

by J. Dewey Soper

**The mammals of
Waterton Lakes
National Park
Alberta**



**Canadian
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Service
Report Series
Number 23**



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Wildlife Service

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Service de la Faune

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Canadian Wildlife Service
Report Series Number 23

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The author

J. Dewey Soper is recognized as one of the senior authorities on mammals in Canada, especially in connection with Alberta and the eastern Canadian Arctic. He is also an accomplished ornithologist. Born on a farm near Guelph, Ontario, on May 5, 1893 he moved to the West in 1912. After higher education at Alberta College and the University of Alberta, Edmonton, he was appointed naturalist to the Canadian Government Arctic Expedition of 1923.

In 1929, during an 8-year period of arctic wildlife research and explorations for the federal government, he discovered the long-sought breeding grounds of the Blue Goose (*Chen caerulescens*) along the Foxe Basin coast of western Baffin Island. He was subsequently honored by the Canadian government in establishing the Dewey Soper Bird Sanctuary in that district.

After a 2-year faunal survey of Wood Buffalo National Park in the early thirties, Dr. Soper was appointed, in turn, Chief Federal Wildlife Officer for the Prairie Provinces and the Yukon and Northwest Territories. During his long career he has discovered several races of mammals and birds new to science, most of which were named after him. As a contribution to exact scientific knowledge, he has collected over 10,000 specimens of Canadian mammals and birds. He retired from the federal service in 1952, but is still a member of several professional societies.

In all, Dr. Soper has published 32 articles and brochures on the mammals and birds of Alberta. His best known work is his definitive book, *The mammals of Alberta*, published in 1964 by the government of Alberta. In addition, he has published 84 popular and scientific works on birds and mammals of various Canadian regions, together with track surveys and articles on general exploration in central and southern parts of Baffin Island. He was awarded an honorary LL.D. by the University of Alberta in 1960 where he presently holds an appointment as Honorary Research Zoologist. At present Dr. Soper is working on a private autobiog-

raphy and also engaged in producing an extensive series of 8- by 11-inch watercolour paintings dealing with wide-ranging subjects of historic interest in the Canadian Arctic based on photographs he took nearly a half-century ago.

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No protracted undertaking can be engaged in, or brought to a successful conclusion, without moral mainsprings and material assistance from a number of agencies, kind colleagues and other persons. First, I feel greatly indebted to the University of Alberta, Edmonton, for years of motivation and financial support concerning my biological work in Waterton park and elsewhere in the Rocky Mountains and foothills. It is a pleasure to especially identify these benefactions with fellow zoologists J. Ralph Nursall (former Head), William A. Fuller (Chairman) and Victor Lewin, Department of Zoology, Edmonton.

The park research work could not have been furthered without the help of J. R. B. Coleman, Director, National and Historic Parks Branch, in providing the necessary suggestions, scientific permits and directives year after year; assistance was also received from other officers of the branch—W. Winston Mair, R. D. Muir and G. M. Stirrett.

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Natural History Branch, National Museum of Canada, Ottawa; David A. Munro, former Chief, Canadian Wildlife Service, Ottawa; and CWS biologists John P. Kelsall, R. H. Mackay and Donald Flook.

Abstract

The aim of this publication is to present for the first time a relatively full field account of the mammals of Waterton Lakes National Park, Alberta, together with descriptions of the existing environmental niches. As introductory matter, chapters are provided on park history, geography and geology, climate, faunal life zones and relative abundance of mammals. Systematic accounts of the latter range from shrews to big game animals.

A total of 55 species are dealt with under subheads in regard to subspecies, measurements, status, habitat and reproduction, followed by general remarks. Commentaries are given on six hypothetical species. The report terminates with a reference list of 65 papers by numerous authors having a direct or indirect bearing on the mammals of the park.

Résumé

Le but de la présente publication est de donner, pour la première fois et d'une façon relativement complète, le compte rendu d'une étude sur le terrain, relative aux mammifères du parc national des lacs Waterton (Alberta), ainsi que des descriptions de niches écologiques actuelles. A titre d'introduction, certains chapitres touchent l'historique du parc, sa géographie et sa géologie, son climat, ses biotopes et l'abondance relative des mammifères qui s'y trouvent. Les exposés systématiques sur ce dernier sujet couvrent une grande variété d'animaux, de la musaraigne au gros gibier.

Au total, 55 espèces font l'objet de l'étude, qui est divisée en articles ayant trait aux sous-espèces, à la taille des animaux, à leur rang, à leur habitat et à la reproduction, et suivis de remarques générales. La publication comporte de plus des observations sur

six espèces hypothétiques. Le compte rendu se termine par une liste de 65 ouvrages de références écrits par de nombreux auteurs ayant tous un rapport direct ou indirect avec les animaux du parc.

Introduction

Unique among wilderness reservations in Canada are the national parks in the Canadian Rockies. Here lies the springhead of vast natural beauty, multiform kinds of wildlife, flowering plants and other perpetual attractions of both popular and scientific appeal. Park visitors can pursue diverse interests—including sightseeing, photography, zoology, botany and geology—in the unspoiled surroundings of some of the world's most extravagant scenery.

Waterton Lakes National Park had its beginnings in 1895. That year the government set aside 54 square miles in the lake district of southwestern Alberta where there were suitable conditions for camping, picnicking, boating, fishing and general enjoyment of the mountains. The area was popular from the start. More and more people trekked in by every means of early conveyance from horses to Model T Fords. Over the years the park area was expanded and boundaries relocated, but the 49th parallel of latitude had long been, and continued to be, the southern boundary.

Through legislation enacted by Canada and the United States in 1932, Waterton Lakes and Glacier National parks were proclaimed the Waterton–Glacier International Peace Park. The two parks are joined across the Alberta–Montana border by the Chief Mountain International Highway that runs from Montana through Waterton park to the road junction at Maskinonge Lake. The present boundaries enclosing an area of 204 sq miles were settled upon by order-in-council in 1947. Unlike Banff and Jasper parks, also on the east slope of the Rockies, Waterton park was never served with a railroad. The park can be reached in comfort, however, over excellent highways.

Sometime before and almost immediately after the creation of the original small park, mammals and birds received some attention from zoologists, but this merely scratched the surface. Lengthy periods went by in which no wildlife investigations were conducted by qualified naturalists. What limited inquiries were made in those times is discussed under "Historical review."

Some desirable gains were made from the 1920's to the 1940's, but a highly comprehensive knowledge of the park's fauna waited upon the future. Information was especially lacking about most of the smaller mammals. The big game animals were much better known through the special efforts of federal government biologists tied in with information gathered by alert wardens who patrolled the park's game areas all year round.

Much needed was a deeper study of the park mammals, big and little, followed by the preparation of a well-rounded report covering results from the earliest efforts of naturalists until the present. Having made extensive studies of the fauna for CWS (with subsequent publication) in several other national parks, I undertook the desirable Waterton investigations with the cooperation and support of the University of Alberta. The field work was carried out at various times during the spring and summer months from 1960 to 1965 under authority of special permits. These activities alternated yearly with parallel inquiries in Jasper National Park at different times of the same summer.

The project involved extensive travel by car and on foot, strenuous trapline operations at various levels and general collecting. The trap-nights aggregate amounted to 3,200. A total of 232 small mammals was preserved, together with several dozen birds. All were deposited in the permanent research collections of the Museum of Zoology, University of Alberta, Edmonton. Besides collecting, as much attention as possible was given to local ecology, especially the study of relative abundance, individual habitats, the broader aspect of life zones and reproduction. Substantial advancement in a knowledge of the park's mammalogy has been achieved, but a great deal remains to be accomplished by zoologists of the future.

Explanatory remarks

In the main body of the report each species receives individual treatment. First it is

given an English title, followed by the scientific name now in use. The former designations are taken from Hall's (1957) *Vernacular names for North American mammals north of Mexico*. The sequence of species and the adoption of most of the scientific names follow *The mammals of North America* by Hall and Kelson (1959).

Departures from that terminology are few. I am indebted to A. W. F. Banfield for informing me of the later changes brought about by recent monographic treatment; these are *Arvicola richardsoni* in place of *Microtus richardsoni*, *Vulpes vulpes* instead of *Vulpes fulva*, *Mustela nivalis* instead of *Mustela rixosa*. Some other name changes have been proposed, but due to lack of agreement on these by American authorities, the terminology of Hall and Kelson is employed herein.

Measurements are given in millimeters in the order of total length, tail vertebrae and hind foot, with some added figures for bats. Numerals in parentheses often following average measurements and weights are the extremes in these quantities found in the given series of specimens collected. Weights are presented in grams (g) for the smaller species and in pounds (lb) for the larger ones.

Unless otherwise indicated, measurements, weights, comments on gravid females, fetus counts, breeding and some other data have originated in my own findings. This applies as well to conclusions on status and habitats, upon which I bestowed much personal attention.

Such self-sufficiency, of course, does not meet all needs. Thus, I searched for published information under "Reproduction", especially with reference to many fur bearers and the big game animals. There is a rich North American literature on this and other subjects in the life history of species. Desired facts on breeding and gestation periods of various mammals, can often be found in the writings of such mammalogists as Seton (1925–28), Asdell (1946), Rand (1948a), Shadle (1951), Fuller (1956), and Hall and Kelson (1959).

Historical review

Under "References" all publications and manuscript reports are listed that were most useful to me in making a study of the mammals in and around Waterton Lakes National Park. Some have no direct bearing on the park as such, but were selected for their value as a source of information on general life history, the characteristics of regional physiography and other matters. The list is not exhaustive. For the general reader and student, a good source work on life histories is Seton's 4-volume publication, *Lives of Game Animals*.

An informative brochure dealing with many facets of the Canadian Rockies is Scharff's (1966) *Canada's Mountain National Parks*. Also not to be overlooked is the excellent account of the geology and topography by Baird (1964) entitled, *Waterton Lakes National Park—lakes amid the mountains*.

The authority for the botanical technical names used in my chapter, "Faunal life zones and vegetation" is that of Breitung's (1957) *Plants of Waterton Lakes National Park, Alberta*.

A total of 55 species of mammals are known to inhabit the park. Six others of only theoretical occurrence are dealt with under "Hypothetical species" at the end of the report.

Explorers, pioneers and general park history

Before the white man settled in the area of southern Alberta, then known as the Bow River District, Northwest Territories, it was the stronghold of the hostile Blackfoot Indian Confederation that stood as a buffer against the westward advance of the fur trader, the rancher and the settler for the greater part of the 19th century. During this period, very little was known of the Waterton park region except for the fascinating tales about the land of the "Shining Mountains" and the Indian description of the lovely "Omoksikimi" which in the Indian tongue means "beautiful waters" (Gladstone, 1961).

The first recorded exploration of the territory now embraced by Waterton Lakes National Park was made in 1858 by Lieutenant Thomas Blakiston. He was in charge of a detachment of the famous British Palliser Expedition engaged in exploring various routes through the Canadian Rocky Mountains. The party trekked through Red Rock Canyon, then up the valley of Pass Creek (now Blakiston Brook) and over the continental divide via South Kootenay Pass into British Columbia. Five miles to the southeast is the mountain named in Blakiston's honour—the highest peak in the park with an altitude of 9,600 ft.

Gladstone (1961) remarks:

Blakiston named the three lakes in honour of Charles Waterton (1782-1865), then famed English naturalist and traveller, from which the park derived its name. The International Boundary Commission arrived in the area a year or so after Blakiston's exploits and were engaged in surveying the boundary between the United States and Canada. Their investigations resulted in new knowledge of the region and their work is commemorated in the names given to many of the principal geological features of the park.

The first white settler in this territory was John George "Kootenai" Brown. He first visited the district in 1865 through South Kootenay Pass. Three years later he returned with his first wife, Mary, to settle

at Waterton Lakes for the remaining 40 years of his life. He homesteaded a quarter section of land where he built a log house 12 by 36 ft in size on the border of Blakiston Brook where the stream joins Dardanelles near Lower Waterton Lake. Brown was chiefly instrumental in persuading the territorial government to establish the park in 1895. He was then appointed as game guardian and fisheries inspector and, on April 13, 1910 was made forest ranger and park administrator. This position he held until his retirement in September 1914. He died about 2 years later and was buried between his first and second wives along the west shore of Lower Waterton Lake.

Waterton was among the first Canadian parks to be created. At first it was very slow to develop because the nearest railway bypassed it at a distance of about 35 miles. At that time no adequate road led to the park—only a wagon trail through the plains and foothills to Waterton Lakes. Moreover, no bridges spanned the rapid creeks and rivers and fording the streams was always a nuisance, often difficult and sometimes dangerous.

The discovery of local oil seepages in 1886 caused a flurry of excitement and a stream of speculators. In 1891 the first Dominion Geological Survey party under J. H. Selwyn arrived in the area to investigate the reported traces of oil. During 1901 several test holes were sunk and some little oil found at varying depths.

Alberta's first producing oil well was situated about 5 miles west of the Waterton townsite along the present Akamina Highway leading to Cameron Lake. Oil was struck there at 1,020 ft and a total of 8,000 gallons pumped out. Some pieces of weathered equipment may be seen to this day at the drilling site, but the old village layout is now completely obliterated by the new forest growth of trees and underbrush.

Gladstone (1961) mentions

The Waterton Lakes were always very popular for sport fishing; so popular that, in 1920, a Dolly Varden trout was chosen as the design for

the transient automobile stickers for Waterton Park. Early residents of Southern Alberta enjoyed the popular sport of fishing on the main lakes and in the tributary streams even before the establishment of the park. The species native to these waters were: whitefish, Rocky Mountain whitefish, lake trout, cutthroat trout, dolly varden trout, northern pike and even ling and suckers...In 1927, a small fish hatchery was erected in the park and after that time continuous plantings were made in park waters.

The first survey of 150 building lots was made by W. F. O'Hara, Dominion Land Surveyor, in November 1910; the lots were located along the lakeshore in the present townsite. This section of the flats had been a favourite camping grounds for many years. The first small hotel was built in 1911 and a new dance hall in 1926. A stately hotel of notable design, styled after a Swiss chalet, was erected in 1926-27 by the Great Northern Railway Company of the United States. The availability of high-class tourist accommodation introduced a new era in the history of Waterton park.

For almost a half century the park had provided a holiday paradise for the residents of Cardston, Pincher Creek, MacLeod and Lethbridge, as well as for ranchers and farmers from wide areas of southern Alberta. But until the 1920's it was practically unknown outside of those areas because of the absence of a railway, good all-weather roads and advertising. Once the two latter shortcomings were corrected, park development and tourist attendance went steadily ahead.

From about 1925 on, scarcely a year went by without the addition of buildings and other improvements in the townsite and the construction of new highways, bridges, secondary roads, foot and fire trails, kitchen and other shelters, warden cabins and enlargements of the golf course and camp grounds. The most pronounced quickening in the life of the park took place after 1946. Tourist attendance partly illustrates this headlong change. In 1914, the number of park visitors was only 2,000; by 1960 this had climbed to an annual attendance of over

349,000 persons and by 1966 to nearly 488,000; recent annual visitor increases have been as high as 23.9 per cent.

Naturalists past and present

In the early days, the Waterton area—unlike the present Jasper and Banff national parks—lay in a quiet backwash little known or disturbed by early explorers, fur brigades and scientists. In the Jasper country, white men were already actively travelling via Athabasca and Yellowhead passes in the early part of the last century. David Thompson and David McGillivray visited the Banff region in the summer of 1800 and, soon after, east-west-bound parties were going and coming via Howse and Kickinghorse passes.

By contrast, the Waterton Lakes territory received its first white explorers—the Captain John Palliser Expedition—over a half century later. So far as we know, the first qualified naturalist to reach this land was the noted American biologist, Dr. Elliott Coues, who in 1874 worked along the international boundary as far, at least, as "Chief Mountain Lake" (Upper Waterton Lake). Here he studied the wildlife and collected specimens of birds and mammals; some of these proved to be races new to science. His investigations carried him for some miles along Upper Waterton Lake in both Montana and Canada. Thus, all notes and specimens gathered along the latter portion of the lake became the earliest faunal records for the area that 21 years later was to become Waterton Lakes park.

The next wildlife observer in the district was the well-known William S. Spreadborough who, in June and July, 1895, made a collection of mammals at Upper Waterton Lake, Thirty-mile Spring, Spur Creek and Castellated Rock for what is now the National Museums of Canada. Spreadborough practised his skills as a master camper, wilderness traveller and faunal collector from one side of Canada to the other. Down the years he was usually in association with the famous naturalists, John and James Macoun. As Taverner (1933) re-

marked: "Henceforth in all his subsequent associations with the Macouns, while they botanized it was Spreadborough's part to collect and prepare birds, mammals and other such material that came his way."

Visiting zoologists were, at first, few and far between. After Spreadborough came the highly skilled animal preparator, Charles H. Young, National Museum of Canada, who collected mammals and birds from May 15 to September 23, 1922. The following year he again observed and collected in various parts of the park from May 9 to September 26. In this early stage of faunal research Young's notes and specimens materially advanced our knowledge of the park's wildlife.

During August, 1938, R. M. Anderson devoted himself to general investigations of park quadrupeds, spending part of the time near Cameron Lake making a collection of small mammals. During the 3rd week of the month I stayed at his camp and joined in similar activities. One of the most interesting finds of the time was the abundance of the red-tailed chipmunk (*Eutamias ruficaudus*) between Cameron Lake and Akamina Pass. On August 21, in the latter locality at 5,835 ft, we obtained the first record of the species for British Columbia by taking a specimen a few yards west of the continental divide.

The following year C. H. D. Clarke carried out some investigations for the National Parks Bureau; a copy of his wildlife field-notes was deposited with the National Museum of Canada. From July 27 to August 13, 1945, A. L. Rand (National Museum of Canada), with student assistant Howard Clemens, studied birds and mammals in the park and later incorporated the ornithological notes in Rand's (1948) bulletin, *Birds of Southern Alberta*. The same year I. McT. Cowan (unpublished data) spent 2 weeks in Waterton making a study of the wapiti situation for the National Parks Service.

Between July 30 and September 10, 1947, A. W. F. Banfield, CWS, conducted important inquiries in the park, primarily in

connection with the status and ranges of the larger quadrupeds. The annotated list in his 1947 report also contains a total of 35 species of smaller mammals, all then known to occur. This was the best treatise on the park mammals to have appeared. Additions to the list and general life history information slowly accumulated.

An important natural history event took place in the park during July and August, 1953—a botanical survey of the area by August J. Breitung of the California Institute of Technology, Pasadena, whose collections totalled over 2,000 catalogue entries, which with duplicates, made up into approximately 7,000 herbarium sheets. Earl Godfrey, National Museum of Canada, spent a short time on bird observations in Waterton in July, 1956, and S. D. MacDonal, of the same institution, devoted several weeks to faunal observations and collecting there during May and June, 1965. Temporary park naturalist, F. Sudol, did a little collecting in 1962, and in 1966 park naturalist, K. E. Seel, added to the park's natural history collection a number of specimens specifically referred to later.

I conducted my operations in Waterton Lakes National Park during the years 1960 to 1963 inclusive, and in June 1965. Investigations were carried out in 11 principal areas, each averaging between 4 and 5 sq miles. Extensive attention was given to four other localities, far from camp and attainable only on foot, but where no small mammal traplines were laid down.

Valuable findings also often resulted from exploratory hikes into many different and relatively distant habitats which were usually visited only once. In all, about 70 sq miles were more or less intimately examined for their wildlife by way of binocular observations, collecting and extensive small mammal traplines. About a third of every 14-hour day was spent on the preparation of research specimens. Much additional faunal information was obtained from park wardens in various districts.

The author's chief study areas are listed by seasons as follows:

1960 (July–August): Cameron Creek below Cameron Lake (5,440 ft); Akamina Pass (5,835 ft); the confluence of Lost Lake Creek and Bauerman Brook (5,500 ft); Twin Lakes (6,500 ft); Lost Lake (6,300 ft) and Belly River near the international boundary (4,500 ft).

1961 (July–August): Blakiston Brook near Lost Horse Creek (4,800 ft); Belly River near Indian Creek (4,400 ft).

1962 (June): Waterton River at north boundary (4,200 ft); Indian Springs (4,500 ft); Blakiston Brook north of Ruby Ridge (4,700 ft).

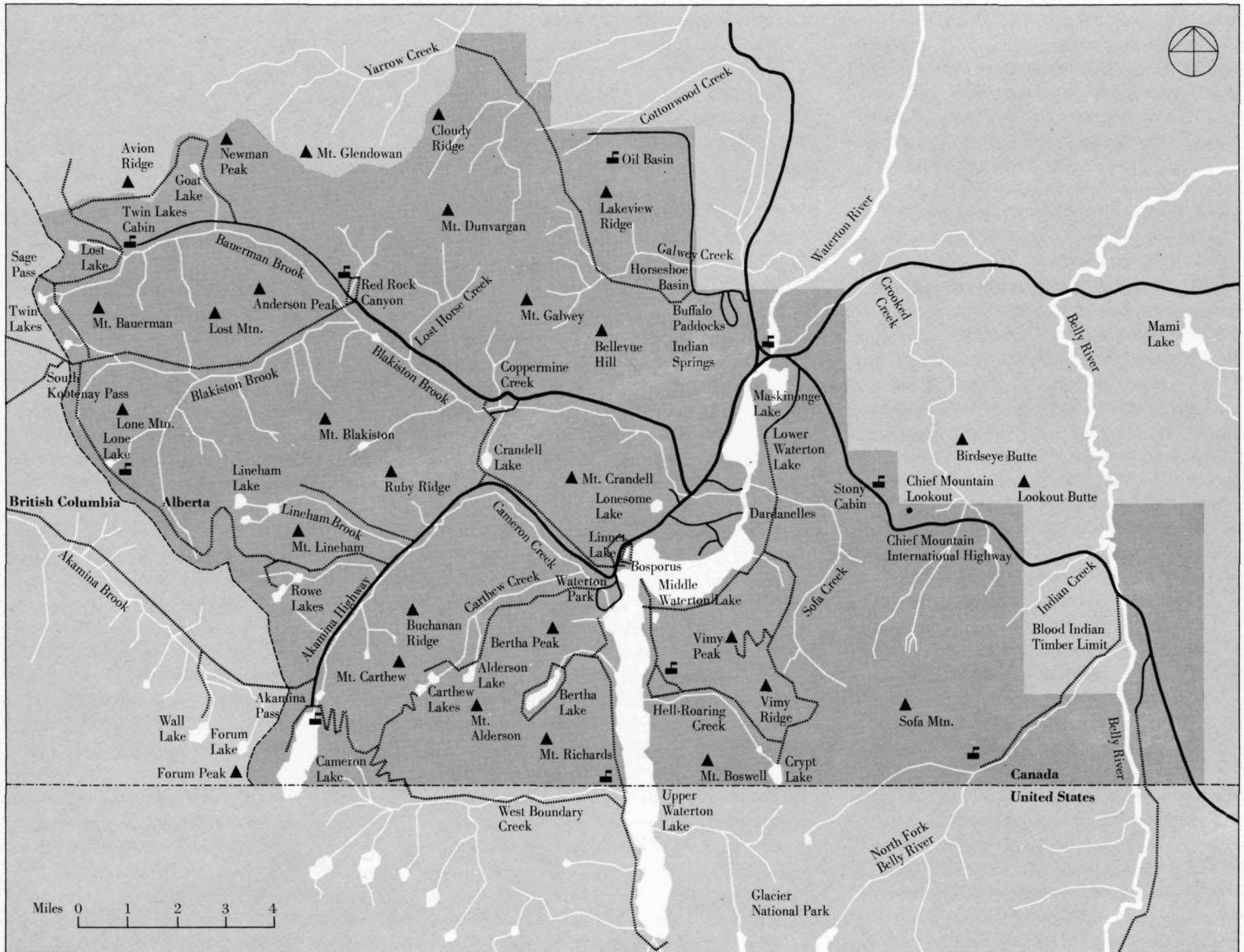
1963 (June–July): Cottonwood Creek at Oil Basin (4,800 ft); Sofa Creek near Lower Waterton Lake (4,300 ft).

1965 (June): Yarrow Creek, northern extremity of park (5,000 ft); Chief Mountain Lookout—Crooked Creek locality (5,000–5,500 ft).

Study area

Figure 1. Map of Waterton Lakes National Park, Alberta.

Figure 1



Legend

- Highway
- Secondary Road
- Walking or Hiking Trail
- Park Area
- Lake
- Mountain
- Warden's Cabin

Physical geography and geology

Waterton Lakes National Park is situated in the extreme south-western corner of Alberta in a highly attractive section of the Canadian Rocky Mountains (Fig. 1). The area is 204 sq miles.

The park is bounded on the south by the international boundary, which is also the northern limit of Glacier National Park, Montana. The western boundary is defined by the tortuous continental divide at the local eastern limits of British Columbia. The northern and eastern boundaries are laid down along Avion and Cloudy ridges and on survey lines stair-stepped to the southeast in foothills, prairie, coniferous forest and aspen parklands to the Alberta-Montana border east of Belly River.

Unlike any other park in the Rockies, part of the eastern mountains soar almost abruptly from the adjoining plains. Westward lie the huge mountain masses that have made the region famous for its spectacular ruggedness. Some of the major eminences are Ruby, Buchanan and Vimy ridges and Sofa, Alderson, Carthew, Blakiston, Anderson and Dungarvan mountains. These range in altitude from nearly 8,000 to over 9,000 ft. The continental divide lies at elevations similar to neighbouring peaks east and west. The more notable passes along the divide are Akamina (5,835 ft), South Kootenay (6,903 ft) and Sage Pass at about 7,900 ft.

On the regional cordillera Baird (1964) remarks:

The mountains are sculptured from a great thickness of sedimentary rocks which were laid down in the seas that covered this part of North America more than a thousand million years ago, in a period of time which the geologist refers to as "the Precambrian". In some places the rocks are flat lying, even in the highest mountains; in others they are standing on edge or are intricately folded. In places they show great "faults", or breaks along which one mass of rocks has ridden up over another. Deep erosion into this complicated mass of rocks has resulted in the array of mountain peaks—some with sharp jagged tops, others resembling castles

or layer cakes, and still others, with rounded contours. The sides of some of the mountains, extending as they do through thousands of vertical feet, expose many varieties of sedimentary rock and, here and there, thin sheets and masses of igneous rocks which at one time were molten.

Glaciation has been largely responsible for the notable carving of rocks seen in present-day topography. The ponderous scouring of ancient glaciers produced many rounded trenches, hanging valleys and passes and, also, smooth lake basins and cirques. Many of the rocks are vividly coloured in cream and brown through greenish and mauve tints, to dominant reds.

Attractive colour and form are everywhere. At the greater heights deep snow accumulates in surface irregularities, and much of it remains unmelted until the latter part of July, often mixed with avalanche debris and wind-blown sand and gravel. About this time, or in early August the last of the old ice is slowly melting away in the high altitude lakes. Some are ice-free somewhat earlier.

The territory drains eastward from the Rocky Mountains. Principal park streams are Waterton and Belly rivers that flow via South and North Saskatchewan and Nelson rivers to Hudson Bay. Most of the park's drainage goes by way of Waterton River which is fed by a multitude of springs, brooks and creeks. The leading tributaries are the well-known Bauerman and Blakiston brooks and Carthew, Cameron, Galwey and Cottonwood creeks. During spring freshets and after heavy rains most of the fast descending streams become roaring white water torrents of great power and potential destruction. At times the townsite is seriously threatened by Cameron Creek and the rising level of Waterton Lakes. At the other extreme, during the heat and diminished rainfall of mid summer, many streams become very shallow and race around gravel bars, stones and boulders.

The park derives its name from the chain of lakes resting in its mid-section. The largest of these is Upper Waterton Lake

(4,193 ft) lying in a deep mountain trench extending south for 5 miles in the park and then for several miles across the international boundary; it is about 9 miles long, ½ mile wide and up to 400 ft deep. Immediately beyond this to the northward is Middle Waterton Lake, followed by Lower Waterton and Maskinonge lakes, all drained by the broad Waterton River.

Aside from these, the largest body of water is Cameron Lake, in the extreme south-west, at an altitude of 5,445 ft. Many charming small lakes and tarns nestle high among the ranges, some in subalpine and timberline situations and others in tundra meadows and singular alpine valleys. Among these gems are Crypt, Bertha, Alderson, Carthew, Lineham, Lost and Twin lakes.

All creeks leaving these lofty bodies of water are clear, ice-cold and tumultuous. Especially turbulent are streams originating at, or relatively near the continental divide. Several descend 1,000 to 2,000 ft, or more in the course of from 5 to 10 air miles. Regional topography has given rise to many picturesque waterfalls, the best known being the much photographed Cameron Falls on the western border of Waterton townsite. Many lovely unnamed falls and cataracts, not shown on park maps, exist here and there. An example is the pair at the head of Crooked Creek, on the north slope of Sofa Mountain, at about 5,500 and 6,000 ft respectively. Wild, white water characterizes Hell-Roaring Creek which, starting at Crypt Lake, drops about 2,300 ft to Upper Waterton Lake in a distance under 4 miles.

Climatic conditions and seasonal events

Mean annual temperatures and weather conditions in general profoundly affect wild-life of all kinds. Weather conditions, related to latitude and altitude, introduce manifold climatic variations and much diversity in the character of environments. General biotic results are readily noted with respect to occurrence, distribution, reproduction, hibernation, estivation and other phases of existence. Should climatic

conditions become inimical to any species in a given situation, ordinarily that species would have to move on, or forfeit chances for survival.

The climate of Waterton Lakes National Park is characterized by relatively short, warm, dry summers and long, cold winters. At times, however, the winter is modified by warm, westerly chinook winds which can obliterate several inches of snow within a few hours. As a rule, the ground is frozen from about mid October until sometime in April. Temperatures drop decidedly with an increase in altitude. This markedly affects various mountain phenomena, including the length of the growing season at any given height from lowlands to high tundra.

The earliest, subtle manifestations of spring appear in late March and early April. At this time temperatures vary between about 26°F and 40°F (Table 1), but some years early March temperatures have dropped to as much as -20°. Occasional heavy snowfalls occur in these months; what with some rain, total precipitation normally amounts to little over 3 inches. Average wind velocity is about 9 miles per hour, but maximum, short-lived speeds are occasionally registered at from 32 to 55 miles per hour. In early April especially the earliest wild flowers burst into bloom, many migratory birds arrive and several species of mammals terminate their winter-long hibernation.

Summer arrives in May and June—after many tentative advances and retreats, vagrant cold and warm winds, occasional light snowfalls in early May and temperatures ranging from about 37 to 66°F. Mean precipitation is between 4 and 6 inches, most falling in June. Average wind velocity is 9 to 10 miles per hour, with maximum speeds similar to those of March and April. A gay profusion of wild flowers bloom; deciduous trees and shrubs burst into leaf; the last of the avian migrants arrive, sing and nest; and many kinds of mammals react with renewed vigour, reproduce and care for their progeny.

July and August are mostly pleasant and warm with little rainfall and temperatures usually varying from around 50 to 75°F.

During the hottest part of the summer, however, high recordings reach from about 83° to 95°F and in open valley situations temperatures can exceed 100°F. Despite periods of sultry weather the nights are invariably cool. Summer, in fact, is the season when temperature extremes are most pronounced. Winds sometimes gust to 49 miles per hour.

While low terrain may be sweltering in heat, the alplands (3,500 to 4,500 ft higher) are moderately warm or cool and sometimes visited by boisterous winds and light snow squalls. Occasionally deep snowbanks from the previous winter persist on high, northern slopes throughout the summer. Autumn and winter arrive in the timberline country much sooner than in the Waterton Lakes lowlands and prairies.

The autumn months of September and October are normally most agreeable and invigorating, enhanced by the fragrant tang of the woods and the vivid autumn colouring. The prevailing temperatures are pleasant at about 40° to 60°F. There are recurring nights of freezing in both months, but occasionally, even in October, temperatures have briefly climbed as high as 80°F.

The cold-sensitive Columbian squirrels disappear for the winter by early September followed by many other species within the next 6 to 8 weeks. Most migratory birds leave the country by the early half of October, some hardy ones lingering on a little longer. The last native flowers perish from frost and cold well before this.

Not uncommonly, November offers some sunny, mild weather with recordings as high as 55° to 60°F, although the long-term mean is only about 31.2°F. For the 3 autumn months rainfall is a moderate 5.7 inches. Snowfall is about 43.9 inches, most falling in late November. Total annual precipitation for the 3 months averages 9.33 inches (Table 1). During this part of the year the annual rut of the deer family is in full swing; hibernating species, except for some black and grizzly bears, have disappeared for the winter; and only a few winter species of birds tenant the silent forest.

Over the long weeks of snow and cold of the winter months, bitter winds commonly harass the region at average speeds of 15 to 18, but sometimes reach 75 or more miles per hour. Monthly mean temperatures are: December, 23.61°; January, 18.16; and February, 24.90°F. Of late years the lowest temperature recorded was -33°F. Table 1 shows the many variables.

Rainfall for the 3 winter months averages 1.10 inches; snowfall, 34.3 inches; and total precipitation 4.01 inches. In the 5-year period employed here, the heaviest snowfall occurred in January, 1966, with a total of 80 inches, the next heaviest in December of both 1964 and 1965, each with a total of 53 inches. Astronomically, winter's end comes with the vernal equinox (March 20-21), but during the latter part of that month periods of frigid, inclement weather can still prevail, surrendering at last to potent spring temperatures during the sunny weeks of April.

Faunal life zones and vegetation

The occurrence and general distribution of mammals and other forms of wildlife is largely controlled by climatic and physiological conditions seriously or even critically important to the rank and file of living organisms. Any kind of mammal is found in the kind of environment for which the mammal's age-old adaptation entirely suits it. The character of any habitat is the sum total expression of mean annual temperature; altitude; kind, quantity and availability of foods; vegetational cover or the lack of it; denning possibilities; breeding conditions and other such indigenous factors.

Over a wide continental land mass infinite combinations of natural conditions exist which determine the character of local faunas. Most regions—and Waterton Lakes park is no exception—display several distinct kinds of environment. Zoologists refer to these major divisions, with respect to physical geography, wildlife and floral aggregates, as faunal life zones.

The character, location and extent of these life zones is governed to a large degree

Table 1
Waterton Lakes National Park, temperatures and precipitation, January 1962 to December 1966

Month	Daily mean minim. temp. Fahr.	Daily mean maxim. temp. Fahr.	Monthly mean	Aver. rain-fall inches	Aver. snow-fall inches	Aver. precipitation inches
January	11.02	26.05	18.16	.62	44.9	4.84
February	17.05	33.93	24.90	1.66	21.4	2.89
March	17.83	35.23	26.18	1.01	28.1	3.63
April	30.06	48.38	39.83	1.79	27.6	4.15
May	37.65	57.63	48.58	3.67	3.0	3.91
June	46.02	65.22	55.08	5.78		5.88
July	50.76	73.88	64.77	1.35		1.35
August	49.11	71.14	60.39	1.84		1.84
September	41.88	60.76	51.82	2.64	14.5	3.51
October	39.64	56.38	47.28	1.36	5.5	1.71
November	24.98	38.43	31.26	1.70	23.9	4.11
December	15.68	31.44	23.61	1.02	36.8	4.30
Yearly average				24.44	205.7	42.12

by latitude and altitude. Four life zones occur in the park known respectively from the lowlands to the mountain heights as Transition, Canadian, Hudsonian and Arctic-Alpine life zones.

Transition Life Zone

This zone lies at the lowest local elevations (about 4,190 to 4,500 ft) and tends, therefore, to have the highest mean annual temperatures. It is especially characterized in Alberta by treeless shortgrass plains and prairielands sprinkled with small groves or larger woods of aspen poplar (*Populus tremuloides*). The latter areas are commonly referred to as parklands. Most of the relatively few prairie-parkland tracts in Waterton park are located west and northeast of Lower Waterton Lake and northward to Indian Springs. Various other small, isolated parkland areas are within, or near, the park's north-central and northeastern boundaries.

Another common tree is the black cottonwood (*Populus trichocarpa*) that thrives along the shores of lakes and streams. In similar locations some western birch (*Betula occidentalis*) occurs, together with

mountain alder (*Alnus crispa*) and several willows such as *Salix caudata*, *S. discolor* and *S. interior*.

A few other characteristic plants of the zone include starwort (*Stellaria alpestris*), wild onion (*Allium cernuum*), delphinium (*Delphinium bicolor*), pincherry (*Prunus virginiana*), pasque flower (*Anemone patens*), serviceberry (*Amelanchier alnifolia*), shrubby cinquefoil (*Potentilla concinna*), wildrose (*Rosa acicularis*), silverberry (*Elaeagnus commutata*), Indian paintbrush (*Castilleja lutescens*), snowberry (*Symphoricarpos albus*), bluebell (*Campanula rotundifolia*) and fringed sagebrush (*Artemisia frigida*).

Some typical park mammals of this zone are
Masked shrew (*Sorex cinereus*)
Little brown myotis (*Myotis lucifugus*)
White-tailed jack rabbit (*Lepus townsendii*)
Yellow-pine chipmunk (*Eutamias amoenus*)
Richardson's ground squirrel (*Spermophilus richardsonii*)
Thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*)
Northern pocket gopher (*Thomomys talpoides*).

Deer mouse (*Peromyscus maniculatus*)
Meadow vole (*Microtus pennsylvanicus*)
Muskrat (*Ondatra zibethicus*)
Coyote (*Canis latrans*)
Long-tailed weasel (*Mustela frenata*)
Badger (*Taxides taxus*)
Bobcat (*Lynx rufus*)
White-tailed deer (*Odocoileus virginianus*)
Bison (*Bison bison*)

Canadian Life Zone

As distinct from lower terrain farther north, in the foothills and mountains, this life zone lies immediately above the Transition Life Zone, between the approximate altitudes of 4,500 and 6,000 ft. The mean temperature is somewhat lower than that of the Transition and exhibits genuine boreal characteristics. This is the most heavily forested of the several regional zones.

Highly representative trees are white spruce (*Picea glauca*), lodgepole pine (*Pinus contorta*), aspen poplar (*Populus tremuloides*) and Douglas fir (*Pseudotsuga menziesii*). The mountain maple (*Acer glabrum*) is common along the banks of streams in some localities, together with occasional paper birch (*Betula papyrifera*). The mountain alder (*Alnus crispa*) is not uncommon and, likewise, several willows such as *Salix drummondiana*, *S. serissima* and *S. candida*.

Several species of the heath family occur, among them the pale laurel (*Kalmia polifolia*), Labrador tea (*Ledum glandulosum*), and bilberry (*Vaccinium caespitosum* and *V. membranaceum*). Other characteristic plants are common juniper (*Juniperus communis*), buffaloberry (*Shepherdia canadensis*), black currant (*Ribes lucustre*), red-osier dogwood (*Cornus stolonifera*), false Solomon's seal (*Smilacina racemosa*), buttercup (*Ranunculus gmelinii*), painted cup (*Castilleja hispida*) and lupine (*Lupinus sericeus*). The zone is rich in grasses and sedges.

Among the characteristic mammals of the Canadian Life Zone are
Vagrant shrew (*Sorex vagrans*)
Water shrew (*Sorex palustris*)
Varying hare (*Lepus americanus*)
Red-tailed chipmunk (*Eutamias ruficaudus*)

Columbian ground squirrel (*Spermophilus columbianus*)

Golden-mantled ground squirrel (*Spermophilus lateralis*)

Red squirrel (*Tamiasciurus hudsonicus*)

Beaver (*Castor canadensis*)

Bushy-tailed wood rat (*Neotoma cinerea*)

Red-backed mouse (*Clethrionomys gapperi*)

Heather vole (*Phenacomys intermedius*)

Long-tailed vole (*Microtus longicaudus*)

Western jumping mouse (*Zapus princeps*)

Porcupine (*Erethizon dorsatum*)

Black bear (*Ursus americanus*)

Marten (*Martes americana*)

Mountain lion (*Felis concolor*)

Wapiti (*Cervus canadensis*)

Mule deer (*Odocoileus hemionus*)

This zone holds most of the fur bearers and a high percentage of the big game animals. Many species inhabit both Transition and Canadian zones and some range at times all the way from the lowlands to the high tundras and mountain passes.

Hudsonian Life Zone

This zone—colder and more inclement than the Transition and the Canadian—winds around the mountain slopes between the approximate elevations of 6,000 and 6,800 and 7,000 ft. In this latitude, timberline usually occurs somewhere near 7,000 ft, but this can vary by several hundred feet in relation to sunny southern slopes, or cool mountainsides of northern exposure. The indeterminate lower limits of the Hudsonian zone blend very gradually with upper Canadian zone features. Its upper limit is the well-defined tree line on the lower border of the Arctic-Alpine zone.

With increasing altitude stands of trees become thinner, gradually more stunted and wind-twisted and finally disappear altogether at the true alpine tundra. The high altitude tree species here are alpine fir (*Abies lasiocarpa*), alpine larch (*Larix lylalii*), limber pine (*Pinus flexilis*), white-barked pine (*Pinus albicaulis*) and Engelmann spruce (*Picea glauca* var. *engelmannii*).

Fairly plentiful willows are *Salix commutata* and *S. vestita*. In some tracts the com-

mon juniper (*Juniperus communis*) spreads over dry inclines and benches and the cinquefoil (*Potentilla diversifolia*) finds congenial ground in subalpine meadows and on grassy slopes. A few of the typical flowering plants are spring beauty (*Claytonia lanceolata*), sandwort (*Arenaria capillaris*), anemone (*Anemone multifida*), buttercup (*Ranunculus eschscholtzii*), saxifrage (*Saxifraga occidentalis*) and gentian (*Gentiana propinqua*).

Some of the mammals regularly inhabiting this zone are

Vagrant shrew (*Sorex vagrans*)

Pika (*Ochotona princeps*)

Least chipmunk (*Eutamias minimus*)

Red-tailed chipmunk (*Eutamias ruficaudus*)

Golden-mantled ground squirrel (*Spermophilus lateralis*)

Heather vole (*Phenacomys intermedius*)

Water vole (*Arvicola richardsoni*)

Gray wolf (*Canis lupus*)

Ermine (*Mustela erminea*)

Wolverine (*Gulo gulo*)

Lynx (*Lynx canadensis*)

Moose (*Alces alces*)

Several Hudsonian zone mammals such as pika, golden-mantled ground squirrel, heather vole, ermine, lynx and wolf also inhabit or occasionally visit both the Canadian zone and Arctic-Alpine territory.

Arctic-Alpine Life Zone

This coldest of the biotic areas is subject to strong and frequent winds. Spring is late and winter early. The zone has the shortest summers and the longest winters of any lands within the cordillera. The local altitude is anywhere from about 6,800 or 7,000 ft up to altitudinal limits, but most higher life is adapted to habitats below 9,000 ft. Some of the singular features of this territory are the spectacular rock massifs, Arctic-like meadows and tundra, rock-slides, scree and permanent snowfields and glaciers.

The alplands, of course, are treeless, but low, nearly prostrate bushes abound in some areas. Woody plants are represented by such species as alpine willows *Salix arc-*

tica and *S. reticulata*, bearberry (*Arctostaphylos uva-ursi*), Labrador tea (*Ledum glandulosum*) and wintergreen (*Gaultheria humifusa*). Commonly occurring in some areas are fescue grass (*Festuca ovina*), alpine meadow grass (*Poa alpina*) and wood rush (*Luzula glabrata*).

During the summer showy beds of alpine flowers provide vistas of extraordinary beauty. Contributing to scenes of this nature are such flowering vascular plants as glacier lily (*Erythronium grandiflorum*), starwort (*Stellaria laeta*), alpine poppy (*Papaver pygmaeum*), saxifrage (*Saxifraga bronchialis*), mountain avens (*Dryas octopetala*), gentian (*Gentiana calycosa*), everlasting (*Antennaria alpina*), arnica (*Arnica alpina*), aster (*Aster sibiricus*), groundsel (*Senecio subnudus*) and dandelion (*Taraxacum lyratum*).

Mammals of regular or casual occurrence in the Arctic-Alpine zone include

Pika (*Ochotona princeps*)

Least chipmunk (*Eutamias minimus*)

Hoary marmot (*Marmota caligata*)

Columbian ground squirrel (*Spermophilus columbianus*)

Golden-mantled ground squirrel (*Spermophilus lateralis*)

Water vole (*Arvicola richardsoni*)

Grizzly bear (*Ursus arctos*)

Wolverine (*Gulo gulo*)

Mountain goat (*Oreamnos americanus*)

Mountain sheep (*Ovis canadensis*)

Mammals of Waterton

Native mammals by groups

Table 2 lists by orders and genera all the different kinds of mammals actually found in Waterton Lakes National Park. The hypothetical forms in the genera *Microsorex*, *Lasionycteris*, *Synaptomys*, *Martes* and *Mustela* are dealt with at the end of the report.

Relative abundance of mammals

The relative abundance of mammals is also discussed under *Status* in the section entitled "Systematic accounts of mammals." Data for the smaller species is presented in Table 3, which gives trapline results from every personally investigated area in the park from 1960 to 1965. The table shows the frequency of capture (catch per 100 trap-nights) of shrews, mice and voles in each of the numerous working localities. The number of trap-nights varies by species and locality. The collective results derived from a total of 3,200 trap-nights are given in a footnote.

The deer mouse (*Peromyscus maniculatus*) was the most abundant small mammal in the park, outnumbering other species several times over. Like many different mammals, its population fluctuates from one season to another as well as from place to place the same season. Figures show these animals rising to peak numbers in 1963 and then declining to a state of sparsity by 1955.

The scarcest species taken was the masked shrew (*Sorex cinereus*). Of the only three captured in the course of total operations, two were secured in 1960 and one in 1963. Data at hand appears to indicate some periodic fluctuations in the numbers of shrews.

Next in abundance to deer mice were western jumping mice (*Zapus princeps*), 79 of which were captured in the 3,200 trap-nights. They were fairly common in 1960, most numerous in 1961 and 1962, declining in 1963 and very scarce in 1965. As I have discovered in other Rocky Mountain districts, jumping mice periodically display sharp numerical instability ranging from abundance to scarcity. At all times they seem to be rare or uncommon in habitats widely separated from water and most plen-

Table 2
Waterton Lakes park mammals

Orders and genera	Number of forms
Insectivora (insect-eaters):	
<i>Sorex</i> (shrews)	3
Chiroptera (bats):	
<i>Myotis</i> (little myotis)	2
<i>Eptesicus</i> (big brown)	1
Lagomorpha (pikas; hares):	
<i>Ochotona</i> (pikas)	1
<i>Lepus</i> (hares)	2
Rodentia (gnawing mammals):	
<i>Eutamias</i> (chipmunks)	3
<i>Marmota</i> (marmots)	2
<i>Spermophilus</i> (ground squirrels)	4
<i>Tamiasciurus</i> (red squirrels)	1
<i>Glaucomys</i> (flying squirrels)	1
<i>Thomomys</i> (pocket gophers)	1
<i>Castor</i> (beavers)	1
<i>Peromyscus</i> (deer mice)	1
<i>Neotoma</i> (wood rats)	1
<i>Clethrionomys</i> (red-backed mice)	1
<i>Phenacomys</i> (heather voles)	1
<i>Microtus</i> (meadow and long-tailed voles)	2
<i>Arvicola</i> (water voles)	1
<i>Ondatra</i> (muskrats)	1
<i>Zapus</i> (western jumping mice)	1
<i>Erethizon</i> (porcupines)	1
Carnivora (flesh-eaters):	
<i>Canis</i> (coyotes and wolves)	2
<i>Vulpes</i> (foxes)	1
<i>Ursus</i> (black and grizzly bears)	2
<i>Martes</i> (martens)	1
<i>Mustela</i> (weasels and minks)	3
<i>Gulo</i> (wolverines)	1
<i>Taxidea</i> (badgers)	1
<i>Mephitis</i> (skunks)	1
<i>Lutra</i> (otters)	1
<i>Felis</i> (cougars)	1
<i>Lynx</i> (lynxes and bobcats)	2
Artiodactyla (even-toed ungulates):	
<i>Cervus</i> (wapiti or elk)	1
<i>Odocoileus</i> (mule & white-tailed deer)	2
<i>Alces</i> (moose)	1
<i>Bison</i> (bison or buffalo)	1
<i>Oreamnos</i> (mountain goats)	1
<i>Ovis</i> (mountain sheep)	1
Total	55

tiful in the immediate vicinity of streams, ponds and lakes.

In descending order of abundance, after deer and jumping mice, are the vagrant shrew (*Sorex vagrans*), long-tailed vole (*Microtus longicaudus*), meadow vole (*Microtus pennsylvanicus*), heather vole (*Phenacomys intermedius*) and red-backed vole (*Clethrionomys gapperi*). None of the voles were common from 1960 to 1963; all hit bottom in 1965, when the only vole captured of the several species was a solitary long-tailed vole trapped at Yarrow Creek. That year must have worked a hardship on all those predators that depend primarily on such small fry for the bulk of their food.

A marked number of mammal species are subject to numerical rhythms or cycles of differing duration. Some cycle regularly every 3½ or 4 years, others about every 10 years. The classic example in the latter category is the varying hare (*Lepus americanus*) that can gradually multiply into amazing abundance, then abruptly decline to a state of near extinction. I saw nothing of this phenomenon in the park during my summer inquiries from 1960 to 1965. Aside from occasional, modestly populated "pockets", hares then were notably scarce, especially after 1961 or 1962. If hares properly cycle at all in Waterton park the development is extremely weak.

Other species that fluctuate in a manner essentially similar to that of varying hares are lynx (*Lynx canadensis*), marten (*Martes americana*) and red fox (*Vulpes vulpes*). I gathered during the investigations that members of these species are not sufficiently numerous to exhibit a cyclic build-up of unqualified, recognizable proportions; however, it may occur. Species that probably have some little rhythmic up and down population changes are red squirrel (*Tamiasciurus hudsonicus*), coyote (*Canis latrans*) and ermine (*Mustela erminea*). More study is needed on population dynamics of the park's several species of ground squirrels.

The most abundant of the area's big game animals is the wapiti (*Cervus canadensis*), followed in apparent order of abundance

Table 3

The frequency of capture of shrews, mice and voles from trapline results at every personally investigated area in the park from 1960 to 1965. Because the number of trap-nights varied according to species and locality, the figures represent the catch per 100 trap-nights. The data is not weighted.*

Species	1960			1961		1962		1963		1965	
	Upper Cameron Creek	Twin Lakes Cabin	Belly River (Lat. 49°01' N.)	Blakiston Brook (5th Merid.)	Belly River at Indian Creek	Waterton River (N. Boundary)	Blakiston Brook N. of Ruby Ridge	Cottonwood Creek (Oil Basin)	Lower Sofa Creek	Yarrow Creek Cabin	Upper Crooked Creek
<i>Sorex cinereus</i>	.4		.3						.3		
<i>Sorex vagrans</i>	.4	.6	.4	1.1	3.0			.3	.3	.3	
<i>Peromyscus maniculatus</i>	1.6	11.1		8.0	7.4	1.3	4.5	7.1	24.5	4.1	.7
<i>Clethrionomys gapperi</i>		1.7		.3			.5		1.7		
<i>Phenacomys intermedius</i>	.8	.3		.6			2.0		1.6		
<i>Microtus pennsylvanicus</i>			.5		1.2	1.3	.5	2.4	.3		
<i>Microtus longicaudus</i>		.6		1.0	.9		3.0	.9		.6	
<i>Zapus princeps</i>	2.4	1.1	3.0	5.0	3.3		8.0	4.2	.6	.3	

*The total catch in 3,200 trap-nights was *Sorex cinereus* 3, *Sorex vagrans* 23, *Peromyscus maniculatus* 199, *Clethrionomys gapperi* 11, *Phenacomys intermedius* 13, *Microtus pennsylvanicus* 17, *Microtus longicaudus* 19, *Zapus princeps* 79.

by mule deer (*Odocoileus hemionus*), mountain sheep (*Ovis canadensis*), mountain goat (*Oreamnos americanus*), white-tailed deer (*Odocoileus virginianus*) and moose (*Alces alces*). Black bears (*Ursus americanus*) are common and probably on the increase, while grizzlies (*Ursus arctos*) exist in much smaller and somewhat uncertain numbers.

Systematic accounts of mammals

Class Mammalia

Order Insectivora

Family Soricidae (shrews)

Masked shrew *Sorex cinereus*

Subspecies: *Sorex cinereus cinereus* Kerr.

External measurements (average of seven regional specimens): total length 94.5, tail vertebrae 41.5, hind foot 11.9 mm (range 90–99, 36–44, 11–12.5). Mean wt: 3.7 grams (2.8–4.8). This species is next to the smallest of Alberta mammals—the pygmy shrew (*Microsorex hoyi*).

Status—Of recent years these little insectivores have been uncommon and irregularly distributed in the park. Of all the

smaller species of mammals inhabiting the region (aside from apparently infrequent bats) the masked shrew is among the scarcest—only three were captured in the park in 3,200 trap-nights (Table 3). Some cyclic rise and fall in population numbers is indicated.

Habitat—Various ecological niches from the Transition Life Zone through the Canadian to various parts of the Hudsonian zone. Such environment includes mixed-wood and coniferous forest, shrubby meadows, borders of lakes and streams, and uplands under cover of leaves, logs and wind-fall. Local altitude ranges from about 4,200 to 6,500 or 7,000 ft. Greater part of the population favours niches at the lower elevations.

Reproduction—Little is known about breeding habits. However, gravid females containing from six to ten fetuses have been taken at various times from mid May until well on in the summer. There is a possibility that sometimes a second litter is born to a mated pair during the same season.

General remarks—Several collectors have captured these shrews in the park, but results have generally been meagre. In the summers of 1922 and 1923 C. H. Young, National Museum of Canada, secured several specimens at Waterton Lakes and in the Belly River drainage. Banfield (1947) observed one along the Bertha Lake trail on August 15, 1947 and commented that “it seemed to be fairly common at elevations below the timberline.” In 1936 Crowe (1943) reported the species as fairly abundant at nearby Twin Butte. Lechleitner (1955) referred to *S. c. cinereus* as abundant in adjoining Glacier park, Montana.

Thus, at times these shrews are common in the region although they were very scarce during the early 1960's. I secured my first park specimen at upper Cameron Creek, July 19, 1960 and another the same season along upper Belly River. Only one other came to light during total operations—an immature taken on July 3, 1963 near the mouth of Sofa Creek.

Vagrant shrew *Sorex vagrans*

Subspecies: *Sorex vagrans obscurus* Merriam. External measurements (average of 14 park adults): 112.9, 45.8, 13.4 mm (range 110–114, 44–48, 13–14.5). Wt: 6.7 g (6.1–8.1).

Status—This is the commonest local member of the genus. About eight times more vagrant shrews than masked shrews were captured in varying numbers in the majority of work localities from 1960 to 1965. A total of 23 was taken in 3,200 trap-nights (Table 3). They were much more numerous in 1960 and 1961 than during the next 4 years.

Habitat—The home surroundings of the vagrant shrew and masked shrew are virtually identical. While some individuals resort to dry, forested uplands, the majority are found under cover of vascular plants and shrubbery along the wooded borders of streams. Zonal and vertical ranges are very similar to those of the masked shrew. In the southern Canadian Rockies the present species has been taken in the alplands to 7,500 ft (Crowe, 1943). In Montana Hoffmann and Taber (1960) trapped the animals up to heights of 10,000 ft.

Reproduction—Relatively little is known about the breeding characteristics of this shrew in the Canadian Rockies. From gravid females, however, it has been learned that young are born in at least June and July and that litters may number from five to nine individuals. On August 4, 1961 a half-grown (2.9 g) juvenile was taken at Blakiston Brook and the next week at Belly River eight immatures were trapped averaging 91, 37.4, 11.3 mm, with a mean weight of 3.1 g. No more than about half developed, these closely resembled mature masked shrews.

General remarks—During 1922 and 1923 C. H. Young collected specimens at Bertha Creek, Belly River and Linnet and Waterton Lakes. On August 20, 1947, Banfield (1947) trapped one at the Waterton town-site. Also, he noted that "A dusky shrew was taken from the stomach of a cutthroat trout (*Salmo clarkii*) caught September 4 at Lineham Lakes, altitude 7,100 feet."

I personally collected specimens at upper Cameron, Lost Lake, Cottonwood, Sofa and Yarrow creeks; Blakiston Brook; and Belly River near the international boundary and Indian Creek. Altitudes varied from 4,300 to 5,600 ft.

Water shrew *Sorex palustris*

Subspecies: *Sorex palustris navigator* Baird. External measurements (mean of 10 Waterton specimens): 151, 74.3, 19.9 mm (Rand, 1948 a). Average adult wt: 11.9 g (range 9.6–15.2).

Status—This shrew, among the rarer of the park mammals, is seldom observed and generally avoids capture. I failed to catch a single example in a multitude of trap-nights from the Montana border north to Yarrow Creek. Possibly the creatures have a numerical cycle and are much scarcer in some periods than in others. Banfield (1947) stated: "This shrew occurs regularly along all permanent water courses, up to moderately high altitudes." Evidently this is not a permanent condition as seen in the light of personal results.

Habitat—Most individuals frequent the waters and borders of cold mountain brooks and creeks flowing through mixedwood or coniferous forest. They also inhabit the shores of lakes under cover of trees and shrubbery. Some live along shrub-lined streams in subalpine meadows and in tundra settings above timberline. Zonal range: From Transition to Arctic-Alpine at local altitudes ranging from 4,200 to about 7,500 ft.

Reproduction—Of this, little is known. It has been established, however, that the young are born from late spring until well into the summer, and that a female may have a second litter in a single season. A litter normally consists of five to seven young (Rand, 1948a).

General remarks—Banfield (1947) mentions that Young took specimens of this shrew at Belly River, Bertha Creek and Waterton Lakes in the summers of 1922 and 1923. He also states that a dead individual was found along upper Sofa Creek on

August 10, 1947, and 5 days later a live one was seen at Bertha Lake. In 1963 I secured my first record of occurrence in Waterton park; while observing at the northern end of Dardanelles River I saw a line of small delicate tracks in the muddy margin near the water, showing large hind feet of a water shrew. The evidence leaves scarcely any doubt that these creatures were scarce during at least the first half of the 1960's.

Order Chiroptera

Family *Vespertilionidae* (evening bats)

Little brown myotis *Myotis lucifugus*
Subspecies: *Myotis lucifugus alascensis* Miller. External measurements (average of seven specimens taken by Banfield in 1947): 89, 40, 9.5 mm; forearm about 39 mm; and wing-spread about (ca.) 248 mm. Mean wt: 10.3 g (7.4–11.6).

Status—Little is known about numbers and park distribution but this is the commonest and the most frequently detected bat of the region. In adjoining Glacier park, Montana, Lechleitner (1955) refers to it as "...fairly common at lower elevations of the park especially around buildings."

Habitat—Mainly cordilleran forest situations in valleys of low or medium altitude—from 4,200 to about 7,500 ft. The animals find retreats in hollow trees, abandoned woodpecker cavities, and various kinds of buildings.

Reproduction—In relation to Glacier park Lechleitner (1955) remarks: "A single young is born during the early summer and it may be carried by the mother on her evening flights for several days after birth. The young can fly in about one month's time and soon becomes self-sustaining." Rand (1948a) says that the species usually mates in the autumn.

General remarks—Evidently C. H. Young was the first to collect this bat in the park, taking examples at Waterton Lakes on August 24, 1923. On August 26, 1947, Banfield collected a series of seven adults and subadults from a group roosting in the attic of the Waterton River warden's cabin. The wardens have reported sighting small flying

bats—apparently *M. lucifugus*—during the evening at Waterton Lakes and in the Belly River country. On several occasions at Cottonwood Creek (Oil Basin), between June 21 and 29, 1963, I saw small, fast-flying bats tentatively recorded under this species. The creatures tend to fly late in the evening when the degree of duski-ness precludes much, if any, success in collecting specimens. On October 14, 1966, park naturalist K. E. Seel found a dry specimen that had apparently died of starvation in the park administration building.

Long-eared myotis *Myotis evotis*

Subspecies: *Myotis evotis pacificus* Dalquest. External measurements: average (Cameron, 1951) 87, 40, 9 mm; forearm ca. 38 mm and wingspread ca. 225 mm. In a large series this species averages somewhat smaller than the little brown myotis; it is therefore the smallest bat known to occur in Waterton Lakes National Park.

Status—Very little is known about this bat in the park. Available information indicates it is uncommon, if not very scarce. Lechleitner (1955) regards the species rare in adjoining Glacier park.

Habitat—This is a mountain form with much the same choice of environment as the preceding species. In Alberta it ranges from the international boundary north to Jasper National Park and west. Hall and Kelson (1959) remark:

The long-eared myotis is an inhabitant of thickly forested to semi-desert areas. Nowhere does it seem to be common. It is not a cave bat and prefers to roost singly or in small clusters in secluded niches of buildings and probably in trees.

Reproduction—There is no data on reproduction for Waterton. Perhaps one or two young are born each year at varying times between May and July.

General remarks—This is the only bat of the region whose ears when laid forward reach substantially beyond the tip of the nose. On August 18, 1922 Young collected this bat in Waterton park. Banfield (1947)

obtained two examples at Stony Cabin (Chief Mountain Highway) on August 9 and 26, 1947. Evidently no other records exist for the park.

Big brown bat *Eptesicus fuscus*

Subspecies: *Eptesicus fuscus pallidus* Young. External measurements: average 120, 47, 12.1 mm; forearm 46 mm and wing-spread 240–280 mm. Mean wt 15–19 g. This is one of the largest of Alberta bats.

Status—This species is generally scarce in the Waterton area, although farther east and north in Alberta it ranks as one of the commoner bats. Banfield (1947) did not list this species. Lechleitner (1955) considered this bat uncommon in neighbouring Glacier park where only one specimen had been collected.

Habitat—Wooded territory in both Transition and Canadian life zones (and possibly part of the Hudsonian) embracing forest glades, meadows, muskegs and patches of prairie. "Big browns" habitually roost in hollow trees, deserted woodpecker holes, rock crevices, caves and old buildings. In extreme southwestern Alberta the altitudinal range extends from a low of 4,200 up to possibly 5,500 or 6,000 ft. There is much more to learn about local distribution.

Reproduction—Said by Rand (1948a) to mate in the autumn and to give birth to one or two young in the spring. They are cared for by the mother for at least a month, and perhaps longer, after which they are able to fly and garner their own insect food from the air.

General remarks—Anderson (1947) refers to Waterton park specimens of this bat in the National Museum of Canada and Rand (1948a) records the presence of the species at Waterton Lakes. During the second week of August, 1961, I saw a fairly large bat on two occasions flying above the forest along Belly River, late in the evening. The body size and wide wingspread appeared to be of this species, while the relatively slow wing beats and straighter courses separated the creatures from the smaller bats with their more rapid, fluttering zig-zag flights.

The big brown bat hibernates in Alberta, but whether the entire summer population does so is not clear. Rand says that the species hibernates in both caves and buildings.

Order Lagomorpha

Family Ochotonidae (pikas)

Pika *Ochotona princeps*

Subspecies: *Ochotona princeps princeps* (Richardson). External measurements (average of 16 Alberta specimens): 181, 12.2, 31 mm (range 170–195, 11–17, 30–32). Mean wt: 143.1 g (127.8–170.4). For Waterton Lakes specimens Rand (1948a) gives average total length of 183 mm and hind foot 30.5 mm.

Status—Pikas are well represented on some of the park's high mountains and scattered ranges and they are common in many rock slides. Their peculiar bleating calls may be heard near and far on warm calm days. Relative abundance varies from place to place. Banfield (1947) said: "This pika is fairly abundant in the park and individuals seem to inhabit every suitable rock slide irrespective of altitude."

Habitat—Most retreats are in rock-slides and coarse talus slopes at the higher wind-swept elevations in Canadian, Hudsonian and Arctic-Alpine zones. A goodly percentage of their habitations are located at, or in the general vicinity of timberline. Occasionally the animals live in low altitude slides (4,200 ft) and from there up to 7,500 ft, or even higher.

Reproduction—Pikas obviously mate at various times during spring and summer, for young are born erratically from the latter part of May and early June through the summer and into early September. Young per litter vary from three to five (Anthony, 1928). The majority reach mature size by at least early autumn and are capable of assisting in the gathering of food plants for winter consumption.

General remarks—Dr. Elliott Coues collected an example of *Ochotona levis* Hollister at Upper Waterton Lake, Glacier County, Montana on August 24, 1874. Hall

The pika ("little chief hare" or "coney") is a hardy inhabitant of the mountain rock-slides. Here it continues active throughout the winter subsisting on "hay" garnered during the autumn. Photo by Ed Cesar.



and Kelson (1959) regard the pikas of this region as subspecifically inseparable from *O. p. princeps* and Lechleitner (1955) refers Glacier National Park specimens to this latter race.

In 1947 Banfield heard pikas calling from rock slides near the shore of Upper Waterton Lake, at 4,200 ft, and saw others in similar habitats at 7,800 ft along the continental divide above Twin Lakes. On August 4, 1947, he collected a specimen at Mt. Crandell and another 15 days later at Mt. Carthew. Rand (1948a) mentions the presence of pikas at Waterton Lakes.

Information from park wardens indicates that pikas occur in the cordillera near Rowe, Alderson and Bertha lakes as well as in the above-mentioned localities. In 1965, I ascertained that at least a few live in slides along Cloudy Ridge near the north end of the park.

Family Leporidae (hares and rabbits)

White-tailed jack rabbit *Lepus townsendii*
Subspecies: *Lepus townsendii campanius*
Hollister. External measurements (average of six southern Alberta specimens): 576, 78, 143 mm (range 485–610, 55–95, 135–150). Mean wt: 6.4 lb. (5.5–7.5). Rand (1948a) gives averages of 606, 92, 149 mm.

Status—The white-tailed jack rabbit occurs rather rarely and erratically in the extreme north-eastern section of the park east and north of Maskinonge Lake, and perhaps occasionally visits the prairielands adjacent to the bison range and to the south.

Habitat: This mammal inhabits the parklands-prairie type of environment chiefly in the north-eastern angles of the park westward from Birdseye Butte, roughly in the vicinity of Waterton River and Crooked Creek.

Reproduction—These hares usually mate in the spring. After a gestation period of about 1 month the young are born in simple surface nests throughout June and early July. Litter number varies from three to six. Some observers believe that occasionally a female may have a second brood before the

The Waterton varying hare is the darkest of the Alberta Lagomorpha and in complete summer pelage is readily distinguished from other members of the family. The animals are also known as "snowshoe rabbits." Photo by Ed Cesar.



summer is out (Seton, IV, 1928), but in Canada it is likely that only one litter per year is produced.

General remarks—Banfield (1947) listed this hare in his report on Waterton mammals, stating that it "undoubtedly occurs in the Park.... A dead specimen was observed on the roadside just outside the park gate on August 5, 1947." On June 19, 1962, I flushed a large adult from a low copse of snowberry on the park prairie east of Waterton River, 1.5 miles northeast of Maskinonge Lake. This is typical Transition zone environment lying at an altitude of about 4,250 ft. This mammal occurs sporadically and with decided sparseness within the park.

Varying Hare or "Snowshoe Rabbit" *Lepus americanus*

Subspecies: Lepus americanus bairdii Hayden. External measurements: average ca. 455, 37, 145 mm with a variation either way of about 5 per cent. Mean wt: 3.4 (2.3–4.5) lb. Lechleitner (1955) gives average measurements of about 460, 38, 128 mm and weights from 3 to 4 lb.

Status—Occasionally in some highly favourable niches, the animals become fairly common especially during the peak periods of the 10-year numerical cycle. In 1947 Banfield rated them "fairly abundant" and on the increase relative to the periodic cycle. I found varying hares uncommon, or very scarce most of the time, although

"pockets" supporting a fair population may have existed. Very moderate numbers inhabited the park in 1960 and 1961, after which they were remarkably scarce up to the end of the field work in 1965.

Habitat—The varying hare inhabits deciduous-coniferous woods of valleys and acclivities including spruce-grown bogs and stands of shrubbery along streams and lakes, subalpine meadows and thickets, and to some extent true alpine terrain above timberline in the vicinity of low thickets. Zonal coverage is mostly Canadian and Hudsonian, at altitudes from 4,200 to about 7,200 ft.

Reproduction—These hares breed from April or May until August. The gestation period is approximately 30 days and litter

As the name implies, the least chipmunk is the smallest of the western chipmunks and among the most dainty and attractive of the smaller quadrupeds. Photo by Ed Cesar.

sizes vary from one to eight (average 3.4). Under some conditions a female may have more than one brood the same season (Rand, 1948a). Young hares in differing stages of development are seen all summer, even half-grown ones in the latter part of August.

General remarks—Anderson (1947) records Waterton park specimens in the National Museum of Canada and Rand (1948a) refers to the Canadian geographical range of *L. a. bairdii* as "extreme southwest Alberta." The animals also occur in moderate numbers throughout adjoining Glacier Park, Montana. In 1947 Banfield saw numerous hares and their signs in the Cameron and Sofa creeks and Bauerman Brook areas.

On July 22, 1960, I collected a typical male near Cameron Lake measuring 450, 43, 140 mm; it was very thin, weighing only 2.5 lb. Only occasional individuals were sighted that year and in 1961. During the next several seasons one could walk the forests and shrubby glades and meadows for days at a time without glimpsing a single individual, or any fresh sign. My Waterton park notes in 1963 comment: "It is inconceivable that varying hares could be any scarcer without reaching a state of extinction."

Order Rodentia

Family Sciuridae (chipmunks, marmots, squirrels)

Least chipmunk *Eutamias minimus*

Subspecies: *Eutamias minimus oreocetes* Merriam. External measurements: This is the smallest chipmunk of the region with averages of 197.2, 88, 31.8 mm (range 193–201, 82–90, 31.0–32.1). Mean wt: 48 g (43–50.7).

Status—Relatively little is known about this species in Waterton. It appears moderately well represented and capriciously distributed on at least some of the higher ranges. The population is perhaps about the same as that of the red-tailed species, but considerably less than that of the yellow-pine chipmunk.

Habitat—Locally, the animals inhabit the upper part of the Hudsonian zone and lower levels of the Arctic-Alpine in the gen-



eral vicinity of timberline. Characteristic niches are brushy Alpine meadows, stony gorges, talus slopes and stunted woods around rock slides. Altitudinal range—about 6,000 to 7,800 ft.

Reproduction—This chipmunk mates from sometime in April or May to early summer following a hibernation period of about 6.5 months. There is one litter per year of four to six young. The first juveniles appear above ground in early July when they are about one-third developed.

General remarks—Not every wildlife investigator has had the pleasure of meeting these “timberline” chipmunks. Spreadborough was the first to collect them in Waterton park, in 1895. Anderson (1947) records specimens from this area, and northward to Tornado Pass and Mt. Forgetmenot.

Banfield (1947) observed individuals on talus slopes above Lost, Twin and Lone lakes and in Sage Pass at altitudes of from 6,500 to 7,500 ft; in Sage Pass he collected a female on August 22, 1952. These were detected only along the continental divide. In July, 1960, I briefly saw two small chipmunks along Avion Ridge, near the head of Castle River, and another about 1 mile north of South Kooteney Pass. These, doubtless were *E. m. oreocetes*; all evaded collection for positive identification.

Yellow-pine chipmunk *Eutamias amoenus*
Subspecies: *Eutamias amoenus luteiventris* (J. A. Allen). External measurements: 23 adults taken in the park averaged 217, 99, 31.9 mm (range 199–230, 90–105, 30.5–34.5). Mean wt: 53.7 g (39.5–69.2).

Status—Ordinarily, this is the chipmunk most often observed by casual travellers in the park. It is widely distributed and the most numerous member of the genus anywhere at the lower levels.

Habitat—Most dwell in a Transition-Canadian zone environment in the lower valleys and foothills with some inhabiting the Hudsonian zone at elevations up to 6,000 ft or even higher in some Rocky Mountain localities. Home locations thus

range from poplar woods, with thick undergrowth along streams and lakes, through mixedwood forest, brushy meadows and rocky tracts on up to stunted subalpine woods of spruce, pine and fir.

Reproduction—Mating is in the spring when winter hibernation is over and days are warm and pleasant. Like other chipmunks, the yellow-pine has but one litter per season, with four to six young (Anthony, 1928). A heavy female (wt 64.4 g) taken at lower Sofa Creek on July 2, 1963, had thick, functioning mammary glands and was obviously still nursing young.

General remarks—The type locality of *E. a. luteiventris* is Upper Waterton Lake, 3.5 miles north of the international boundary, where this form was first collected by Elliott Coues on August 24, 1874 (Howell, 1929). In 1895 Spreadborough collected a series of specimens in the park, as did Young in 1922 and 1923. During August, 1947, Banfield took specimens near Crandell Lake (5,300 ft) and at Upper Waterton Lake (4,200 ft); he also saw many individuals in the valleys of Cameron and Blakiston brooks and Belly River.

During my park field work at various times from 1960 to 1965, the animals were noted in most study areas. Relative abundance varied markedly from apparent scarcity to the commonplace in different locations. I personally collected or observed these chipmunks in a dozen localities from Belly River westward to Red Rock Canyon and Bauerman Brook and northward to the Oil Basin and Yarrow Creek.

On August 10, 1966, along Red Rock Canyon Road near Coppermine Creek, K. E. Seel secured a specimen for the park collection that measured 224, 95, 32 mm and weighed 45.2 g. At the lower elevations these chipmunks are well represented in the valley of Blakiston Brook and along the skirts of the adjacent mountains.

Red-tailed chipmunk *Eutamias ruficaudus*
Subspecies: *Eutamias ruficaudus ruficaudus* A. H. Howell. External measurements (average of 13 park adults): 244, 99, 34 mm

(range 215–236, 93–103, 33.5–35). Mean wt: 68 g (63–73).

Status—The red-tailed chipmunk is well dispersed at intermediate elevations. It chiefly inhabits elevations above those favoured by the yellow-pine chipmunk, and goes up to and overlaps the altitudinal range of the least chipmunk in some areas. In my field notes I rated it as scarce to common, or fairly numerous, from one mountain locality to another. Its overall population in the park is about the same as that of the least chipmunk.

Habitat—Local distribution is normally in the higher reaches of the Canadian zone and throughout the Hudsonian to timberline, thus ranging from about 5,200 to 7,000 ft. They are chiefly creatures of the mixedwood forest and the higher spruce-fir associations until the woods thin out and gradually decline to the limit of tree growth.

Reproduction—Scarcely anything is known about reproduction in these chipmunks in the southwestern Alberta Rockies. It is assumed that most procreative developments resemble those characterizing other members of the genus. Rand (1948a) says there are four to six young in a litter.

General remarks—Spreadborough took the first park specimens of *E. ruficaudus* in the summer of 1895. These are in the National Museum, Ottawa, as are specimens collected in the park by Young, in 1922, and by Anderson in August, 1938. I was associated with Dr. Anderson in 1938 while collecting at Cameron Lake and vicinity, at which time these chipmunks were fairly common and energetically engaged in gathering seeds for winter consumption. On August 21, 1938, I collected two specimens of *ruficaudus* near Akamina Pass at an altitude of 5,800 ft. Specimens were also taken at Vimy Ridge, Cameron and Summit lakes and Carthew Trail.

During August, 1947, Banfield collected this species at Bertha Lake (6,000 ft), Mt. Carthew (7,000 ft) and Lone Lake (6,500 ft). During the third week of July 1960, I acquired a few examples along Upper

No mammal is more distinctly characteristic of the high cordillera than the hoary marmot, or "whistler." On a calm day its clear, high-pitched whistles can be easily heard over a distance of several hundred yards. Photo by Jessie M. Woollett, National Collection of Nature Photographs.



Cameron Creek and a short distance below Twin Lakes at 6,200 ft.

Yellow-bellied marmot *Marmota flaviventris*
Subspecies: *Marmota flaviventris nosophora*
A. H. Howell. External measurements: average ca. 620, 170, 85 mm; the maximum by Hall and Kelson (1959) is 700, 250, 133 mm. Weights run from about 10 to 15 lb.

Status—This species is rare in the park and perhaps occurs only very casually at most. Banfield (1947) did not list it, nor did Lecheitner (1955) for adjoining Glacier park.

Moore (1952) first definitely recorded the species in southern Alberta based on a specimen taken during the summer of 1951 in a rocky coulee of the Milk River Valley north of Sweet Grass Hills. Local information indicated that the animals had moved north into Alberta during the previous 10 years. Moore also refers to the earliest known occurrence of this race in Waterton Lakes park, saying, in a footnote:

It may be noted that Brown (Ent. Soc. Amer. Ann. 37, p. 210, 1944) in a study of Alberta fleas and their hosts has reported *M. flaviventris avara* from Waterton, Alberta...The skin of Brown's specimen is in our collection [U of A Museum of Zoology, Edmonton] and is considered to be *M. flaviventris cf nosophora*—a conclusion that has been confirmed by Dr. H. W. Setzer of the United States National Museum.

Hoary marmot *Marmota caligata*
Subspecies: *Marmota caligata nivaria* A. H. Howell. External measurements: Averages by Howell (1915) 753, 237, 107 mm (range 700–820, 200–245, 95–113). Mean weight of five individuals, both sexes, as provided by Seton (1V, 1929) is 15.9 lb, extremes being about 11 and 17 lb. Some fat autumn males may weigh more.

Status—Investigations to date find these animals nowhere actually plentiful in the park. At the same time they are widely distributed and in some favourable locations not uncommon. As elsewhere, extensive

mountain areas exist quite unsuited to their needs.

Habitat—Haunts are generally on the upper slopes of the Rockies near and well above timberline in Hudsonian and Arctic-Alpine zones. Characteristic habitats embrace talus slides, rocky slopes and benches and boulder-strewn alpine and subalpine meadows. Vertical range is commonly from about 5,500 to at least 7,500 or 8,000 ft, but occasional pairs inhabit rocky tracts as low as 4,200 ft.

Reproduction—Marmots mate in the spring and, following a gestation period of about 1 month, the four or five young (Lecheitner, 1955) are born in late May or early June. They are first seen scampering about their rocky homeland in the early part of July when they are about one-third grown and 2 or 3 weeks later, about one-half.

General remarks—The first Canadian specimen of *M. c. nivaria* was taken by Wm. Spreadborough on July 10, 1897, at Mt. Forgetmenot, 40 miles southwest of Calgary

The thirteen-lined ground squirrel is extremely shy and withdrawn. It is normally difficult to observe because of its skulking habits in dense grass and shrubs. Photo by W. D. Addison, National Collection of Nature Photographs.

(Anderson, 1934b). This is about 140 miles northward of Waterton park. The race occupies the east slope of this mountain to Glacier park, Montana, where Lechleitner (1955) calls it abundant. Banfield (1947) says the race occupies Waterton park in small numbers on the upper slopes and rock-slides above timberline and mentions observing individuals in the neighbourhood of Rowe, Carthew and Twin lakes.

In late July, 1960, I saw signs of marmots but not the animals themselves along the continental divide between Lost and Twin lakes. During that and succeeding seasons information was gathered respecting occurrence not only at the lakes mentioned by Banfield, but also at Mt. Alderson and in rocky terrain above Bertha and Goat lakes. Scattered examples are said to occur in a number of places along Cloudy Ridge. Doubtless they inhabit many other localities not yet closely examined.

Richardson's ground squirrel *Spermophilus richardsonii*

Subspecies: *Spermophilus richardsonii richardsonii* (Sabine). External measurements: This is the second largest ground squirrel of the region with averages of 300, 85, 50 mm and a weight of about 350 g (260–450); a marked difference prevails between lean spring and fat autumn individuals.

Status—These ground squirrels occur very sparingly and may be easily overlooked. In the past, several naturalists conducting investigations in the park failed to find any. At present just a few relatively rare individuals comprise the entire local population.

Habitat—These squirrels inhabit open, undulating prairie here and there interrupted by groves of aspen poplar and copses of snowberry, wildrose and other shrubs. Most of the suitable environment in the park lies in a rather restricted area of grassland northward from Maskinonge Lake, with some smaller, favourable tracts to the southeast.

Reproduction—Mating occurs near the end of winter hibernation in the latter part

of March or early half of April. Gestation lasts for 28 to 32 days. The number of young per litter varies from six to eleven. By late May, or early June, the first youngsters are above ground scurrying about, playing with each other and nibbling on the first succulent vegetation of the season.

General remarks—The first published record of the species in Waterton Park is contained in the following statement by Brown and Roy (1943): "Along the foothills this animal had invaded the range of the Columbian, or mountain ground squirrel and specimens have been taken at Cowley and in Red Rock Canyon at Waterton." The latter incidence appears extraordinary, as after the extensive observations of the early sixties, neither the wardens nor myself detected a single example anywhere in or near Blakiston Valley leading to Red Rock Canyon. Banfield (1947) included the species in his list of park mammals with the remark, "This typical plains mammal is reported to occur within the park boundary on the Cardston Road."

In July 1960, I saw nothing of the species in the park, but was informed that a few inhabited grasslands in the eastern fringes of the area. On August 13, 1961, I fleetingly sighted a ground squirrel, possibly of this species, along the highway a mile northeast of Maskinonge Lake. The following summer I positively identified one in grassland east of Waterton River just within the local northern boundary of the park. Possibly some occur in the prairie tracts around Indian Springs where badgers and other prairie species reside. In the summer of 1966 two individuals were seen by wardens at the Belly River Campground.

Columbian ground squirrel *Spermophilus columbianus*

Subspecies: *Spermophilus columbianus columbianus* (Ord). External measurements: Specific Alberta averages, 355, 100, 53 mm (range 345–375, 95–110, 47–56). Mean wt: 584 g (468–681.6).

Status—This is the common ground squirrel of the region with wide but often



markedly localized distribution. It occurs sparingly in eastern tracts, such as in the neighbourhood of Waterton River, and then soon thins out and disappears. To the west, the animals are more firmly entrenched and gradually become common, or abundant. Such is the case on foothills grasslands southward from Indian Springs, including the bison range, and westward in the valley of Blakiston Brook and other mountain trenches and highlands. The park population is reckoned in the thousands.

Habitat—A wide variety of ecological niches from foothill and mountain grasslands, at the lower elevations, up to rocky slopes and benches, subalpine glades and alpland tundra at varying heights above timberline. Zonal range is therefore from Canadian to Arctic-Alpine at elevations of 4,200 to 7,500 or 8,000 ft.

Reproduction—These squirrels mate immediately after emerging from hibernation during the latter part of April, or perhaps early May in a cold, late spring. The gestation period is 24 days. Size of litters vary from two to seven (Rand, 1948a). The first young appear above ground anytime after late June. By the first week of August most youngsters vary from about one-third to one-half adult size (ca. 200–300 gm).

General remarks—Banfield (1947) properly refers to the species as the typical ground squirrel of the park, where it was commonly observed from valley grasslands and stony flats near the townsite, at the golf course, in the foothills sector, at Crandell Lake (5,000 ft) and up to alpine slopes and tundra meadows above timberline. From 1960 to 1965 I observed *columbianus* in the foregoing areas as well as in open tracts at Cameron Lake and Creek, the long valley of Blakiston and Bauerman brooks, Red Rock Canyon, Lost and Twin lakes, Cottonwood Creek (Oil Basin), Yarrow Creek and upper Crooked Creek on the north flank of Sofa Mountain. Wardens have seen them in several high mountain areas a few miles north of the international boundary.

Curiously, not one could be found in the Belly River Valley; incidentally, Lechleitner

(1955) mentions total absence of the animals throughout the same valley in Glacier park. Abundance varies greatly from place to place. Sometimes there are only a few scattered pairs, but again there may be dozens or scores of these very sociable and gregarious animals in well populated colonies.

Thirteen-lined ground squirrel *Spermophilus tridecemlineatus*

Subspecies: *Spermophilus tridecemlineatus tridecemlineatus* (Mitchill). External measurements (average of a large provincial series): 275, 90, 38 mm (range 255–305, 75–110, 35–40). Mean wt: 170 g, with spring and fall variations from about 150 to 230 g (Soper, 1964). Males average a little larger than females.

Status—This species is very sparingly distributed and is uncommon or perhaps even rare in most parts of its park range. It is seldom seen by anyone. The occasional individual is spotted by wardens on patrol as it dashes rapidly across a road. Rarely, one is killed by a passing motor car.

Habitat—In southern Alberta, they live chiefly in a grass-shrub type of environment in the dry plains and parklands of the Transition zone. In eastern Waterton park the animals occupy woodland glades and patches of shrubbery, aspen poplar and brushy prairie in a mixed Transition–Canadian zone setting. They are confined to eastern park localities at altitudes of 4,200 to about 5,100 ft.

Reproduction—Breeding activities reach a peak when winter hibernation ends. The time varies considerably depending upon the character of spring, but is usually the second or third week of April. Gestation lasts for 27 or 28 days, the size of litter varying from five or six to ten (Rand, 1948a). Usually, the young are born during the latter half of May and leave the den, at first only a few hesitant feet from the burrows, apparently not until late June or early July. At this stage they are only one-quarter to one-third the size of adults.

General remarks—These squirrels went undetected for some time after the park was

established. This is not surprising in view of their deep-rooted shyness, silence, restricted local range and scarcity. Waterton park specimens of the species are in the National Museum of Canada (Anderson, 1947). Lechleitner (1955) calls it rare for adjacent Glacier park, and mentions that one was seen in a meadow of the Belly River Valley, "a place where none of the other ground squirrels is known to occur." Ordinarily, the species is seldom seen by anyone either in or outside of the parks.

In the latter part of July, 1960, Warden Robert Thompson informed me that he had sighted an individual a short distance east of the Waterton River Registration Office. Shortly after this he saw another one in his garden (same locality) and photographed it. On August 12, 1961, Warden Jack Christiansen observed two immatures drinking from a small spring at the side of the fire trail beside Belly River near Indian Creek.

On June 19, 1962, I sighted two of these squirrels in shrubby grasslands a half-mile east of Waterton River near the north boundary. About the same time Warden Thompson saw one crossing Chief Mountain Highway near Stony Cabin. In June, 1963, I saw another cross the highway about 1 mile northeast of Waterton River Station. In late spring of 1965 one was found dead on the road near the fish hatchery and a few weeks later one was seen in grasslands near Lower Waterton Lake. The animals are rare anywhere west of Waterton Lakes and River where the terrain approaches the east wall of the Rockies.

On July 15, 1966, warden Thompson trapped an example at the Waterton River Station (228, 94, 37 mm, wt 85.75) and 3 days later in lower Blakiston Brook Valley, K. E. Seel secured one measuring 261, 96, 37 mm and weighing 169.90 g. Both Anderson (1947) and Lechleitner (1955) referred the local animals to the race *pallidus* Allen, but Hall and Kelson (1959) show them as belonging to the presently listed subspecies.

Golden-mantled ground squirrel *Spermophilus lateralis*

Subspecies: *Spermophilus lateralis tescorum* (Hollister). External measurements (average of a series of 15 adults): 279, 93, 44 mm (range 265–305, 85–95, 42–46). Mean wt: 223 g (184–280); very fat autumn specimens may reach 350 g or more.

Status—This squirrel is rather erratically dispersed in only moderate numbers. It is noticeably more numerous than either Richardson's or striped ground squirrels, but far less common than the Columbian. In many widely scattered areas in the mountains the present species appears rare or non-existent, but some favourable rocky localities attract a fair number of individuals.

Habitat—Habitat is markedly diversified and locally ranges widely both below and above timberline over open situations in the valleys, stony hillsides, semi-wooded terrain, rugged mountain slopes and boulder fields. The animals favour a rugged, rocky environment and often inhabit rock slides. Vertical range in the park extends from the lowest terrain at around 4,200 ft up to 7,500 ft or more.

Reproduction—The long winter's sleep ends during early April or a little later, depending upon prevailing weather conditions, slope exposure and altitude. Around this time breeding takes place and the four to eight young are brought forth from about mid May until early June after about a 1 month gestation period. Immatures of different sizes scamper about through the months of July and August. Most are nearly, if not full-grown, by the time the rank and file hibernate in the latter part of September.

General remarks—Anderson (1947) calls attention to park specimens in the National Museum of Canada. Banfield (1947) found the animals "irregularly distributed in the park", and much scarcer than *C. c. columbianus*. He observed individuals at Waterton Lake, Mt. Crandell and Sage Pass and collected a large specimen on Mt. Carthew at well over 7,000 ft.

During my investigations not a single example was recorded in the eastern portion

of the park from Cottonwood Creek south-eastwards to Indian Springs, Waterton River, lower Sofa Creek and Crooked Creek to Belly River. In this sector rock outcrops are rare or absent. Most of the animals are in the cordillera to the west and north to Cloudy Ridge, including subalpine and alpine areas along the continental divide, where I saw occasional individuals in the neighbourhood of Lost and Twin lakes.

Red squirrel *Tamiasciurus hudsonicus*
Subspecies: *Tamiasciurus hudsonicus richardsoni* (Bachman). External measurements: Seven park specimens average 324, 120, 51.6 mm (range 298–332, 93–132, 50–54). Mean wt: 248.49 g (226.4–283.2).

Status—The red squirrel is more or less uniformly distributed in suitable mixed wood and pure coniferous forest, but varies markedly in relative abundance from one district to another and, at times, from year to year. In many areas examined the animals were scarce, especially at elevations over 5,500 ft. At least a few were seen in nearly all working localities. In 1960 and 1961 they appeared most numerous in the spruce-poplar woods of Belly River Valley. Elsewhere only moderate numbers were seen thereafter.

Habitat—This animal inhabits the mixed-wood and coniferous forests of Canadian and Hudsonian zones from 4,200 to about 7,600 ft. A few individuals dwell in groves of spruce, fir and larch at or near timberline. Sometimes they are seen running over adjacent rock-slides inhabited by pikas and golden-mantled ground squirrels.

Reproduction—Mating takes place from early to late spring. After a gestation period of 36 to 40 days, the young are born from the latter part of May until early June. A litter usually consists of three to seven young (Hall and Kelson, 1959). By the latter part of August most immatures are at least two-thirds to three-quarters adult size.

General remarks—Anderson (1947) refers to Waterton park specimens of *T. h. richardsoni* in the National Museum of Canada and remarks they are in "fairly typ-

ical form" and that they intergrade with *T. h. columbianus* to the northward of Crowsnest Pass. Banfield (1947) stated that *T. h. richardsoni* "occurs commonly in all the forested areas of the park," and that a specimen was collected at the townsite.

Besides observing red squirrels or their signs in nearly all parts of the park traversed, I collected specimens at Lost Lake Creek, Blakiston Brook near Lost Horse Creek, Belly River at Indian Creek, Yarrow Creek and Chief Mountain Lookout. In some choice and long-inhabited tracts in the coniferous forest, well-worn tree to tree runways were conspicuous in the mossy ground cover and large midden heaps testified to many years of occupation in the daily shelling of spruce cones. The amount of characteristically abundant black hair in the terminal part of the tail varies markedly in different specimens.

Northern flying squirrel *Glaucomys sabrinus*

Subspecies: *Glaucomys sabrinus latipes* A. H. Howell. External measurements: Averages for the species in Alberta are 320, 143, 36.9 mm (range 297–339, 130–150, 38–43). Mean wt: 158 g (142–178).

Status—From all accounts, flying squirrels are widely distributed in the better forested areas, but probably not particularly common anywhere. Wardens say they occur only sparingly in some localities, where only an occasional individual is detected, especially when it makes a habit of entering a building. Lechleitner (1955) states that in Glacier park the animals are common in timbered areas, especially west of the continental divide.

Habitat—This squirrel inhabits hollow stubs and tree cavities in tracts of mature forest on lowlands and mountainsides in Canadian and Hudsonian zones from the valley floors up to about 7,200 ft. The chosen environment is essentially the same as that frequented by red squirrels—semi-open forest with large trees which allow for extensive gliding from tree to tree in their routine movements.

Most golden-mantled ground squirrels are found solitary on rocky terrain in contrast with other more sociable members of the ground squirrel family. Photo by Ed Cesar.



Reproduction—Most mating culminates between late March and late April and the young are born from 40 to 42 days later. Size of litter varies from three to six. For more information on breeding refer to Soper, 1964, p. 162. When a month old the youngsters are about one-third grown and by late summer are nearly as large as the adults.

General remarks—Anderson (1947) reports Waterton specimens in the National Museum, Ottawa. Rand (1948a) remarks that people seldom see flying squirrels, even where common in the forest. Wardens sight occasional individuals.

In the spring of 1960 one was caught by a warden while it was frequenting a summer cottage in the town-site.

From 1960 to 1965 I attempted to secure flying squirrels in 11 widely-spaced study areas, but with no success. This could indicate scarcity, but not necessarily, as normally the animals take far less readily to bait in summer than in late fall and during the winter. About midnight of June 12, 1965, a flying squirrel repeatedly ran over the roof of my tent at Yarrow Creek; traps failed to catch it on succeeding nights. Outside the parks during the winter months many flying squirrels lose their lives acci-

dentally in the baited cubby sets made by professional trappers for such fur bearers as lynx, marten and ermine.

Family Geomyidae (pocket gophers)

Northern pocket gopher *Thomomys talpoides*

Subspecies: *Thomomys talpoides talpoides* (Richardson). External measurements: Average of 40 adults, 220, 56, 29.3 mm (range 208–248, 49–75, 28–31). Mean wt (Soper, 1964): 144.8 g (121–212).

Status—These gophers are not uncommon in some eastern areas of the park and are numerous or even abundant over some localized tracts. Within the overall potential park range, however, they are scarce, or absent in many localities—incomprehensibly so occasionally in places that appear ideal for their burrowing and feeding.

Habitat—*Talpoides* inhabits typical prairie areas, mixed grasslands and aspen poplar groves and grassy uplands, forest glades and meadows in Transition and Canadian zones. In Waterton park the altitudinal range embraces the 4,200-ft campestrian lowlands and, in favourable locations, up to at least 5,300 ft.

Reproduction—These subterranean rodents are fairly prolific and in some areas build up to very substantial populations. Mating occurs in the spring and the four to eight per litter (Anthony, 1928) are born in June and July. In some cases, evidence points to the production of two litters in a single season. One-third to two-thirds-grown young, ranging in weight from about 45 to 115 grams, may be trapped from at least the last week of July until early September.

General remarks—Years ago the race represented in southwestern Alberta and south into Glacier National Park, Montana, was thought to be *T. t. fuscus*. It is now clear that the present subspecies ranges all the way from the central parklands of the province south to at least Waterton Lakes National Park. This conclusion is supported by Crowe (1943) who referred specimens from Twin Butte, 7 miles north of the park, to *T. t. talpoides*. (See Soper, 1964, p. 167).

Beavers are the largest of the rodents. They display astonishing skill and instinctive capacity in the construction of dams and lodges and in the underwater storage of birch, poplar and willows for winter food. Photo by Ed Cesar.



Banfield (1947) remarked: "The workings of this mammal are commonly observed at lower elevations in the foothills area of the park." I noted the presence of park gophers in the Belly River Valley; the district embracing Indian Creek, upper Crooked Creek and Chief Mountain Lookout; lower Sofa Creek and north of both sides of Lower Waterton and Maskinonge lakes and Waterton River; the golf course; Blakiston Brook Valley to a point south of Bellevue Hill, together with grasslands east and north to Indian Springs; Cottonwood Creek (Oil Basin); and prairie flats at Yarrow Creek.

A juvenile personally secured at Belly River on July 30, 1960, weighed 48 g and another trapped near the mouth of Indian Creek, August 9, 1961, was only 3.9 g heavier. In some areas gopher diggings extend from open grasslands well into woods of poplar and spruce, such as I saw near Indian and Yarrow creeks and Waterton River.

Family Castoridae (beavers)

Beaver *Castor canadensis*

Subspecies: *Castor canadensis canadensis* Kuhl. External measurements: The largest of North American rodents with averages of about 1,030, 360, 175 mm and a variation in size of 10 per cent more or less. Average weight lies between 35 and 45 lb. Seton (IV, 1928) remarks that "Old and large beavers reach a weight of 60 to 70 pounds."

Status—At present beavers occur in only moderate numbers along streams and lakes of the eastern lowlands and in adjoining areas of medium elevation. Old signs reveal that the animals were more abundant long ago.

Habitat—Lakes, rivers and tributary creeks in Transition and Canadian zones from the lowest eastern valleys and basins up to an altitude of at least 5,100 ft. A governing factor in general dispersal is a plentiful local supply of poplars and willows.

Reproduction—Beavers are believed to mate permanently, or until one of the partners dies. Breeding takes place at various times in late winter and early spring with a

gestation period of between 3 and 4 months. There is one litter per annum; size varies from two to seven or eight young (Hall and Kelson, 1959) born anytime from late spring until early summer. Progeny stay with the parents until they are about 2 years old, after which they instinctively leave the home lodge and fend for themselves (Lechleitner, 1955).

General remarks—There has been relatively little change in the beaver population of the park since Banfield made his investigations in 1947. He found 13 active beaver lodges and five sites where single beavers had been operating—chiefly in eastern locations. He estimated the entire population at about 83 individuals. Considering the availability of good, uninhabited sites with ample food supplies, the region was regarded as understocked.

This population suffered a setback with the incursion of tularemia during the autumn and winter of 1952–1953 (Banfield, 1954). In all, 26 beaver carcasses were found at Waterton River and Crooked and Indian Creeks and there may have been many more not discovered. Marked recovery took place during the next 8 or 10 years, until beaver conditions appeared back to about normal. A park game report, dated December 31, 1961, described beavers as plentiful.

During my investigations in the early 1960's, inhabited streams and ponds were practically the same as mentioned by Banfield for the year 1947. I noted the presence of beavers in the following localities: the length of Belly River within the park; Indian Creek and west in the upper Crooked Creek swamplands to the vicinity of Chief Mountain Lookout; Dardanelles and Lower Waterton Lake; Waterton River and tributary creeks; lower Blakiston Brook; and Cottonwood Creek in the Oil Basin area.

In many instances lodges existed, but on the smaller streams only dams were in evidence indicating that the animals lived in bank dens. Old signs were noted in a number of places no longer occupied by beavers. There are numerous excellent, potential

living tracts with plenty of aspen poplars and willows that beavers have not yet utilized. Probably the animals will gradually move into such inviting habitats. At the old fish hatchery, on July 13, 1966, warden R. Thompson found a young beaver that appeared to have died a natural death and was saved for the park collection; it measured 556, 159, 105 mm and weighed 12 lb.

Family Cricetidae (mice, voles)

Deer mouse *Peromyscus maniculatus*

Subspecies: *Peromyscus maniculatus artemisiae* (Rhoads). External measurements (average of 38 park adults): 176.8, 80.4, 20.9 mm (range 168–191, 70–90, 20.5–22.3). Mean wt: 23.59 g (20–33.2).

Status—These mice, the most plentiful small mammal of the region, are virtually ubiquitous. However, from time to time they can vary from scarce to common, or notably abundant, and may so fluctuate capriciously from one locality to another the same season. During the course of the field work a total of 199 individuals was taken in 3,200 trap-nights. The largest catches were made at Twin Lakes Cabin in 1960 (11.1 per cent) and at lower Sofa Creek (24.5 per cent) in 1963 (Table 3).

Habitat—These animals inhabit all types of forest, brushy meadows and brulé from the lowest valleys upward through Transition, Canadian and Hudsonian zones to the vicinity of timberline at about 6,500 to 7,000 ft. They also resort to rocky outcrops and talus slides in high, stunted woods of spruce, fir and larch, but are much less numerous at the higher altitudes.

Reproduction—Mating occurs during the spring and summer and more than one brood may be produced during the same season. The gestative process requires from 21 to 27 days. Litters vary from three to eight young, but five appears average. Pregnant females may be taken anytime from April until August. On August 8, 1961, a gravid female was taken near the mouth of Indian Creek carrying six fetuses 23 mm in length. One-third to one-half-grown juveniles were collected at Lost Lake Creek, late

Bushy-tailed wood rats are also known as "pack rat", "trade rat" and "mountain rat". They have the curious habit of making off with small objects from about camp and replacing these with worthless twigs, leaves, pebbles, cones, etc. Photo by Ed Cesar.

July, 1960; at Blakiston Brook, early August, 1961; at Belly River, mid August 1961; Cottonwood Creek, late June, 1963; and at Yarrow Creek in mid June 1965. During late July and in August most of the dusky juveniles range from about one-half to three-quarters adult size.

General remarks—In outlining the geographical range of the present subspecies, Anderson (1947) included the park territory, i.e., "east along the International Boundary to extreme southwestern corner of Alberta." Lechleitner (1955) lists it as the form occurring in part of neighbouring Glacier park. Banfield (1947) remarked that *P. m. artemisiae* was of common occurrence throughout the park at all elevations below timberline, but was most numerous on lower terrain near water. During August, 1967, he collected specimens at Upper Waterton Lake and at Stony Cabin, Chief Mountain Highway. In the course of my work in numerous park localities, the deer mouse was taken in greatly varying numbers in all localities except Belly River Valley, near the Montana border, in late July, 1960.

On Hall and Kelson's (1959) range map of the *P. maniculatus* group, *P. m. osgoodi* is the race shown occurring in the park area. However, typical or subtypical characters are relatively little in evidence and are absent over most of the park. On the other hand, most of the characters of *artemisiae* dominate together with numerous *artemisiae-borealis* intergrades.

In one of my park field reports I wrote:

The adults average big in total length and have long tails. While there is marked variation in colour of pelages it seems best to refer most of the specimens to *artemisiae*. Some specimens are intermediate in colouration and size in relation to both *borealis* and *osgoodi*, but rather sparingly for the latter form. Some specimens closely resemble *borealis*. Limited *osgoodi* influence prevails in the eastern portion of the park, while it is absent in western localities to and beyond the Continental Divide.

In July, 1962, park naturalist, F. Sudol, referred to *P. m. artemisiae* at the Waterton



townsite where the animals are sometimes abundant and cause some inconvenience by finding their way into buildings.

Bushy-tailed wood rat *Neotoma cinerea*
Subspecies: *Neotoma cinerea cinerea* (Ord).
External measurements: average of 12 adults, 383, 161, 46 mm (range 320–443, 118–192, 42–48). Mean wt: 345 g (200.8–524.4).

Status—So far as could be ascertained, wood rats are absent, or uncommon in a high percentage of localities. They appear to have better and more consistent distribution, with superior numbers, in the western part of the territory to and along the continental divide.

Habitat—Wood rats inhabit forested banks of streams and lakes in cavities under roots and boulders, fissures in cliffs, rock slides, and old buildings, from the lowest terrain through Canadian and Hudsonian zones locally to timberline.

Reproduction—These rodents are active throughout the year and normally have but one litter each summer. Breeding occurs at widely different times during the spring followed by a gestation period of about 32 days (Rand, 1948a). Sizes of litters vary from two to five or six. Young are born during

the months of May, June and July. By the latter month some broods are about half-grown and reach adult size in the autumn.

General remarks—The National Museum, Ottawa, has specimens of *cinerea* from Waterton Lakes park (Anderson, 1947). Rand (1948a) records it in extreme southwestern Alberta, and Lechleitner (1955) reported this race as "quite common" in neighbouring Glacier. Banfield (1947) omitted the wood rat in his list of park mammals, likely denoting scarcity and lack of reliable records at that time. My experience was similar for I did not secure a single specimen in all the localities examined and rarely saw even any sign of occurrence.

The wardens, however, state that a few "pack rats" are scattered about the region including the townsites where a few have been eliminated in the past. A few years ago along the east shore of Upper Waterton Lake warden R. Thompson discovered a small cave occupied by the animals and housing a large, typical nest of sticks, vascular plants, cones, animal droppings, pebbles and other debris. The place reeked with the characteristic musky odour of the species. On June 30, 1962, F. Sudol trapped an individual (394, 169, 40 mm) at Crypt Landing for the park collection. In June, 1965, I

saw old signs of the animals at the warden cabin near Yarrow Creek, but the rats had apparently deserted the place, for a series of traps set for several nights yielded no results.

Gapper's Red-backed Mouse *Clethrionomys gapperi*

Subspecies: *Clethrionomys gapperi galei* (Merriam). External measurements: average of 31 specimens, 141.8, 39, 18.8 mm (range 133–151, 33–50, 17.5–20). Mean wt: 28.4 g (20.4–41.8).

Status—During my inquiries in the early 1960's, the red-backed mouse was one of the scarcer park mammals; only 11 were captured in 3,200 trap-nights. It was slightly more numerous than elsewhere at Twin Lakes Cabin in late July, 1960, and at lower Sofa Creek, late June, 1963. Extremely reduced numbers prevailed during the summer of 1965 (Table 3).

Habitat—This mouse inhabits brushy mixedwood and dense coniferous forest in valleys and on mountain acclivities in Canadian and Hudsonian zones up to sub-alpine tracts of dwarf spruce, fir, pine and shrubbery, also moist, boggy areas flanking streams, ponds and swamps. Vertical range is 4,200 to about 7,000 ft.

Reproduction—Procreation in better years may yield more than one litter per pair in a single season. Breeding is from April to May until late summer. Duration of pregnancy is from 17 to 20 days and the number in a brood, from two to seven. Immatures about three-quarters developed may be taken as early as mid June, and during July and August. Some are practically adult size at different times from late July to early September.

A gravid female (wt 28.3 g) captured on July 2, 1963, at Sofa Creek, carried seven embryos with a mean length of 4 mm, likely to be born about July 17. During the same week several immatures had an average weight of 17.9 g, hence about three-quarters grown.

General remarks—The National Museum of Canada has specimens of *C. g. galei* from

Waterton (Anderson, 1947) and Rand (1948a) includes the park within this mouse's geographic range. Regarding *galei* in adjoining Glacier, Lechleitner (1955) remarks: "This mouse is found in more dense forest situations than any other microtine. It is rather abundant on the west side of the park and common in the dense cedar forests of the McDonald Valley."

Out of the 11 localities that I studied from 1960 to 1965, the red-backed mouse was captured in only four: Twin Lakes Cabin, Blakiston Brook (5th Merid.), Blakiston Brook near Coppermine Creek and lower Sofa Creek. Population levels clearly fluctuate from time to time and one locality to another the same season. The trapline results suggest that the animals are either absent in many eastern localities, or markedly less numerous than in the cordillera at higher altitudes to the west.

Heather vole *Phenacomys intermedius*

Subspecies: *Phenacomys intermedius levis* A. B. Howell. External measurements (average of eight adults): 140, 35, 18.2 mm (range 134–150, 30–38, 18–19.5). Mean wt: 28.9 g (25.3–38.4).

Status—During the early 1960's these voles were among the least common of park mammals; the overall catch was only 13 individuals in 3,200 trap-nights (Table 3). The only scarcer small species were the masked shrew and red-backed mouse. In many localities the heather vole was unquestionably rare, or absent. At various times and places, however, the animals can be fairly common.

Habitat—Shrubby margins of meadows, glades, muskegs, lakes and streams in fairly dry, lowland mixedwood and higher coniferous forests from the Canadian zone to timberline; also, occasionally, in alpine depressions and elevated meadows partly clothed with flowering plants, heather, bearberry and dwarf willows. Vertical range is about 4,200 to 7,500 ft.

Reproduction—This vole breeds from May until August, with litter sizes ranging from four to six (Rand, 1948a). Length of gesta-

tion is approximately 3 weeks. About half-grown young (11–16 g) were captured as early as mid June and others in similar stages of growth from that time until early September. More juveniles come to hand in July than any other month.

General remarks—In extensive sections of its range across Canada *Phenacomys* is very scarce, or genuinely rare, and therefore highly prized for research collections. This does not so much apply to the present race in the Rocky Mountains where at times it is fairly well represented in many localities. As with several of the smaller species of rodents, however, heather voles become much scarcer some years than others and therefore more difficult to come by. With respect to Glacier, Lechleitner (1955) says: "This is a fairly common mouse in the high mountain meadows and cirques of the park." For interesting life-history notes on these voles consult Shaw (1924) and Foster (1961).

During the summers of 1960 to 1965 I captured these voles in the following park localities: Upper Cameron Creek (5,435 ft), Twin Lakes Cabin (5,500 ft), Blakiston Brook near Lost Horse Creek (4,700 ft), and lower Sofa Creek (4,300 ft). In several localities it was not detected. On July 5, 1966, at the Maskinonge picnic grounds (4,200 ft) park naturalist K. E. Seel found a dead individual and saved its skull for the park collection.

Meadow vole *Microtus pennsylvanicus*

Subspecies: *Microtus pennsylvanicus drummondii* (Aud. & Bach.). External measurements (average of 10 park adults): 159, 45, 19 mm (range 142–185, 37–60, 17.5–20). Mean wt: 32.5 g (20.4–48.5). Many individuals with similar measurements differ in weight by as much as 14 to 16 g.

Status—Periodically, the meadow vole is among the most abundant of small mammals and commonly second in numbers only to deer mice. During the early 1960's, however, the animals had become so scarce that only 17 individuals were caught in 3,200 trap-nights. They appeared most nu-

merous at upper Cottonwood Creek (4,900 ft) in June, 1963, when seven were taken in 310 trap-nights (Table 3).

Habitat—The meadow vole is found in niches of marked variety from lowlands in the Transition zone all the way up to Hudsonian and Arctic-Alpine zones. Favourite resorts include meadows, swamps, forest grasslands and the moist fringes of streams, ponds and lakes. Regional vertical range extends from 4,200 to about 7,500 ft.

Reproduction—Active breeding takes place from late April until late summer, during which time several litters may be produced in a favourable season. The gestation period is approximately 3 weeks. Size of broods vary from four to eleven. Evidently the earliest-born can procreate before the summer breeding season comes to an end. Many juveniles are nearly half-grown by early June. Others of similar weight and up to nearly adult size may be caught from July until September.

General remarks—This is a wide-ranging species in Canada with two subspecies in Alberta. The present form is distributed throughout the province, except in the extreme southeast, where it is replaced by *M. p. insperatus*. Of the present form in the southwest Rand (1943) remarks: "Specimens from Waterton Park are slightly greyer than more northern animals, but are definitely *drummondi*."

More often than not this vole is the most numerous member of the genus at the lower altitudes, but higher up it gradually becomes scarcer in competition with other species. Vertical range in the park covers about 3,000 ft. I caught a few specimens in most study areas. In 1960 none was secured at the higher altitudes of upper Cameron Creek and Twin Lakes Cabin. The population seems to have hit bottom in the summer of 1965, as not a single individual was obtained in multiple traplines at Yarrow and upper Crooked creeks.

Long-tailed vole *Microtus longicaudus*
Subspecies: *Microtus longicaudus vellerosus*
J. A. Allen. External measurements (aver-

age of eight park adults): 174, 62, 20.1 mm (range 163–180, 59–65, 19.5–20.5). Mean wt: 36.7 g (25.7–44.1).

Status—In the early 1960's all species of voles had sunk to low numerical levels, hence the acquisition of specimens for study was slow and often disappointing. The present species proved almost as scarce as heather voles. Relative abundance was almost the same as that of the meadow vole, 19 being taken in 3,200 trap-nights. In five study areas none was obtained (Table 3).

Habitat—This species inhabits alpine and subalpine meadows, wet sphagnum-Labrador tea swamps, moist grassy depressions and brushy tangles along streams and lakes in mixedwood and coniferous forest from the Canadian to the Arctic-Alpine Zone. Some individuals live in shrubby tundra above timberline. Borders of high mountain brooks are favourite resorts. Vertical range covers all elevations from the lowest terrain (4,200 ft) up to about 7,500 ft.

Reproduction—The species has a long breeding season; many gravid females have been collected from May until August. The gestation period is assumed to be about 3 weeks as in several related forms. Litter size varies from two to seven with an average of 4.8 (Hall and Kelson, 1959). By early July juveniles are commonly from about one-third to half adult weight and by the end of the month are practically adult size. Gravid females were taken as follows: May 28, six embryos averaging 5 mm in length; June 18, five embryos about 3 mm long; and August 18, six embryos averaging 7 mm in length. Juveniles, ranging from three-tenths to about three-quarters adult weight (11.7–27 g), were captured in mid June, the third week of July, and early August.

General remarks—Anderson and Rand (1944) assigned the present race to Waterton Park with the proviso that at least some individuals show intergradation with *M. l. mordax*, a subspecies with more yellowish to rusty colouration over the head; 17 Waterton specimens in the National Museum of Canada were available to the above authors for study and comparison. On

August 14, 1947, Banfield collected a female at Boundary Cabin, Upper Waterton Lake, that he referred to *M. l. mordax*. With reference to neighbouring Glacier park Lechleitner (1955) remarked: "This mouse *M. l. mordax* is abundant in wet woods about the park."

During my own investigations a few examples of *M. l. vellerosus* were collected in six study areas listed in Table 3. While these voles exhibit a pronounced liking for wet, or moist situations, many were also trapped in dry mixedwood and coniferous forest along the banks of streams clothed with willows, silverberry and buffaloberry. Not infrequently they were associated with meadow voles, vagrant shrews and jumping mice. My specimens support Anderson's conclusion that Waterton park material is closer to *vellerosus* than to *mordax*.

Water vole *Arvicola richardsoni*
Subspecies: *Arvicola richardsoni richardsoni* (DeKay). External measurements: Anderson (1943) gives the average for six park specimens as 238.2, 66.3, 27.8 mm. Hall and Kelson's (1959) maximum figures are 261, 92, 30 mm; weights of two adult males, 112 and 123.3, respectively. Mean wt (Soper): 70.4 g (53–113.9).

Status—Very little is known regarding relative abundance and distribution of this vole in Waterton. A number of considerations indicate it is rather uncommon and of highly restricted local occurrence. Few home sites have been found in this territory.

Habitat—This high altitude microtine ranges in Hudsonian and Arctic-Alpine zones between altitudes of about 6,000 and 7,800 ft. Dens and runways are located on the banks of cold mountain streams and ponds both below and above timberline. Prevailing growth in the habitat commonly consists of grasses, sedges, herbs and scattered stands of low willows, dwarf birch, alders and occasional shrubby cinquefoil.

Reproduction—The water vole breeds at various times during spring and summer. Litter size is reported numbering from two to eight, with births occurring from June

The muskrat displays considerable industry in building lodges, or "houses", of aquatic vegetation in swampy ponds and shallow lakes. Sometimes its dens are in the banks of streams with underwater entrances. Photo by Ed Cesar.



until September. Under optimum conditions there may be more than one litter during the summer. On August 12, 1965, at Highwood Pass, I trapped a large gravid female (wt 113.4 g) with five well developed fetuses apparently due for birth within a week or 10 days. There are half-grown young, collected in both June and July, in the National Museum of Canada.

General remarks—This is the largest member of the vole family in the mountains. Because of its close association with water and ability as a swimmer, it has been given the current English name. In some cordilleran localities it can become temporarily common, but members fluctuate drastically

from time to time. Anderson and Rand (1943) list six specimens from Waterton and for adjoining Glacier Lechleitner (1955) says the species "is found along numerous stream courses of the high mountain meadows," such as at Logan Pass.

Muskrat *Ondatra zibethicus*
Subspecies: *Ondatra zibethicus osoyoosensis* (Lord). External measurements: The approximate average is 570, 255, 81 mm (range 470–620, 205–270, 67–85). Estimated mean wt ca. 1,180 g or 2.6 lb (Soper, 1964).

Status—Most of the park is unsuited to muskrats and thus the animals are uncommon and irregularly dispersed. Except in a

few favourable tracts muskrats or their signs are seldom noted and mostly absent.

Habitat—This muskrat inhabits sluggish streams, low-lying lakes and beaver and other ponds in eastern areas of the park having essential, aquatic vegetation; such situations are confined to the prairie-foot-hills sector in Transition and lower levels of the Canadian zone at altitudes from 4,195 to about 5,000 ft.

Reproduction—Breeding occurs at different times during the spring and summer. Under highly favourable physical and climatic conditions, muskrats may have two or three litters the same season. The period of gestation is 29 to 30 days (Asdell, 1946). Litter size varies from four to nine or more, but the average is closer to six or seven.

General remarks—Neither Anderson (1947) nor Rand (1948a) specifically mention the occurrence of the present geographical race in the park; the latter author does not include *O. z. osoyoosensis* in his list of southern Alberta mammals. On the other hand, Banfield (1947) recognizes this muskrat as the local subspecies of the extreme southwest, as does Lechleitner (1955) for Glacier Park. Banfield remarked: "Muskrats were observed feeding and their lodges noted in several abandoned beaver dams in the Stony and Crooked Creek systems." Lechleitner regarded the animals as uncommon in Glacier.

The local range of muskrats closely parallels that of beavers. The animals inhabit Belly River, Indian Creek, ponds in the upper Crooked Creek swamplands, Sofa Creek drainage, Waterton Lakes and River, Maskinonge Lake, and perhaps other locations to the northwest. Banfield (1954) dealt with the incidence of tularemia in park beavers and muskrats during the fall and winter of 1952–53. Evidently muskrats were only moderately affected since only four carcasses were discovered—two at Indian Creek and two at Waterton River.

The population was restored to normal in succeeding years. The park superintendent's annual report of December 31, 1961, referred to muskrats as locally plenti-

ful. In this territory, as on the prairies and elsewhere, these rodents build lodges in ponds and lakes, but many also live in bank dens, the entrances to which are often invisible under water.

Western jumping mouse *Zapus princeps*
Subspecies *Zapus princeps idahoensis* Davis.
External measurements (average of 30 park adults): 240, 144, 31.2 mm (235–260, 135–156, 30–33). Mean wt: 26.7 g (19.9–38.8).

Status—During the early 1960's, at least, jumping mice were fairly common to plentiful, with wide and rather consistent distribution. They were eclipsed in numbers only by deer mice. A total of 79 was captured in 3,200 trap-nights. The animals were much scarcer in the summer of 1965 than in previous seasons (Table 3).

Habitat—Various cordilleran life-association niches from mixedwood and coniferous forest, at the lower altitudes, up to open grass-shrub environment of the alplands. The better populated resorts are the tree and shrub-grown borders of streams, ponds and lakes, in Canadian to Arctic-Alpine zones, from the lowest terrain to about 7,000 ft.

Reproduction—After hibernation jumping mice breed in the spring, perhaps into June, and produce litters of from four to six young. Most juveniles are about half-grown by the end of July, or somewhat earlier; the great majority approach or have reached adult weight by late August or early September.

General remarks—Jumping mice rank among the most attractive and interesting of small mammals. In my experience the mountain races have been much more numerous—with a pronounced predilection for the immediate vicinity of streams and lakes—than forms well eastward of the Rocky Mountains. Anderson (1947) assigns *idahoensis* to Waterton park based on 25 specimens in the National Museum of Canada. In 1947 Banfield trapped a male on August 14, beside a stream at Boundary Cabin, Upper Waterton Lake. In relation to

Glacier park Lechleitner (1955) says: "These little jumpers are common in the grassy meadows of the park both in the valleys and some of the higher mountain regions."

Personal investigations revealed the presence of jumping mice in all work areas with the exception of Waterton River and upper Crooked Creek. Overall rate of capture was 2.5 per 100 trap-nights; lowest was 0.3 and the highest 8.0. Most individuals are strictly nocturnal, but occasionally one begins roaming for food before sundown when shadows are long and cool in the valleys. These mice acquire a layer of fat before autumn hibernation; infrequently, one becomes remarkably fat by late July or early August, but the majority reach this condition only later in August and are then heavier than usual.

Family Erethizontidae (porcupines)

Porcupine *Erethizon dorsatum*

Subspecies: *Erethizon dorsatum nigrescens*
J. A. Allen. External measurements (average for large adults): 830, 285, 110 mm. Wt ca. 20 to 25 lb. A juvenile secured at West Castle River July 31, 1959 (575, 170, 80 mm) weighed 8 lb (Soper, 1964). Measurements by Rand (1948a) for a British Columbia male: 802, 240, 116 mm.

Status—These animals are by no means common in the park and judging by my own experience they are evidently quite scarce or lacking in many or most localities. Long distances may be covered on foot, by saddle horse or car without encountering a single example.

Habitat—Mixedwood and coniferous forest from the Transition through Canadian and Hudsonian zones to timberline and beyond. During the summer a few take up quarters in thickets of dwarf birch and willow on alpland tundra. Vertical range embraces a marked diversity of ecological niches from the lowest valleys up to about 7,500 ft.

Reproduction—Mating takes place in late autumn or in early winter, followed by a gestation period of between 6 and 7 months

(Rand, 1948a). The usual number of progeny is one, but occasionally there are two. Born sometime in the spring, the youngsters are about half-grown by late autumn. A short distance north of the park on July 30, 1958, I collected a juvenile weighing 8 lb—about one-third adult size.

General remarks—Anderson (1947) places the porcupines of Waterton under *E. d. nigrescens* based on specimens in the National Museum, Ottawa. In his 1947 park report on mammals Banfield omits the species, ostensibly on grounds of scarcity and lack of sightings. I experienced similar results when, in some seasons and many localities, not one was detected.

During all of my investigations I saw only two but noted a few browsing signs and droppings from time to time. The first observed was during mid June, 1962, when a subadult was met with near Waterton River; the other was an adult encountered in scrub pine and fir near the source of Cottonwood Creek (5,500 ft) during late June, 1963. Signs of gnawing by porcupines were noted in June, 1965, at the old warden cabin near Yarrow Creek, but the animals themselves were not sighted.

Order Carnivora

Family Canidae (dogs)

Coyote *Canis latrans*

Subspecies: *Canis latrans lestes* Merriam.
External measurements: averages by Young and Jackson (1951), 1,130, 344, 189 mm (range 1,092–1,282, 318–394, 178–200). Mean wt is about 27 lb, but some heavy old males may reach 40 lb or a little more.

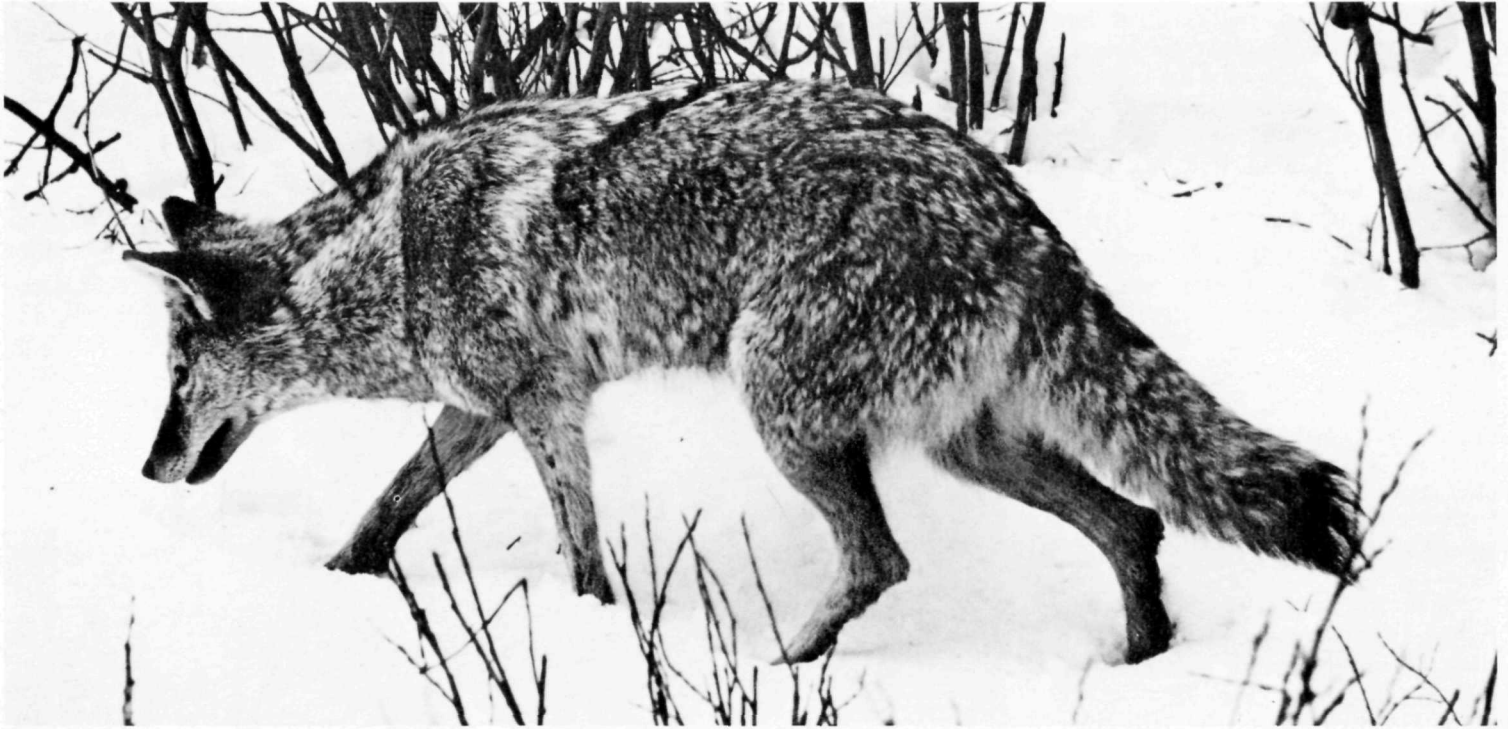
Status—Coyote numbers fluctuate down the years, but the animals were fairly common on the whole from 1955 to 1965. In both 1955 and 1961 the wardens noted some increase in the population. The aggregate then remained rather steady for the next 4 years, during which time individuals were often sighted.

Habitat—Coyotes live in all forest and grassland environment from the valleys of the Transition upward to timberline. Occasional individuals visit the open tundras of

Porcupines are the only regional mammals with a fearsome, defensive covering of multitudes of needle-sharp quills. These are used with telling and sometimes fatal effect on their occasional attackers. Photo by H. Thomson, National Collection of Nature Photographs.



The coyote is one of the most efficient, clever and enduring predators of the dog family. It tends to persist when other members not uncommonly suffer diminution leading to near or final extinction. Photo by Ed Cesar.



the alplands. Most of the park population inhabits the mountain valleys and scattered grasslands at the lower elevations.

Reproduction—The height of the breeding season is reached from late February to early April, followed by a gestation of about 60 days (Hall and Kelson, 1959). Usual litter size varies from five to seven. The whelps are born in spring and many are large enough to make daily sallies from the den by about mid June. By mid August the pups are nearly half-grown.

General remarks—Banfield (1947) found coyotes fairly common and concluded that they ranged over nearly all of the park excepting the highest and most rocky terrain. He noted them in many localities, including the valleys of Cameron and Blakiston brooks, Waterton Lakes and upper Rowe Valley. The winter range is chiefly at low altitudes such as at Belly River, Sofa and Crooked Creek drainages and prairie uplands. Predation on deer was not regarded as serious.

During my investigations in the early 1960's, coyotes or their spoor were seen on many occasions in eastern sections of the park. In 1963 they were common in the semi-open country at upper Cottonwood Creek where several were sighted in addition to a sociable pack of five that appeared to be hunting Columbian ground squirrels. At intervals the creatures were heard giving voice to their weird, clamorous incantations during twilight and into the night, in areas such as Yarrow Creek, Indian Springs and upper Crooked Creek.

Gray wolf *Canis lupus*

Subspecies: *Canis lupus irremotus* Goldman. External measurements: averages by Young and Goldman (1944), 1,901, 442, 245 mm (range 1,803–2,406, 410–480, 232–263). Mean weight lies between 70 and 80 lb, but some old males have exceeded 100 lb.

Status—Wolves still existed in fair numbers at the beginning of the century, but gradually became very scarce, if not totally

exterminated over a wide region. Of late years an occasional individual has wandered into the park, but the animals are still only rare stragglers from outside territory.

Habitat—This is much the same as that of the coyote, embracing grassland reaches and mixedwood forest from the lowest valleys to the alplands during the summer months. Vertical range is from 4,200 to about 7,500 ft. Occurrence is apparently more frequent at relatively low altitudes.

Reproduction—The breeding ritual usually occurs in February and March. Duration of pregnancy is 60 to 63 days, the whelps being born sometime from April to June (Hall and Kelson, 1959). Litter size varies from four to eight or more, six or seven being about average. When a month to 6 weeks old the pups are developed enough for some daily play about the mouth of the den. They are usually mature when between 2 and 3 years old.

General remarks—*C. l. irremotus* is probably now extinct, in which event the

Black bears are highly typical inhabitants of the Canadian wilderness. They occasionally become overly sociable when inadvisably fed by people at campgrounds and in national and provincial parks. Photo by Alma Carmichael, National Collection of Nature Photographs.

stragglers in Waterton are likely members of the race *occidentalis* from farther north. Anderson (1947) includes Waterton Park in the range of *irremotus* (based on specimens in the National Museum of Canada), as does Banfield (1947).

Cowan (1947) wrote

Information on the Waterton Lake area was obtained from F. H. Rigall of Twin Butte, Alta. Grey wolves used to be fairly common in this region. In 1921 increasing depredations upon domestic livestock led the stockmen to employ a noted wolfer, H. Rivière. As a result of this man's activities wolves were locally extirpated and did not reappear until 1943, when one black individual entered the area. In 1944 two black wolves were present, but the male was shot at a beef carcass killed by a grizzly bear within Waterton Lakes Park.

Similar conditions existed in Glacier National Park, Montana, when, following extirpation during the 1920's, occasional wolves began appearing some 20 years later (Brittan, 1953). Since then wolves have rarely been detected anywhere in Waterton park and vicinity. Years may elapse without any known encroachments whatever. The park superintendent's annual report, December 31, 1958, records one having been seen along Akamina Highway. Again, during 1965, lone tracks were noted by wardens at Belly River, Stony Flats and Red Rock Canyon. Because of wolf scarcity, ungulate predation by these animals has long been insignificant. I saw nothing of wolves in the park during the summers from 1960 to 1965.

Red fox *Vulpes vulpes*

Subspecies: *Vulpes vulpes macroura* Baird. External measurements: average by Rand (1948a), 1,015, 461, 172 mm. Mean wt ca. 10 lb (8-12); some males reach 15 or 16 lb. Females are about one-tenth smaller.

Status—This is one of the scarcer park carnivores. This status existed fairly constantly before the park's establishment in the spring of 1895 and throughout the ensuing years red fox appearances have been relatively few and sporadic.



Habitat—Habitat is similar to that of the coyote from the lower valleys through the Canadian to the Hudsonian zone and occasionally beyond to the alplands. The vertical range extends from the lowest valleys up to about 7,200 ft.

Reproduction—Mating materializes in late February and in March followed by a gestation period averaging about 51 days. Litter sizes vary from four to ten. Most pups are born sometime in late April and in May and emerge from the den to play and do a little local exploring when about 5 weeks old (Hall and Kelson, 1959). By autumn they are well developed and able to fend for themselves.

General remarks—Neither Anderson (1947) nor Rand (1948a) clearly indicate the geographical race represented in Waterton Lakes park and elsewhere in extreme southwestern Alberta. Lechleitner (1955) rates the red fox as rare in Glacier and assigns the animals to *V. f. macroura*. McCowan (1938) gives a good popular account of the red fox in the foothills of Alberta.

Foxes in this region are so wild and retiring that they are rarely seen by anyone and haunt only the remoter sections of the wilderness. At long intervals tracks may be seen on dusty trails or sandy lake shores. For several decades an average of no more than one or two individuals have been spotted in any one year. The park superintendent's reports reveal that wardens saw from one to three foxes in 1961, 1963 and 1964. I saw none during my investigations.

Family Ursidae (bears)

Black bear *Ursus americanus*

Subspecies: *Ursus americanus cinnamomum* Aud. & Bach. External measurements: The following specific averages are derived from many sources: 1,500, 120, 180 mm; height at shoulder about 640 mm. Weight varies markedly (fat and age factors), the average being between 250 and 350 lb, but some old, fat individuals have exceeded 500 lb (Soper, 1964). Rand (1948a) gives the weight of a Waterton female as about 350 lb.

Status—This is the most numerous of the larger regional carnivores. Black bears occur commonly along many park roads and trails, around the townsite, at garbage disposal areas and elsewhere. In some places they become unqualified pests at campsites, sometimes causing annoyance and damage.

Habitat—Mixedwood and coniferous forest from the lowest Canadian zone valleys to medium mountain-side elevations in the Hudsonian zone. Some individuals range still higher to beyond treeline and well into the lofty alplands, chiefly during the hot weather of mid summer.

Reproduction—The animals first mate at about 3 years old, during late spring and early summer. Gestation lasts for approximately 7.5 months. Litter size is usually one or two and, rarely, four. The young are born in the winter den during January or February and are amazingly small (8–10 oz) in relation to the size of the mother. By April they weigh about 5 lb and when a year old, from 60 to 100 lb.

General remarks—Anderson (1947) mentions this race whose skins are in the National Museum, as occupying Waterton park. This form of the black bear displays the highest percentage of the brownish, or cinnamon colour phase, hence the adoption of the descriptive trinomial name. Banfield (1947) found that 28 per cent of the park bears observed were of this cinnamon colouration.

While these bears are bold, fearless and sociable in many tourist-ridden sections of the park, in more remote areas they can be very wild, withdrawn and infrequently encountered. I have spent a week or more in some remote tracts inhabited by the animals without sighting a single individual. During the several summers of study, bears or their signs were seen in most work areas. In some localities they were troublesome. At Twin Lakes Cabin a bear plundered food items from my camp while I was at Lost Lake, and at Blakiston Brook a subadult with one swing of its foot, slashed my silk tent open from peak to sod-cloth while I sat inside preparing specimens! Such

experiences are rather uncommon and certainly rare, or unknown, among unsophisticated bears of the far backwoods.

Grizzly bear *Ursus arctos*

Subspecies: It is uncertain which true form or forms occur, or did occur, in the Waterton park territory; see comments under *General remarks*. External measurements: a well developed individual reaches 2,234, 72, 201 mm; height at shoulder about 1,370 mm (Rand, 1948a). Seton (II, 1926) says that 500 lb is near the average weight of males and 400 lb for females and that only exceptional giants reach a weight of 800 to 1,000 lb.

Status—Generally grizzlies are furtive and evasive—much more so than black bears—and haunt the more remote, secluded sections of wilderness. Thus they are seldom observed by casual visitors to the park. The rugged nature and complexity of the cordillera renders it difficult to arrive at a sound knowledge of total numbers. Grizzlies are widely distributed, particularly in western sectors. The rate of fortuitous warden sightings, in relation to territory, indicates a population of several dozen individuals.

Habitat—Grizzlies live in rough, mountainous terrain from the lower Canadian zone valleys upward to the bleak, wind-swept tundra above timberline. The latter area becomes the favourite environment during summer when grizzlies are only infrequently seen below an altitude of about 6,000 ft. In the spring and autumn a few grizzlies may appear occasionally low down in the principal valleys and flats and near main park highways.

Reproduction—This bear mates in late spring and early summer at intervals of 2 or 3 years. Length of gestation is between 6 and 7 months and litter size is usually one or two and rarely three. In relation to the huge bulk of the mother, the cubs are astonishingly puny at birth, weighing a mere 24 to 30 oz!

General remarks—Several authors assign the form *horribilis* to the southwestern

Alberta Rockies and adjacent Montana, at least east of the continental divide. However, uncertainties prevail that can perhaps only be removed by further revision of the genus *Ursus*. Anderson (1947) lists *U. canadensis rungiusi* Merriam as occurring in Waterton and north to the headwaters of Athabasca River, but there are further perplexities caused by racial overlappings and at least the theoretical intrusion of *U. a. imperator*.

In 1947 Banfield found grizzlies fairly well represented and remarked that "The summer ranges of this animal seem to be along the backbone of the continental divide and adjacent promontories such as the Mount Alderson complex and Mount Dungarvan." Other sightings occurred at Goat, Twin, Lone and Carthew lakes and in Rowe Valley. On May 24, 1952, Warden R. L. Hand reported that skiers had chased a grizzly out of hibernation at Cameron Lake (Francis, 1960). The park superintendent's annual reports indicate that wardens observed numbers of grizzlies each year from 1955 to 1965, mostly at high altitudes and ostensibly near the continental divide. However, in 1961 wardens ran into grizzlies at Red Rock Canyon, Crypt Lake and, surprisingly, at Belly River, for up to that time the animals were believed not to frequent any part of the region east of Waterton Lakes (Banfield, 1947).

In 1962 a potentially dangerous female and a cub at the townsite had to be destroyed when no ordinary methods would induce them to leave the area. The following year five grizzlies were reported in ranchlands adjacent to the park, and two others in the vicinity of Waterton Lakes. Just before denning for the winter, in 1965, a mother grizzly and two cubs became unwelcome visitors at the townsite, but, happily, a few rifle shots were sufficient to scare them away for good. Concerning the grizzly in Waterton, Scharff (1966) says: "Rarely sighted—inhabits remote areas along Continental Divide, Carthew Lakes, west of Red Rock Canyon and occasionally in the Belly River valley."

The grizzly bear is the largest, most powerful and, on occasion, the most dangerous of the native carnivores. For the most part, however, they seek escape from humans in the remoter solitudes of the mountain ranges. Photo by J. Sime.

The ermine, or weasel, is one of the few North American mammals that change from a brownish summer coat to one of spotless white (except for black tail tip) during the winter months. They are notably furtive, skilled killers of the smaller mammals. Photo by Ed Cesar.



Family Mustelidae (weasels)

Marten *Martes americana*

Subspecies: *Martes americana abietinoides* Gray. External measurements: Rand (1948a) gives the following figures for a Banff park male—596, 181, 96 mm; maximum male measurements by Hall and Kelson are 682, 240, 90 mm. Mean wt ca. 2.75 lb. Seton (II, 1925) says that a full-grown marten may weigh up to 4 lb.

Status—In primeval times marten were doubtless plentiful in these parts, but were nearly exterminated by the all-out trapping of the past century. Marten populations seemingly require a long time to fully recover, for, despite full and long-continued protection in the park, the population appears to remain small. The animals are rather erratically distributed and rarely sighted.

Habitat—Martens inhabit the Canadian zone of the Rocky Mountains in dense stands of spruce, fir, pine and underbrush. To some extent they also resort to the poorer forest of the Hudsonian zone up to and approaching timberline. Local vertical range extends from the lowest valleys with suitable timber up to 6,500 or 7,000 ft.

Reproduction—This animal mates in late July and in August. The progeny are produced from about 220 to 230 days later, that is, sometime in March or April (Asdell, 1946). Young at a birth usually number three or four (Hall and Kelson, 1959). They are weaned after 6 or 7 weeks and then go on simple little hunting trips with the mother. By the beginning of winter they are nearly full-grown, self-sufficient and bear a close resemblance to their parents in stature and colour.

General remarks—The indigenous race is a relatively small, dark brown one that ranges the length of the Alberta Rockies and south into Montana. Little information is available on the species in the present area. Neither Anderson (1947) nor Rand (1948a) make clear which race resides in Waterton. Under *M. a. abietinoides* Banfield (1947) remarks that one was seen along the Alderson Lake Trail on July 13, 1946, and that marten scats were sometimes common-

ly noted along woodland trails in Cameron, Rowe and Bauerman valleys. Warden Christiansen reported that marten tracks were locally numerous during winter in the Bauerman Brook territory.

In the early 1960's I did not detect a single marten in any study area, but I did observe a few scats along the trail to Akamina Pass and, likewise, on the trails leading to Lost and Twin lakes. From time to time wardens briefly sight the animals, as is borne out by the park superintendent's annual reports. A paper by Cowan and Mackay (1950) contains an excellent discussion of food habits.

Ermine *Mustela erminea*

Subspecies: *Mustela erminea invicta* Hall. External measurements (average for both sexes): ca. 285, 80, 37.2 mm (range 255–290, 70–85, 32.3–39.9). Ordinary weights are around 150 to 160 g, but some males reach at least 175 g. Males are normally about 10 to 12 per cent larger than females.

Status—These are the common mustelids of the region, as they are in most of the forested mountain and foothill country to the north. Locally, they are fairly common and well distributed, especially in the eastern two-thirds of the park. They also occur in diminishing numbers to the west.

Habitat—Ermines chiefly inhabit coniferous forest, poplar "bluffs", brushy grasslands and brulé in Transition and Canadian zones at low and medium altitudes. Smaller numbers inhabit the higher woods and meadows of the Hudsonian zone to the vicinity of timberline. Local vertical range is 4,200 to about 7,000 ft.

Reproduction—Breeding activities take place about mid summer. The gestation period lasts for 9 or 10 months, and the customary four to eight young are delivered during the following April and May. They are usually weaned in about 6 weeks and are practically full-grown by early or mid autumn (Lechleitner, 1955).

General remarks—Anderson (1947) lists *M. e. invicta* for the southwestern Alberta territory supported by park specimens in

the National Museum of Canada. For adjoining Glacier, Lechleitner (1955) remarks: "These are the common weasels in the park and may be found in a variety of habitats from the valley floors up to the high mountain meadows." On August 30, 1947, Banfield saw two individuals hunting pikas in a rock slide at the lower end of Cameron Lake.

During my investigations I ascertained from the park wardens that ermine were wide-spread and not uncommon, especially in eastern localities. Such included the Belly River Valley and vicinity and westward over the low ridge, pond and stream wetlands from Indian Creek to Crooked and Sofa creeks. Also, some inhabit the lowlands of the Waterton Lakes and River trench, the valley of Blakiston Brook, and terrain northward to and beyond Indian Springs. Tracks were noted in a few places, imprinted on the damp sandy and muddy margins of lakes and streams. In June, 1963, I observed one running about the barn of the warden station at upper Crooked Creek (Oil Basin) and on June 13, 1965, briefly sighted another in a pile of driftwood along Yarrow Creek, near the northern tip of the park.

Long-tailed weasel *Mustela frenata*

Subspecies: *Mustela frenata longicauda* Bonaparte. External measurements (average for both sexes): 420, 147, 48 mm. Males only 438, 158, 50 mm; some individuals reach a length of 480 mm. Mean weight is about 370 g, but some specimens reach at least 397 g.

Status—A few of these large weasels inhabit the park, notably in eastern localities and in gradually decreasing numbers west to the continental divide. While not rare, the species is much less numerous than the ermine and generally observed only at long intervals, chiefly by wardens on patrols.

Habitat—Within the park these animals inhabit prairie-parklands and mixedwood forest of eastern Canadian zone localities up to moderate elevations in the Hudsonian zone. They rarely range beyond the limit of

trees. Regional vertical extremes are from 4,200 to about 7,000 ft.

Reproduction—Breeding occurs in July and August and gestation lasts for an average of about 279 days (Hall, 1951). The five to eight young are therefore born sometime in April or May. As Hall and Kelson (1959) point out, embryos are implanted only 21 to 28 days before the young are born and in the preceding long gestation period (205–337 days) the embryos lie dormant in the uterus as unimplanted blastocysts. The lactation period lasts for about 5 or 6 weeks. At 10 to 12 weeks the youngsters are nearly as large as the mother.

General remarks—Relatively little chance exists that the casual visitor will see one of these weasels. They are normally shy, furtive and nocturnal in habit, although an occasional individual may be seen darting about during the day. Most sightings are by wardens who patrol widely and regularly at all seasons. Best estimates of population numbers are gained by observing the intricate, wide-ranging snow trails during the winter.

Warden Christiansen informed me that he had observed long-tailed weasels on several occasions in the eastern portion of the park, mostly in the Belly River drainage area. One of the clearest sightings occurred on June 30, 1960, when a large example bounded across the road near Belly River a few miles north of the international boundary. Hall (1951) mentions two specimens of *M. f. longicauda*, in the National Museum of Canada, taken in Waterton park.

Mink *Mustela vison*

Subspecies: *Mustela vison energumenos* Bangs. External measurements: average for males approximately 640, 195, 70 mm; females noticeably smaller. Ordinary male weights vary from about 1.75 to 2.55 lb, but some individuals exceed 3 lb. Females average about 1.65 lb. Male maximum measurements as given by Hall and Kelson (1959) are 720, 194, 75 mm.

Status—Available information points to a very modest park aggregate. The animals

are rather capriciously dispersed to include some favourable lakes and streams, or portions thereof, chiefly in eastern locations. Many extensive tracts are devoid of mink owing to quite unsuitable food and shelter conditions.

Habitat—Acceptable environment is substantially confined to the forests, sluggish streams, swamps, lakes and ponds of the Canadian zone up to about 5,500 ft. In some places the species also inhabits beaver ponds and other bodies of water in and about muskegs and swampy bottomlands.

Reproduction—Mating is a spring event that varies with different pairs as to date during the months of March and April. Duration of pregnancy is 39 to 76 days and the usual litter numbers five or six, but can go as high as ten (Hall and Kelson, 1959). By July the youngsters are weaned and old enough to play some of the time above ground and learn to pursue and kill mice, voles, chipmunks and small birds.

General remarks—Mink have long inhabited suitable streams and lakes of the Rocky Mountain region. Along with other highly prized fur bearers such as beaver, marten and fisher, they were eagerly sought by the early trappers and traders. Banfield (1947) saw fresh mink scats on the shore of Cameron Lake and remarked that superintendent Bailey found a few of the animals regularly frequenting grounds around the fish hatchery. With reference to neighbouring Glacier park, Lechleitner (1955) remarks,

Minks are fairly common mammals along the stream banks and lake shores throughout the park. They appear equally at home in the dense forests of the west side and in the willow bottoms of the prairie meadows of the east.

It was learned from the wardens that a few minks inhabited various areas of the park in the early 1960's and earlier. Warden Thompson had seen mink tracks along the east shores of Waterton Lakes and near the mouth of Sofa Creek. In late July, 1960, I saw fresh spoors in the muddy margin of

Belly River near the confluence of North Fork. Indistinct impressions seen along upper Cottonwood Creek, June 1963, were believed to be those of mink. On the whole I gained the impression that the animals were uncommon and irregularly distributed. In the park superintendent's annual reports for 1961 and 1964 he mentions that wardens had recorded a few minks.

On July 29, 1966, warden R. Thompson found a road-killed mink, near the park's east gate, that was preserved for the park collection; the individual measured 506, 190, 62 mm and weighed 635.2 g. Despite complete protection for many decades, the species possibly was more abundant in the past century than it is today. Probably, the old-time population was virtually extirpated by a generation or two of trappers before the park was created; under such circumstances full recovery could be long delayed.

Wolverine *Gulo gulo*

Subspecies: *Gulo gulo luscus* (Linnaeus).

External measurements (average for both sexes): ca. 1,048, 220, 190 mm. Male maximum measurements by Hall and Kelson (1959)—1,125, 260, 192 mm. Usual weights are from about 24 to 40 lb. Females average 10 per cent less in linear measurements and 30 per cent less in weight.

Status—Exact status is uncertain. Clearly, however, the animals are far from plentiful, widely scattered and rarely sighted. Because of their suspicious, solitary nature demanding the solitude of far-flung living space, it is very doubtful if wolverines were ever consistently numerous anywhere in the cordillera.

Habitat—Wolverines inhabit light to heavily timbered tracts in the Canadian and Hudsonian zones to the Arctic-Alpine tundras. They regularly visit the alplands, especially during the summer. Vertical range extends capriciously from the lowest valleys up to about 8,000 ft.

Reproduction—This member of the weasel family breeds in autumn and early winter, the time of copulation varying greatly

with different couples. The gestation period is reported to be as much as about 183 days, with two to five young to a litter (Rand, 1948a). The majority are born in late winter and early spring (Krott, 1959). Hall and Kelson (1959) remark: "As in many other mustelids there seems to be a long period between fertilization of the ovum and its implantation."

General remarks—Anderson (1947) includes the whole length of the Canadian Rockies within the wolverine's range, and down the cordillera to Colorado. In the park a few random individuals roam the high country along the continental divide more consistently than elsewhere. Banfield (1947) notes regional occurrence, especially in the area at and beyond Akamina Pass in British Columbia, where a trapper during the 1940's secured several each winter. The park superintendent's annual reports for 1960, 1961 and 1965 state that wardens either sighted wolverines in the park, or observed their tracks in the snow during those years.

Lechleitner (1955) reported occasional individuals in Glacier park. Interesting information on wolverine occurrences in neighbouring Montana is contained in the paper by Newby (1964). While most park wolverines prefer the higher and more remote solitudes, one infrequently wanders well down into low country. A very unusual happening of this sort is that of one killed by a motor car on February 19, 1963, 5 miles northeast of Cardston on the open plains about 25 miles from Waterton park (Scotter, 1964).

Badger *Taxidea taxus*

Subspecies: *Taxidea taxus taxus* (Schreber).

External measurements: combined averages of both sexes by Hall and Kelson (1959), 702, 129, 107 mm, with maximum of about 870, 155, 125 mm. The usual weight is approximately 12 to 16 lb, but big oldsters may reach 20 to 25 lb.

Status—Because of a restricted area of ecological sufficiency within the park, only a very limited population of badgers can

develop. In no section of the occupied territory are the animals actually common, but a fair number have permanent homes where favourable conditions prevail.

Habitat—All inhabited eastern tracts are characterized by open prairie, brushy bottomlands and aspen groves. Such lie within the somewhat modified Transition zone immediately east of the first outer range of the Rocky Mountains northward from Waterton Lakes. There the mean altitude is about 4,250 ft. Similar conditions prevail here and there for 3 or 4 miles westward from Lookout Butte where the mean elevation is around 5,150 ft. There is some local occupation of marginal terrain in the Canadian zone. Within the park only about 50 sq miles appear to be suitable local range for badgers.

Reproduction—Mating occurs sometime in August and September. A curious evolution is the delayed sperm implantation until about mid February, after which the true gestation period is approximately 6 weeks (Hall and Kelson, 1959). There are one to five young in a litter. The somewhat larger than half-grown juveniles may be seen in the latter part of July and in early August.

General remarks—The occurrence of badgers within the prairie-foothills sections of the park has been known since the region was first explored. Banfield (1947) remarks:

The badger is fairly common and is distributed over the foothills area of the Park. Their dens and diggings are one of the characteristic sights of the badlands...The badger is not looked upon with much favour on the golf course where it digs up Columbian ground squirrels (*Citellus columbianus*) on the fairways.

On August 4, 1961, I saw my first badger in the park as it ran across the Red Rock Canyon Road and through thickets due south of Bellevue Hill. In succeeding seasons I observed the animals, or their conspicuous diggings, in various places east and west of Waterton River and Lower Waterton Lake, for several miles up Blakiston Brook Valley, at Indian Springs and along

the north boundary at upper Cottonwood Creek. The park superintendent's annual reports for 1959 and 1961 refer to fairly frequent sightings by wardens during the summer.

Striped skunk *Mephitis mephitis*

Subspecies: *Mephitis mephitis hudsonica* Richardson. External measurements (average of adults, both sexes): ca. 640, 220, 78 mm. Normal wt: 4 to 6 lb, but fat autumn adults can go to 8 or 10 lb. Progeny at birth weigh about .5 oz and, at 8 weeks, 1.5 to 2.0 lb.

Status—The striped skunk occurs more or less sparingly, but may be locally common in eastern quarters—typically in sections of prairie-parklands, brushy bottomlands and lowland mixedwood forest in the vicinity of streams and lakes. They are scarce over the park at large and completely lacking in higher terrain. At times they have been fairly numerous around the townsite and garbage dumps.

Habitat—This animal's environment is quite similar to that of the badger, but embraces more Canadian zone territory to the southeast, including the drainage area of Belly River and Crooked Creek.

Reproduction—Skunks usually pair off and breed at or near the end of winter hibernation during March and the early part of April. The customary four to seven young are born following a gestation period of around 63 days (Hall and Kelson, 1959). At this time they weigh about 15 to 20 g. They first leave the den when 5 or 6 weeks old and do not stray far from the mother. When 3 months old they are about half-grown. The mother and young stay together throughout the first autumn and winter.

General remarks—In the greater part of the park's major scenic and camping areas the skunk is fortunately scarce or totally wanting. However, in some east-central areas, as around Lower and Middle Waterton Lakes, it is definitely necessary at times to remove numbers of skunks for the sake of human convenience and equanimity. Since the species is almost totally nocturnal

in searching for prey, run-ins with humans are relatively rare.

Banfield (1947) mentions the regular occurrence of the animals in some localities, especially in the general area referred to above. In the south-central part of the park few of the animals reside westward of the longitude of Waterton townsite, most of the population being in comparatively low terrain to the east and northeast. Chief warden, Frank Camp, told me in 1963 that skunks sometimes become too common and objectionable around the townsite making it expedient to reduce their numbers. Thus, in the summer of 1962 about 40 individuals were trapped and removed from the locality in a single season.

I sighted the creatures, or their signs, infrequently but obtained positive evidence of occurrence along Belly River, Waterton River Valley near the north boundary, the Cardston highway a mile northeast of Maskinonge Lake, the Indian Springs locality and at upper Cottonwood Creek. The wardens reported skunks as fairly plentiful in some eastern locations during the summer and autumn of 1961 and status remained about the same for the next several years. On July 20, 1966, at the government compound, warden Thompson secured an immature for the park collection that measured 502, 203, 65 mm and weighed 1,182 g. The following month he found two good skulls at Indian Springs.

River otter *Lutra canadensis*

Subspecies: *Lutra canadensis canadensis* (Schreber). External measurements: Males average about 1,190, 410, 120 mm; Hall and Kelson (1959) give maximum measurements of 1,300, 507, 146 mm. Females are about one-fifth smaller and less stockily built than males. Mean wt ca. 20 lb (18–22).

Status—The otter is one of the rarest members of the park's mammalian fauna. It may never have been common in this mountain setting. Today its presence anywhere in the region is an unusual event and one is justified in assuming that in the greater part of the park not a single individual exists.

No lower animal is more shunned than our common striped skunk owing to its powerful and repulsive defensive battery of scent glands whose fluid can be ejected for several feet. However, the defence is normally employed only under extreme provocation. Photo by Ed Cesar.



Habitat—River otters inhabit the larger streams and lakes, chiefly in the Canadian zone from 4,200 to perhaps 5,100 ft. They also visit swampland lakelets and beaver ponds sometimes inhabited by fish and muskrats.

Reproduction—Mating takes place in the winter and early spring and the one to four progeny are born about 60 days later (Rand, 1948a), sometime in April and May. Their eyes are closed at birth and for many days thereafter. They first enter the water when nearly 2 months old and have the stature of adults at about 9 or 10 months.

General remarks—All Banfield (1947) had to say about this species in Waterton was, "Mr. Bailey reported that an otter had appeared at the fish hatchery several years ago." In the last 10 years of annual reports the park superintendents make no reference to otters. Lechleitner (1955) says that otters were uncommon in Glacier Park and only occasionally seen along some of the larger streams and lakes, notably west of the continental divide. During my investigations I saw nothing of the species within the park.

Family Felidae (cats)

Mountain lion; cougar *Felis concolor*
Subspecies: *Felis concolor missoulensis*
Goldman. External measurements: averages by Young and Goldman (1946), 1,836, 714, 260 mm and by Hall and Kelson (1959), 2,071, 698, 255 mm, with a maximum of 2,743, 815, 292 mm. Weights usually run from about 90 to 150 lb, but an occasional old male reaches 200 lb, or somewhat more.

Status—These big cats are observed with more or less sparing regularity, particularly, it seems, in the seclusion of the more rugged territory approaching the continental divide. Occasional individuals wander over the lower levels summer and winter. Mountain lions are not, however, common. It is doubtful if more than a dozen or so are permanent park residents. Probably a few wander back and forth through the passes from British Columbia and from mountain territory to the northward.

Habitat—Normally cougars inhabit the most sequestered and heavily timbered districts of the Canadian zone and sometimes higher altitudes. Some hunting grounds are also in semi-open lowlands. Dens are located in caves and below bedrock overhangs and as ground nests of leaves and grass in dense forests and thickets.

Reproduction—Time of breeding differs among mating pairs by several weeks or months. Births range from February to July, but seemingly most kittens are born sometime in the spring, after a gestation period of 90 to 96 days. Litter size may vary from one to six, but the usual number is two (Hall and Kelson, 1959). The youngsters are weaned when about 4 months old. Thereafter they soon learn to do a little hunting and not uncommonly stay with the mother for 2 years.

General remarks—Mountain lions, being highly sensitive, alert and retiring are seldom surprised, or sighted by man. A person may travel in mountain lion country for weeks or months without even glimpsing a single example. Much more readily discovered are their tracks and other sign, especially during winter. In his 1947 report Banfield mentioned the occurrence of several individuals, as well as the somewhat regular detection of spoor in the Blakiston Brook and Belly River valleys. In 1946 two of the animals were seen at close range.

The annual reports of the park superintendent include some interesting notes on cougars: In March 1955, a cougar pair visited the townsite and killed two deer in the vicinity. Wide-spread spoor in the snow were noted by wardens the previous winter. Likewise several cougars were sighted in 1956, 1959 and 1960. The reports indicated some increase in numbers in 1961. However, for the next 4 years only two or three at most were recorded in any 12-month period.

Early in March, 1967, W. J. Lunney, park superintendent, informed me that a mountain lion entered the town of Waterton in the late summer of 1966, was given a tranquilizer shot and then safely trans-

ported to a distant park locality. Another individual was sighted on February 27, 1967, at Mile 7 along the Akamina Highway.

Lynx Lynx canadensis

Subspecies: *Lynx canadensis canadensis* Kerr. External measurements: Combined average for both sexes approximately 910, 96, 225 mm; males are somewhat larger than females. Weights vary from about 15 to 28 lb. Some well-conditioned old males may exceed this by several pounds.

Status—This species is uncommon and seldom encountered by anyone throughout this region or in adjacent Glacier park. It is uncertain whether the species was common or fairly numerous through this part of the Rockies in early times.

Habitat—The lynx inhabits basically the same environment as the mountain lion in Canadian and Hudsonian zones. It seems to prefer the more moderate elevations in close association with the best habitats and populations of the varying hare.

Reproduction—The mating urge strikes chiefly in March, but some unions are consummated many weeks earlier and perhaps some even a little later. The usual two to five kittens are delivered after a gestation period of about 63 days (Rand, 1948a). They suckle for 2 or 3 months, then venture into the open to engage in little hunting forays in the general vicinity of the den.

General remarks—With a mammal such as the lynx it is difficult to arrive at a sound estimate of relative abundance. The animals are keenly perceptive and wary under all ordinary circumstances and rather rarely sighted even when the population is high in relation to the 10-year cycle. The most reliable index to numbers is a check on the frequency of spoor in the snow.

Banfield (1947) remarked, "According to Ali Ashman, lynx tracks are observed but rarely in the continental divide area and the Akamina Valley." The animals are also uncommon in Glacier park. The annual reports of the Waterton park superintendent indicate that the wardens usually

observe but one or two individuals each year. The animals are scarce, more or less continuously, in this region.

Bobcat *Lynx rufus*

Subspecies: *Lynx rufus pallescens* Merriam. External measurements: Average, both sexes, approximately 875, 160, 175 mm. Adult weights vary between 12 and 25 lb (occasionally heavier) with a mean of about 21 lb. Sometimes measurements and weights of individual adult lynx and bobcat overlap.

Status—Bobcats inhabit the park in limited numbers and are among the less common of the regional species. Probably in some areas population closely matches that of lynx, but bobcats are more numerous than lynx in the southeast.

Habitat—This cat haunts heavy forest less than the lynx, showing preference for more open woods, rocky thicket-strewn hillsides, brushy coulees and semiarid situations. Local zonal distribution comes within the Transition and sometimes lower part of the Canadian zone between 4,200 and 5,100 ft.

Reproduction—Time of breeding activities is similar to that of the lynx, but in lower country and latitudes occurs somewhat earlier. After a gestation period of between 7 and 8 weeks the two to four kittens are brought forth in April or early May. General habits and development closely resemble that of the lynx.

General remarks—The bobcat inhabits only the more open country on the eastern side of the park. There, simpler topography and generally a more attractive environment for this species prevails. Banfield (1947) remarks that during the winter of 1946-47 warden A. Pittaway came in close contact with a bobcat in the Belly River Valley and reported that tracks of the animals were regularly noted in that district. For decades the occasional individual has been sighted at different seasons within the park. Reports of the park superintendent reveal that in most years wardens sighted a few bobcats.

The wapiti, widely known among sportsmen and others as "elk", has a noble bearing and is the most numerous member of the deer family in southwestern Alberta. Photo by Valerie May, National Collection of Nature Photographs.



Warden J. Christiansen informed me that he had seen a number of individuals along Chief Mountain International Highway between Maskinonge Lake and Indian Creek and in the Belly River Valley. On June 28, 1963, we saw a bobcat bound across the Sofa Creek road a little north-east of Lower Waterton Lake. On June 22, 1965, I saw one at close range in a patch of shrubby grasslands about 2 miles southwest of Birdseye Butte. A few days prior to this warden Christiansen had spotted one near Indian Creek. Of the bobcat in Glacier, Lechleitner (1955) remarks:

Bobcats are rather rare in the park, but occasionally they are seen or their tracks are noted in the brushy valleys. Because of the deep snow and lack of extensive suitable environment it is doubted if this cat was ever very abundant here.

Order Artiodactyla
Family Cervidae (deer)

Wapiti or elk *Cervus canadensis*
Subspecies: *Cervus canadensis nelsoni* V. Bailey. External measurements: average ca. 2,430, 145, 550 mm; maximum measurements (Hall and Kelson, 1959) 2,972, 213, 660 mm. Weight of bulls range from

about 700 to 1,000 lb and cows, 500 to 600 lb. Height at shoulders approximately 1,300 to 1,530 mm. A new-born calf weighs from 25 to 30 lb.

Status—The wapiti, the most abundant of the park's hoofed mammals, is well distributed in favourable feeding areas over most of the region. Total summer population amounts to several hundred head, while over 1,000 have been observed on the winter ranges.

Habitat—Mixedwood and coniferous forests in foothills, mountain valleys, dry grasslands, meadows and alpine tundra.

The mule deer is the larger of the two smaller native deer. The male is most readily distinguished from that of the "whitetail" by the pronged tines of the antlers, whereas the latter has undivided tines. Photo by D. Thyer, National Collection of Nature Photographs.



Zonal range is from the Transition to the Arctic-Alpine. The animals resort to high forests, meadows and alplands in summer and low mountain valleys and prairie during the winter. Local vertical range during the year is from 4,200 to about 7,500 ft.

Reproduction—Mating reaches a high pitch in September and October. Following successful coition gestation lasts for approximately 260 days (Seton, III, 1927). The one or two calves are dropped in May or the early half of June and stay close to the mother for many weeks. The baby coat is covered with white spots for several months. By October the calves can forage for themselves, but stay with the mother throughout the winter.

General remarks—Banfield (1947) points out that in the early years of this century elk were unknown in the present territory, but old, weathered antlers testified to their occurrence at an earlier date. After first being seen again locally about 1920, they steadily became more numerous. By 1936 wapiti had so increased that they were spreading out and causing serious damage to stacks of feed on neighbouring ranchlands. In August 1938, Anderson (1938a) implied an abundance of elk, adding that most lowland animals were in the thick forest and brush along Belly River where observations were difficult.

Cowan (1945, unpublished data) believed the park's summer population to be about 500, but Banfield considered this estimate too high—his estimate in 1947 was a total of about 110 during the summer, with around 1,520 head on the winter ranges. Banfield stated that

The park population increases fifteen-fold in the winter because of immigration of elk from other areas, including that portion of the Belly River in Glacier National Park, the Castle and Sage River valleys of Alberta and the Akamina valley of British Columbia.

All winter feeding grounds lie in open or semi-open eastern areas of the park at altitudes from 4,200 to about 5,200 ft, stretching brokenly from Belly River northwest

to Cottonwood Creek. The largest single tract of about 30 sq miles lies east and west of Lower Waterton Lake and Waterton River and the lower reach of Blakiston Brook Valley. In summer, most elk are distributed more or less throughout the park's cordilleran highlands, including the continental divide terrain and general vicinity.

The total population fluctuates somewhat from year to year, and occasionally due to the limited carrying capacity of the ranges, controls are necessary. By 1956, numbers had again increased to such an extent that available feeding grounds were overstocked. Consequently, during the next 5 years the winter herds were gradually reduced by about 570 individuals to ease the inroads of overbrowsing and grazing. Superintendents' annual reports reveal that from 1960 to 1965 the average number of wintering wapiti was approximately 620, with a high count of 929 in January, 1962.

In a letter of March 3, 1967, W. J. Lunney, park superintendent, remarked:

In a co-operative elk study between the Warden Service of this park and Glacier National Park in Montana, the current estimate of total elk population in this area has been set at 700 head.

Scharff (1966) says of the local wapiti:

They are common in the Stony Flats, Belly River, Horseshoe Basin and Oil Basin areas during most of the year. They often move out into the open prairie areas around the buffalo paddock during the winter. Elk are rather scarce in the remainder of the Park.

Mule deer *Odocoileus hemionus*

Subspecies: *Odocoileus hemionus hemionus* (Rafinesque). External measurements (averages, both sexes): ca. 1,710, 165, 500 mm. Height at shoulders about 42 inches (1,070 mm). Weights are usually from 200 to 250 or 300 lb, but some bucks may reach about 450 lb. Females are noticeably smaller and slimmer.

Status—This deer, the second most plentiful large mammal in the park, is exceeded

in year-round abundance only by the wapiti. The situation was reversed 20 years ago when the winter population of mule deer was estimated at about 1,700 head—of late years the count has been substantially lower. Scharff (1966) says that "These deer can be found throughout the park and are very tame around Waterton townsite and along the main entrance roads."

Habitat—Mule deer inhabit parklands, mixedwood and coniferous forest, brûlé and meadows from the lowest valleys through Canadian and Hudsonian zones to the alplands well above timberline. Local altitudinal range is 4,200 to about 7,900 ft.

Reproduction—Peak of sexual activity, known as the rut, is reached in October and November with perhaps isolated unions somewhat earlier and later. Length of gestation averages about 215 days; thus the one or two spotted fawns may be born sometime in April and May, and in some belated cases in early June. Mother and immatures stay together until the following year.

General remarks—Mule deer frequent practically all parts of the region. In summer a major proportion live high, or fairly high, up in the mountains, not uncommonly in small social groups. After mating in the autumn the animals soon descend from the high country to winter at much lower altitudes. The deer then assemble in a more restricted range where, at times, there may be some temporary over-utilization of available food supplies.

Many does with fawns do not accompany the rank and file onto high ground in the summer, but remain in river valleys that are normally part of the species' winter range. There they often come into contact with humans and develop trust and fearlessness. Numbers frequent the townsite and general surroundings and with their confiding ways delight nature lovers including wildlife photographers of many nationalities.

The annual park superintendent reports indicate that mule deer were markedly numerous in the early 1950's and that from 1960 to 1965 the winter census varied somewhat from year to year with a high

count of 378 in March, 1965. During that month, at least, three of these deer were killed by cougars. John Stelfox of CWS studied the park's mule deer population in February, 1967, and arrived at an estimate of about 400 head.

White-tailed deer *Odocoileus virginiana*
Subspecies: *Odocoileus virginiana ochroura* (V. Bailey) External measurements (approximate averages embracing both male and female): 1,700, 250, 480 mm. Height at shoulder 36 to 40 inches (918–1,020 mm). Mature males range from 150 to 300 lb and females, about 100 to 130 lb. Fawns are born with a weight of 4.5 to 7.0 lb (Cowan and Guiguet, 1956).

Status—Compared with the mule deer—which dominate the region—"white-tails" are scarce. In most districts they are either very thinly dispersed, or apparently wanting. There appears to be a total of a few dozen at best within the park boundaries. Some become very tame upon taking up quarters in and around the townsite.

Habitat—The environment of this deer is essentially the same as that of the mule deer from lowland valleys up to and beyond timberline.

Reproduction—Most details of reproduction are the same, or very similar, to those of the mule deer. Hall and Kelson (1959) remark, "Breeds in November, two fawns (1–4) born after a gestation period of about 6.5 months." Like *O. hemionus* fawns, young of the "white-tail" are liberally dappled with white spots retained until early autumn; the pelage is then shed and replaced with a new, slick coat similar to the greyish-brown winter pelage of the adults.

General remarks—When the earliest explorers arrived in Alberta this species was fairly common in the foothills of the southwest, but for some reason became very scarce by the beginning of this century (Webb, 1959). Numbers continued low in foothills and mountains for many years. In the past few decades, however, the animals have prospered in Alberta, as a whole, having made remarkable gains in numbers

and territorial expansion to the east and north.

About 35 years ago Anderson (1938) regarded this species as a "rare straggler" in Waterton. In 1945 Cowan learned of a small population along Waterton River and tributaries near the park's eastern boundary and wrote that "Consensus of local opinion placed the herd at about 20 to 25 individuals. There has been no apparent increase in the herd for several years." Evidently similar conditions prevailed when Banfield remarked, after his investigations in 1947: "It is most commonly observed around the townsite during the winter."

During the summers of 1960 to 1965, I sighted only a very few; in various localities I did not sight a single example for weeks. The relatively few recorded were noted in the Waterton Lake–Indian Springs sector and in the area westward of Indian Creek. The park superintendent's annual reports from 1955 to 1965 reveal a small and static population, the census figures varying from 12 to 28 individuals. Thus, there appears to have been no significant increase during the past 20 years.

With respect to Waterton "white-tails" Scharff (1966) writes: "While fairly common along the eastern margins of the Park, they are not often seen by visitors. They may be glimpsed occasionally along Chief Mountain Highway and the Pincher Creek Entrance Road." When leaving the park by this road in late June, 1965, I saw a pair of white-tailed deer bound into parkland thickets east of the bison paddock. In many widely-separated areas to the east and northeast, the species is much commoner than in Waterton park and other mountain localities.

Moose *Alces alces*

Subspecies: *Alces alces shirasi* Nelson. External measurements: Combined specific averages from Seton (III, 1927) and Anthony (1928) are 2,755, 63, 790 mm, with maximum lengths of about 2,900 mm; height at shoulder 66 to 79 inches (1,683–1,990 mm). Weight of males ranges from

about 750 to 1,100 lb, or more. Cows are from 10 to 15 per cent smaller than bulls.

Status—At present the park's moose population is quite moderate, about on a par with that of the white-tailed deer. For many years the aggregate has been stabilized at a relatively few individuals with little or no apparent increase in numbers.

Habitat—Moose are found in mixedwood and coniferous forests, thickets and brulé, usually in close association with lakes, ponds, streams and bogs from the lowest valleys to brushy meadows above timberline. Zonal range: Canadian to Arctic-Alpine (4,200 to about 7,200 ft).

Reproduction—The breeding season is spread over a few weeks in late September and during October. With a gestation period of from 240 to 250 days (Hall and Kelson, 1959) the one or two progeny are commonly born in May and for a time are notably uncouth, maladroit and shaky on their long legs. It is not long, however, until they can travel over the roughest ground nearly as fast as the adults. They remain with the mother until the following spring.

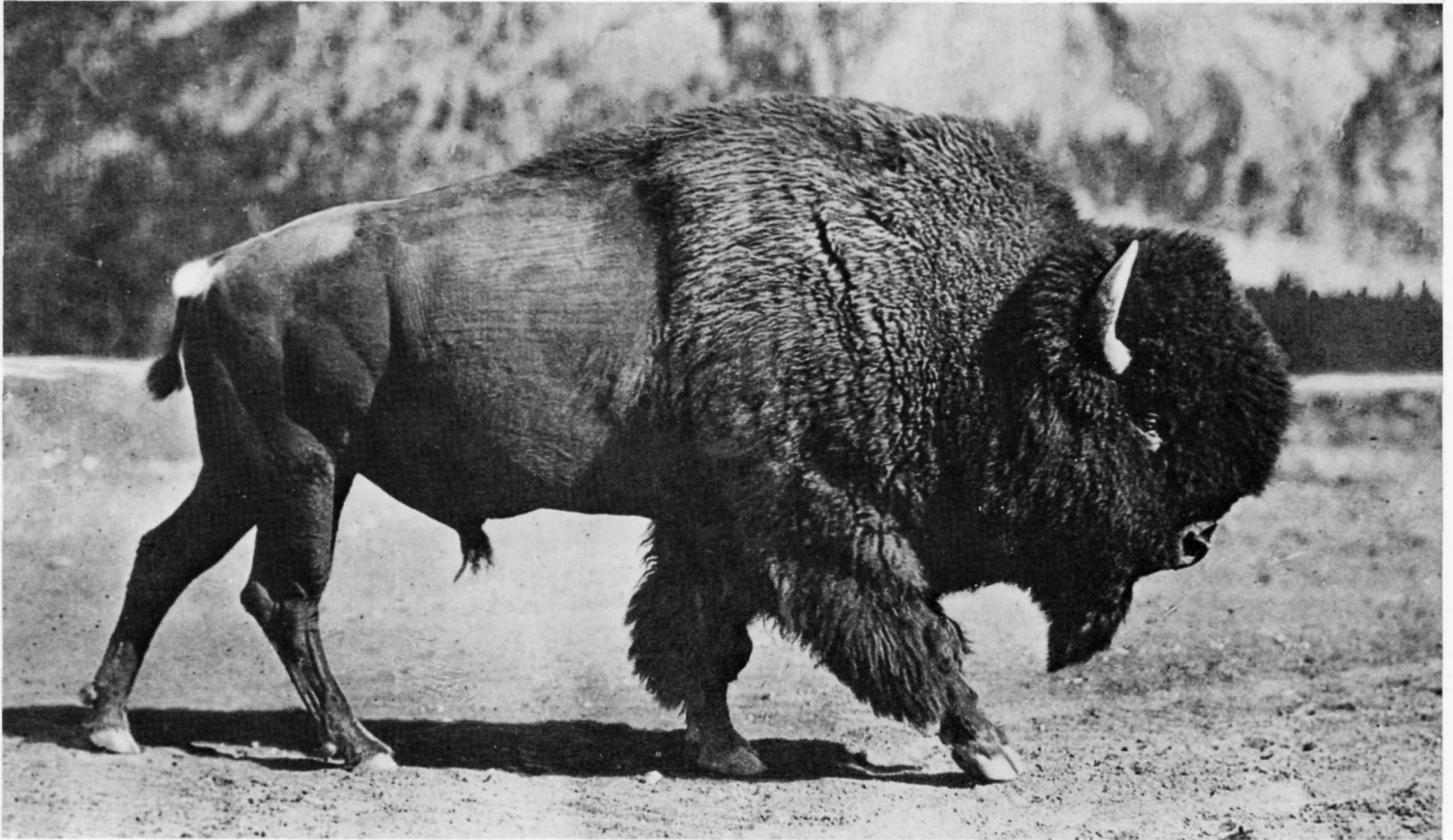
General remarks—Anderson (1947) did not include Waterton park within the range of *A. a. shirasi*, but Peterson (1952) does so on the basis of a specimen taken in the park years ago. Lechleitner (1955) assigns this race to Glacier. Regarding Alberta moose, Webb (1959) stated,

No estimates of early numbers are available, but they were numerous in some regions. Then, as with the other ungulates, numbers dwindled to an extreme low by the year 1900. The species actually became extinct in the southern foothills and subalpine zones.

By 1930 moose slowly reappeared south of Clearwater River and in some areas became fairly common again by the 1930's and 1940's.

This modest upsurge in numbers did not quite reach Waterton for the species continued to be noticeably scarce in that region. Anderson (1938) did not mention moose in the park, signifying great scarcity, or absence in most localities up to that time. Ban-

The huge, lordly bison is more often referred to by the layman as "buffalo", but this is a misnomer as it is not a true buffalo. The animal is now extinct in southern Alberta in a wild state. Department of Indian and Northern Affairs photo.



field (1947) stated that the species had only recently reappeared in the park. About this time moose noticeably increased in foothills and mountains from north of Crowsnest Pass south to Waterton and Glacier parks. At this juncture Banfield's estimate of the Waterton park population was a total of 35 head, chiefly located in the valleys of Cameron and Bauerman brooks, around parts of Waterton Lakes and at Sofa Mountain.

Down the years my sightings were relatively few and far between, but I noted old droppings and browsing signs of the previous winter in the majority of study areas. The impression was that moose were scarce in relation to total, serviceable environment. In most of this territory the summer is not the best time to observe moose; they

are shy, retiring and tend to gravitate to unbroken solitudes at high levels, whereas in winter they browse in the more acceptable wild tracts at lower altitudes.

Annual reports of park superintendents indicate that a modest slump occurred from 1955 to 1958, followed by a fair increase in numbers. There were many sightings in the Cameron Lake, Red Rock Canyon and Belly River districts and, more rarely, in the vicinity of Waterton Lakes. I saw a mother and young on only one occasion, on June 25, 1963, about a mile west of the warden cabin at upper Cottonwood Creek (Oil Basin) where cow and calf appeared in an open stretch of mountainside. As I watched, the calf was having real difficulty keeping up with its mother and was, in fact, falling farther and farther behind. Finally they

were lost to view in a stand of scrub pines at an altitude of about 5,200 ft.

Scharff (1966) writes:

Moose are solitary and may be seen in the early mornings or at dusk browsing in the meadows, swamps and bogs of valley bottoms. During July and August they are frequent feeders in lakes, often wading out to depths of 4 to 5 feet.... Moose can usually be observed near Cameron Lake, Red Rock Canyon, and the lakehead area of the Waterton Lakes.

Family Bovidae (bison, goat, sheep)

Bison, buffalo *Bison bison*

Subspecies: *Bison bison bison* (Linnaeus). External measurements: a combination of averages from Anthony (1928) and Rand (1948a) 3,420, 705, 620 mm; maximum length about 3,800 mm and height at

shoulder from 1,670 to 1,850 mm. Weights of bulls vary from about 1,800 to 2,200 lb and cows 800 to 1,000 lb, or slightly more.

In early times the plains bison roamed the prairies and foothills in teeming thousands. The last remnants of these mighty herds were finally exterminated in the province about 1885. Various signs show that at least 85 to 90 years ago they inhabited the open grasslands and wooded foothills in at least the eastern expanses of the present Waterton park. To this day bison bones, skulls and horns are occasionally discovered in that sector.

Banfield (1947) remarked,

In the Blakiston Brook valley above the Pass Creek warden's cabin is a bluff, supposed to have formed a natural trap over which many bison plunged to their deaths. Formerly skulls were abundant at this site and many bones still may be found there.

For much information on former distribution of bison in the Rocky Mountains refer to Fryxell (1928).

In early times it was the wood bison (*B. b. athabascae*) that roamed the forested wilderness from the Mackenzie District and Grande Prairie region south in the Rocky Mountains well into the United States. When the last of the wood bison were killed in the present park area is not known with certainty, but this probably took place about the middle of the last century (in relation to Banff National Park see Banfield, 1958).

During 1952 a few plains bison were brought to the park after a strongly fenced buffalo paddock had been prepared at Indian Springs. The terrain is typical bison environment embracing virgin prairie, patches of aspens and shrubs, ponds and small lakes. By 1955 the miniature herd had increased to 19 individuals. The annual calf crop was more than satisfactory. From then on the yearly increases were periodically controlled by adult elimination so as to keep the herd at a practical maximum of about 2 dozen head. On December 31, 1965, the range supported 25 of these lordly and

fascinating quadrupeds, an ample number for exhibiting their physical characteristics and behaviour to park visitors.

Mountain goat *Oreamnos americanus*

Subspecies: *Oreamnos americanus missoulae* J. A. Allen. External measurements: averages (Anthony, 1928) 1,683, 165, 343 mm; height at shoulder 41 inches (1,045 mm). Maximum length from Hall and Kelson (1959), 1,787 mm. Weights run from about 150 to 300 lb, with a mean of perhaps 200 lb. Females are from 10 to 20 per cent smaller than males.

Status—The species is not very abundant in the park. Nevertheless, there is an attractive aggregate in relation to acceptable range; adult goats and a good percentage of kids are widely distributed and may be seen in many suitable localities. However, they are far exceeded in number by mountain sheep which, with the goats, are the most typical animals of the alpine fauna.

Habitat—Mountain goats almost exclusively inhabit wilderness areas within the scantily forested upper limits of the Hudsonian zone and the moorlands of the Arctic-Alpine zone at varying heights above timberline. They are seldom seen below altitudes of 5,500 to 6,000 ft and then only for limited visits to natural salt licks. They commonly forage at elevations of 7,000 to 8,000 ft or more.

Reproduction—Mating normally takes place in November at which time the billies engage in considerable fighting for sexual advantage. One or two kids are born annually in mid or late spring, following a gestation period of about 6 months (Seton, III, 1927). The young stay close to the mother for many weeks. These, together with yearlings, form sociable little bands on the mountain heights throughout the summer while the males are off by themselves.

General remarks—In their whitish garb mountain goats stand out in stately contrast against the backdrop of dark, rock slopes and alpine meadows. Thus, they are rather commonly sighted by visitors who make the effort to tramp the high trails to the alpe-

lands. In his Waterton park report of 1938 Anderson found goats "in reasonable numbers and holding their own" and remarked (1938b) that in the Rocky Mountains the animals were still found on most of their original ranges.

Banfield (1947) estimated the park population of goats at about 80 head. Most were located in lofty cordilleran pastures from Sofa Mountain and Crypt Lake, in the southeast, northwest to Alderson, Buchanan, Blakiston and Bauerman mountains and Bertha, Forum, Rowe, Lineham, Lone, Lost and Goat lakes. Most were noted around Bertha, Alderson and Goat lakes.

During summer the adult sexes separate and the billies chiefly haunt the higher benches, cirques and talus slides along the continental divide. The relatively static population continues much the same from one decade to another. Wardens regularly observe the animals while making patrols in high country. Scharff (1966) writes,

These animals may occasionally be seen near Bertha Lake, Crypt Lake, Lineham Lakes, on Sofa Mountain and at high altitudes in remote areas along the continental divide. They can also be seen, at times, near the south end of Cameron Lake.

Mountain sheep or bighorn *Ovis canadensis* Subspecies: *Ovis canadensis canadensis* Shaw. External measurements: The results of combined averages from Anthony (1928) and Rand (1948a) are 1,522, 110, 397 mm; maximum figures from Hall and Kelson (1959) are 1,953, 150, 482 mm; height at shoulder 35 to 40 inches (892–1,020 mm). Rand (1948a) cites weights of 285 to 344 lb and Seton (III, 1927) put the average weight of 6-year-old rams at about 300 lb. Ewes are 12 to 15 per cent smaller and lighter.

Status—The species is a fairly common and highly characteristic member of the regional wildlife. Sheep were once scarce, but the recent population has exceeded 300 individuals, numbers fluctuating from time to time. Of the hoofed mammals, only wapiti and mule deer exceed them in abundance.

In the fastnesses of the Rockies the mountain goat, in its whitish coat, stands out conspicuously against the dark backdrop of sombre rock walls and talus slides. This is not protective colouration, but the situation is corrected once the snows of winter arrive. Photo by Valerie May, National Collection of Nature Photographs.



Habitat—In summer, mountain sheep inhabit subalpine grassy slopes and alpine meadows, benches and passes above timberline. In winter they normally range at lower elevations in valleys and contiguous terrain in the Canadian zone. Hence, the total vertical range extends from the lowest 4,200-ft level up to at least 8,000 ft.

Reproduction—The ram is promiscuous in his mating which usually comes to a head in the months of November and December. Gestation lasts approximately 180 days. Lambs number one or two. The majority are born in May and early June (Hall and Kelson, 1959) and are able to frisk about shortly thereafter. In a few days they are

remarkably skilful afoot, readily following their mothers about in some of the most rugged terrain in existence. At this season ewes and lambs live in close-knit groups of their own separated from the stag parties of rams.

General remarks—Bighorn sheep have inhabited these mountains from time im-

memorial and, for the most part, carry on from decade to decade with relatively little numerical alteration. At long intervals, however, the flocks may suffer some type of acute setback. Cowan (1945) reported,

The status of the bighorn of Waterton Lakes Park is one giving grounds for concern. According to information supplied by F. H. Rigall of Twin Butte the sheep were decimated in 1936 by an epidemic disease believed to have been septicaemia. The following spring he made an examination of a small area of winter range in the park and found some 50 carcasses.

Partial recovery, at least, was relatively rapid since Anderson (1938a) reported that following this epidemic "The sheep in Waterton Park are said to be doing well at present and increasing in numbers." When Banfield conducted park investigations in 1947 mountain sheep appeared in excellent condition.

During my investigations the summer range was ascertained to include practically the same localities as frequented by mountain goats, (excepting Lineham and Goat lakes and Mt. Blakiston), and with the addition of Vimy Ridge, Crandell and Galwey mountains and an area west of the Oil Basin. During winter sheep more or less concentrate in areas near Carthew and Rowe lakes, Blakiston Brook Valley, south slopes of Mt. Galwey and Bellevue Hill, the southwestern part of Lakeview Ridge, and a tract on the east side of upper Waterton Lake opposite the townsite.

Data at hand unquestionably indicates that in the decade following 1947 "big-horns" built up to a healthy and practically static population of satisfactory size. Superintendents' annual reports reflect this condition in the 1950's and through 1960 to 1965. Periodic census figures vary somewhat, but this is the result of fortuitous weather conditions and observations rather than any markedly abrupt fluctuations in the living aggregate. As of June 30, 1964, the highest seasonal or yearly count to date was 222 individuals, a figure that was exceeded within the next 30 months.

Park superintendent W. J. Lunney, in a letter of March 3, 1967, commented on mountain sheep as follows,

Mr. John Stelfox, Canadian Wildlife Service, recently took a helicopter count of the park's sheep population. His actual count amounted to 271 and he estimated the total population to lie between 321 and 377 sheep.

For decades mountain sheep had not shown better form and promise than shown by this census.

Hypothetical species

Pygmy Shrew *Microsorex hoyi*

This smallest of North American mammals is by far the rarest member of the Soricidae in southwestern Alberta. Specimens are secured only at long intervals and usually in widely separated localities. There is no record of occurrence in Waterton yet despite the thousands of trap-nights that have been devoted to small mammals. Its presence is a definite possibility, and I think it is only a question of time until it is confirmed.

For this region distribution is given as southeastern British Columbia and southern Alberta (Jackson, 1928; Anderson, 1947). Encouraging a belief in the eventual discovery of *M. hoyi* in Waterton is the paper by Setzer (1952) in which he gives two records of the species in neighbouring Montana—one for the south fork of Flathead River, July 25, 1949, and the other for the vicinity of Thompson Falls, Sanders County. The nearest Alberta record in relation to the park is one that I collected 50 miles to the north at the forks of Racehorse Creek and Oldman River, August 15, 1958 (No. 5635: 77, 29, 10 mm; wt, 2.6 g).

Habitats of the species are essentially the same as those of the masked shrew in upland woods and brushy areas, chiefly in the Canadian zone. Gravid females have been collected with fetuses numbering as high as seven. The regional race is *M. hoyi hoyi* (Baird).

Long-legged myotis *Myotis volans*

No authentic record exists for the occurrence of this bat in Waterton park, but its eventual discovery there is anticipated. The species has been recorded in a nearby locality of eastern British Columbia and Lechleitner (1955) lists it among the bats of neighbouring Glacier National Park. His reference to it (under *M. v. interior* Miller) is somewhat vague, however, with the words, "The long-legged bat is apparently scarce in the park but more intensive study is needed to determine its exact status." A range map of the species by Hall and Kelson (1959) shows the demarcation line between *M. v. interior* and *longicrus* as passing through Waterton Lakes National Park. This species is similar in size to the little brown myotis with average measurements of about 90, 39, 8.5; forearm, 38; wing-spread, 245 mm. Estimated weight is 8 to 10 g.

Silver-haired bat *Lasionycteris noctivagans*
This bat's presence in Waterton park is virtually certain. Although there is no positive park record as yet, it is distributed over contiguous territory in several directions. Crowe (1943) recorded a specimen taken at the U.S. Customs Port a few yards from the border between Waterton and Glacier National Parks; hence, there is little or no doubt that the species occurs occasionally or otherwise in Waterton National Park in the summer. Rand (1948a) refers to its occurrence in the Twin Buttes locality which is only 7 miles from the northern boundary of the park. Lechleitner (1955) believed that the silver-haired bat was probably common in adjacent Glacier park, commenting, however, that its status was not yet very well known.

The species migrates in some numbers spring and fall into and out of Alberta, occurring in Transition zone parklands and mixedwood forest of the Canadian zone over most of the province. Night flying for insects is performed in semi-open forest and over glades, swamps and meadows. The one or two young are born in June and

July. Average measurements are approximately 103, 43, 11 mm and wing-spread, 280 mm. Weight is from about 10 to 12 g. This bat has developed no geographic races, so there is the specific form only, *L. noctivagans* (Le Conte).

Northern bog lemming *Synaptomys borealis*

This vole has not yet been discovered in the park, but reliable records of occurrence not far off to the north and south, leave little doubt of its presence despite unquestionable rarity. To the north the species has been collected at Mt. Forgetmenot and Highwood Pass and, to the south, several have been taken in Glacier Park (Lechleitner, 1955), including one by Wright (1950) that was trapped at Camas Creek. Considering its undoubted scarcity and erratic distribution, the species may continue to elude mammalogists in Waterton park for years to come.

The customary habitats embrace spruce-sphagnum muskegs, shrubby bogs, swampy alpine meadows and the sodden borders of marshes, lakes and streams grown to herbaceous vegetation, willows and alders. Zonal range is Canadian to Arctic-Alpine from regional lowlands up to about 7,500 ft. The creatures breed at various times during spring and summer and produce four to six young to a litter. Fully adult individuals measure about 130, 25, 18.5 mm, and weigh from about 20 to 30 g. The geographical race represented here is *S. b. chapmani* J. A. Allen.

Fisher *Martes pennanti*

The fisher is now one of the rarest carnivores in most of the Alberta Rockies and many other areas. Doubtless it formerly occurred at least sparingly in the present territory; according to available information it was not especially numerous even before the coming of the white man. Anderson (1947) says that the animals ranged through the Rocky Mountain region and south, formerly, to at least central Idaho. Thus, the range appears to have embraced

the southern Canadian Rockies, including the area under review. For overall distribution refer to Hagmeier (1956).

There are no firm records of the fisher in the present area—particularly in recent years—since 1885. In relation to Glacier, Lechleitner (1955) says,

If present at all in the park, the fisher is extremely rare.... The last sight record was at Waterton Lake in 1946. Bailey (1918) reports that several of the animals were trapped in this area before it was a national park.

Glacier park was established in 1910. Probably the last fishers on the Canadian side, in the Waterton Lakes country, disappeared about this time.

The home environment of the species is Canadian-Hudsonian Life Zone forest, the same as inhabited by marten. Rand (1948a) remarks: "Mating...occurs in the spring or summer of one season for the young to be born in the next." A litter consists of two to four young, while the average appears to be three. Mean measurements are approximately 960, 380, 102 mm, and weights vary from 8 to 12 lb. The regional subspecies is shown by Hall and Kelson (1959) to be *M. p. pennanti* (Erxleben).

Least weasel *Mustela nivalis*

These tiny beasts of prey occur sparingly in some parts of southern Alberta, but up to now they have never been found in Waterton park. If present at all the species is very rare indeed, and branded with the peculiarity of having avoided detection for a long time. The park is well within its geographic range as shown by Hall (1951, p. 187). Possibly a park record will materialize in time. Somewhat supporting this assumption is the occurrence mentioned by Lechleitner (1955); on July 23, 1953, a least weasel was killed by a motor car just inside Glacier National Park on the Two Medicine Road, a point only 38 miles south of Waterton Lakes National Park.

The usual habitat is the same as, or similar to, that frequented by ermine (*M. erminea*), consisting of coniferous and mixed-

wood forest, aspen poplar parklands and brushy areas flanking streams and lakes. Separate pairs breed through disparate months of the year and have three to six progeny at a birth. This weasel is the smallest of living carnivores with average measurements (both sexes) of about 190, 31, 21.1 mm and a weight of 45 to 60 g. The regional subspecies is *M. n. rixosa* Bangs.

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