus orarius* Preble,
*Zapus pacificus* Merriam,
*Zapus saltator* Allen.

The unentered species *Zapus* (*Napæozapus*) *insignis* Miller is found in Eastern Canada; in the southern Alleghanies it grades into *roanensis*; on the north shore of Lake Superior it grades into *abietorum*, but it does not reach Manitoba.

temperate Eastern North America, from Virginia to James Bay and from Nova Scotia to Alaska. As shown in Map 35. it begins on our prairies to grade into the larger, brighter-coloured form that E. A. Preble calls *campestris*.

In the wooded parts of Manitoba we may expect the typical form of *hudsonius*, as it has been taken in northern Minnesota, and Preble collected it at Norway House as well as in many places between Lake Winnipeg and Hudson's Bay.[1]

ENVIRONMENT

The typical Jumping-mouse (Z. *hudsonius*) is commonly found in thickets by meadows, and along the edges of the woods; and the prairie form, as far as I have seen, is not an animal of the prairie, but of the prairie border-lands. I never saw it far from the scrubby underbrush that surrounds most of our small lakes, and its favourite localities are the low thickets of brush and weeds, near streams or ponds, among the poplar groves and half-open country.

HOME-RANGE

I have no evidence on the home-range of the individual, but its wonderful powers, no doubt, enable the Jumper to travel much further than any other of the Mice.

ABUNDANCE

I have never heard of a region where Jumping-mice were abundant, with the meaning the word would convey if applied to the Meadow-mice. A dozen each summer represent those that have come within my observation. It is, however, very local in distribution, and E. A. Preble got a score of specimens in four days at Oxford House.[2]

UNSOCIABLE

It seems to be a solitary species. I have never seen two adults together, nor have I heard of it except in the case of a pair caught in the same nest. I did, however, find two old ones drowned together in a little water-hole on my farm near Fort Pelly on the 17th of June, 1884. This is the only case of united action that I have observed in the species.

[1] N. A. Fauna., No. 22, 1902, p. 58.
[2] *Loc. cit.*

VOICE, ETC.

For some months Audubon and Bachman kept three specimens, apparently of true *hudsonius*, in a cage for observation, and state:[3] "They were usually very silent, but, when we placed a Common Mouse in the cage, squeaked with a loud chattering noise, like some young bird in pain."

BURROWS

It is a burrowing animal, notwithstanding its reversal of the true digger build, which requires the fore-paws to be the strongest. Kennicott says that it usually lives in short burrows underground; in summer these are near the surface, in fall and winter much deeper. Audubon and Bachman comment[4] thus on their captives, which were a female and two young: "We placed a foot of earth at the bottom of the cage; in this they formed a burrow with two outlets. They used their feet and nails to advantage, as we observed them bury themselves in the earth in a very short time."

NESTING

In the woods, according to Kennicott,[5] it is often found nesting in situations similar to those occupied by *P. leucopus*. "It cannot climb, but crawls up the inside of hollow trees to a considerable height from the ground, and is sometimes found nesting in them, but its nest is often discovered under the bark of rotten trees or stumps * * * sometimes found in a tuft of grass above the surface or under an inverted sod." Audubon and Bachman say: "The domicile of the Jumping-mouse in summer, in which the young are produced, we have always found near the surface, seldom more than six inches underground, sometimes under fences and brushwood, but more generally under clods of earth, where the sward had been turned over in early spring, leaving hollow spaces beneath, convenient for the summer residence of the animal. The nest is composed of fine grass, mixed with which we have sometimes found feathers, wool, and hair."[6] These remarks may have been made with the Southern form (*americanus*) partly in view, but it is unlikely that the sub-species differs much in habit from the true *hudsonius*.

[3] Quad. N. A., 1849, Vol. II, p. 254.
[4] *Ibid.*
[5] Quad. Ill., 1857, p. 96.
[6] *Loc. cit.*, p. 255.

The foregoing refers to their summer and breeding nests. The winter or sleeping nest is in the ground, two or three feet from the surface, and is thoroughly warmed and lined with leaves and grass.

MATING

All the evidence available goes to show that this species pairs. Whenever a nest is found in winter it contains either one or a pair. Bailey records[7] that in July, 1887, at Harwood, Dakota, he found two in a nest near a wheat-field. Preble found *Zapus montanus* nesting at Crater Lake, Oregon, August 18, 1896,[8] and says[9] of these elaborate late summer structures: "These nests are usually occupied by two individuals, presumably a pair, and seem to be used only at the close of the breeding season."

On September 8, 1903, while camped in the Bitter Root Mountains of Idaho, the cook brought me a male Jumping-mouse (Z. *princeps*) caught near by. Its sexual organs were much enlarged and had all the appearance of rut. It is possible that, like several other hibernators, the species mates in the fall.

BREEDING

As already noted, Preble collected a number of Hudsonian Jumping-mice between Lake Winnipeg and Hudson's Bay. He found in them from 5 to 8 embryos. The following details have been supplied me from his note-book:

"Robinson Portage, June 28, 1900. Two specimens, 5 and 6 embryos, respectively; of 20 adult specimens taken at Oxford House, 5 were adult females, which were fully examined and then entered: June 30, 1 with 5 embryos; July 1, 1 with 8 embryos; July 2, 3 with 6, 7 and 8 embryos, respectively."

As no young were taken, this shows conclusively that the latter are produced in July in that latitude. It is well to remember here a principle elsewhere laid down, that the young in the nursery average lower in number than uterine embryos. Most hen's nests have some eggs that come to nothing. Kennicott

[7] Rep. Orn. U. S. Dep. Agr., 1888, p. 447. [8] N. A. Fauna, No. 15, 1899, p. 29.
[9] *Ibid.*, p. 8.

says[10] that in Illinois this species[11] produces only from 2 to 4 young at a birth, and * * * probably not over 1 or 2 litters in a year." E. Slade of Somerset, Mass., writes Dr. C. H. Merriam: "As a rule, 3 litters are produced in a season, each consisting of 2 to 4 young." Audubon and Bachman make a similar statement,[12] so that the northern animal appears to have larger broods, though it is likely that the southern one breeds twice as often each season as the species observed by Preble near Hudson's Bay.

YOUNG

In Massachusetts this same observer found evidence that the young are born in May or June, but sometimes as late as September, "from which it seems probable that a second litter is raised, or that the breeding season continues throughout the summer. Three specimens obtained by my brother at Wilmington, Mass., September 25, 1897, which, with their parents, were turned up by a plow, were so young [about two-thirds grown] that the posterior upper molars had just appeared" (*loc. cit.*, p. 8). Similarly Audubon and Bachman state:[13] "We have seen the young on several occasions in May and August."

The mother frequently carries them attached to her teats. Dekay records[14] a case of a female going off with 4 young ones attached to their mother by her teats; and many observers since have added similar testimony. This habit is well-developed in most of the Mice, but it is most remarkable in the *Zapus*, because of the flying leaps that it takes. It is hard to say which gets the worst of it, in these vast bounds, the helpless sucklings, bumped and bruised on brush and stones, or the mother who is trying to make unusual speed with three or four heavy babies hanging to her flesh like a bunch of little bull-dogs.

A popular error has already grown up around this fact, an

[10] Quad. Ill., 1857, p. 97.
[11] Mam. Adir., 1884, p. 292.
[12] Quad. N. A., 1849, Vol. II., p. 254.
[13] *Ibid.*
[14] Zool. N. Y., Pt. I, p. 72.

error which as early as 1851 was partly pointed out by Audubon and Bachman in the following paragraph:[15] "We are not, however, to argue from this that the young immediately after birth become attached to the teats in the manner of the young Opossums, and are incapable of relaxing their hold; on the contrary, the female we had in confinement only dragged her young along with her when she was suddenly disturbed and when in the act of giving suck; but when she came out of her own accord, we observed that she had relieved herself from this encumbrance. This was also the case with the other species referred to [viz.: White-footed Mouse, Florida Rat, and Flying-squirrel]."

Most of our Mice have been seen carrying their young in this way, but no one ever saw the mother doing it deliberately, calmly, and comfortably, as though it were her regular mode of transport. It seems only to occur when the old one is alarmed while suckling the brood. Then she dashes forth instinctively, and they hold on instinctively, though not very effectually for any length of time. The only exception to this that I find is stated by E. A. Preble, who writes me: "I have caught *Microtus* in traps with young attached to the teats; near the burrow, however."

HOME-LIFE

One of my purposes throughout has been to learn the home-life and the social side of each animal. But there is wofully little of it on record. If in the present case we take out the paragraphs about the female and young, we find the rest of the history relates chiefly to the creature's struggle for life.

Whether or not it has any social amusements I cannot ascertain. The only discoverable suggestion of such a thing is in the following sentence quoted by Dekay[16] from Jesse Booth of Orange County, N. Y.:

"I once saw two of them [Jumping-mice], between sunset and dark, jumping up in rapid succession, and making a chirping noise like sparrows."

[15] Quad. N. A., 1849, Vol. II, p. 254.

[16] Zool. N. Y., 1842, Pt. I, p. 72.

We know that the swift-footed Antelope races in its social games, the sturdy Bear wrestles, and cattle fence with their horns, each to his specialty, so may reasonably assume that the *Zapus* has a jumping performance when moved to social play.

SPEED

The jumping is perhaps the most remarkable habit of the species. When first seen creeping through the grass it often passes for a Deer-mouse, but the moment one comes near, it bounds away through the brush covering ten or twelve feet at a bound. After the second or third leap it usually crouches among the leaves and, as Dr. Merriam remarks, may readily be mistaken for a wood-frog. On two occasions, at Carberry, I have seen the Jumper alight, after its leap, on a large horizontal branch two or three feet from the ground. There it studied me for a moment before renewing its marvellous bounds. Audubon and Bachman say:[17] "We doubt whether there is any quadruped in the world, of its size, that can make its way over the ground as rapidly, or one that can, in an open space, so quickly evade the grasp of its pursuers." As it can leap forty times the length of its own body, it would be like a Deer clearing 100 yards at every bound.

So far as I know the *Zapus* never jumps in its ordinary travelling or when searching for food; it leaps only when it must to save its life, and that is no small portion of the time. I should think that these dashes for life must average three a day.

An admirable account of its ways[18] is furnished by Elisha Slade. "It possesses," he says, "a momentary agility second to no other rodent, and a muscular strength of enormous power for so small a creature. When suddenly disturbed it often moves away in a direct line, the first three or four leaps being eight or ten feet in length, but these distances rapidly decline to about four feet, which are continued until it considers itself out of danger. This is not always the case, however, for it frequently takes an irregular course and jumps at diverse angles for several successive leaps, keeping the same general

[17] *Ibid.*, p. 253.

[18] Merriam, Mam. Adir., 1884, p. 292.

direction or changing it at will. It can double, and quickly, too, if pursued, and by its manœuvres and instantaneous squattings, can, and often does, elude a hawk or an owl, and its spontaneous irregularities enable it to escape being brained by a Weasel or swallowed whole by the common black-snake."

It is widely stated and believed that the *Zapus* jumps from its hind-feet unaided by its fore-feet or tail, and lands on all fours as well as on tail; that is to say, it jumps from two legs and lands on five. But how they know I cannot say. I have seen it jumping often enough, but the movement was all too quick for my eye. I saw nothing but a dim buff flash.

TAIL

The preposterous tail of this animal is of great service to it in these leaps. It acts as the tail to the kite and keeps the body right end up. It is almost sure that, deprived of its tail, the *Zapus* would lose the benefit of its wonderful hind-leg development, and either jump very weakly, or with such bad aim, that it would be much better for it not to jump at all.

Since writing the above I have found the following account by G. S. Miller, Jr.:[19]

"A young individual [of the present species] had lost its tail by the knife of a mowing machine in a damp meadow and was rendered thereby helpless. Not that its jumping power was in any way impaired; on the contrary, I have seldom seen a Mouse of the size leap more energetically or to greater distances. But the animal had lost all control of its movements. When I approached, it made violent efforts to escape, but the moment it was launched in air, its body, deprived of its balancing power, turned end over end, so that it was as likely as not to strike the ground facing the direction from which it had come. The next frantic leap would then carry it back to the starting point."

Commenting on the incident, Rhoads adds:[20]

"That this misfortune would not always prove fatal I have proof from an old individual, whose stump tail was about two

[19] Mam. N. Y., 1899, p. 330.

[20] Mam. Penn., 1903, p. 111.

inches long, entering my traps. It was otherwise in good condition, though the end of the tail showed it had been a long time in this plight."

If webbed feet made a swimmer, the *Zapus* should be as much at home in the water as the Muskrat, but apparently it is far from it. I never heard of or saw one swimming, and two or three times in Manitoba I found them drowned in spring-holes, whence they might have escaped by swimming twenty-four miserable little inches.

FOOD

In the Adirondacks, according to Merriam, the *Zapus* feeds upon beach nuts and various seeds and berries. In Manitoba I think that the acorns are important in its diet.

Audubon and Bachman state:[21] "This species, feeding on small seeds, does very little injury to the farmer * * * it is fond of the seeds of several species of *Amaranthus*, the pigweed (*Ambrosia*), burr-marigold, beggar or sheep ticks (*Bidens*), all of which are regarded as pests."

Kennicott found[22] the food of this species to "consist chiefly of herbaceous plants with their seeds, and the seeds and nuts of trees when it inhabits the woods. In cultivated fields, it devours grain." E. Slade adds[23] to its food list, buds, leaves, twigs, bark, berries, and grass, in fact, every kind of vegetable growth. Although no one has yet accused the Jumper of being an habitual carnivore or a cannibal, I shall be greatly surprised if it escapes the common reputation of all Mice.

STORAGE HABIT

The storage habit was highly developed in the specimens kept captive by the naturalists Audubon and Bachman, who say:[24] "We observed that everything that was put into their cage, however great might be the quantity, was stored away in their holes before the next morning. We fed them on wheat, maze, and buckwheat. They gave the preference to the latter, and we observed that when they had filled their storehouse with a

[21] Quad. N. A., 1849, Vol. II, p. 255.
[22] Mam. Adir., 1884, p. 292.
[23] Quad. Ill., 1857, p. 96.
[24] *Loc. cit.*, p. 254.

quart of buckwheat they immediately formed a new burrow in which they deposited the surplus."

Kennicott also testifies:[25] "It devours grain, of which it has sometimes been observed to collect stores in its burrows." Later he remarks on these stores that they are collected at all seasons, exclusive, I suppose, of winter, and consist of nuts, grain, and seeds.

DIURNAL OR NOCTURNAL

The early naturalists claimed that the Jumping-mouse was strictly nocturnal. Dr. Merriam says it is crepuscular.[26] In Manitoba I have frequently seen it moving out by day and have seen it captured at night by the cat. In Ontario, near Toronto, one afternoon, I captured a milk-snake that promptly disgorged a newly swallowed *Zapus*. In the Bitterroots of Idaho and in the woods of the upper Ottawa I have twice or three times seen a *Zapus* about the fire at night. We can indeed find evidence for each of the twenty-four hours. I suspect that the creature is like nearly all mammals, including man, a lover of the soft twilight, but able under pressure to travel by day or by night.

ENEMIES

Its enemies are every sanguinary flesh-eater that can catch it. In view of its agility, this would seem a short list, and yet somehow they do manage to keep its numbers down. Although so prolific, it is nowhere an abundant species.

HIBERNATION

This animal is unique among our Mice in its habit of hibernation. Among the country people of Ontario the Jumping-mouse is called one of the "Seven Sleepers," the rest of the somnolent brotherhood being the Blackbear, the Coon, the Skunk, the Woodchuck, the Chipmunk and the Bat. At one time it was not believed that the Jumping-mouse really did hibernate, but the observations of Dr. B. S. Barton at Philadelphia, General T. Davies at Quebec, Robert Kennicott in Illinois, Dr. Hoy in Wisconsin, Prof. S. Tenney in Indiana, and E. Slade in Massachusetts, as set forth by Dr. Merriam in

[25] *Loc. cit.* [26] Mam. Adir., 1884, p. 291.

"Mammals of the Adirondacks" (1884), show conclusively that the *Zapus* is a winter-sleeper, and the colder the weather the deeper its sleep.

It seems to prepare a deep burrow late in the summer, preferably under some stump. In this, below the reach of frost, it makes a warm, comfortable nest, and not far away it has several storehouses of food, as already noted. As soon as the nights become cool and crisp the Jumping-mouse retires from the upper world. The further north we go the earlier it retires. Its time is early September in most of Canada; but about Toronto it seems to go down near the end of the month. In my journal for 1888 I find this note:

September 27. To-day I got a Jumping-mouse. It was in a nest of leaves under the roots of a stump that was pulled up by the stumping machine, and was nearly torpid when found.

In the country near Carberry I never saw it after September 1st. V. Bailey states[27] that at Fort Buford, in September, 1887, he found one in "a nest of fine grass under fallen weeds and brush; it was an adult male and exceedingly fat." Nearly all of those found hibernating are solitary.

One of the most detailed cases is set forth by Professor S. Tenny in the *American Naturalist* for June, 1872:[28]

"On the 18th of January of the present year (1872), I went with Dr. A. Patton, of Vincennes, Indiana, to visit a mound situated about a mile or a mile and a half in an easterly direction from Vincennes. While digging in the mound in search of relics that might throw light upon its origin and history, we came to a nest about two feet below the surface of the ground, carefully made of bits of grass, and in this nest was a Jumping-mouse (*Jaculus budsonius* Baird) apparently dead. It was coiled up as tightly as it could be, the nose being placed upon the belly, and the long tail coiled around the ball-like form which the animal had assumed. I took the little Mouse into my hand. It exhibited no motion or sign of life. Its eyes and mouth were shut tight, and its little fore-feet or hands

[27] Rep. Om. U. S. Dep. Agr., 1888, p. 447.
[28] Quot. in Merriam's Mam. Adir., 1884, pp. 297–8.

were shut and placed close together. Everything indicated that the Mouse was perfectly dead, excepting the fact that it was not as rigid as perhaps a dead Mouse would be in the winter. I tied the Mouse and nest in my handkerchief and carried them to Vincennes. Arriving at Dr. Patton's office I untied my treasures, and took out the Mouse and held it for some time in my hand; it still exhibited no sign of life; but at length I thought I saw a very slight movement in one of the hind-legs. Presently there was a very slight movement of the head, yet so feeble that one could hardly be sure it was real. Then there came to be some evidence of breathing, and a slight pressure of my fingers upon the tail near the body was followed by an immediate but feeble movement of one of the hind-legs. At length there were unmistakable evidences that the animal was breathing, but the breathing was a laboured action, and seemingly performed with great difficulty. As the Mouse became warmer the signs of life became more and more marked; and in the course of the same afternoon on which I brought it into the warm room it became perfectly active, and was as ready to run about as any other member of its species.

"I put this Mouse into a little tin box with holes in the cover and took him with me in my journeyings, taking care to put in the box a portion of an ear of corn and pieces of paper. It ate the corn by gnawing from the outside of the kernel, and it gnawed the paper into bits with which it made a nest. On the fourth day after its capture I gave it water which it seemed to relish. On the 23d of January I took it with me to Elgin, Illinois, nearly three hundred miles further north than the region where I found the specimen. The weather was intensely cold. Taking the Mouse from the box I placed it on a newspaper on a table, and covered it with a large glass bell, lifting the edge of the glass so as to admit a supply of air. Under this glass was placed a good supply of waste cotton. Soon after it was fairly established in its new and more commodious quarters it began to clean every part of its body in the most thorough manner, washing itself very much in the same manner as a cat washes. On coming to the tail it passed that long member, for its whole

length, through the mouth from side to side, beginning near the body and ending at the tip. At night as soon as the lights were put out the Mouse began gnawing the paper, and during the night it gnawed all the newspaper it could reach, and made the fragments and the cotton into a large nest perhaps five or six inches in diameter, and established itself in the centre. Here it spent the succeeding day. The next night it was supplied with more paper, and it gnawed all it could reach, and thus spent a large part of the night in work. I could hear the work going on when I was awake. In the morning it appeared to be reposing on the top of its nest; but after watching it for some time, and seeing no motion, I lifted up the glass and took the Mouse in my hand. It showed no signs of life. I now felt that perhaps my pet was indeed really dead; but remembering what I had previously seen, I resolved to try to restore it again to activity. By holding it in my hand and thus warming it, the Mouse soon began to show signs of life, and although it was nearly the whole day in coming back to activity, at last it was as lively as ever, and afterward, on being set free in the room, it moved about so swiftly by means of its long leaps, that it required two of us a long time to capture it uninjured.

"On the evening of February 6th I reached my home in Williamstown, and on my arrival the Mouse was in good condition, but the next morning it was apparently dead; in the course of the day, however, being placed where it was warm, it gradually came back to activity as before."

The argument from the foregoing is that torpor depends on temperature. This is sustained by Dr. Merriam's observations.

"On the 11th of February, 1874 [he says [29]], I caught an active male at Easthampton, Mass.; and Mr. Elisha Slade writes me that, in the vicinity of his home, at Somerset, Bristol County, Mass., the animal 'retires to holiow trees, stumps, or fissures of rocks, during cold snaps,' and reappears with every return of warm weather. During the winter of 1881-

[29] *Ibid*, p. 300.

1882, unprecedented for its mildness, I several times observed it in Lewis County, in Northern New York."

But the original recorder of the hibernation of *Zapus*, Dr. B. S. Barton, of Philadelphia, makes these somewhat contrasting observations in 1804:[30]

"In the month of August, 1796, one of these little animals was brought to me from the vicinity of this city. It was put into a large glass jar, where I was so fortunate as to preserve it for near four months. Though it made many efforts to escape from its confinement, it seemed, upon the whole, pretty well reconciled to it. It continued active, and both ate and drank abundantly. I fed it upon the bread, the grain of Indian corn (*Zea mays*), and the berries of the *Prinos verticillatus*, sometimes called black-alder.

"On or about the 22d of November it passed into the torpid state. It is curious to observe that, at the time it became torpid, the weather was unusually mild for the season of the year, and moreover the animal was kept in a warm room, in which there was a large fire the greater part of the day and night. I sometimes roused it from its torpid state; at other times it came spontaneously out of it. During the intervals of its waking it both ate and drank. It was frequently most active while the weather was extremely cold in December; but when I placed the jar upon a thick cake of ice, in the open air, its movements or activity seemed wholly directed to the making of a comfortable habitation out of the hay with which I supplied it. It was sufficiently evident, however, that the cold was not the only cause of its torpid state. It was finally killed by the application of too great a degree of heat to it, whilst in its torpor.

"During its torpor it commonly laid with its head between its legs, with the claws or feet of these closely applied to the head. Its respiration could always be perceived, but was very slow.

"The fact of the torpidity of this little animal is known to the gardeners and others near the city. They call it the 'seven sleepers,' and assert that it is frequently found in the earth, at

[30] Trans. Am. Phil. Soc., 1804, Vol. VI, pp. 143–4.

the lower extremity of the horse-radish and other perpendicular roots. Does it use these as a measure of the distance to which it shall go in the earth to avoid the influence of the frost?

"I have said that the *Dipus americanus* becomes torpid in the neighbourhood of this city. But this, I believe, is not always the case. During the winter season, this little animal and another species, which I call *Dipus mellivorus*, take possession of the hives of bees, in which they form for themselves a warm and comfortable habitation, having ingeniously scooped away some wax. The materials of its nest are fine dry grass, down of feathers, and old rags. It lives upon the honey, and seems to grow very fat upon it. I believe two individuals, a male and a female, commonly inhabit one hive. They sometimes devour the greater part of the honey of the hive.

"The circumstance just mentioned is not altogether uninteresting. It plainly proves what I have, long since, asserted, that the torpid state of animals is another 'an accidental circumstance,' and by no means constitutes a specific character. The same species becomes torpid in one country and not in another. Nay, different individuals of the same species become torpid, or continue awake, in the same neighbourhood, and even on the same farm."

We may also infer from these observations that, while torpor is more or less controlled by temperature, the habit of torpidity, like the changing pelage of the White-hare, is so deeply engrained constitutionally that there is a strong tendency to torpify at a given time without regard to the original cause.

We may consider it settled, then, that in southern Canada the Jumping-mouse goes into its winter quarters late in September when the nights become too cool for pleasant rambling. Ordinarily it continues there till springtime, but, like the Chipmunk, it is quite ready to respond at any time to any spell of unusually fine, unseasonable weather, even in the depths of winter, and it is probably for these arousing times, as much as for the springtime famine, that it lays up its abundant stores of food.

## XXVIa.

### Prairie Jumping-mouse.

*Zapus hudsonius campestris* Preble.
(L. *campestris* of the open fields or prairies.)

*Zapus hudsonius campestris* PREBLE, 1899, N. A. Fauna No. 15, p. 20.
TYPE LOCALITY.—Bear Lodge Mts., Wyoming.

This beautiful prairie race is distinguished externally first by its greater size. Preble gives[1] the average of 4 adults from type locality at: Length, $8\frac{3}{4}$ inches (222 mm.); tail, $5\frac{5}{16}$ inches (135 mm.); hind-foot, $1\frac{3}{16}$ inches (30.5 mm.). Occasionally it reaches a length of 9 inches (229 mm.).

Second, by its much more vivid colouration, having the dorsal area much flecked with the colour of the sides; in fall pelage this area is nearly black, while in true *hudsonius* it is not very dark in fall, or flecked with the warm colour of the sides.

#### LIFE-HISTORY.

This race I found fairly common at Carberry and Boggy Creek, near Fort Pelly. Preble records[2] specimens from Portage la Prairie, Red River, and Selkirk Settlement. V. Bailey found it common in weedy places near Pembina.[3] A. S. Barton writes that it is quite common along the foot of Turtle Mountain. No doubt it will be found in scrubby places and woodland edges throughout the prairie region of south-western Manitoba.

Its habits are believed to be the same as those of the foregoing form.

[1] N. A. Fauna, No. 15, 1899, p. 20.
[2] Rep. Orn. U. S. Dep. Agr., 1888, p. 447.
[3] *Ibid.*, p. 21.

## XXVII.

## Canada Porcupine, Gray Porcupine, Quill-pig, or Urson.

*Erethizon dorsatum* (Linnæus).

(Gr. *Erethizon* ppr. of *erethizein*, to excite or irritate; L. *dorsatus*, from *dorsum*, the back, in allusion to its formidable 'backing' or 'back armour.')

*Hystrix dorsata* Linn. 1758, Syst. Nat. X ed. I, p. 57.
*Erethizon dorsatum* F. Cuvier, 1822, Mem. Mus. d'hist. Nat., Paris, IX, p. 432.

Type Locality.—Eastern Canada.

French Canadian, *l'Urson, le Porc-èpic velu.*
Cree, *Kahk.* Richardson gives it *Cawquaw.*
Saut. and Muskego, *Kagh.*
Ojib., *O-ga'.*
Chipewyan, *Thee.*
Yankton Sioux, *Pah-hee.*
Ogallala Sioux, *Pah-hin'.*

The Porcupine Family, or *Erethizontidæ*, is sufficiently characterized in the generic description.

The genus *Erethizon* (F. Cuvier, 1822) comprises thick-set, short-faced, large Rodents. They have the lips all hairy, head and body *covered on back and sides with long, sharp spines;* tail, short, thick, spiny above; short ears; 4 toes on fore-feet, 5 on hind-feet; 4 mammæ, all pectoral. The teeth are:

$$\text{Inc.}\ \frac{1-1}{1-1};\ \text{prem.}\ \frac{1-1}{1-1};\ \text{mol.}\ \frac{3-3}{3-3} = 20$$

To these generic characters the Canada Porcupine adds the following:

size

Length, about 36 inches (914 mm.); tail, 6 inches (153 mm.); hind-foot, 3½ inches (39 mm.).

"Well-conditioned adults average from 15 to 20 pounds in weight.[1]

"Their maximum weight when fat is very great, reaching upward of 35 or 40 pounds."[2]

The general colour is a brownish black, but the tips of the long hairs on the back are more or less white or yellowish-white, especially on the shoulder. The front teeth are deep orange. The quills, white with dark tips. They show chiefly on nape, rump, and tail.

In the museum at St. Johnsbury, Vt., is a pure albino Porcupine.

Two races are recognized:

*dorsatum*, the typical form.
*picinum* Bangs, distinguishable by its much blacker colour.

## Life-history.

RANGE

Map 36 sets forth sufficiently the ranges of the species and races. That of *dorsatum* coincides, in Manitoba, nearly with the Canadian faunal area. I have yet to hear of a specimen taken beyond the indicated limits.

HOME-RANGE

The home-range of the individual is extraordinarily small. Audubon and Bachman cite[3] a case of a Porcupine that confined itself "to a space of about two acres of ground through the winter." Hearne gives another good illustration of its local fixity. He says:[4] "They are so remarkably slow and stupid that our Indians, going with packets from Fort to Fort, often see them in the trees, but, not having occasion for them at that time, leave them till their return; and should their absence be a week or ten days, they are sure to find them within a mile of the place where they had seen them before."

[1] Merriam Mam. Adir., 1884, p. 300.
[2] Rhoads Mam. Penn., 1903, p. 118.
[3] Quad. N. A., 1849, Vol. I, p. 283.
[4] Journ., 1795, p. 382.


**MAP 36—RANGE OF THE NORTH AMERICAN PORCUPINES.**

This map must be considered diagrammatic and provisional.
Founded on records by Messrs. V. Bailey, O. Bangs, E. W. Nelson, J. A. Allen, G. S. Miller, D. G. Elliott, J. D. Figgins, R. MacFarlane, A. P. Low, S. N. Rhoads, E. A. Preble, L. M. Turner, C. H. Merriam, W. H. Osgood, C. H. Townsend, Audubon and Bachman, and John Richardson.

**The species are:**

*Erethizon dorsatum* (Linn.), with its 2 races,

*Erethizon epixanthum* Brandt, with 4 races.

NON-MIGRANT

This unwandering disposition, combined with the unchanging abundance of its food, has resulted in the extermination of all migratory impulse, if it ever had any.

NON-HIBERNANT

It does not need to hibernate, and is another proof of the theory that, given abundance of food, most animals will adapt themselves to any kind of climate.

ENVIRONMENT

Thick hemlock or jackpine woods are the Porcupine's choice. Occasionally it is found in the hardwood, if there be also a sprinkling of conifers and a few elms, basswoods or aspens.

CREPUSCULAR

Though it feeds and travels both by night and day, there can be no doubt that, like most creatures, it prefers the soft light of evening and early morning, taking advantage also of the substitute furnished by moonlight.

NUMBERS

The Adirondack Mountains have more Porcupines than any other region I have lived in, but 1 or 2 a day is all one usually sees. There are, I suspect, few places to-day where they are at all numerous.

"In Labrador [says Bell[5]] the Porcupine is met with as far north as Nain, where it is common. It is met with everywhere in the region between the Great Lakes and Hudson's Bay, but is always scarce. Mr. Isbister, of the Nelson River House on the Churchill, informs me that it was once abundant there. It is rare between Lake Winnipeg and Hudson's Bay, but an individual is occasionally found as far north as York Factory."

W. Case, of Cleveland, Ohio, wrote to Bachman, about 1840,[6] that Porcupines were very abundant in the Western Connecticut Reserve, "one person killed 7 or 8 in the course of an afternoon's hunt for Squirrels within three or four miles of this city."

In certain of the Catskills to-day one may see a dozen Porcupines in a night about the camp. This, however, means

[5] Mam. Hud. Bay., Geol. Surv. Can., 1884, p. 49 DD.
[6] Aud. & Bach., Quad. N. A., 1849, Vol. I, pp. 285–6.

that the population is concentrated there for a mile or two around. Audubon tells[7] of 13 killed during one season in a grove that had about 100 cottonwood trees. This was on the upper Missouri.

NON-SOCIABLE

Entirely unsociable and non-gregarious, the Porcupine is among the most solitary of our quadrupeds. Half-a-dozen are sometimes found gathered at a lumber camp, but these are accidental meetings; they are drawn together, not for each other's company, but for attractive foods not found elsewhere in their woods.

NOISES

The Porcupine *sniffs*, *grunts*, *squeaks*, *whines*, *mews*, *chatters*, sometimes *shrieks*, and even *cries* like a child. It has, indeed, an amazing collection of noises, considering how little it seems to use them for the benefit of its kind.

Bachman wrote[8] concerning a captive specimen at Charleston, S. C., "our efforts to force it from the tree were the only provocatives by which it could be made to growl at us. We occasionally heard it during the night, uttering a shrill note that might be called a low, querulous shriek."

E. P. Bicknell thus describes[9] their numbers and their noises on Slide Mountain (Catskills, N. Y.) in June, 1882:

"From evening till morning dusk our cabin, on the extreme summit of the mountain, was virtually besieged by them, and through the chinks their dark forms could be seen moving about among the shadows in the moonlight, while their sharp cries, and often low conversational chatter, singularly like the voices of infants, were weird interruptions of the midnight silence, or later, of the moaning wind."

NEST

Various authorities attest that the Porcupine's nest may be in a hollow tree or log, a cave, a hole under a rock, or maybe in the ground under the roots of trees. The only one I ever saw was the winter nest of an old male near Ottawa; it was in

[7] *Loc. cit.*, p. 283.
[8] Trans. Linn. Soc. N. Y., 1882, p. 121–122.
[9] *Ibid.*, p. 283.

a deep crevice of a low, rocky ledge. The bed was a poor affair, and outside of it was a great pile of dung, showing that it had been the animal's headquarters for a long time.

MATING

The marriage customs of the Porcupine are practically unknown. Those whose opportunities are such that they should know have filled the unfortunate blanks with some rare and picturesque myths that need not be recorded. I never saw one of this species at the time of copulation, but witnessed the act of the Crested Porcupine, and found it not different from that of other rodents. The female had such control of the posterior quills that they were radiated out of the way; obviously she had complete control of the situation.

Richardson[10] and other northern travellers say that it pairs in September. The evidence is complete that the mating takes place in fall; at least this fits in with other facts of the case, because the young are born about the end of April or first of May, and are of remarkable size, which is guarantee of a long gestation.

Since the above was written I have learnt from Bert A. Dobson, the Adirondack guide (of Wanakena), that he once witnessed the mating of Porcupines, and that it took place late in October. The place of meeting was high up among the branches of a large tree.

All evidence goes to prove that the father takes no interest in his offspring.

YOUNG

The young are generally 1 or 2 in number, sometimes 3 or even 4. According to Merriam,[11] they "are born about the first of May, and are monstrous for the size of the species. They are actually larger, and relatively more than 30 times larger, than the young of the Blackbear at birth.

* * * * * * *

"May 1, 1882, I shot, at Big Moose Lake, a female Porcupine which contained a fœtus that would certainly have been born within three or four days. It weighed 1¼ pounds

[10] F. B. A., 1829, Pt. I, p. 215. [11] Mam. Adir., 1884, p. 305.

avoirdupois (567 grm.), and measured in total length 11¼ inches (285 mm.), the head and body measuring about 7¾ inches (just 195 mm.). It was densely covered with long, black hair, and the quills on its back measured a little over half an inch (13 mm.) in length. The discoid placenta measured 2¼ inches (57 mm.) in diameter."[12]

Concerning the further development of the young, I have no information beyond the fact that, early in August, I found young Porcupines half-grown in the Adirondacks, and already leading independent lives. What time they begin to leave the nest, whether they follow their mother and are cared for by her, and when fully grown, have not yet been recorded.

SPEED

On the ground the Porcupine's best speed is slow, but it is fast compared with its movements in the branches. Here it goes about like a sloth, when it does move, often spending days in a single tree. In the water it floats because of its quills; each one is a little barrel of air to hold it up, and it manages to paddle in the desired direction to considerable distance. A half-grown specimen that I was photographing took to the water to get rid of me, and swam with much splashing and little speed to the other shore, some 50 yards away.

MENTALITY

'*The stupidest thing in the woods*' is the descriptive verdict applied to the Porcupine by all who know it at home. It will waddle into almost any kind of danger, and eat almost any kind of food with utter oblivion of consequences.

At Ingolf, Ont., on September 16, 1904, in the woods near the railway I found a dynamite box and a stick of dynamite, one-third eaten by a Porcupine. There were no 'Porky' remains near, so evidently he had not chewed hard enough.

You may drive the creature out of your camp with fire and sword, but that will not prevent its coming back, if able to crawl, within half an hour, to blunder into the same mischief as brought down vengeance before.

[12] *Ibid.*

E. P. Bicknell says of those in the Catskills:[13] "The seeming nocturnal temerity of these creatures appeared to be simply an exhibition of excessive stupidity. It was found impossible to drive them from the camp for any length of time; they seemed to be destitute of the faculty of memory, and even a light charge of shot sent among them was only for the moment effectual. Even when one particularly stupid individual had been shot dead in the doorway, trying to effect an entrance by gnawing its way through a gap, another, shortly after, continued the operation beside the lifeless body of his companion."

FOOD

In the winter its native food is supposed to be exclusively the bark and twigs of hemlocks, aspen, jackpines, elm, basswood, cottonwood, and other trees; of these its favourite is hemlock. Its method of feeding is thus described by Merriam:[14] "When he has selected and settled himself in a tree to his liking, he may not leave it day or night until he has denuded it of the whole of its foliage. I have seen many hemlocks thus completely stripped, not a green twig remaining, even on the smallest bough. It seems incredible that so large and clumsy an animal should be able to climb out far enough on the branches to reach the terminal leaves; but he distributes his weight by bringing several branches together, and then, with his powerful paws, bends back their ends and passes them through his mouth. When high in the tree tops he is often passed unnoticed, mistaken, if seen at all, for the nest of a crow or hawk."

Audubon and Bachman credit [15] a Porcupine with destroying a hundred trees in a winter, by girdling the bark. There is a tradition in the north-west that the Porcupine never kills a tree if he can help it, carefully avoiding a complete girdling of the bark. In jackpine woods I have seen a great many instances that *looked* like this. But the fact is, the Porcupine climbs up to some comfortable crotch, and then gnaws at all

[13] *Loc. cit.*

[14] Mam. Adir., 1884, p. 302.

[15] Quad. N. A., 1849, Vol. I, p. 283

the bark within easy reach; if there are crotches on both sides, it is likely to girdle the tree, if not, it takes the easiest way, which may mean go half-way around, then move to another fork.

In the summer its food is much more varied; doubtless it eats all manner of foods that are allowable to a strict vegetarian. Its fondness for lily-pads is well known, and is thus referred to by Merriam:[16]

"When feeding on lily-pads along the borders of watercourses they sometimes utter extraordinary noises, and occasionally quarrels arise for the possession of some log which affords them easy access to the coveted plants. At Beaver Lake, in Lewis County, Mr. John Constable once witnessed an encounter during which one of the combatants was tumbled into the water. The animals did not attempt to bite, but growled, and snarled, and pushed."

Herrick, in his "Mammals of Minnesota,"[17] has given us interesting light on this food habit. He relates that while out one July night, canoeing with jacklights, "our attention is attracted by a most peculiar clattering sound—evidently the teeth of some animal in very rapid motion, but more rapid and louder than anything we had ever heard. The source of the sound we are at first unable to make out, but again we start at the sound of heavy feet and crackling branches. Some heavy animal comes down to the water's edge where the banks are covered with a new growth of arrow-head leaf (*Sagittaria*), succulent and green, for it is June, and the receding waters have but lately exposed the roots to the sun. The clatter of teeth is again heard very loud and inexplicable, until we make out the gray form of a burly Porcupine, which at once starts up the bank much as an overfed hog might do. A shot brought the animal to the water's edge, where, after floundering about a little, it began to swim toward us evidently in a vindictive mood. Another shot made it ours, and we found it an immense animal measuring over 3 feet from its blunt muzzle to the end of the spiny tail. The stomach of this

[16] *Loc. cit.*, p. 303.

[17] Mam. Minn., 1892, p. 247.

specimen, a full-grown male, contained nothing but the finely comminuted shoots of *Sagittaria*."

SALT

There is one very marked departure from its vegetarian diet that the Porcupine continually makes, and that is, it eats any sort of salt pork or butter that it can find, doubtless disliking the grease, but forcing it down for the joy of the salt. It is so keen after this delicacy that it will gnaw up every bit of wood that tastes in the least degree briny.

I have many times visited old mining camps in the Rockies and lumber camps up the Ottawa to find that the common fate of every wooden article of furniture in the kitchen, from the meat block to the soup ladle, was to be devoured by Porcupines for the sake of the salt they held. It seems to be this weakness that brings them about the camp, where they are such a nuisance, and this, therefore, more than any other, brings on their death sentence from man. Doubtless it is this craving for salts and grease that makes them gnaw the cast antlers of Deer.

QUILLS

But the central thought in the Porcupine, the wonderful peculiarity, the secret of its life, indeed, is its quill equipment. To specialize and grow quills it has relinquished speed, cunning, and keenness of senses; all the revenues of its body seem to have been converted to the growing of those awful spines, and in the primitive times when first evolved the idea was absolutely justified by results.

The quills are about 1 inch long on the head and 4 inches on the back, they are absent from the muzzle, the under parts and the legs. They are so hidden in the wool and hair that they are hard to see, but are always unpleasantly easy to feel. They are so thickly placed that a Porcupine stripped of its wool and hair, as I have seen it by partial decomposition, is still clad densely with quills; each of these is a keen, many barbed, and poisonous dagger—not arrow, for they are not and cannot in any sense be thrown. There is, however, this to be said—while those on the head and body are defensive, those on the

PLATE XLI.—THE LYNX MAKING A MISTAKE.

tail are offensive, for the latter is thrashed about vigorously at a foe, and the daggers, being loosely attached, are driven into the enemy's flesh to rankle and sink, and defy all efforts to remove them.

Through the courtesy of the Geological Survey at Ottawa I recently had the opportunity to make an enlarged drawing of a representative quill (Fig. 173). The specimen was taken

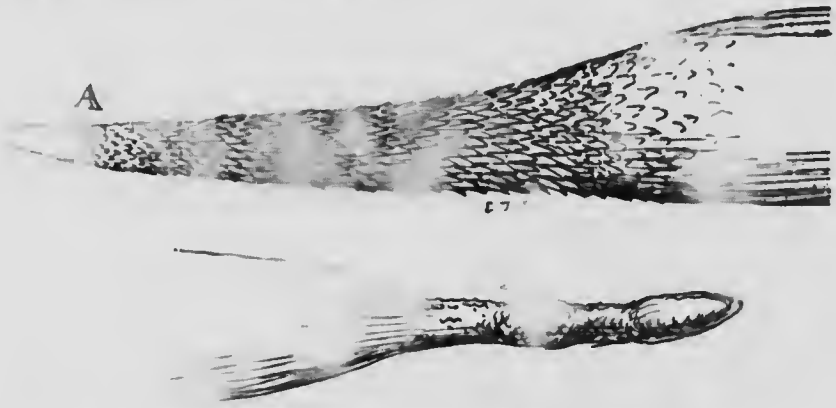



Fig. 173—[illegible] sck of Porcupine; magnified 14 diameters. A, point; B, root or bulb.

from the back of a stuffed Porcupine (*E. dorsatum*). I expected to find those of the tail more highly specialized [illegible] was disappointed. Examples from head, back, and [illegible] ered chiefly in [illegible]

The extreme point is polished and keen; spec[illegible] the barbs [illegible] to show. I reckoned up a round thousand on this specimen. They die away on the shoulder of the quill. When soaked in warm water they stick out much more, so we may believe that they also flare out when in the warm flesh of the victim.

The barrel is smooth and highly polished. The bulb presented no special features.

DEFENCE

How are these daggers used? The creature does not curl up into a many-rayed globe—hedgehog or globe-fish fashion—as some seem to think. I have tried many times to make it do

so, without success. Indeed, if the animal be turned on its back (and it costs the investigator much effort to turn it, as it is sturdy in its legs), it lies exposed and helpless, which would not be the case if it had the habit of making itself into a ball. The old hunters say it never does so except, perhaps, when falling from a height, and then it opens out on striking the ground. After many opportunities to observe, I can state that, on meeting an enemy from which it cannot escape, the Porcupine tucks its head under a root, a log, or other cover, raises its quills, radiating them all ways from the small of the back, and lashes with its tail at the slightest intimation of the foe being near. If it has no cover for its head, but happens to know of one in the direction of the enemy, it backs toward that, lashing its tail to clear the way, and there be few creatures indeed that do not heed the warning.

An adult female which I caught on the Oswagatchie, N. Y., was held with a noose on its hind-foot while being examined. The foolish thing so resented this indignity that it lashed its own outstretched foot full of quills; and it cost us no little trouble to get them out, as we felt in honour bound to do, before we let the fretful one go free.

Bachman has left us this very exact picture of the Porcupine repelling a foe:[18]

"A large, ferocious, and exceedingly troublesome mastiff, belonging to the neighbourhood, had been in the habit of digging a hole under the fence, and entering our garden. Early one morning we saw him making a dash at some object in the corner of the fence, which proved to be our Porcupine, which had during the night made its escape from the cage. The dog seemed regardless of all its threats, and probably supposing it to be an animal not more formidable than a cat, sprang upon it, with open mouth. The Porcupine seemed to swell up in an instant to nearly double its size, and as the dog pounced upon it, it dealt him such a sidewise lateral blow with its tail as caused the mastiff to relinquish his hold in-

[18] Quad. N. A., 1849, Vol. I, p. 281.

stantly, and set up a loud howl in an agony of pain. His mouth, tongue, and nose were full of Porcupine quills. He could not close his jaws, but hurried open-mouthed out of the premises. It proved to him a lesson for life, as nothing could ever afterwards induce him to revisit a place where he had met with such an unneighbourly reception. Although the servants immediately extracted the spines from the mouth of the dog, we observed that his head was terribly swelled for several weeks afterward, and it was two months before he finally recovered."

What dreadful punishment, in spite of immediate and abundant human aid! What would have been the offender's fate had he been a wild animal?—assuredly death. The records of natural history abundantly prove it.

"We have mentioned in our article on the Canada Lynx [say Audubon and Bachman [19]] that one of those animals was taken in the woods in a dying state, owing to its mouth being filled with Porcupine quills. We have heard of many dogs, some Wolves, and at least one Panther, that were found dead, in consequence of inflammation produced by seizing on the Porcupine."

On September 16, 1901, in Rio Blanco County, Colorado, I found a Fox at the point of death from the quills of a Porcupine that he must have attacked some weeks before.

In *Forest and Stream* of March 20, 1884,[20] J. L. Davidson, of Lockport, N. Y., states that he had recently examined a golden eagle that had been shot at Plessis, Jefferson County, N. Y. He says: "The feet of the eagle were full of Porcupine quills, which was probably the last animal he had dined off."

A remarkable case of a horned owl, shot shortly after it had attacked a Porcupine, is detailed[21] by C. E. Eifrig, of Ottawa, Ont. It took place in December, 1907, at a place 50 miles northeast of the city; 66 Porcupine quills were taken out of that misguided owl's body.

[19] Quad. N. A., 1849, Vol. I, p. 285.
[20] P. 144.
[21] Auk, January, 1909, p. 58.

A careful search in the annals of natural history will eventually put on the list of 'killed by Porcupine' every savage flesh-eater in the region where the Quill-pig dwells; even the Bear has paid with his life, for an unjudicious attempt to eat the quill-clad rodent of the pines.

And well it knows its power. At Gal Pond, Adirondacks, August 4, 1908, I saw many fresh signs around—new-cut branches of poplar, and dung—and on glancing about, found a young Porcupine in a poplar, some 10 feet up. My guide took a pole and pushed it off; then we put a noose on its foot and took it out into the sun to get photographic light. Though but a half-grown female, it lashed its tail savagely, and chattered defiance with its teeth. On being put on a log that had fallen into the water, it ran to the far end, and when I followed, *it backed toward me lashing its tail.* Then it took to the water and swam to the farther shore, some 50 yards away.

That same day at West Pond, as we sat quietly on a bank, a large Porcupine came ambling through the woods. He saw us as soon as we saw him, though 30 yards apart, and made for a tree with amazing celerity. Before we could get near he was safe in the upper branches. I was for climbing, but the guide said it was dangerous to go after a 'Porky.' As soon as it knows the hunter is near, it will back down quickly, lashing its tail. In this way a friend of his had had his arm filled with quills and suffered terribly, as the arm swelled up as big as a leg, and the man was laid up for weeks. Having several times previously seen a Porcupine 'face' a man in that way, I did not climb the tree; the "Hedgehog," as the guide miscalled it, was left in peace, and we went on more than ever impressed with the idea that even man must render due respect on approaching the quilly grunter.

ENEMIES

Who then are the enemies that this fearless one should fear? Setting the least first, we must begin with forest-fires. The Deer and the Wolf can run before them or turn aside to purer air, but the slow Porcupine is enveloped in stifling fumes

that extend their path of death for miles down wind, and the higher it climbs the surer its fate. For three years after the 1898 forest fire on the White River Plateau of Colorado no Porcupines were seen.

But the fire is local and transient. The knight of many spears carries a worse foe within its own mail,—most adults seem more or less infected with tapeworms.

Next and chief on the list of natural foes is the Fisher or Pekan. It is the testimony of all northern naturalists that the Fisher can and does habitually prey on the Quill-pig.

As already noted, the Spiny's position of defence is with head thrust under any log or root, or, failing that, between its own fore-legs, its belly hugging the ground, while its tail with lashings much more dreadful than those of lion or bull tail, girds blindly at the foe. But the Pekan, with foxy craft, and arrowy speed, attacks, not with foolish canine jaw, but, with insidious catlike paw inserted underneath, upsets the dull, dazed skinner of the trees, and tears its belly open ere it can regain its unvulnerable pose.

Why the Pekan does not suffer as do others of the red-toothed kind is unknown. It is speared enough, as will be seen in the history of that species, yet seems to live. Once only have I heard of a Fisher that succumbed to the barbs of the vengeful Quill-pig.[22]

Man is the worst and last on the list. The Indians kill the Porcupine for food. The white hunters, who will not eat its rank, flabby meat, kill it because it is a constant danger to the dogs. The lumbermen kill it because it girdles young trees, or comes about his shanty at night to gnaw his wooden tools or rattle its teeth on his iron pans, to the utter abolition of calm repose; thus ruthless sentence of death has been passed on the race with obvious results.

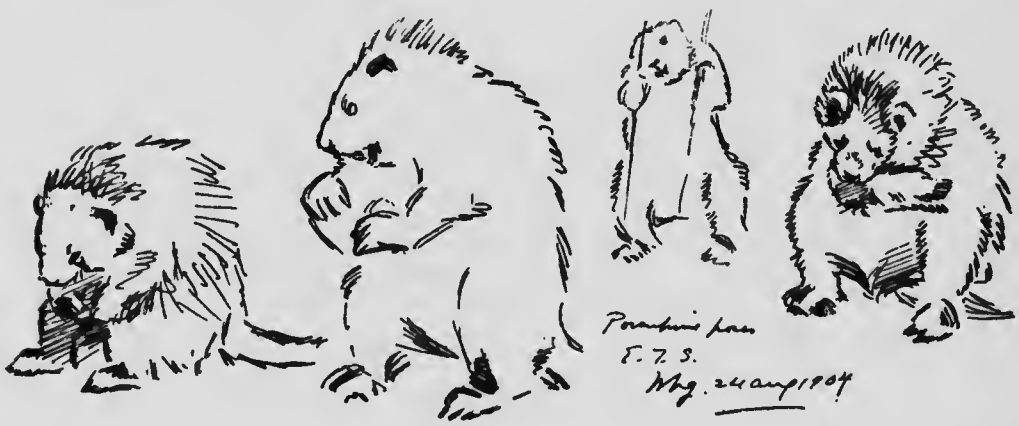
USE TO MAN

Against infrequent fires and winter-famished Fishers the Porcupine still could live, but man was overmuch, the balance turned. Porkey grew scarce in all the lumber-woods.

[22] See Fisher article, Vol. II.

Then a new thought came. Lumber cruisers in the pineries got lost from time to time, and armed only with a blazing axe, they must starve or find a Porcupine. As these animals grew rare the men *did* starve. So a new law exists to-day, the thorny rodent is protected under grievous penalties, and none but the starving may molest it. Furthermore, since its chief enemy is also the enemy of its enemies, and has killed off the Fishers, the Spiny race is prospering again.

This is its use to man to-day. But in days gone by it rendered a more æsthetic service. The quills—always the quills—were sought after by the Indian women for their fancy work, they were ready-made laces with a ready-made needle at one end; dyed with roots, berries, barks, and lichens to a white, brown, black, red, green, and yellow, or left their natural white, they proved excellent material for the gorgeous embroidery of coats, moccasins, robes, and canoes that are famous now as the Redman's art—an art that we believe was far too true to die, and yet will wield its influence in our modern world, even though it was the savage outcome of a savage's idea, expressed in the spines of a stupid beast, stained in dyes of the plants that it fed on.



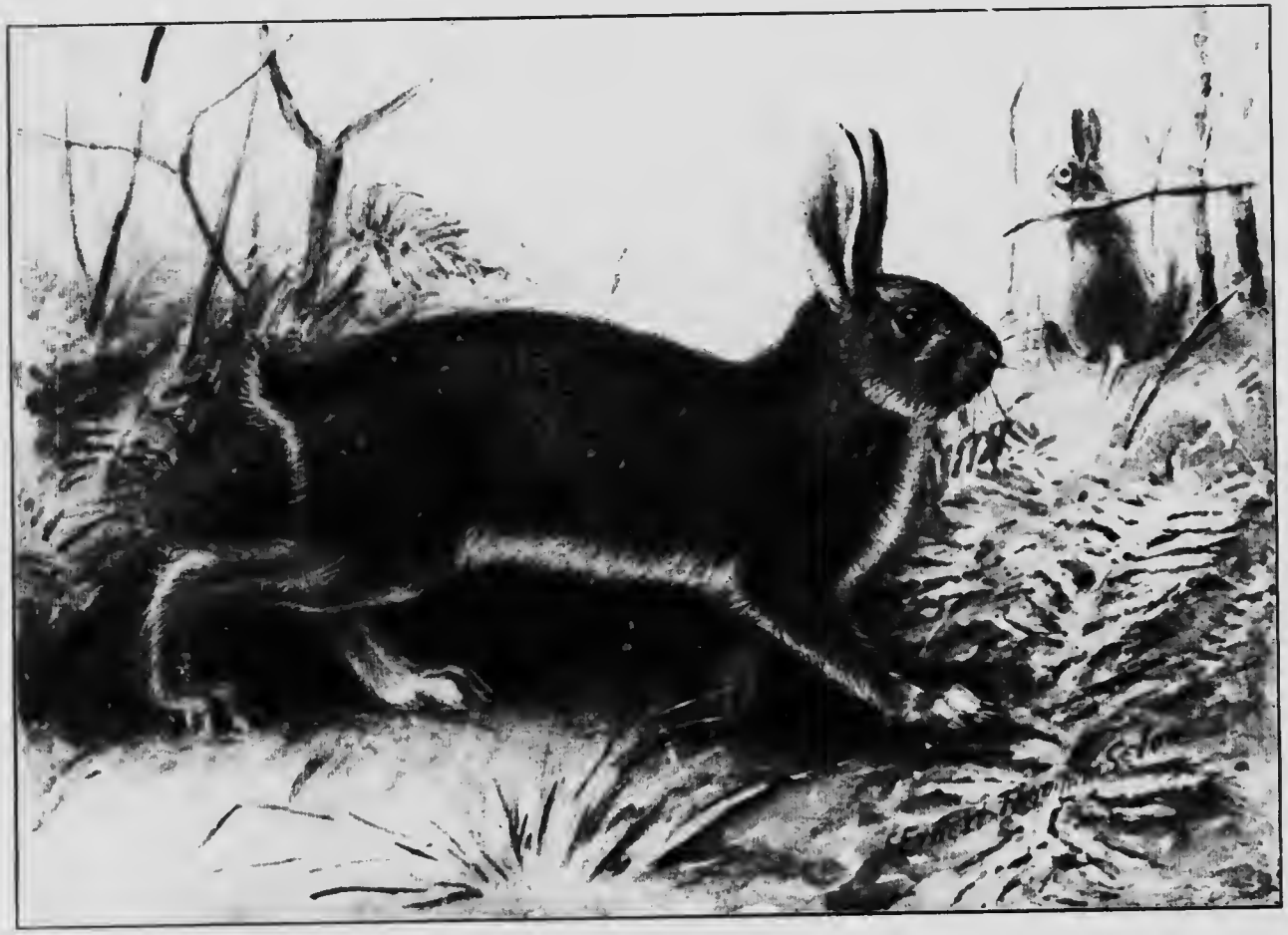


PLATE XLII.—SNOWSHOE-RABBIT IN SUMMER COAT.

(*Lepus americanus* Erxl.)

From specimen taken at Carberry, Manitoba, in June, 1883.

## XXVIII.

## Snowshoe-rabbit, Common Bush-rabbit, White-rabbit, White-hare, Northern or Varying-hare.

*Lepus americanus phæonotus* Allen.

(L. *Lepus*, a hare; *americanus*, because this was the first American hare recog[nized] as distinct; *phæonotus*, from the Greek *phaios*, dusky, and *notos*, back.)

*Lepus americanus* Erxleben, 1777, Syst. Reg. An., I, p. 330.
Type Locality.—Hudson Bay Territory, probably near Fort Severn.

*Lepus americanus phæonotus* Allen, 1899, Bull. Am. Mus. Nat. Hist., XII, p. 11, March 4.
Type Locality.—Hallock, Kittson County, Minn.

French Canadian, *le Lapin.*
Cree, *Wah-poos.'*
Ojibwa and Saut., *Wah-boos.'*
Chipewyan, *Kah.*
Yankton Sioux, *Mah-steen'-cha.*
Ogallala Sioux, *Mah-stin-cha' la.*

The Family *Leporidæ* comprises large, terrestrial rodents which have soft, dense fur, very long ears, long hind-legs, short, bushy tail, and a remarkable duplication of the upper incisors, that is—behind the usual 2 in front of the upper jaw is a rudimentary pair.

The genus *Lepus* (Linn., 1758) agrees with the above and has the following tooth formula:

$$\text{Inc.}\ \frac{2-2}{1-1};\ \text{prem.}\ \frac{3-3}{2-2};\ \text{mol.}\ \frac{3-3}{3-3} = 28$$

Combined with the generic characters, the Snowshoe-rabbit has marked peculiarities of size, etc.

A male taken at Carberry, Man., November 2, 1886, was size 18 inches (457 mm.) from snout to end of tail-bone; the head

and body were 16½ inches (419 mm.); the tail-bones, 1¼ inches (31 mm.).

The hind-foot is about 5½ inches (140 mm.).

Two small males were each 2 pounds 4 ounces in weight.

A medium-sized female shot at Carberry, Man., November 2, 1886, was 17⅝ inches (447 mm.) in total length from snout to tip of tail-bone; the head and body were 16 inches long (406 mm.); the tail-bones 1⅜ inches (36 mm.).

The average weight of 7 females, taken at Carberry in autumn, was 3 pounds 1½ ounces; the heaviest was 3 pounds 8 ounces; the above female weighed exactly 3 pounds.

COLOUR

*In summer* the typical Varying-hare about Hudson Bay is of a reddish-brown above, more or less peppered with black tips to the hairs, especially on the back; becoming clear pale sienna on the legs, and pure white below generally, as shown in Plate XLII; the upper part of the tail is very dark gray, almost black; the under part white; the ears are tipped with black behind and bordered with white in front.

*In winter* it is pure white with tinges of brown below the surface, and with the black ear-tips unchanged.

Dr. J. A. Allen has described the Minnesota Bush-rabbit as a variety of *Lepus americanus*, giving it the sub-specific name *phæonotus*.

It is distinguished by its paler and buffier colour. A careful comparison of my specimens from Lake of the Woods, Ingolf, and Carberry show that the Manitoba form, except in Turtle Mountain, is the same as that from Minnesota.

The following races then are recognized:

*americanus* Erxl., the typical form.
*phæonotus* Allen, paler and buffier than type, darker than *columbiensis*.
*bisbopi* Allen, duller than *americanus*, with short, broad skull.
*virginianus* Harlan, largest and most richly coloured, a rusty brown form.
*struthopus* Bangs, size of *americanus;* ears, longer; colour like *virginianus*, but duller and browner.

*macfarlani* Merriam, larger than type, with longer ears; a dusky gray form, darkest of all; black on top of tail, and nearly black on rump; feet white.
*dalli* Merriam, like *macfarlani*, but paler and more buffy.
*columbiensis* Rhoads, small, dull buffy gray; top of feet brown.
*bairdi* Hayden, like *americanus*, but more dusky reddish-brown; feet usually white.
*cascadensis* Nelson, much like *bairdi*, but darker and more dusky reddish-cinnamon brown, with rump more blackish.
*washingtoni* Baird, a small dark reddish form, with little or no white; it does not turn white in winter.
*klamathensis* Merriam, much like *washingtoni*, but paler.

(These remarks refer, of course, to summer coat.)

The first 8 forms may constitute one species.

The next 2 (*bairdi* and *cascadensis*) may be another.

The last 2 may also become established as a distinct species, remarkable for *not turning white* in winter.

'Snowshoe,' from its equipment, is its very descriptive popular name. Its older name, 'Varying Hare,' records the fact that it varies its colour with the season. The seasons in all its proper country are of two ground colours, brown for six months, white for six; from this the Northern Hare takes its cue. All summer long, from mid-April till mid-October, it is a little brown Rabbit. Then comes the snowy cold, the brown coat is quickly shed, a new white coat appears, the snowshoes grow fuller, and the little brown Hare has become the Snowshoe Hare of the Woods.

Most naturalists have assumed that the fur of the animal actually changes in colour. This is not the case. Dr. J. A. Allen, after an exhaustive study of the subject, has demonstrated[1] that the variation is due not to a change of colour, but to a moult; the brown coat being succeeded by a new coat of white each autumn; this in turn being shed in spring to be

[1] Bull. Am. Mus. Nat. Hist., Vol. VI, Art. IV, pp. 107-128, May 7, 1894.

replaced by the brown or summer coat; the changes are regular as the moults of other fur-bearers, and are not influenced by the weather. The order of change in autumn is feet, ears, sides of nose, front of head, rump, flanks, crown, and last, the back. The order is reversed in spring when the creature turns brown.

The more vigorous individuals are first to change, those that are very young or sickly being a week or two later, and sometimes do not turn completely white.

Dr. Allen makes also the following interesting remarks:[1]

"Whether or not the soft under-fur is also shed in autumn cannot readily be determined, but from its increased length and abundance in winter, as compared with summer and early autumn, it is evident that if not wholly renewed it at least is greatly augmented.

In the case of the spring moult, there is little doubt that the whole pelage is renewed, the under-fur quite as completely as the overhair.

In the case of wounds from fighting or other cause, resulting in the violent removal of large bunches of fur, it is interesting to note that in the autumn the new hair comes out white, often weeks in advance of the general change, and that in spring, under similar circumstances, the hair comes out brown, like the summer coat, much in advance of the general change to summer pelage."

Numerous melanisms, that is black freaks, of this Hare, are on record; I have seen 3—1 in Montreal, 2 in New Hampshire. The reverse, a white freak or albinism, is less common. One that I saw in Hine's shop at Winnipeg was shot near the city in the autumn of 1886. It was everywhere pale buff, and its eyes, as usual in these specimens, were bright pink.

### Life-history.

RANGE

The map (No. 37) shows that all Manitoba falls within the range of the White-rabbit; it is absent only from the prairie sections that are totally without cover.

[1] *Ibid.*, pp. 120-1.

PLATE XLIII. —SNOWSHOE-RABBITS.

Photographed in Wyndygoul Park, to show the autumnal change of color beginning on the feet, legs and ears.


**MAP 37—RANGE OF THE SNOWSHOE-RABBIT AND ITS RACES.**

*Lepus americanus* Erxleben.

This map is founded chiefly on E. W. Nelson's map in "Rabbits of North America," Fauna 29, U. S. Dep. Agr., 1909, with additional records by John Fannin, J. P. Howley, E. A. Preble, R. Bell and E. T. Seton; *struthopus* has recently been introduced in Newfoundland.

LIFE

The Snowshoe-rabbit, the Wabasso of Hiawatha, is a wonderful creature, the product of a snowdrift crossed with a little Brown Hare. The terror of the northern woods is—not cold, there are many ways of meeting that—but deep snow. Snow is the fearful menace, snow that covers up the food sup-

FIG. 174—Feet of Hares, half life-size. The three at left illustrate the snowshoes of the *Lepus americanus;* the two at the right the feet of Kansas Jack-rabbit (*Lepus melanotis*), which weighs twice as much.

plies, that robs the swiftest of its speed, and leaves it to the mercy of the foes that are winged or otherwise equipped to follow fast and lay it low.

Nature has tried many means of saving her own from the snow-death, one is—sleeping till it is over; this is the way of the Woodchuck. Another is storing up food and hiding; this is the manner of the Wood-mouse. Yet another is stilts; the plan that the Moose has adopted. The last is snowshoes. This is the simplest, most scientific, and best—and the plan of the Snowshoe-hare.

The Moose is like the wading bird of the shore, that has stilts and can wade well for a space, yet soon reaches the limit, where it is no better off than a land bird. But the Snowshoe is like the swimmer, it skims over the surface where it will, not caring if there be 1 or 1000 feet of the element below it. In this lies Wabasso's strength.

Here are the feet of a Snowshoe-hare (Fig. 174) that weighed but 3 pounds, and here also the corresponding feet of its cousin the Kansas Jack-rabbit that weighs 6 pounds. The latter is at the mercy of the hunter in deep, soft snow—the other skims over it so lightly that none can follow far; it scoffs at all pursuit, even as its thick, soft fur enables it to mock at the raving storm.

ENVIRONMENT

It is essentially an animal of thick cover, the thicker the better, provided there are some open spaces where it can enjoy a sun-bath. Tamarac and cedar swamps, if not actually wet, are much to its taste. Open forests with nothing but big timber make no appeal to it; but dry copses, varied with open glades, and willow thickets so dense that the Fox, the Lynx, and the Wolf have no chance in open chase, are the ideal homes of the Snowshoe-hare.

HOME-RANGE

Each individual has of course its own little territory in which its life is spent. How large then is the home-ground of this free-footed ranger? Marvellously small. It varies in size somewhat with the kind of country, but in very thick, brushy woods, I should think it is certainly not more than 20 or 30 acres; in more open woods, perhaps twice as much. Some individuals, I believe, will even pass their lives within a radius of 200 yards, never venturing outside of this, unless hard pressed by pursuit. The circle that a White-hare makes when a hound is on its trail is usually around its home-range, and thus it shows the hunter exactly where it dwells.

On my own land I had a White-hare, brought from New Hampshire, that spent all summer within a radius of 100 yards, although free of 100 acres of thick woods. It was easily distinguished by its having but one eye. I could count with certainty on finding it on any morning, in one of three 'forms' or beds under the brush; in the evening it was usually feeding in the open, not far off. I never saw it in other parts of the woods, and all attempts to drive it elsewhere were

futile; it merely circled about its own corner. The fact that it was maimed may have limited its range, but I think, nevertheless, that it showed the usual habit of its kind.

Another Snowshoe, on my grounds, passed all its life within 60 or 70 yards of a certain rocky knoll. Its tracks in the winter were found only near this, and in the summer it was never seen far away. As it was the only White-hare in my woods, at the time, the observations are reliable. When chased it merely dodged about this knoll.

In five or six cases I had Cottontails and White-hares in a wire enclosure of about an acre. They were kept in for a month, then two large gates in their prison wall were thrown open, but they continued to haunt the same place as though still fenced in; and, if they chanced to run out of one gate, would go butting their heads against the wire fence in their efforts to get back to their little home-ground. All of this goes to prove that the individual range of the White-hare, like that of the Cottontail, is very small; probably still smaller in summer than in winter.

SOCIABILITY

This creature is sociable only in slight degree. Hares come together when their numbers are such that they cannot help it, and, on the whole, are not benefited by such close association. The only advantages they reap are that the pathways are kept well-worn and open, and they notify each other of danger by stamping, by running, or, in extreme cases, by squealing. As a matter of fact, these Hares intercommunicate little but trouble and disease.

My friend, Charles G. D. Roberts, informs me that in New Brunswick he has frequently seen half-a-dozen Hares gathered on moonlit winter nights. They come together as by appointment and have a sort of game chasing each other in some open space and through the adjoining woods.

Among many human races there exists a prejudice against moonlight. It is interesting to note that the animals do not share this feeling; indeed, there are many species that make the moonlight nights their chosen time for sallying forth.

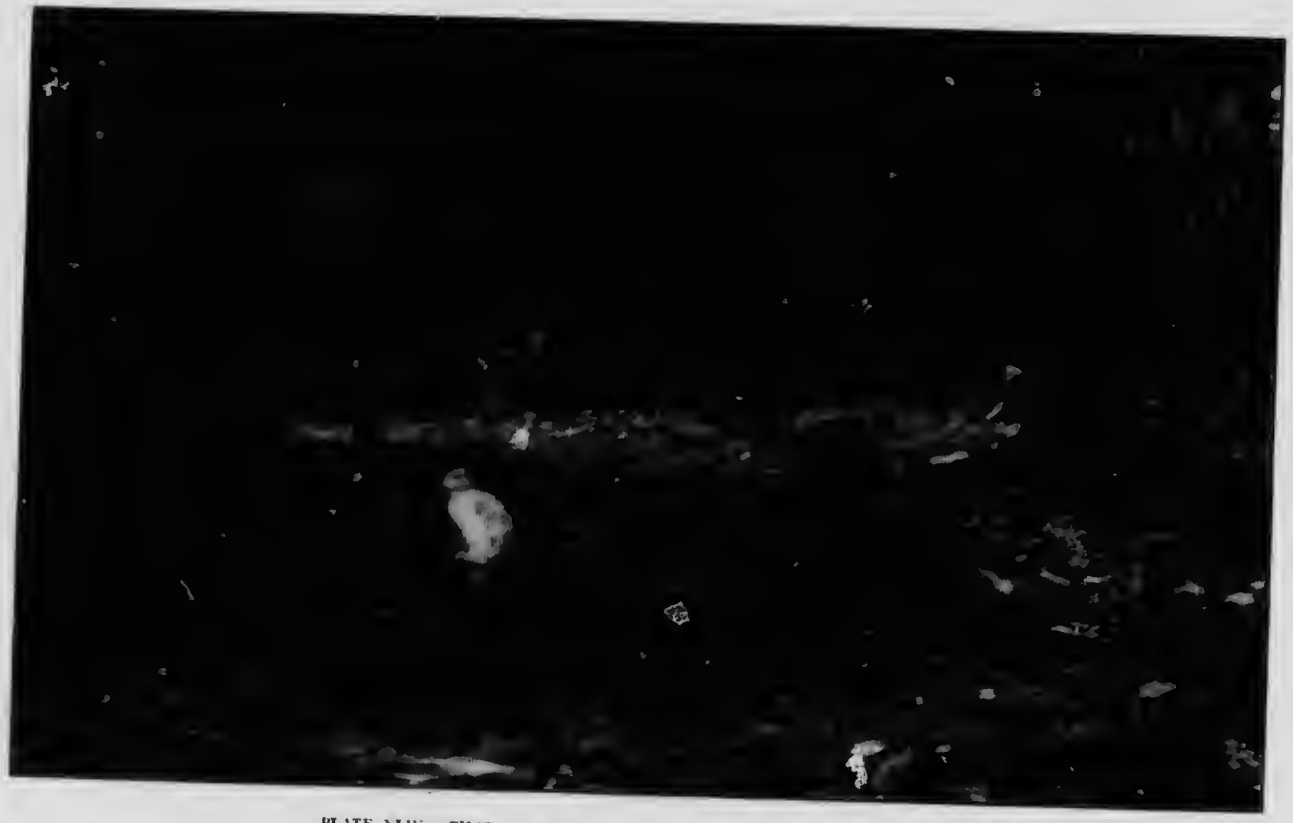


PLATE XLIV.—PHOTOGRAPH OF SNOWSHOE-RABBIT (FROM NEW HAMPSHIRE).
In Wyndygoul Park, to show complete assumption of white coat before there was any snow.

On June 25, 1884, near Minnedosa, I saw two Hares chasing each other among the willow thickets. On being 'collected' both proved to be males. The energy with which they were engaged, however, was suggestive of battle rather than play.

While camped in the Bitter-root Mountains of Idaho, September 7, 1902, I saw something that looked like a social gathering among the Snowshoes.

I had captured a half-grown one and at night put it under a box. It soon made the forest ring with a loud tattoo beaten on the box with its front feet. Shortly afterwards a full-grown Snowshoe-rabbit darted across the open camp space and into the dark forest again. Another and another appeared, and we heard the alarm thump in the woods around. Armed with an acetylene lantern and a camera, my companion (W. E. Bemis) and myself went forth to investigate. As we set the lantern on the ground, a Rabbit rushed into the light, gazed at it and disappeared. Another came, gazed, gave an alarm thump and vanished. Then two came, then others, then more, a dozen Snowshoe-rabbits at length, were gazing into that marvellous light. One gave the alarm and all dashed off. But they came back, and yet closer, and began to caper about in the bright place and chase each other in play, leaping past the lantern which I held on the ground, and over the camera which my friend was holding.

At length one of them jumped on the camera between my friend's hands, and was caught. It shrieked with terror. In a twinkling every Rabbit had disappeared, and though we were two weeks longer in that second camp, we did not see another of this species.

A second illustration of the fascinating power of a lantern I find in my Journal for September 16, 1904. I was then at Ingolf, Ont., and during a stay of twenty-four hours, myself and two companions saw over 20 live Rabbits in the woods and found 6 dead on the railway track. These, the station agent said, had been killed by the trains. At night they get on the tracks, and are so bewildered by the headlight that they

run before the engine until overtaken. Apparently it does not occur to them to plunge out of the brightly-lighted dangerous space into darkness and safety at one side. The figures above show that a considerable proportion may be thus destroyed.

VOICE

I have often heard the White-hare give a loud squeal when in extreme fear, but I think, *not* when in great pain. This squealing is uttered also by the Cottontail, the English Rabbit and the English Hare. The female of the last-named is said to have a soft plaintive call for the young. The Jack-rabbit of Kansas, I know, makes a snarling sound, when fighting with its own kind. Probably these cries are also uttered by the Snowshoe.

MATING

In Manitoba the mating season is about the first of March. What their marriage customs are has not yet been ascertained. While many observers consider the Hares promiscuous, or polygamous, there is some testimony that tends to clear the species from such charges.

A good father generally means a good husband, and it is strong evidence in favour of their true monogamy when we find the male animal fighting in defence of the young; and of mating, as distinguished from promiscuity, when the male fights in defence of the female; and it is a further disproof of polygamy when two males live peaceably together in the presence of females during the mating season. All of this we can find in Bachman's description of some White-hares that he kept and bred in captivity. "The old males at this period," he says,[3] in describing their family life, "seemed to be animated with renewed courage; they had previously suffered themselves to be chased and worried by the common English Rabbit, even retreated from the attacks of the Gray-rabbit; but they now stood their ground, and engaged in fierce combats with the other prisoners confined with them, and generally came off victorious. They stamped with their feet, used their teeth and claws to a fearful purpose, and in the fight, tore off

[3] Q. N. A., Vol. I, pp. 98 and 99.

patches of skin, and mutilated the ears of their former persecutors, till they were left in undisturbed possession of the premises.

GESTATION

The period of gestation is probably 30 days, as is the case with the European Hare, but I have no direct evidence. On April 10, 1882, I shot a female White-hare at Carberry (that is where Carberry came afterward), which contained 2 very small embryonic young. They were probably of two weeks development, and due to be born late in April. Litters are produced all through May and even as late as the first week of June.

NESTING

The nest of the Hare is usually made in a sheltered place on the ground, under some brushwood or tangle of dead and living herbage, and is admirably concealed. It is not unlike that of a duck, being made externally of straw, grass and leaves, and lined with down, which the mother plucks from her own breast. Enough of the down is provided to make a coverlet as well, and, on leaving them, she pulls this over the little ones, so that they are both warm and concealed from view.

Percy H. Selwyn, of Ottawa, tells me that in Brandon Hills, Man., he once found a Snowshoe nesting in a hollow poplar stump. This was June, 1887.

YOUNG

The young are usually 2, sometimes 3, in number. Cases are on record of 4 and 6. C. W. Nash tells me that he once found 7 embryos in a female of this species. R. MacFarlane contributes an item of exceptional interest. "A litter," he says,[4] "usually consists of 3 or 4; but when on the periodic increase, females are known to have as many as 6, 8, and even 10 at a time, and then gradually return to 3 or 4."

According to all testimony, the young are born with eyes open and are covered with very fine close hair.

The males of those that were bred in captivity by Bachman[5] "did not evince the vicious propensity to destroy their

[4] Mam. of Nor. West Terr., 1905, p. 740.
[5] Aud. & Bach., Quad. N. A., 1849, Vol. I, p. 99

young, which is observed in the domesticated English Rabbit; on the contrary, they would frequently sit beside their little family, when they were but a day or two old, seemingly to enjoy their playfulness and to watch their progress to maturity."

"These young ones left their nest in ten or twelve days, and from that time seemed to provide for themselves and to derive little sustenance or protection from their mothers."[6]

My impression is that when the young are between two or three weeks old they leave the home nest and never return to it. Then and there the family is scattered. They are now independent of the mother's care and are seldom seen near her. I never expected to hear of a mother Hare followed by her brood, so was much interested in an exceptional case observed by D. R. Hanford, of Duluth, Minn. His record contains more than one surprise:

"Two years ago this June [he says], while trout-fishing on French River, a stream about twelve miles from here, I saw a mother Hare coming down the trail, followed by 4 young ones, about half or two-thirds grown. Upon killing the mother, we found 2 young ones, fully developed, and about ready for birth." (Letter of April 24, 1907.)

On June 21, 1883, I was seeking for bird's nests in the Carberry Spruce forest (Manitoba). A White-throated Sparrow was chirping plaintively near, and I was peering into every likely place for the nest, when under a brush pile I saw a young Hare crouching as still as a moss bump. I cautiously reached down through the branches and caught it, whereupon it squealed vigorously, and an old Hare, doubtless the mother, came running through the woods. She rushed about in distress, keeping at a distance of fifteen or twenty yards, but seemed half-disposed to attack me. The little one ceased squealing when put in my pocket, and then the mother disappeared.

The place where it had been sitting was a mass of twigs, but I think not the nest; no sign of fur or lining was to be seen

[6] *Ibid.*, p. 98.

there, nor were any brothers visible; besides, it was now a quarter grown, evidently old enough to run with its mother. Judging its development by that of the domestic Rabbit, it was about three weeks old, and therefore born about June 1.

On September 7, 1902, in the Bitter-roots of Idaho, I caught another half-grown Rabbit in the same way, but saw no parent.

The mother Snowshoe has never been recorded actually fighting for her young, but most of the family are known to do so, and as a hint of what to expect on fuller observation, I add some paragraphs by J. E. Harting on the common Wild-rabbit (*L. cuniculus*) of England:

"In October, 1891, a game-keeper in the service of Mr. Deacon of Southborough, Tunbridge Wells, on going through a wood saw a Stoat which had caught a young Rabbit, playing with it as a cat does with a Mouse, letting it go and then catching it again. Before the keeper could interfere, he saw a full-grown Rabbit, probably the doe, rush out of some underwood close by, knock over the Stoat, and carry off the young one in its mouth. The Stoat, on recovering itself, followed through the underwood, but presently reappeared in retreat pursued by a couple of Rabbits."[1]

As further evidence, I may say that I have been attacked several times and bitten as well as scratched by an old doe Belgian hare, whose young I was trying to pull out of their underground nest.

The young of the Snowshoe are usually full grown by autumn, but do not breed till the following spring.

They are mature at a year old, and are believed to live for eight or nine years, unless, as more often happens, the Remorseless One removes them as soon as their powers begin to wane.

HABITS

As a rule the Varying-hare sits quietly in its form all day; toward sunset it often moves to some high place where it can sit in the light of the red orb as though to enjoy the scene.

[1] The Rabbit, p. 20

Soon afterwards it stretches its legs and hops away to seek its favourite feeding-grounds, remaining more or less active until dawn. It may run about the woods in early evening, but it is very careful, when making a foray on the farmers' pea-fields or gardens, to do it only under cover of darkness.

MENTALITY

"As much wit as a Rabbit" is an old expression of contempt among Red folk as well as White. The rodents are not high in the order of intelligence, and the White-hare is

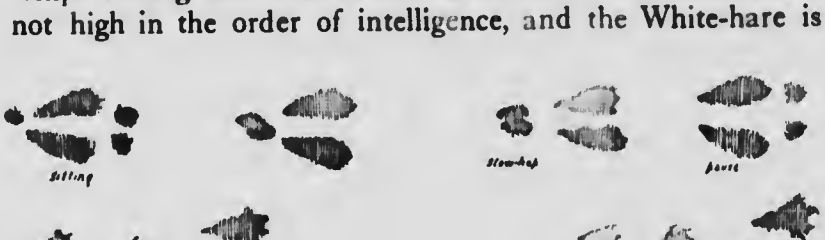


FIG. 175—Tracks of the Snowshoe-rabbit.

low among rodents. Its keen senses, its wonderful speed, the willow thickets, and finally its snowshoes, are the reasons it is left alive to-day among countless enemies, for it is not equipped in any degree for self-defense. Its speed and fecundity are indeed its holds on existence.

CLEANLINESS

The Snowshoe-rabbit dresses its coat much after the manner of the cat, and is in some respect a model of cleanliness. But it does not hesitate to void its dung in the nest. This violation of the sanctity of the home is a mortal sin, one for which nature makes it pay dear in the end. This may be the very breach by which the dreaded epidemics are enabled to enter in and work such havoc on the race.

TRACKS

Fig. 175 sets forth the tracks very fully, except that it does not show the 8 and 10-foot bounds that the Hare can make, or suggest the wonderful lightness of its tread on the lightest of snow.

WINTER HABITS

The life of the White-hare is in the same places and continues much the same in winter as in summer. The principal changes are those of coat and of diet.

NON-MIGRATORY

So far, I have not seen any sign of migration in the species. The individuals that I had in my park kept the same part of the woods in winter as in summer, and the three or four 'forms' that were their homes when the snow was on the ground, were still their homes in the height of the warmest weather.

TORPIDITY

I suspect, however, that it has a habit of occasional torpidity. It is well known that the English Hare and the common Cottontail will lie up, under stress of bad weather, letting the snow drift over them. There they continue several days without eating, and in a semi-torpid state, until aroused by some outside change for the better. I never saw a White-hare doing this, but from the fact that no tracks are seen for a day or two after a very cold spell, I can readily believe that they share the family habit. In the case of the White-hare on the knoll, referred to in the paragraph on home-range, his tracks were not seen for two or three days after each heavy snow-storm, and in the spring we found a lair in a rocky crevice where, no doubt, he whiled away the worst of the weather.

FOOD

Of all our rodents the Hares are least given to flesh-eating. Yet we know the domestic Rabbit will sometimes eat its own young, and I should not be surprised to find the White-hare at some time showing the morbid taste for meat that it is not supposed to indulge.

Its summer food is grass, clover, and a great many herbaceous things that its nose or its instinct enable it to select without danger of poisoning. Its winter diet is dead grass, buds, and the bark of poplar, willow, dwarf birch trees, and occasionally tamarac. In some localities it eats a great deal of white cedar and spruce leaves, so that its taste becomes unpleasantly strong of resin, and on that account is judged unfit for human food.

I find a curious note in my Journal which may be a food item: August 28, 1904. While examining Snake Island in Lake Winnipegosis to-day, I was struck by the quantities of Rabbit dung lodged in every cranny of the rocks that characterize the north side of the island. Each sheltered nook was thickly pebbled over with the pellets. In some places a bushel might have been collected within a radius of ten feet. It was probably left there in winter, as it had the fibrous, woody quality of winter dung. It was far above high water mark and it could not have drifted here. I suppose that the sheltering rocks caused the Rabbits to seek these places. A remarkable feature of the dung piles was a large mixture of crayfish remains. There were hundreds of claws and leg pieces scattered through them. I cannot account for their presence there. Possibly it was accidental.

DRINK

The young Snowshoe will, as I have seen, drink milk in quantities, but, so far as known, the adult never drinks anything.

SPEED

The Snowshoe's safety is chiefly in its speed. It can clear 8 or 10 feet at a bound and make 4 bounds to a second, that is at the rate of over 26 miles an hour. It has further the two advantages of a light creature, it can get up full speed at once and dodge with marvellous adroitness; and, above all, its faithful snowshoes are there to turn the dreadful snow-drifts into staunch allies.

Like the Jack-rabbit, the White-hare will sometimes make an observation hop, or high leap, as it runs, to take in the situation, but it does not do it so often or so well as its prairie cousin; obviously the act is of less service to the woodland species.

SWIMMING

Few persons know that this dry land, fluffy thing can swim. It does not love the water, nevertheless it does not hesitate to take the plunge when it needs must, and swims well for considerable distances. The following instance I recorded at Carberry, Man., in November, 1886:

The frost came suddenly and with great severity this year. The weather had been bright and warm all through the autumn, but a strong north wind, with flying snow, set in on the evening of the 21st. In the morning the lakes were frozen over for the first time. The ice on them was not clear, but largely composed of floating snow, and there was a thin coat of snow on all the land.

As I crossed a small pond near the south side of Chaska Water I came across a curious and tragic record—a common Snowshoe-rabbit frozen in, near the north margin of the pond. The marks in the opaque ice showed how it had leaped into the water from the south side, apparently to escape a Fox, had plunged through the weeds, and swum across the open part. But the course grew crooked, showing that its strength was going, and at the north end, near the bank, I found its body hard frozen in the new ice.

Its head and back were out of water and dry, its eyes wide open, its legs spread as though striking out. The entire course it left in the ice was about 50 feet. Thus was the tragedy written out with fullest details in the new ice and snow of the earliest storm.

Dr. Merriam records[1] several cases of Hares afloat, thus: "Rabbits are not commonly supposed to swim, but Mr. William Brewster has kindly written me of a case that fell under his personal observation. He says, 'While at Lake Umbagog, Maine, in the summer of 1873, I saw something which may interest you. I was paddling up Cambridge River one warm July morning, when, upon rounding a bend, my attention was attracted by a slight splashing sound ahead, and, looking closely, I discovered a Rabbit (*Lepus americanus*), evidently about to attempt the passage of the stream which at that place was, perhaps, 100 feet wide, and at least 8 or 10 feet deep. He entered the water deliberately, but without apparent fear or hesitation, and was soon beyond his depth and striking out boldly for the opposite shore. A more ridiculous (albeit suc-

[1] Mam. Ad., 1884, pp. 309–311.

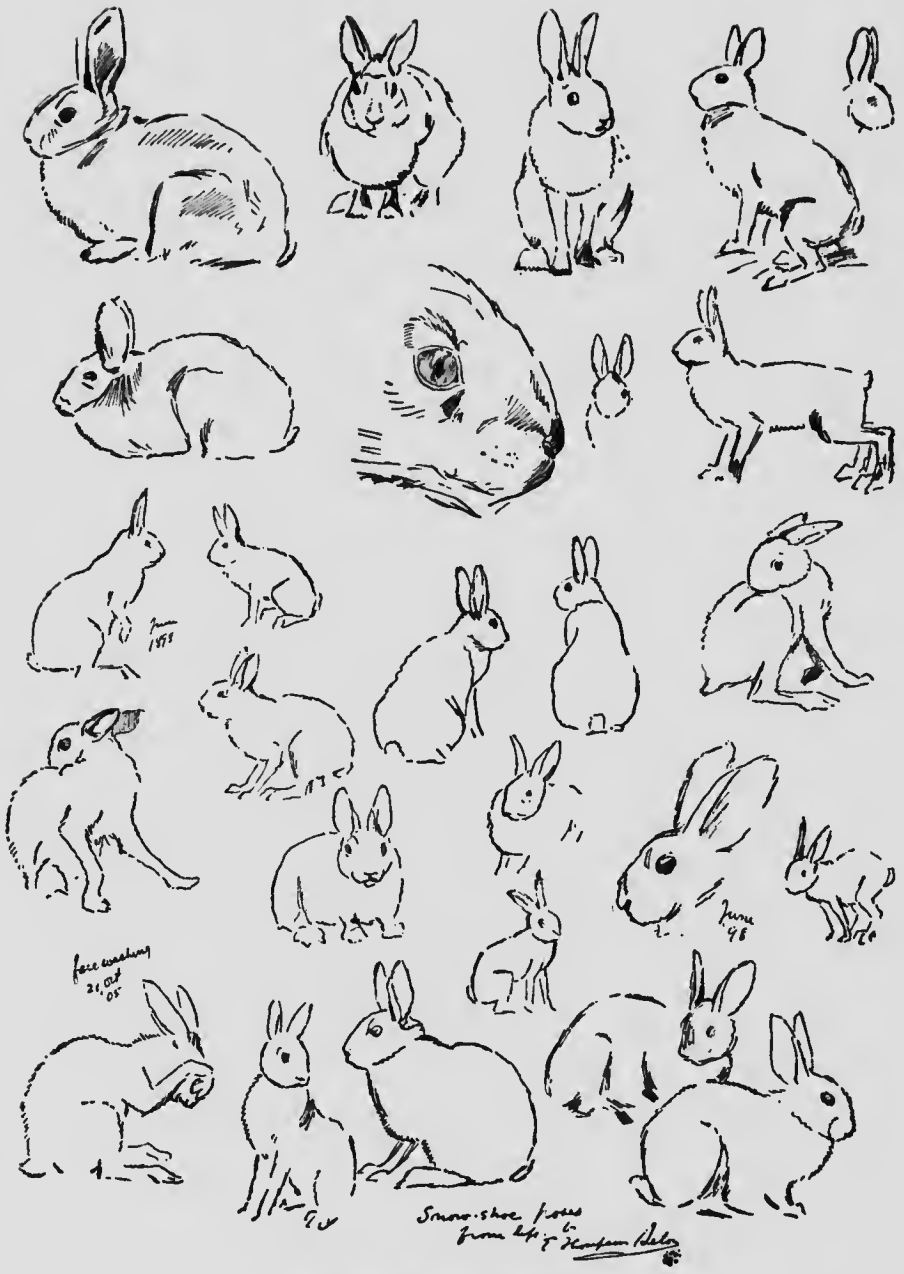



FIG. 176—Snowshoe-rabbit—poses from life.

cessful) attempt at swimming can scarcely be imagined. He literally *hopped* through the water, using only his hind-legs, and kicking with such vigour that the whole forward part of his body was raised above the surface at each stroke. Between the strokes he would sink back until sometimes only the tip of his nose was exposed. I fancy that an immense bull-frog, weighted after the manner of Mark Twain's 'Dan'l Webster,' would cut a somewhat similar figure.

'This method of progression was naturally fatiguing, and before the animal reached the opposite bank the strokes became feebler and the intervals between them longer, until I began to fear that the tired creature would be drowned. At length, however, he struck bottom, and, loping across a stretch of bare mud, disappeared in the woods. *Such* an appearance as he presented on emerging from the water—the lankness of his form revealed by the clinging and bedraggled fur, the ears drooping, and the whole expression one of dejection and shame.

'None of the guides or trappers of my acquaintance have ever seen a Rabbit swim, although I have been told of an instance where one was observed to take to the shallow water on the margin of a pond and run through it for several hundred yards before leaping again into the woods. The purpose of this manœuvre was apparent a moment later when a Sable appeared on the Rabbit's track, and, following it to the water's edge, lost it there.

'On the occasion just described, however, no pursuer appeared, nor do I think that *this* Rabbit entered the water under compulsion, or for the purpose of obliterating the scent of his tracks. On the contrary, the action was undertaken so deliberately, that I believe the animal to have been impelled by some idle whim, merely—such as a desire to try fresh pasturage, or, perhaps, to see what the world was like on the other side of the stream. However this may be, the case is doubtless exceptional, for *Lepus americanus* ordinarily has as great an aversion to the water as any house cat.'"

"Nelson Harris, a well-known Adirondack hunter, tells me that while still-hunting in Northern Michigan, a few winters

ago, he saw a White-rabbit, that had stumbled into camp and was 'cornered,' plunge fearlessly into a swiftly flowing river and swim to the other side."

POPULATION

The Hare population of a given area in the northwest is more variable than that of any other large animal, as the species more than most others goes in cycles of multiplication. In some large districts it increases, for a period of years, reaching enormous numbers; just why is not known, but it is generally believed, as already recorded, that a wave of fecundity sweeps over the race.

But invariably the year of greatest numbers is followed by a year of plague, which sweeps them away, leaving few or no Rabbits in the land. I should say then that Hares were very scarce when there was but 1 to the square mile of woods, and abundant when there was 1,000. I have, nevertheless, seen as many as 10,000 to the square mile.

These periods of increase have been remarked on by every observer in the north-west.

I find the following Rabbit years are on record:

Lake of the Woods region, 1856, followed by plague in 1857. (Professor H. Y. Hind.[9])

Upper Assiniboine, 1857.[10] (Professor H. Y. Hind.)

Savanne Portage, about 70 miles west of Fort William, 1858–9. (Professor H. Y. Hind.[11])

Northern British Columbia, 1872.[12] (Professor John Macoun.)

Portage la Loche, 1875.[13] (Professor John Macoun.)

George Grieve says that 1884 was a Rabbit year in Manitoba along the Ridge that is two miles west of Reaburn. There with three others he shot 147 in three hours.

"At Shoal Lake and Stony Mountain, Manitoba, Rabbits were very abundant 1883–4. In the spring of 1885 they were

[9] Nar. Can. Red R. Expl. Exp., 1860, Vol. I, p. 119.
[10] *Ibid*, p. 284.
[11] Expl. Labrador, 1863, Vol. I, p. 108.
[12] Man. & Grt. N. W., 1883, p. 352.
[13] *Ibid.*

found killed everywhere. I saw specimens that were so sick they could not get out of my way. Their necks were swollen and their ears were full of blue ticks." (Dr. J. H. Cadham.)

Red River and Assiniboine Valleys, all the poplar country in the basins of Lakes Manitoba and Winnipegosis, Pembina, Riding Mountain, Duck Mountain and Turtle Mountain had a great Rabbit season in the winter of 1886–7; followed by the plague in the spring of 1887.

Around Shoal Lake, 1893–4 was a Rabbit year, according to William G. Tweddell, of Woonona.

In the central part of Manitoba, 1894 was a Rabbit year. Dr. D. A. Stewart, of Winnipeg, tells me that in the fall of that year "the Rabbits were so abundant along Pembina Mountain that in a 6-mile drive between Altamont and Miami I saw 35 along the roadside. They were beginning to whiten, though there had been no snow."

In the fall of 1896 Dr. Stewart says that they were fairly plentiful along the Yellowquill trail south of Portage le Prairie; he saw a number lying dead that year. George Grieve gives similar testimony for the ridge west of Reaburn. In 1898, though the Rabbits were not very abundant, the plague appeared among them in Shoal Lake Country. (George H. Measham in letter.)

In the whole Mackenzie River Valley 1903–4 was a marvellous season for Rabbits; their numbers were incalculable. The plague appeared in January, 1904, but did not finish its work for over a year. In 1907 I spent 7 months camping in the region without seeing a single Rabbit.

The year 1904 was to some extent a Rabbit year in the Pine country of Eastern Manitoba from Whitemouth to Rat Portage, as shown by these notes from my Journal:

April 25, 1904, Monday, on the railway 25 miles west of Rat Portage (now Kenora), going westward. This appears to be a Rabbit year. The snow which still lies on all the shady places is pattered over with their tracks. From the train I have seen but two or three of the Rabbits themselves. Two were snow white, one was half brown; they were quite con-

spicuous when sitting on the brown earth. Doubtless a walk in the woods would discover many. The most obvious proof of their presence, seen from the train, is the barking of the brushwood. Wherever a poplar tree has been felled its top is seen completely barked, the buds and finer twigs devoured. In a less degree this applies also to the birch, tamarac and willow; their favourite food seems to be the poplar. It is curious, however, that I see few or none of the large standing trees gnawed; the bark near the ground seems less acceptable than that of the fine twiggery. The few standing trees that were peeled were of very small size.

Whitemouth, same day, 11:20 A. M. Though I do not see any Rabbits from the train here, their work is more and more conspicuous. Vast numbers of saplings, poplars, tamarac, black birch, and, I think, willows, are barked, evidently this past winter. I see no Rabbits, no doubt because the country is so wet with spring floods.

Again, going eastward, May 1, 1904. Near the eastern boundary of Manitoba I saw the first Rabbit. It was now about 6 P. M. During the next 30 miles I saw in all 38 Rabbits clearly, and close to the tracks. I saw none at all dead, though they would have been conspicuous in the white fur, as the snow is all gone.

As we drew near Keewatin they were no longer seen; evidently they abound only in a small region about 30 miles across, at the eastern edge of Manitoba.

After this I saw no more Rabbits until next day in the region along the north shore from Nipigon to Pardee, where, watching for many hours, I saw 5 all told.

All the way from Lake Nipigon to Ottawa I saw but 1.

In September of that same year I returned to Ingolf with Dr. Gordon Bell and Dr. J. H. Cadham to investigate the supposed plague, but was much disappointed to find how scarce the Rabbits were. In twenty-four hours we saw 20-odd alive, found 6 dead in the woods, and 6 dead on the railway, not enough, however, to account for the disappearance of those I saw. Possibly I was wrong in assuming them to have

been so abundant. Those taken showed no sign of disease, although thoroughly examined by my two medical friends. In western Manitoba this same year they were very scarce.

These are the generalizations that may safely be drawn: A Rabbit year in one part of the country is not necessarily a Rabbit year in another, the condition being local.

GENERAL CONCLUSIONS

An abundance of Rabbits is accompanied by an abundance of birds and beasts that prey on them, especially of Lynxes, and yet the destruction by these enemies makes no perceptible difference. They are wiped out in a single spring by epidemic disease or diseases usually characterized by swelling of the throat, sores under the arm-pits and groins, and by diarrhœa.

The denser the Rabbit population the more drastically is it ravaged by the plague. Apparently none are left in the year after the most marvellous abundance.

NUMBERS IN YEAR OF PLENTY

In the spring of 1882, when first I lived at Carberry, I could find, perhaps, 2 Rabbits in three or four hours' tramping through the woods. In 1883 they seemed no more plentiful; in 1884 one might see a dozen or more in a morning walk; in 1885 they were perceptibly more numerous; but 1886, though not a Rabbit year, at Lake of the Woods, it was the greatest ever known in the western country. The area of abundance began about 30 miles east of Winnipeg, and included all of the poplar country west and north-west of the city, that is all the south-western half of the Province, excepting the open plains. The abundance that year was prodigious. It so happened that the snow was late in coming (November), yet promptly in October the Snowshoes donned their winter garb of white, so here was the vast brown country speckled and dotted, streaked and crawling, with snow-white Rabbits in myriads. Wherever you looked in scrub lands it was the same. W. R. Hine wrote me: "In October of this year on the Stinking Water I killed 75 Rabbits in two hours. I could have killed 500 in a day."

At Carberry they were even more plentiful. At no time were the near bushes without two or three twinkling ghosts of Bunnies silently flitting by. Many of the neighbours killed a few hundred to lay away for chicken food. I could at any time have killed 50 an hour. They were in similar abundance from Pembina to Pelly, between the Great Lakes and in all the wooded mountains of western Manitoba, throughout the Province indeed, excepting in the pine forests and on the open prairies.

Near the Spruce Hill, at the edge of the poplar woods near Carberry, I stood, and looking round, counted the Rabbits within a radius of 30 yards. They numbered 11, and there were evidently many that I did not see; so that 20 would be a safe number at which to put them. That is 20 to the acre, but dividing it by 2 to allow for sparser places, it would easily total 5,000 to the square mile. Assuming then that this high rate of population was confined to the poplar belt that angles across the Province from Dufferin to Swan River (which it was not), we should have here a population of over 100,000,000 Rabbits.

It was a glorious feast for the naturalist. There is an inexpressible joy in seeing so much wild life, but the farmers, who knew about the ravages of its cousin in Australia, began to have the gravest apprehensions. Where would it stop? At present the Bunny millions were confined to the woods. But another year of increase might, indeed must, make a change. Already the woods are suffering from the ever-hungry hordes; in another year they would be driven forth into the crops. Then farewell to the old-time prosperity, good-by to the golden grain.

But the fear was groundless. Before the winter waned the plague had stalked through the woods and had done its work, coming and working mysteriously, silently but effectually. The country from Whitemouth to Whitesand, 250 miles long by 150 miles wide, was flecked with the bodies of white-furred Hares. My friend, Miller Christy, who spent 1887 in Mani-

toba, writes:[1] "On the sides of the line [C. P. R.], as it runs through the wooded country between Portage la Prairie and Carberry, a distance of about 50 miles, the dead bodies of the Rabbits lay literally in hundreds, if not thousands. In some spots several bodies were to be seen lying near one another, and over considerable distances a fluffy White-rabbit's body might be seen every few yards, as the train rushed along, lying on the edge of or close to the line."

THE PLAGUE

Just so great as were the numbers was the destruction by the plague. It seemed to have *taken them all*. The summer and fall of 1892 I spent in the same region and did not see a single Snowshoe. I have heard of one or two areas in eastern Manitoba where a temporary abundance of Rabbits has been observed since then, but never in the Province has there been another such a Rabbit year as 1886.

The next question is one brought forward by Miller Christy in the article referred to: "Why cannot we find in this disease a means of combating the Rabbit-pest in Australia?" Is it not possible that Science may discover a mighty weapon in the virus of the stricken White-hare. The difficulty hitherto has been to bring together disease and pathologist. But an unexpected chance has recently brought about this desirable conjunction.

I had stocked the park about my home with Rabbits—Jacks from Kansas, Snowshoes from New Hampshire, local Cottontails, Prairie-hares from Manitoba. They were in abundance. I could see a dozen Rabbits at least every day, when, late in summer of 1903, they began to die, and, in a few weeks, all were gone. The plague had come, and it swept them away. Those found dead appeared to have had their throats cut, but were too far decomposed to be properly examined. All perished but three or four which seemed very sickly. In the fall of 1904 I at last secured a freshly dead one with its "throat cut" as before. This was shipped to Dr. Seelye Little, of Rochester, N. Y., who thus reported:

[1] Exterm. of the Rabbit in Australia, Zoologist., Nov., 1892, p. 383.

DISEASES "Animal very thin; ulcerated sores on skin, especially in region of neck and right side of chest; abdominal organs all right; heart and lungs in good condition. There was a large number of enlarged lymph nodes, many of them having undergone cheesy degeneration. These enlarged lymph nodes were in the region of the neck, the right axillary region, and about the lungs.

"Bacteriological examination: Cultures taken from the lymph nodes (the diseased ones) on agar and on bouillon all showed a pure culture of the ordinary germ of suppurative processes (the staphylococcus *Pyogenes aureus*).

"Cultures from the lungs were negative. Examination for the tubercle bacillus was negative.

"Diagnosis: The Rabbit died, I should say, from a septicæmia due to infection by the staphylococcus *Pyogenes aureus* (the yellow pus-producing coccus that grows in clusters).

"This infection may easily have started in some accidental or skin wound, or possibly in some parasitic skin disease common to Rabbits, and might easily be transmitted from one to another.

"There was no hemorrhagic condition present in the mucous membranes or elsewhere, though that and very extensive changes in all parts of the body (kidney, liver, spleen, etc.) would doubtless have taken place, had the animal lived longer, because the germs were present in the blood and so were carried everywhere.

"One of my associates, Dr. Casey, kindly assisted me in the bacteriological examinations."

Two unfortunate Snowshoe-hares from Maine came in October. Their heads were plentifully beaded with blue ticks; at least a score were hanging about each ear. They died in a short time and the autopsy showed that they had had still other troubles. Dr. W. Reid Blair, of the New York Zoological Park, examined them and reported:

"Both bodies showed identical lesions, viz.: gastric and intestinal catarrh, with small hemorrhages throughout the

digestive canal, caused by round worms. There were two species of parasites present. The stomach worm, which I recognized as the *Strongylus strigosus*, is a most dangerous parasite, since it lives by sucking the blood of its host and causes death chiefly by anæmia and emaciation. This parasite is blood-red in colour, about ⅜ to ¾ of an inch in length, and marked by numerous longitudinal lines from which it derives its name (striped strongle). The parasites were present in great numbers, many hundreds in each animal. The species found in the small and large intestines I am unable to identify, but since it is not a blood-sucking parasite, it is less important than the stomach-worms. These worms are ¼ of an inch long and of the thickness of thin twine.

"The oil of areca nut is the best treatment to reach these worms; and the separation of infested animals and the changing of the runs are important matters."

Dr. W. T. Hornaday, who took part in the investigation, adds: "I examined them under the microscope with great interest. They were present in very large numbers, and the eggs which the *Strongylus* seemed about ready to put forth betokened reproduction by hundreds of thousands. I think the two parasites account for the periodical seven-year plague among the Northern Varying-hares, and also the Rabbits of the West. The life-history of *Strongylus* is not well known, but it may easily develop that the cycle of this creature's destructiveness is seven years long."

Another specimen which died in the park in January, 1906, was thus reported on by Dr. W. Reid Blair:

"Death was due to a generalized infection with tapeworm cysts. These cysts are present in enormous numbers in practically all the tissues of the body, the liver, mesentery, diaphragm, spleen, and pectoral muscles being most involved. A multilobular cyst situated over the ribs on the left side was completely encapsulated by the superficial muscles; on removal it was found to be about the size of a duck's egg and to weigh 6 ounces. This cyst contained besides 4 ounces of clear fluid, about 300 heads of the *tænia* (mature), every one

of which is fully capable, under favourable circumstances, of developing into a mature tape-worm.

"Dogs, Wolves, and Foxes are the mature hosts of this particular species of cysticerci (*Cœnurus serialis*). Rabbits and Hares harbour the cystic form. Treatment of this disease is out of the question."

Another specimen died from tuberculosis of the liver; others were found, but not soon enough for autopsy. At that time I also lost Whitetailed Jack-rabbits from pneumonia, enteritis, diarrhœa, and inflammation of the bowels. Doubtless the Snowshoes also are subject to these complaints. In fact, they seem to have all the ills of the flesh (except possibly writer's paralysis and housemaid's knee), and I feel more and more satisfied that the so-called Rabbit plague is not one disease but *many* run riot, through the Rabbits being overcrowded and the whole country rendered unsanitary for their species.

It is worthy of note that a number of Belgian Hares also running wild in the park at Wyndygoul were *immune from the epidemic*. As this Hare is simply a race of the Common European Rabbit, the last circumstance should interest Australians who would import our Rabbit disease.

PARASITES

'The creature of many friends', the Hare has been called, on account of its harmless life, yet none have a greater array of enemies. Deer have bots, warbles, and flukes. Foxes have flies and lice. Grouse have ticks and tape-worms; but the unfortunate Hare is harassed by each and all of these little pests, as well as by every bird, beast, fish, and reptile of prey that inhabits its country!

No matter what time of summer or fall you examine a Snowshoe Rabbit, you will find firmly attached somewhere about it at least one or two of the blood-sucking wood-ticks (*Ixodes*). I found them on two males taken June 25; each was decorated with about a dozen. On specimens which I got at Ingolf in September, 1904, I found several hundred ticks, varying in size from pin-heads to peas. They were in the ears of the

Rabbits; the lower part of the ear in each was clogged with a mass of ticks; none, however, had ventured into the wax-protected inner vestibule. As soon as their host was dead and cold, these ticks loosed their hold and scrambled in all directions, seeking elsewhere for a renewal of comfort. On October 15 I received two Snowshoes from Maine, and, on the 22d, two more; all had the ears beaded with scores of blue-ticks.

Plentiful as they are now, I am inclined to think the ticks have been worse, as attested by the following paragraph from Henry's "Journal":[15]

"Ever since April 25 [1801] we have been plagued with wood-ticks [a species of *Ixodes* E. Coues], and now that we are daily in the woods and grass, our clothes swarm with those troublesome and dangerous insects, which often get into the ear and cause inflammation. When they have time to get firm hold, they cannot be removed without pulling the body from the head, which remains in the skin, and causes an itching which may last for several months. The bellies of our horses and dogs are covered with them; they adhere to the flesh until they have sucked themselves full of blood and are swelled nearly to the size of a musket ball, when they fall off of themselves. Their natural size is about that of a grain of barley, and in shape they are perfectly flat, with a tough hard skin of chestnut colour. They continue to the end of July, when they suddenly disappear."

ENEMIES

A full list of its enemies would give first place to the plagues already described, next would be a catalogue of all the predacious birds, beasts, fish, and reptiles in the country. Anything can kill a Hare that can catch it. Its only safety is in its speed among the tangled copses, a speed which, thanks to its snowshoes, is not diminished in the season of stress. In the open this is of high order, not enough, perhaps, to save it from a Fox; but sufficient, as I have several times seen, to put Wabasso beyond reach of an ordinary collie dog. But in the undergrowth it is absolutely safe from open attack of nearly all.

[15] Henry's Journal, 1799–1814, pub. 1897, p. 180.

The Hare can dart at speed between saplings that are but three inches apart, it can double around a bush or under a fallen tree in a way that mocks at the Fox, Lynx, hawk, or owl; but it often falls before them when they steal on it sleeping, or when two of its foes unite and so form the drive and ambush.

These combinations are not always pre-arranged. A Fox seeing another Fox or a Lynx creep into the Hare cover may lie in wait on some runway without the knowledge of the hunter before him. Even a hawk or owl, I am told, will circle round a Hare home while a Fox is ransacking its depths, knowing that in the general stampede there is an excellent chance of good things coming his way.

The Hare has one enemy that, though much slower than itself, is yet a terror, maybe the worst of them all, and that is the Brown or Ermine Weasel.

I have many times seen the trail of the pair in the snow showing where the Weasel, with indefatigability that more than made up for its lower speed, was bounding along the track of some Hare. I have many times heard of the finish of that hunt, but have never seen the actual death.

During the December of 1886 I saw a chase that had a very unexpected end. I was out with a friend hunting in the sand-hills north-east of Carberry. The Snowshoe-rabbits were very abundant in the thicker woods, and there were some in an open grove where we halted to feed our horses. While there I saw one running about at full speed, and after it what at first I took for a smaller Rabbit in hot pursuit. As it circled in full flight around our sleigh a number of times, I learned the cause of its haste. The smaller one behind was not a Rabbit at all, but a White Weasel, plunging along with tremendous energy through the snow, and evidently running this Rabbit down. The Weasel was winning. He was within a few yards of his victim, when at last, the Rabbit, in desperation took refuge near my feet, under the sleigh, and the Weasel, deciding to be discreet, ran off before I could lay hands on a gun. There is not the least doubt that the Rabbit feared me as an enemy,

for shortly before it had been running from me. But it did as many others have done in dire extremity, and in this case at least proved it the part of wisdom, for a little later it went its way in peace.

STRANGE INSTANCES

W. G. Tweddell calls my attention to the fact that sometimes White-hares are caught bearing dermoid cysts, within, which is a growth covered with skin, more or less hairy, and sometimes even provided with teeth. The Indians treasure these as great medicine and call them *Pee'-to-wab-oos-ongs,'* that is 'the little Rabbit within.' To pass one of these through a Rabbit snare is, they believe, to guarantee its immediate success. Such cysts are well known and have already been mentioned in the Moose chapter (p. 182.)

This same hunter relates another strange case: In February, 1883, while hunting with the Chief Metwayash at Rabbit Point Lake, Manitoba, he caught sight of a Snowshoe-rabbit twenty feet up a sloping tree. On examination it was found dead and frozen stiff, one leg caught in a crotch. He is satisfied that it was not put there by any man, but that the creature ran up, possibly scared by a Fox, then slipping was caught and held till dead. This is the first time that he ever heard of a Rabbit climbing a tree.

A singular monument was found on Turtle Mountain in 1896 by A. S. Barton. While seeking an old Indian camp on a wooded hill he found several piles of Rabbit skeletons—skulls and other bones complete. The piles were three or four feet across and a foot high.

I doubt not these Rabbits were collected by the Indians in time of plenty. They had secured hundreds of them and left them frozen. In the spring when they moved away these were left to rot.

COMMERCIAL VALUE

The knowledge that the White-hare is so subject to disease may keep many from using it for food, thus exemplifying the danger of a little knowledge. These persons should remember, first, that there is no record of any one getting

diseases of this kind from Rabbits they have eaten. Second, every kind of human food, whether animal or vegetable, is more or less infected by microbes. If that thought is to weigh, we must never again eat a bite of *anything*. There is no way of saying beforehand which are safe and which are dangerous, but we may trust to the general principle that proper cooking will put all these micro-organisms beyond the possibility of doing harm.

FUR

Next after its flesh the skin of Wabasso is of service to man. The hide is too weak and the fur too brittle for its commercial use as a peltry, but the Indians cut it into long strips and plait or weave these into blankets that are marvellously warm, and that have this advantage over other fur robes—they give ventilation, and so do not sweat the wearer, or become damp during active service. They are very light as well as warm, and in great demand by prospectors and travellers in the far north. Many a miner, of the few that won on that long, desperate Klondike trail, can truly give thanks for salvation and golden success to the Snowshoe-hare, from which was pillaged the blanket that kept him alive to win.

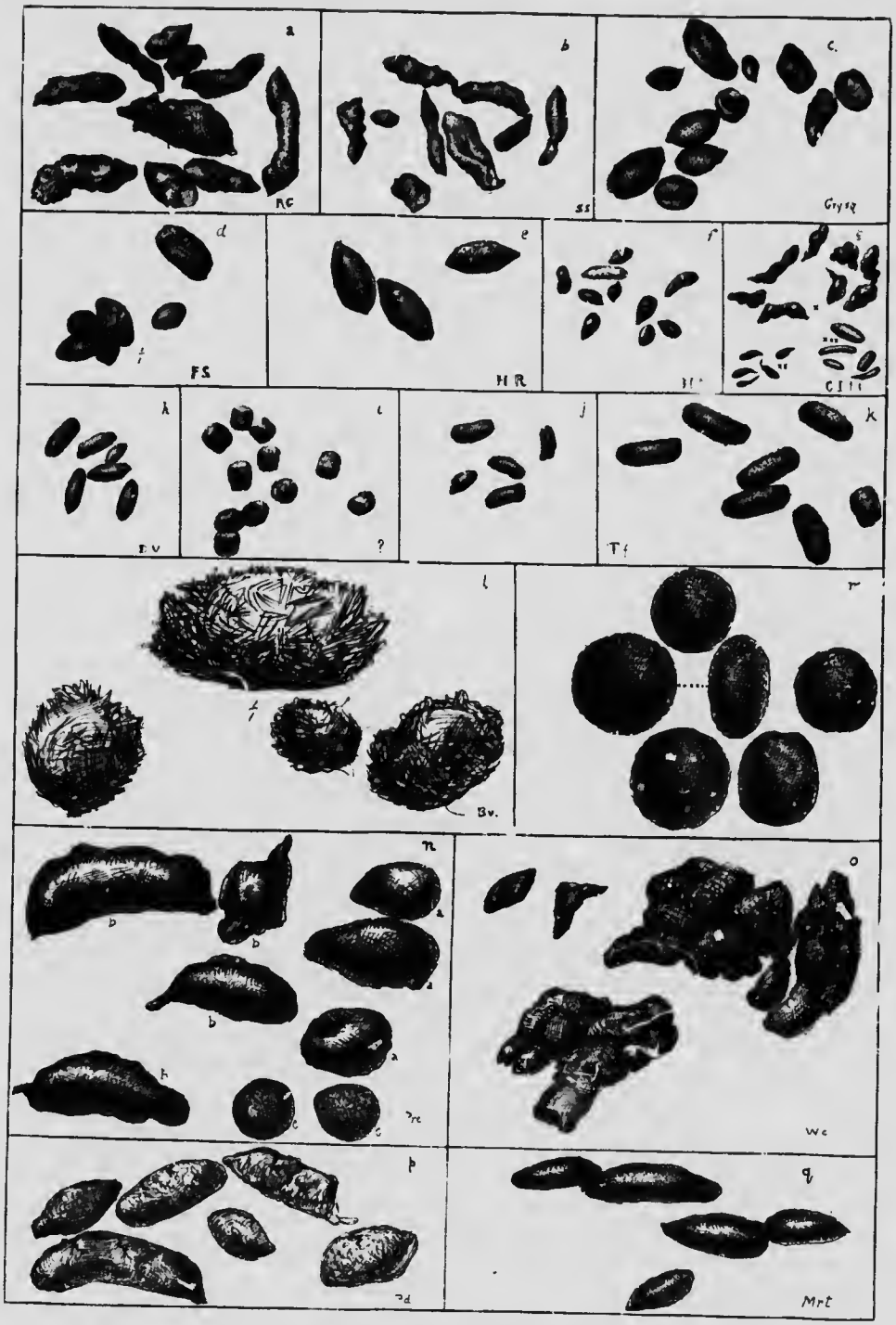


PLATE XLV.—SCATOLOGY OF CERTAIN RODENTS.

*a*. Richardson Ground-squirrel.
*b*. Thirteen-striped Ground-squirrel.
*c*. Carolina Gray-squirrel.
*d*. Southern Flying-squirrel (*volans*).
*e*. House-rat, living in the woods.
*f*. House-mouse.
*g*. Connecticut Deermouse (*novaboracensis*).
*x*. Feed on bread, etc.
*xx*. Different individual the night after capture.
*xxx*. Same as last, nut-fed for days.
*h*. Drummond vole.
*i*. A great pile found in the woods at Cos Coh, evidently dating from winter, probably *Microtus pinetorum*.
*j*. Synaptomys cooperi? Ottawa River.
*k*. Pocket-gopher (*T. fossor*).
*l*. Beaver all woody fibre.
*m*. Snowshoe-rabbit (winter).
*n*. Porcupine, 3 different individuals. the large (*b*) wild, the others (*a*, *c*) captive.
*o*. Woodchuck in October.
*p*. Common Prairie-dog.
*q*. Muskrat, September.

## XXVIIIa.

## Turtle Mountain Snowshoe-rabbit.

*Lepus americanus bishopi* Allen.

(*L. bishopi*, in honour of Dr. Louis B. Bishop, who secured the type specimen in North Dakota, July 12, 1895.)

*Lepus americanus bishopi* ALLEN, 1899, Bull. Am. Mus. Nat. Hist., XII, p. 11, March 4.

TYPE LOCALITY.—Mill Lake, Turtle Mountain, N. D.

The Turtle Mountain Snowshoe has recently been described by Dr. J. A. Allen as a separate species, under the name *Lepus bishopi*. It is chiefly distinguished by its small size and very small ears. As it seems to me at best a race of *americanus*, I have so entered it.

### LIFE-HISTORY.

Nothing is known of its life-history. There is no reason to expect that it will be found differing in habits from the typical form as set forth in the previous chapter.

## XXIX.

### Prairie-hare, Whitetailed Jack-rabbit or White-jack.

*Lepus campestris* Bachman.

(L. *Lepus*, a hare; *campestris*, of the open fields or prairies.)

*Lepus campestris* Bachman, 1837, Jour. Ac. Nat. Sci. Phil., VII, p. 349.

Type Locality.—Plains of the Saskatchewan.

French Canadian, *le Lièvre.*
Ojibway, *Kit'-chee-wah-boos'* (big white rabbit).
Cree, *Mis-tah'-boos* (big white rabbit).
Yankton Sioux, *Mah-steén-cha Tuńg-ka.*
Ogallala Sioux, *Mahs-tin'-shkah.*

SIZE The specimen from which the drawing (Plate XLVI) was made is a typical female from Boissevain, Manitoba, collected by A. S. Barton, September 27, 1904. It is 2 feet (608 mm.) from nose tip to root of tail; the tail to tip of bone is about 4 inches (102 mm.). The hind-foot, heel to end of longest claw, is 6 inches (152 mm.)

WEIGHT An adult specimen which I got at Carberry, Man., weighed only 6 pounds. A female shot at Gardner, Montana, August 16, 1897, was in milk; she weighed 7¼ pounds. C. W. Nash records that he saw one at Mountain City, Man., that weighed 8 pounds. Dr. S. J. Thompson, of Carberry, shot a large one in his garden and found that it weighed 11 pounds. Francis Dickie tells me that on October 8, 1905, he shot a very large one that turned the scale at 12 pounds. These doubtless represent extreme weights; 7 or 8 pounds is about average.

COLOUR In *summer coat*, above it is pale wood brown, faintly mottled or peppered with very dark umber, turning clear silvery gray back of the hips. The pepper-and-salt effect


PLATE XLVI.—PRAIRIE-HARE.

(*Lepus campestris* Bachman.)

A female specimen taken at Boissevain, Manitoba, September 27, 1904.

becomes stronger on the forehead and on the ears as seen in front. The back of the ears and their edges in front, the chin, throat, lower cheek, ring around eye, spot on forehead, nape of neck, lower parts generally, together with the rump and the entire bushy tail, pure white.

The outer side of each leg is more or less tinged with clear brown. The tip of the ear is jet black inside and out; the bristly pads of the feet are earth-stained nearly black.

The Prairie-hare is very pale compared with other Hares in summer coat, but its conspicuous label mark is the brushy *tail of pure white*. As it bounds away, this is held not downwards like that of a Texas Jack, or against his back like that of a Cottontail or a Snowshoe-rabbit, but straight out behind, or switched from side to side like the white flag of a White-tailed Deer.

By this and its size the Prairie-hare may be known at all times.

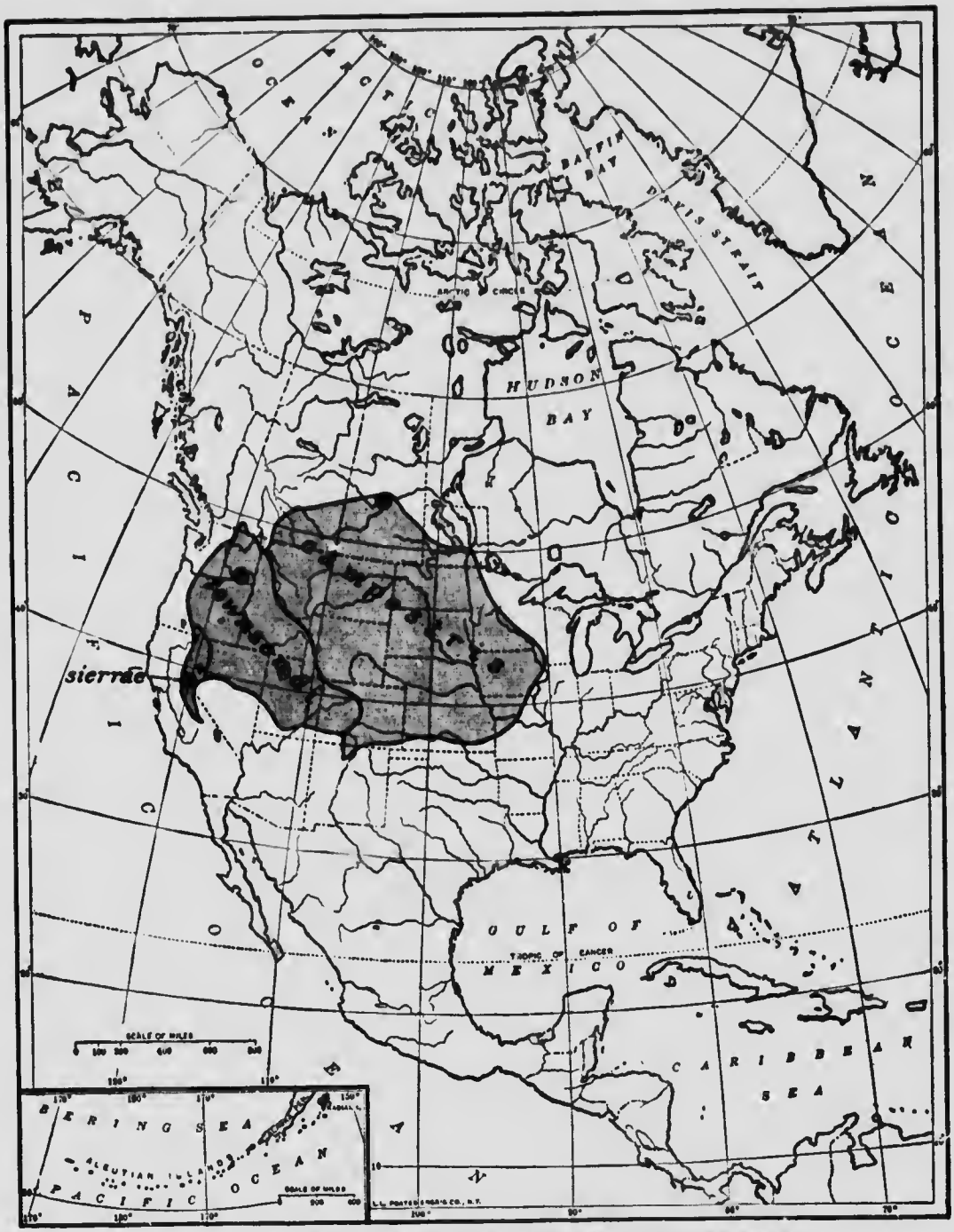
In *winter coat*, it is white with black marks on the ears; old and vigorous individuals are pure white, but most young specimens have a sprinkling of gray on head and back all through the winter.

The three recognized races are:

*campestris* Bachman, the typical form.
*townsendi* Bachman, a desert form, smaller and paler than *campestris*, and with reduced black spots on ears.
*ierræ* Merriam, from the Sierra, the largest of all, a pale form with much black on ears.

EARS

Why has the Jack-rabbit developed such ears? Not for hearing I suspect. The plains animals are less in need of hearing gear than the wood creatures. It is very clear what its long legs were made for, and it is possible that the general demand for increased extremities was indiscriminately applied, resulting in a beneficial lengthening of its four important




**MAP 38—RANGE OF THE PRAIRIE-HARE AND ITS THREE RACES.**

***Lepus campestris* Bachman.**

Founded on E. W. Nelson's map in N. A. Fauna, No. 29, with corrections from personal observation in Manitoba, etc.

outliers and a fortuitous unprofitable development of tail and ears.

The only use I can see for the additional ear-flaps is as a sort of roof when it squats in its 'form' during hard rains. They cover its back like two long leather shingles or a pair of empty gloves, and may ward off many an attack of pneumonia, etc. Their position when the owner squats is exactly like that of a seaman's or fireman's hat, and similarly may serve to keep the floods from pouring down the back of the wearer's neck.

## Life-history.

RANGE

This, the largest of the Hares in temperate North America, has a wide distribution on prairies, plains, mountains, and in forests of the north-west, apparently influenced by little but climate.

In Manitoba it is now found on all prairies, but it seems to have been unknown in the early days, although Richardson gives[1] it a general range that includes the south-western part of our Province.

Alexander Henry, in his voluminous notes on the creatures of Red River Valley (1795 to 1812), did not record it for Manitoba, and but once for North Dakota.

On October 21, 1804,[2] while mounted on his "famous gray horse" and hunting near the junction of Pembina and Red Rivers in Dakota, he "started a large Meadow-hare and killed it only after a long chase, as they are very swift."

Kennicott, the naturalist, who searched the Red River Valley for small animals about 1856, did not meet with it. Professor H. Y. Hind explored all the Manitoban prairies in 1858–9 without finding one. J. H. Cadham, who came to Winnipeg in 1870, tells me that it was then unknown in Manitoba. Dr. Elliott Coues collected birds and quadrupeds all along the southern boundary of Canada in 1873 from Pembina westward, and did not meet with the Prairie-hare

[1] F. B. A., 1829, I, p. 224.

[2] Journal, 1897, p. 251.

till he got on the Coteau du Missouri, or over fifty miles west of the Manitoba line.[3] In 1882 I travelled all summer on the Plains of the Souris, from Pembina River west to Turtle Mountain and south-west from Brandon, and from Carberry over the north-west country toward Fort Pelly, without seeing or hearing of a Prairie-hare. In 1883–4 I travelled over the prairies north and east of the Assiniboine, and still met with none but the common American Wood-hare. But in September, 1883, Miller Christy saw a Prairie-hare just west of Fort Ellice, and in 1885 George F. Guernsey reported it common at Fort Qu' Appelle.

A. S. Barton, of Boissevain, writes me: "The first Jack I ever heard of here was in 1881; since then they have increased." C. W. Nash saw one killed at Mountain City in March, 1887. From this time it has spread steadily northward and eastward.

On August 26, 1892, I collected a specimen at Carberry. This was their first record for Manitoba north of the Assiniboine. None of the residents had ever seen one before. In 1894 Dr. S. J. Thompson tells me they became common at Carberry, and in 1897–8 were so numerous that one could see 15 or 20 in a mile drive. About Napinka especially they had become extremely numerous in 1898, and were proportionably destructive to the crops. They now abound in all the rolling prairie region of the Province.

J. H. Cadham, after 35 years' residence in Manitoba, tells me that the first he ever saw was near Winnipeg in 1896; in 1898 the species was seen for the first time at a place 6 miles west of Stony Mountain. Farmers who had lived there 15 years had never seen one before. It has steadily increased, and is now found in all the prairie country east of Red River, but not north of Winnipeg yet on the east side of the river. The united testimony of witnesses is that this Jack-rabbit is now found in all the open regions of the Province, that it has advanced from the south-west, and is rapidly becoming very abundant.

[3] Field notes, 49th Parall., 1878, Geol. Surv. Bull. 3, Vol. IV, p. 547.

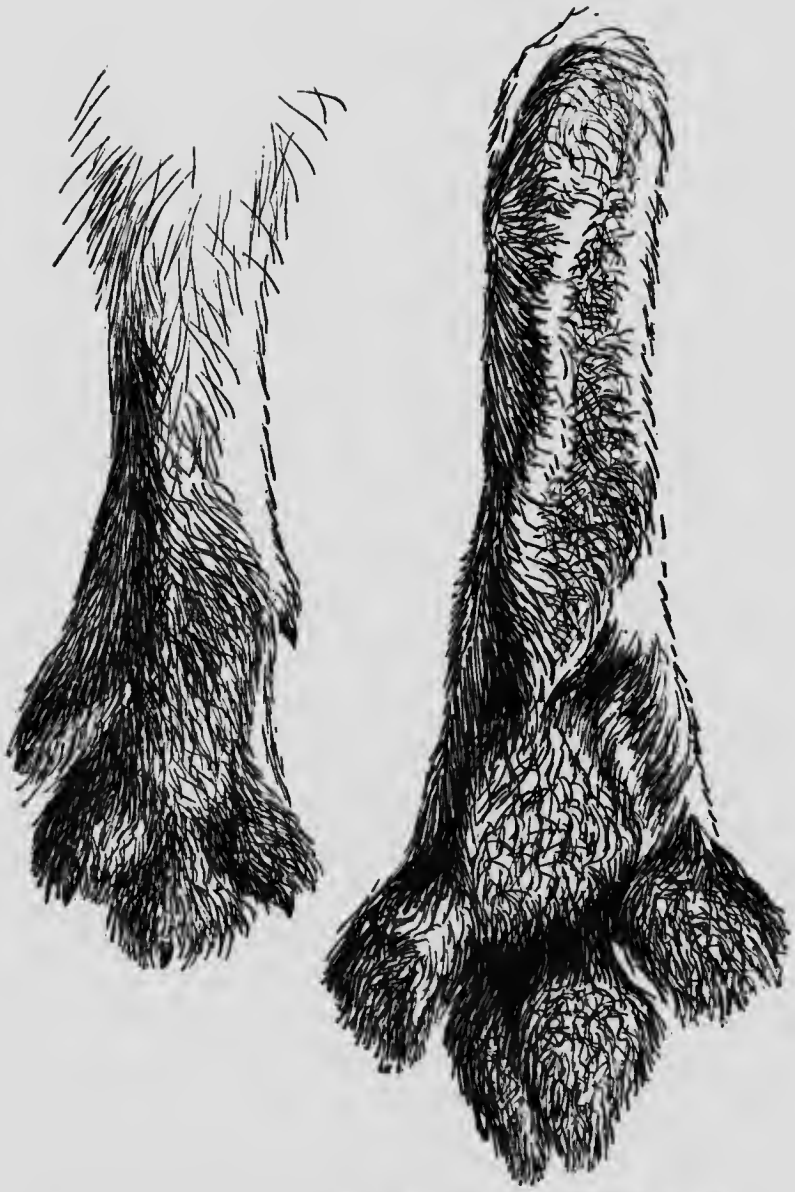


FIG. 177—Feet of Prairie-hare. Left fore and right hind—life size. Chicago, March 9, 1902.

ENVIRONMENT

Although called Prairie-hare, I have seen this species in the pine forests of California and high up among the Rocky Mountains of Wyoming and Montana, as well as on the sage deserts. It is indeed less strictly a 'prairie' Hare than many of its relatives, and I note with interest that in some parts of Manitoba it is called 'Mountain-hare.' The prairie with scattering low cover is, nevertheless, its favourite home, and it shows also a remarkable partiality for the ploughed parts. In such places it is very much at home, though most running animals find them a disadvantage. Possibly we may find in this one explanation of the Hare's spreading with the spread of cultivation. An advantage connected with this possibly is that the ploughing of the ground destroys the germs of many diseases that might otherwise make havoc in their numbers.

HOME-RANGE

The home-range of the individual Hare is probably not more than 2 miles across, may even be smaller. It is well known that when pursued this animal rarely runs more than a mile from a central point, but circles around that; also that a Hare once discovered may usually be found thereafter within a few hundred yards of the same place.

In 1892, while I was living at Carberry, W. H. White told me one evening that an immense Rabbit or Hare was on his pea-field that day. It was some new kind, larger than any he had ever seen in the country before, and that if it was like its cousin, the English Hare, it would be found on the same spot, at the same time next day. This proved correct. I found the Hare in its 'form' on the pea-field. It turned out to be the present species. In the park at Wyndygoul, where I had White-tails for years, I found that each individual kept closely to his own region of 10 or 15 acres, though free of 120.

Analogy also bears out the theory of a limited range. T. W. Proger, the Welsh naturalist, writes me concerning the European Hare, which is closely akin to our own: "The home locality of the Hare is less than 2 miles across"; that is, a radius of 1 mile; around this it runs when pursued. I

have proved a similar habit in the Jack-rabbit of Kansas. So that a small range is the family rule.

NON-MIGRANT

This Hare is not at all migratory. At most it changes its range in winter to adjoining places that are warmer or better supplied with food.

SOCIABILITY

"Nor is the Prairie-hare in the least gregarious [says Coues[4]]. I have never seen nor heard of several together, and indeed it is rare to find even two together at any season whatever. It is one of the most solitary animals with which I have become acquainted. * * * I have never found any kind of locality even, which, presenting special attractions, might invite many Hares together."

Lewis and Clark recorded[5] one hundred years ago that these Hare "are generally found separate, and are never seen to associate in greater numbers than two or three."

COMMUNICATION

In noting the Hare's methods of intercommunication we must not forget its uniform, so distinctive with its blazonment of markings black and white—markings that plainly advertise to all the world the wearer's identity; notifying others of the species that this is one of their own kind, and therefore it is needless to flee; or showing the carnivorous foe with equal certainty that this is a Jack-rabbit of winged heels, and therefore it is useless to follow.

When captured this Hare sometimes utters a loud coarse squealing; it is not unlike the '*caw, caw, caw*' of a crow.

The Hare of Europe, a close kinsman, has a soft, plaintive call for the young, and the Blacktailed Jack, when fighting with its own kind, utters an angry '*churr churr.*' These sounds also are probably used by the Whitetailed Jack.

MATING

Mating apparently takes place in April. It is not known whether the species pairs or not; probably it is polygamous, and the male, therefore, is unlikely to take an interest in the

[4] Bull. Essex Inst., VII (1875), 1876, pp. 80-81.
[5] Quoted by Richardson, F. B. A., 1829, I, p. 276.

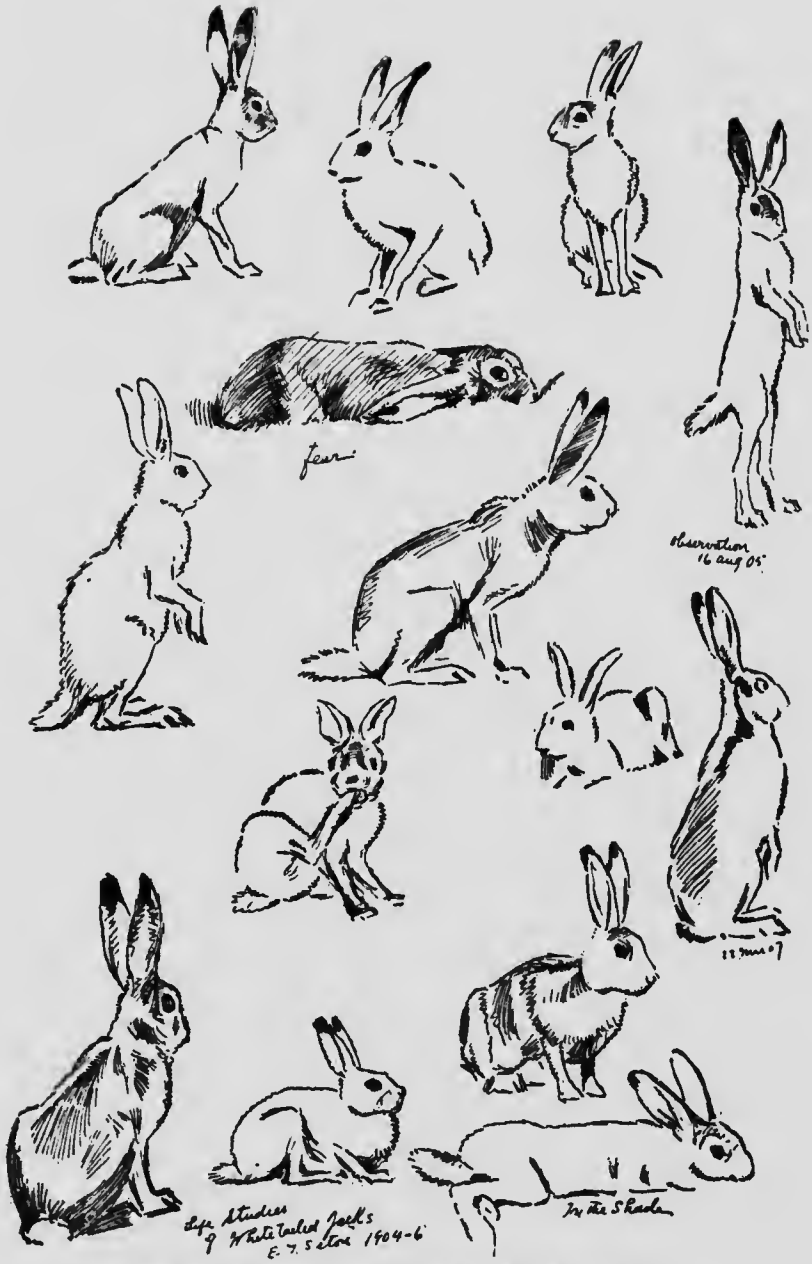



FIG. 178—Life-studies of Prairie-hare, made chiefly in Wyndygoul Park.

young. A. S. Barton writes me from Boissevain, Man.: "The Jack-rabbits run in packs after the females; about 20th of April many people told me they had seen 4 or 5 together, and I once saw 3 all in string."

As evidence in point I quote from my own Journal:

Cos Cob, Conn., April 28. For the past two weeks I have noted in the park, at Wyndygoul, 2 Jack-rabbits, one a Whitetail, the other, a Blacktail, running and keeping together, evidently paired. (They continued together for a year afterwards.) I have also seen at another part of the park 2 Whitetails running together. These things incline to show that the species does pair. In the former case it looks as though they were at times guilty of mésalliance. The weight of evidence at present, however, would prove the Prairie-hare addicted to polygamy, or even a still lower order of matrimony.

NESTING

All observers agree that the nest, or 'form,' is like that of other Hares, a mass of leaves or dry grass on the ground under some tussock of grass or low bush in the open country.

YOUNG

Gestation lasts 30 days with the true Hares, and no doubt the rule applies here, as this is a true Hare. The young are born in June or early July, oftener the latter in Montana, according to Dr. Coues,[6] who studied them in the Milk River country. They are 3 to 6 in number, 4 being the most frequent.

The young of the European Hare are born with eyes open and continue in the nest for about three weeks, during which time they are suckled two or three times a day. When she leaves them, the old one covers them over with a dummy mother that is made with grass and down from her own breast. The father, it is generally believed, takes no interest in the young. After a month the little ones begin to follow the old one and learn what to eat and what to let alone.

These remarks are found to be near the truth for the Prairie-hare.

Some interesting notes on the development of the young

[6] See Note 4.

have been supplied me by Percy H. Selwyn, of Ottawa, Ont. The first Jack-rabbit he ever saw in Manitoba was at Elliot Settlement, 18 miles south-east of Brandon, on May 25, 1885. He fired at it, it fell dead, and he was sorry to see that it was a female evidently within a few hours of becoming a mother, for there was something moving in her body. On performing the Cæsarian operation he found 3 young, one dead from a shot, the other 2 very active and *with eyes open*. When set on the ground they ran about so quickly as to be hard to catch. He took them home and raised them by spoon-feeding From the first they were perfectly tame and became the most playful Rabbits he ever saw, leaping high in the air and turning so as to alight facing the other way. When 3½ months old, and about half-grown, they were killed by accident.

Similarly, A. S. Barton, after much experience among the Hares in Southern Manitoba, writes me: "The young ones make good pets, they are so easy to raise on milk, and soon learn to drink out of a saucer."

In July, that is, when five or six weeks old, the young are big enough to shift for themselves.

Many observers believe that in Manitoba this Hare has 2 litters each year. Dr. Coues thought 1 litter a year was all it reared in Montana.

In the Yakima Valley (Wash.) the farmers assured me that the Whitetails breed every month of the year except February; this I interpret to mean that young ones are continually seen, except in the depth of winter, which would show at best that 2 or perhaps 3 broods are reared each year in the warmer regions of the Whitetails' range. But in the latitude of Manitoba I believe 1 brood each season to be the rule.

HABITS

Who can adequately describe the wonderful thrill of delight—half animal, half poetic—that comes when first he sees a wild Deer bound away from his path? The old, old thrill, that dates from times when finding that Deer was a matter of life or death. This same vivific shock I never cease to get each

time I see a Whitetailed Jack-rabbit leap up from its near-by lurking place. It never fails to be two things—unexpected and superb. You never know where you may find a Jack—no one does—you never see it till it leaps at close range and lopes away on stiff four-cornered bounds, rising without effort, like an Antelope, and switching its great white brush from side to side like a miniature Whitetailed Deer; blazing with snowy white and punctuated with sharp black spots on his ears, it is the king of all its kind, the largest and finest of the Hares. The Blacktailed Jacks of New Mexico and California I got used to, without, however, entirely losing the little sudden taste of a naturalist's joy, as the live, lithe things sprung from my path; but the great Whitetail of the North, with its sudden leap into life and showy contrast on the plain, where a moment before it was a dead, invisible clod, never fails to give the hunter thrill that can scarcely be felt when we slowly creep up on a larger creature that we have watched and stalked for hours.

A bright pen picture of this Hare in its home has been given by Dr. E. Coues:[7]

"The first sign [says he] one has usually of a Hare which has squatted low in hopes of concealment, till its fears force it to fly, is a great bound into the air, with lengthened body and erect ears. The instant it touches the ground it is up again, with a peculiar springy jerk, more like the rebounding of an elastic ball than the result of muscular exertion. It does not come fairly down and gather itself for the next spring, but seems to hold its legs stiffly extended, to touch only its toes, and rebound by the force of its impact. The action is strikingly suggestive of the 'bucking' of a mule—an affair with which people in the West are only too familiar. With a succession of these high, jerky leaps the animal makes off, generally in a straight course; there is nothing of the dodging or scuttling about that marks the running of the smaller Rabbits. As it gains on its pursuers, and its fears subside, the springs grow weaker, just as a flat stone 'skipped' on the water diminishes in length of the

[7] Bull. Ess. Inst., VII (1875), 1876, pp. 80–81.

rebounds, and finally the animal squats in its tracks on its haunches with a jerk, to look and listen. * * * The attitude at such times is highly characteristic. One fore-foot is advanced a little before the other, and the ears are held pointing in opposite directions. A Hare in such an attitude as this is always upon the watch, and the slightest stimulation of its fears at

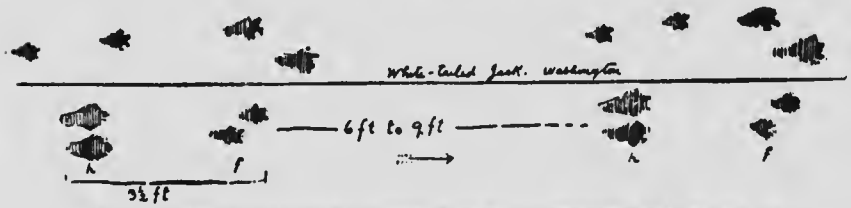



FIG. 179—Tracks of the Prairie-hare, sketched in State of Washington and in Wyndygoul Park.

such a time is enough to start it on its bounding course. It is a beautiful exhibition of timid watchfulness."

It rarely stirs about while the sun is high in the sky.

SPEED

It is undoubtedly the speediest wild four-foot left on the Manitoban prairies to-day. In my scale of swiftness I have put it next to the Antelope. It is far faster than dog, Coyote, or Fox, and can often outrun the greyhounds in an open chase. Captain Lewis measured the leaps of this animal and found them commonly from 18 to 21 feet;[8] and many observations lead to the conclusion that it can travel for a mile or more at the rate of nearly 30 miles an hour.

This high velocity was doubtless a result of the severest pressure. I suppose we are safe in estimating that at least once a day a Jack-rabbit must save itself by its speed, and at least once a week it is hard pressed in a long race for life.

An individual that I watched closely while it ran at its easy, unafraid gait, covered 52 yards in 13 hops over the snow, an average of 12 feet to the half-speed hop.

All the Jack-rabbits have a habit of making an occasional bound straight up in the air, to take an observation in springbok fashion. This custom, seen at its highest development in

[8] Coues, Ed., Lewis and Clark, 1893, Vol. III, p. 866.

the Blacktailed Jack of Texas, is at a minimum in the present species. I suppose because all its bounds are of the nature of spy-hops.

Several times while watching the above named ill-matched pair I have had good opportunities of comparing the gaits of the two species. The Whitetail runs like a Deer, with high,


FIG. 180—Lines to illustrate the actions of Whitetail and Blacktail Jack-rabbits running.

long bounds; the Blacktail lower, with shorter, quicker bounds, and much more regularly punctuated with a spy-hop. Their courses may be thus suggested by the lines in the accompanying diagram (Fig. 180).

SWIMMING

The Prairie-hare does not love the water, yet takes to it fearlessly when it must, and proves a strong swimmer, for the good reason that it can progress by the same motions as those which enable it to move on land.

Throughout the Yakima Valley of Washington I was told that the Whitetailed Jack never hesitated to plunge *into* any water that barred its path if too broad to be overleaped. It always manages, however, to shorten the swim considerably by leaping as far as possible at the start.

An acquatic exploit by this Hare has been described to me by an eye-witness, Colonel L. L. Hawkins, of Portland, Ore.:

In the late fall of 1880, he was at work with a gang on the Snake River, 60 miles above its junction with the Columbia. He and his men stopped at a long, narrow island. It was about 500 yards in length, and 150 yards across; this widest part was covered with scrub; the rest was a long, bare point. As they landed they saw a big Whitetailed Jack-rabbit jump into cover.

The whole gang of men went after him. They were fifteen in number, and forming a line across, soon drove him out into the open and narrow part. He raced to the far point, then back a couple of times. They came within 50 or 60 feet of him, and now were nearly shoulder to shoulder, as here the point was only 20 yards wide. Seeing no other escape, the Jack ran to the left of the island, raced straight across to gather speed, then on the right side at the exact waters' edge he leaped with all his power into the river—covering fully 20 feet in that jump—and struck out bravely for the shore, 100 yards away. He swam very high and fast, splashing with his front-feet, and moving forward with jerks as though jumping from his hind-feet, his ears were laid back, and although the river was deep, cold and swift, he crossed about as quickly as a dog would have done, and lost very little through drifting. As soon as he got on shore he shook the water from his coat, then sitting up high, he took one look at his foes, and bounded away into the sage. With one impulse the men took off their hats and gave him a cheer as he went.

When first they saw him on the island Colonel Hawkins supposed the Jack had crossed over when the water was so low that there was a dry road, but, after seeing the way he swam, concluded that he crossed at any time he wished.

MENTALITY

The Hares are low in the mental scale, and this one is low among Hares. It is so swift that it needs but little art to escape its enemies. Cadham says that if it is pursued by one dog, it commonly plays with it, teasing the dog by allowing it to get very near; but that when two dogs are turned loose, the Hare usually decides that present safety is better than posthumous glory, and proceeds to demonstrate that his are the winged heels, and that nothing on four legs can catch him, when he wishes to leave the scene—as at present. When hard pressed, he is known to double back, make a tremendous side jump, then squat.

An instance of this was told me by Chauncey Thomas, of Denver, Colo. He saw a wounded Jack-rabbit walk along the

railroad track for 200 yards, return backward, then jump and squat. The double he believed was intended to hide the track.

FOOD

The food of the species is nearly everything that is green or grain. In the winter it adds to the list the bark of many shrubs, and comes by night to the gardens and barnyards of the farmers for a delightful change in the form of oats, hay, turnips, cabbage, and indeed all the stock foods, for it has a 'crop for all corn.'

The British Hare is credited by Robert Drane, of Cardiff,* with habitually eating its own dung, thus securing all nutriment by a process of double digestion, a sort of reversible rumination or *post mortem* chewing of the cud. This frugal habit has not yet been observed in American Hares.

ENEMIES

It is a shorter task to enumerate the friends than the foes of the one who has all the world against him. Every bird, beast, fish, reptile, insect, and disease makes fair game of the Whitetail. It is the old story of the Hare with many friends —none hate him, because all love him to eat. His only faithful friends are his four fast legs and his fecundity.

The eagles are among the most dangerous foes. Harry Wells, of Clayton, N. M., says that in the Canadian River country eagles are very destructive to Texan Jack-rabbits when they can find them on the open prairie, but when under a bush, no matter how small, the eagle will not swoop at them. Doubtless the king of fowls has learned this discretion from numerous sad experiences with Spanish bayonet, cactus, and barbed-wire fencing.

Hamlin Garland tells me that on the Colorado Plains he once saw a Jack-rabbit pursued by a hawk. The Jack made for a barbed-wire fence, and, dodging through, back and forth beneath it, easily defied its pursuer.

The Fox is another enemy to be dreaded, chiefly, however, by the young; it is unlikely that it often secures a full-grown Jack. Dr. S. J. Thompson has given an incident that shows how this foe may be discomfited.

* Trans. Card. Nat. Hist. Soc., Pt. II, 1894-5.

While driving near Neepawa one day Dr. Thompson saw a Jack-rabbit that bounded along a prairie ridge, then suddenly squatted under a tussock. A Fox appeared close at hand; he also had seen the Rabbit, and slunk out of sight into a hollow, along which he ran as fast as he could, so as to come under the place where the Jack was sitting. As soon as he was within 50 yards Reynard commenced an elaborate stalk, like a cat, crawling on his belly till he was within 15 feet of the unconscious Rabbit. He was now as close as he could get undiscovered; so carefully placing each foot he braced himself and made a grand leap, but fell short. The Jack was so alarmed that at first it seemed to loose its head; jumped about back and forth and high in the air for a few times, but before the Fox could close, it got under way, and off they went. Within 100 yards the Fox was left far behind and gave up the chase.

DISEASES

A deadly epidemic of some sort has appeared more than once among the Prairie-hares in the far West, when they have been unduly multiplied, but I have not heard of this occurring among those in Manitoba. The whole family, however, is notoriously beset by many diseases. A. S. Barton writes: "We have not eaten any of them for years; so many have on the back a cyst full of watery fluid and quantities of white eggs, which I take to be the eggs of tape-worm. This disease, or whatever it is, does not affect the condition of the animal in the least." On February 25 ('07) I opened a 2-inch cyst on the side of a large male White-jack in Wyndygoul Park; on March 14 I opened a much larger one on the same animal. It contained about 2,000 embryonic tape-worms, the size of No. 6 shot. The cyst was 5½ inches by 3½ by 2 inches high. The Jack seemed indifferent alike to cyst, worms and operation.

Dr. T. S. Palmer, in his report on the Jack-rabbits, says:[10]

"Many persons have a prejudice against eating Jack-rabbits because the animals are infested, at certain seasons, with parasites, or because the flesh is supposed to be 'strong.'

[10] U. S. Dep. Agr. Bull., 8, 1896, pp. 71–2.

This prejudice, however, is entirely unfounded. The parasites of the Rabbit are not injurious to man; furthermore, the ticks and warbles occur at a season when the Rabbit should not be killed for game; while the tape-worm can only develop in certain of the lower animals, *e. g.*, in the dog or the Coyote. The most important parasites of the Jack-rabbit are ticks (*Ixodes*),

FIG. 181.—Prairie-hare with horns, each about 3 inches long. The specimen was taken in Pierre, Dakota, and is now in the collection of L. G. Fisher, of Chicago.

the larvæ of a fly (*Cuterebra*), and of a tape-worm (*Tænia*). Ticks are especially troublesome during the summer, and may sometimes be found clustered about the ears in great numbers. A large fly of the genus *Cuterebra* attacks these Hares as it does the Deer, Squirrels, and Wood-rats, and punctures the skin in order to find a suitable place to lay its eggs. The egg hatches soon after being deposited, and the parasite larvæ, becoming incased in a capsule immediately beneath the skin of its host, forms a lump sometimes an inch or more in length, which is usually known as a 'warble.' These warbles are most often seen in July or August. The larva emerges from its case in due time as a perfect insect, and the wound heals, leaving little or no scar. On some of the Rabbits brought to market

large 'water blisters' or 'boils' are occasionally found, which are the larvæ of a tape-worm (*Tænia serialis*). This larva is called *Cænurus serialis*, and has been found in the California Jack-rabbit (*Lepus californicus*), the Prairie-hare (*L. campestris*), the Old World Hare (*L. timidus*) and Rabbit (*L. cuniculus*), the coypu of South America (*Myopotamus coypu*), a species of Squirrel (*Sciurus*), and in the horse. *Cænurus* does not develop into the adult tape-worm in any of these animals; but in the dog and the Coyote, which eat many Rabbits, it reaches the adult stage."[11]

The Whitetails in my grounds have died from enteritis, pneumonia, and what I took to be hemorrhagic septicæmia.

HORNED RABBITS

Rabbits with horns are frequently found in the dry region of the West. These horns are a disease, said to be a sort of growth caused by the irritant power of a skin mite. I had seen several Cottontails so afflicted, and had heard of Black-tailed Jacks that were 'horny,' so that I was not surprised to learn that L. G. Fisher, of Chicago, had a horned Prairie-hare in his collection. He courteously permitted me to make the accompanying sketch (Fig. 181), but the specimen was in a sealed case, so that I could not complete the examination. The growth seemed to be of real horn and had no resemblance to the growths I have hitherto seen on Rabbits.

AGE

What age do they reach? Analogy is our only source of light here. Cowper's tame Hares of the British species lived, respectively, the male 8½ years, the female 10 years. Miller Christy tells me that he knew of an English Hare that lived 12 years in captivity.

SERVICE TO MAN.

When in point, I have concluded each biography with a consideration of the creature's value, or service to man. In the present case, this is not evident in material form. The Prairie-hare's pelt is so fragile, in fur and in hide, that it

[11] This list of hosts of *Tænia serialis* was furnished by Dr. C. W. Stiles, U. S. Dept. Agr.

does not constitute an acceptable barter stock, even where the fur-trade rivalry is keenest. The flesh is wholesome food, but has never achieved any popularity. It may yet establish itself as desirable game, to which high rank all sporting men should aim to help it as a measure of protection. But in making such apologetic enumeration of possible virtues, I feel myself guilty of something like special pleading, of making an appeal to the earthy jury, 'called law-makers'; for after all, its claim strongest with the lovers of the wild things, certainly with myself, is this—that, like so many I would save, without being able to prove their economic worth, the Hare is an exquisitely beautiful creature, an ornament to the plains, a delight to behold. I would preserve it, and a hundred others, even as I would preserve a beautiful picture, or view, for the unsordid joy of feasting the eyes on a sentient fellow creature, that is a little pinnacle on the cathedral of evolution, and glorious as an exemplar of beauty in the wild way of life.

FIG. 18a—Tail-pieces of four species.
I. Prairie-hare. II. Black-tailed Jack. III. Snowshoe. IV. Cottontail.