PRELIMINARY REPORT ON THE BIRDS AND MAMMALS OF KOOTENAY NATIONAL PARK, BRITISH COLUMBIA[1]

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INTRODUCTION

FIELD WORK in connection with a faunal survey of Kootenay National Park was carried on by Munro from June 8 to June 28, 1943. The trapping of small mammals was the chief activity, the observation of birds and the collecting of specimens when necessary being incidental to this work. Cowan spent April 29 and the period June 23 to June 28, 1943 studying the larger mammals of the region and using whatever opportunities occurred to obtain information regarding birds and small mammals.

The survey was of necessity a preliminary one and much work remains to be done. In the time available it was not practicable to visit the alpine sections of the park, nor could the numerous vertebrate habitats be studied in detail. The area, being a cross-section of the west slope of the Rocky Mountain system, is of considerable zoological interest and would well repay further study.

The following account of the birds and mammals is based on the limited activities outlined above and supplementary data obtained from the park wardens. Apparently no other zoological investigations have been made within the park.

PHYSIOGRAPHY

Between the semi-arid Rocky Mountain Trench and the Continental Divide lie a series of mountain ranges separated by lateral valleys. Here are the sources of rivers that flow westward to swell the great Columbia as it moves toward the Pacific Ocean. Two of them, the Kootenay and its tributary the Vermilion, have formed wide valleys and it is observed when ascending them that the dry climate of the Kootenay Plain gradually gives way to one of increasing moisture, a feature that is reflected in the forest types and the animals that inhabit them. Kootenay National Park, from the gateway in the Columbia River Valley to Vermilion Pass on the Continental Divide, spans the width of this mountainous, forested territory and thus provides a satisfactory cross-section for zoological studies.

The park consists of a strip 10 miles wide, east to west and 50 miles long, southeast by northwest, the greater part lying in the valley of the Kootenay and Vermilion rivers. The west boundary of the park follows the summits of the Briscoe and Vermilion Ranges that are separated by the valley of the Kootenay River; the east boundary follows the summits of Hawk Ridge and the Mitchell Range that are separated by the valley of the Simpson River. These boundaries are about equi-distant from a section of the Banff-Windermere Highway that traverses the park. From various points along the highway a view of the whole width of the park and its approximate boundaries may be obtained. The region is well supplied with numerous streams tributary to the rivers mentioned and except on recent burns is heavily forested in the valley bottoms and on the lower mountain slopes.

The highway enters the park at Radium, altitude 2,644 ft. and, following up Sinclair Creek, crosses an outlying ridge of the Briscoe Range at Sinclair Pass, altitude 4,875 ft. It then descends a thousand feet to the valley of the Kootenay River which it crosses and continuing over a low summit enters the valley of the Vermilion River which it follows to Vermilion Pass, altitude 5,264. Thus in the territory made accessible by the highway there is an altitudinal relief of nearly 3,000 feet with changes in the forest types as summarized below.

The section from Radium to Sinclair Pass is rough, broken country with a lodgepole pine and Douglas fir association forming the main forest cover. In the narrow valley of Sinclair Creek is a riparian growth of Engle-

1.—Received for publication January 14, 1944.

mann spruce, western red cedar, black cottonwood, aspen, mountain alder, mountain birch, and dogwood. This is the area of least precipitation.

Northward along the Kootenay Valley, Douglas fir gradually disappears, Englemann spruce is first in importance on the river bottom along creeks and in muskegs, and alpine fir first appears. Under primitive conditions Englemann spruce probably prevailed over large areas above the valley bottom proper and in course of time was largely replaced after fire by lodgepole pine. This is now the prevailing forest type. Some of the older pine forests are park-like with little underbrush. Deciduous trees are chiefly aspen, black cottonwood, and western white birch.

Between the predominantly lodgepole pine forest of the Kootenay Valley and the forest of the Vermilion Valley farther north where Englemann spruce predominates is a wide belt of burnt-over territory now in process of reforestation chiefly by lodgepole pine. Much of the west slope on lower levels is covered with deciduous growth in which aspen predominates.

North of this great burn as higher altitude is reached the road enters the third forest type, that of Englemann spruce. Here alpine fir becomes more conspicuous, precipitation is greater and swamps, muskegs, and spring creeks numerous. The forest floor and the older fallen trees are deeply covered in moss; there is an underbrush of *Vaccinium, Lonicera, Menziesia, Viburnum,* and *Salix.* This condition, modified to some extent by areas of lodgepole pine reproduction on old burns, prevails to the boundary of the park. Altitudinally above the lodgepole pine and Englemann spruce forest types is a fourth type dominated by alpine fir.

MODIFICATION OF ENVIRONMENT

There can be no doubt that modification of forest type by fire has affected the distribution of birds and mammals. It can be conjectured that after fire had swept up the valleys and one floral type was replaced by another, certain animal species found conditions unsuitable and their numbers were reduced, while other more highly specialized species disappeared entirely. Following this a different aggregation of animals impelled by population pressure elsewhere moved in and eventually a different biota was established. As burned-over areas again became reforested the process was reversed.

We are indebted to Mr. George Hopping for some historical data pertaining to this subject.

> "Starting a few miles south of Nixon Creek, there is a scar caused by a fire in the summer of 1917. This extends southward beyond the park boundary. It has been naturally reforested by lodgepole pine with a small percentage of spruce. From the edge of this fire scar northward to Dolly Varden Creek there is a mature stand (now mostly dead) of lodgepole pine with two distinct age classes. These were undoubtedly caused by successive fires. The first one occurred about 1800 and gave rise to an even-aged stand now 130 to 140 years old. This extends from south of Nixon Creek to a point two miles north of McLeod Meadow.
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> "Another fire which occurred about 1320 burned from this point northward causing an even-aged stand 110 to 120 years old extending to Dolly Varden Creek. A third fire burned from Dolly Varden Creek northward about 1870 giving rise to another even-aged stand 60 to 70 years old extending to Kootenay Crossing. Finally, a fire occurred in 1926 which burned from Kootenay crossing northward to Wardle Creek up Vermilion River and north-westward up the Kootenay Valley beyond the park boundary."

While the changes in biota brought about by ancient fires can not now be demonstrated nevertheless several major fires, the last in 1926, have exerted an influence on animal life that is clearly apparent. An area of some 27 square miles of Englemann spruce and lodgepole pine forest has been replaced by an open range type of habitat upon which grasses, aspens, and various shrub species, used as browse by members of the deer family, have become established during the process of coniferous reforestation. The present status of these animals is considered elsewhere in this report and it is necessary here to mention only that their increase has been conspicuous. Not so apparent, however, are the changes in bird life brought about through this change in environment. Thus such birds as Franklin grouse, olive-sided flycatcher, Canada jay, winter wren, golden-crowned kinglet, and olive-backed thrush have disappeared and an

entirely different type of bird life is in process of establishment. It has become a centre of abundance and distribution for Columbian ground squirrels while most of the forest-dwelling mammals have disappeared.

Another factor that is creating a changed environment is the current infestation of lodgepole pine by bark beetles. The total extent of the infected areas has not been measured but it is very large and in some stands most of the mature trees are dead as a result. Undoubtedly this will have far-reaching effects on the biota. In reference to this condition Mr. Hopping informs us that:

> "The present outbreak started about 1929 at the extreme southern end of the area near Pitts Creek. This is in the oldest stand of pine. By 1937 over 80% of the timber had been killed in this stand south of McLeod Meadow and between 40 and 50% north of this point. Up to 1938 the 110-120 year old stand had suffered less than 10% mortality. In 1939 and 1940 however, a sharp increase occurred in this zone and by 1941 three plots located here had a mortality of 46, 68, and 79% respectively, increasing from south to north. Thus the active centre of infestation has followed the same progression as the fires which gave rise to the different age classes. At the present time the centre of infestation is in the northern end of the 110 to 120 age class and is passing into the zone with the 60 to 70 year old trees."

LIFE ZONE CLASSIFICATION

In preparing a review of the avi-fauna and life zone classification of British Columbia we have deemed it advisable to recognize 13 terrestrial and 2 marine biotic areas designated as follows: Osooyos-arid, Dry Forest, Cariboo Parklands, Columbia Forest, Sub-alpine Forest, Coast Forest, Boreal Forest, Peace River Parklands, Southern Alplands, Northern Alplands, Puget Sound Lowlands, Gulf Islands, Queen Charlotte Islands, Coast Littoral, and Pelagic Waters.

We have regarded three criteria as evidence for identifying a biotic area, namely, the presence of distinctive plant species, the presence of distinctive animal species, and the absence of species, both plant and animal, that are conspicuous in adjacent areas.

Considered on the basis of this formula two biotic areas, each typical in its manifestations, and a third area, less readily identified, are represented in Kootenay National Park. The two of typical character are the Sub-alpine Forest and the Southern Alplands. The third, occupying the lower altitudes from the neighborhood of Kootenay Crossing to the southern park boundary, exhibits floral and faunal characteristics common to both the Sub-alpine and the Dry Forest and is a broad area of transition between these two biotic areas.

The Sub-alpine Forest biotic area occupies a zone between approximately 4,000 and 6,500 feet altitude, in other words it is a forest belt between the intermediate area and the Southern Alplands biotic area. The forest is almost exclusively coniferous with Englemann spruce the dominant over the lower two-thirds and alpine fir the dominant over the upper third of this altitudinal range. The precipitation is relatively high and winter temperature low; no precise figures are available.

Birds restricted to this biotic area are: hudsonian chickadee, hermit thrush,bohemian waxwing, Tennessee warbler, and Lincoln sparrow.

The marten is more common here than elsewhere and it is the chief range for wolverine but apparently all the larger mammals found here occur also below the altitudinal boundaries of this biotic area. Lemming vole and Richardson vole, neither of which was recorded, undoubtedly are present and probably do not appear at lower altitudes. Common small mammals are cinereous shrew, dusky shrew, golden-mantled ground squirrel, Columbian ground squirrel, chipmunk, red squirrel, white-footed mouse, red-backed mouse, meadow vole, long-tailed vole, and jumping mouse.

The Southern Alplands biotic area consists of the alps, the high meadows, and summit country generally, above timber line. No information is available in reference to the status of birds and mammals in these portions of the park but it can be inferred that hoary marmot, pika, lemming vole, Richardson vole, white-tailed ptarmigan, golden eagle, pipit, and grey-crowned rosy finch are established there. The least chipmunk, abundant in this biotic area right up to the Alberta boundary line, will also be present.

The territory referred to as transitional between the Sub-alpine and Dry Forest biotic areas merges imperceptibly along its higher

margins into the former. So also elements of the latter become more manifest toward the south boundary of the park. Nowhere, however, is it typical of the Dry Forest biotic area which is characterized by a yellow pine — Douglas fir association. The former does not enter the park; the latter is not found in stands of any great extent. A small stand of western larch is established in this area adjacent to Settler's road. Floristicly this intermediate territory cannot be classified with precision but as its fauna contains many elements associated with the Dry Forest it seems best to include it in this biotic area. The precipitation is less, the temperature higher, and in general climatic conditions are drier, in comparison with the Sub-alpine Forest biotic area.

Birds found here more or less commonly and absent or casual elsewhere within the park are: red-shafted flicker, yellow-bellied sapsucker, hairy woodpecker, Wright flycatcher, mountain bluebird, red-eyed vireo, yellowthroat, and western tanager.

Little is known of the small mammals inhabiting this transitional territory. There is evidence of the occurrence of skunk, badger, barred bobcat, and muskrat all of which are representative species of the Dry Forest biotic area.

VERTEBRATE HABITATS

The study of vertebrate habitats no doubt will be a major objective in any plan for future faunal investigations in the park. It is to be emphasized that our survey was preliminary in scope and intensive work was not attempted. However certain primary habitats are conspicuous and can be discussed here summarily. These might be placed in two groups, namely (1) those in which water in one form or another is a controlling factor in development of the flora and the establishment of an animal population, and (2) land areas in which water is not a controlling factor. The first group includes river and river-edge, meadow-streams, forest-streams and swamps, mountain-streams, willow swamp and *Carex* meadow, lakes and ponds. The second embraces lodgepole pine and Douglas fir forest, lodgepole pine forest, Englemann spruce forest, deciduous woodlands, roadside and camp clearings, the burns, the slides.

River and river-edge. The river system is of first importance and its history from ancient times undoubtedly has been interwoven with the history of the biota. From a remote past rivers have been the dominant force in establishing the physiography of the park, carving the valleys, leaving a residue of silt that was to act as a basis for all growth and serving as the great artery of drainage. All the glacial-born streams, the brooks and rills that carry off the melted snow, all the springs, creeks, and ponds drain into the river system of the Kootenay and Vermilion. The river system provided a highway for the movement of animal populations that, as conditions grew suitable for them, advanced along its course and became established. Now, as in the past, the river system is the central fact of greatest importance. Along it wapiti and other members of the deer family first entered the district and to-day along its course they advance in spring behind the melting snows and retreat before the onset of winter. In summer it is a potent force in the life of these animals; they browse close to its shores and cross from one side to the other — their day by day movements are inscribed on the sands and mud of its beaches. It ensures shelter and food for mink, and beaver build their dams in its back waters and at the mouths of its tributaries. Marten travel the forest trails that follow its course and in its undercut banks are well-beaten runways used by smaller mammals of various kinds. Spotted sandpipers nest along its margin; belted kingfishers and rough-winged swallows nest in its banks and its riparian thickets are populated by various flycatchers, warblers, and other brush-loving birds and finally it provides a highway of bird migration from the Great Basin of the Interior Plateau.

Meadow-streams. The type of stream referred to here is one of small proportions that drains swampy, open ground dominated by *Carex*. In such places the jumping mouse and meadow vole are the most abundant small mammals and weasels travel the stream banks in their pursuit. The frequency of such meadow-streams in the park was not determined.

Forest-streams and swamps. A densely populated community centres about areas of wooded, swampy tracts in the Sub-alpine forest. Usually these are drained by small rills that empty into an adjacent forest stream. The lowest portions support grasses of various kinds; the drier places are covered deep

in moss as are the prostrate tree trunks. Conspicuous among the flowering plants are *Calypso borealis*, *Cyripedium Calceolus* var. *pubescens*, *Orchis rotundifolia*, *Pinguicula vulgaris*, *Primula Maccalliana* and *Ledum groenlandicum*. Higher knolls are covered with a shrubbery in which *Vaccinium ovalifolium*, *Rhododendron albiflorum* and *Menziesia ferruginea* usually are included. Englemann spruce and alpine fir are dominant, the trees wider spaced and usually smaller on the wet portions than on the surrounding higher ground. Cinereus shrew, meadow vole, long-tailed vole, and red-backed mouse are the commonest small mammals; hermit thrush, varied thrush, ruby-crowned kinglet, and Tennessee warbler are the commonest birds.

Mountain-streams. The alpine rills that form the headwaters of larger streams flow through all the varied habitats of the alplands. Now cataracts tumbling down precipitous cliffs and gurgling out of sight beneath the broken talus they emerge for a time onto the wet meadows of high altitudes. Here their banks are carpeted with the varied flora of that altitude, *Saxifraga nivalis*, *Parnassia montanensis*, *Trollius laxus* and *Anemone occidentalis* being prominent where drainage is fair while the more constantly moist reaches support a dense growth of sedges (*Carex Mertensii* and *C. nigricans*) with the white tufts of the cotton grass *Eriophorum callitrix* and the short spires of *Tofieldia glutinosa* silvering broad stretches that in midsummer show purple in the distance as the richly coloured heads of *Pedicularis contorta* burst into flower. Lower still, willows dominate the riparian flora with the silvery foliage and two-inch catkins of *Salix Barrattiana* most conspicuous.

Few animals have adapted themselves to life under the rigors of alpland climate. Lemming vole and Richardson vole are characteristic while meadow vole and jumping mouse range up from lower altitudes.

Willow swamp and Carex meadow. Habitat of this type is prevalent in the valley of Dolly Varden Creek and probably in other narrow valleys of the same kind. This is a fairly large stream containing a fish population so that it attracts mink and the occurrence of otter has been reported. It supports several families of beaver and is a nesting ground for mallard. The willow thickets are frequented by yellow-throats.

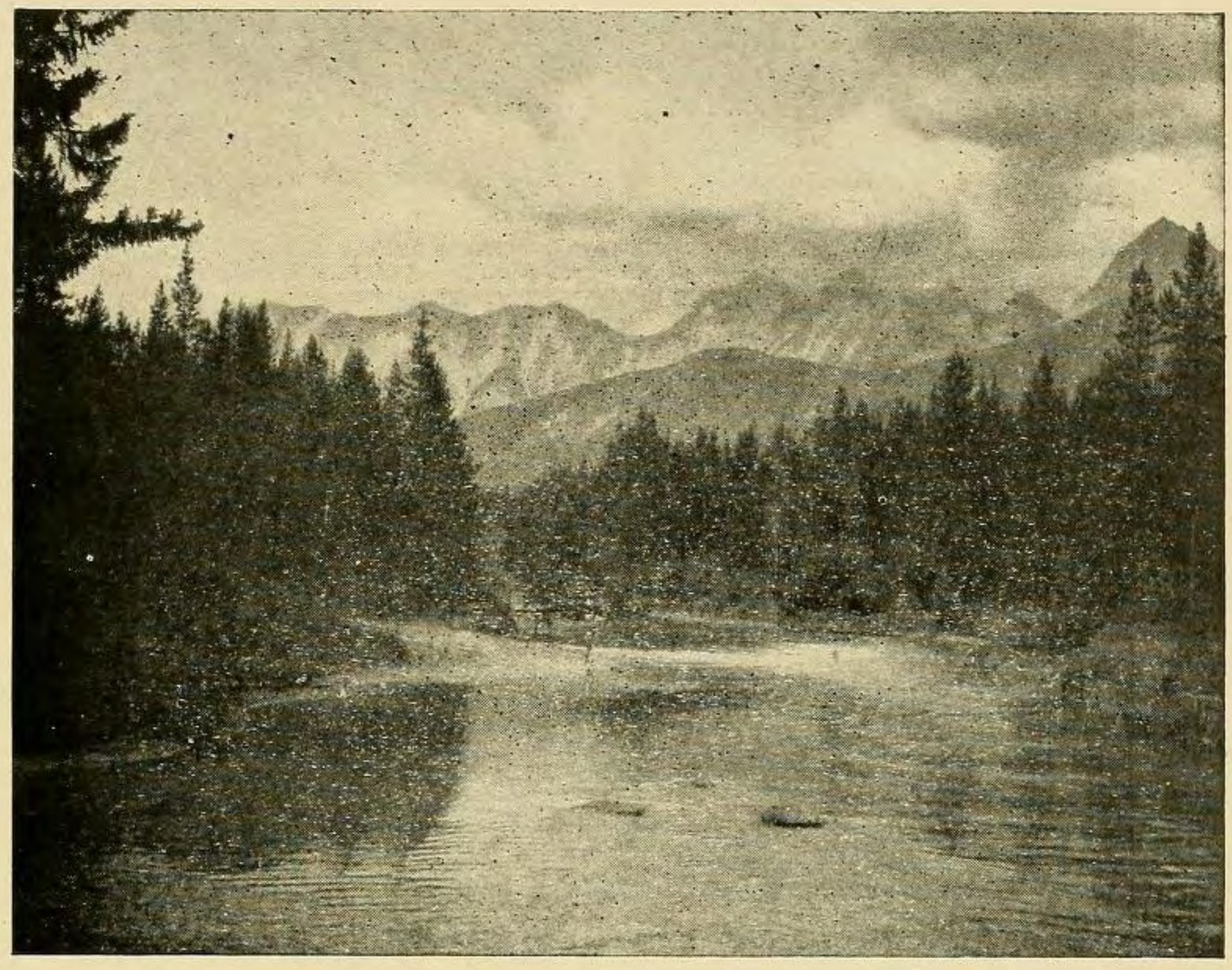
Lakes and ponds. Olive Lake on the Sinclair Summit and a small forest pond south of Vermilion Crossing were the only waters of this type visited. So far as could be learned neither has exerted any marked influence on the biota. Dog Lake, east af McLeod Meadows, is reported to be a nesting ground for loons; this and other lakes in the park require investigation.

Lodgepole pine and Douglas fir forest. Forest of this type examined is confined to the more arid slopes adjacent to Sinclair Canyon. Beneath the open stand of Douglas fir and lodgepole pine a varied shrub-flora includes aspen, buffalo berry, service berry, choke cherry, dogwood, rose, and buck brush *Ceanothus* sp. *Juniperus communis and J. scopulorum* are both common. Forbs are scarce and grasses dominate the herbaceous vegetation.

Tanagers, pine siskins, and Audubon warblers are abundant, Cassin finch, white-crowned sparrow, and blue grouse are less common but characteristic. It is year-round range for mule deer and some sheep and a much larger population of both species utilize it as winter range.

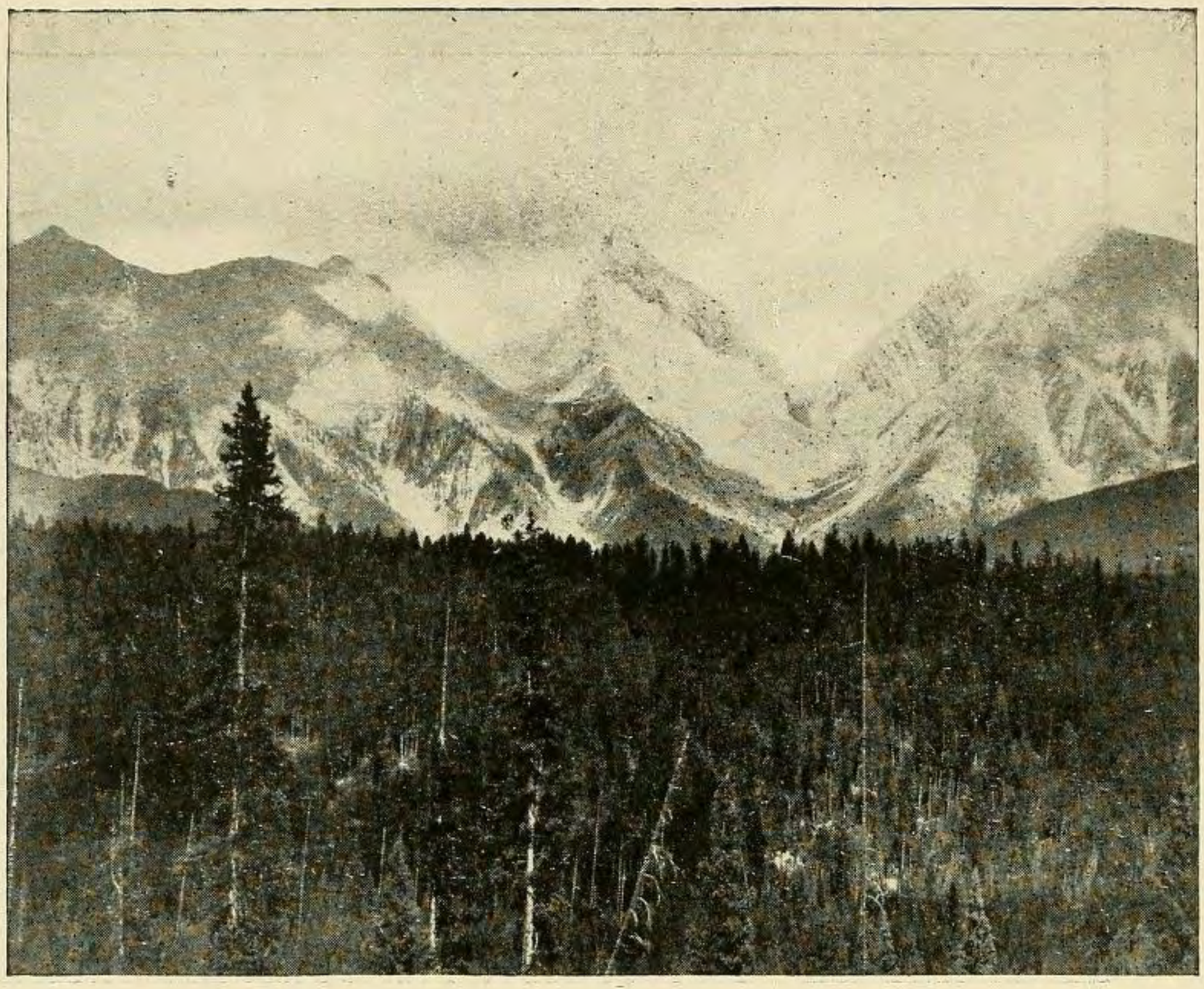
Lodgepole pine forest. Tracts of almost pure lodgepole pine are not infrequent. Such are fairly open with an attendant flora dominated by grasses. Common birds here are American three-toed woodpecker, Hammond flycatcher, olive-sided flycatcher, American robin, red-breasted nuthatch, mountain chickadee, Audubon warbler, and Oregon junco. Less abundant and near the limit of their altitudinal range are red-shafted flicker, western wood peewee, and western tanager. It is summer range for mule deer and white-tailed deer. No information was obtained regarding the small mammal population.

Englemann spruce forest. The forest floor is rough with much fallen timber and underbrush. Marten are abundant, red squirrels commoner than elsewhere; moose and mule deer are plentiful, wapiti and white-tailed deer much less so. The small mammal population includes dusky shrew, phenacomys, red-backed mouse, meadow vole, and white-footed mouse. Bird life is not so plentiful as in the forests at lower altitudes; American three-toed woodpecker, olive-sided flycatcher, Canada jay, hudsonian chickadee, red-breasted nuthatch, olive-backed thrush, and evening grosbeak are characteristic species.

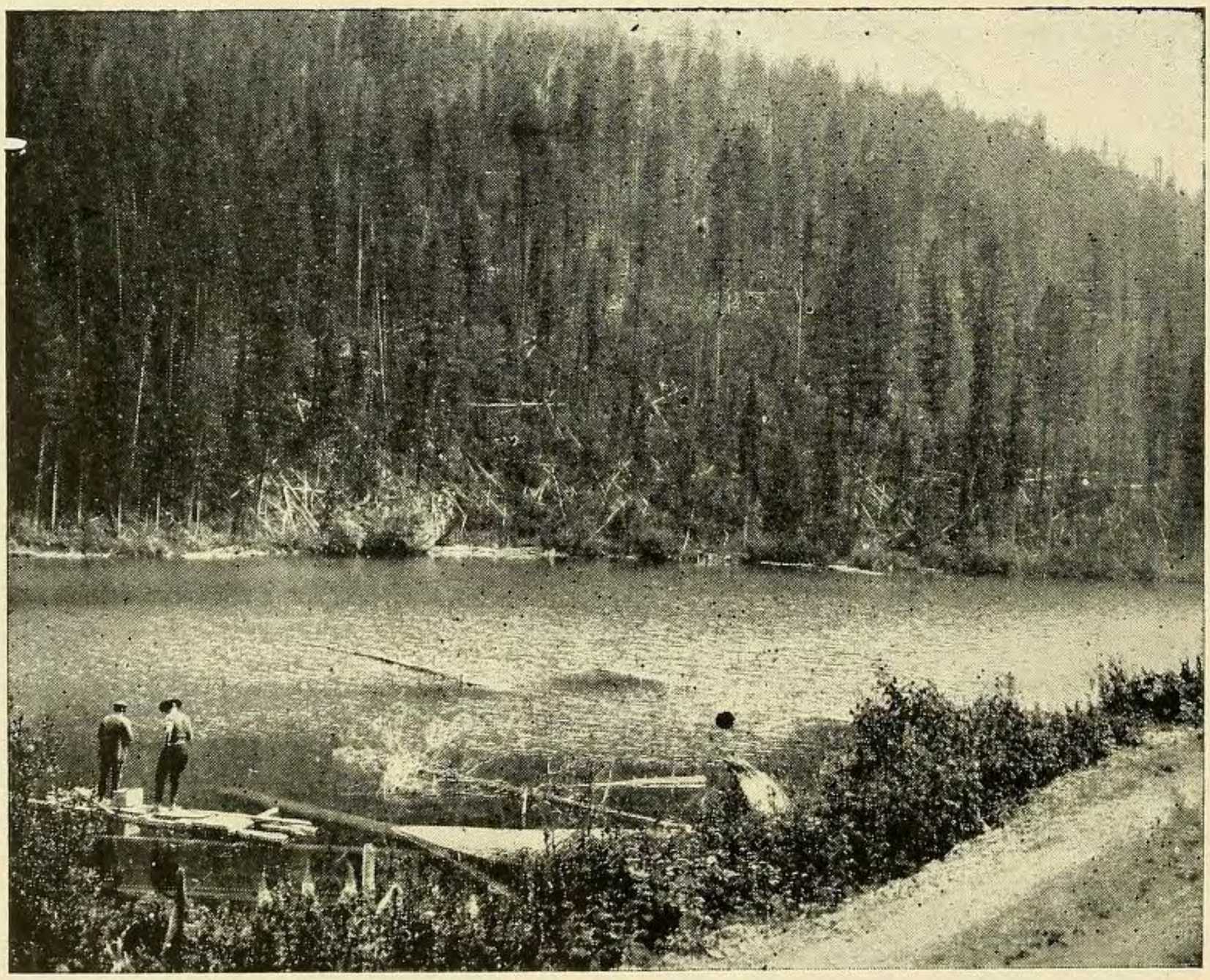


Kootenay River near McLeod Meadows, Kootenay National Park, B. C.

Bridge at Kootenay River Crossing, Kootenay National Park, B. C.



Range near Kootenay Crossing, Kootenay National Park, B. C.



Olive Lake, Kootenay National Park, B. C.

Deciduous woodlands. In the Kootenay Valley clear stands of tall aspens and black cottonwood are established in breaks in the lodgepole pine forest and along streams. These provide nesting sites for red-shafted flicker, yellow-bellied sapsucker, and hairy woodpecker. Warbling vireo is another species characteristic of this type of woodland. Apparently no mammals are peculiar to it.

Roadways and camp clearings. Openings in the coniferous forest such as the roadways and camp-grounds attract various mammals and numerous species of birds. Black bear travel the roads and eat the new grass and *Equisetum* along their margins; camp clearings with their abundant pasture also are favorite feeding grounds. For members of the deer family the roads provide easy passage from one feeding ground to another and are used regularly for this purpose. Chipmunks appear to be more numerous here than in the forest; Columbian ground squirrels are common and golden-mantled ground squirrels have taken possession of several camp clearings; snowshoe rabbits, usually hard to detect in the woods, frequently are seen by the roadside.

Such openings have permitted the added growth of aspen, alder and shrubbery; while various plants of forage value such as clover and dandelion have been introduced with perhaps not insignificant effect on animal life. Thus clover provides additional food for rabbits and for grouse; pine siskins seek the dandelion seeds and deer feed on the roadside browse.

American robin, chipping sparrow and Oregon junco have populated these open places and Townsend solitaire, rough-winged swallow and cliff swallow find nesting sites in the cut-banks. All these are conspicuous to the traveller along the road. Finally the open areas provide opportunities to view nighthawks, black swifts and swallows in flight over the tree tops.

The burns. Extensive areas in the park have been burned over in recent times and for a while following the fire these were zoological deserts. Now they are being reclaimed rapidly by vegetation and are in process of colonization by various kinds of animals. For some bird species the clearing away of the forest by fire meant that additional territory near the periphery of their altitudinal range became available. Red-shafted flicker, mountain bluebird, and tree swallow are species so affected and probably these now find the limit of their altitudinal distribution in the park in the marginal territory provided by the burn that extends for six miles or so south of Wardle Creek. For other species whose distribution is not greatly modified by altitude the burned-over areas are not marginal territory but additional favourable habitat. Thus such ground-nesting birds as Oregon junco and white-crowned sparrow are established there and the change in environment also favoured an increase of Townsend solitaire. It is a hunting ground for red-tailed hawk that probably feed on Columbian ground squirrels for which the burn is a centre of distribution for the whole park. Finally the new supply of browse provides abundant food for members of the deer family so that the burns are summer range of first importance.

The slides. The west side of the Vermilion Range is notable for the series of extensive slides that cut through the forest from timber line to the valley bottom. Above are the high bare escarpments, some almost sheer, of the mountain ridge. South of Vermilion Crossing the base of one slide reaches the highway, its apex being at the mouth of a narrow, steeply-sloping valley several thousand feet above. The greater part is covered with mountain alder, the more open lower slope by dwarf birch, small aspen, highbush cranberry, service berry, and wild rose. Macgillivray warbler, Wilson warbler, Lincoln sparrow and fox sparrow were found in this particular slide and these no doubt are characteristic species of this habitat elsewhere. It was observed also that the lower levels were cut up by trails of moose and wapiti and that the brush had been extensively eaten by these animals.

BIRDS

The spring bird migration was nearly over when observations commenced at Vermilion Crossing on June 8. On this date and subsequently until June 13 numbers of olive-backed thrushes continued to pass through and on the latter date the first Tennessee warbler was recorded. Apparently all other summer visitants with the exception of nighthawk had arrived and this species first appeared on June 24. Townsend warbler, Macgllivray warbler and chipping sparrow were on their nesting territorities and in full song; other species that had arrived earlier, for example Amer-

ican robin, Audubon warbler, and western wood peewee, were in a later stage of the nesting cycle, and such resident species as three-toed woodpecker, hairy woodpecker, and dipper were incubating or feeding young in the nest.

The bird life of Kootenay National Park is more varied than is usually the case in the heavily forested regions of British Columbia and in comparison with those of the Selkirk Mountain region the population is more dense. This variety and relative density of population is most apparent in the woods bordering clearings such as are provided by the burns, roadways and camp-grounds and in portions of the semi-open, lodgepole pine forest. In addition to the species normally to be expected in such places the population includes others to whom the region is near the limit of toleration. In this category are included red-shafted flicker, yellow-bellied sapsucker, alder flycatcher, Wright flycatcher, western wood peewee, mountain bluebird, tree swallow, rough-wingd swallow, cowbird, and western tanager.

The comparative accessibility of the region, its connection with a broad highway of migration, the fact that important modification of habitat is in process plus the dynamic of population pressure explain this infusion of bird species characteristic of lower altitudes. Undoubtedly changes in the constituents of the population in this marginal territory will continue. It will be unstable; there will occur an ebb and flow in harmony with the processes of population pressure elsewhere so that species present one year may be absent the next or the reverse of this will take place.

The birds of the Sub-alpine Forest, beyond the limits of such infusion, are those characteristic of this biotic area in southern British Columbia. Two exceptions were noted, namely, Tennessee warbler and bohemian waxwing — species that elsewhere in the Province occur in higher latitudes.

The following list of birds comprises 79 species of which 69 were observed by us. The remainder, 10 species, are included on the basis of satisfactory evidence submitted by park wardens.

Loon. *Gavia immer.*- Reported to occur each summer on Dog Lake which lies on the east side of the Kootenay River east of McLeod Meadows. Four were seen there in May, 1943. (Thompson).

Canada Goose. *Branta canadensis.*- Seen fairly regularly on migration (Thompson).

Snow Goose. *Chen hyperborea.*- On an evening in the autumn of 1941 a large flock was seen in flight near Kootenay Landing (Thompson).

Mallard. *Anas platyrhynchos.*- Occurs on migration and nests in the meadows along Dolly Varden Creek where broods of young have been met with (Thompson).

Barrow Golden-eye. *Glaucionetta islandica.*- Two pairs observed on a small lake about three miles north of Kootenay Crossing, April 29, 1943.

Harlequin Duck. *Histrionicus histrionicus.*- Observed on Tokumm Creek and on Sinclair Creek (Meredith).

Goshawk. *Astur atricapillus.*- An adult male seen flying across the highway near Marble Canyon on June 25. Meredith reports seeing an adult kill a ruffed grouse in the winter of 1942-43.

Sharp-shinned Hawk. *Accipiter velox.*- One seen on June 21 flying through the woods in Sinclair Canyon.

Red-tailed Hawk. *Buteo borealis.*- The red-tailed hawk was observed on three occasions and undoubtedly nests in the park. An old stick nest in a tall lodgepole pine at Dolly Varden Creek was thought to be of this species.

Golden Eagle. *Aquila chrysaëtos.*- Said to nest on Wardle Mountain. In the spring of 1943 five were seen feeding on an elk carcass near Kootenay Crossing (Thompson).

Sparrow Hawk. *Falco sparverius.*- One heard at Kootenay Crossing on June 14, another pair apparently nesting on the flats adjacent to Settler's road on June 28.

Blue Grouse. *Dendragapus obscurus.*- Reported as common on the open side hills along the upper Kootenay Valley (Thompson). Three adult males seen on the west slope of Mount Berland, north of Radium on June 24, 1943.

Franklin Grouse. *Canachites franklini.*- On June 27 an adult male was flushed in a dense swamp. It flew into a small spruce and alighted on a branch about 10 feet from the ground. Here it turned so that it was parallel with the branch on which it stood and displayed, wings slightly drooped, the tail expanded and at right angles to the back. This was the only

specimen met with but droppings were noticed in various places. Meredith and Thompson consider it to be the commonest grouse in the park. The remarks in reference to possible predation on the ruffed grouse by marten are applicable here also.

Ruffed Grouse. *Bonasa umbellus.*- Not common in 1943. Two flushed in open woods bordering a beaver meadow in Dolly Varden Creek Valley, June 14, a female with small brood observed on June 25, and a male and two females with downy chicks seen on John McKay Creek on June 27 represented the total records. However Thompson reports a recent increase in population.

There are no figures in reference to the cyclic curve of population as it may operate in the park. Apart from this there may be a co-relation between the present scarcity of grouse and the present abundance of marten. To what extent grouse enter into the diet of marten is not known but presumably such predation occurs and the extent of the pressure may in turn be related to the population cycle in mice, a staple food of marten. Study of this problem would be of economic importance.

White-tailed Ptarmigan. *Lagopus leucurus.*- Observed in 1938 on Wolverine Pass (Meredith) and at Luxor Pass and above Floe Lake (Rutherford).

Spotted Sandpiper. *Actitis macularia.*- One seen on the Kootenay River near Kootenay Crossing on June 18, five others noted at various points along the upper reaches of Tokumm Creek on June 25.

Horned Owl. *Bubo virginianus.*- Reported to be resident in the park. One seen by Meredith flying across the highway near Hawk Creek in June, 1943.

Nighthawk. *Chordeiles minor.*- Established as a summer visitant in the open region of the park from Kootenay Crossing south. First seen June 24 (Thompson).

Black Swift. *Nephoecetes niger.*- A pair was observed on the evening of June 24 and again on June 27 at Vermilion Crossing.

Rufous Hummingbird. *Selasphorus rufus.*- One seen at Vermilion Crossing on June 12; a female near the same place on June 16 acted in the manner of a nesting bird. Noted also at Kootenay Crossing on June 18 and on John McKay Creek on June 27,

Belted Kingfisher. *Megaceryle alcyon.*- Nests along the Kootenay River where one was seen on June 14 and a nest was located in a clay and sand cliff in this vicinity 10 days later. Thompson notes it as a regular summer visitant.

Red-shafted Flicker. *Colaptes cafer.*- One pair observed near Rocky Mountain bungalow camp, June 25; another about a mile south of this point, June 29, were evidently nesting. A third pair nested on a dead fir stub in the horse pasture at Kootenay Crossing. This tree was felled on June 16 and four of the eight young in the nest were killed. Part of the shell of the tree broke off exposing the upper part of the nest cavity and the workmen had covered the gap with a piece of bark. When the nest was examined on June 18 the four young were active and their bellies were tight with food. It seemed clear that the young were being fed even under these unusual circumstances. Neither of the parents appeared but one was heard calling from the edge of the forest a short distance away.

Pileated Woodpecker. *Ceophloeus pileatus.*- Reported from Nixon Creek by G. Hopping and from Sinclair Summit by W. B. Johnstone. Noted also at Kootenay Crossing by Thompson. Two seen on Tokumm Creek, June 25, and on June 29 single birds were observed at John McKay Creek and at McLeod Meadows.

Yellow-bellied Sapsucker. *Sphyrapicus varius.*- Apparently not common. Observed at Kootenay Crossing and south of this point. A male collected on June 28 had eaten five carpenter ants, *Camponotus* sp., seven smaller ants of a different species, and two adult Clark beetles, *Ips.* sp.

Hairy Woodpecker. *Dryobates villosus.*- Associated with the aspen and cottonwood stands from Kootenay Crossing south; none seen north of this point. One nest 20 feet from the ground at Rocky Mountain bungalow camp, discovered by Mr. Hopping, contained large young on June 14. These were being fed by the female. Several old nest cavities in cottonwood trees near Dolly Varden Creek were probably made by this species. An adult male collected near Kootenay Crossing on June 14 had eaten 11 carpenter ants and one Cerambycid beetle; a juvenile male taken near the same place on June 28 had eaten thirteen carpenter ants and two adult Cerambycid beetles, *Spondylus upiformis,*

Arctic Three-toed Woodpecker. *Picoides arcticus*.- On June 9 two were seen along the highway between Dolly Varden Creek and Kootnay Crossing.

Three-toed Woodpecker. *Picoides tridactylus*.- The most common woodpecker in the park. It was thought possible that the invasion of the lodgepole pine stands by bark beetles *Dendroctonus* sps. might have a tendency to increase the woodpecker population in the infected areas but this cannot be determined because nothing is known of the species' status there before the outbreak occurred. At the present time the woodpecker population does not appear to be larger in the lodgepole pine areas of high infection than it is in the spruce dominated areas that contain only a relatively small number of infected pines. Scattered here and there through both forest types are pines that three-toed woodpeckers have worked over but such trees do not appear to be more common in areas of high infection than they are elsewhere.

The woodpeckers when working on an infected tree systematically scale off the bark to the cambium layer. Such trees denuded thus of their bark show the channels cut in the cambium surface by the bark beetle larvae. In some observed instances the bark had been removed from the entire circumference of the tree for a distance of 30 feet or more above the ground. In others the birds had worked on one side of the tree only.

Only one of the five specimens collected contained bark beetles; this bird had eaten nine *Dendroctonus monticola* larvae. Cerambycidae larvae were present in the stomachs of all five, and Bupestridae larvae in two. One bird had taken three *Cucujus clavipes* larvae; another had eaten three carpenter ants; two had eaten larval Cleridae and two contained spiders.

During the time we spent in the park most of the three-toed woodpeckers were feeding young in the nest or so it semed from their behaviour. Several times one was detected flying straight away through the trees apparently making directly for its nest.

From near the top of a tall tree on the nesting territory, and invariably concealed by the trees' thick foliage, one or another of a pair performed the rolling call characteristic of woodpeckers in the nesting season. This was repeated at rather long intervals. In volume the sound seemed somewhat less than that made by the yellow-bellied sapsucker. They became excited when the nesting territory was approached and flew from one tree to another calling repeatedly and acting generally in a fearless and conspicuous manner, the reverse of their habit at other times. A male under observation on June 10 travelled up a tree trunk in a succession of hops; his yellow crown feathers were erected and he gave a chattering call at short intervals.

A recent nest cavity excavated in a live lodgepole pine about four feet from the ground had been attacked, apparently by a bear. The surface of the tree for six inches or so around the entrance was chewed away to a depth of an inch below the bark and tooth marks of the animal responsible were plainly visible in the wood. The nest was deserted.

Alder Flycatcher. *Empidonax trailli*. - Considered to be the least common flycatcher in the park. One was identified, on the basis of voice, at Kootenay Crossing on June 14.

Hammond Flycatcher. *Empidonax hammondi*.- This was the commonest flycatcher; met with in many localities from the Sinclair Summit to Marble Canyon.

Wright Flycatcher. *Empidonax wrighti*.- Included on the basis of voice identification. Specimens were not obtained. It appears to be much less abundant than Hammond flycatcher and the few seen and heard were in brushy thickets along Dolly Varden Creek.

Western wood peewee. *Myochanes richardsoni*. Seen on several occasions at Kootenay Crossing and in the open territory to the north. A female taken on June 19 was in breeding condition.

Olive-sided Flycatcher. *Nuttallornis mesoleucus* The first was heard on June 13, subsequently it became common and was recorded from various places along the highway between Vermilion Crossing and Vermilion Pass.

Violet-green Swallow. *Tachycineta thalassina*. Amongst a small number of white-bellied swallows flying over the big burn on June 24 one at least was identified satisfactorily as this species.

Tree Swallow. *Iridoprocne bicolor*.- Several pairs seen on two occasions in the big burn were evidently nesting in old tree stubs that stand on the rough slope above the river.

Rough-winged Swallow. *Stelgidopteryx ruficollis*.- Approximately six pairs nested in a bank beside the road near Kootenay Crossing; others were seen in similar places between that point and the Sinclair Summit.

Cliff Swallow. *Petrochelidon albifrons*. - On June 24 a pair was seen flying about a hard sand-cliff near the big burn and it was assumed that they were nesting there.

Canada Jay. *Perisoreus canadensis*. - Small bands of Canada jays composed of adults and young were met with at various places between Dolly Varden Creek and Marble Canyon.

Steller Jay. *Cyanocitta stelleri*. - Thompson informed us that one wintered at Kootenay Crossing 1942-43 and Rutherford reports seeing it occasionally on Sinclair Summit.

Magpie. *Pica pica*. - Meredith and Thompson report seeing magpies occasionally in spring at Kootenay Crossing and state that formerly they occurred more regularly. Apparently a number were killed by the wardens some years ago and in recent years they have been decidedly scarce. Possibly at one time magpies nested in the park but apparently none does so now. On June 27 the wing of a magpie was picked up on the timbered slope north of Radium.

Raven. *Corvus corax*. - Several wintered in 1942-43 at Kootenay Crossing (Thompson). Seen in Lower Kootenay Valley, January, 1943 (Rutherford).

American Crow. *Corvus brachyrhynchos*.- Observed in the spring of 1942 and 1943 at Radium (Meredith) and reported as casual at Kootenay Crossing (Thompson). Not known to nest within the park but three seen at Radium on June 29 may have been nesting locally. It is significant to note that crows were first noted in the park in the spring subsequent to the epidemic in the Sinclair Canyon sheep band. The abundant carrion may well have been responsible.

Clarke Nutcracker. *Nucifraga columbiana*. - A pair with full-grown young were seen near Rocky Mountain bungalow camp June 18 and subsequently others were seen on Wardle Mountain. Thompson reports it at Marble Canyon and at other points in winter.

Black-capped Chickadee. *Penthestes atricapillus*.- A pair of these birds answered an owl call on Tokumm Creek on June 25.

Mountain Chickadee. *Penthestes gambeli*.- Seen only once, in the pine woods near Rocky Mountain bungalow camp, but the species is probably more plentiful than this lack of records would indicate.

Hudsonian Chickadee. *Penthestes hudsonicus*.- Pairs observed several times in the thick spruce woods where nesting was evidently in progress.

Red-breasted Nuthatch. *Sitta canadensis*. - Occurs in all forest types throughout the park.

Dipper. *Cinclus mexicanus*.- Heard on the Vermilion River near Vermilion Crossing and reported from Marble Canyon by Thompson. A single bird seen on Tokumm Creek on June 25. On June 29 a young bird with the slightly-spotted, light-coloured breast of the first plumage was observed at close range on Sinclair Creek close to Radium Hot Springs.

Winter Wren. *Nannus hiemalis*.- This species is subject to noticeable fluctuations in numbers of population. In 1943 it appeared to be scarce as only four birds were recorded, - one at Vermilion Crossing where it was heard on June 10 and again on June 11, three others in the heavy timber bordering Tokumm Creek.

American Robin. *Turdus migratorius*.- One of the commonest birds of the park observed along the road from Sinclair Canyon to Vermilion Pass and at numerous places inside the forest.

Varied Thrush. *Ixoreus naevius*. - Pairs or single birds were seen or heard from Sinclair Summit to Tokumm Creek. A pair observed up Tokumm Creek on June 25 was feeding young in the nest.

Hermit Thrush. *Hylocichla guttata*.- The song of the hermit was not heard anywhere in the forests at lower elevations, nor were any birds seen there. It was observed in several places at higher altitudes along Tokumm Creek and probably is the common Hylocichline thrush in the sparsely-timbered upper section of the Sub-alpine Forest biotic area.

Olive-backed Thrush. *Hylocichla ustulata*.- Numerous transients were recorded at Vermilion Crossing June 9-June 13, while at the same time pairs in the early stages of the nesting cycle were established on their territories, and males were in full song. During the following week several females were captured accidentally in traps set for mice; each of these had brood patches.

What was identified as an old nest of the species had been built 10 feet from the ground in a small spruce. The nest foundation included dry *Equisetum*, moss, and other plant material; the rim was fine grass exclusively and the lining fine grass mixed with moose hair.

Mountain Bluebird. *Sialia currucoides.*- Fairly common in open situations in the Kootenay Valley and one was seen three miles south of Vermiiion Crossing on June 17. Several pairs nested in the big burn and another occupied a bird house at the Rocky Mountain bungalow camp.

Townsend Solitaire. *Myadestes townsendi.*- Seen regularly along the highway between Sinclair Canyon and Vermilion Crossing and in the open territory of the burns. Apparently it was nesting in cut-banks beside the road and in similar places in the burned-over areas.

Golden-crowned Kinglet. *Regulus satrapa.*- In the early part of June golden-crowned kinglets were detected several times among a drifting population of small birds that kept high up in the spruce trees. On June 25 several pairs were seen in the open spruce woods bordering Tokumm Creek. Very likely it is a fairly common summer visitant to the Subalpine Forest biotic area.

Ruby-crowned Kinglet. *Corthylio calendula.*- Not particularly common. A male sang frequently from a particular point in the woods near the warden's cabin at Vermilion Crossing and the song was heard in other places south to Kootenay Crossing.

Bohemian Waxwing. *Bombycilla garrula.*- A pair, evidently nesting, was observed at the edge of a clearing near Kootenay Crossing, June 19, and another pair in thick woods at Vermilion Crossing, June 23, 24. Very likely it is distributed in summer throughout the alpine forests as it is in adjacent regions on the east slope of the Rocky Mountains.

Solitary Vireo. *Vireo solitarius.*- A single singing male seen at John McKay Creek on June 27 constitutes our only record.

Red-eyed Vireo. *Vireo olivaceus.*- Three were noted on June 27 in the dense deciduous growth bordering John McKay Creek.

Warbling Vireo. *Vireo gilvus.*- On June 10 two were seen at the edge of the Vermilion Crossing camp ground and on June 14 its unmistakeable song was heard in several places where aspens and cottonwoods predominate, near Dolly Varden Creek. Seen also at John McKay Creek in a similar environment.

Tennessee Warbler. *Vermivora peregrina.*- Common in the spruce woods where the song was first heard on June 13. The slight, sibilant song comes usually from the thickly-foliaged upper portion of a spruce where the singer is hard to detect.

Audubon Warbler. *Dendroica auduboni.*- This is the commonest warbler in the park and from the time of our arrival the males were heard singing in various types of wooded habitat. Males were seen also flying out from a tree in pursuit of passing insects in the manner so characteristic of this warbler. The females, that were incubating at this time, were less in evidence.

Townsend Warbler. *Dendroica townsendi.*- Satisfactory identification of this warbler, by song or by sight, was made a number of times between June 10 and June 24 in the vicinity of Vermilion Crossing. Several others were seen on June 25 along Tokumm Creek. There were numerous occasions also when an instant glimpse of a small warbler in the tall spruces was insufficient grounds for its identification but many such were probably this species.

Macgillivray Warbler. *Oporornis tolmiei.*- A transient appeared in a brushy thicket at Vermilion Crossing on June 12 and on June 25 a singing male was taken in shrubbery near the foot of a slide. Up Tokumm Creek on June 25 this warbler was found to be fairly common in the tangled, deciduous vegetation of the slides.

Yellow-throat. *Geothlypis trichas.*- Two males of this species were observed at close range in a flooded willow swamp on Dolly Varden Creek, June 14.

Wilson Warbler. *Wilsonia pusilla.*- Seen at Kootenay Crossing on June 18 and June 22. Very likely further investigation will show this to be of regular distribution in brushy thickets and aspen woods throughout the park.

American Redstart. *Setophaga ruticilla.*- A female was taken at Vermilion Crossing on June 10; this was the only specimen seen.

Western Meadowlark. *Sturnella neglecta.*- Included in the park's fauna on the authority of Warden Rutherford who stated that in April, 1937, one settled on a bare piece of

ground close to the cabin at Marble Canyon and remained in the vicinity for two days thereafter.

Cowbird. *Molothrus ater.* - Several seen accompanying horses in the pasture at Kootenay Crossing during the early summer of 1943 (Thompson).

Western Tanager. *Piranga ludoviciana.*- In Kootenay Park the western tanager is near its westerly limit of distribution and is not common. A singing male seen at Rocky Mountain bungalow camp, June 14-21, evidently represented a nesting pair. Another singing male was observed in the spruces at Vermilion Crossing June 24 and a pair in the trees beside the moose lick about six miles south on June 27. At the lower elevations adjacent to Radium it was more abundant and several were seen there on June 27 and 29.

Evening Grosbeak. *Hesperiphona vespertina.*- Several times at Vermilion Crossing the presence of small wandering bands was announced by their loud whistled calls. They would alight near the tops of the tallest trees to remain only a short time before taking flight again. Thus on June 12 a flock of five appeared and on June 19 two males and two females together visited the same group of trees. Later in the day a flock of six was seen in flight near Dolly Varden Creek and on June 24 a mated pair was in the trees at the edge of the moose lick.

Cassin Purple Finch. *Carpodacus cassini.*- On June 29 an adult male was seen on the roof of the gateway building at Radium Hot Springs.

Pine Siskin. *Spinus pinus.*- Common in flocks of five or six in the woods, and the open places as well, from Sinclair Canyon to Vermilion Crossing. One such flock frequently appeared on the lawn at Vermilion Crossing bungalow camp.

Red Crossbill. *Loxia curvirostra.*- Crossbills are highly erratic in local distribution and in the summer of 1943 were found to be scarce throughout the southern Rocky Mountain area. The only individuals seen in Kootenay Park were three, feeding in a pine grove at McLeod Meadows on June 28.

Vesper Sparrow. *Pooecetes gramineus.* - A single bird seen at Radium on June 27 constitutes the only record for the park.

Oregon Junco. *Junco oreganus.*- Abundant along the highway and in clearings in semi-open woods. The deep spruce woods were less favoured. Juncos were nesting when we arrived but no young was seen out of the nest prior to our departure on June 29. A nest containing four eggs, from which the female flushed, was examined on June 21. This was in a strip of cleared lodgepole pine woods alongside the highway, the nest being in a bed of moss and overhung by a two-inch shelf of this growth. The materials used in construction were fine grass, horse hair, and deer hair.

Chipping Sparrow. *Spizella passerina.*- Common in pairs in many parts of the park where they frequented the same habitat as that occupied by juncos. On June 14 in open pine woods one was seen carrying nesting material.

White-crowned Sparrow. *Zonotrichia leucophrys.*- In the big burn a pair was established on a nesting territory which centred about the upper portion of a steep, rough slope and some flat, grassy land above it where uprooted trees, seedling pines, and shrubbery provided a variety of cover. Both birds were under observation on June 24 and June 25. This was the only record, neverthless the species probably is of common occurrence at higher altitudes.

Fox Sparrow. *Passerella iliaca.*- On June 25 one was heard singing at the edge of the forest bordering a slide about five miles south of Vermilion Crossing. Two other males were seen on the same date on slides bordering Tokumm Creek. No doubt further investigation will reveal that fox sparrows nest commonly in many such places.

Lincoln Sparrow. *Melospiza lincolni.*- A singing male was heard and seen on June 24 and June 25 on the same slide referred to above.

MAMMALS

Trapping of small mammals was carried on in the vicinity of Vermilion Crossing, at Rocky Mountain bungalow camp south of Kootenay Landing and at several localities between these two points. The only species that could be described as common (on the basis of trap returns) was the meadow vole. With this exception the population of shrews, mice, and voles was not large, the returns from 50 to 75 traps averaging less than a six per cent catch in 24 hours.

Species representation was large. Thus in one small area of spruce forest (roughly 300 feet by 200 feet, composed of dry and wet habitat and including portions of several small streams) a total of 11 species was taken. These were: *Sorex cinereus, S. obscurus, S. palustris, Microsorex hoyi, Eutamias amoenus, Peromyscus maniculatus, Phenacomys intermedius, Clethrionomys gapperi, Microtus pennsylvanicus, M. mordax* and *Zapus princeps.*

Many of these mammals used the same runways and burrows, as many as four different species being taken in the same trap in successive nights. It seemed likely that this crowding together of a mixed population was a temporary condition brought about perhaps as a result of flooding during the spring thaws.

Time did not permit a study of the general distribution of small mammals. This important question and the cyclic pattern of small mammal populations in relation to that of the highly valuable marten population, should be one of the main objectives in future work.

Much of the game animal population is migratory and present in the park only during the spring and summer months. From a game animal standpoint Kootenay Park as at present delimited will never occupy an important position as a reserve. Its area is not large enough and is disproportionately poor in winter range for the migratory species. Thus, with the exception of moose and goat and, to a less degree, of wapiti, the park is entirely dependent for its game population upon the conditions for survival on the wintering grounds beyond its boundaries.

The time at our disposal was too limited to permit of more than a restricted reconnaisance of game distribution. Though all species save the grizzly were encountered, the precise details of the distribution of each are apparently largely unknown. Further game studies are highly desirable.

The following list of the park's mammalian fauna is probably nearly complete. Richardson vole, lemming vole, and least chipmunk undoubtedly occur at altitudes higher than those investigated and the presence of bats other than the species recorded can be expected.

Cinereus Shrew. *Sorex cinereus.* - Two specimens of this shrew, both adult males, were trapped at Vermilion Crossing - one under a rock ledge beside a small stream, the other at the entrance to a burrow under a stump. A third specimen, about three-quarters grown, was taken beside a stream six miles south of this station.

Dusky Shrew. *Sorex obscurus.* - During the first ten days of trapping no dusky shrews were captured but subsequently, between June 24 and June 28, traps in the same locality captured three adult males and two adult females. Four were taken in a spruce swamp at Vermilion Crossing, the fifth at the entrance to a small burrow in the river bank some two miles north.

American Water Shrew. *Sorex palustris.*- Apparently rare in the park. Traps set along small streams in seemingly favourable places produced only one specimen, an adult male, in three weeks. This was captured in a trap set in a notch of a small log that dammed a diminutive stream flowing through spruce woods.

Pigmy Shrew. *Microsorex hoyi.*- Two specimens of this rare shrew were taken at Vermilion Crossing near the edge of the clearing in which stands the park cabin. One was trapped on the morning of June 10, the other in the afternoon of June 18; both were nursing females.

Little Long-eared Bat. *Myotis evotis.*- A small colony of this bat, from which specimens were taken on June 28, was established in the lodge kitchen at Vermilion Crossing. In day time they secreted themselves in a narrow space between a brick chimney and the house wall. All the seven specimens taken were pregnant females.

Bats of an unidentified species of *Myotis* were observed flying over the swimming pool at Radium Hot Springs.

Black Bear. *Euarctos americanus.*- Black bears frequented the highway and adjacent territory, the largest number seen in one day (June 21) being six of which three were yearling animals, the remainder consisting of a brown female with two brown cubs. One large animal came regularly to the campground at Vermilion Crossing and another smaller animal, probably a yearling, proved a constant nuisance at the lodge and at the park cabin. It was observed that droppings of the previous year, still largely intact, were composed chiefly of huckleberries. During June the diet consisted primarily of a wide

variety of green vegetation but the above-mentioned brown female was found, on June 28, to have eaten a mule deer fawn.

Grizzly Bear. *Ursus horribilis.* - No grizzly bear were seen by us. According to the wardens' accounts there are a number in the park, usually remaining in its more remote parts but occasionally in spring appearing on the highway. Thompson reports seeing a total of 11 in one day (1939) in the vicinity of Tumbling Creek. This number was composed of two parties, each comprised of two adults with two cubs and three other single animals.

Along Tokumm Creek on June 25, grizzly sign, both old and recent, was much in evidence. Here the bears had been digging the roots of the red loments. In one place a colony of small microtines had been excavated. Unmistakeable signs of the earlier presence of grizzly were seen along the upper parts of John McKay Creek on June 27. The westernmost record is that of a young female destroyed at Radium in 1929 (Meredith).

Marten. *Martes americana.*- Abundant in the Sub-alpine Forest and occurring elsewhere less commonly to the southern park boundaries. All the wardens agree that the population has increased and spread during recent years. As of some interest here it is to be noted that a trap-line in the Simpson Valley along the east boundary of the park produced 21 pelts in the winter of 1941-42.

Precise information concerning the food of marten in the park is a necessary preliminary in any plan for care and management of the species. Much could be learned from a study of the food debris in droppings. The collecting by park wardens of marten scats to be used for this purpose is suggested.

Fisher. *Martes pennanti.*- Apparently quite rare, the only record available being that of Mr. U. La Casse, who saw a single animal on Tokumm Creek in the summer of 1911.

Short-tailed Weasel. *Mustela cicognani.*- A nursing female was trapped beside a small creek at Rocky Mountain Bungalow Camp on June 21. No information is available concerning the status of this weasel in the park.

Mountain Weasel. *Mustela frenata.*- Trapping in numerous locations was unsuccessful in obtaining specimens of this animal and none was seen. It is included here on the authority of the park wardens.

Mink. *Mustela vison.*- Not particularly common. The wardens report that mink tracks are seen occasionally along the Kootenay River and Dolly Varden Creek. A specimen was trapped at Vermilion Crossing on June 27.

Wolverine. *Gulo luscus.*- Tracks are seen by the wardens every winter from the Sinclair Summit, where it is rare, to the northern limits of the park where it is more common. One was trapped on Simpson Creek near the eastern park boundary in the winter of 1941-42.

Otter. *Lutra canadensis.*- Of rare occurrence. Thompson reports seeing tracks and slides along Dolly Varden Creek in the winter of 1941-42.

Skunk. *Mephitis mephitis.*- Apparently quite rare. One was killed by a car near Kootenay Crossing several years ago (Thompson).

Badger. *Taxidea taxus.*- No animals seen but unmistakable burrows were observed in a small colony of Columbian ground squirrels on the flats of the Kootenay River along Settler's road.

Red Fox. *Vulpes alascensis.*- Thompson reports seeing tracks each winter and Rutherford saw one animal, December 1942, on Sinclair Pass.

Coyote. *Canis latrans.*- One was observed near the highway on June 24. It is apparently not common, and according to the wardens' observations is present only rarely in winter. The majority leave the park in late autumn, following the deer to their winter range in the Columbia and Lower Kootenay valleys.

Timber Wolf. *Canis lupus.*- No altogether satisfactory records have been obtained. It seems reasonable to suppose that animals cross the valleys from one range to another and this is the opinion of old residents who should know. Mr. V. H. Lord is satisfied that he heard wolves howling and saw one animal on the highway near Vermilion Crossing about eight years ago. Mr. W. Nixon, of Invermere, who trapped the valley before it was park territory, informed us that two wolves came up river from near Canal Flats in the spring of 1906. They crossed through the park in the vicinity of the Simpson Monument.

Cougar. *Felis concolor.*- Tracks considered to be those of five different animals observed between Radium Hot Springs and Wardle Creek January (or February) 1943 (Thompson),

The opinion was expressed that approximately this number of animals travel in and out of the park and that in no case is the entire circuit of an animal circumscribed by the park boundaries. The only sign seen by us was on the park boundary immediately north of Radium. Here a single scat of the previous winter contained the remains of bighorn.

Canada Lynx. *Lynx canadensis.*- Rare in the southern part of the park, one track seen on Sinclair Summit winter of 1942-43 (Rutherford). Tracks are noted regularly in winter, sometimes those of two or three animals, chiefly between Vermilion Crossing and Wardle Creek (Thompson). W. Nixon reports trapping 29 lynx in this same region in the winter of 1916-17. This is known to have been a year of peak abundance at widely scattered points in British Columbia.

Barred Bobcat. *Lynx fasciatus.*- Tracks seen in the snow on Sinclair Summit in 1935 were identified by Meredith as those of bobcat. This appears to be the only evidence of the occurrence of this species.

Hoary Marmot. *Marmota caligata.*- Two adult marmots were seen by the roadside at different places on Sinclair Summit, June 21. One ran into a burrow under rocks at the roadside, the other ran down a steep hillside and disappeared. Both these animals were silvery white on the foreparts and bright rusty brown posteriorly. Hoary marmots are not common in the lower altitudes of the park, whatever may be the conditions higher up. It may be of interest to record that in July 1926, Munro saw one standing on the base of the monument marking the boundary between Kootenay Park and Banff Park. Thompson reports that a pair still frequent that immediate area but none was seen there by us in 1943.

Golden-mantled Ground Squirrel. *Citellus lateralis.*- Several pairs of adults in winter pelage and a larger number of last year's young were under observation on June 13 in the camp-grounds at Marble Canyon. Burrows had been excavated under the camp buildings, beneath a log pile, and on an adjacent steep slope. Another smaller colony is established in a small burn about two miles south of Vermilion Crossing and a single animal was seen on the Sinclair Summit. There is said to be a colony at Radium Hot Springs but this was not verified.

Columbian Ground Squirrel. *Citellus columbianus.*- Abundant in most of the burns and other dry, open places, more particularly so in the vicinity of Kootenay Crossing. It was not seen north of Vermilion Crossing. No young had appeared up to the time we left the park on June 29.

Chipmunk. *Eutamias amoenus.*- Seen and a few trapped in various places between Sinclair Summit and Marble Canyon. An apparent scarcity of the animals at this time might be explained by the fact that females were nursing young and hence less active and conspicuous than is the case later in the season.

Red Squirrel. *Tamiasciurus hudsonicus.*- Heard or seen rarely and more often in the Sub-alpine Forest than elsewhere. Evidence of a greater abundance, perhaps in the previous year, were present in the form of workings and apparently unused burrows about mossy stumps and under the roots of spruces.

It is generally believed that the red squirrel is an important item in the diet of marten but to what extent this is so in the park is not known. A study of the relationship between these two animals would be essential in any program of management in the interest of marten.

Flying Squirrel. *Glaucomys sabrinus.* - It is related that flying squirrels frequently were taken in marten traps when trapping was permitted in what is now the park and the animal was considered to be abundant. Very likely it continues to be so but the only definite record obtained was that of an adult female trapped at Vermilion Crossing on June 17.

Beaver. *Castor canadensis.* - There are several beaver colonies in Dolly Varden Valley. One, close to the crossing, occupies an area of flooded *Carex* and willow. It was noted here on June 14 that mud had recently been added to a dam and other evidence of occupancy in the form of fresh droppings was observed. Rutherford informed us that two lodges about four miles above the crossing are now in use.

The park wardens state that beaver are moving from the creeks where living conditions are, or have been, at optimum to the Kootenay River which may be classed as submarginal environment. They believe that this

has followed as a result of a reduction in the amount of available poplar brought about by moose feeding on the young trees. To what extent such environmental change has taken place on the creeks was not determined. The explanation is perhaps valid in part at least but it is to be considered that beaver will feed and apparently thrive on lodgepole pine which is always abundant. Furthermore a natural increase of beaver that has probably taken place under protection would involve expansion and the eventual occupation of submarginal environment.

We found numerous old beaver workings on the Kootenay River and examined a recently established colony situated about a mile south of Rocky Mountain bungalow camp. Here a dam has been built across a small stream near its outlet and a considerable amount of spruce bottom has been flooded. Several poplars up to 56 inches in circumference have been felled and the branches removed. Here as elsewhere on the river the beaver live in burrows and do not build lodges.

It is suggested that a beaver census in the park is practicable and would provide information of considerable value.

White-footed Mouse. *Peromyscus maniculatus.*- Evidently at a low point in the population cycle in 1943. Only six were trapped at Vermilion Crossing, five of these in the cabin and one in the cabin clearing. Two other specimens were taken, one five miles south of Vermilion Crossing beside a small stream, the other in a meadow at Rocky Mountain cabin camp.

Bushy-tailed Wood Rat. *Neotoma cinerea.* - Said to be much in evidence during autumn when the dispersal of young is in progress. At that time and in winter it is attracted to the cabins. The only specimen examined was a young individual taken by Meredith at Radium on June 30. Here they were damaging flowering plants in a garden.

Rocky Mountain Phenacomys. *Phenacomys intermedius.* - Three adult specimens were trapped near the Vermilion Crossing cabin. One of these was taken at a burrow entrance under a moss-covered stump that was used also by meadow vole of which several were captured later in the same trap. Another was trapped on the edge of a small creek about six miles south of Vermilion Crossing.

Red-backed Vole. *Clethrionomys gapperi.* - This vole was fairly common in the spruce woods at Vermilion Crossing. It was taken on the banks of streams and on logs that spanned them, beside moss-covered logs and in numerous other situations. The first young were trapped on June 24.

Meadow Vole. *Microtus pennsylvanicus.* -The most abundant of the small mammals. It was trapped at burrow entrances under stumps and trees in the spruce woods, in runways beside logs, under log piles in open forest, in runways through patches of *Arctostaphylos uva-ursi* and on wet ground in *Carex* meadows. One colony, about two miles north of Vermilion Crossing, had numerous burrows in a small, mossy bank above a small stream and a patch of sphagnum. At the entrance of two burrows were cuttings of fine *Equisetum* about five inches long, and near another burrow entrance in a dry situation were cuttings of service berry. A female trapped on June 12 contained seven embryos; the first young to be trapped, June 23, was about one-quarter grown. Subsequently young of similar size were taken repeatedly.

Long-tailed Vole. *Microtus mordax.* - Much less common than the former.On June 10 an adult male and female were trapped beside burrows under mossy stumps near a small stream and another male was captured the following day at the same place. A nursing female and a male about one-third grown with enlarged testes were taken in a similar situation about two miles north on the night of June 28.

Muskrat. *Ondatra zibethica.*- Seen in Sinclair Creek and tracks identified on the shore of Dog Lake (Meredith). Reported also from a slough in Dolly Varden Creek Valley on the basis of tracks (Thompson).

Rocky Mountain Jumping Mouse. *Zapus princeps.* - Trapped with some regularity beside forest streams, in clearings, and in the spruce woods at Vermilion Crossing. Others were taken beside a meadow stream at Rocky Mountain bungalow camp.

Yellow-haired Porcupine. *Erethizon epixanthum.* - Reported to be less common than formerly. One was seen on June 14 near the bungalow camp at Vermilion Crossing.

Rocky Mountain Pika. *Ochotona princeps.* - The portions of the park visited contain no

talus heaps of the sort used by pikas and we saw none of these animals in 1943. However in 1931, one of us encountered them on the slopes of Boom Mountain. Undoubtedly they occur at higher altitudes but no other definite records were obtained.

Snowshoe Rabbit. *Lepus americanus.* - Observed occasionally on or near the road from near Radium Hot Springs to near Marble Canyon; it was nowhere abundant. The park wardens have not observed any marked change in numbers over a period of years.

Wapiti. *Cervus canadensis.*- Abundant and widely distributed in the park with major concentrations centred in the Kootenay and Vermilion Valleys. Here winter snowfall is light enough to permit wintering at least as far up river as Wardle Creek. On April 29 Wapiti of both sexes were ranging consistently as far as Vermilion Crossing and others were travelling further along the cleared road. Tracks of one individual were followed all the way from Vermilion Crossing to the Bow Valley in Banff Park. The tracks were followed for 11 miles.

In summer many of the bulls leave the herd and are seen on the slides up Tokumm Creek and along the Vermilion opposite Hawk Creek. Cows and young stock, accompanied by some bulls, summer in the valley bottom and on the lower slopes of the adjacent hills.

Wapiti come almost daily to the lick by the roadside just below the Simpson monument but do not become as tame as the moose that frequent the same lick.

White-tailed Deer. *Odocoileus virginianus.*- This deer is one of the most abundant and characteristic animals of the Vermilion and Kootenay Valleys.

According to local reports the bulk of the population moves down the Kootenay and out of the park in the late fall.In the last two years however small bands have wintered in the vicinity of the camps where men are engaged in removing beetle-killed pine. Here the logging operations provided a continuous food supply in the form of the *Usnea* on tree limbs.

When the park was visited on April 29 white-tails were already present as far up river as two miles west of Vermilion Crossing.

In the summer scattered individuals were recorded throughout the entire length of the main valley from Settler's road to Vermilion Pass and tracks were seen at least nine miles up Tokumm Creek.

Mule Deer. *Odocoileus hemionus.* Found to be less common than the white-tail in the parts of the park examined by us. Individuals, mostly does, were seen at Radium, John McKay Creek, Olive Lake, and up the Kootenay and Vermilion Valleys to Vermilion Summit.

As with the white-tail, the majority leave the park in the winter. However there is a limited area of wintering range adjacent to Radium and a few individuals were known to winter just north of Mount Wardle as recently as 1925.

Moose. *Alces americana.*- The most widely distributed, and with the possible exception of wapiti, the most abundant game animal in Kootenay Park. Signs of winter activity were found in all parts of the park visited. A heavy concentration had occupied the Kootenay Valley and the lower reaches of the Vermilion; all the slides up Tokumm Creek were heavily browsed.

Five or six individuals were noted almost constantly in the vicinity of the wet lick near the Simpson monument. Here they become very tame and constitute a great attraction for passing tourists.

In the summer months, however, the bulk of the moose population ranges in the alplands and near the upper limits of the Subalpine Forest biotic area.

A cow with twin calves was seen on June 24 on the banks of the Vermilion River just above Hector Gorge.

Rocky Mountain Bighorn. *Ovis canadensis.*- The bighorn has but a limited distribution in Kootenay Park. The only band known to be permanently resident inhabits the hills adjoining Sinclair Canyon. While the majority of the flock moves back to a summer range as yet unknown, small groups of ewes and young appear at road level periodically throughout the summer. They are attracted by two marl licks exposed by the highway cut-banks.

Prior to 1938 this flock was estimated to number 140 head but in the winter of 1938-39 a severe epidemic removed at least 114 individuals and there were doubtless additional, undiscovered deaths.

Three rams seen on the Simpson River during the summer of 1942 (Meredith) constitute the only other recent occurrences of sheep in the park.

However J. J. Meredith tells of shooting

rams on the west face of Mount Selkirk in the autumns of 1914 and 1915. Other evidence was discovered to bring the known occupation of this area down to as recently as 1920. There may still be a small summer population between Mount Selkirk and Split Peak.

Mountain Goat. *Oreamnos americanus.*- Goats are probably of general distribution in the higher parts of the park but were seen at but two places during the present study. On June 24 two were seen four miles up Tokumm Creek and on June 26, 49 were counted in small bands on the south and west slopes of Mount Wardle.

ACKNOWLEDGMENTS

We wish to express our appreciation of the various courtesies extended by Park Superintendent F. G. Horsey and staff during our stay in the park. Grateful acknowledgment is made also to park wardens Meredith, Rutherford, and Thompson for information included in this report and to Mr. Geo. Hopping, Entomological Branch, Dominion Department of Agriculture, for assistance in the field, for the use of unpublished data in connection with his investigation of bark beetle infestation, and for the analyses of the stomach contents of woodpeckers collected in the park.

AMENDMENTS TO BY-LAWS
——Ottawa Field-Naturalists' Club——

AT A MEETING of the Council of the Ottawa Field-Naturalists' Club held on Thursday March 30th, 1944 the following Amendments to the By-Laws were passed.

No. 1. STANDING COMMITTEES.

Two Standing Committees of at least five members each shall be appointed by the Council from among its members, viz.: A Publications Committee and an Excursions and Lectures Committee.

No. 6. DUTIES OF THE EXCURSIONS AND LECTURES COMMITTEE.

The Excursions and Lectures Committee shall make arrangements for field excursions and lecture programs subject to the approval of the Council. The chairman of this Committee shall submit a signed report to the Council at the close of each year, outlining the activities carried out under the supervision of this Committee during the past season. This report shall be embodied in the Annual Report of the Council.

By- Law No. 9. to become No. 8.

By-Law No. 10. to become No. 9.

By-Law No. 11. to become No. 10.

No. 10. AMENDMENTS.

An amendment or an addition to these By-Laws may be passed at any meeting of the Council, by a three-quarters vote of the members present, due notice embodying a copy of the proposed amendment having been given at a previous meeting of the Council. Any such amendment or addition shall be published in the next issue of the *Canadian Field-Naturalist.*