

WINTER WILDLIFE REPORT WELLS GRAY PARK 1953 - 1954
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INTRODUCTION

The following report deals with winter studies carried out in Wells Gray Park from December 1953 to April 1954. Winter work concentrated on moose, the main phases involving distribution and migration studies, live trapping and tagging, and spring census or inventory.

Field work was carried out by the writer under the direction of R.Y. Edwards until March, when the spring moose census and live trapping operations were begun. J.C. Norman, C.E. Gaglardi, and R.G. Miller carried out most of the track counting and strip censusing reported here. Their complete notes are on file and contain much valuable information. An aerial moose count was made in March, in which Mr. P.W. Martin, BC Game Department, and Park Ranger L.E. Cook planned details and participated in the count. Many local residents assisted in various aspects of the live trapping program, such as driving, roping, and setting the traps.

The writer wishes to express his appreciation to all who assisted him on various occasions through the winter. Special thanks are due Ted and Roy Helset and to Park Ranger L.E. Cook, who helped to make the winter's work less burdensome on many occasions.

ABSTRACT

Studies carried out in Wells Gray Park from December 1953 to April 1954 were largely a continuation of study of winter moose ecology begun in the previous winter. Physical condition of autopsied moose was comparable with that of those autopsied in the previous winter. Parasite infestation was comparable except that tick loads were significantly less.

Spring track counts gave a total of 813 northbound moose, or a reduction of one hundred animals from the past spring. The decrease is apparently due to the larger number of animals staying north for the winter. Making allowance for moose which do not cross the line, a huntable population of 1150 is arrived at from the track count.

A strip census involving one a small sample of the winter range gave a population estimate of 1300 moose on this range.

An aerial strip count gave an estimate of 300 moose for the park winter ranges. Lack of snow made the air count a failure.

Winter ranges showed continued improvement in many areas due to lighter moose concentrations brought about by a winter of shallow snow.

Caribou reconnaissance by Mr. Miller and Mr. Gaglardi revealed bands of caribou wintering to the southeast of the park.

Wolf numbers are believed to be about the same as in the past year. Some records of their winter travels are given.

Apparent decreases in lynx, bobcat, marten, and coyote populations were noted. Wolverine appear to be increasing. Rabbit populations were much lower than in the previous winter and this decrease is believed to have influenced many of the fur bearers.

MIGRATION

Moose moved into the early winter range typified by study area "D" in mid-December. They were still heavily concentrated there in mid-January. On January 12th, twenty-three moose were seen on this study area, and it seemed likely that there were up to forty moose on this square mile at that time. On area "C", moose had begun to arrive in mid-December, but there was no concentration on this area until late December because of hunter disturbance. On January 11th, sixteen moose were seen on this study area from a vantage point on the Pyramid, and it seemed likely that there were about twenty moose in this square mile at that time. Moose were still moving into the region in mid-January and, on one occasion, six moose were seen on the north banks of the Murtle, attempting to make a southward crossing. A cow and calf (Fig.1) were observed to cross and it is presumed that others crossed at the same time. When ice partially covered the river, moose seemed to stay on the northern banks until they were able to cross on solid ice.

In late December, moose began to move down into the high altitude burns on the south and west facing slopes below Battle Mountain. The number of moose visible on the upper slopes reached a peak near the end of January. Their numbers gradually dwindled through February, and in mid-March it was difficult to detect any moose on these slopes, except on the lower benches. With thawing conditions in late March, an upward movement trend was noted.

Movement of moose from the flats of the Murtle River practically ceased by the end of February. Most moose remaining in the flats at this time appeared to spend the winter in pockets of suitable habitat scattered throughout the burn. There seemed to be a distinct preference for wintering areas where a timbered region was nearly or where there were broken ridges. These type of habitat could be escape terrain necessary for survival in case of wolf attacks. Snow depth in the burn at the elevation of Gauge Hill average greater than 40" in late winter and packed snow of this depth made it difficult for moose to travel swiftly.

An illustration of the ease with which wolves might have captured moose then is seen in the following: On March 17th, a fresh moose track was found in the vicinity of the Gauge Hill cabin, and after a chase of less than one hour on snowshoes, the moose was brought to bay. Later in the day, a cow and calf were pursued on the edge of the open burn on Gauge Hill. The calf dropped back after about a quarter of a mile run and would have been overtaken easily had not the chase led into windfalls and later into a patch of timber. Here the moose could walk on bare ground for much of the time and were able to escape readily. In these chases, we sate about 4" while on snowshoes, and it is doubtful if a wolf would sink more than 6" in the same kind of snow. Moose, on the other hand, were sinking 40" to the ground.

The mean migration speed of southbound moose in mid-winter appears to be less than one half mile per day. If it can be assumed that moose move from the Murtle flats near French Meadows into the Hemp Creek valley, then a calculation may be made as follows: the peak of moose numbers at French Meadows occurred about January 12th and the peak of numbers at Hemp Creek about February 13th. The map distance is approximately 12 miles between these two points, so the moose were traveling slightly less than .4 miles per day. In some cases, movement is much faster. The writer saw a group of eight moose moving southward along the Murtle River. They traveled approximately three-quarters of a mile in a little more than four hours. Here the moose were following a well-defined trail and lack of feed immediately adjacent to the trail seemed to keep the animals moving.

Certain animals may maintain a home range during the winter, but this only occurs for a limited length of time. The writer noted a southward drift in the Hemp Creek area until March 7th, and northward movement began one month later on April 10th. It is evident that moose are on the move for almost the entire winter, with only a brief interlude when the population as a whole can be considered more or less sedentary.

The first northward movement was noted on the track-counting line on April 16th, almost two weeks later than last year's movement.

The northward movement seems more rapid than the southbound migration, but is sometimes slowed by cold snaps when the animals may even turn south. Wolves may also drive animals back on their migration routes. On April 28th, the northward trend was interrupted apparently by cold weather. Track counts on the 29th revealed a net southward drift of twenty-eight moose. Wolves were known to be north of the line at that time and conceivably could have been at least partly responsible for the southward movement.

Stimuli causing the northward migration are not properly understood as yet. Studies of temperature, weather, and snow depths are being continued but no definite correlations have come to light.

WINTER MORTALITY

Herd losses were again apparently light through the winter months. Shallow snow enabled most moose to forage at will over the winter range and, as stated elsewhere, wolf numbers on winter range were not excessive. Losses on marginal winter range may occur without our knowledge and the extent of these losses could be great in some winters. At least some moose which winter at higher elevations succumb to starvation or predation. Several moose carcasses were found on the highland plateaus above Kostal Lake in 1950 and there are undoubtedly other areas where moose try to winter in areas of deep snow which eventually brings about their death.

The following is a list of moose carcasses found during the winter, spring, and early summer months:

1. Mature bull - found at Murtle Lake outlet; dead for at least a month. Cause of death unknown.
2. Mature bull - found on ridge east of Hemp Creek, March 6th, dead for at least a month. Marrow in femur: red, gelatinous. Cause of death unknown.
3. Calf female - found at Hemp Creek on March 22nd, dead for a couple of weeks. Marrow in femur: red, partially fat bordering on gelatinous. Believed to be wolf kill.
4. Calf female - found at MacLeod Hill, April 3rd, dead for a day or so. Believed to be wolf kill.
5. Calf, sex unknown - found on banks on Murtle River above Helmcken Falls on April 19th, dead for at least a month. Marrow in femur: pink, fat. Possible cougar kill. (J.C.N.)
6. Calf, sex unknown - found north of Murtle River on ridge southwest of Pyramid Lake on June 7th, dead for an undetermined period. Cause of death unknown.
7. Calf, sex unknown - found north bank of Murtle River next to trail above cable crossing on June 18th, dead for an undetermined period. Believed to have been killed by hunters in fall.

All remains discovered had been previously eaten by such animals as wolves, wolverine, or coyote. These do a thorough job of cleaning up kills in many cases, and carcasses are hard to find for this reason.

It should be noted that seven carcasses were found this year as compared with four in the year previous by people working in approximately the same territory.

MOOSE SEX AND AGE RATIOS

Figure VI shows the results of sex and age data gathered by four observers on winter range in the same period of time. These totals do not include animals captured in the corral, for the trap may favour the capture of cows and calves. As in the spring of 1953, there is a wide variance between the ratios obtained by the four individuals. In the percentage of calves to the classified totals, there is a difference of 12% between the two extremes.

All observers but one saw a smaller percentage of calves than in the previous spring. It is not known whether this represents an actual decrease in the percentage of short yearlings on the winter range, or whether it is due to more conservative work on the part of the observers. Apparently the obtaining of a correct sex and age sample of the herd is more difficult than formerly thought.

Fig. I: Cow and calf cross the Murtle River in mid-January.

Fig. II: Three captive deer at west side of corral.

Fig. III: Doe pinned down for tagging.

Fig. IV: SUMMARY OF MOOSE SIGHTING RECORDS OF FOUR OBSERVERS ON WINTER RANGE FROM MARCH 4th to MAY 7th, 1954

| Observer | Bulls | Cows | Calves | Adults not sexed | Unclassified moose | Totals |
|----------|-------|------|-----------|------------------|--------------------|--------|
| A | 28 | 34 | 23 (16%) | 66 | 77 | 228 |
| B | 27 | 37 | 38 (20%) | 83 | 126 | 311 |
| C | 6 | 5 | 6 (8%) | 49 | 50 | 116 |
| D | 34 | 38 | 34 (17%) | 89 | 130 | 325 |
| Totals | 95 | 114 | 100 (15%) | 287 | 383 | 975 |

LIVE TRAPPING

A live trapping program was initiated in the fall with the construction of a moose corral on one of the main migration route to late winter range. Mr. C. Ludtke constructed the corral for Two Hundred Dollars, under contract.

The corral is an octagon with sides 8' x 25'. Materials are sturdy cedar posts and aspen rails (Fig. II).

Animals were trapped when they crossed a trip rope releasing a lever supporting one of the gates. In falling, it is turn released the other gate.

Short wings were constructed of brush to guide southbound moose and deer into the corral. These proved ineffective. The animals crawled through, or walked over the loosely piled brush. In March, better wings were constructed on the south approaches to the corral. These were erected by wiring aspen rails to "A" frames or to convenient trees which served as posts. It was found that moose would readily jump any part of the fence which was not over five feet high. Heights of six feet or more were not attempted. Calf moose (short yearlings) usually attempted to squeeze through small openings and it was found that the maximum distance between rails should be about 16" to discourage small moose from doing this.

Baiting was tried, using shoots of red osier dogwood, clover and alfalfa hay, and salt. Apparently an abundance of natural food made it unnecessary for moose to come to bait, although some dogwood outside the corral was utilized. Clover proved palatable to deer and they came to it readily in the early winter. Deer in the spring found ample fresh clover growing on the hillsides and

ignored such bait. Salt was ignored by moose and deer in the corral, but deer were attracted near the corral by salt placed on the corral trail in spring.

Several drives to chase moose into the corral were successful in driving moose for distances up to about half a mile if there were at least three persons participating in the drive. Most moose were captured by letting the animals drift into the corral of their own accord while on northward migration. Camouflaging the entrance to the corral with evergreen trees induced moose to enter the enclosure more readily.

The first deer (Fig. III) and moose were tabbed by roping them and forcing them to the sides of the corral. It was safer to tag moose from outside the corral, reaching through the rails, but with deer it was safe to enter and tag them while inside. Roping proved too rough a method and one calf moose died from strangulation and shock. Later a squeeze was made of aspen and cedar poles. Moose were forced into a narrowing chute and there confined by rails placed behind and above.

While it was not possible to observe moose or deer then they first entered the trap, there were several occasions when they were seen only a short time after being enclosed. Both moose and deer usually attempted to jump the walls almost at once. Moose would rarely succeed in getting their hind feet off the ground, and would be knocked backwards when they hit the fence. They showed almost no natural ability to jump successfully over this height of eight feet. After three or four such attempts, they ran back and forth along the corral walls until exhausted. Their tongues hung out and their movements became laboured. At this time, some animals, depending on their temperament, became defiant and, with ears laid back, would face their captors. After being confined in the chute, or after being roped, tagged, and released, most animals, even including some short yearlings, assumed an air of defiance when approached by humans.

Deer were far better jumpers than moose and were almost able to escape over the fence. Doe #114 was able, on several occasions, to reach the top rail with her nose in a jump intended to carry her over the fence. Besides being able to jump higher, they made more attempts to clear the fence than did moose.

The trap was in operation for approximately four months during which time three deer and twenty moose were captured (Fig. IV). While tending the corral, a careful check was kept on tracks over the trail. During the period of southward migration, a net southward drift of one hundred and nine moose tracks were recorded. Most of these tracks were tallied on the trail near the corral where wings of about three hundred yards would cut across their line of travel. A trap in the wings both to the north and south of the corral would probably double the catch of moose.

Information obtained by tagging moose will be of value in the following ways:

1. It will be possible to define more clearly the winter range of moose which are hunted in the fall.
2. The summering areas of moose wintering the Clearwater Valley will be defined more clearly.
3. Data on longevity, migration routes, and territories of individual moose will be gathered more readily.
4. It will be possible to refine aging techniques base on tooth wear when jawbones of moose of known ages are collected over a period of time.
5. It may be possible to make estimates of population size by use of the Lincoln index when a large number of moose have been tagged.

The live trapping and tagging program is one of our most important projects at the present time, and considerable effort will have to expended to catch as many moose as possible. Wings of at least three hundred yards will be construct on each of the north wings. Two additional traps

should be constructed, one south and one north of the present corral. Another trapping site on the north bank of the Murtle River, near the Pyramid, would probably be productive and a trap should be erected there. It should be pointed out that future traps could probably be much smaller and more cheaply erected than the present corral.

Fig. IV: SUMMARY OF MOOSE AND DEER LIVE TRAPPED, WINTER 1953 - 54

| Date of release | Species, sex and age | Tag description |
|-----------------|---|---|
| January 17 | female deer, mature female deer, fawn female deer, fawn | #114 pink triangle both tagged previously in summer of 1953 |
| February 13 | cow moose calf moose, female | #117 pink triangle, right ear no tag, died in corral |
| March 2 | bull moose, mature | #118 pink triangle, left ear |
| March 7 | cow moose, mature | #119 pink triangle, left ear |
| April 1 | cow moose, young ** bull moose, 22 months bull moose, young | #124 pink triangle, right ear #121 pink triangle, right ear #122 pink triangle, right ear |
| April 14 | cow moose, mature calf moose, male calf moose, female | #103 pink circle, right ear #105 pink circle, left ear #126 pink circle, left ear |
| April 19 | cow moose, mature calf moose, male | #113 right ear, pink circle #112 right ear, pink circle |
| April 23 | cow moose, mature calf moose, male * | #184 right ear, pink circle #107 left ear, pink circle; torn right ear |
| May 1 | cow moose, mature calf moose, male | #136 right ear, pink half circle #135 right ear, pink circle |
| May 4 | cow moose, mature | #140 right ear, pink circle |
| May 5 | bull moose, 23 months | #129 left ear, pink circle |
| May 7 | cow moose, mature calf moose, male | #133 right ear, pink circle #132 right ear, pink circle |

* not calf of #184

** young means probably less than three years old

AUTOPSIES

Post mortem examinations of ten moose were made through the winter. Nine of these were shot and the tenth was killed as a result of rough handling in tagging operations. The results of these examinations are recorded on autopsy sheets and a summary is given below:

All moose examined, save for a calf, had light to heavy infestations of leg worm (probably *Wehrdickmansia cervipedis*).

Cysticerci (probably *Cysticercus tenuicollis*) were present in all but one of the adult moose examined. The calf was found to be free of this parasite also. Liver was the most common site of infestation (seven cases), followed by omentum (four cases). The largest number of cysts occurring on one liver was seven.

Hydatid cysts were found to be present in lungs or liver of all but one adult. The greatest number of cysts in one lung was eleven.

No nose bot was found in this winter's sample.

All adult females autopsied were pregnant, six with single pregnancies (four female embryos, two male), and two with twin pregnancies (three male and one female embryos). One cow, autopsied on April 28th, carried a male embryo which measure approximately 200 millimetres less than a male embryo of a cow killed on March 28th. This is the only record from winter autopsied moose of "late" breeding in park moose.

GRAPH I: MOOSE ACTIVITY IN WINTER

Enlarged ticks were first noted on the calf autopsied February 13th. All moose autopsied after that date had enlarged ticks on them. Tick infestations of autopsied moose were generally light to moderate. No tick counts of autopsied animals were made. However, notes taken on tick abundance of autopsied animals suggest significantly lighter tick loads than in the winter of 1952 - 53.

During the spring moose census, a record was kept of beds and of engorged ticks found in them. In 230 beds examined, there were 112 engorged ticks, or approximately .5 ticks per bed. This compares with 1.4 engorged ticks per bed in the spring of 1952 - 53. The maximum number of engorged ticks in one bed was six.

PELLET GROUP FACTOR

Further work was carried out to find the number of fecal pellet groups deposited per moose day. Direct observation and tracking (chiefly the latter) involving 77.9 hours of moose time showed 57 pellet groups or 17.5 groups per day. This figure is significantly greater than the figure found last year, and further study is needed to determine the true deposition rate.

ACTIVITY

Graph I shows the activity of moose seen during different periods of the day in winter months from the fall of 1952 to the spring of 1954. Observations of the activity (whether standing up or lying down) were recorded along with the time of sighting every time it was convenient to do so. All observations of moose activity which may have been caused by the presence of the writer were omitted. A total of 527 observations of moose activity are involved.

It is seen that there is a peak of moose activity during the early daylight hours and a falling off of activity as the morning progresses. A second period of activity begins before noon and reaches its peak shortly after noon. Activity again declines late in the afternoon. A third period of activity begins just before dark.

There is need for more observations on individual animals, but our present data suggests that most moose are active for three and sometimes four periods during the day in the depth of winter. These periods of activity are devoted largely to feeding and very little aimless wandering occurs. Few animals observed on Green Mountain travelled more than two hundred yards straight line distance in one feeding period. In better feeding grounds north of the Murtle, animals restricted by deep snow often travelled less than fifty yards to fill their paunches.

There is no quantitative data to support the belief, but the writer has the impression that moose tend to become more inactive in periods of extreme cold. There appears to be almost no aimless wandering during these periods, and feeding is concentrated.

AERIAL MOOSE CENSUS

A strip census was made in March, using a pontoon-equipped Beaver aircraft. The aircraft was piloted by Mr. Jim Marshall, of Pacific Western Airlines, with Ranger Les Cook acting as observer, and Mr. Pat Martin, BC Game Department and the writer tallying.

The pilot counted all moose which he saw, as did the observer, who occupied the seat beside the pilot. Talliers recorded all moose seen inside a strip delimited by a cord attached to the strut of the aircraft and by the pontoon. The observer recorded time elapsed between known land marks, and the number of moose counted by the talliers between these land marks. This gave the number of moose seen on each strip flown in the sample. The observer also classified all moose which he saw as to probable age. This method has been found most satisfactory by Mr. Martin in aerial moose counts by the Game Department.

Weather conditions were excellent with clouds only over the mountains and light winds which did not affect the maneuverability of the aircraft. Ground was one-third bare in the lower parts of the moose range and about one hundred percent snow covered above the 3000' level.

As pontoons made it impossible to see under the aircraft, all tallying had to be done in a strip well to the side of the line of flight. From a height of 400', moose on the outside of the strip were almost 800' distant from the observers and difficult to see except under ideal conditions. Since other difficulties involved in aerial census have already been discussed by Edwards (An Aerial Moose Census, BC Forest Service Res. Note No. 23, 1952), the results of this flight are summarized only, and its shortcomings pointed out in the comparison of census methods.

FLIGHT SUMMARY:

Mean air speed: 90 mph

Mean height: 400 feet

Total strip width: 816 feet

Minutes of strip flown: 86

Total strip areas: 19.8 miles

Moose seen on strip: 40

Moose per square mile: 2

Areas of occupied moose winter range: 127 square miles in south end of park and 20 square miles in Archer Creek burn for a total of 147 square miles

Moose population calculated from above: 294 moose

Distribution:

South of Murtle River: 2.3 minutes flown for each moose seen on strip

North of Murtle River: 2.4 minutes flown for each moose seen on strip

Archer Creek burn: 2.5 minutes flown for each moose seen on strip

Moose seen by pilot on flight: 183

Moose seen by observer on flight: 53

As well as flying strips, a reconnaissance was made from Stillwater to Murtle Lake, along the south shore of Murtle, thence up the north arm, north-west behind Centre Mountain to MacDougall Lake, over the plateau to the south of Goat Peaks, and then around the west of the Kilpil. Only one moose was seen on this flight, at about the 4500' level on Centre Mountain. No caribou sign was noted. Wolf sign was seen at the east end of Murtle at an old wolf kill.

TRACK COUNT

Track counting was carried out over the same route as in 1953, with the exception that trail 'A' was abandoned. Only thirteen moose went north over this trail in 1953, and it was apparent that time involved in traveling this trail could be better used elsewhere.

Fig. V shows the daily net drift of moose over the track counting line for the entire period of the census. The moose started to move north a little more than two weeks later than in the previous spring. Stimuli causing the northward movement are not as yet understood. There is some correlation between the number of moose crossing the line and the mean temperature of the day previous. Snow depths apparently influence the movement to some extent. However, we have as yet no means of telling when the moose will begin to move. In the past two springs, twenty-two days have been involved each year in the actual count of the north migration, while twenty-two and seventeen days respectively were spent in waiting for the movement to begin. The time spent on the count could be cut in half if there were some way of predicting the time of the initial movement north.

A total of 813 northbound moose were tallied. To this must be added the number of moose in the area between the counting line and the northern extremity of the winter range. In this region, air and ground strip census give approximately 200 animals in the Murtle River flats and MacLeod Hill. At the Archer Creek burn, the populations was estimated at 60 animals from the aircraft strip census. Approximately seventy-five animals are believed to summer south of the track counting line. This gives a revised total of approximately 1150 moose. No allowance is made for moose which cross the line after the termination of the track count.

Fig. V: NUMBERS OF MOOSE CROSSING TRACK COUNTING LINE
FROM MARCH 30 TO MAY 7, BOTH DATES INCLUSIVE

| March | Days Drift |
|-------|------------|
| 30 | 4 n |
| 31 | 3 n |
| April | |
| 1 | 4 s |

| | |
|----|-------|
| 2 | 1 s |
| 3 | 1 s |
| 4 | -- |
| 5 | 5 s |
| 6 | 7 s |
| 7 | 0 |
| 8 | 0 |
| 9 | 0 |
| 10 | 1 s |
| 11 | 0 |
| 12 | 0 |
| 13 | 0 |
| 14 | 0 |
| 15 | 0 |
| 16 | 7 n |
| 17 | 12 n |
| 18 | 14 n |
| 19 | 20 n |
| 21 | 33 n |
| 22 | 61 n |
| 23 | 100 n |
| 24 | 26 n |
| 25 | 14 n |
| 26 | 28 n |
| 27 | 18 n |
| 28 | 3 n |
| 29 | 28 s |
| 30 | 22 n |

May

| | |
|---|-------|
| 1 | 14 n |
| 2 | 73 n |
| 3 | 136 n |
| 4 | 85 n |
| 5 | 88 n |
| 6 | 43 n |
| 7 | 28 n |

813 n

The drop of one hundred moose from last year's total is apparently due to a larger number of moose remaining north of the line throughout the winter. Counting conditions were similar in both years, and the count this year was extended two weeks longer than in the previous spring to compensate for the later movement.

The accuracy of track counts could be increased greatly if about two miles of the trail were grubbed out to a width of about 3 1/2'. There are certain portions of the line which become bare of snow while other parts are still snow covered. If these portions were grubbed out to mineral soil, many tracks would be recorded which are missed at the present time.

A cabin large enough to house two men should be erected at the east end of the line. This would eliminate the necessity of returning nightly to Hemp Creek, and one man could usually do the track count. In time of difficult travel, an additional man would be necessary for trail breaking.

GROUND STRIP CENSUS

A strip census was undertaken from March 15th to 18th inclusive. It was conducted in two areas, the first being roughly the same region sampled in the spring of 1952 (ref. L.E. Cook, J. Norman, and C. Gaglardi, 1952, unpub. report), the second in the country north of the Murtle River bounded by the base of the Kilpil on the north and by the Pyramid on the southwest.

In the first area, strips were run between known surveyed distances on the same routes as in 1952. Fifteen and two-tenths miles of strip 400' wide were covered. Eighteen moose were seen strip, giving a density of approximately fifteen moose per square mile.

In the area north of the Murtle, strips were run by compass between points which were easily recognized on aerial photographs and distances calculated from these. Distances calculated by this method are believed to be accurate enough for our purposes. Twelve and a half miles of strip 400' wide were travelled and three moose were seen on the strip. This gives a population density of about three moose per square mile.

The area to which the first sample applies occupies 40 square miles and therefore contained about 600 moose. The area in which the second sample is probably valid, contains about 30 square miles and was occupied by about 90 moose. The remainder of the occupied winter ranger (except the Archer Creek burn) is about 60 square miles in area and was believed to have a moose density intermediate between the two extremes of range censused. If this were taken as the exact mean, nine moose per square mile, the remainder of the range would have approximately 540 moose. The total populations arrived at by strip census and estimation from it, would then be approximately 1230 moose. If air census figures are used for the Archer Creek burn, the total population figure becomes approximately 1300.

COMPARISON OF THREE CENSUS METHODS

The figures for moose population on Wells Gray wintering grounds obtained by different methods are as follows: (1) aerial strip census: 300; (2) track count: 1150; (3) ground strip census: 1300. Previous figures for population on the wintering grounds were 2000 - 2500 in 1952 (Edwards, op.cit.) and 1300 in 1953 (Ritcey, op.cit.)

It is at once apparent that the aerial count this spring yielded far too low a figure for the population. The chief reason for failure of this air census was lack of snow, making it difficult to see animals at the height flown. That a large percentage of the animals were missing by the flight is apparent in the following: in the southern part of the range, where ground strip count gave fifteen moose per square mile, the aircraft count gave about two per square mile. Here large patches bare of snow made the air count especially difficult. North of the Murtle River, where the ground was nearly 100% snow-covered, the air count of two per square mile corresponded with ground strip count of three per square mile. In future, no flights should be made unless snow conditions are suitable for maximum visibility.

The ground strip census and the track count give figures in fairly close agreement. However, both of these methods also give too low a population estimate. In the ground census, moose unhampered by deep snow will often move from the strip before then are seen by the counter. This happens most often in crusted snow, although it can happen when traveling conditions are relatively noiseless. Visibility over much of the area censused is less than 300 feet, and, in some

cases, less than 200 feet. In one instance, a moose was observed to take flight and leave the strip area while the observers were still almost 400 yards away. Sign indicated that similar instances occurred on more than one occasion.

Large areas of the winter range are not adapted to ground strip census because of broken topography and brushy cover. The error involved in avoiding these areas may be as great as inaccurate counts made there.

To increase accuracy, the following precautions should be observed when making a ground census in snow:

1. Strips should be run in uncrusted snow when possible.
2. Strips should be run facing the wind.
3. Allowance should be made for animals missed on the strip by examining sign during the count and after the strip has been run.

The track count appears to be the most reliable method of census yet tried in that it gives fairly consistent figures on moose numbers in years of light snow when air census cannot be considered accurate. It also has the advantage of censusing those animals which appear to spend most of the year within the park. Our understanding of moose movement is not developed to a point where we can predict what proportion of the winter range population summers in the park. The track count has the disadvantage of needing a supplementary census for animals remaining north of the line. Allowance must also be made for animals remaining south of the line, or for those which cross after the completion of the count. The track count is very time consuming, however, as compared to the aerial method.

MULE DEER

Shallower snow enabled deer to remain in the north part of their winter range for a longer period of time than last year. Apparently a few stragglers remained in the vicinity of Hemp Creek for the entire winter, although no tracks were recorded in March.

The chief winter food of deer on the northern winter range is *Pachystima*, obtained by nuzzling or pawing in shallow snow. Deer appear to be more efficient ground feeders than moose, and fed on *Pachystima* and other low-growing vegetation when the snow depth was about 18". Moose generally abandon *Pachystima* when snow depths exceed 12 - 14".

Winter survival was apparently very good, although there were reports of wolf kills to the south of the park. No significant figures were obtained on sex or age ratio of the wintering herd.

CARIBOU

In early November, caribou sign was abundant on the Mobely Mountain trail, as in the fall of 1952. Caribou had been traveling the trail which was also heavily used by moose. The caribou had fed on ground vegetation, including the leaves of ground dogwood (*Cornus canadensis*) and of arctic raspberry (*Rubus pedatus*). They fed on tree lichen (*Alectoria sarmentosa*) as well. It was difficult to determine how many animals were in the vicinity but two adults were seen and there appeared to be several more scattered through the region. Moose feeding here were browsing on huckleberry, elderberry, false box, and bracken. There appeared to be little competition between moose and caribou for food. The former seemed to prefer browse species while the latter fed chiefly on small forbs and lichens. Food studies involving stomach analysis would likely be the quickest means of determining the extent of competition for food between these two species.

In February, R.G. Miller and C.E. Gaglardi snowshoed through the territory between Blue River and Murtle Lake, south to Stevens Lakes, and east to the headwaters of the Mad and Raft Rivers. Caribou sign was found at elevations exceeding 5000'. Here caribou walked in the settled snow without too much difficulty. They sank to an average depth of about one foot. By contrast, a man on snowshoes sank about 6" in the same snow. Caribou were eating tree lichen on standing and fallen timber in this region. There seemed to be no shortage of tree lichen in the regions visited.

On February 18th, old tracks of caribou were seen at the river crossing at the west end of Murtle. The tracks were at least a week old and appeared to have been made by between eight and twelve animals. No caribou sign was seen at lake level at the east end of Murtle at this time.

Snow depths of 36" to 38" in the balsam - spruce stands and in the meadows at the west end of Murtle indicated about 20" less snow pack than in the previous year. Snow deciduous browse was available due to the shallower snow, but it did not appear to be used by caribou.

A report of caribou crossing through the valley floor from east to west at Trout Creek on February 5th was received from Mr. F. Ludtke. This report is probably accurate.

TIMBER WOLF

The following account of wolves and their movements in the park during the winter 1953 - 54 has been compiled from notes taken by spring moose census workers, from report of wolves by reliable local residents, and from the notes of the writer.

In early October, wolves ranged the shores of Murtle Lake. Tracks indicated up to ten wolves were there at that time. By late October, wolves began to appear on the early winter moose range of the Stillwater flats, MacLeod Hill, and French Meadows. Here their numbers were estimated at about six. Though they were heard frequently by hunters and guides, there were no reports of moose or deer kills attributed to them. After a period of activity in these areas, which lasted through November and December, wolves began to occur in the lower valleys from Hemp Creek southward.

Through January, wolves were heard at intervals in the vicinity of Hemp Creek although they rarely remained long in one place. Their number were estimated at from four to six and they appeared to be hunting as a unit. Their tracks were seen heading northward at the latter end of the month.

On February 10th, wolf tracks were noted between Majerus and Horseshoe Falls on the north banks of the Murtle River. It is suggested that these same wolves came south from Stillwater less than a week previously. The river ice was much travelled by wolves in February as unpacked snow made travel in the burns rather difficult.

In March, with settled snows and with the arrival of better traveling conditions, wolves began to range farther afield and their sign was again noted in the lower country at frequent intervals.

Two wolves were within a hundred yards of the Hogue residence on March 6th. It is believed that at that time they killed the orphaned calf which had been seen in the vicinity previously. They did not return to the kill, which was found on March 22nd.

A lone black wolf was seen on the Murtle River on March 15th. It was feeding on a horse bait at the river's edge. Tracks of five wolves were seen on the west side of Green Mountain at this date. The five passed through Hemp Creek, going north on the 16th.

No wolf sign was noted in the next few days, so a group of four wolves seen on Clearwater Lake on March 19th, from the air, could conceivably be a part of the pack which passed through Hemp Creek on the 16th. This does not seem likely as no wolf sign was noted on a trip made on the 18th, which would have bisected their line of travel had they gone this far north. The wolves on Clearwater Lake were running a couple of hundred yards behind three moose which appeared to be having little difficulty in keeping out of their way. All wolves in this pack were black.

Wolf sign was also noted at Stillwater, the east end of Murtle, and in the Archer Creek burn. From the height flown, it was impossible to know how recently the tracks had been made, and in some cases coyote and wolverine tracks may have been mistaken for wolf tracks.

Five wolves passed south through Hemp Creek again on the night of March 26th or in the early hours of the 27th. These wolves were heard by D. Archibald in the early hours of the 29th when they headed south towards the canyons.

Wolves were active on MacLeod Hill in April. On April 2nd, wolves ran moose north along the ridge east of Hemp Creek and presumably onto MacLeod Hill. The snowshoe trail to the east of Hemp Creek was cut up by running wolves and moose, crossing and recrossing. It is estimated that there were around seven wolves in the pack. On April 3rd, a heifer calf was found dead near the track counting line on MacLeod Hill. Tracks of wolves were seen frequently on MacLeod in April and, as the month progressed, tracks indicated that they were more likely to be found in pairs or as singles. Females were probably finding denning sites and the winter band or bands had disbanded.

From this data, one would conclude that there was a pack of five wolves which ranged the moose winter range from Stillwater southwards at least ten miles south of the park boundaries to the vicinity of the canyons. At least one or two other wolves were ranging the same territory during the same period, independently of the main group. A pack of four wolves on Clearwater Lake may have been an independent band. The population of wolves which preys on the wintering herd of moose may be as high as a dozen.

Rabbits, deer, and caribou are probably taken by park wolves but moose, especially calves, appear to be their chief winter food. As stated previously, hunters seem unable to crop the annual increment of moose so predator control is unwarranted at present.

While the small number of wolves on the winter range probably kill only a small percentage of the moose herd annually, their indirect effects may be much greater. The flats of the Murtle River, with abundant food supplies, could remain under-populated during the winter because of wolf harassment. Snow depths here are not sufficient to prevent moose from finding sufficient forage in normal winters. The snow depth is great enough to make moose easily captured by wolves and, possibly for this reason, large food supplies are not utilized. This, however, is largely speculation and predator control on the basis of such speculation is unjustified, except experimentally.

FUR BEARERS

Fur prices remained low in the past year so little information was obtained through trappers operating in the park. With the exception of beaver and mink, prices are so low that trappers can rarely afford to take a harvest from their lines.

General impressions of abundance of fur animals has been recorded from sign observed through the winter. However, the best source of data comes from tracks of fur bearers recorded on the spring moose track counting line (Graph II). While many factors influence the number of tracks

beside actual animal numbers, it is hoped that yearly track records will reflect the most important changes in fur bearer members. Tracking conditions, chiefly presence or absence of crust, influence the counts of small mammals to a much greater extent than track counts of the large ungulates.

As the trail passes through lowland burn for most of its length, there have been no marten tracks recorded. Tracks of coyote are not shown on this graph, for in many instances in both years they have been recorded only as "several", "many", or "few". Weasel, squirrel, and rabbit tracks have been too numerous to record.

GRAPH II: TRACKS OF FUR BEARERS AND PREDATORS ON TRAIL 'B' OF TRACK COUNT LINE, 1953 & 1954

MARTEN

There has been an apparent decrease in marten in the past year. Mr. Miller had less success in live trapping this year than during the fall of 1952. Fewer tracks were seen at the edges of low altitude timbered regions, but there is no data available for marten range at the west end of Murtle Lake to compare with last year.

Early fall live trapping for marten on the shores of Murtle Lake was unsuccessful. Mr. Miller believes that many marten stay above or near timberline in the last summer until forced down by snows in the fall.

A live marten was captured by Mrs. Bob Miller, to be used in an anatomy study at U.B.C. When it was learned that this marten was not needed, it was tagged and released at Hemp Creek on October 25th. It was seen near buildings at Hemp Creek on several occasions in the next few days. When the first snowfall came on November 19th, a careful watch was maintained for its track but none was seen. It was later learned that this marten, a juvenile female, was captured and killed at the homestead of J.C. Norman on November 28th or 29th. This represents a distance travelled of approximately 6 miles. Tags #10 and #11, placed in the ears on release, were still in place when the marten was captured.

FISHER

The writer had the impression that this species suffered a decrease in the past year. Both Mr. Miller and Mr. Norman report a decrease in their notes. However, more fisher tracks were recorded on the track counting line than in the past year (Graph II). A possible explanation is that there was a concentration of fisher near the line due to a horse bait and a dead moose being nearby.

WOLVERINE

Two or more wolverine appeared in the lowlands this winter and their tracks were seen around Hemp Creek in several places where they were absent during the previous winter. On two occasions, wolverine tracks were seen right at the ranger residence. Twenty-eight wolverine crossings were recorded on the Hemp Creek - MacLeod Hill - Murtle River track counting line, where only three were recorded in the previous season. A total of six wolverine sightings were

recorded: two by Roy Helset above Stillwater, one by J.C. Norman at the pine flats west of Majerus cabin, one by R.G. Miller and the writer on the Murtle River, and one by the writer on the road in the timber north of Hemp Creek.

Moose carrion remaining from the fall hunt undoubtedly is attracting some wolverine to areas where they were not previously abundant. The absence of trapping activity may also account for the increase of wolverine near the more settled parts of the valley. However, it seems likely that there is a general increase over the southern part of the park.

OTTER

Otter sign was gain found to be well-distributed along water courses in the southern part of the park. Sign was found at Deer Creek meadows in March. An otter had dragged a muskrat or a small beaver between two open holes in a beaver pond on Deer Creek. In this region, otter must live on amphibians and aquatic mammals, for no fish are found in the creek at this point.

LYNX

A definite decrease is apparent in the lynx population what was probably at a high in the winter of 1952 - 53. Four lynx were taken in traps near the southern boundaries of the park though trappers did not venture far afield this winter. Fewer lynx tracks were recorded on track counting lines. The decline is undoubtedly due to rabbit scarcity.

BOBCAT

Never abundant within the park, the animal seems to have decreased in the past year.

BEAVER

Beaver have continued to increase, and each year they are seen in territories not formerly occupied. It is difficult to determine whether the beaver are reaching a level of over-population or whether they are still pioneering suitable habitat not previously occupied. Beaver populations on all lines in the southern part of the park were over-trapped during the period of high fur prices, and recovery may be still in progress.

RABBIT

Fewer rabbits were seen during the past winter than in the year previous. Although no precise data is available, it seems that in many areas there are now only half as many rabbits. It is to be expected that fisher and lynx will be affected by the decrease in rabbit numbers.

RECOMMENDATIONS

It is recommended that:

1. Continued efforts be made to increase the moose harvest by increasing hunter access and by continuing existing liberal hunting regulations.
2. Spring track counts be made more accurate and efficient by improving the track counting trail so that tracks on bare ground may be recorded, and constructing a cabin at the east end of the trail.
3. Aerial moose counts be made only when conditions offer good changes for accurate counts.
4. Winter live trapping and tagging of moose be carried out on a more intensive basis. This would include the construction of additional traps and wing fences.

5. Caribou studies be intensified with collection of some specimens for stomach samples and for taxonomic purposes.