

MIGRATIONS OF CARIBOU IN A MOUNTAINOUS AREA IN WELLS GRAY PARK, BRITISH COLUMBIA

R. YORKE EDWARDS and RALPH W. RITCEY

Parks Branch, Department of Recreation and conservation, Victoria, British Columbia

Field work on which this paper is based had the original objective of gathering information on the life history and ecology of caribou *Rangifer arcticus* in Wells Gray Park, British Columbia. It was soon apparent, however, that it was a major problem simply to find caribou in the field. These animals inhabit rugged terrain in which they do much wandering. Since the total population is small, probably less than 200 animals, small bands are characteristic. Their small number adds to the difficulty of finding or trailing these animals. A biologist afoot, intent upon studying these caribou, could easily devote most of his time to searching. As a result of this difficulty, high priority was given to a search for facts on the local distribution of these caribou, and to the changes in distribution that accompany the changing seasons. This paper deals with results from this study of distribution.

Data have been gathered since 1951 on reconnaissance trips from park headquarters, and in two years by an observer living through the winter in a cabin located near wintering caribou. Aircraft have been used sparingly, and with variable success, to locate inhabited areas. Horses and aircraft were used regularly to transport supplies. Most field work was undertaken on foot, frequently while carrying equipment and food sufficient for periods up to a week. Field work in winter could not be undertaken when snow conditions made snowshoeing impossible.

Studying caribou in mountainous terrain is strenuous work with small returns in knowledge from long hours afield in all kinds of weather. Much winter field work connected with this study

was done by R.G. Miller, on his own time as a trapper as well as while employed by the Park Branch of the British Columbia Department of Recreation and Conservation. He is a good wilderness traveler and a keen observer, whose field notes are unusually accurate and complete.

DESCRIPTION OF AREA

The area to which most caribou are confined in Wells Gray Park centers on a valley the floor of which has an elevation of 3500 feet. Contained in the valley is Murtle Lake, an irregularly shaped lake some 14 miles long. About the lake are rounded mountains, foothill-like elevations, reaching up to 8000 feet. These tend to have flat or rounded tops, so are characterized by extensive alpine meadows above timberline.

These rounded mountains are transitory to high, rugged mountains to the north where the topography is precipitous, and extensive glaciers cover many square miles. This rugged topography is not favored by caribou (Edwards, 1958).

The climate of this area is characterized by frequent rainfall in summer and by cold winters with heavy snowfalls. Precipitation is evenly distributed throughout the year, varying locally with elevation and, in the valleys, with proximity to mountains. The mountains foster local storms. While the uplands receive frequent showers, parts of the broad valleys receive them less frequently. Snow depths in winter vary much as does precipitation in summer. Six to 10 feet of snow may pile up at timberline by late winter when valley bottomlands have only two or three feet of snow on the ground.

The local climates are reflected in the vegetation. At an altitude of about 2000 feet, lowest valleys have dry Douglas fir *Pseudotsuga menziesii*-grassland conditions on the warmest slopes. With increasing elevation the forest becomes one of red cedar *Thuja plicata*, western hemlock *Tsuga heterophylla*, alpine fir *Abies lasiocarpa* and Engelmann spruce *Picea engelmanni*. This is the Columbia forest of Halliday (1937), known within this province as the Interior Wet Belt. This dense forest resembles in some respects the coniferous 'rain forest' of the Pacific Coast, for in both forests the climax dominants appear to be red cedar and western hemlock. About 4000 feet this lowland forest gives way to a deep belt of subalpine forest, composed mainly of Engelmann spruce and alpine fir. This forest becomes increasingly open with elevation. Poorly drained sites in this forest have open stands of lodgepole pine *Pinus contorta*. At about 7000 feet the forest openings have enlarged to form extensive alpine meadows. These are variable in their vegetations, depending in part upon soil depth and available water. There are, however, no ground lichens, such as *Cladonia*, anywhere in this area with sufficient size or abundance to provide useful lichen pastures for caribou.

Fire has considerably modified the pattern of vegetation in this park. Much of the forest below 3000 feet has been burned. These lands now support stands of willow (*Salix spp.*), aspen *Populus tremuloides* and birch *Betula papyrifera* and *B. glandulosa*. Caribou do not usually frequent these burns (Edwards, 1954) but confine their lowland range to unburnt coniferous forest, and to shores, lakes when frozen, and meadow associated with this forest.

PATTERN OF MIGRATIONS

Like deer *Odocoileus hermionus* and moose *Alces alces* in these mountains, the caribou there are mi-

gratory. But while both deer and moose have a rather simple migratory pattern, climbing into the mountains in spring and descending into the valleys in autumn, the pattern of caribou migration is more complex. Caribou perform two complete oscillations, or migratory descents and returns, every year. This double migration has been described briefly in a previous paper (Edwards, 1954).

These caribou inhabit alpine meadows and associated subalpine forests from June to October. In the latter month they begin to appear in lowland forests about Murtle Lake and by November they are there in numbers. They remain in this forested valley through December and much of January. By late February they have climbed to inhabit the country about timberline. They remain there from February to April inhabiting some of the coldest portions of Wells Gray Park, and at elevations having the deepest snows. In April, with the arrival of spring thaws, caribou again appear in the lowland forests. There they remain until June, when they leave the lowlands to summer in the high country, at and above timberline.

This annual pattern of altitudinal distribution, high in summer, low in early winter, high again in late winter, low again in spring, is unusual. We know of no other animal in these mountains that has a similar series of migrations, nor of one with any kind of migratory movements resulting in two treks and returns annually between alpine areas and temperate forests.

MIGRATION AND THE ENVIRONMENT

Caribou in Wells Gray Park are not browsers in any approach to the degree that mule deer and moose are browsers. Throughout the summer these caribou graze in arctic-alpine habitat, feeding extensively on the ground vegetation in timberline forests as well as above the trees.

New snow appears early in these alplands. The first falls usually come in September, but snows do not usually persist and deepen until October. As deepening snows pile upon their summer range, and snowline moves down the valley floor in October, still pawing through shallow snows, and grazing on nearly bare ground where the dense foliage of trees has held falling snow aloft. Eventually, as snows deepen, the animals can no longer obtain much ground vegetation. There follows a period of deep new snow when traveling is difficult even for a man on snowshoes. Field observations show that caribou can become relatively immobilized by such snow. They have been observed sinking to the chest in the unsettled snow of early winter. More or less trapped in the valley by this snow, the caribou turn to arboreal lichens (*Alectoria* spp.) as their major source of food. They remain in the valley, feeding on lichen, until some time in January.

Usually there is a brief but marked thaw in January which settles the soft snow. Travel becomes relatively easy as a result. The caribou climb to timberline and there, until April, continue to eat arboreal lichens almost exclusively. These lichens are more abundant near timberline than in the forests below.

Spring arrives first at lowest elevations. These caribou descend again into the valley in April while snow at timberline is still firm and provides good footing. This movement may be a retreat before thaws soften the snow, but it appears, rather, to be timed so that caribou reach the valley floor when the first ground vegetation is appearing through the melting snow. Their appearance in the lowlands in spring often coincides phonologically with the return of the first crows, robins and flickers.

The caribou remain in the valley into June, grazing mainly in meadows and open forest where snow has melted most rapidly. In that month they

follow spring up the mountain slopes to their alpine summer range.

The reason for the return of these animals to the alpine meadows in early spring is not apparent from observations in the field. Perhaps it is simply a return to the most suitable summer environment, comparable to the return of birds to more northern latitudes coincident with the northward retreat of winter, and to the return of migrating springboks on the African veldt to areas where rain has ended the drought which apparently made migration necessary (Cronwright-Schreiner, 1925).

As Hochbaum (1955, p. 39) has pointed out, it appears to be part of an animal's inherited ability to somehow recognize the ecological niche to which it is adapted. This innate characteristic of animals results in the limited kinds of habitats which most animals frequent. Superimposed upon this inherited preference for a kind of place are learned traditions which may restrict the activities of the animal to a specific area that has suitable ecological attributes. This mechanism of habitat selection, partly innate, partly learned, is perhaps the explanation for some migratory movements of the caribou under study. While there is evidence that snow depths and food supply are important factors in the fall and winter treks of these animals, in spring and summer they seek alpine tundra. Perhaps by so doing they seek the most suitable environment. Seasonally this environment becomes less favorable, even uninhabitable, and the reaction of caribou is retreat, in the form of migration, to environments temporarily better suited to their needs for survival.

The lowland coniferous forest used by caribou in fall and spring is very different from the vegetation usually regarded as caribou habitat. This is one of the densest forests in temperate North America, closely allied to the west coniferous 'jungles' on the coast of Oregon, Washington, British

Columbia and southern Alaska. In an abundance of moisture, growth is rapid and trees are large, while a dense canopy shades the ground. Caribou often frequent the densest stands, grazing on ground vegetation or taking foliage from under-growth. More time is spent in forest openings, however, at forest edges along beaches, and in open meadows and bogs associated with this forest on flat terrain.

While the foods eaten by these caribou will be the subject of a separate paper, the role of arboreal lichens in this pattern of caribou migrations is worthy of brief treatment here. Survival of these caribou through each winter seems to depend upon these lichens as the principal food supply. The distribution of these lichens in space is important to understanding of their unique role as winter food. They may occur on trees from lowest branches to the highest twigs, although environmental limitations may vary their abundance according to forest site, distance from the ground, and the species of tree concerned. While snow may quickly cover the grasses and herbs used by animals grazing on the ground, and may less rapidly bury twigs used by browsing animals, these arboreal 'lichen pastures' are quite different. Arboreal lichens are especially abundant near timberline. Here also the climate in winter produces deep but firm snow on the ground. Deepening snows brings fresh supplies of edible lichen within reach. The distribution of this food supply in space can result in deep snow being an asset to caribou, provided that the snow is solid to walk upon.

Some caribou on the Arctic tundra of Canada perform a 'double migration' every year (Clark, 1940; Banfield, 1954) but it is quite different from that noted in Wells Gray Park. In both cases there is movement from tundra to forest in autumn, and a return to tundra in spring. While the Wells Gray animals perform another complete oscillation in winter, the Arctic animals make additional treks in

late summer. In the latter case the main migration from winter range carries them deep into the barrens by July. In a few weeks they move back towards treeline, pause while still on tundra, move away from treeline in September, then, with the first severe blizzards, move again toward treeline and forested winter range. The summer movement away from treeline does not carry them so far into the tundra as does the main trek in spring.

There appears to be no direct relationship between the two extra oscillations, one in winter, the other in summer. In the mountains there is a return in winter to elevations frequented in summer; on the barrens there is a movement in late summer over terrain hurried through in spring. These treks in Wells Gray Park seem necessary to utilize the best supplies of food available. Future work in the north may uncover similar causes.

SUMMARY

Caribou *Rangifer arcticus* in Wells Gray Park, British Columbia, migrate between alplands above 7000 feet and lowland coniferous forest at 3500 feet. Migrations differ from those of deer *Odocoileus hemionus* and moose *Alces alces* which descend in autumn, climb in spring. These caribou move down in late autumn, climb in January to winter near treeline, descend again in April, then climb again in May or June. Factors controlling these migrations appear to be available food supply as affected by snow, and the influence of snow upon the mobility of the animals. At timberline, in winter, an abundance of arboreal lichens is made available by deep, firm snow.

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