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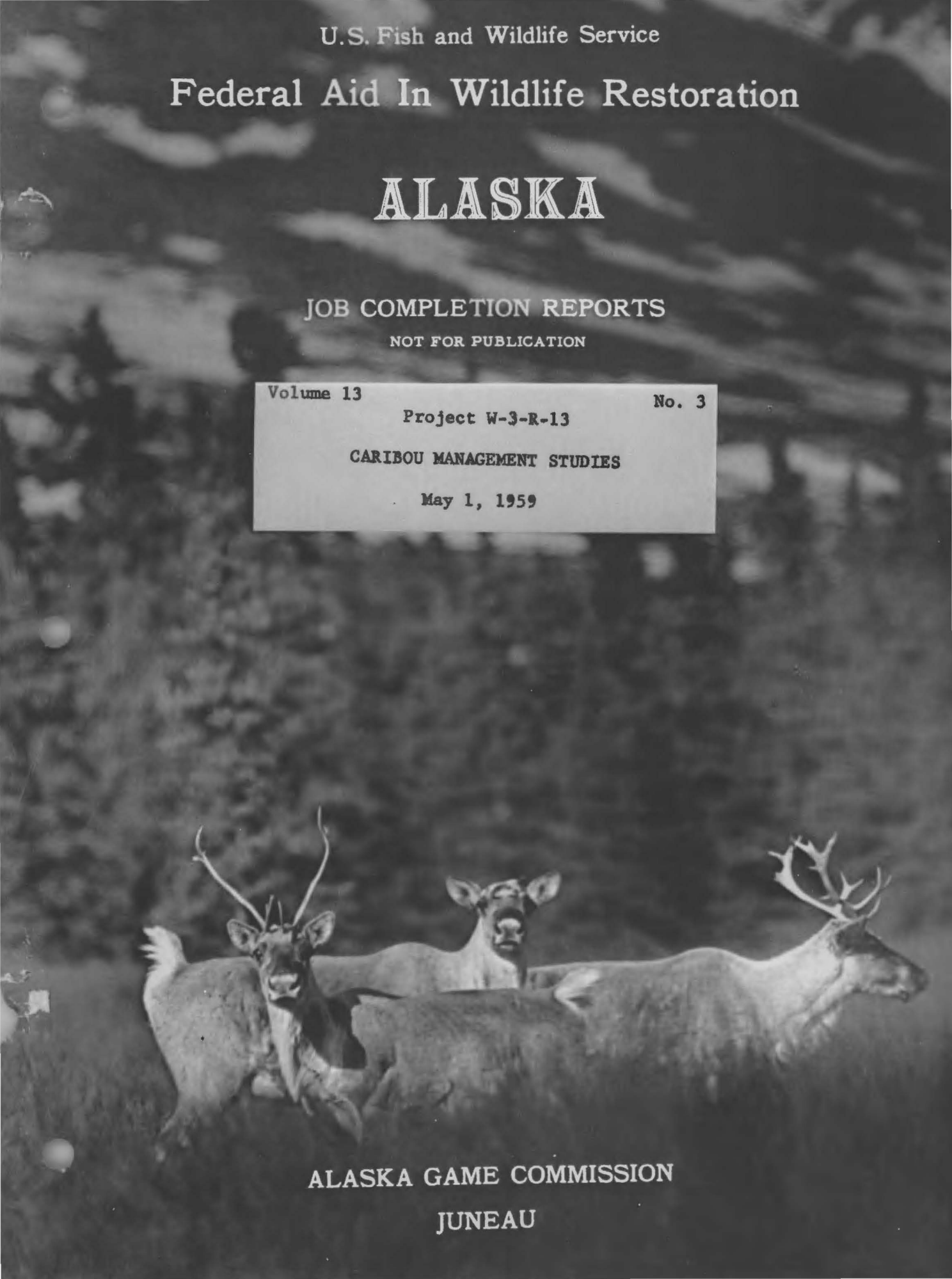
CARIBOU MANAGEMENT STUDIES

May 1, 1959



ALASKA GAME COMMISSION

JUNEAU

Volume 13 Number 2

JOB COMPLETION REPORTS

Project W-3-R-13 Alaska May 1, 1959

Wildlife Investigations

Work Plan B

CARIBOU MANAGEMENT STUDIES

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C O N T E N T S

SUMMARY

Job No. 1(a)--Movements, Distribution, and Numbers--Nelchina Herd

Movements by the Nelchina caribou during the past year continued to reflect the western shift in range-use evident in recent years. The once favored wintering grounds on the Lake Louise Flat again received little winter use. The largest segment of the herd summered in the area between the Little Nelchina River and the head of Coal Creek, with the major shift in late summer and fall to the Deadman-Nadiwen Lakes region. During the winter over 15,000 animals utilized the Talkeetna River basin, with several thousand of these extending onto the west slopes of the Talkeetna Mountains, as far south as the Kashwitna River, for the first time in the recorded history of the herd. Another group of 10,000 or so spent the winter in the region encompassing the Chickaloon River, lower Caribou Creek, Sheep Mountain, and Eureka, the first such concentration recorded. In mid-winter a group of several thousand moved westward to the hills northeast of Cantwell, and small bands extended north to Yanert Fork. In February some 5,000 animals from the Talkeetna River group moved into the Nadiwen Lake area. The herd definitely seems to be extending its range into previously seldom-used areas.

A review was made of all past observations presently recorded in the Anchorage files regarding caribou on the Nelchina Range. These observations permitted an evaluation of past movements of the herd and the determination of the main summering and wintering grounds and main routes of travel used in the past. The principal summering grounds have been, and remain, the area lying between the Little Nelchina River and upper Coal Creek. The principal wintering grounds have been the Lake Louise Flat, with a noticeable shift to the westward in the past five years.

Various data, estimates, and assumptions were used to reconstruct past populations of the Nelchina herd during the period 1945-1959, based upon the 1955 population estimate of 40,000 derived from an intensive census. The results disclose an average annual herd increment of 9 percent, from an estimated 16,000 animals in April, 1945, to about 51,000 in April, 1959.

A current census was not feasible due to the herd's distribution, but an estimate of total size was made by utilizing productivity and mortality data. At present the herd probably contains at least 50,000 caribou.

Job No. 1(b)--Movements, Distribution, and Numbers--Fortymile Herd

Herd movements and distribution were essentially similar to 1957-1958. The calving segment of the herd migrated out of Canada in late April and by May 20 calving was in progress in the White Mountains and the north end of the Tanana Hills. Eleven thousand adults and 6300 calves migrated across Eagle Summit in June enroute to summer ranges between the Steese and Taylor Highways. The herd remained stationary and widely disbursed during the summer months and early fall. A major migration occurred during

the last three weeks of October which resulted in a mass movement across the Taylor Highway into Canada. It is presumed but not definitely known that most of the caribou wintered somewhere south of Dawson City and east of the Yukon River. Approximately 3000 caribou remained in Alaska and wintered primarily between Birch Creek and Beaver Creek.

In April caribou began crossing the Yukon River from the east south of Dawson principally in the vicinity of the Sixtymile River presumably the vanguard of the spring calving migration.

Job No. 1(c)—Movements, Distribution, and Numbers—Arctic Caribou and Other Herds.

Observations concerning distribution, movements, and population estimates of Alaska Arctic caribou are presented for the period January 31, 1958. The designation of the three major areas discussed were changed to Western Arctic Alaska, Central Arctic Alaska, and Eastern Arctic Alaska.

1. During the winter and spring months, caribou were widely disbursed throughout the Western Arctic Alaska with no significant concentration or movements detected. In early June, a calving concentration numbering approximately 100,000 cows plus calves was located at the headwater drainage of Utukok, Colville, and Kokolik Rivers. This concentration broke up in July, moving south into the Noatak and northeast along the coast. Except for an estimated 50,000 animals in the upper Noatak Valley, most of the caribou in this area were again spread out into small widely disbursed groups by fall and early winter.

2. Most of the Arctic caribou were located in Central Alaska during the winter and early spring months. By the middle of June, most of the caribou had taken part in a large migration to the west wherein most of the cows moved into the western Arctic area to calve. The bulls, yearlings, and cows without calves lagged well behind the cows. During the summer months many of these caribou drifted north across the flats towards the Arctic coast. Fall found the caribou widely scattered almost everywhere from the coast throughout the mountains with few concentrations being noted anywhere except south of Barrow and at the head of the Ivashak and Savanirktok Rivers. About 50,000 caribou moved out of the upper Noatak area in November spreading eastward into the Alatna-Anaktuvuk Pass area.

3. Relatively few caribou were observed in eastern Arctic areas during the winter and spring months. A large calving concentration located in early June between Barter Island and Peters Lake was followed by an estimated 10,000 bulls in July. These may have been part of the Canadian Porcupine herd. The Porcupine herd migrated southwest out of the Richardson Mountains across the Porcupine River in late August and September. By late October, except for signs of one relatively large group of caribou on the Firth River, few caribou were seen east of the Coleen River. Residents of Hershel Island reported caribou abundant in that vicinity during December.

4. The total minimum caribou population for Arctic Alaska is estimated 230,000 based on a combination of actual counts and field estimates obtained during the past year.

5. The status of the Delta River or Minchumina herds remained the same as in 1957.

Job No. 2(a)--Analysis of Productivity--Nelchina Herd.

The productivity of the Nelchina herd continued at a relatively high level. The limited breeding and fertility data gathered indicated that most adult cows bred successfully during the fall of 1957. This assumption was substantiated by the high calf crop the following May.

Calving progressed similarly to past years, and again the peak was thought to occur about May 26. A count near the close of the calving period revealed that the calf crop approximated that of the previous year. It was estimated that about 60 percent of all cows older than yearlings had calves at the end of June. The calf increment on July 1, 1959, was estimated at 13,400 animals.

Calf survival during the 1958-59 period was good, with about 70 percent of the calves surviving to the yearling stage. About 25 percent of the calves died during the July-November period, and 7 percent November-April. The high survival is attributed to the low wolf population, low hunter calf-kill, and mild winter. The increment of yearlings to the herd was estimated at 9,400.

The annual herd increment was estimated at 4,000 animals.

Job No. 2(b)--Analysis of Productivity--Steese-Fortymile Herd

Productivity and survival studies during 1958 and 1959 provided the following information:

1. Calving took place in both the Tanana Hills south of the Steese Highway and the White Mountains northwest of the highway. The largest calving concentration was located in the White Mountains.

2. Antlered cows comprised 77% of the cows enroute to the calving grounds and established a pre-calving estimate of the initial calf crop.

3. The initial calf:cow ratio immediately after calving was over on, June 1, was 74:100. By the time the herd had crossed Eagle Summit two weeks later, the calf:cow ratio had decreased to 62:100 indicating a light early mortality rate of 19 percent.

4. At Eagle Summit 17,360 caribou (including calves) crossed the highway. Composition counts indicate that 36 percent

were calves, 60 percent were cows, 4 percent were yearlings and less than 1 percent were bulls.

5. The survival of calves to the yearling age was better than in previous years, however, considerably below what is usually believed to be normal. Only 33 percent of the calves alive on June 1958 survived to March 1959.

6. The minimum annual increment based on the number of "short yearlings" added to the herd is 2100 individuals. This level is not sufficiently great to provide adequate insurance that the herd can maintain itself in the face of the cumulative effects of natural mortality over a year's time.

Job No. 3(a)-- Herd Composition Surveys--Nelchina Herd.

The limited field work during the past year provided no new information regarding the sex and age composition of the Nelchina Herd. Three aerial counts were made, primarily to trace calf survival. No significant variations were noticed from counts in previous years. It was observed, however, that calves had begun to separate from the cows as early as March 28, the earliest previous data recorded being April 16. The herd composition as of May 1, 1959, is assumed to correspond with last year's estimate: 19 percent yearlings, 46 percent cows, and 35 percent bulls.

Job No. 3(b)--Herd Composition Surveys--Steese Fortymile Herd.

Sex and age ratios obtained during the year were used to measure productivity and calf survival. No data were obtained which would provide an index to the population structure of the herd as a whole.

Job No. 4--Analysis of Nelchina Caribou Range.

The Nelchina Caribou Range was divided into fifteen units on the basis of vegetation types, drainage, topography, and caribou usage. These enclose an area of about 18,000 square miles. A general description of each is presented.

Several sites within eight of these units were checked during the summer and transects were run to determine lichen distribution and condition and to measure caribou utilization. Lichen cover and height were recorded in square-meter quadrats by species and group, the lichens being grouped according to their form and/or their palatability to caribou. Five stages of lichen succession were formulated to designate the relative condition of the lichens at various locations.

Enough data were available to evaluate, in general, six of the units, namely Units 2) Monahan Flat, 5) Deadman Lake, 6) Tangle Lakes, 9) Alphabet Hills, 12) Kosina Creek-Oshetna River, and 13) Lake Louise Flat. In regard to lichen growth, Units 2 and 6 seem to be progressing toward the climax stage; Units 5, 9, and 13 seem to be regressing under heavy caribou use; Unit 12 is poor in lichen growth and continued heavy use by caribou will prevent any advancement of the lichen cover. All these units, except Unit 12, contain large quantities of lichen forage.

Job No. 5--Winter Range Utilization--Nelchina Herd.

No work was accomplished on this job.

JOB NO. 1(a)--Movements, Distribution, and Numbers--Nelchina Herd

PERIOD COVERED: April 1, 1958, to March 31, 1959
(Plus a resumé of past years.)

ABSTRACT

Movements by the Nelchina caribou during the past year continued to reflect the western shift in range-use evident in recent years. The once favored wintering grounds on the Lake Louise Flat again received little winter use. The largest segment of the herd summered in the area between the Little Nelchina River and the head of Coal Creek, with the major shift in late summer and fall to the Deadman-Nadiwen Lakes region. During the winter over 15,000 animals utilized the Talkeetna River basin, with several thousand of these extending onto the west slopes of the Talkeetna Mountains, as far south as the Kashwitna River, for the first time in the recorded history of the herd. Another group of 10,000 or so spent the winter in the region encompassing the Chickaloon River, lower Caribou Creek, Sheep Mountain, and Eureka, the first such concentration recorded. In mid-winter a group of several thousand moved westward to the hills northeast of Cantwell, and small bands extended north to Yanert Fork. In February some 5,000 animals from the Talkeetna River group moved into the Nadiwen Lake area. The herd definitely seems to be extending its range into previously seldom-used areas.

A review was made of all past observations presently recorded in the Anchorage files regarding caribou on the Nelchina Range. These observations permitted an evaluation of past movements of the herd and the determination of the main summering and wintering grounds and main routes of travel used in the past. The principal summering grounds have been, and remain, the area lying between the Little Nelchina River and upper Coal Creek. The principal wintering grounds have been the Lake Louise Flat, with a noticeable shift to the westward in the past five years.

Various data, estimates, and assumptions were used to reconstruct past populations of the Nelchina herd during the period 1945-1959, based upon the 1955 population estimate of 40,000 derived from an intensive census. The results disclose

an average annual herd increment of 9 percent, from an estimated 16,000 animals in April, 1945, to about 51,000 in April, 1959.

A current census was not feasible due to the herd's distribution, but an estimate of total size was made by utilizing productivity and mortality data. At present the herd probably contains at least 50,000 caribou.

OBJECTIVES

To record the seasonal distribution and patterns of movements of the Nelchina caribou herd, and to obtain as accurate an estimate of total numbers as possible.

TECHNIQUES USED

Periodic aerial surveys traced the movements and distribution of the herd throughout the year, the resulting data being supplemented by information gained from local observers and co-operating FWS personnel. A thorough perusal of the available records was made in order to piece together a picture of past movements for this herd.

An intensive aerial census was planned tentatively again this year for late winter to obtain an estimate for total numbers. Past records and data from censuses and counts were assembled to trace the population fluctuations through recent times.

FINDINGS

Movements and Distribution

Movements of the Nelchina herd seem to revolve more or less around the calving grounds. Each spring for the past 10 years or more the animals have returned from the wintering areas to calve in a region of some 1,000 square miles which extends from Kosina Creek southeastward to the Little Nelchina River. This region also has constituted to great extent the main summer grazing area. From there the animals have moved in all directions to their wintering grounds, which in recent years have become quite varied.

Recent: March, 1958, to March, 1959.

During 1958 the Nelchina caribou continued the western shift in range-use noted in recent years. Their major movements encompassed several areas seldom used in the recorded past, while other areas frequented previously, notably the Lake Louise Flat, remained comparatively unused. The winter of 1957-58 had marked the first time that a major portion of the herd had invaded the basin of the upper Talkeetna River. Other western concentrations occurred in the Deadman Lake area and on Monahan Flat. Probably three-fourths of the herd spent that winter in the western half of the range. In March, 1958, the following estimated caribou concentrations were noted: Talkeetna River-Fog Creek--20,000; Deadman Lake--1,000; Monahan Flat--2,000; upper Caribou Creek--1,000; and West Fork of the Gulkana River--1,000. Figure 1 shows this distribution. The discussion following traces the seasonal movements of these caribou from these concentration points through the year to March, 1959. The movements and distributions described refer mainly to those involving a large portion of the herd. Stragglers and stray bands, of course, commonly occur throughout the range almost any time of the year.

Spring (April-May). The spring movement of calving groups essentially began in early April. The first movements of note took place in the Talkeetna River and Caribou Creek areas, animals from the former drifting eastward toward Kosina Creek and those from the latter area, northward and eastward into the drainages of Tyone Creek and the Little Oshetna and Little Nelchina Rivers. In late April calving groups from the Monahan Flat area moved southward onto the Watana Creek drainage, where many remained through early May. During the same period animals from the West Fork area were moving westward.

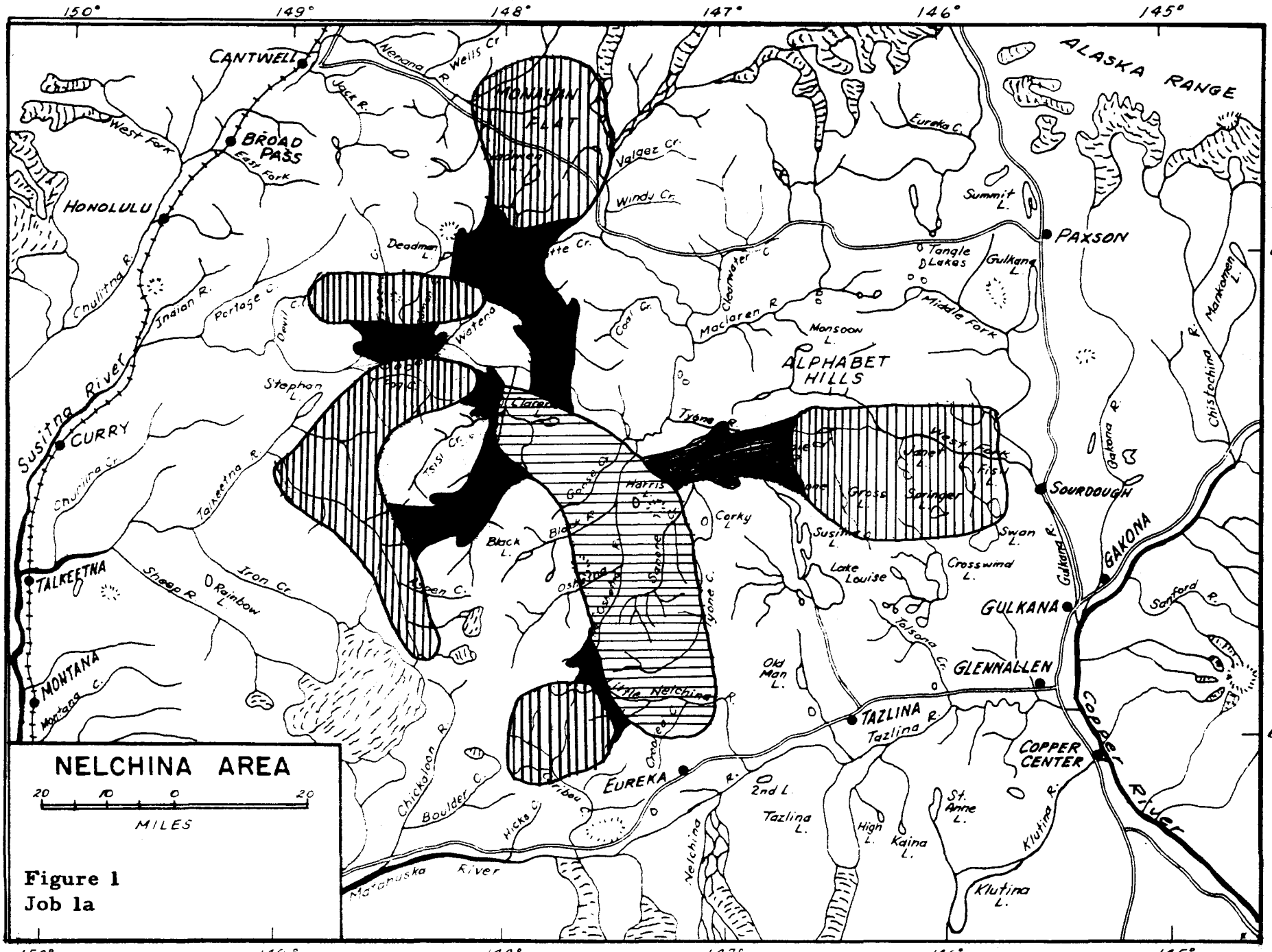
By the second week of May the major portion of the calving segment of the herd had entered the main calving grounds, which extend approximately from Kosina Creek southeastward to the upper Little Nelchina River. Within this area the major movements at first were to the south and southeast, but then to the northwest in mid-May, with many of the cows ultimately concentrating on the flat, rolling terrain just south of Clarence Lake. Figure 1 shows these movements and concentration points.

FIGURE 1. Main distribution and movements of the Nelchina caribou herd--March to May, 1958.

Wintering grounds: March

Movements: April-May

Calving grounds: Late May



NELCHINA AREA

20 10 0 20

MILES

Figure 1
Job 1a

Noticeably absent from this year's observations of the spring movement were the many, long, moving files of cows so characteristic of the pre-calving movements recorded in previous years. Another noticeable difference was the wide dispersal of animals, both within and without the main calving grounds. Non-calving groups occurred in every portion of the range, while limited calving activity extended to the treeless hills west of Prairie Creek, the snowfree slopes of Flat and Crooked Creeks, the spruce-covered flat just west of Tyone River, and the rolling hills of upper Butte Creek.

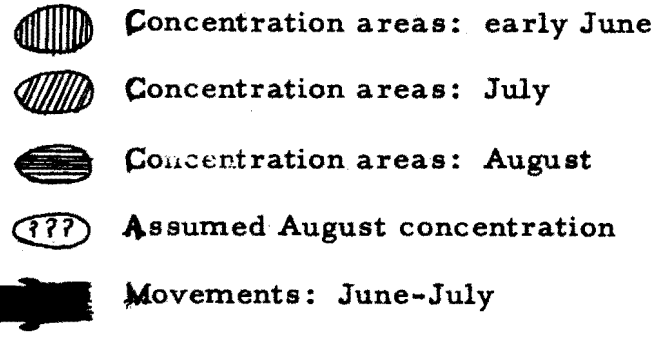
The various movements of the main calving segment continued throughout May, but during the latter half of the month developed into a general southeast drift. By the first of June some 10,000 adults plus calves were concentrated at the upper ends of the Oshetna, Little Oshetna, and Little Nelchina Rivers, as shown in Figure 2.

Summer (June-August). Many of the animals in the last mentioned concentration area in early June reversed their movements and by June 27 over 10,000 had reached the Clarence Lake area. Many animals, however, mostly bulls, remained to the south and spent the summer in the Caribou Creek drainage and adjacent areas. Scattered groups remained in the Alphabet Hills, the Deadman-Nadiwen Lake Area, and in the Talkeetna River drainage system.

During July animals from the Clarence Lake region moved northward across the Susitna River near Jay Creek, and by July 26 an estimated 10,000 were spread out over the rolling terrain at the heads of Jay and Coal Creeks. Another concentration of about 2,000 lay between Deadman and Nadiwen Lakes, and about 2,000 remained near Clarence Lake.

These concentrations remained essentially the same throughout August, except for a greater dispersal of the animals. Several hundreds moved into the lower Maclaren River area and the west end of Alphabet Hills. In addition, various scattered bands in the west had moved into the basin of the upper Talkeetna River. Estimates indicated that there were about 10,000 caribou in that area; 15,000 in the Deadman Lake-Nadiwen Lake-Coal Creek region; 2,000 near Clarence Lake; and scattered groups totaling several thousand in the Caribou Creek drainage. Figure 2 illustrates the main movements and distributions of Nelchina caribou during the summer.

FIGURE 2. Main distribution and movements of the Nelchina caribou herd--June to August, 1958.



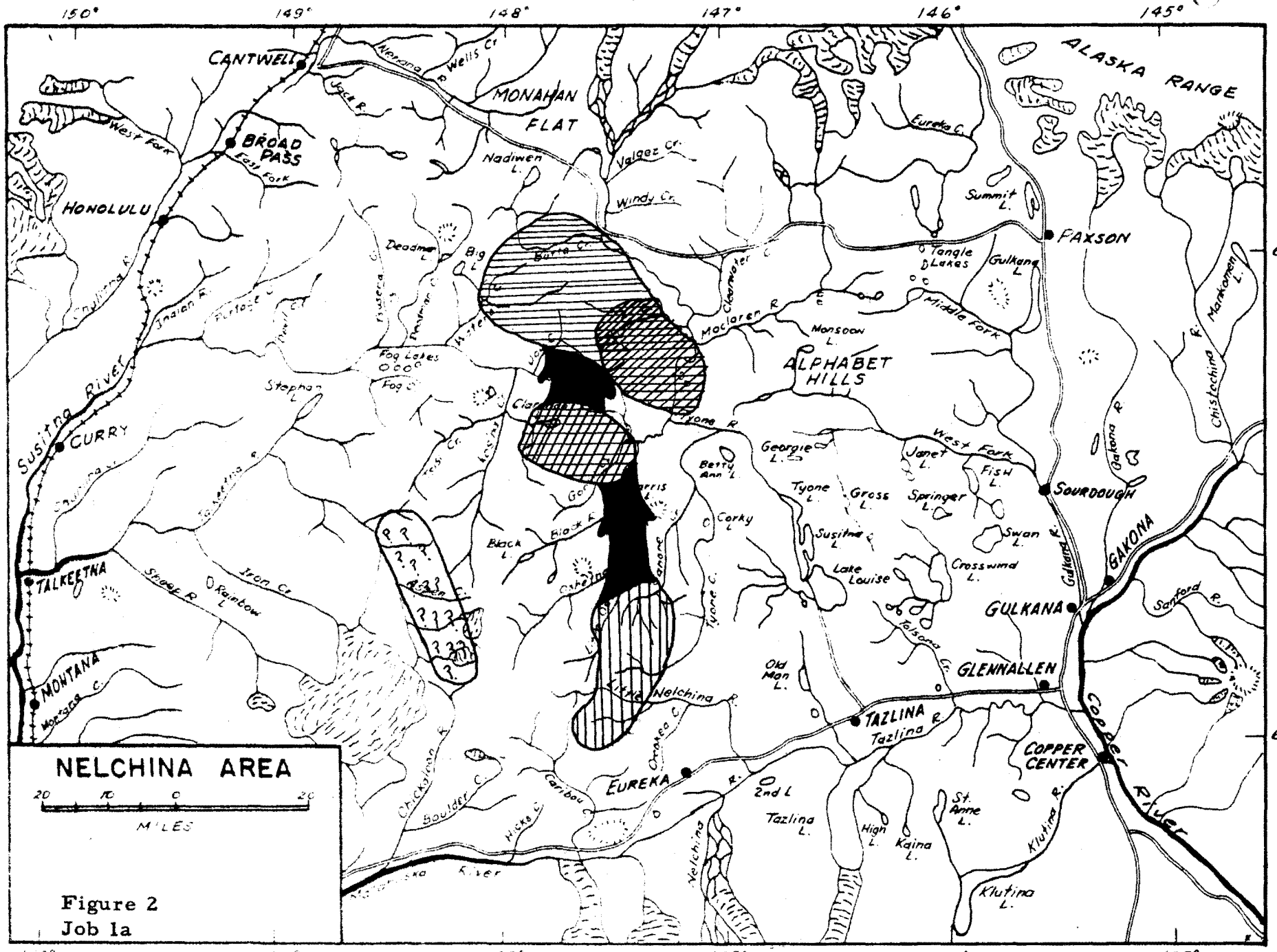


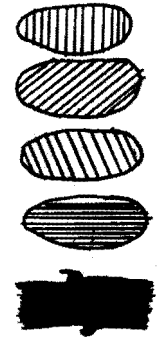
Figure 2
Job 1a

Fall (September-October). Major shifts in concentrations occurred during the fall throughout the range. During September several thousand animals left the Talkeetna River area moving northeastward south of Clarence Lake toward the mouth of Goose Creek, with others moving eastward along the foothills south of Fog Lakes. Over 5,000 remained along the upper Talkeetna. Animals scattered over the Caribou Creek and upper Oshetna River drainage moved southward and eastward, and by October 1 had concentrated in the area just north of Eureka; within a few days, however, they began a general movement to the north. This latter movement proceeded along Sanona and Tyone Creeks, joining, north of the lower Tyone River, caribou from the Talkeetna, upper Coal Creek, and lower Maclaren River areas. The animals then swung eastward down the West Fork of the Gulkana River and then southward, with bands extending to the Richardson Highway. By October 21 several thousands had spread-out over the east-central portion of the Lake Louise Flat, near Crosswind and Ewan Lakes. In late October about 10,000 of these moved westward into the Eureka area. Meanwhile bands from the Deadman Lake region had moved southwestward past the Fog Lakes into the Talkeetna River basin.

By the end of October the following estimated concentrations occurred: 10,000 in the Hicks Creek-Sheep Mt. area; 15,000 in the Talkeetna River basin, most of them above Aspen Creek; and scattered bands totaling several thousand in the Deadman Lake region and the Lake Louise Flat. Figure 3 depicts the fall movements and distribution.

Winter (November-March). During late October and early November animals in the Talkeetna River area were pushing westward and southward. By mid-month they extended to timberline along the west slopes of the Talkeetna Mountains, mostly along upper Montana Creek but also as far south as the upper Kashwitna River. There were over 5,000 caribou west of Rainbow Lake--the first such occurrence presently on record. At the same time about 10,000 had moved southward to the head of the Talkeetna River, above the mouth of Yellowjacket Creek. Meanwhile, caribou remaining on the Lake Louise Flat in November tended to concentrate in the area lying between Tyone Creek and the Lake Louise water system, although scattered bands remained throughout the Flat. That portion of the herd in the Hicks Creek-Sheep Mt. area remained stationary except for local movements back and forth.

FIGURE 3. Main distribution and movements of the Nelchina caribou herd--September to October, 1958.



Concentration areas: mid-September

Concentration areas: late September

Concentration areas: mid-October

Concentration areas: late October

Movements: September-October

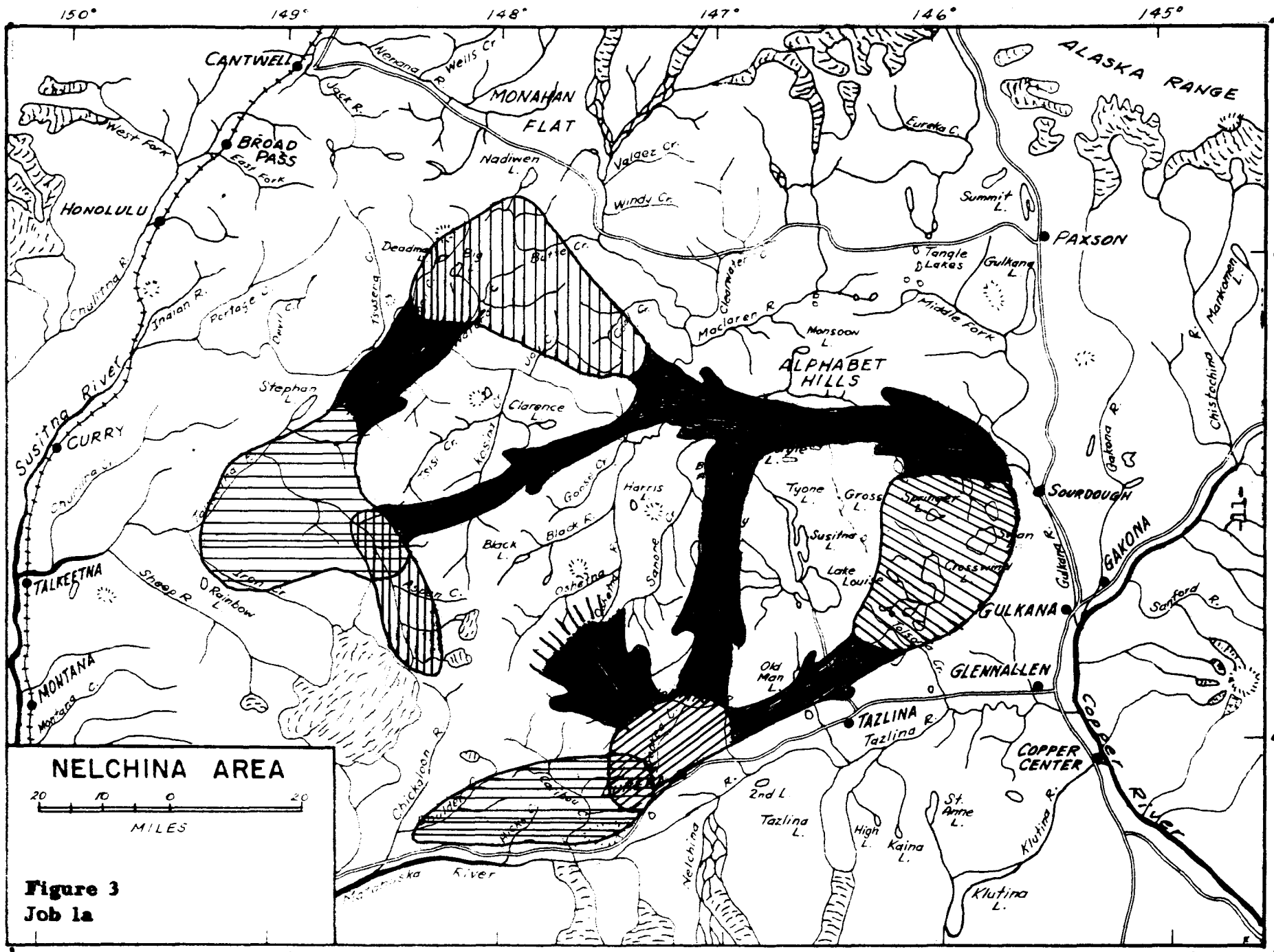


Figure 3
Job 1a

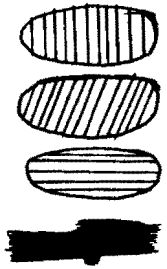
These concentrations changed but slightly during December. The western portion of the Talkeetna River group started to move northeastward into the basin of the upper Talkeetna late in the month; scattered bands in the Deadman Lake and adjacent areas moved onto Monahan Flat; and the Lake Louise group spread out over most of the Flat.

January witnessed a continued dispersal of the animals. Late in the month the main estimated concentrations were as follows: 15,000 were spread over the entire drainage of the upper Talkeetna River; 3,000 of those on Monahan Flat had moved westward into the hills northeast of Cantwell, with some bands extending onto Yanert Fork to the north, close to the north slopes of the Alaska Range; 4,000 of those in the Hicks Creek-Sheep Mt. area extended up the Chickaloon River, from Boulder Creek to the head, and others were moving eastward toward the Little Nelchina River; and several thousand remained scattered over the Lake Louise Flat. The Chickaloon River movement also represented a first for our records.

These groups remained essentially in the same areas through early February, but with a northeastward movement noted near Stephan Lake, a northwestward movement on the lower Tyone River, and a southwestward drift near Old Man Lake. Figure 4 shows a generalized picture of these movements and concentration points during the November-February period.

The region was not checked again until late March, and by then two notable changes had occurred in the caribou distribution. An estimated 5,000 animals had moved into the Deadman-Nadiwen Lake region, presumably from the Talkeetna River because heavy, snowfilled trails extended from that direction at Deadman Lake. Heavy snows early in the month had obliterated most of the old sign. The groups contained mostly cows and calves, but many bulls were present along the southern edge of Monahan Flat. The other new concentration occurred in the Tangle Lakes area, consisting of several thousand animals, mostly cows and calves. At that time (March 26) their movement appeared to be southward, but previous movements could not be ascertained. The present concentration could have resulted from an assembling of scattered groups already in the area, or possibly from a movement from the Lake Louise Flat via the Susitna and Maclaren Rivers.

FIGURE 4. Main distribution and movements of the Nelchina caribou herd--November, 1958, to February, 1959.



Concentration areas: mid-November

Concentration areas: mid-December

Concentration areas: mid-February

Movements: November-February

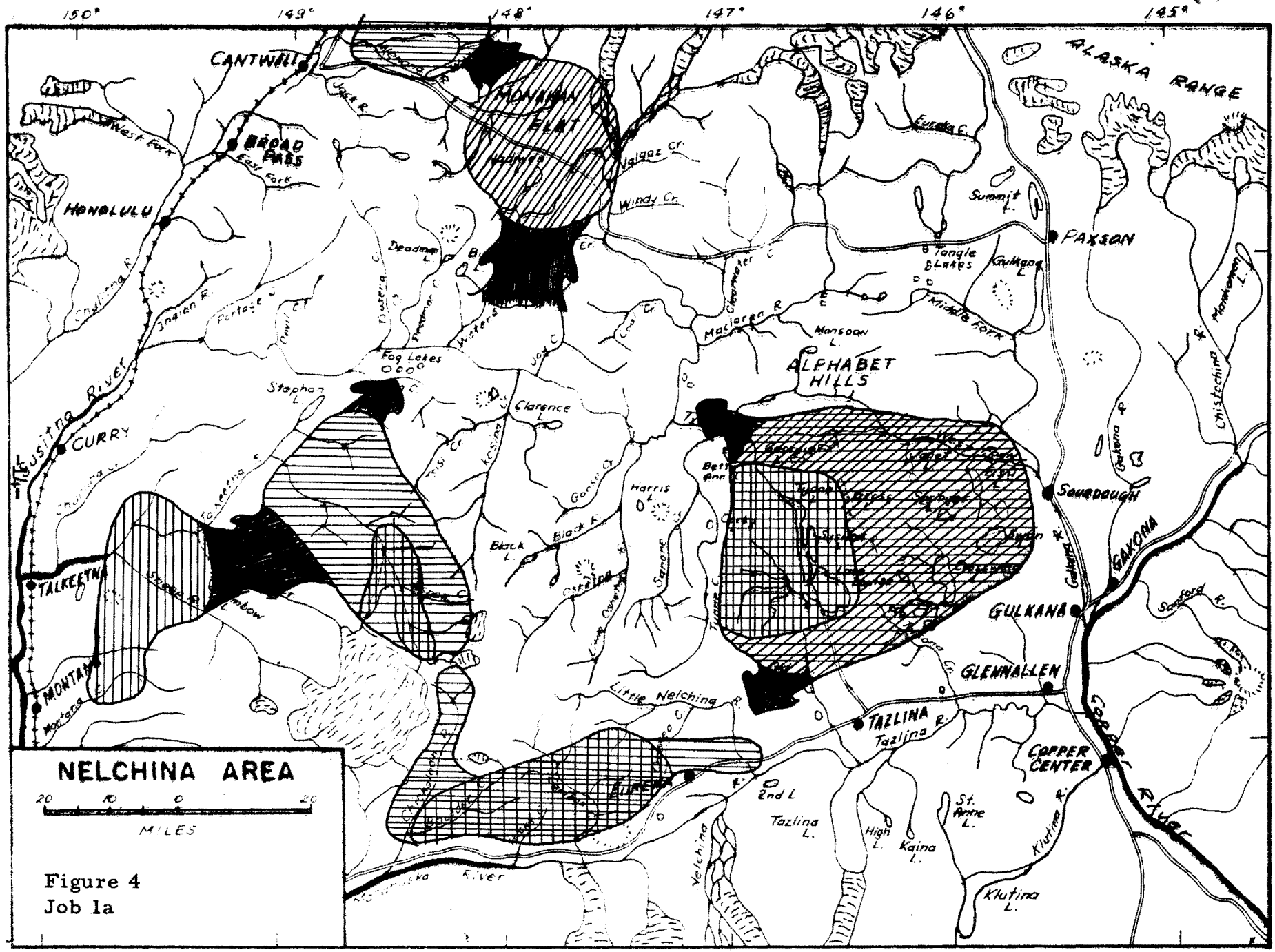


Figure 4
Job 1a

Caribou on the Lake Louise Flat in late March were concentrated along the West Fork of the Gulkana River. Several thousand animals extended from upper West Fork eastward to the Sourdough area, with bands to the east of the Richardson Highway as well. To the northwest, near Cantwell, caribou were still present, but the highly wind-blown conditions there prevented the tracing of movements. One old, heavy trail was sighted briefly at one point on the ice of the Nenana River in Windy Pass, north of Cantwell, but no further sign was discernible. Neither caribou nor tracks were present along Yanert Fork. Extensive sign noted along Dry Creek, just west of Healy, probably involved the McKinley-Minchumina herd, although the Cantwell animals easily could have moved that distance. Lack of information precludes stating definitely whether or not any animals left the Nelchina Range via Broad and Windy Passes.

Thus in late March the estimated caribou concentrations were as follows: Talkeetna River basin--10,000; Chickaloon River--4,000; Caribou Creek-Eureka--10,000; West Fork of Gulkana--2,000; Tangle Lakes--5,000; Deadman-Nadiwen Lakes--5,000; and Cantwell--2,000(?). Figure 5 shows the locations of these concentrations.

Past: 1935-1959. The assemblage and perusal of the available data on movements and distributions of caribou within the Nelchina range revealed definite information regarding the principal summering and wintering grounds and the principal routes of travel used by the animals during the period 1935 to 1959. Table 1 summarizes all these data. The tabulated observations extend back to 1898, but most of those before 1930 reflect movements of portions of two large adjacent herds onto the Nelchina range. Formerly, a large number of caribou from the McKinley-Minchumina herd moved through Broad Pass each fall, spending much of the winter in the northwest quarter of the present Nelchina range, notably the Monahan Flat and upper Susitna River areas. During the same period a large portion of the Steese-Fortymile herd moved southward through Isabel and Mentasta Passes to winter in the eastern half of the present range. Both these movements ceased about 1930. After that date the Nelchina herd is considered to have become an entity, even though caribou(other than those from the two herds mentioned) evidently were present throughout the Talkeetna and Chugach Mountains previous to that time. Little information exists as to how many such caribou there were and whether or not they moved as a herd. The lack of inform ation suggests that their

FIGURE 5. Concentration areas of Nelchina caribou occurring in late March, 1959.

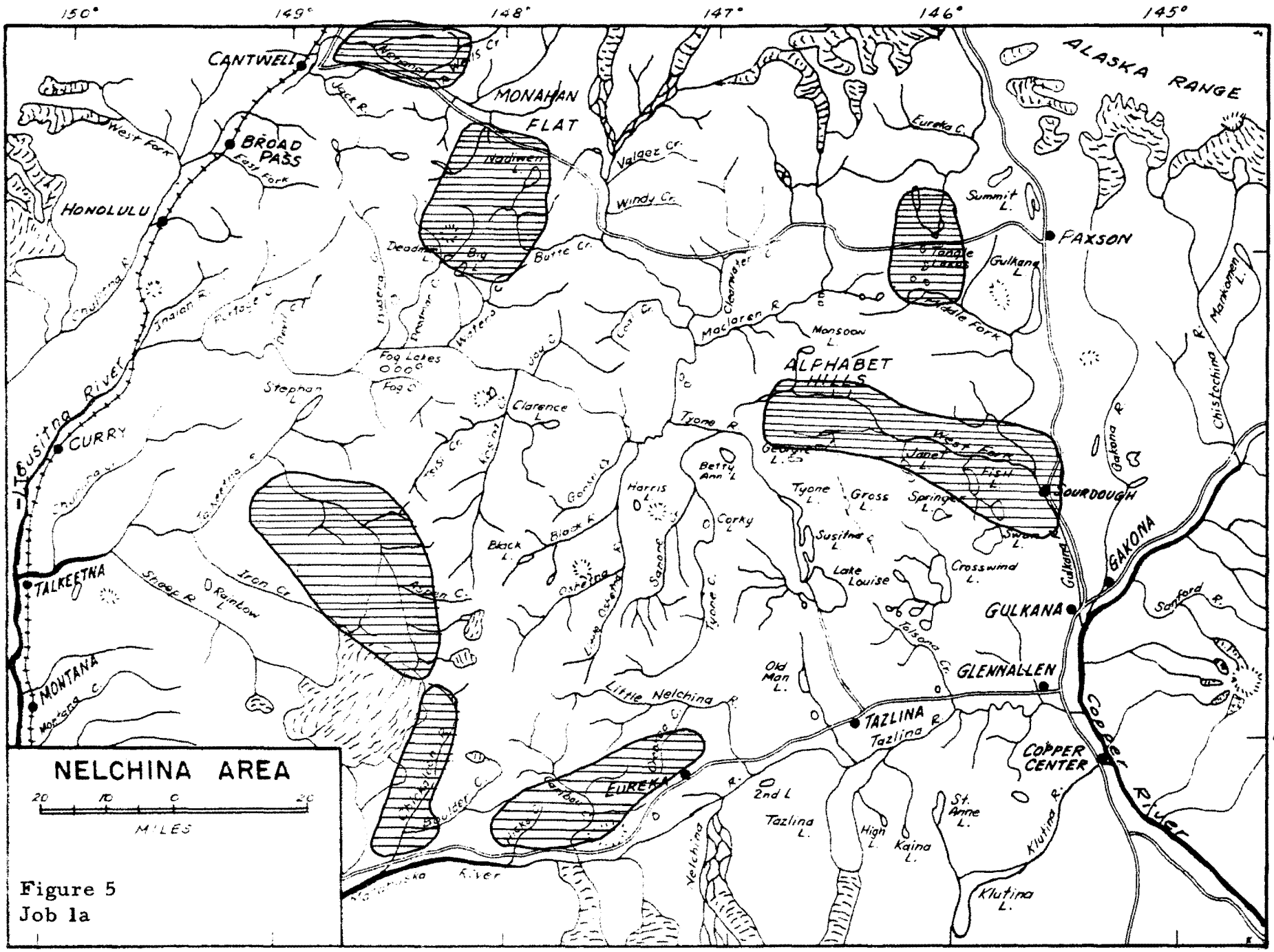


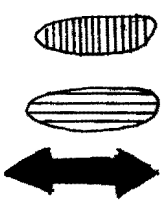
Figure 5
Job 1a

numbers were not great. In the following discussion then the writer has interpreted the data presented in Table 1 as regards the present Nelchina herd, during the past twenty-year period.

Distribution. Certain portions of the range have received extensive winter and summer use during this period. Records before 1945 are too few for a complete picture, but apparently as late as 1938 the Talkeetna Mountains were still the main range of the so-called Nelchina herd, with other(?) caribou still using the Deadman Lake-Monahan Flat and Tangle Lakes-Paxson areas. An Alaska Game Commission Report records a spring movement in 1937 of "lots of caribou" crossing Broad Pass to the summer feeding grounds (presumably McKinley Park), and in March, 1938, of a "good sized band" crossing the Tangle Lakes. Other such reports mention that during the winter of 1937-38 caribou were present around the head of the Nelchina River in "numbers exceeding anything formerly seen", and that (in 1946) the main area of caribou concentration lay between the Alaska Range and the Talkeetna Mountains. Sometime between 1938 and 1945 the Lake Louise Flat came to be the primary wintering grounds, being used extensively during the eleven year period 1945-1955. Late in 1955 began the westward shift in winter use that has continued to the present time, and the upper Talkeetna River and Deadman-Nadiwen Lake areas, and to some extent the Tangle Lakes-Paxson area, have regained their former importance as wintering grounds, the main difference now being the greatly increased size of the herd as compared with the mid-1930's. The Alphabet Hills region has received some winter use in recent years, but the area seems to be mainly one used by transient caribou. Some use also has been made of the area at the heads of the Oshetna, Little Oshetna, and Little Nelchina Rivers, notably during the winter of 1950-51, and last winter, of the Chickaloon River-Caribou Creek-Eureka region. Figure 6 shows the main wintering grounds used during the past twenty years.

The summering grounds have remained essentially the same during the period being discussed. Those of most importance during this season consist of that area lying between lower Kosina Creek and upper Little Nelchina River and that lying at the heads of Coal and Jay Creeks, the former being used mainly May-July and the latter, July-August. Few records of summer use before 1949 exist, but ground evidence supports the assumption that these areas were used extensively previous to that date. The vegetation there consists predominantly of grass, sedge, and willow, with an

FIGURE 6. Main summering and wintering grounds and travel routes used by the Nelchina caribou during the 1935-1959 period.



Summering grounds

Wintering grounds

Main travel routes

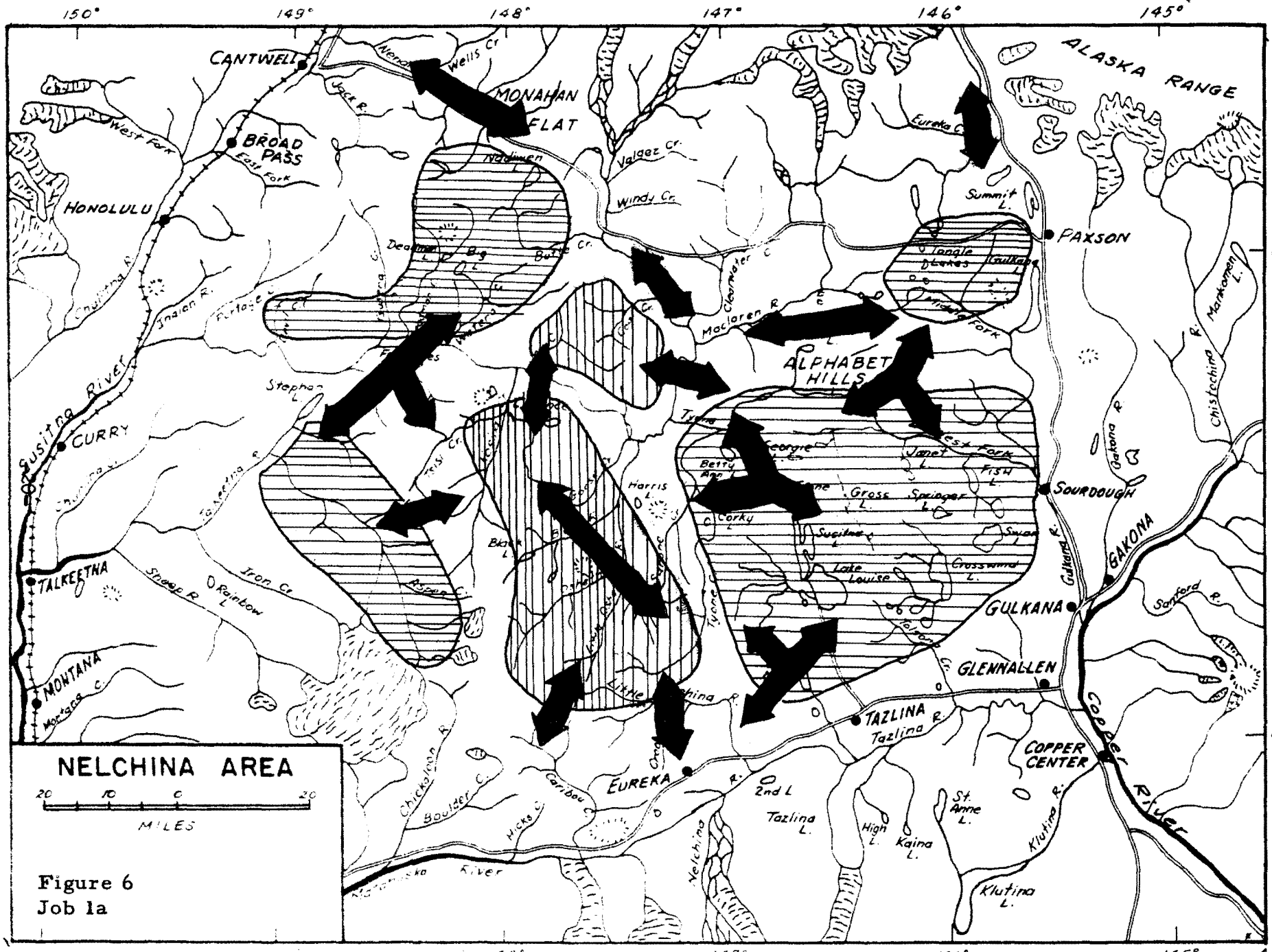


Figure 6
Job 1a

abundance of forbs, all utilized heavily by caribou during the summer. Deep trails occurring throughout both areas suggest a continual, heavy use in the past. Adjacent areas also have supported caribou during the summer, but generally not in large concentrations. The drainage of the upper Matanuska River north of the Glenn Highway long has been a "bull pasture", the animals being scattered thinly over the slopes of Boulder, Hicks, and Caribou Creeks. Other important summering grounds have included the Deadman-Nadiwen Lakes region, the Alphabet Hills, and the uppermost drainages of the Susitna and Maclaren Rivers. Here too, the animals have consisted mostly of bulls. One desirable feature of a summering ground during July, the height of the fly season, is the presence of windswept knolls; thus the high rolling hills at the heads of the Oshetna, Little Oshetna, and Little Nelchina Rivers and the heads of Coal and Jay Creeks are favored localities at that time. Figure 6 shows the location of the two major summering grounds mentioned above.

Movements. Most major movements by caribou take place in the spring and fall, generally in reference to the summering and wintering grounds. During April-May the calving groups assemble and move into the calving area, which for this herd has encompassed that lying between the head of Fog Creek and the upper Little Nelchina River. The main movement generally has proceeded in a SE-NW direction, with most animals entering from the Fog Creek or lower Oshetna River areas, although the location of the wintering animals determines greatly how this movement progresses.

Caribou wintering on the Lake Louise Flat generally drift to the northwest in early spring as the snow-cover regresses and then proceed westward north of Lone Butte across the Oshetna River toward lower Kosina Creek. The snow-covered hills of upper Tyone Creek possibly discourage a more direct westward move from the Flat at this time. The next stage seems to be a strong movement to the southeast in long files into the upper drainage of Tyone Creek. Sometimes this movement reverses, possibly because of lingering snows, and the caribou retrace their paths toward the northwest, although the movement may reverse again, until finally the animals disperse over the area to calve.

Caribou wintering in the upper Talkeetna River basin reach lower Kosina Creek in spring via the tributaries of both streams or via the Fog Lakes and Fog Creek. Those animals in the Deadman Lake region proceed southward across the Susitna River mostly between Deadman and Jay Creeks. Those wintering in the northeast follow various routes to the calving grounds. Most travel westward either across the Maclaren River flats or along the Alphabet Hills and cross the Susitna River between the Maclaren and Tyone Rivers onto the heads of Coal and Jay Creeks, and then swing southward across the Susitna again into the Clarence Lake area. At other times the northeast groups will cross the Alphabet Hills and move southward across the corner of the Lake Louise Flat to the lower Oshetna River, and then move either westward toward Kosina Creek or southward to the upper Oshetna. Regardless of these initial spring movements, most of the calving groups in recent years eventually have entered the SE-NW pattern described above.

Nearing the end of the calving period in early June, the calving groups assemble in large bands of several thousand, and in recent years then have drifted southward or westward to the hills at the heads of the Oshetna, Little Oshetna, and Little Nelchina Rivers and Caribou Creek. By then many bulls have joined the ranks of the cows. This concentration frequently lasts till mid-July or later. Then a strong movement to the north usually occurs with an ultimate concentration near Clarence Lake, often succeeded by a movement across the Susitna River to the heads of Jay and Coal Creeks. Som e animals may continue to the Deadman Lake area, while in the south many bulls are dispersing over the region embracing Boulder, Hicks, and Caribou Creeks. Thus by early August, herd concentrations occur from upper Coal Creek southward to the Little Nelchina River, in varying proportions, with other animals scattered throughout the range.

In the fall and early winter multiple movements take place until the animals finally have settled on the wintering grounds. During September the bulls in all areas drift toward the main herd concentrations for the mating season in late September and early October. By rutting time the bands contain both sexes and all age-classes of animals, usually the only period of the year when such a phenomenon occurs.

Occasionally major movements occur in the fall, but more often the animals simply assemble in one or several areas and then continue to drift in various directions within the region. During the past ten years, the period for which we have the most data, the rut has taken place most frequently (five) in the Clarence Lake and adjacent areas. On two occasions a strong movement in late September has brought the caribou into the Alphabet Hills-Tangle Lakes region for early October. Other areas utilized at this time have included the Deadman Lake, Little Nelchina-Eureka, and Lake Louise areas. Generally then, the herd seems to concentrate within or near some portion of the main summering grounds for the mating season. After the rut, the adult bulls tend to drop out of the bands as they move toward the various wintering grounds.

Those animals wintering on the Lake Louise Flat usually enter that area southeastward from the lower Tyone River, southward from the Alphabet Hills and Tangle Lakes, or eastward from the Little Nelchina River. Those entering the Tangle Lakes-Paxson area usually do so along the Maclaren River flats or the Alphabet Hills. Animals move onto the Deadman-Nadiwen Lake wintering grounds via the Susitna River and Butte Creek or via Jay, Watana, and Deadman Creeks. The upper Talkeetna River basin is reached via Fog Lakes or upper Kosina and Tsisi Creeks.

Generally the animals remain dispersed and somewhat sedentary during the winter, but in recent years some major movements have occurred at this time. During the first half of the past decade most of the herd wintered on the Lake Louise Flat, remaining there pretty much throughout the November-March period. The animals frequently did exhibit a clockwise movement in their feeding pattern that was quite pronounced at times, but usually they stayed within the boundaries of that area. In four of the past five winters, however, the herd has not settled down until late December or January. During the winter of 1954-55 a large portion of the herd first entered the Tangle Lakes area and then swung southward in late December and early January to the Lake Louise Flat. During 1955-56 the herd split from the Alphabet Hills-Tangle Lakes region in January, one portion moving west to the Deadman Lake area, another south to the Flat, and a third portion remained. During 1956-57 a large portion of the herd moved from the Tangle Lakes-Paxson area through Isabel Pass and back in December and early January, and then

most moved westward to the Deadman Lake region; also during December several thousand moved westward from the Deadman Lake area to the hills near Cantwell. During 1957-58 the main herd settled first in the Deadman-Nadiwen Lake region and then moved into the upper Talkeetna River basin during late December and January. In 1958-59 the various winter concentrations, as described earlier, remained relatively stationary during the November-March period.

Whether or not such winter movements occurred in the past also is not known. Such movements in recent years possibly could represent one effect of an increased population--a growing restlessness due to higher population densities. Of note also in recent years is the apparent splitting of the herd into various segments at certain seasons in different portions of the range. Previously the herd seemed to act more as an entity. As the Nelchina herd continues to expand the changes that take place in distribution and movements will be of great interest. Figure 6 shows the main summering and wintering areas and the generalized routes of travel used by Nelchina caribou during the past twenty years.

TABLE 1. MOVEMENTS AND OCCURRENCES OF CARIBOU ON THE NELCHINA RANGE DURING THE PERIOD 1898-1958.

Year	Observation	Source
1898	July 25: Killed several caribou between Chunilna Creek and the Talkeetna River. July: Caribou were numerous along the mountains on trip up Susitna River valley to Broad Pass; caribou sign was numerous in the Pass--it appeared to be the wintering place of game. August: Passing Hicks Creek headed east into the "caribou country", and caribou sign was abundant. August 5: Tazlina Lake, upper. Comment on local natives. "They expected to go to the mountains after caribou and sheep in a few days,..." August 20: Head of Gulkana River. "We passed close to a couple of caribou--a doe and a calf..." August 31: Head of Delta River. Sighted two caribou. "Game signs, including moose, caribou, bear, wolf, and fox were more abundant here than at any place we had passed over, especially around some lakes that we passed a mile back." August 20: Killed a caribou doe at divide between the Chickaloon and Talkeetna Rivers. August: They passed an old caribou fence at the mouth of the Chistochina River. These fences are built by the Indians and shaped somewhat like the letter "V", extending several miles.	Explorations by Capts. Glenn and Abercrombie.
1918 1919 1920	Many caribou at the head of Delta River in and winter of 1918, 1919, and 1920. October: Many caribou reached Paxson; 10,000-12,000 animals passed south through Mentasta Pass.	Olaus Murie, 1935.

TABLE 1. (Continued)

Year	Observation	Source
1920	October: Large portion (300,000) of Steese-Fortymile herd moved into Isabel Pass region, where they remained throughout the winter.	Frank Glaser, letter to Regional Director, Jan. 9, 1950.
1921	Spring: Herd moved northeastward from vicinity of Miller's Roadhouse, just north of Rainbow Mountain. September: Large portion of Steese-Fortymile herd moved up the Delta River from the heads of Shaw Creek and Salcha River. Some continued as far as Copper Center. December: By this date the main herd had left.	
1926	August: Large portion of McKinley Park herd moved from the park into Broad Pass, many continuing eastward across Monahan Flat.	
1927	Many animals spent the winter of 1926-27 in the vicinity of Valdez Creek and the Maclaren River. April: Last time Glaser saw that many animals in one herd, when they returned northwestward that spring. Fall: Large portion of McKinley herd migrated north from the high country west of Savage River, many passing through the town of Nenana. This herd continued north and next spring he talked to miners from the head of the Koyukuk River that said caribou by the thousands had moved in during the winter and continued north in the spring.	
1929	Last year that great numbers of caribou moved past Cantwell. That fall was the last time caribou were present in the area in any numbers until the winter of 1956-57.	Jack West, Cantwell.

TABLE 1. (Continued)

Year	Observation	Source
1930	Run of caribou through Broad Pass in the fall was not quite normal. In the Nelchina country they are plentiful.	Alaska Game Commission.
1931	Both migrations (Broad Pass, Isabel Pass, and Mentasta Pass) stopped about this time. Caribou plentiful at headwaters of the Susitna River and to southeast of Paxson; many seen near Mt. Sanford and Chistochina this spring; have been seen as far south as Copper Center.	
1933	Reindeer herding at Cantwell ended about 1933, after which time they went, or were left to go, wild.	Jack West, Cantwell.
	Herds in the Talkeetna-Nelchina region have dwindled notably. Runs along the Richardson Highway have been somewhat of a failure as compared to former years.	Alaska Game Commission report.
1935	September 1-16: 15 sighted along Prairie Creek. The Nelchina herd, reported last year as having disappeared, is again wintering in the Talkeetna Mountains. (1935-36)	
1937	Spring: Lots of caribou crossing Broad Pass to the summer feeding grounds. It is possible that the caribou herds may become divided and more or less localized in remoter areas, such as is taking place in the Talkeetna-Nelchina region.	
1938	Caribou wintered around head of Nelchina and Talkeetna Mountains this winter (1937-38) in numbers exceeding anything formerly seen. Caribou are extremely scarce in the entire Copper River district. March: A good sized band was reported crossing the Tangle Lakes. Only a few years ago they migrated in great numbers through Isabel Pass and ranged southwestward along the range adjacent to the Nabesna Road and the Copper River.	

TABLE 1. (Continued)

Year	Observation	Source
1943	"Thousands" of caribou seen at the West Fork of the Chulitna River by ARR employee.	Chatelain's diary.
1944	September 1-5: Only five caribou sighted by FWS agent on patrol in Little Nelchina River district.	Alaska Game Commission report.
1945	A herd of about 10,000 is reported to be ranging in the foothills of the Talkeetna Mountains and on the flats to Lake Louise.	
1946	The main area of caribou concentration is between the Alaska Range and the Talkeetna Mountains. The herd is holding its own but has somewhat changed its range from close to the Glenn Highway to the Maclaren River flats.	
1947	The take of caribou has approximated 200 animals for each of the past three years.	
1948	John Luster, resident and guide in Chickaloon, stated that normally about 200-300 male caribou summer in the Boulder-Caribou Creek area, both singly and in small groups, moving eastward to the foothills of the Talkeetnas in late August.	
	Fall Status: Analysis of 464 guide reports concerning the Nelchina area revealed that 18 percent thought the caribou had increased, 43 percent, neither increased nor decreased, and 39 percent, decreased. November 1-6: Kosina-Oshetna drainages--298 sighted; Eureka area--3,352; Lake Louise Flat--169. November 19: Caribou moving NE past Lake Louise; an estimate 4,000 animals on the Flat.	Chatelain's diary.

TABLE 1. (Continued)

Year	Observation	Source
1949	March 3: Sighted about 1,000 caribou between Tyone Creek and Oshetna River. Trails throughout area. Lack of snow in last two months.	
	September 8: Oscar Vogel saw 12 caribou near Stephan Lake. September 15-25: Bernard Blanchard of Anchorage reports seeing caribou near mouth of Black River. September 19-24: Frank Swanda reports a few caribou near the Fog Lakes. September 19-25: Oscar Vogel reports seeing 500-1,000 caribou in Fog-Clarence Lakes area.	Guide reports, Juneau files.
	Fall: Small group of caribou on bare hills just SE of Chulitna	Frank Swanda.
	December 3: 500 caribou on upper Little Nelchina drainage. December 16: 300 caribou scattered between the headwaters of the West Fork of the Gulkana and upper Tyone River; 30 at the junction of the Black and Oshetna Rivers; 80 near Crosswind Lake; and 2,700 moving up the Susitna River, presently within ten miles of Valdez Creek.	Chatelain's diary.
1950	January 12: Flight route extended, zig-zag fashion, eastward from Cantwell across Monahan Flat to Valdez Creek and then southward across Oshetna River drainage to Anchorage, with side excursions into adjacent areas. Only 50 animals, with an estimate of 100 based on tracks, were seen west of the Susitna. The large group seen last month must have moved either east or southeast.	Scott's field notes.

TABLE 1. (Continued)

Year	Observation	Source
	March 2-5: About 3,000 caribou moving south from Tyone River along the Oshetna River bench; 100 in Eureka area; 30 near Old Man Lake; 60 on Lake Louise Flat; and 50 along upper West Fork of the Gulkana River. March 14-30: Herd moved west to Kosina Creek, where it remained that month, moving up and down that creek.	Alaska Game Commission report.
	August 10: Report of caribou on distant ridges above Caribou Creek. One large bull near camp.	Burkholder's field notes.
	August 30-31: On trip from Leila Lake to Harris Lake, sighted 28 caribou, including several females w/calves; sighted 9 caribou, including 3 ♀'s w/calves at Wolf Lake.	Harris' field notes.
	September 16-19: Report of 500 caribou being sighted along the upper Oshetna River.	Harold Curtis.
	December 7: Tallied 986 caribou moving NW from area at head of Little Oshetna River. December 17-21: 24 caribou near Lake Louise; much caribou sign along West Fork of the Gulkana; 45 caribou at Copper Lake. December 28-29: Over 4,000 caribou (one tally: 140 adults, 28 calves) in area encompassing the heads of the Little Oshetna, Little Nelchina, and Tyone Creek moving northward; 500± near Crosswind Lake.	Chatelain's diary.

TABLE 1. (Continued)

Year	Observation	Source
1951	January 14-18: 18 caribou sighted near Tazlina; 400 in small bands sighted on trip from Crooked Creek to Little Nelchina to head of Oshetna River; about 300 between Oshetna River and Clarence Lake; 100 at head of Maclaren River.	Kelly's field notes.
	February 3-4: Sighted 310 caribou at head of Nelchina River; 14 males south of Glenn Highway near Eureka; along the upper Little Nelchina, 747 adults plus 110 calves.	Miner's field notes.
	February 24-March 1: The main group of about 3,000 animals was located on the upper Little Nelchina River, with bands moving north and northeast. March 8-9: No caribou along the upper Talkeetna River; caribou feeding along upper Tyone Creek. March 15: Center of abundance from the mouth of Black River to Tyone River, major movement to the west; no segregation was noted, each band having both sexes and all age classes.	Alaska Game Commission report.
	March 29: Main herd near the Oshetna River, well scattered.	Kelly's field notes.
	August 27: Several caribou sighted near Chickaloon.	Larsen's field notes.
	September 6: Caribou have moved north from Eureka and Crooked Creek. September 9: Scattered bands of caribou east of Clarence Lake, along Jay Creek, and along Maclaren River; none in the Deadman Lake area.	Chatelain's diary.

TABLE 1. (Continued)

Year	Observation	Source
	September 14: About 200 caribou sighted at Clarence Lake.	Frank Swanda.
	September 26-28: Sighted 500 caribou just E of Stephan Lake.	Oscar Vogel.
	September: The herd moved eastward from its summer range in the Talkeetnas, between August 20 and September 5, in three main bands. One group was observed near Eureka on August 23; another was sighted just south of the Susitna River; and the third came eastward north of the Susitna. All groups proceeded to the Lake Louise area where they spread out. December: Caribou still scattered over the Lake Louise Flat.	Alaska Game Commission report.
1952	January 30-February 8: About 3,500 caribou concentrated along the Nelchina River and Fossil Mt. areas; about 3,000 tallied in the Lone Butte-Tyone Creek area; others scattered over the entire range; no movement noted.	
	June 20: Over 4,000 caribou, in groups of 5 to 200, concentrated in the area lying between the head of the Little Nelchina and the lower Black River, with biggest concentration between the Black and the Oshetna, near Twin Hills; these groups contained mostly cows and calves; scattered caribou along the Talkeetna River, 26 sighted (males); 63 tallied in the Deadman-Nadiwen Lakes area; about 100 along Crooked Creek; 20 near Lake Louise, and 16 along the upper West Fork of the Gulkana; and 17 were sighted along the lower Maclaren River.	Chatelain's field notes.

TABLE 1. (Continued)

Year	Observation	Source
	July 10: Groups of 2,000, 1,500, and 1,000 sighted along the Black, upper Oshetna, and upper Little Nelchina Rivers, respectively. July 15-28: The animals remained mostly on the high windswept ridges in compact groups, the main concentrations being in the upper Goose Creek, Black River, and Oshetna River areas. A general movement to the SE was evident. July 31: The following concentrations were noted--about 1,500 along upper Kosina Creek, 3,000 between upper Tyone Creek and the Little Oshetna River, and 500 in the Lone Butte area. August 15: About 2,000 animals between the upper portions of Black and Oshetna Rivers; 200, mostly large males, along the upper Little Nelchina; 65 just south of Clarence Lake and about 1,000 north; and about 400 along Jay Creek. August 27: Few caribou in Crooked Creek area. Late August: Movement continued to north and east. September 1: About 1,000 along upper Little Nelchina; 1,000 in Clarence Lake area; 2,000 north of mouth of Tyone Creek; and 500 along Sanona Creek. September 10: 1,000 near Clarence Lake; 2,500 in the Alphabet Hills; and many scattered on Lake Louise Flat. September 20: All major groups apparently now have reached the Lake Louise Flat and spread out, with bands as far east as the Richardson Highway.	
	September 23: Sighted 150 caribou just E of Stephan Lake.	Oscar Vogel.

TABLE 1. (Continued)

Year	Observation	Source
	September 26-27: Flight from Cantwell to Monsoon Lake--sighted several small groups, mostly less than 10 and mostly bulls, all heading westward.	Nelson's field notes.
1953	February 14-16: About 3,500 animals E and SE of Lake Louise, about 1,500 W and NW, and about 1,500 to the south; about 300 along the Chistochina River and 250 along the Nelchina River; the Oshetna River, Maclaren River, Tangle Lakes, and Tyone Creek areas were mostly devoid of caribou.	Alaska Game Commission report.
	June 16: Main band of caribou was located along the upper Oshetna River; counted 1,225 adults plus 393 calves. June 20: No caribou sighted near Deadman Lake. September 17-18: Large caribou herd near mouth of the Tyone River; 500 below Black Lake moving SW; 100 along Sanona Creek moving SW; and 2,000 at the heads of Jay and Coal Creeks. Late September: Largest part of herd was located along both sides of the Susitna between Clarence Lake and the Fog Lakes; the tally included 1,459 animals.	Chatelain's field notes.
1954	January 25-29: The herd was well dispersed over the Lake Louise Flat, the extremes being the Little Nelchina River, Susitna River, Tangle Lakes, Richardson Highway, and the Tazlina River. Movement noted seemed somewhat clockwise over the area noted.	Alaska Game Commission report.

TABLE 1. (Continued)

Year	Observation	Source
	July 8: 8,000 estimated to be in the Clarence Lake area. August 20-30: Large groups in upper Coal Creek-Alphabet Hills region, movement eastward; 250 sighted near mouth of the Maclaren River.	Watson's field notes.
	September 11-27: Sighted 1,000± caribou near Stephan Lake.	Oscar Vogel.
	November 14-21: Over 5,000 had moved into area lying between Paxson and Tangle Lakes from the south; these began moving westward just south of the Denali Highway, and by late November the main concentration encompassed Butte Creek and that portion of the Susitna River; about 200 remained along the Little Nelchina.	Watson's field notes.
1955	During December (1954) and early January the main groups swung south and east into the Lake Louise Flat.	Alaska Game Commission report.
	February 1-3: Aerial census revealed that about 36,000 caribou were scattered over the Lake Louise flat; about 300 along the East Fork of the Susitna; 20 south of the Glenn Highway; and a few scattered animals west of the Oshetna. April: Bulk of herd drifted into Kosina Creek-Clarence Lake area, but returned to upper Tyone Creek area for calving in May.	Scott's field notes.
	July 3: "Thousands" of caribou sighted in Clarence Lake area.	James Sumpter.

TABLE 1. (Continued)

Year	Observation	Source
	July 13-14: 12,000-15,000 at head of Sanona Creek, bulls constituting less than 10%, near Joe and Fourth of July Creeks.	Watson's field notes.
	July 21-22: No caribou sighted along Tyone River, Clarence Lake area, Fog Lakes area, nor Stephan Lake; scattered groups reported along West Fork of the Gulkana. July 30: Estimated 15,000 in compact groups at head of Little Oshetna River; deep trails along upper Caribou Creek; no caribou in Lake Louise area.	Scott's field notes.
	August 1: Estimated 10,000 at head of Caribou Creek, above Mazuma Creek.	Bud Thompson.
	August 5: Estimated 20,000 between Sanona and Tyone Creeks, headed north.	Scott's field notes.
	August 8-14: About 5,000 along lower Black River; scattered animals along middle portion of Talkeetna River; and 25 sighted near Fog Lakes.	Fredericksen's field notes.
	August 20-September 25: About 2,000 caribou sighted along Watana Creek; 50 animals near Coal Creek Lake; 30 along Boulder Creek; 500 seen moving SE across lower Black River in late September. September 29: Large concentration along upper Little Nelchina River; about 10,000 of these at head of Flat Creek.	Various people.

TABLE 1. (Continued)

Year	Observation	Source
	October 21: Several thousands concentrated in area lying west of Paxson Lake, encompassing the Middle Fork of the Gulkana River and the east end of the Alphabet Hills; these were moving westward across Moraine Flat on October 28.	Scott's field notes.
	November 2-3: Estimated 8,000 moving down Susitna River near mouth of Maclaren River.	Burkholder's field notes.
	December 21-22: About 1,500 sighted along Clearwater Creek; about 500 along the Maclaren River; about 1,000 at east end of Alphabet Hills; scattered bands east of Tyone Creek from Lake Louise to mouth of Tyone River; about 50 sighted in upper Oshetna River area.	Watson's field notes.
1956	January 27-30: No sign in the Oshetna River area; 1,000± between Old Man Lake and the Little Nelchina; about 1,500 along lower Tyone Creek headed north; over 1,000 on the Lake Louise Flat; 1,500 at the west end of the Alphabet Hills, movements both north and east, with vanguards moving up Butte Creek; about 3,000 along the east end of Alphabet Hills, movement southward.	Skoog's field notes.
	March 6-8: Concentrations as follows: Deadman Lake area--15,000; East Fork of the Susitna--500; Tangle Lakes--4,000; Alphabet Hills--5,000; Lake Louise Flat--2,000 thinly scattered; Little Nelchina River--lower Oshetna River-Tyone Creek area--11,000.	Aerial census.

TABLE 1. (Continued)

Year	Observation	Source
	May 20-31: About 15,000 caribou (adults, mostly cows and yearlings) spread out over the calving grounds extending from Fog Creek southeastward to the head of Tyone Creek.	Skoog's field notes.
	June 18: Reported seeing 100-150 caribou scattered along east side of railroad from Summit to Curry.	Capt. Yearout.
	June: Several hundred caribou crossed the railroad near Chulitna and headed southwestward down the Chulitna River.	ARR employee.
	July 2: About 10,000 adults, plus calves, at the heads of Caribou Creek and the Little Nelchina River; 5,000 plus calves, in area along upper Tyone Creek.	Skoog's field notes.
	July 21-25: Concentration along the upper Oshetna River moved north to Clarence Lake area; movement continued northward, and over 2,500 crossed the Susitna near the mouth of Jay Creek.	Hensel's field notes.
	September 22-29: Thousands of caribou moved eastward across the Susitna River between the mouths of the Maclaren and Tyone Rivers.	Various sources.
	October: Early in the month a concentration of several thousand occurred on upper Butte Creek and another of over 10,000 between the Tangle Lakes and the Richardson Highway; late in the month, portions of the latter group extended south to Ewan Lake and west to the lower Maclaren River, while the former group drifted southwestward.	Skoog's field notes.

TABLE 1. (Continued)

Year	Observation	Source
	December 4: About 15,000 caribou in the Devil Creek-Fog Lakes area.	
	December 10: Several thousand caribou on both sides of the Richardson Highway moving northward through Isabel Pass, extending almost to Black Rapids; several caribou sighted near Mentasta Lodge.	Various sources.
1957	January 7: Over 15,000 in the Isabel Pass-Tangle Lakes-Paxson Lake area; over 1,000 along the upper Talkeetna River; about 1,000 in the Devil Creek area; and over 2,000 just NE of Cantwell; no sign along the Oshetna River and little on the Lake Louise Flat. January 22-25: Tangle Lakes group moving westward across Moraine Flat and up Butte Creek. March 6: Over 5,000 in the Tangle Lakes-Isabel Pass region; 15,000 in the Deadman Lake-Butte Creek area; 1,000 in the Devil Creek area; over 2,000 near Cantwell; and about 2,000 along the upper Talkeetna River; only scattered, small bands (mostly bulls) on the Lake Louise Flat. May: Over 10,000 adults plus calves scattered over the calving grounds, from Fog Creek to the upper Little Nelchina River. Late June: Calving groups concentrated in area at heads of Caribou Creek, Little Nelchina River, Tyone Creek, and the Oshetna and Little Oshetna Rivers.	Skoog's field notes.

TABLE 1. (Continued)

Year	Observation	Source
	July: Above concentration moved into Clarence Lake area, and in late July moved across the Susitna River between Goose Creek and Watana Creek. August: Main portion of herd spread out in the Deadman Lake-Coal Creek-Nadiwen Lake area.	
	September 17: About 15,000 moving east along Maclaren River; about 5,000 in the Clarence Lake-lower Black River area; about 15,000 in the Tsusena Creek-Brushkana Creek-Nadiwen Lake area.	Watson's field notes.
	October 23-29: Over 10,000 spread out from Wells Mt. to Nadiwen Lake and Coal Creek; over 5,000 on the Lake Louise Flat, mostly from Susitna Lake to Fish and Crosswind Lakes. November: Over 15,000 in the Deadman Lake-Monahan Flat region; over 500 along hills bordering Alfred and Crooked Creeks; and over 500 on the northern half of Lake Louise Flat. December: Strong movement southwestward from the Deadman Lake region into the Talkeetna River basin.	Skoog's field notes.
1958	January-February: Over 20,000 in basin of the upper half of the Talkeetna River, with groups extending to Iron Creek and Rainbow Lake on the west and the Fog Lakes on the northeast; scattered groups in the Monahan Flat and Deadman Lake areas, and on the northern half of Lake Louise Flat. March 15: Over 20,000 remain in Talkeetna River-Fog Creek area; over 1,000 in Devil Creek-Deadman Lake area; over 2,000 on Monahan Flat; over 1,000 at the head of Caribou Creek; and over 1,000 on the northern half of Lake Louise Flat.	

TABLE 1. (Continued)

Year	Observation	Source
	May: Calving groups moved onto calving grounds extending from Fog Creek to the upper Little Nelchina; groups more dispersed than in past years, calving bands extending west to Disappointment Creek, south to Crooked and Flat Creeks, east to Tyone River, and north to Nadiwen Lake. June: Over 10,000 concentrated at heads of Little Nelchina and Little Oshetna Rivers, shifting in mid-month to hills between Oshetna and Black Rivers, and finally to Tsisi Creek-Clarence Lake area in late June; many bulls in Deadman-Nadiwen Lake area. July: Over 10,000 caribou spent most of this month in the grass-sedge-willow terrain lying at the heads of Jay and Coal Creeks; scattered groups occurred near Watana Mt. and Clarence Lake; others, on Monahan Flat and eastward. There quite likely was a major portion of the herd along the Talkeetna River during the summer, or perhaps at the heads of the Oshetna, Black, and Little Nelchina!? August: Large concentration remained in Deadman-Nadiwen-Coal Creek region. September 29: Over 5,000 caribou present along the upper Talkeetna River; from there groups are extending west, north, and east; over 1,500 are moving NE across Kosina Creek; several thousand have moved to the head of the Little Nelchina River.	

TABLE 1. (Continued)

Year	Observation	Source
	October 7: Over 5,000 between upper half of Little Nelchina River and the Glenn Highway, with strong movem ent to the north; over 500 proceeding north just east of the middle portion of Tyone Creek; over 500 moving east into the Alphabet Hills from the Susitna River; little or no sign on Lake Louise Flat and in Tangle Lakes area, nor west of Rainbow and Stephan Lakes. October: Large number of caribou swung north along west side of Lake Louise Flat, then east and south past Fish and Crosswind Lakes, then westward to the Sheep Mountain area late in the month; other groups moved into the Talkeetna River basin from the north; on October 28 over 1,000 were moving NW at the head of Gilbert Creek; and scattered groups occurred everywhere. November: The Sheep Mt. group (10,000+) spread westward onto Caribou and Hicks Creek and the Chickaloon River, with a few hundred moving northward along the Little Oshetna; over 15,000 animals covered the upper end of the Talkeetna River, above Aspen Creek; over 1,000+ spread to the Wells Mt. area, as far west as Rainbow Lake; and over 500 were moving south just east of Tyone Creek. December 16-19: Over 10,000 on the upper end of the Talkeetna River; over 5,000 west of Rainbow Lake, in hills adjacent to Disappointment, Montana, and Sheep Creeks; over 10,000 in Chickaloon River-Sheep Mt. region;	

TABLE 1. (Continued)

Year	Observation	Source
	over 5,000 in Lake Louise area, over 5,000 on Monahan Flat; and scattered groups everywhere.	
1959	January 28: Over 15,000 caribou scattered over drainage of upper Talkeetna River above Prairie Creek; over 4,000 along the Chickaloon River; over 10,000 in the Caribou Creek-Sheep Mt.-Eureka area; over 5,000 scattered over the Lake Louise Flat, most in the northern half; over 3,000 in the hills NE of Cantwell; and bands scattered throughout the range; most noticeable void exists in the Oshetna River drainage. March 28: Estimated caribou concentrations as follows: Talkeetna River basin--10,000; Chickaloon River--4,000; Caribou Creek-Eureka--10,000; West Fork of Gulkana--2,000; Tangle Lakes--5,000; Deadman-Nadiwen Lakes--5,000; and Cantwell--2,000(?).	

Numbers

Obtaining accurate total population figures for most game animals represents a difficult and baffling chore, and usually necessitates the manipulation of the available data plus the use of various estimates. Estimates alone, however, are rather unreliable, for individuals can vary greatly in their evaluation of animal numbers. At some stage in the process a reasonably accurate census technique must be applied.

This stage was reached in regard to the Nelchina caribou herd during the winter of 1954-55, after speculations as to the size of the herd had reached argumentative proportions. Previous to this time estimates had been made on the basis of reconnaissance flights over the range during which as many caribou were tallied as possible. The ease and accuracy with which caribou can be counted, however, hinges greatly upon their distribution. The same number of animals, first concentrated over a relatively small area and another time dispersed widely, could elicit greatly different estimates by the same person, a smaller figure generally being obtained with the greater dispersal of the animals. The above reconnaissance flights all were made during the winter months, mostly December and January, when the dispersal of caribou usually is the greatest. In addition most observers tend to underestimate caribou numbers. Tested on a series of photographs depicting various sized groups of caribou, 19 FWS personnel averaged nine percent low in their estimates; invariably as the group-size increased the average was even lower. Thus past estimations of the Nelchina herd logically were low. The last column in Table 2 lists the annual estimates appearing in Fish and Wildlife Service reports during the past ten years or so. The 10,000 figure of 1945 resulted from a late fall concentration along the west side of Lake Louise Flat. In late 1954, estimates by various FWS personnel ranged from 5,000 to 20,000 animals.

In early February, 1955, an extensive census of the Nelchina herd was undertaken by the Fish and Wildlife Service, under the planning and direction of Robert F. Scott. A detailed description of this census is presented in the Pittman-Robertson report, W3R, Vol. 9, No. 4. Suffice it here to state merely that the census combined sampling transects, complete counts, and estimates, with a computed sampling error in the sampled portion of about 4 percent. The resultant estimate for total

TABLE 2. POSSIBLE APRIL TOTAL POPULATIONS OF THE NELCHINA CARIBOU HERD, 1935-1959, BASED ON VARIOUS PERCENTAGES OF YEARLY INCREASES IN REFERENCE TO THE POPULATION ESTIMATE OF APRIL, 1955 (ASSUMING NO INGRESS NOR EGRESS OF ANIMALS).

YEAR	YEARLY INCREASE				HERD ESTIMATES
	5%	7.5%	10%	15%	BY FWS
1935	15,000	9,300	5,900	2,400	-
1936	15,800	10,000	6,500	2,800	-
1937	16,600	10,700	7,100	3,200	-
1938	17,400	11,500	7,800	3,700	-
1939	18,300	12,400	8,600	4,300	-
1940	19,200	13,300	9,500	4,900	-
1941	20,200	14,300	10,500	5,600	-
1942	21,200	15,400	11,500	6,400	-
1943	22,300	16,600	12,700	7,400	-
1944	23,400	17,900	14,000	8,500	-
1945	24,600	19,300	15,400	9,800	10,000
1946	25,800	20,800	16,900	11,300	-
1947	27,100	22,400	18,600	13,000	-
1948	28,500	24,100	20,500	15,000	4,000
1949	29,900	25,900	22,600	17,300	5,000
1950	31,400	27,800	24,900	19,900	5,000
1951	33,000	29,900	27,400	22,900	5,500
1952	34,600	32,200	30,100	26,300	7,000
1953	36,300	34,600	33,100	30,300	7,000
1954	38,100	37,200	36,400	34,800	13,000
1955	40,000	40,000	40,000	40,000	40,000
1956	42,000	43,000	44,000	46,000	40,000
1957	44,100	46,200	48,400	52,900	-
1958	46,300	49,700	53,200	60,800	45,000
1959	48,600	53,400	58,500	69,900	-

population was 40,000 animals--twice as many caribou as the highest estimation prior to the census.

The results were surprising to everyone concerned with the census, and immediately caused speculation as to the size of the herd in previous years. Obviously the herd could not increase from the estimated 4,000 figure of 1948 to 40,000 in seven years, assuming no influx of animals from outside sources. Annual increases of about 21 percent have been recorded in certain reindeer populations, but such a rate requires unusually low calf and adult mortality. In caribou populations, assuming a 50:50 sex ratio, a high calf crop (60 calves:100 cows, one month after calving), low calf mortality to yearling age-class (30 percent), and an adult mortality of 4 percent (excluding hunters), the highest rate of annual increment approximates 15 percent. Table 2 shows possible past populations of the Nelchina herd based on various rates of increase.

By use of a few assumptions, enough data exists at present to reconstruct theoretical annual populations of the Nelchina herd back to 1945. Since 1955 we have collected sufficient data on calf production and mortality to compute the annual increment of yearlings. In addition hunter-kill figures exist since 1945, and we have some information regarding the present herd's sex ratio. Few data are available concerning adult mortality due to wolves and other natural causes, such as disease or accidents, but estimates can be made for these.

Of 136 caribou carcasses examined completely, only 2 have shown signs of disease that possibly could have caused death. This sample is biased, however, because attention was directed to these animals. Of the "thousands" of animals that have been brought through hunter checking stations, much less than 1 percent have been diseased (to the extent of causing death). Accidents account for some adult losses, and victims of snowslides and of falls on ice have been identified. It is assumed that some adult animals break through the ice in spring and fall, that some topple from cliffs, and that others drown while crossing the Susitna River; the lack of such evidence, however, implies a low mortality. The writer assumes a natural loss (disease, accidents, etc.) of three percent of the adults (older than calves).

Predation losses probably are low in this herd, because of the low wolf population, the latest estimate being 40 wolves (Burkholder). The observations of Bob Burkholder, Mammal Control Supervisor, have shown that wolves feed extensively on moose as well as caribou, one pack having spent about half the two-month observation period in moose habitat and another, the entire period. In a previous Federal Aid report--W3R, Vol. 10, No. 4--it was estimated that a wolf killed about 30 caribou a year, assuming full time with the caribou; if that wolf spent half its time on moose, the caribou kill would be halved, or 15. Thus forty wolves would kill about 600 caribou a year, or slightly more than one percent of the present number of adults. (Calf losses to wolves are disregarded, because such mortality is reflected in the yearling counts.) The writer assumes an annual one percent loss to wolves back through 1951, the period of low wolf numbers, two percent in 1950, three percent in 1949 during the intensive wolf control program in the Nelchina area, and four percent during the 1945-48 period when control was at a minimum and the wolf population was high.

In the past four years the July (one month after calving) calf increment has approximated 28 percent of the total April population. This figure represents a high calf crop, and for this discussion the writer assumes such a calf production annually back through 1945. Calf mortality during the July-April period has averaged about 35 percent during the past four years, and this figure is used through 1951. With a greater wolf population the writer assumes a greater calf loss, and thus raises the calf mortality to 37 1/2 percent in 1950 and to 40 percent beyond that.

Table 3 tabulates the results of these various data and assumptions, and shows the theoretical populations of the Nelchina herd during the 1945-59 period. The population figures expressed for the years previous to 1955 probably represent minimum ones, for they would be larger if the calf crops were smaller or if any of the mortality figures were greater. This discussion also assumes that no ingress nor egress of animals has taken place.

Admittedly the whole discussion rests on a rather presumptive foundation, but it does show the possible growth of a caribou population. The average annual herd increment of nine percent probably represents a maximum, unless the calf

TABLE 3. ESTIMATED APRIL TOTAL POPULATIONS OF THE NELCHINA CARIBOU HERD, 1945-1959, BASED ON THE POPULATION ESTIMATE OF 1955, USING ACTUAL DATA AND ESTIMATES FOR HUNTER KILLS, CALF CROPS, AND MORTALITY.

Year	Herd Size April	Calf Increment July (28%)	Mortality								Herd Increment	
			Calf		Adult					Total		
			%	No.	Natural %	Natural No.	Predator %	Predator No.	Hunter Kill	Mortality	No.	%
1945	16,600	4,600	40	1,800	3	500	4	700	200	3,200	1,400	8
1946	17,000	4,800	40	1,900	3	500	4	700	200	3,300	1,500	9
1947	19,500	5,400	40	2,200	3	600	4	800	200	3,800	1,600	8
1948	20,100	5,600	40	2,200	3	600	4	800	300	3,900	1,700	9
1949	21,800	6,100	40	2,400	3	700	3	700	400	4,200	1,900	9
1950	23,700	6,600	37.5	2,500	3	700	2	500	500	4,200	2,400	10
1951	26,100	7,300	35	2,500	3	800	1	300	500	4,200	3,100	11
1952	29,200	8,200	35	2,900	3	900	1	300	500	4,600	3,600	12
1953	32,800	9,200	35	3,200	3	1,000	1	300	700	5,200	4,000	12
1954	36,800	10,300	35	3,600	3	1,100	1	400	2,000	7,100	3,200	9
1955	*40,000	*11,200	*35	4,000	3	1,200	1	400	4,000	9,600	1,600	4
1956	41,600	*11,600	*38	4,400	3	1,200	1	400	3,500	9,500	2,100	5
1957	43,700	*12,200	*32	3,900	3	1,300	1	400	2,500	8,200	4,100	9
1958	47,800	*13,400	*30	4,000	3	1,400	1	500	3,500	9,400	4,000	8
1959	51,800											
											Average	9

* Estimates from actual data.

crops have been underestimated and/or the mortality factors overestimated. The present size of the Nelchina herd, as of April, 1959, is estimated at 50,000 animals.

The intensive census planned for the winter of 1958-59 proved not feasible, because of the caribou's distribution. The herd scattered over such a wide area and in such rugged terrain that a sampling technique which would census the herd practically, without too great a sampling error, seemed impossible. Total counts also were not possible, because of the excessive flying time and number of personnel needed for such a venture.

RECOMMENDATIONS

Movements of the Nelchina herd should be followed closely in order to determine the seasonal movement patterns and seasonal range utilization, and to record any ingress or egress of animals.

An intensive census should be made when feasible to determine the present size of the herd.

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JOB NO. 1 (b): Movements, Distribution and Numbers-Steese-Fortymile Herd

PERIOD COVERED: May 1, 1958 to April 30, 1959

ABSTRACT

Herd movements and distribution were essentially similar to 1957-1958. The calving segment of the herd migrated out of Canada in late April and by May 20 calving was in progress in the White Mountains and the north end of the Tanana Hills. Eleven thousand adults and 6300 calves migrated across Eagle Summit in June enroute to summer ranges between the Steese and Taylor Highways. The herd remained stationary and widely disbursed during the summer months and early fall. A major migration occurred during the last three weeks of October which resulted in a mass movement across the Taylor Highway into Canada. It is presumed but not definitely known that most of the caribou wintered somewhere south of Dawson City and east of the Yukon River. Approximately 3000 caribou remained in Alaska and wintered primarily between Birch Creek and Beaver Creek.

In April caribou began crossing the Yukon River from the east south of Dawson principally in the vicinity of the Sixtymile River, presumably the vanguard of the spring calving migration.

OBJECTIVES

To determine distribution and gains and losses due to movements and trace seasonal migrations.

TECHNIQUES USED

Periodic reconnaissance flights were conducted during the year to discover and trace caribou movements as well as to determine the distribution of stationary groups. Reports of cooperating personnel from the Bureau of Sport Fisheries and Wildlife, the Cooperative Wildlife Research Unit at the University of Alaska and the Canadian Wildlife Service, private and commercial pilots and residents of the area were used to supplement these aerial observations. The observations made by Joe Miner, Vernon Berns, and Art Brazda during the course of predator control activities were especially helpful.

FINDINGS

The patterns of movement and distribution during the period May 1, 1958 to April 30, 1959 were essentially the same as recorded in the previous year. The spring movement originating in Canada south of Dawson culminated on the calving grounds in the White Mountains and the northern Tanana Hills. Approximately 11,000 caribou utilized the area on the headwaters of Beaver Creek and Preacher Creek for calving, and a lesser but unknown number, the hills on the upper drainages of Birch Creek. The entire herd was widely distributed between the Steese and Taylor Highways

during the summer and early fall. The characteristic major migration southeast to the Canadian wintering ranges occurred in October leaving only small remnant groups totalling about 3,000 animals to winter in Alaska. The following discussion traces the year's movements and distribution in detail beginning with the spring migration out of Canada.

Spring - (April - June, 1958)

The Steese-Fortymile caribou herd with the exception of approximately 2000 head wintering between Beaver and Birch Creeks was still in Canada in early April. The northwestward migration toward the calving grounds in the Tanana Hills and White Mountains was first observed during the latter part of April when large numbers of caribou, primarily cows and a few yearlings moved northwest across the Taylor Highway between Mile 22 and Polly Creek Summit. No counts or estimates of total numbers involved were made due to the widespread erratic nature of this portion of the migration which lasted until about May 10. By May 14, the bulls, characteristically lagging behind the cows, were moving through the vicinity of Mount Fairplay and Chicken.

The migration was traced from the Taylor Highway across the Steese Highway on May 14. Heavy trails clearly delineated the route followed. After leaving the Taylor Highway the front narrowed down becoming more definite in purpose and direction as it crossed the divide between the North and Middle Forks of the Fortymile River and the headwaters of the Charley River. Moving northwest, it progressed across the headwaters of the Salcha and Chena Rivers fording Birch Creek near the confluence of the North Fork and the Clums Fork. The trails led thence across the Steese Highway and dispersed into the White Mountains. Approximately 2,000 caribou wintering between Beaver Creek and the drainages of Birch Creek joined the migration as evidenced by the occasionally smaller, less distinct trails coming into the major migration route from the east.

The head of the calving migration reached the Steese Highway at Faith Creek about May 3 according to the Bureau of Public Road crews opening up the highway for traffic. The first groups of caribou seen were small and widely dispersed. The movement gradually increased in intensity until May 17. By May 20, the movement had stagnated completely.

The major portion of the caribou crossed the Steese Highway between Faith Creek at Mile 69 and Fish Creek at Mile 99. Pre-calving composition counts tallied 2,364 caribou across on May 16, 17 and 18; however, it was obvious from the reports of the road crews that this represented only a small part of the total group. The migration halted before the entire calving segment of the herd crossed the highway. It is believed, however, that the largest part of the herd moved into the White Mountains. The bulls which lagged behind the cows did not reach the highway area in significant numbers. Only occasional lone bulls were sighted southeast of the highway and constituted less than one percent of the caribou crossing the highway.

The calving area occupied northwest of the highway was much the same as in previous years, except for an extension westward. Calving

groups were observed on May 28, generally along the divide from the ridges at the head of Faith and Beaver Creeks northwest to the slopes of Cache Mountain and the headwaters of Fossil Creek.

The movement out of the calving area first became apparent on June 1. Calving groups began leaving the western-most portion of the calving area on Cache Mountain and Fossil Creek and there were indications that the scattered small bands had begun to congregate into larger groups. Moving eastward toward Eagle Summit, the first groups crossed the highway at Eagle Summit on June 3. The peak of the crossing came between June 10 and June 15. By June 18, 11,076 adults and 6,386 calves had been tallied at Eagle Summit. No attempt was made to trace the migration beyond this point.

Summer (June - August, 1958)

During the summer months the herd remained widely disbursed throughout the entire area between the White Mountains and the Taylor Highway. No large concentrations or significant movements were noted anywhere. In late August small bands totalling an estimated 1500-2000 caribou were observed ranging between Preacher Creek north of the Steese Highway and the upper tributaries of Birch Creek. Additional small groups were reported in the vicinity of Far Mountain and Chena Dome.

Fall (September - November, 1958)

Little change in movements and distribution occurred during September. In early October however, the herd began a large scale migration southeast across the Taylor Highway and on into Canada's Yukon Territory. On October 9, the first elements began crossing on a broad front which extended sporadically from Logging Cabin Creek to American Summit. The greatest number crossed between Polly Creek Summit and Boundary on the Dawson Road from the 14th to the 20th of October. After this date caribou continued to straggle through for the remainder of the month. Circumstances prevented actual counts; however, the extent of the tracks and trails indicated that it may have been the largest crossing since 1956. Canadian reports indicate that the migration proceeded on deep into Yukon Territory south and possibly east of Dawson. No attempts were made to follow the herd and by November they had been lost to observation.

A few remnant groups remained in Alaska. Approximately 1000 caribou were observed in November in the hills between Eagle Summit and Circle Hot Springs.

Winter (December, 1958 - April, 1959)

Herd distribution changed little during the winter months except for the influx of a few caribou onto the north end of the Steese-Fortymile Range. These probably stemmed from small isolated groups left in the wake of the main fall migration to Canada.

These caribou congregated in little groups apread out on the headwater divides of Beaver and Preacher Creeks, Far Mountain, Chena Dome and

Birch Creek between Twin Mountain and Twelve-mile Summit. The furthest west extension of range for this particular herd in recent years was recorded when a group of 100 caribou were sighted on Victoria Mountain, March 18. By the end of March, 2500 caribou were wintering in this area. Except for local movements the distribution remained relatively unchanged until the second week in April. The Canadian Wildlife Service reported that caribou were beginning to cross the Yukon River above Dawson particularly at the mouth of the Sixtymile River, apparently the beginning of the spring calving migration which in all possibility will repeat the performances of the previous three years.

The migrations, local movements, and seasonal distribution during the period May 1958 through April 1959 are shown in Figures 1, 2 and 3.

Numbers

There was no opportunity to definitely determine the total number of caribou in the Steese-Fortymile herd during the year. Past calving counts in June at Eagle Summit showed that approximately 11,000 adults (92 percent cows) and 6300 calves moved out of the White Mountains to summer ranges south of the Steese Highway. This was only part of the herd since it was known that a segment of the herd did not cross the highway to the White Mountain calving area. The number of caribou involved in the latter is not known although it is believed that they were fewer in number than the former.

A general evaluation of the fall migration indicated that the overall size of the Steese-Fortymile herd was as large or larger than in past years. In past years the population level has been estimated at 40,000; at present, there is little reason to change this estimate. As stated previously, gains or losses incurred during the winter months in Canada by virtue of contact with Canadian herds could mask losses or gains as a result of mortality or annual increment from the calf crop. Future investigations should include plans to follow the migration into Canada and ascertain winter distribution in an effort to evaluate any changes in herd status during this period.

RECOMMENDATIONS

The present program of tracing herd movements and ascertaining seasonal distribution should be continued to maintain current knowledge of the whereabouts of the Steese-Fortymile herd. Particular emphasis should be placed on following the fall migration through to its destination as well as determining the location and extent of wintering areas utilized in Canada's Yukon Territory. The possible effects of contact with Canadian caribou herds should also be evaluated.

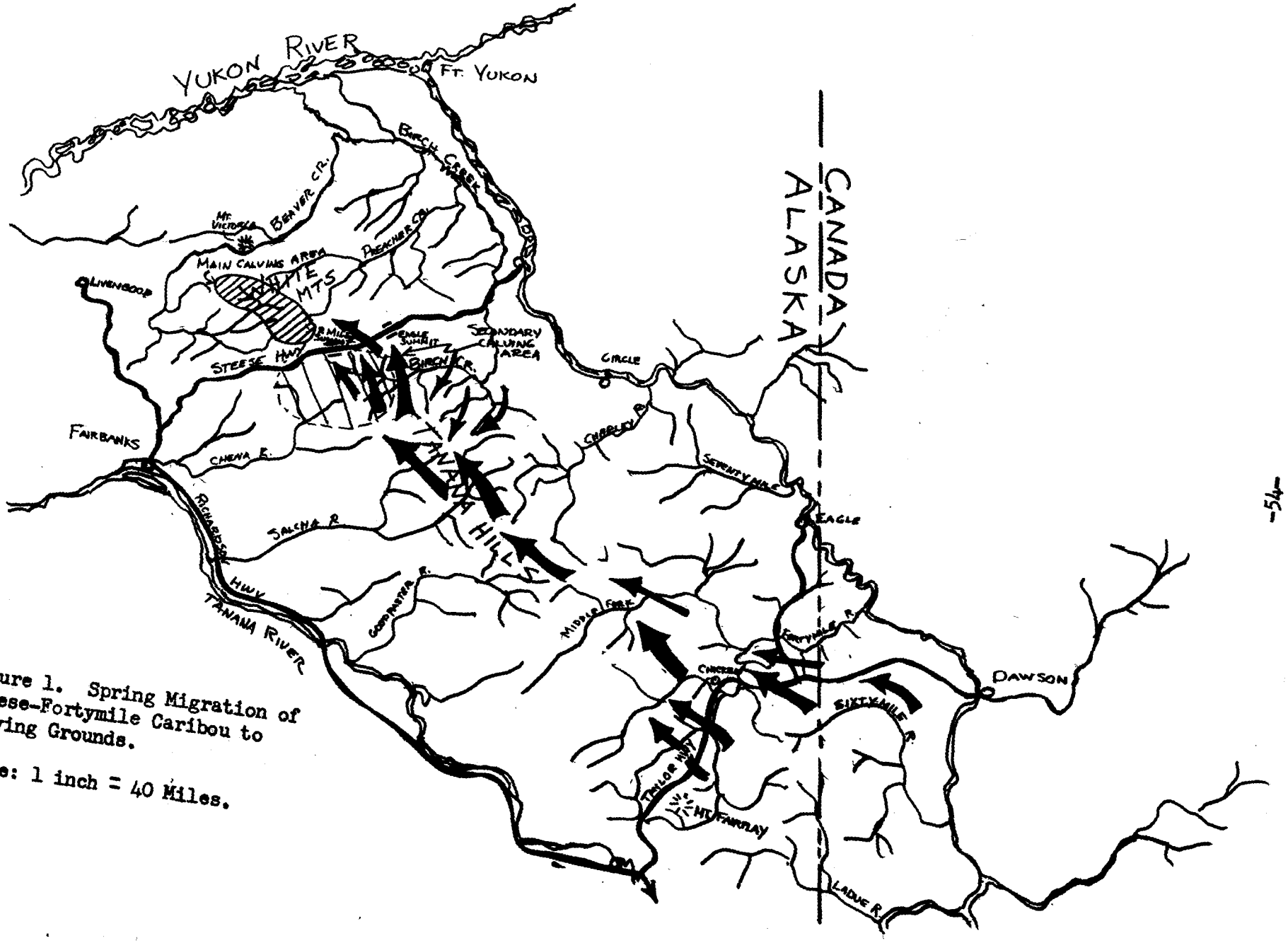


Figure 1. Spring Migration of Steese-Fortymile Caribou to Calving Grounds.

Scale: 1 inch = 40 Miles.

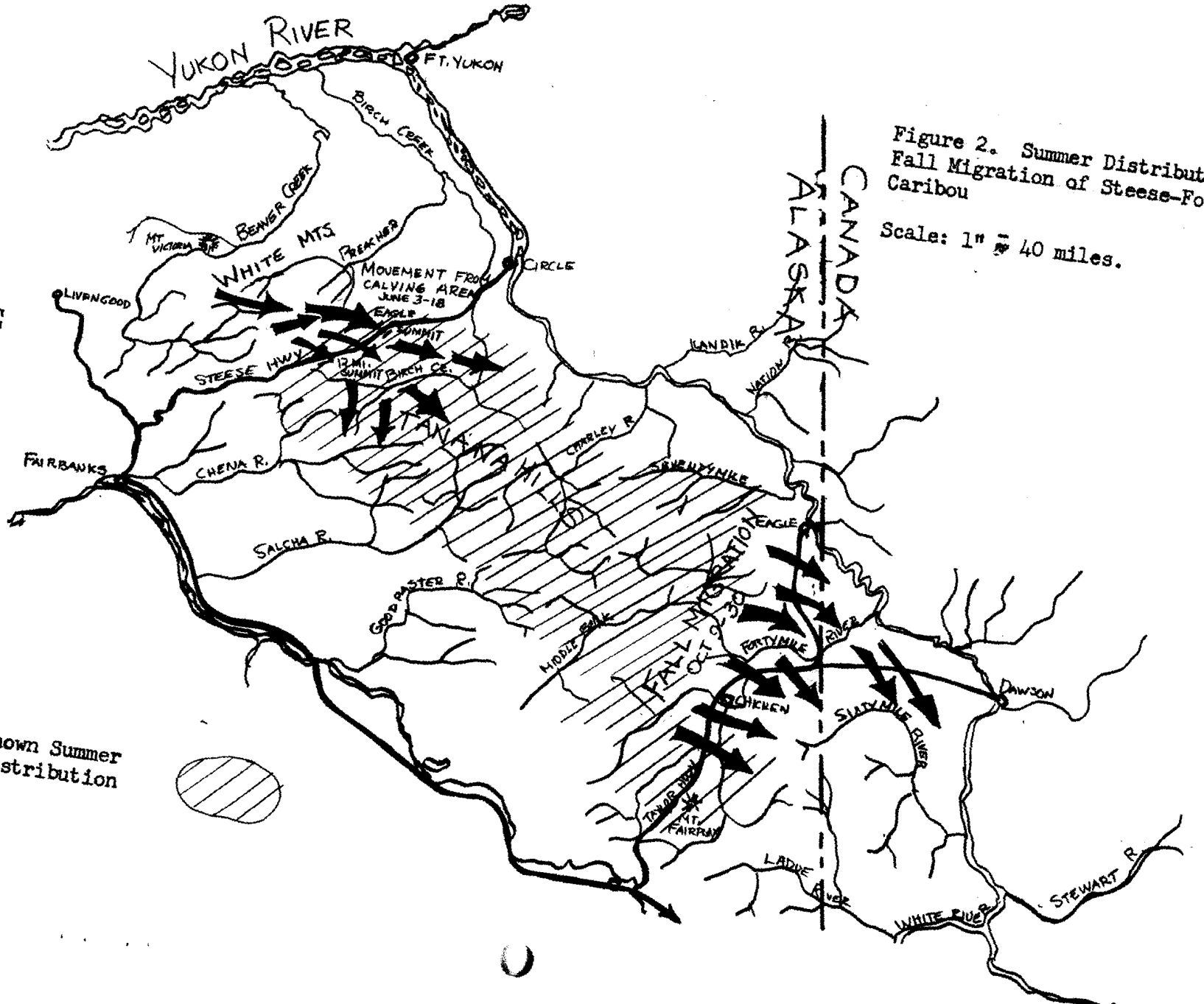
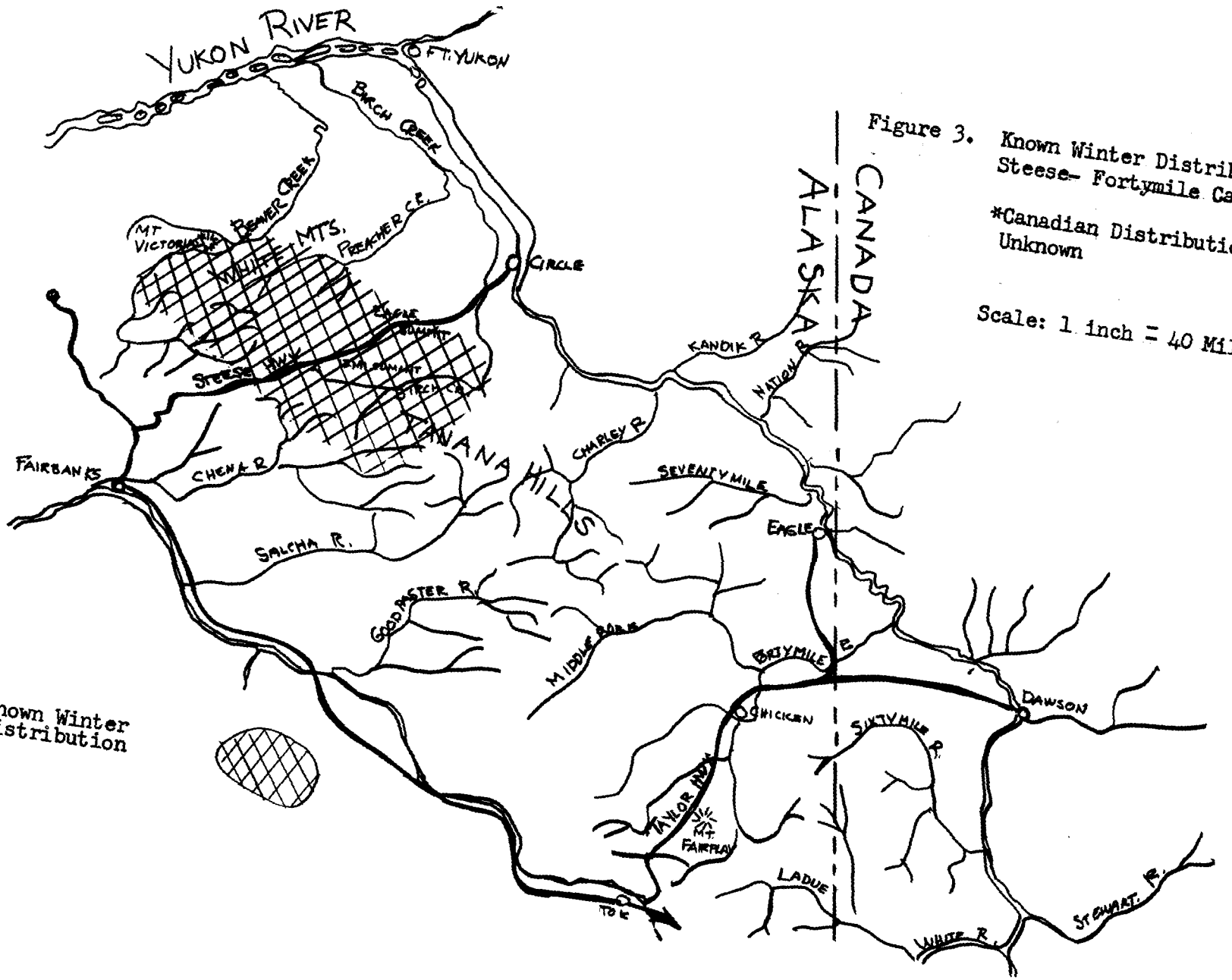


Figure 2. Summer Distribution and Fall Migration of Steese-Fortymile Caribou

Scale: 1" = 40 miles.



Known Winter Distribution

Figure 3. Known Winter Distribution of Steese- Fortymile Caribou*

*Canadian Distribution Unknown

Scale: 1 inch = 40 Miles.

Every attempt should be made to capitalize on opportunities to obtain estimates or actual counts which would provide information resulting in determination of the total number of caribou in the Steese-Fortymile herd.

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JOB NO. 1(c): Movements, Distribution, and Numbers--Arctic Caribou and Other Herds.

PERIOD COVERED: January 1, 1958 to December 31, 1958

ABSTRACT

Observations concerning distribution, movements, and population estimates of Alaska Arctic caribou are presented for the period January 1, 1958 to December 31, 1958. The designation of the three major areas discussed were changed to Western Arctic Alaska, Central Arctic Alaska, and Eastern Arctic Alaska.

1. During the winter and spring months, caribou were widely disbursed throughout the Western Arctic Alaska with no significant concentrations or movements detected. In early June, a calving concentration numbering approximately 100,000 cows plus calves was located at the headwater drainage of Utukok, Colville, and Kokolik Rivers. This concentration broke up in July, moving south into the Noatak and northeast along the coast. Except for an estimated 50,000 animals in the upper Noatak Valley, most of the caribou in this area were again spread out into small widely disbursed groups by fall and early winter.

2. Most of the Arctic caribou were located in Central Arctic Alaska during the winter and early spring months. By the middle of June, most of the caribou had taken part in a large migration to the west wherein most of the cows moved into the western Arctic area to calve. The bulls, yearlings, and cows without calves lagged well behind the cows. During the summer months many of these caribou drifted north across the flats towards the Arctic coast. Fall found the caribou widely scattered almost everywhere from the coast throughout the mountains with few concentrations being noted anywhere except south of Barrow and at the head of the Ivashak and Savanirktok Rivers. About 50,000 caribou moved out of the upper Noatak area in November spreading eastward into the Alatna-Anaktuvuk Pass area.

3. Relatively few caribou were observed in eastern Arctic areas during the winter and spring months. A large calving concentration located in early June between Barter Island and Peters Lake was followed by an estimated 10,000 bulls in July. These may have been part of the Canadian Porcupine herd. The Porcupine herd migrated southwest out of the Richardson Mountains across the Porcupine River in late August and September. By late October, except for signs of one relatively large group of caribou on the Firth River, few caribou were seen east of the Coleen River. Residents of Hershel Island reported caribou abundant in that vicinity during December.

4. The total mimimum caribou population for Arctic Alaska is estimated 230,000 based on a combination of actual counts and field estimates obtained during the past year.

5. The status of the Delta River or Minchumina herds remained the same as in 1957.

OBJECTIVES

To follow movements and ascertain seasonal distribution and relative abundance of Arctic caribou herds as well as other smaller, isolated herds north of the Alaska Range.

TECHNIQUES USED

All information used in this report was obtained through interviews and reports received from private and commercial pilots whose interests and livelihood enable them to make observations throughout much of the Arctic. Additional data came from reliable local residents living in the various Arctic communities. Bureau of Sportsfish and Wildlife personnel contributed a large share of the data collected during the course of other official duties in the Arctic. The caribou calving survey conducted by Sig Olson and Joe Miner in June was the only BSFW project specifically aimed at obtaining information on Arctic caribou. The extensive aerial search for Regional Director Clarence Rhode and Game Management Stan Fredericksen which was carried out from August 24, to November 31, provided a great deal of data usually not available at this time of the year. Although the collection of caribou information understandably received low priority during the search, all persons involved are to be commended for their efforts to record data whenever possible.

In order to avoid lengthy indentifying references for each observation reported by the various individuals, a list of contributing personnel is presented in Table 1. References hereafter will be by name only of the person or persons reporting.

The observations include the current calender year from January 1 to December 31, 1958. Thus, the pattern of movements for one complete year are covered from winter back to winter. It must be understood that there are comparatively large gaps in the continuity and overall coverage from area to area. Non-mention of caribou does not necessarily mean that there were none in a given time and place. The Alaskan Arctic is a tremendously large area and it is impossible to maintain a complete record of caribou distribution and movement. The text of this report, therefore, represents a minimum of coverage.

The Arctic caribou range has been divided in past reports as a matter of convenience for discussion into Northwestern Alaska, Central Brooks Range and Arctic Slope, and Eastern Brooks Range. These terms have served their purpose, however, they tend to be vague and somewhat misleading. It is believed that the following descriptions are considably more appropriate: Western Arctic Alaska, Central Arctic Alaska, and Eastern Arctic Alaska and adjacent Yukon Territory. These three areas are delineated in Figure 1. It should be understood that the areas do not necessarily designate particular herds of caribou, since it is known that groups of caribou move in and out of each of these areas at various

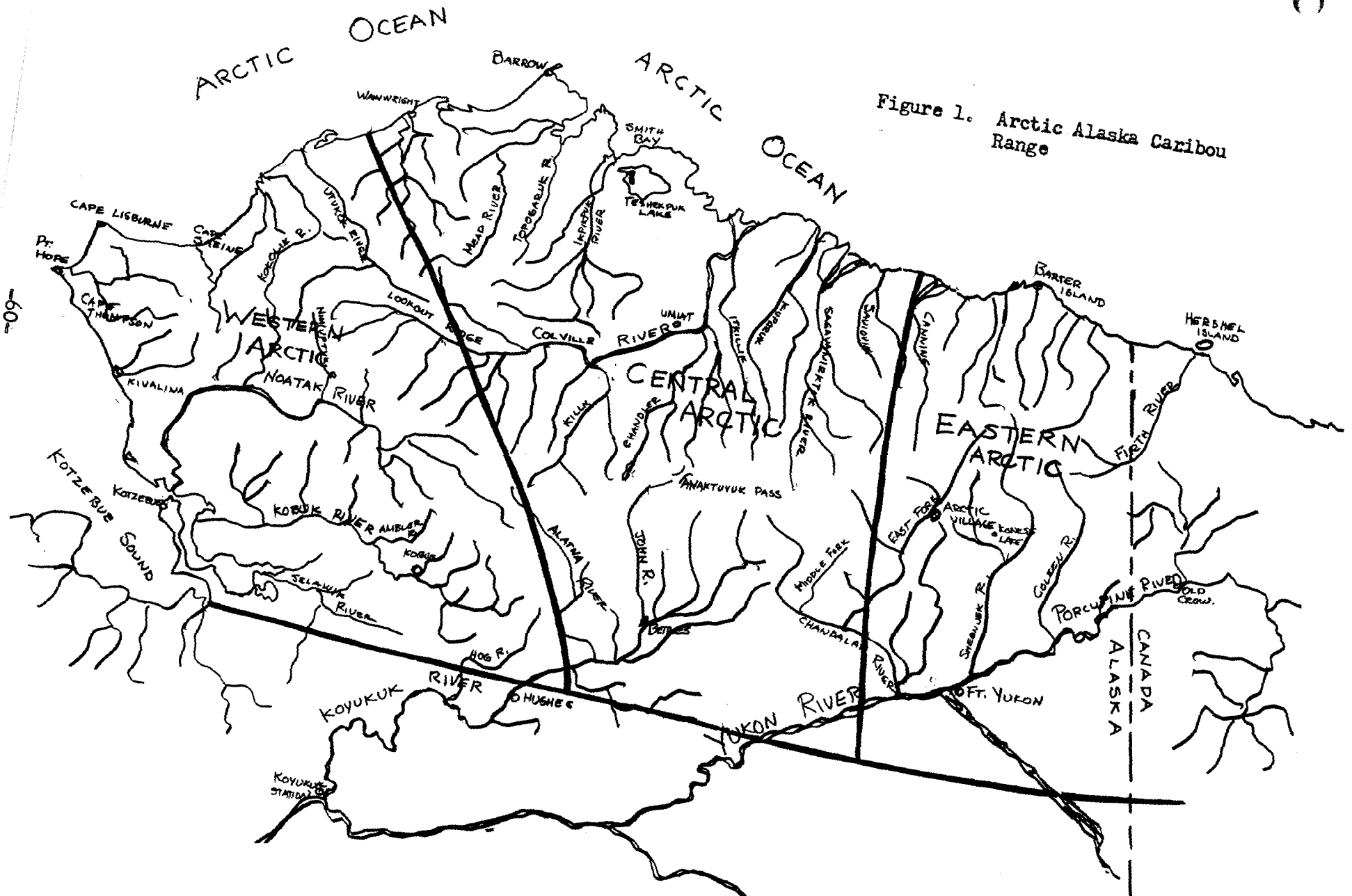

Figure 1. Arctic Alaska Caribou Range

TABLE 1. List of persons contributing Arctic Caribou observations January 1, 1958 to December 31, 1958

NAME	RESIDENCE	REMARKS
Stan Fredericksen	Fairbanks BSF&W	U.S. Game Mgt. Agent, (Pilot)
John Klingbeil	" "	" " "
Joe Miner	" "	Predator Control Agent (Pilot)
Sigurd Olson	" "	Wildlife Mgt. Biologist
Glenn Orton	" "	U.S. Game Mgt. Agent (Pilot)
Geo. Warner	" "	Fishery Mgt. Biologist (Pilot)
Roger Allin	Anchorage "	" " " "
Gordon Watson	" "	River Basin Biologist
Henry Hansen	Juneau "	Waterfowl Biologist
Clarence Rhode	" "	Regional Director (Pilot)
Dr. J. Buckley	College, Alaska	Leader, Coop. Wildlife Research Unit, Univ. of Alaska
Robert Elliot	Fairbanks, Alaska	Wolf Hunter - Pilot
Charles Gray	" "	" " - Guide - Pilot
Wm. Parker	" "	Technician - DEW Line
Earl Boese	Arctic Village	Wolf Hunter - Pilot
Robert Fisher	Barrow	Arctic Research Lab. Pilot
Frank Gregory	Barrow	Wien Airline Pilot, wolf hunter, Guide
Jules Thibideau	Barrow	Interior Airlines pilot- wolf hunter, Guide
H. Helmericks	Barrow	Guide, bush pilot
James Anderson	Bettles	Wien pilot, Guide
Nelson Walker	Kotzebue	Wolf hunter, big game guide, bush pilot
Warren Thompson	Kotzebue	Wolf hunter, pilot
C.W. Saunderson	Old Crow, Y.T.	Royal Canadian Mounted Police
M. McDonald	" "	" " " "
Father Bouilliard	" "	Missionary, Angelican Church
Joe Netro	" "	Trader
Dennis Thompson	Valdez	Wolf hunter, bush pilot
Henry Childs, Jr.	Berkley, Calif.	Univ. of Calif, Scientist IGY

times and no one group can be definitely identified with a particular area over a period of time

Western Arctic Alaska

Caribou were widely distributed in Western Arctic Alaska during the early winter months. No large concentrations were observed or major movements recorded. During January, residents of Kobuk and Shungnak reported many caribou immediately north of the two villages. The usual native description of "many, man" had to suffice; however, it is believed that several thousand animals were involved. Buckley and Fredericksen reported an estimated 5,000 in the vicinity of Rabbit Mountain in early January. They counted 800 caribou 15 miles inland from Kivalina on January 17 and the following day, on a course from 68° east to Cape Thompson, 587 caribou were counted in 30 linear miles. They believed that many thousand caribou were present in the general area between Kivalina and Cape Sabine; however, fog prevented a check of the area.

In early March, Olson and Fredericksen found 5,000 caribou at the head of the Hog River and 2,000 more on the upper Kobuk Valley as far west as the head of the Selawik River. No caribou were found west of this point. In the mountains immediately south of the Noatak River between the Kelly and Cutler Rivers, 4,000 caribou were located on March 6. On March 8, counts in the area between the Wulik River and Cape Thompson indicated that at least 2,500-3,000 caribou were present. Walker and Thompson stated that while wolf hunting, they had encountered comparatively large numbers of caribou all winter in both these areas.

In late May and early June, caribou began to move into the area at the head of the Colville, Kokolik, and Utukok Rivers. By June 12, Olson and Miner estimated that a minimum of 100,000 caribou were concentrated in this area. On June 11, they actually counted 67,698 adult caribou on the drainages of the upper Colville, Utukok, and Kokolik Rivers. These were mostly cows with new born calves plus a few groups of bulls, yearlings, and cows without calves around the edges of the main herd or moving into the area from the east. Group sizes ranged from 20 to as high as 3,000 individuals and were generally semi-continuous.

Childs, during the course of his studies in the vicinity of Cape Sabine, counted a herd of 108,000 caribou as they moved past his camp June 22-23. Walker, in mid-July, observed an estimated 60,000 caribou in one large compact group moving slowly eastward through the DeLong Mountains. It took about 10 days for the group, which occupied about a 10 square mile area, to move from the head of the Kelly River to Feniak Lake. The above two groups probably stemmed from the tremendous calving concentration observed by Olson and Miner in June plus the bulls, yearlings, and cows without calves they observed moving toward the calving area from the east (see section on Central Arctic). These caribou spent most of the summer in the upper Noatak Valley between the Nimiuptuk River and Howard Pass. Numerous reports of large numbers of caribou throughout this area were received from hunters and persons participating in the search for Regional Director Rhode during August and September.

Caribou began moving out of the Noatak in late September. Woolford reported "at least 50,000" moving up the Noatak River through the mountains onto the drainages north of the Kobuk River on September 28. Anderson reported "many thousands" in the mountains between the head of the Ambler River and Walker Lake October 1-20. A smaller concentration was sighted during the same time between Survey Pass and Anaktuvuk Pass. East of Anaktuvuk there were only scattered small groups indicating that most of the caribou had moved east out of the Noatak in late September and October.

Caribou were also numerous along the upper drainages of the Colville River in September. On September 1, 3,000 were counted by Watson along Lookout Ridge north of Liberator Lake. By November, the larger concentrations had broken up and caribou, in semi-continuous small herds, were well spread out throughout the Baird Mountains, between the head of the Kobuk and the lower Noatak Rivers. Orton and Klingbeil estimated that 3,000 caribou were moving down the Ambler and Shungnak Rivers on November 11. Allin and Warner recorded 1,000 caribou ranging along the Salmon River east of Kiana on November 12. No observations were made during the month of December.

Central Arctic Alaska

Most of the caribou in the Arctic were located in this area for the balance of the winter. Buckley and Fredericksen encountered many small, scattered bands between Barrow and Umiat on January 19. Their relatively uniform distribution permitted a running tally to be kept, thus, between Barrow and Umiat, a distance of 168 miles, 1,252 caribou were counted. Only those caribou within a half-mile of either side of the aircraft were recorded, therefore, a one-mile wide transect was covered along the route. The average density was 7.4 caribou per square mile. Between Umiat and Chandler Lake, caribou densities were considerably greater. On this leg of the flight, 1,715 caribou were counted for an average density of 22.9. per square mile. No attempt to calculate total numbers was made, since the distribution of the caribou contacted was not known. Caribou were scarce between Chandler Lake and Bettles.

On March 14, Olson and Fredericksen flew 372 linear miles of random transects in the area between Umiat and Barrow covered previously on January 19. Caribou were again uniformly distributed over the 6,000 square mile area between the Colville and Topogaruk Rivers and the counts indicated a density of 9.4 caribou per square mile. By calculation, 56,400 caribou were contained within this area. The next day, 42,100 caribou were actually counted in a heavy concentration area located further south in the foothills between the Chandler River and the Etivluk River. Wolf hunters Thompson and Gray estimated an additional minimum of 50,000 caribou in the adjacent mountains and also reported uncounted thousands more scattered through the foothills and mountains east to the Saganavirktok River. Excluding the latter, since no estimates or counts were obtained, there was an estimated minimum of 150,000 caribou ranging in the above described area at this time.

South of the range, the only caribou evident were 3,000 reported by Anderson in the Big Lake-Chandalar Lake area.

During April, winter concentrations north of the Brooks Range began to spread out. Gregory and Thibideau reported approximately 5,000 traveling northeast onto the flats out of Birthday Pass. The annual spring caribou surveys with Regional Director Rhode on April 19 to 20 showed that caribou were widely dispersed over the north slopes as well as the "prairies" towards the Arctic coast.

A major migration developed during late May and the first week in June. Olson and Miner, on an intensive aerial reconnaissance of the north slopes and flats June 3-12, found most of the caribou west of the Saviovik River, migrating west. Vast numbers of bulls, yearlings, and cows without calves moved steadily west across the foothills for 10 days towards the wide-spread concentration of cows and new calves located between the head of the Colville and Kokolik Rivers. In width, the migration extended from the edge of the mountains out onto the flats to an east-west line about 30 miles north of Umiat. Within the limits of the migration route, caribou were constantly within sight of the observers even in the areas of least density. When one considers that the density of caribou increased as they progressed westward and the caribou were distributed over an area 350 miles long and 75 miles wide, the number of individuals involved must have been very great. It is believed that with the exception of the caribou found in Alaska's eastern Arctic and adjoining Yukon Territory, most of the Arctic caribou were involved in this particular migration.

Using the same techniques described earlier for the winter counts, 12,000 caribou were counted during the survey. Approximately 27 hours flying time were expended, thus, about 440 caribou were seen per hour or 5.2 per square mile. The survey covered approximately 24,000 square miles, therefore, by simple multiplication, 124,800 caribou were migrating west towards a calving concentration believed to number 100,000 adults plus calves (see section on Western Alaska). This indicates that approximately 225,000 adult caribou were spreadout over the north slopes of the Brooks Range in June. These are admittedly crude data, however, there is little doubt that the number of caribou in the Arctic exceeds earlier estimates to a considerable degree.

No calving activity of significant proportion was observed in this area though occasional cows and calves were sighted along the migration route. The movement apparently stagnated during June. Many caribou moved out onto the coast during the summer to escape the heat and insects of the interior tundra. Helmericks stated that caribou, including many cows with calves, were extremely abundant on the Colville Delta and adjacent areas until August 15. One large compact concentration of 10,000-12,000 was seen a few miles south of Oliktok Point. Parker, traveling the DEW Line between Barrow and Barter Island during late August and September, observed small bands everywhere along the Arctic coast and immediately inland.

There were few caribou south of the range during the summer months. Isolated groups of varying sizes were found here and there throughout the mountain valleys according to Anderson. Klingbeil reported 2,000 bulls moving southwest at the head of the Killik August 14-16 and scattered groups of bulls between Anaktuvuk Pass and the head of the Hunt Fork.

As September progressed, many caribou began to pull away from the immediate coast moving into the foothills and mountains of the Brooks Range. Small bands were still common, however, almost everywhere on the Arctic slopes during September and early October. On September 11, Woolford and Whitesel noted 25,000-30,000 congregated between the upper Ivashak and Sagavanirktok Rivers. At the head of Easter Creek and the Killik River, Olson observed at least 1,000 head of caribou moving rapidly west.

Caribou counts made along transects flows over a 1,700 square mile area 70 miles south of Barrow during the Rhode search late in September, showed that no less than 40,000 caribou were moving generally east across the drainages of the Meade, Chipp, Topogaruk, and Ikpikpuk Rivers. Relatively few caribou were found either west or south of this area. Apparently, these caribou did not move very far for the villagers of Barrow reported large numbers of caribou south and east of the village during October and November.

Substantially large groups of caribou had filtered back into the Brooks Range during October and November and began appearing on the south slopes. Anderson reported many thousands between the head of the Kobuk River and Anaktuvuk Pass in mid-October. Warner and Allin, on November 16 reported a herd of 5,000 north of Walker Lake and another herd of 10,000 on the middle section of the Alatna River. Scattered small bands were observed between Easter Creek and the head of the Anaktuvuk River on November 16. Woolford and Smith reported approximately 3,000 caribou moving east from the lower Alatna River across to the John River via Crevice Creek on November 24. They further reported caribou plentiful all through the Anaktuvuk area and estimated 2,000 animals observed at the head of the Hunt Fork. No records were obtained for the month of December.

Eastern Arctic Alaska

Relatively little is known concerning caribou distribution, movements, and numbers in Eastern Arctic Alaska during the winter months. Widely scattered small groups of caribou totaling approximately 5,000 individuals were observed in January by Boese between the east fork of the Chandalar River and the Canadian border.

During April, Elliot located a band of 500 at the mouth of the Coleen River and 1,000 immediately north of Arctic Village. Olson and Rhode observed a herd of 6,500 in the vicinity of Koness Lake on April 20. Klingbeil and Fredericksen reported signs that a sizable movement had occurred between the Middle Fork of the Coleen

and Sheenjek Rivers passing just east of Arctic Village in March.

Most of the caribou in this area must have moved through the Brooks Range onto the Arctic slopes during the spring and summer months for relatively few caribou were seen south of the range even as late as September and October. Small groups spread out sparsely were the usual rule.

Several pilots flying for Wien Airlines reported many thousands of cows and new calves (minimum 5,000) between Barter Island and Peters Lake during the first ten days in June. It is very possible these were a part of the Porcupine Herd which seems occasionally to move into Eastern Arctic Alaska from Yukon Territory of Canada for the spring and summer. Two flights during April which covered the upper drainages of the Porcupine, Peel, and Ogilivie Rivers in Canada and the Squirrel, Black, Little Black Rivers in Alaska failed to locate any portion of this herd according to Olson. Old tracks and trails indicated that large numbers had previously moved north and east out of the Black and Squirrel River drainages. An IGY party at Peters Lake observed an estimated 10,000 caribou, primarily bulls, move out of the mountains past their camp and onto the flats towards the coast July 1-7. It is thought that these also might be part of the Porcupine herd.

During the late summer and fall there were small groups of caribou almost everywhere on the north slopes and foothills of the Brooks Range, however, no large concentrations were found east of the Saganavirktok drainage. These were possibly caribou which had gradually drifted in from the west.

On the Canadian side of the border, the Mounted Police at Old Crow reported a significant migration west across the Porcupine between the Driftwood and the Bell Rivers between August 15 and September 7. No estimate of numbers were given, however. In mid-October, just below Old Rampart, 2,000 caribou crossed the Porcupine River according to Netro. This herd was moving generally north and east. Olson noted widely scattered small bands of caribou along the Coleen River on October 24. On the same date, Miner observed tracks and trails in addition to several hundred caribou that indicated a sizable northward movement along the Firth River. This was probably the same movement first observed by Netro in October. Apparently it continued on towards the coast in the vicinity of Hershel Island for the local residents there reported caribou plentiful during November and December, according to radio reports received by Bouilliard.

There were no caribou to be found anywhere on the Old Crow flats during October except for a very small group of less than 100 seen on the west edge of the flats on October 24. With the exception of the bands which migrated up to the Firth River to Hershel Island, it is very apparent that caribou were almost totally absent in this area into December.

Olson and Miner observed 1,200 - 1,500 caribou at the mouth of the middle fork of the Chandalar on October 25. Except for a few small,

widely disbursed bands of caribou along the southern slopes of the eastern end of the Brooks Range, there were practically no caribou in this area during the late fall and early winter.

NUMBERS

At various times, attempts have been made to determine the number of caribou ranging in Arctic Alaska. Scott in 1950 estimated that the northern herds number 139,000, based on aerial surveys conducted in the spring of 1949 and reports from other observers. There have been no estimates published since that time although most observers agree there are substantially larger numbers of caribou than Scott indicated.

Current counts and estimates indicate there are in excess of 230,000 caribou in Arctic Alaska. Perhaps for the first time enough good estimates and actual counts of large numbers of caribou have been obtained in different areas almost simultaneously to arrive at a fair approximation of at least minimum population levels by combining the total individuals counted for each area. This was accomplished four times during the year. The dataare shown in Table 2. Data from the four different periods have been included merely to illustrate the possibility of determining minimum population levels at different periods. It should be pointed out that the totals shown are based on caribou actually seen and do not represent the numbers of caribou which may have been present in areas not covered. For example: In March, in the Central and Eastern areas, it was known that there were many thousands of caribou throughout the north slopes of the Brooks Range, the foothills and flats east of Chandler Lake as far as Barter Island. No one, however, could give a satisfactory evaluation of how many, therefore, large numbers of caribou have been omitted. The same is true for the areas between Survey Pass and Howard Pass. During August and September, caribou were widely distributed over most areas and it was impossible to even attempt an estimate or to calculate total numbers (except in two or three instances) despite wide coverage at this time.

We are not presently in a position to state whether the Arctic caribou herds have substantially increased, decreased or merely been static. Survey methods and coverage have improved with experience, therefore, the present population estimates are believed to be more reliable than in the past.

It is becoming increasingly apparent that it is possible to census large segments of the Arctic caribou population at certain times. The most opportune period seems to be during the first two weeks of June when most of the caribou are north of the mountains on the gently rolling foothills and flats. The complete lack of brush and trees plus the very light-colored pelage of the caribou renders them extremely vulnerable to counting more so than at any other time of the year. Olson's and Buckley's counts north of Umiat have indicated it is possible to census on a transect basis when caribou are found in the "prairie" late in the winter prior to the time the snow leaves. Once the snow begins to go, visibility is

Table 2. POPULATION ESTIMATES FOR ARCTIC CARIBOU HERDS* - 1958

LOCATION	DATE	NUMBER	OBSERVER
Western Arctic			
Hog River	March 3	5,000	S. Olson
Noatak River	March 6	4,000	S. Olson
Cape Thompson	March 8	3,000	S. Olson
	TOTAL	12,000	
Central Arctic			
Barrow to Umiat	March 19	56,400	S. Olson
Umiat to Chandler Lake	March 20	42,100	S. Olson
Chandler Lake to Killik	March 20	50,000	C. Gray
Chandalar Lake	March	3,000	A. Anderson
	TOTAL	151,500	
Eastern Arctic			
E. Fork of Chandalar River	Feb.-March	500	E. Boese
Head of Black River	March 18	1,000	R. Elliot
Koness Lake	March 20	6,500	S. Olson
	TOTAL	8,000	
	TOTAL FOR ENTIRE AREA	171,500	

* Numbers based on actual observations. Totals include only those locations mentioned and do not include the entire area, thus figures portray absolute minimum numbers for the area as a whole.

Table 2. POPULATION ESTIMATES FOR ARCTIC CARIBOU HERDS (Cont'd.)

LOCATION	DATE	NUMBER	OBSERVER
Western Arctic			
Head of Utukok River	June 12	100,000	J. Miner & S. Olson
Central Arctic			
Saviovik River to Head of Colville	June 3-12	124,800	J. Miner & S. Olson
Eastern Arctic			
Barter Island to Peters Lake	June 1-10	5,000	Wien Pilots
	TOTAL	229,800	
Western Arctic			
Cape Sabine	July 8	108,000	H. Childs
Feniak Lake	July 11	60,000	N. Walker
Central Arctic			
Oliktok Point	July	11,000	DEW Line Personnel
Eastern Arctic			
Peters Lake	July 10	10,000	IGY Personnel
	TOTAL	189,000	
Western Arctic			
Liberator Lake	Sept. 1-10	3,000	G. Watson
Noatak	Sept. 28	50,000	R. Woolford
Central Arctic			
Upper Ivashak	Sept. 11	30,000	R. Woolford
Killik	Sept. 10	1,000	S. Olson
Barrow to Umiat	Sept. 26	40,000	S. Olson & H. Hansen
Eastern Arctic			
Entire Eastern Arctic Area (Minimum Estimate)	September	10,000	
	TOTAL	134,000	

too poor to count satisfactorily until June when all the snow is gone.

The opportunity will probably never arise wherein the caribou herds are so situated that it will be possible to obtain sufficient census data to calculate the actual total size of Arctic Alaska's caribou population. Census work will have to be largely fragmentary, however, it should be possible to determine at least minimum population levels and show population trends.

OTHER HERDS

Delta River: There was little opportunity to observe this herd during 1958 except for occasional sightings by Joe Miner during predator control activities. No significant counts were obtained during the year, however, it is believed that the present population is approximately 2,500.

Minchumina: The status of this particular herd, according to Ray Tremblay, Game Management Agent at McGrath, has remained unchanged during 1958. The total population is estimated to be about 2,000.

RECOMMENDATIONS

That the movement and distribution of Arctic caribou and other local herds north of the Alaska Range should be recorded each year.

Prepared by:

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Approved by:

SIGURD T. OLSON
Acting Supervisor Game Restoration

DATE: April 30, 1959

JOB NO. 2(a)--Analysis of Productivity--Nelchina Herd.

PERIOD COVERED: September 1, 1957, to April 30, 1959.

ABSTRACT

The productivity of the Nelchina herd continued at a relatively high level. The limited breeding and fertility data gathered indicated that most adult cows bred successfully during the fall of 1957. This assumption was substantiated by the high calf crop the following May.

Calving progressed similarly to past years, and again the peak was thought to occur about May 26. A count near the close of the calving period revealed that the calf crop approximated that of the previous year. It was estimated that about 60 percent of all cows older than yearlings had calves at the end of June. The calf increment on July 1, 1959, was estimated at 13,400 animals.

Calf survival during the 1958-59 period was good, with about 70 percent of the calves surviving to the yearling stage. About 25 percent of the calves died during the July-November period, and 7 percent November-April. The high survival is attributed to the low wolf population, low hunter calf-kill, and mild winter. The increment of yearlings to the herd was estimated at 9,400.

The annual herd increment was estimated at 4,000 animals.

OBJECTIVES

To obtain quantitative data regarding breeding, fertility rates, parturition, and survival of calves to yearling age.

To determine the factors affecting these elements of productivity, and to interpret the data obtained in terms of management requirements.

TECHNIQUES USED

This project attempts to determine the elements of productivity as reflected by one calf segment of the population during the period from conception, through parturition, to the yearling age-class. Thus

data collected during this twenty-month period would encompass breeding behavior, fertility rates, progression and magnitude of calving, and the survival of calves through their first winter.

Ground surveys were planned for early October, 1957, to obtain information on breeding behavior. Testes and ovaries were collected from all kills whenever possible for ultimate analysis to obtain information on reproductive phenomena.

Past years' intensive calving studies have delineated the parturition period fairly well, so no attempt was made to duplicate that effort. Aerial counts were made at various times to ascertain the relative size of the calf crop and the survival of calves to the yearling stage.

FINDINGS

Breeding and Fertility.

The distribution of Nelchina caribou during September and October, 1957, was such that most of the animals were inaccessible. The main rutting groups remained out of reach during early October (A transition period when the landing of aircraft in the high country becomes difficult.), and no information was gathered concerning breeding behavior. Aerial observations, however, indicated that the bulls had joined the cows by late September. The hunters' kill was low and most of it took place during August and September; although some testes and ovaries were collected, few cows were checked for pregnancy. Of 14 adult(2 years and older) cows examined after November 1, 11 (79 percent) were pregnant. Though the sample was small, this percentage compares closely with that (82 percent) obtained the previous year from the examination of 38 such cows. These few data, substantiated by the apparent high calf crop the following May, show that a high percentage of the cows had bred successfully.

Calving.

Movements of calving groups from the wintering grounds began in late April, 1958, with the animals moving into the lower Kosina Creek and lower Oshetna River areas. Then, instead of moving southeastward in the long files so characteristic in previous

years, many of the animals seemed to drift to the lower Oshetna River, entering a strong movement up the Oshetna and Black Rivers, with many then moving southeast to upper Tyone Creek. The general lack of snow during the winter of 1957-58 could have influenced this change in the movement pattern. The change disrupted the writer's plans to tally antlered versus unantlered cows as they filed to the calving grounds in early May; such a tally was desired for determining the approximate fertility rate.

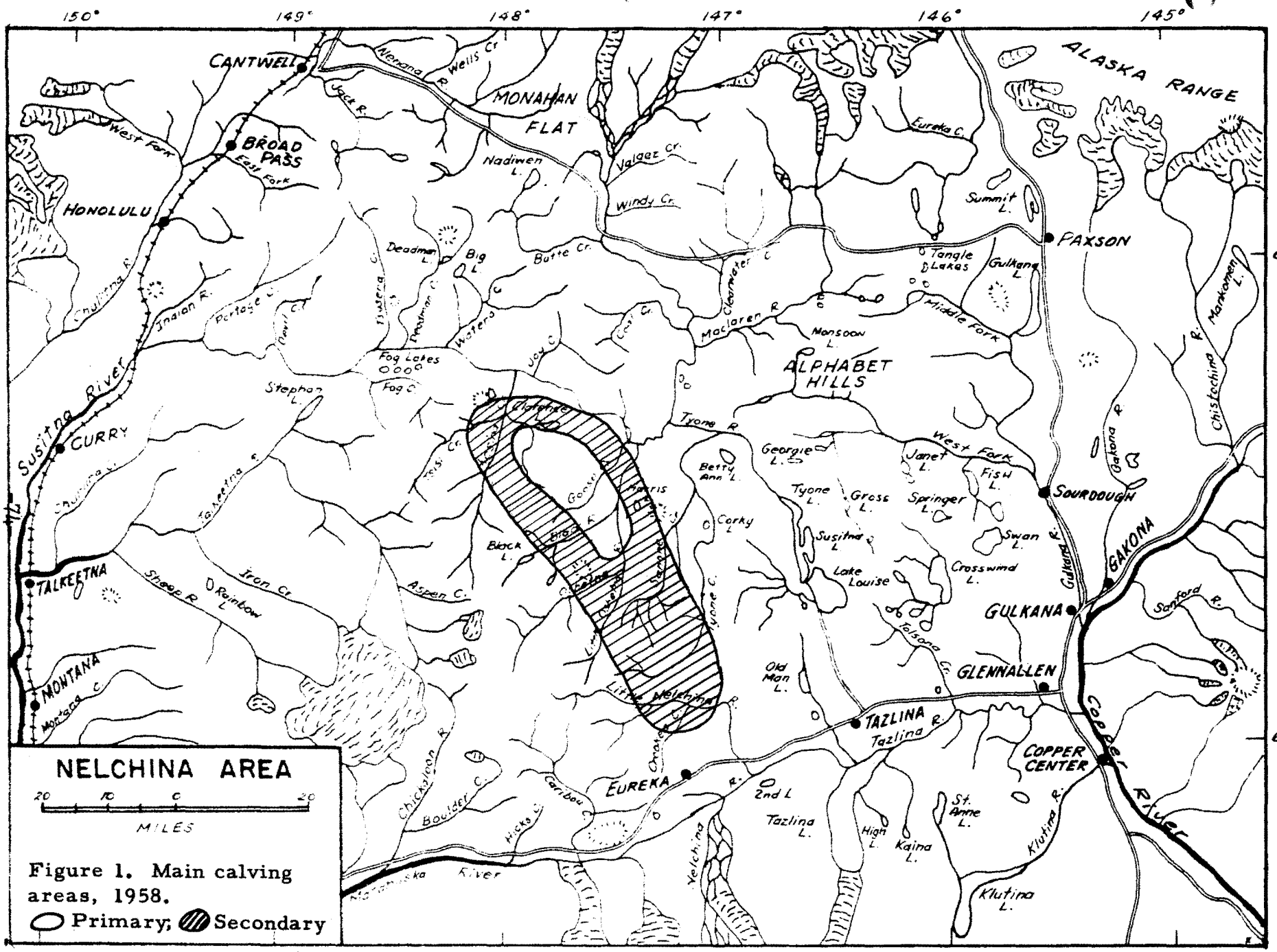
During latter May a strong movement to the northwest brought most of the calving groups into the Gilbert-Goose Creeks area, south of Clarence Lake, where the main calving took place. Calving activity extended from Kosina Creek to the upper Little Nelchina River, and a few cows calved west of Stephan Lake and north and west of Nadiwen Lake. Figure 1 shows the location of the main calving area in 1958.

Calving during May and June progressed in much the same fashion as that observed in the previous three years, with the peak again occurring about May 26. The results of the intensive calving studies during these years made the continuation of that phase of the program unnecessary. A calf count was taken on June 7, near the close of calving activity, to ascertain the relative size of the calf crop. At that time several thousand caribou had concentrated at the head of the Little Oshetna River. From this group 4,010 animals were tallied, of which 1,299 were calves, indicating a calf:adult ratio of about 48 percent. Previous data have shown that in the main calving groups about 80 percent of the adults (animals older than calves) were cows 2 years and older. Applying this percentage to the above count discloses a calf:cow ratio of about 60 percent (1,299 calves:2,169 cows). This calf:cow percentage compares with that obtained in previous years, and probably approximates the ratio existing by July 1.

Sex-ratio data have revealed that about 46 percent of the total herd in April is composed of cows older than yearlings. If 60 percent of these have calves on July 1, then the size of the calf crop at that time approximates 13,400 animals--assuming a herd size of 48,000 in April, 1958.

Calf Survival.

Calf counts were taken again in early winter (November 2-3, 1958) and in late winter (April 6, 1959) to determine calf



NELCHINA AREA

20 10 0 20

MILES

Figure 1. Main calving areas, 1958.

Primary; Secondary

survival through the winter. These counts are tabulated in the herd composition report--Job 3(a); only the Caribou Creek counts will be used for computing survival, because those are the most comparable.

Eliminating the 139 adult bulls(over 3 years old) from the November tally leaves a calf:adult ratio of 294:809. The 809 remaining "adults" were thought to approximate the calving segment of the herd in composition, i.e. 15 percent yearlings, 80 percent cows, and 5 percent bulls. The comparison is largely speculatory, however, and the percentage of bulls could be higher and/or the yearlings lower. Assuming this composition to be true, however, the writer estimated the calf:cow ratio in early November to approach 45 percent(294 calves:647 cows).

The same process of reasoning was applied to the April count of 204 calves, 59 bulls over 3 years old, and 665 "adults" older than calves. The 606 "adults" remaining after the omission of the adult bulls were estimated to contain 485 cows(.80 x 606), and thus the resulting calf:cow estimate for April 1, 1959, was 42 percent(204 calves:485 cows).

These calf:cow ratios reveal a high survival of calves to the yearling age-class. The following table illustrates the computation of calf survival from the figures expressed above.

Date	Calf:Cow Ratio	Percent Calf Mortality	Percent Calves surviving
July 1, 1958	.60	0	100
November 2-3, 1958	.45	25	75
April 6, 1959	.42	7	70

Thus, approximately 25 percent of the calves died July-November and 7 percent, November-April, for an overall mortality of 30 percent. This figure compares closely with the 32 percent mortality estimated last year. A survival of 70 percent during the July-April period is feasible because of the low wolf population, low hunter calf-kill, and

the comparatively mild winter. Also, at the base for these calf survival estimates--July 1--most of the calves are at least one-month-old, and by then are quite hardy and able to follow the adults readily over most obstacles. The final estimate, of course, hinges upon certain assumptions that could be quite erroneous, but results from the best information presently available.

Herd Increment.

By the end of June, 1958, the writer estimated that 13,400 calves had been added to the herd. An estimated 70 percent of these survived to April 1, 1959, and thus the Nelchina caribou received an increment of about 9,400 yearlings. Other caribou mortality during the year was estimated at 5,400 animals (see Table 3, Job 1a), so the resulting figure for the annual herd increment approximates 4,000 animals.

RECOMMENDATIONS

Information on both the breeding behavior and sexual cycles of caribou remains inadequate. An attempt should be made to close this gap in our knowledge. In addition more data concerning fertility rates would serve to round out this phase of the productivity study. A larger collection of testes, ovaries, and fetuses could supply much of the presently lacking information.

Calf counts should be taken at various times of the year in order to determine the calf crop and the survival of calves to the yearling age-class. Mortality data concerning the other animals in the herd are needed in order to assess the annual herd increment.

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Approved by:

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Date: April 30, 1959.

JOB NO. 2 (b): Analysis of Productivity--Steese-Fortymile Herd

PERIOD COVERED: May 1, 1958 to April 30, 1959

ABSTRACT

Productivity and survival studies during 1958 and 1959 provided the following information:

1. Calving took place in both the Tanana Hills south of the Steese Highway and the White Mountains northwest of the highway. The largest calving concentration was located in the White Mountains.

2. Antlered cows comprised 77% of the cows enroute to the calving grounds and established a pre-calving estimate of the initial calf crop.

3. The initial calf:cow ratio immediately after calving was over on June 1, was 74:100. By the time the herd had crossed Eagle Summit two weeks later, the calf:cow ratio had decreased to 62:100 indicating a light early mortality rate of 19 percent.

4. At Eagle Summit 17,360 caribou (including calves) crossed the highway. Composition counts indicate that 36 percent were calves, 60 percent were cows, 4 percent were yearlings and less than 1 percent were bulls.

5. The survival of calves to the yearling age was better than in previous years, however, considerably below what is usually believed to be normal. Only 33 percent of the calves alive on June 1958 survived to March 1959.

6. The minimum annual increment based on the number of "short yearlings" added to the herd is 2100 individuals. This level is not sufficiently great to provide adequate insurance that the herd can maintain itself in the face of the cumulative effects of natural mortality over a year's time.

OBJECTIVES

1. To obtain quantitative data regarding breeding, fertility rates, parturition, and survival of calves to yearling age.

2. To determine the factors affecting these elements of productivity and interpret the data obtained in terms of management requirements.

TECHNIQUES

Techniques did not vary significantly from the past year's operations. In order to accomplish the objectives of the project, both ground and aerial surveys were employed. Joe Miner, Mammal Control Supervisor and Sig Olson, Wildlife Management Biologist, conducted the aerial reconnaissance and counts as pilot and observer respectively. Olson supervised and assisted the ground surveys and counts conducted by a crew consisting of Biological Aids Howard Kantner, Ken Durley and Alan Courtright. Courtright directed the activities of the ground crew and was responsible for progress of the project. Wilbur J. Libby, biologist for the Alaska Department of Fish and Game, contributed his efforts during the highway crossing at Eagle Summit and conducted calf: adult counts to determine calf survival.

The project was divided into three phases: The pre-calving period, the calving period, and the post-calving period. Aerial reconnaissance during the pre-calving period served to trace the migration to the calving area, locate the calving areas, and establish a time table for ensuing ground and aerial counts. The ground counts intercepted the migration to the calving rounds in order to obtain the ratio of antlered cows to antlerless cows as an index to fertility prior to calving. Composition counts also indicated the makeup of the segment of the calving herd moving into the White Mountains. Observations of calving groups adjacent to the highway provided an opportunity to establish the onset of calving.

Calving studies in previous years have shown that calving usually begins during the third week in May gradually increasing in intensity until a peak is reached on or about May 25. The rate of calving then beguns to decrease until by June 1, calving is largely over with. A few additional calves are produced during the first week or 10 days in June, however, they are so few in number they do not contribute significantly to the crop as a whole. Aerial calf:adult counts were therefore conducted at the end of the calving period to determine the initial productivity of the calving herd on the White Mountain calving grounds. In addition, the extent of the calving area was outlined and the beginning of post-calving movements detected.

The post-calving phase was covered entirely by ground surveys conducted in the vicinity of Eagle Summit as the calving herd crossed the Steese Highway enroute to summer ranges to the east and south. Total counts and detailed composition counts provided data indicating the size and composition of the calving herd, the size of the calf crop, early or initial survival of calves to ten days of age, and causes of calf mortality. Aerial calf:adult counts were conducted in August and March following to determine calf survival to yearling age class.

The three phases are relatively clear-cut as outlined in the foregoing discussion. It must be remembered, however, that they are somewhat overlapping and it is impossible to state precisely where one stops and the next begins. Caribou had begun to calve before the migration to the calving ground was over, and the migration away from the calving ground had begun before calving was over. The entire phenomena is a dynamically progressive one wherein each phase begins, picks up momentum

until a peak of activity is reached, then subsides and merges into the next phase. All field studies have been conducted with this thought in mind.

FINDINGS

Movements and Distribution

The Steese-Fortymile caribou herd moved out of Canada to the calving areas in the Tanana Hills and White Mountains during late April and the first three weeks of May. After calving activities were over the calving groups migrated out of the White Mountains and became widely dispersed throughout the Tanana Hills between the Steese and Taylor Highways. A detailed description of the migration to and from the calving areas is presented in the section on Movements Distribution and Numbers, Job No. 1-b., and will not be discussed further here. The map showing the location and extent of the calving area is also included in Job 1-b.

Pre-calving

Past experience has shown that the percentage of antlered adult cows in the calving segment of the herd quite closely approximates the initial calf:cow ratio, thus providing a rule-of-thumb indication of current fertility rate. Skoog has accomplished some preliminary investigations in this direction which seems to indicate that in the Nelchina herd most of the antlered cows are pregnant and nearly all the antlerless cows are not. (see Federal Aid Completion Report, Vol. 12, No. 3, page 5 and 55).

Composition counts were made on 117 bands of caribou as they crossed the Steese Highway between Mile 83 and 99 enroute to the White Mountains calving area. A total of 2,359 caribou were tallied of which 2,314 (98 percent) were adult cows; 41 (2 percent) were yearlings and 4 (T.) were bulls.

Antlered cows comprised 77 percent of the total adult cows. The counts obtained came from the rear of the movement since a large proportion of the caribou had crossed before it was possible to gain access to the crossing area to conduct counts. Previous experience has indicated that the proportion of antlerless cows is greater towards the head of the movement and it is therefore believed that the percentage of antlered cows is possibly slightly high. On the basis of this information, it was concluded that the expected current fertility rate would be approximately 75 percent. This is not a precise figure, however, it does provide a method whereby the investigator may arrive at an estimate of the current calf crop just prior to the calving season.

As stated previously, the entire Steese-Fortymile herd did not calve in the White Mountains. It was very evident that the calving migration came to a halt before all the calving groups crossed the highway, thus, it was possible to observe some calving activity from the highway where the composition counts were being conducted. Cows with newborn calves were seen at Mile 95 and Mile 98 on the morning of May 17, therefore, it is believed that calving began as of this date.

Calving

The initial calf:adult ratio was determined by aerial counts conducted on May 28 and June 1. The counts are presented in Table 1. The counts were conducted after the time when "center" and "fringe" areas could be clearly distinguished, thus, it was necessary to lump all the observations together. Caribou on the calving grounds had begun to regroup and were beginning to drift east in the initial phase of the migration to their summer ranges.

Post-calving composition counts at Eagle Summit showed that 92 percent of caribou (excluding calves) coming from the calving grounds were adult cows (2 years or older); 7.6 percent were yearlings; and less than 1 percent were bulls. By substituting the percentage of adult cows for the overall adult percentage obtained on the calving grounds, the initial calf: adult ratio of 68:100 then becomes a calf:cow ratio of 74:100. This compares favorably with the calf:cow ratios obtained in previous years. It also approximates the percentage of antlered cows obtained from pre-calving counts (77%) and lends support to the assumption that the percentage of antlered cows prior to calving is indicative of initial productivity. The initial calf:cow ratios obtained from counts on the calving grounds and the percentage of antlered cows prior to calving for the last five calving seasons (including 1958) is presented in Table 2.

All pre-calving and calving data show that the fertility rate and initial productivity of the Steese-Fortymile caribou herd is satisfactory. This, again, indicates that calf survival rather than herd productivity is the problem should a lack of calves become apparent later in the year.

Table 1. Aerial calf:adult counts - White Mountain Calving Grounds

DATE	TOTAL	ADULT(1)	CALVES	CALVES:100 ADULTS
5/28	1620	966	654	68:100
6/1	2115	1255	860	68:100
TOTAL	3735	2221	1514	68:100

(1) Includes yearlings

Table 2. Comparison of initial calf:cow ratios obtained on the calving grounds and the percentage of antlered adult cows 1954-1958.

RATIO	1954	1955	1956	1957	1958
Initial calf:cow	74.9	72.0	75.0	(1)	74
Percent of cows w/antlers	73.8	70.9	74.4	71.0	77

(1) Initial calf:cow ratio not available

Over the past five years it has become apparent that normal initial productivity seems to be in the neighborhood of 70-75 calves:100 cows. This can be used in the future as an expected normal value in determining initial production. The pre-calving percentage of antlered adult cows should not be depended on alone, however, it can be used as a check.

Post Calving - Highway Crossing at Eagle Summit

Data which determined the size and composition of the calving herd, the size of the calf crop for this particular herd, and early calf mortality were obtained during the period when the calving groups moved southeast across the Steese Highway at Eagle Summit immediately after calving was completed.

Numbers

Between June 3rd and June 20th, 9,456 caribou (excluding calves) were actually tallied across the highway. Estimates based on tracks and sightings where detailed counts were not possible accounted for an additional 1620 head for a total of 11,076 adult caribou. A summary of the daily tallies is shown in Table 3.

It was not possible in every instance to obtain a complete count of the calves accompanying each band of caribou particularly when the bands were moving swiftly in compact groups at a distance too great to distinguish calves clearly. Included in each of the daily total counts of adults were sufficient calf:adult counts to establish a calf:adult ratio for the day. This ratio was thus applied to the total number of adults counted to calculate the total number of calves for the day. Of the 11,076 adults tallied, 6,698 were included in bands on which calf-adult counts were obtained. These adults were accompanied by 3,486 calves. The total calculated number of calves accompanying the total adults counted was therefore 6,284. This total added to the 11,076 adults accounts for 17,360 caribou counted across the highway. The calf-adult composition counts are presented in Table 4. The subsequent daily calculated calf count obtained by applying the daily calf:adult ratio to the total number of adults counted for each day and the grand total of caribou counted across the highway is presented in Table 5. The totals should be considered as minimum counts since it is entirely probable that a few caribou may have crossed the highway undetected despite the excellent visibility (main crossing area above timber line) and almost constant surveilance by the ground crew.

As mentioned earlier, significant numbers of caribou failed to reach the White Mountains by calving time. No attempt to evaluate the size or extent of this segment of the herd was made. Therefore, the number of animals involved is unknown. General observations, however, just made prior to calving, indicated that the calving herd in the White Mountains was larger than that segment which remained below the highway.

Table 3. Summary of Daily Total Counts of Caribou (excluding calves) crossing the Steese Highway at Eagle Summit June 3-17, 1958

DATE JUNE	ACTUAL COUNT	ESTIMATED COUNT(1)	TOTAL CARIBOU
3	32	150	182
4	439	250	689
5	369	0	369
6	232	0	232
7	493	70	563
8	766	0	766
9	537	0	537
10	2645	0	2645
11	805	0	805
12	486	100	586
13	274	1000 (2)	1274
14	329	50	379
15	2046	0	2046
16	1	0	1
17	2	0	2
TOTALS	9456	1620	11,076

(1) Groups seen but exact counts not possible

(2) Estimated on basis of tracks by W.L. Libby.

Table 4. Summary of Calf:adult Counts Obtained June 3-15, 1958 from Bands of Caribou Crossing Steese Highway at Eagle Summit (1)

DATE JUNE	TOTAL CARIBOU	NUMBER CALVES	NUMBER ADULTS (2)	CALVES PER 100 ADULTS
3	36	4	32	13:100
4	611	172	439	39:100
5	543	186	357	52:100
6	328	96	232	41:100
7	615	122	493	25:100
8	932	166	766	22:100
9	780	243	537	45:100
10	1387	504	883	57:100
11	1228	423	805	53:100
12	844	358	486	74:100
13	492	218	274	80:100
14	513	184	329	56:100
15	1872	810	1062	76:100
TOTAL	10,181	3486	6695	------

(1) Counts made only when complete counts were possible.

(2) Adults include all caribou older than calves of the year.

Table 5. Calculated Total Number Caribou Crossing Steese Highway at Eagle Summit - June 3-17, 1958

DATE JUNE	TOTAL ADULTS COUNTED	CALF:ADULT RATIO (1) (CALVES:100 COWS)	TOTAL CALCULATED NO. OF CALVES	TOTAL CARIBOU
3	182	13:100	24	206
4	689	39:100	272	961
5	369	52:100	192	561
6	232	41:100	96	328
7	563	25:100	140	703
8	766	22:100	168	934
9	537	45:100	241	778
10	2645	57:100	1507	4152
11	805	53:100	426	1231
12	586	74:100	433	1019
13	1274	80:100	1019	2293
14	379	56:100	212	591
15	2046	76:100	1554	3600
16	1	-----	----	----
17	2	-----	----	----
TOTAL	11,076	57:100	6284	17,360

(1) Ratios based on calf:adult counts in Table 2.

Calf Mortality

Comparison of the initial calf:cow ratio on the calving grounds and the calf:cow ratio two weeks later as the herd crossed Eagle Summit provides considerable insight into the extent of early calf mortality. The actual fertility rate, except as based on the percentage of antlered cows in pre-calving counts(The percentage of pregnant adult cows) is not known. Therefore, the extent of original mortality, i.e. still births, calves that die almost immediately after birth, or perhaps even including resorption of embryos, is not known. We therefore must be satisfied with using the observed initial calf:cow ratio as a basis for comparison with calf:cow ratios observed at a later date.

The initial calf:cow ratio on the calving grounds was 74:100. Two weeks later when the herd crossed Eagle Summit, this ratio had decreased to 62:100 indicating a 16% mortality had occurred. Calf mortality can also be expressed by the number of cows with distended udders without calves. Unfortunately such counts during the 1958 crossing were too fragmentary and infrequent to be of any value. Comparison of the above ratios makes it quite evident that early calf mortality was quite low as compared to previous years, (See Table 7). If it is assumed that the indicated rate of early mortality is characteristic of calving groups other than the White Mountain group, the current initial productivity can be regarded as excellent.

Early mortality is caused by a number of factors. Inclement weather, predation, and inability of calves to keep up with the herd due to weakness or injury. There are undoubtedly others less obvious in nature. Their relative importance is not known, however, their combined effect serves to create a recognizable decrease in the number of calves surviving to two to four weeks of age.

Grizzlies were observed to kill calves on three occasion. Seven other dead calves were found of which four were victims of some sort of predation. Four lone calves were seen after migrating bands had passed through. Although no evidence of predatory activity was noted, these individuals are extremely vulnerable to wolves, grizzly bears, and perhaps even eagles. All above observations were made in an area of approximately three square miles.

In addition to the afore mentioned instances, a grizzly was observed chasing a band of caribou over a ridge. Three minutes later a wolf chased the band back to where it came from. No evidence of predation by either the bear or the wolf was noted. Three wolves were observed in the vicinity of Eagle Summit during the time the caribou were migrating through the area. Wolves raided the camp meat cache on two occasions. Golden eagles were in the area almost constantly. They were usually seen hovering near a band of cows and calves or perched on a nearby vantage point. On one occasion two eagles were observed by Olson and Courtright making repeated attacks on a calf. The cow however repelled the eagle by either furnishing shelter to the calf with her body or striking vigorously at the eagle with her fore feet. Golden eagles are more likely to be an effective predator when the calves are first

born. When the calves are able to travel their agility cuts down the eagle's effectiveness.

Weather did not appear to be a significant contributing factor to mortality during this period. Snow was almost completely absent and precipitation except for an occasional rain shower was minimal. Temperatures varied from a night low of 38° to a noon high of 71°. The average temperature on Eagle Summit at noon, June 3 to 20 was 63° and at 8 PM was 51°. One rain and hail storm lasting 45 minutes occurred on June 16, however, this was after the majority of caribou had left the area.

Survival of Calves to Yearling Age

Calf:adult counts were conducted in August 1958 and March 1959 to establish an index to calf survival during the first year of life. The herd was widely scattered during these periods resulting in relatively small samples. The counts are, however, comparable to the June counts since very few bulls are present at these times and the groups were primarily comprised of cows, calves and yearlings. The August and March counts were aerial counts as opposed to the June counts which were ground counts.

The August counts were conducted between the Steese Highway and Birch Creek. The composition count on the 167 animals tallied was 40 calves, 127 adults including 7 bulls. The calf:adult ratio was therefore 33 percent.

The ensuing March composition counts on a total of 857 caribou were obtained. These were part of a group of approximately 3000-4000 animals wintering in the White Mountains north of the Steese Highway. There were practically no bulls observed. Of the total caribou counted, 136 were calves and 721 were adults, providing a calf:adult ratio of 19 percent.

Calf mortality based on the above ratios from June 15 to August 19 was 42 percent. By the following March, 42 percent of the remaining calves had succumbed to some mortality factor. The total mortality for the entire period was 67 percent or conversely 33 percent of the original calf crop survived to be "short" yearlings.

Table 8 shows the calf mortality-survival rate for 1958-59 and also compares it to the preceeding two seasons. Although the survival rate for the Fortymile Herd is far below that exhibited by the Nelchina Herd in 1957 (68%) it is much better than that shown for 1956 and 1957.

The actual causes of the high mortality rate during the first year of life for the past three years are not known or understood. There is little quantitative data providing any insight into the problem. Predation by wolves could well be an important factor. It is interesting to note that wolves suddenly increased in the area between the White Mountains and the Taylor Highway in 1956 and 1957. Wolf densities decreased slightly in 1958 and by the spring of 1959 following three years of intensive predator control, wolves became relatively scarce. This is based

Herd Composition

The overall composition of the calving group can be determined since the total number of calves and adults are known (Table 5), and composition counts provide the proportions of yearlings, adult cows and adult bulls. The composition of caribou herd which calves in the White Mountain Area north of the Steese Highway is shown in Table 6.

The yearling data may be questionable due to the small number of individuals involved in the composition counts, however, pre-calving counts indicated that only two percent of 2350 adults enroute to the calving area were yearlings. Since the latter counts came from the rear of the movement, it is probable that the proportion of yearlings was greater than indicated. The composition of calving groups from 1954 through 1958 are compared in Table 7.

The percentage of calves in 1958 was ten percent greater than in 1957 and represents the highest percentage of calves since 1954. The corresponding calf-cow ratio is likewise the highest since 1954. Both ratios indicate that initial productivity continues to be satisfactory.

The yearling-cow ratio although greater than 1957 is still well below previous years. Although it is known that this yearling count does not necessarily represent the actual yearling-cow ratio for the herd as a whole, it does nevertheless indicate trends representing the frequency of occurence of yearlings.

Bulls, as usual, comprise a negligible segment of the calving herd's composition. The number observed accompanying the calving group in any one year has never exceeded one percent of the total number of animals tallied. It is possible that an occasional two year old bull may not be recognized, however careful observation has shown this to be extremely unlikely.

It is quite evident from the above discussion that the composition of the calving groups or segments of the total herd is basically the same from year to year. These groups are made up largely of adult cows, a few yearlings, and a very occasional bull. After calving has occurred, the proportions change to account for the new calves which are then second in number to the cows. It is believed that the relationship of the other segments of the population to the adult female segment of the population provides the most constant element upon which to base periodic comparisons. It is therefore necessary to determine herd composition in order to segregate this one important component since all other segments of the herd are expressed as "so many per 100 cows." Comparisons of the various ratios thus provide a means of evaluating productivity, mortality and survival and population trends.

Table 6. Composition of Calving Herd in White Mountains, June, 1958
(Based on composition counts - Eagle Summit)
June 3-15, 1958

CLASS	NUMBER	PERCENT
Calves	6,284	36%
Yearlings (1)	886	4%
Cows (2)	10,162	60%
Bulls (3)	28	T
TOTAL	17,360	100%

Calf:adult Ratio - 57:100
Calf:cow Ratio - 62:100
Yearling:cow Ratio - 9:100

(1) Yearlings comprised 7.6 percent of 355 adults (calves excluded). Tallied in composition counts .76 x 11,076 Total Adults - % yearlings in total herd. 17,360 total including calves.
(2) Total adults (11,076) - yearlings (886)
(3) Three adult bulls observed in composition counts on 1176 adults, therefore, 28 bulls calculated for total.

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Table 7. Percent Composition of Caribou Herds Calving in the White Mountains 1954 through 1958 (1)

	Percent Composition				
CLASS	1954	1955	1956	1957	1958
Calves	37	30	32	26	36
Yearlings	11	7	11	3	4
Cows	51	63	59	70	60
Bulls	1	T	T	1	T
Calf:cow ratio	73:100	55:100	54:100	38:100	62:100
Yrlg:Cow ratio	21:100	12:100	16:100	4:100	9:100

(1) Based on composition counts made at Eagle Summit.

on the number of wolves seen per flying hour by predator control teams operating in this area, as well as the number of wolves taken, (Table 9). It should also be pointed out that as the predator control teams worked in the area they became more familiar with the terrain and distribution and activity patterns of the wolves, thus increasing their chances of encountering wolves.

Calf-survival was very poor in 1956-57 and 1957-58 during the periods when wolf densities were high. In 1958-59 when wolf densities apparently decreased, calf survival improved somewhat (Table 8). Whether or not the correlation between these two situations is a matter of cause and effect or merely coincidental is as yet unknown. However, the possibility exists that predation by wolves could have adversely affected calf survival and should be recognized as a potential source of early calf mortality.

Table 8. Calf Survival During 1958-59 as shown by Calf Counts Taken in June 1958, August 1958, and March 1959. (1957 and 1958 included for comparison) Steese-Fortymile Herd

DATE AND AGE (MO)	CALF:ADULT RATIO	PERCENT CALF MORTALITY	PERCENT OF JUNE CALF CROP SURVIVING
1958- 1959			
June 15, 1958 (Age - ½ Mo.)	57:100	—	—
August 19, 1958 (Age - 3 Mo.)	33:100	42	58
March 29, 1959 (Age- 10 Mo.)	19:100	67	33
1957 - 1958			
June 15, 1957 (Age - ½ Mo.)	36:100	—	—
February, 1958 (Age - 9 Mo.)	3:100	92	8
1956 - 1957			
June 15, 1956 (Age - ½ Mo.)	47:100	—	—
February, 1957 (Age- 9 Mo.)	3:100	94	6

Disease may also play an important role during this period as has apparently been the case in eastern Canada. It is quite obvious that the most important decimating factor operating against this particular herd at present is the low rate of calf survival. The full effects of this phenomenon will become evident when the females reach breeding age and the rate of productivity will be greatly reduced due to the existence of at least three weak age classes in the segment of the herd which produces the major portion of the annual increment.

Herd Increment

The initial known calf crop as of June 15, 1958 was a minimum of 6284 individuals. This does not include those born south of the Steese Highway which could add several thousand more to the total. As of March 29, 1959, 33% or 2074 of these animals had reached the age of yearlings. Generally speaking, the minimum increment to the herd was approximately 2100 yearlings. The hunter kill during the 1958 season did not exceed 600 animals. Therefore, despite the reduced calf crop, it is evident that present hunting pressure has no effect on the herd as a whole. Whether or not other causes of mortality served to deplete the herd beyond the current increment is not known. It is quite evident, however, that the present increment is not sufficiently great to provide adequate insurance that the herd can positively maintain its present status in the face of normal annual mortality. It is very possible that predation, disease, accidents and other less obvious causes of mortality could exceed the present annual increment. There is one complicating factor to be considered relative to total numbers. It is quite possible that caribou either joining or leaving the herd on the Canadian wintering grounds could effectively mask the effects of the annual calf crop for any given year.

Table 9. Wolves seen and taken during Predator Control Operations in the (1) Steese-Fortymile Area— 1957, 1958 and 1959

YEAR		NO. WOLVES OBSERVED	NO. WOLVES KILLED	NO. FLYING HOURS	WOLVES SEEN PER FLYING HR.
1957	(Jan. April)	85	52	80.0	1.06
1957-58	(Nov. April)	36	26	66.2	.54
1958-59	(Oct. April)	11	3	55.1	.19

(1) Data provided by Joe Miner, Mammal Control Supervisor, Fairbanks

Management Recommendations

The present hunting regulations in force appear to have little effect on the Steese-Fortymile caribou herd. The average annual hunter take is well below the annual increment despite low productivity resulting from poor survival. Weather which regulates hunter access to this herd and seasonal herd movements are the actual factors which determine the hunter kill. As mentioned previously, the cumulative effects of poor survival will ultimately become evident when the breeding potential of the herd is depressed because of three consecutive weak age classes caused by low survival rates for three years.

Predation by wolves may be an important cosideration under the present circumstances since the rate of calf survival decreased coincident with the rapid increase of wolves in 1956-57. During the winter of 1958-59 following an intensive year round predator control program in this area, wolves were much less evident and for the first time in three years the survival rate has improved. It is entirely possible that these phenomena are merely coincidental; on the other hand, however, a cause and effect relationship may exist.

Control of predators in this area may well be one management tool effective in improving calf survival. Forty-two percent of the calves in 1958 were lost during the summer months, therefore, if predation is a factor, control of predators on the summer range should reduce mortality. Predator control should be continued in the White Mountains and Tanana Hills, between the Steese and Taylor Highways in particular since this area comprises the principal summers range of the herd. Future investigations should include provisions for study of this particular relationship.

RECOMMENDATIONS

Investigations of the productivity of the Steese-Fortymile caribou herd should be continued with particular emphasis on the following:

1. Breeding behavior during the rut.
2. Study of fertility rates and factors affecting them.
3. Evaluation of initial production and the limiting mortality factors.
4. Factors responsible for calf mortality during the first 12 months of life.
5. Herd composition studies aimed at clearer definition of the various herd segments to facilitate the determination of accurate calf:cow ratios.

6. Determination of calf survival and subsequent annual herd increment through periodic aerial calf-adult counts.

7. Trace herd movements into Canada to obtain information on gains or losses due to contact with other herds.

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JOB NO. 3(a)--Herd Composition Surveys--Nelchina Herd.

PERIOD COVERED: May 1, 1958, to April 30, 1959.

ABSTRACT

The limited field work during the past year provided no new information regarding the sex and age composition of the Nelchina herd. Three aerial counts were made, primarily to trace calf survival. No significant variations were noticed from counts in previous years. It was observed, however, that calves had begun to separate from the cows as early as March 28, the earliest previous date recorded being April 16. The herd composition as of May 1, 1959, is assumed to correspond with last year's estimate: 19 percent yearlings, 46 percent cows, and 35 percent bulls.

OBJECTIVES

To determine sex and age ratios in order to ascertain calf survival and herd composition as an index to the current population status of the herd.

TECHNIQUES USED

Aerial segregation counts taken periodically from the main portions of the Nelchina herd provided information on calf survival through the year and on composition changes occurring with major movements. All counts attempted to classify the animals as completely as possible. Segregation from the air, however, was limited largely to calves, adult bulls (four-year age-class and older), and "others".

A special effort for ground counts was planned during the rut in early October, because that is the only time both sexes and all age-classes are represented fully.

FINDINGS

Field work was held to a minimum most of the year due to the scheduled cessation of Federal Aid activities by the Fish and Wildlife Service on June 30, 1959. Only three counts were taken during the year--June 7, November 2-3 and April 6--and the primary purpose of these was to measure calf survival. The results of the counts are tabulated below.

Date	Area	Total Animals	Calves	Adults			Calf Percentages	
				Total	Cows/ Young Bulls	Bulls 4 yrs. /	Calf: Adult	Calf: Cows/ Bulls
6/7/58	Oshetna R.	4,010	1,299	2,711			47.9	
11/2-3/58	Caribou Cr.	1,242	294	948	809	139	31.1	36.3
	Talkeetna R.	1,733	391	1,342	1,203	139	29.1	32.5
	Totals	2,975	685	2,290	2,012	278	29.9	34.0
4/6/59	Caribou Cr.	869	204	665	606	59	30.7	33.7

The April count was limited to one day's effort by bad weather, but the sample seemed quite representative of the caribou in that area. In the table, the "Adults" category represents all animals older than calves, and the "Bulls, 4 yrs. /", those adults with large antlers (hard or velveted) or without antlers (after October). These counts show no significant deviations from those taken in previous years at those times. Of interest this year was the apparent separation of calves from the cows as early as March 28, with bands of mostly calves being not an unusual occurrence by April 6. The earliest date such separation has been observed previously was on April 16, 1958. A discussion of calf survival as pertains the above counts appears in the report, Analysis of Productivity, Job No. 2(a).

The available data on the sex and age composition of the Nelchina herd was reviewed in last year's report, Caribou Management Studies, W3R12. No data has been gathered during the past year to augment that presentation, and therefore, lacking further information, the herd composition remains as estimated then: 19 percent yearlings, 46 percent cows, and 35 percent bulls. A more complete breakdown by age-classes is not possible at this time.

RECOMMENDATIONS

A definite gap exists in the present data concerning the sex and age composition of the Nelchina caribou herd. A concerted effort should be made during the rut in early October to obtain adequate segregation counts. A good series of lower jaws from cows older than yearlings would provide a fair index to the age structure of the herd(it is assumed that little age bias exists in the shooting of cows). Periodic calf counts are necessary to trace calf mortality throughout the year, as well as to measure the size of the calf and yearling segment in the herd.

Prepared by:

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Approved by:

Sigurd T. Olson
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Date: April 30, 1959.

JOB NO. 3 (b): Herd Composition Surveys --Steese Fortymile Herd

PERIOD COVERED: May 1, 1958 to April 30, 1959

ABSTRACT

Sex and age ratios obtained during the year were used to measure productivity and calf survival. No data were obtained which would provide an index to the population structure of the herd as a whole.

TECHNIQUES

Periodic segretation counts were made during the year to determine productivity and calf survival. Aerial counts were conducted on May 28, June 1, August 19, and March 29. With the exception of the last count in March all counts were made using a supercub piloted by Joe Miner with Sig Olson as the observer. The March count was done by Burt Libby of the Alaska Department of Fish and Game using a chartered aircraft. Ground counts were made at Eagle Summit on the Steese Highway during the post-calving migration from the White Mountain calving grounds to summer ranges.

Detailed herd composition counts and collection of jaws scheduled for September and October did not materialize due to a succession of unforseen circumstances.

FINDINGS

The results of ground and aerial counts have been reported on in Job No. 2 (b), Analysis of Productivity - Steese Fortymile Herd, elsewhere in this volume and need not be discussed further here. There was no opportunity to collect lower jaws during the hunting season in sufficient quantity to establish an index to the current age structure of the herd, nor was it possible to obtain comprehensive enough composition counts during the rut in late September and early October to establish a reliable adult sex ratio.

Therefore, whether or not the status of the herd has changed significantly from the year previous or the trend towards a greater preponderance of individuals in the older age classes as reported in 1958 is continuing is not definitely known at this time. Calf:adult ratios obtained during the current year (Job No. 2 (b)) indicated improved survival over the previous two years but poor survival compared to the expected normal survival. The lack of a substantial (less than 5 percent) increment of yearlings during each of the last three years tends to indicate that the above trend will continue.

RECOMMENDATIONS

There exists, at present, a regretable lack of information on herd composition with respect to both age and sex. The difficulty involved in obtaining this information is recognized; never-the-less, the fact remains that the information must be obtained in order to successfully ascertain the current welfare status of the herd, reliably guage calf survival, calculate total numbers, and evaluate the effects of mortality on the adult segment of the herd with respect to age structure.

Every effort should be made to obtain extensive herd composition counts during September and October when all elements of the herd are together as a result of the rut. Should a significant harvest by hunters occur, a suitable sample of jaws from females older than one year should be collected to provide an index to the age structure of the herd. Calf counts in October and the following March are necessary to trace calf survival during the year and the resultant increment of yearlings to the herd.

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Approved by:

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DATE: April 30, 1959

JOB NO. 4: Analysis of Nelchina Caribou Range

PERIOD COVERED: June 15 to September 30, 1958

ABSTRACT

The Nelchina Caribou Range was divided into fifteen units on the basis of vegetation types, drainage, topography, and caribou usage. These enclose an area of about 18,000 square miles. A general description of each is presented.

Several sites within eight of these units were checked during the summer and transects were run to determine lichen distribution and condition and to measure caribou utilization. Lichen cover and height were recorded in square-meter quadrats by species and group, the lichens being grouped according to their form and/or their palatability to caribou. Five stages of lichen succession were formulated to designate the relative condition of the lichens at various locations.

Enough data were available to evaluate, in general, six of the units, namely Units 2) Monahan Flat, 5) Deadman Lake, 6) Tangle Lakes, 9) Alphabet Hills, 12) Kosina Creek-Oshetna River, and 13) Lake Louise Flat. In regard to lichen growth, Units 2 and 6 seem to be progressing toward the climax stage; Units 5, 9, and 13 seem to be regressing under heavy caribou use; Unit 12 is poor in lichen growth and continued heavy use by caribou will prevent any advancement of the lichen cover. All these units, except Unit 12, contain large quantities of lichen forage.

OBJECTIVES

To examine further the patterns of plant succession and the factors affecting succession, maintenance, and occurrence of the plant communities comprising the Nelchina Range, with the major emphasis on lichens.

To develop a procedure for evaluating the effects of caribou upon the range, and a method of estimating carrying capacity for caribou in the Nelchina area.

TECHNIQUES USED

The research undertaken last summer intended to supplement Dr. Hanson's work, W3R, 12(4), and attempted to secure significant

data on the following segments of the Nelchina Range analysis project: 1) the distribution of major vegetation types, 2) the distribution and condition of the forage lichens, 3) the various stages of lichen succession, and 4) the effects of caribou upon the range. These were considered in relation to specific portions or units of the range, fifteen such divisions being outlined beforehand on the basis of vegetation types, drainage, topography, and caribou usage. As many of these units as possible were to be inspected, with a number of sites within each being examined in detail. The resulting goal was to be a general assessment of each unit, based on the condition and relative amount of lichen forage present. Such an extensive project necessarily placed the emphasis on qualitative rather than quantitative data, for not enough time was available for a more exacting study.

At each site a day was spent running transects in the major type or types containing lichens. These were spaced one-half to three miles apart and located in vegetation that seemed characteristic of that area. Each consisted of two meter-square quadrats separated by 100 feet of measuring tape. In the quadrats, lichen cover and height were recorded by species and group, the lichens being grouped according to their palatability as caribou forage. Table 1 shows this grouping, which is based upon information from the following sources:

Hadwen, Seymour, and L. J. Palmer. 1929. Reindeer in Alaska. USDA Bulletin No. 1089.

Hustich, Ilmari. 1951. The lichen woodlands in Labrador and their importance as winter pastures for domesticated reindeer. Acta Geographica, 12:1.

Larin, I. V., et al. 1937. Forage plants of the meadow and pasture lands of the U. S. S. R. Lenin Academy of Agricultural Science, Leningrad. (translated by Nicholas Hedlesky)

Lichens in Groups I, II, III, V, VI, and VIII were listed by species; those in Groups IV and VII were considered only as a group in recording cover and height. Specimens of the species encountered were collected by the writer and later identified by Dr. Mason E. Hale of the Smithsonian Institution.

Lichen cover was estimated by the modified Hult-Sernander scale, as used by Dr. Hanson. This scale is as follows:

Table 1. Lichens occurring on the Nelchina Caribou Range grouped, for the purpose of range analysis, according to their form and/or their palatability to caribou.

Group I: Fruticose--High Palatability.

Cladonia alpestris	Cladonia rangiferina
C. mitis	C. sylvatica

Group II: Fruticose--High-Medium Palatability.

Cladonia amaurocraea	Cetraria cucullata
C. crispata	C. delisei
C. gracilis	C. islandica
C. uncialis	C. nivalis

Group III: Fruticose--Low-Medium Palatability.

Cladonia cornuta	Cetraria richardsonii
C. deformis	Dactylina arctica
C. degenerans	Stereocaulon spp.
C. ecmocyma	Thamnolia vermicularis

Group IV: Fruticose--Low Palatability. (Funnel-like Cladonias)

Cladonia coccifera, etc.

Group V: Fruticose--Mostly Not Palatable.

Alectoria ochroleuca	Cornicularia divergens
Cetraria nicricans	Sphaerophorus globosus

Group VI: Foliose--Mostly Not Palatable.

Cetraria chrysantha	Parmelia spp.
C. spp.	Peltigera spp.
Lobaria linita	Sticta spp.
Nephroma spp.	Umbilicaria spp.

Group VII: Crustose--Not Palatable.

Group VIII: Fruticose--Medium to High Palatability. (Epiphytes)

Alectoria jubata	Usnea spp.
Evernia spp.	

1- Plant covers less than 1/16 of the square meter
2- " " 1/16 to 1/8 " " " "
3- " " 1/8 to 1/4 " " " "
4- " " 1/4 to 1/2 " " " "
5- " " 1/2 to 3/4 " " " "
6- " " 3/4 to 1/1 " " " "

Lichens covering less than one percent of the quadrat were recorded as "T" (trace). Total lichen cover and average height were recorded in each quadrat, as were the amount of bare ground and the number of caribou droppings, the latter as a possible index to recent caribou usage. Along the 100-foot tape the amount of ground disturbed by caribou, ground squirrel, frost, water, or other activity and that covered by moss pedestals was recorded in tenths of a foot. Disturbed ground was considered to be that in which the turf had been exposed and the vegetation torn loose or compacted to a thin, "half dead" layer.

A general description was made of the area surrounding each transect, concerning the major vegetation type, drainage, exposure, elevation, caribou usage, condition of range in regard to lichens, and the stages of lichen succession evident. At the end of each day the investigator wrote a general description of the whole area visited at each site. These descriptions, together with the quantitative data from each transect, are to be combined for a general evaluation of each range unit, and ultimately of the caribou range as a whole.

In addition, as portions of the range were traversed in flying from point to point, the vegetation types evident from the air were plotted on U. S. Geological Survey maps. The main purpose here was to obtain a general idea of plant distribution in order to better describe the various range units.

FINDINGS

This phase of the range work got its initial start last summer, but due to various delays did not progress as far as intended. Therefore, the findings herein reported are tentative and subject to change as more complete data are gathered.

Range Units

The Nelchina Range was divided into 15 units to facilitate recognizing and delineating the apparent differences existing in regard to topography, drainage, vegetation types, and caribou usage. These

units enclose an area approximating 18,000 square miles and are designated as follows: 1) Upper Nenana River, 2) Monahan Flat, 3) Clearwater Mountains, 4) Chulitna Mountains, 5) Deadman Lake, 6) Tangle Lakes, 7) Chistochina River, 8) Upper Susitna Bottomland, 9) Alphabet Hills, 10) Chunilna Hills, 11) Talkeetna River, 12) Kosina Creek-Oshetna River, 13) Lake Louise Flat, 14) Sheep Creek, and 15) Chickaloon River-Caribou Creek. In some instances the unit boundaries are mostly artificial, such as the Alaska Railroad along the west side, for example, and result from the writer's attempt to simplify the descriptions. In other instances the differences between units are not distinct and a clear-cut division is difficult to assign. Figure 1 shows the approximate location and boundaries of each unit. Table 2 lists them by number, name, area, and percent of total range. The units are described in detail below. Climatological data have not been included for the most part, because these were presented in Dr. Hanson's report, W3R, 12(4).

Unit 1: Upper Nenana River.

This area lies in the northwest corner of the range, west of Monahan Flat and near the railroad station of Cantwell. It is bounded on the west by the Alaska Railroad, on the south by the Jack River and its East Fork, on the east by Seattle Creek and the main stem of the Nenana River, and on the north by the divide separating the drainage of the upper segment of the Nenana River from that of Yanert Fork. These boundaries encompass about 500 square miles, which constitute about 3 percent of the total range.

The altitude ranges from 2,100 feet near Windy to 7,000 feet along the northern divide, with an average elevation of about 3,500 feet. The snowfall here is higher than in most portions of the range and the frequent strong winds make hard drifts, although many sections of ground above timberline are bared. These sections give the area a patchwork appearance in winter. All drainage is to the Nenana River.

The vegetation has not been examined closely, but seems to consist of three major types: Spruce, Dwarf Birch, and Heath. The first extends along the streams and valleys below 3,000 feet; the second occupies areas above and occasionally within the Spruce, generally below 4,000 feet; and the third ranges from timberline, on exposed sites, to well above 4,000 feet. Bog and Sedge occur sporadically on poorly drained sites near the Nenana River, and Willow extends along most drainages.

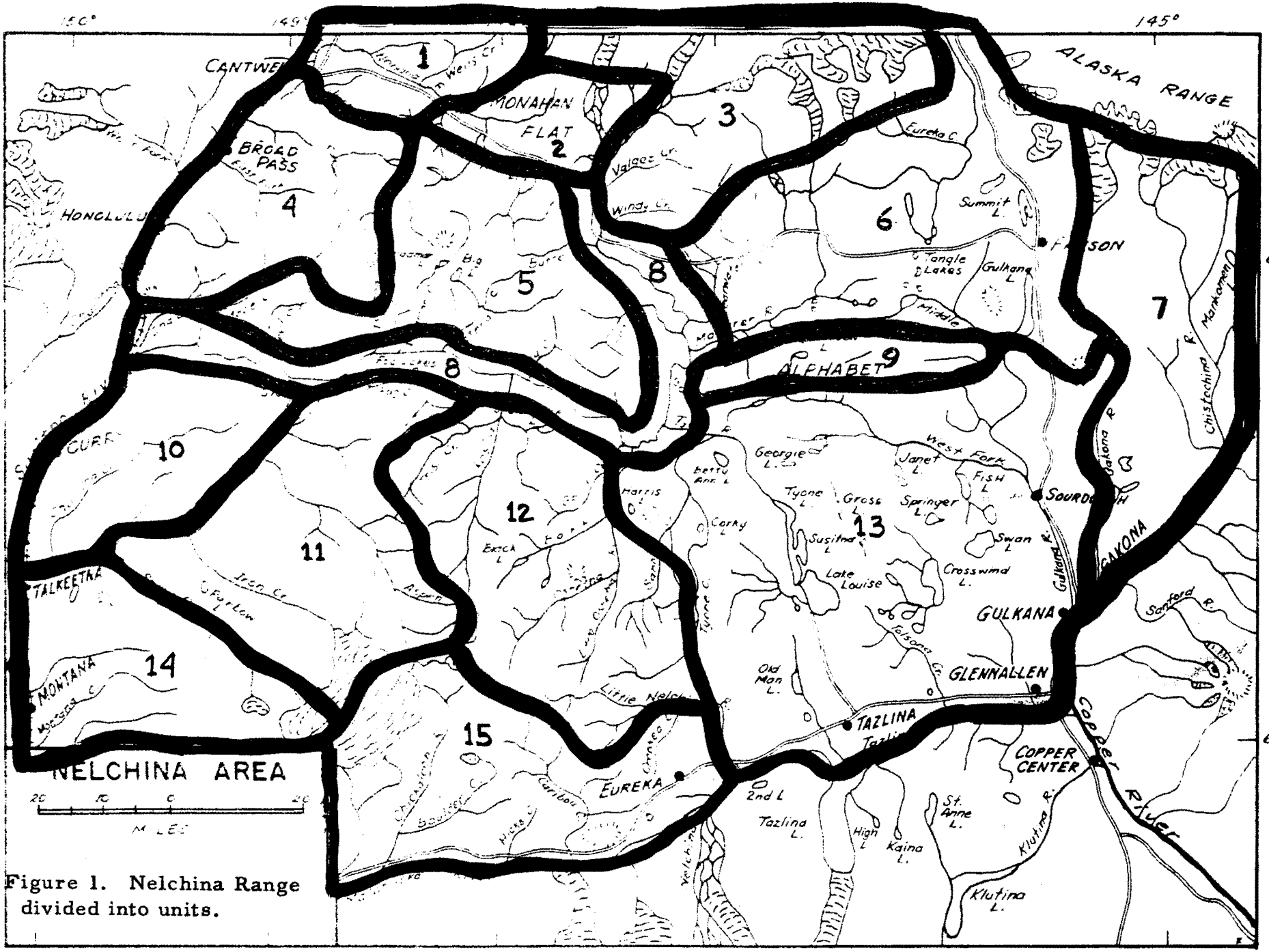

Figure 1. Nelchina Range divided into units.

Table 2. List of Nelchina Range Units by number, name, and area.

Unit No.	Unit Name	Area (Square Miles)	Percent of Total
1	Upper Nenana River	500	3
2	Monahan Flat	400	2
3	Clearwater Mountains	1,100	6
4	Chulitna Mountains	1,100	6
5	Deadman Lake	1,300	7
6	Tangle Lakes	1,800	10
7	Chistochina River	1,300	7
8	Upper Susitna Bottomland	1,000	6
9	Alphabet Hills	400	2
10	Chunilna Hills	700	4
11	Talkeetna River	1,500	8
12	Kosina Creek-Oshetna River	1,600	9
13	Lake Louise Flat	3,300	18
14	Sheep Creek	900	5
15	Chickaloon River-Caribou Creek	1,300	7
	Total	18,200	100

Excellent climax stands of Cladonia alpestris (6"-8" high) were found along the slopes just south of the Denali Highway, but such stands seem limited in distribution. Lichens seem to be rather sparse in the northern half of the unit, which consists primarily of the drainages of Bruskasna and Wells Creeks. More ground reconnaissance is necessary before properly assessing the area.

Significant winter-use by caribou during the past ten years has been limited to 1956-57 and 1958-59. Both years involved several thousand animals. Other than these two instances the area has remained more or less in disuse apparently, except for scattered caribou grazing both in summer and winter, since the 1920's and early 1930's. Then large numbers of animals from the McKinley-Minchumina herd annually moved through in fall and spring, wintering to the south and east; this movement stopped about 1932. During the same period a few thousand reindeer were grazed in the hills northeast of Cantwell; these were abandoned about 1933. Thus this unit has lain fallow, so to speak, during most of the past twenty years or more. The lush lichen growth to the south possibly reflects this lack of caribou usage.

Unit 2: Monahan Flat.

This portion of the range lies immediately to the east of Unit 1. The southern boundary follows timberline (about 3,100 feet) eastward, mostly south of the Denali Highway, from Seattle Creek to the mouth of Valdez Creek; the eastern boundary proceeds along the east bank of the Susitna River to the foot of Susitna Glacier; and the northern boundary continues westward across the foot of West Fork Glacier to the head of the Nenana River. This area contains about 400 square miles, or about 2 percent of the total.

The area consists mostly of poorly drained, relatively flat land, ranging in elevation from 2,600 feet on the east and west to 3,200 feet on the slopes to the north and south, averaging about 2,700 feet. The snowfall approximates that to the west, but the winds are less severe and hence the snow-cover probably is deeper. The ground becomes free of snow relatively early in the spring, however, probably because of the generally open terrain and the warm temperatures at those lower elevations. The eastern one-third of the unit drains to the Susitna River, and the remaining two-thirds, to the Nenana.

The vegetation here consists mainly of four major types: Sedge, Bog, Dwarf Birch, and Spruce, that order representing more or less the successional sequence occurring. Based upon a ground reconnaissance in 1958, the writer estimates the ground coverage of these four to be

10, 30, 45, and 15 percent respectively, the first including ponds and lakes, also. Willow occurs along many of the drainages, but covers a small percentage of this unit. Generally, the area is poorly drained. White Spruce occurs mostly at the higher elevations to the south, but black spruce stands occur sporadically throughout the area. Dwarf Birch occupies much of the northern half of the unit and many "islands" admidst the bogs.

Lichen growth is good to excellent and covers about 60 percent of the area. The dominant species include Cladonia alpestris, C. sylvatica, C. rangiferina, C. uncialis, C. gracilis, and Cetraria cucullata, 3 to 5 inches high, with some stalks of Cladonia rangiferina actually measuring 10 inches. All major vegetation types except the Sedge and certain portions of the Spruce contain excellent forage lichens. All examined were in good condition and showed little evidence of disturbance.

The abundance of sedges and lichens make Monahan Flat a desirable wintering ground, yet relatively few caribou have wintered there since the early 1930's, as far as is known. The excellent condition of the lichens testifies to this lack of usage. Scattered bands of caribou, however, can be sighted during every season, and during several periods in the past three years several thousand animals have used the southern half of the unit briefly.

Unit 3: Clearwater Mountains.

This unit encompasses the mountainous terrain lying in the north central portion of the range, immediately east of Unit 2. The area is bounded on the west by the east and north boundaries of Unit 2; on the south and east, by the 4,000-foot (approximately) contour level running from Valdez Creek south, east, northeast, and north to the foot of Black Rapids Glacier; and on the north, by a line running up the latter glacier and across the upper portions of Susitna and West Fork Glaciers to the Nenana Glacier. The enclosed area approximates 1,100 square miles, or about 6 percent of the total, but glaciers and rock outcrops comprise at least 25 percent of this.

The elevation ranges from 2,800 feet along the Susitna River north of Valdez Creek to over 8,000 feet among the peaks to the north, with an average of about 5,000 feet. The snowfall is heavy throughout the area and persists late in the spring. High winds are common, and most exposed places are swept clear of snow. Most of the region drains into the Susitna River, except for the northwest and northeast corners, which drain to the Nenana and Delta Rivers, respectively.

The writer has not examined the vegetation in this unit and has viewed the area from the air only in winter. Hence, he can only speculate as to the major vegetation types present. The high elevations preclude the Spruce. Dwarf Birch probably extends to at least 4,000 feet and possibly higher. Sedge bogs and meadows could be fairly common, because the map indicates many gentle slopes above 4,000 feet in the southern half of the area. Heath probably is the dominant type.

Nothing is known about the lichen growth. It is possible that forage lichens are abundant, however, because of the heavy snow-cover and the lack of shading (both an aid to the growth of these lichens), and the apparent low utilization of the area by caribou.

Caribou have been observed in the area during the winter, usually along the East Fork of the Susitna River, but never in great numbers. Sig Olson reported in December, 1956, that many caribou had moved up the Black Rapids Glacier and then turned southward to the Tangle Lakes, but this movement was rather transitory. Reports from the early 1930's, however, indicate that then and previously many animals had wintered along Valdez Creek and the adjacent hills. The area probably has received little use since then, although limited numbers of caribou, mostly bulls, do spend much of the summer in the Clearwater Mountains.

Unit 4: Chulitna Mountains.

These mountains lie in the northwest quarter of the range, to the south of Unit 1. The Alaska Railroad forms the western boundary of this area. The southern boundary starts at Chulitna, bears due east to Portage Creek, and continues up that creek and then easterly, excluding the drainage of Devil Creek but including that of Clark Creek, to Tsusena Creek. The eastern boundary continues north, from that point, along the divide between the drainages of Tsusena and Deadman Creeks and between those of Soule and Brushkana Creeks to the head of the East Fork of Jack River. The northern boundary adjoins the southern one of Unit 1. The area enclosed totals about 1,000 square miles, or about 6 percent of the total.

The elevation ranges from 1,400 feet at Chulitna to 6,600 feet at various places within the area, averaging about 4,500 feet. As a whole, the mountains are quite rugged in appearance, with steep slopes and much bare rock. Snow-cover and wind conditions probably resemble that described for Unit 3. All of the area drains to the Chulitna and Susitna Rivers, except for a small portion in the north that drains to the Nenana.

The vegetation has been checked from the ground only at the heads of Jack River and Soule Creek. In those two places the major type along the valleys, to about 4,000 feet, was the Dwarf Birch, with Heath being dominant above that. From the air that distribution seems applicable to most of the area, except for a few poorly drained sites where the Sedge meadow seems dominant. Along the west side, however, the Spruce is dominant from the railroad to about 3,000 feet.

The lichens were in good to excellent condition in the valleys at both sites checked, with Cladonia alpestris and C. rangiferina of 3 to 5 inches high being among the dominant species. Aerial observations have indicated that most of the valleys in the unit contain similar lichen stands. Much of the slopes above the valleys, however, are so steep and wind-swept for the most part that the lichen growth there probably is poor.

Caribou usage in recent years has been limited to a few animals in winter and summer, although many animals have passed through at times. Movements noted have been along Portage, Tsusena, and Soule Creeks and along Jack River. The region apparently was used extensively before the early 1930's, but since then has been used little.

Unit 5: Deadman Lake.

This region lies in the northwest quarter of the range adjacent to the right bank of the upper Susitna River. It is bounded on the west by Unit 4, on the south and east by timberline (approximately), and on the north by Unit 2. The area approximates 1,300 square miles, or about 7 percent of the total range area.

The terrain consists mostly of rolling hills except for the more rugged mountains in the south-east one-third. The elevation ranges from 2,400 feet on lower Watana Creek to peaks of 5,800, with an average elevation of about 3,500 feet. Both snowfall and winds are of medium intensity. All drainage is to the Susitna except for the northwest corner, which drains to the Nenana River.

Most of the area lies above timberline so the Spruce type is limited to fingers extending up the larger streams. Heath is the dominant vegetation type, followed by Dwarf Birch, Sedge meadow, and Fescue. Willow is common along most of the drainages. Sedge is an abundant plant and in total volume probably represents a vast amount of forage.

Ground examinations at various places showed that the lichen growth had been good to excellent in the past, but since then has deteriorated, probably due to excessive use by caribou. The primary forage lichens (Cladonia alpestris, C. rangiferina, and C. sylvatica) were relatively poor, and have been replaced by secondary ones, such as Cladonia uncialis, C. gracilis, Cetraria cucullata, and C. nivalis. A few sections did contain good growth in spots, and perhaps other portions of the unit are in better shape than those checked.

This unit has received a great deal of use by caribou during the past decade, mostly summer use during the first five years, but winter, also, during the second. Undoubtedly some of the animals from the Broad Pass migrations during the 1920's and early 1930's wintered here then, but to what extent is not known, nor is the extent of usage between then and the late 1940's. Ground evidence does show heavy use, however, because of the many trails and the disrupted and trampled appearance of the lichens.

Unit 6: Tangle Lakes.

This unit comprises most of the northwest quadrant of the Nelchina Range. It is bounded on the west by Unit 3 and by the limit of spruce (approximately) from about Mile 65 on the Denali Highway southward across Clearwater Creek and the Maclaren River to about the 3,200-foot contour level of the Alphabet Hills. The southern boundary continues eastward at that level, drops to the Middle Fork of the Gulkana River near Gulkana Lake, continues to the outlet of that lake, and then swings east and south around Round Top Mountain to the mouth of Excelsior Creek on the Gakona River. The eastern and northern boundaries are marked by Unit 3 and by a line running from the foot of Black Rapids Glacier due east to the head of Jarvis Creek, then southward across Castner, Cantwell, and Gakona Glaciers, and down the Gakona River to Excelsior Creek. The boundaries enclose about 1,800 square miles, or about 10 percent of the total.

Generally the area is one of gentle slopes and rolling terrain, except for a few rugged mountains here and there and in the northeast corner. The elevation ranges from 2,300 feet at Black Rapids to 8,000 to the southeast, but with an average of about 3,500 feet. Most of the region has been glaciated in the past, as evidenced by the many moraines and eskers still present; glaciers persist in the mountains to the north. Snowfall is rather heavy compared with other portions of the range, and the snow persists late in the spring. Strong winds are common, but do not seem to bare much ground except along

ridgetops. About half the area drains north to the Delta River; one-fourth, southwest to the Susitna; and one-fourth, south to the Gulkana.

The Dwarf Birch type covers about 75 percent of the area, including both the tall and the low subtypes. On exposed slopes and above 4,000 feet the Heath becomes dominant. Willow, Sedge, Fescue, and Alpine Meadow occur commonly, and Spruce extends up the valleys in the northeast and southeast corners.

The lichen growth varies from fair to excellent, and some localities, notably that between the Maclaren River and Tangle Lakes, contain lush stands of Cladonia alpestris. The area east of Tangle Lakes, however, exhibits some deterioration due to recent caribou usage. The northern portion is poorly drained, mostly, and forage lichens are not abundant.

Caribou have wintered and summered in the Tangle Lakes region sporadically during the past ten years, with winter concentrations occurring in 1954-55, 1955-56, and 1956-57. Formerly (1920's and early 1930's) many caribou from the north annually wintered here. Since then, however, relatively few animals have used the area, and the winter forage is in good condition.

Unit 7: Chistochina River.

This easternmost portion of the range represents a transition zone between the Nelchina caribou and those ranging the mountains to the east. Both groups utilize the area occasionally. It is bounded on the west by the Gakona River, on the south by the Copper River, on the east by the divide separating the drainage of the Chistochina River from that to the east, and on the north by the Alaska Range. The area totals about 1,300 square miles, or about 7 percent of the total.

The altitude ranges from 1,500 feet near Gakona on the south to 10,000 in the mountains to the north, with an average elevation of about 2,800 feet. The north-south gradient continues in regard to snowfall and winds, being high in the north and low in the south. All drainage is into the Copper River.

Spruce occupies about two-thirds of the area. Little is known about the other types present, but Dwarf Birch and Heath probably are dominant above 3,000 feet.

Lichen growth probably is not too good in the Spruce, because

the area is rather poorly drained as a whole. Lichens examined at Mankomen Lake in the northeast section were in fair condition, but have not reached the climax stage. The northern half of the unit possibly has some good lichen stands.

Caribou usage is limited mostly to stragglers from the east or west. In the past five years, however, several hundreds from the east and possibly some from the Nelchina herd have wintered in this area. This unit too had been used extensively during the 1920's and early 1930's by caribou moving through Isabel and Mentasta Passes from the Steese-Fortymile herd. Few caribou have been in the area since about 1935.

Unit 8: Upper Susitna Bottomland.

This unit extends along both sides of the Susitna River from the Alaska Railroad upstream to the mouth of Valdez Creek. The boundaries on both sides of the river follow timberline (approximately), with certain exceptions that are delineated in the description of the boundaries of the adjoining units. The units adjoining this one are 2, 3, 4, 5, 6, 9, 10, 11, 12, and 13. The area approximates 1,000 square miles, or 6 percent of the total.

The terrain encompasses both river banks and consists of gentle, poorly drained slopes to steep, well drained ones. The altitude varies from 800 feet near the railroad to 3,400 at several places, averaging about 2,400 feet. Both the snowfall and the wind are moderate, and the banks are snow-free early in the spring. All drainage, of course, is into the Susitna River.

The vegetation consists predominately of the Spruce type, covering about 90 percent of the ground. Sedge, Bog, and Willow probably constitute most of the other types represented.

The lichens have been examined only at a few places, but there the growth was poor to fair. The spruce tends to be too thick and the ground too damp over much of the area to support a good lichen growth.

Caribou usage is limited largely to transient animals for the unit lies perpendicular to many of their movements. Occasionally they will spend time in the area, notably in the Fog Lakes and lower Maclaren River sections, but the thick spruce and wet conditions probably are not qualities that normally would attract them. Heavy trails crisscross the main migration points, and the animals do graze somewhat during their passage through.

Unit 9: Alphabet Hills.

This group of hills occupies the east central section of the range just south of the Tangle Lakes area and north of Lake Louise Flat. Timberline forms the boundary, approximately, which encircles the area at about the 3,200-foot contour level. The 400 square miles enclosed constitute about 2 percent of the total range.

The area consists of two lines of low, rounded hills lying in an east-west direction. Moraine and esker features are evident in the valley between the two. The elevation ranges from 2,600 to 5,400 feet, with an average of about 3,500. Snowfall and wind are of moderate intensity, and the ground becomes free of snow early in the spring. Most of the drainage is to the Gulkana River, except for a small portion in the west which is to the Susitna River.

The dominant vegetation types are Dwarf Birch and Heath, with Spruce extending up the streams and valley. The first continues from the spruce line (3,000 to 3,200 feet) to about 4,000 feet, and the second occupies exposed slopes from about 3,000 feet and upward. Above 4,000 feet the terrain becomes rather rocky and the Heath type is discontinuous in distribution. Sedge is a common type on the poorly drained sites.

The Dwarf Birch contains fair to good lichen growth, and the Heath, poor. From all appearances the western half of the unit has received much more use than the eastern: lichen growth to the west consists primarily of the secondary lichens and exhibits a disrupted, trampled appearance; that to the east consists of good (2"-3") stands of Cladonia alpestris, C. rangiferina, and C. sylvatica and is more erect and vigorous.

Caribou have used this area commonly during the past ten years and probably previous to that, also, both in winter and summer. Usually this usage has involved comparatively few animals, but winter concentrations did occur in 1955-56 and 1956-57. These hills lie along a major migration route, however, and thousands of caribou occasionally move through the area. Heavy trails exist in many sections, and some range deterioration is evident.

Unit 10: Chunilna Hills.

This unit encompasses the hills located adjacent to Chunilna Creek, between the Susitna River and the lower portion of the Talkeetna

River. It is bounded on the west by the Alaska Railroad, on the south and east by the Talkeetna River and Prairie Creek, and on the north by the 3,000-foot contour level (approximately), just south of the Susitna River. The 700 square miles enclosed constitute about 4 percent of the total.

The terrain consists of low, gentle-sloped, rounded hills lying mostly above timberline. The altitude ranges from 400 feet near the mouth of the Talkeetna to 4,500 feet at various points, with an average elevation of about 2,800. The snow-cover is moderate to heavy, but disappears soon in the spring. Winds are of moderate intensity. All drainage is to the Susitna, much via the Talkeetna River.

In spite of the relatively low altitude of this unit over half of it lies above timberline. Spruce predominates to about 2,500 feet along the drainages of the various creeks within the unit. Calamagrostis stands, and possibly Festuca and Sedge, occur commonly. Heath is present at the highest elevations and on wind-exposed ridges. At present little is known about the distribution of the various vegetation types.

Ground examinations have not been made, but aerial observations reveal that good stands of lichens are present. Many seem to be climax or near-climax stages of Cladonia alpestris.

Caribou usage in recent years has been limited to a few wandering bands. The few records available from the past suggest that such has been the pattern for many years.

Unit 11: Talkeetna River.

This unit encompasses the drainage of the upper portions of the Talkeetna River. It is bounded on the west by Unit 10 and the Sheep River, on the south by Sheep River and the divide separating the drainages of the Talkeetna River and Kosina Creek, and on the north by Unit 8 (timberline, at about 3,000 feet). The area approximates 1,500 square miles, or about 8 percent of the total.

The terrain consists generally of high, rugged mountains. The altitude ranges from 500 feet at the mouth of Sheep River to peaks of well over 8,000, with an average elevation of about 3,800 feet. The snow-cover is moderate to heavy, but the valleys become free of snow early in the spring. Winds are of moderate intensity. All drainage is to the Susitna River, and most of that via the Talkeetna River

except for the northeast corner which drains directly.

Spruce extends up all the streams to about 3,000 feet, but most of the area is above timberline. The dominant type seems to be the Heath, with Dwarf Birch forming a transition zone between that and the Spruce. Sedge bog and/or meadow occurs on many of the poorly drained slopes. In addition, extensive white birch stands occur near Rainbow Lake, below 3,000 feet. The area has been examined from the ground only at two places in the winter and aerial flights in the summer have been at a minimum, so little is known about the condition and distribution of the lichens. At the two ground sites checked--upper Talkeetna River near Aspen Creek and upper Fog Creek directly south of Fog Lakes--the lichen growth seemed rather discontinuous and to consist mostly of the secondary lichens. Such an examination in the winter, however, does not provide much information.

Caribou utilization of this unit during the past three winters has been relatively heavy, with a large portion of the herd spending a great deal of time there. Summer use has been consistently light, but the area probably "always" has had caribou at that time. A few reports indicate that the Talkeetna River had been used in winter by moderate concentrations of caribou at least twice during the late 1930's and early 1940's. The recent shift in range-use to the west suggests that the importance of this unit for winter grazing will increase.

Unit 12: Kosina Creek-Oshetna River.

This unit occupies a central position in the range and encloses the main calving and summering grounds of the Nelchina caribou. It is bounded on the west by Unit 11; on the south by the divide that separates the Oshetna River and Flat Creek from Caribou Creek, and Flat Creek from Crooked Creek; on the east by a line running northward from the bend of the Little Nelchina River to the mouth of Daisy Creek, continuing down Tyone Creek to the spruce-line, approximately, and following that westward almost to the Oshetna River and then northward to a point about six miles upstream from the mouth of the Oshetna River; and on the north by timberline, which approximates the 3,000-foot contour level. These boundaries contain about 1,600 square miles, which constitute about 9 percent of the total range.

The area contains rugged mountains at the heads of the Black and Oshetna Rivers, but consists generally of gentle-sloped, rolling hills. The altitude ranges from 2,000 feet along lower Kosina Creek

to 7,600 at the head of Black River. The snow-cover is moderate to heavy, and it persists late in the spring except for certain small areas. Winds are of moderate intensity. All drainage is to the Susitna River, except the southeast corner which drains to the Copper River.

Except for fingers of spruce extending up the lower reaches of some of the streams the whole area lies above timberline. The dominant vegetation types are Dwarf Birch, Fescue, Heath, and possibly Sedge. It is difficult from the air to determine whether sedge is the dominant plant in portions of the uplands or merely a co-dominant and thus actually being a part of the Heath or Fescue types. The areas in doubt have not been checked from the ground. The Willow type is present along most of the drainages, and Dwarf Birch occupies most of the stream valleys. The writer estimates the distribution of the various types as follows: Dwarf Birch, 30 percent; Fescue and Sedge, 45 percent; Heath, 15 percent; and the remaining types, 10 percent.

Lichen cover throughout the area generally is poor. That present consists mostly of the secondary species and occurs mostly in the Dwarf Birch and Heath types. The poor growth results both from the abundance of poorly drained areas and the heavy usage by caribou in the past.

This unit has been the site of the main calving activity in the spring for a long period, probably much longer than that for which we have information. Heavy trails interlace the region. Although most of the herd spends much or part of the summer there, only a few animals are present in winter, except for transient groups passing through.

Unit 13: Lake Louise Flat.

This unit comprises most of the southeast quadrant of the Nelchina Range. It is bounded on the west by Unit 12 and the Little Nelchina River, on the south by the Nelchina and Tazlina Rivers, on the east by the Copper and Gakona Rivers, and on the north by Units 6, 8, and 9. The area enclosed approximates 3,300 square miles and constitutes about 18 percent of the total.

The area consists of a nearly level plateau lying at an average elevation of about 2,400 feet. The altitude ranges from 1,600 feet in the southeast corner to hills of 3,400 feet in the northwest portion. Snowfall and winds are light to moderate, and the ground becomes

free of snow early in the spring. As a whole the area is poorly drained and contains many lakes and ponds. The northwest section drains to the Susitna River and the remaining two-thirds or so, to the Copper River.

By far the major vegetation type is the Spruce, interspersed with Aspen-Poplar, Sedge, Bog, and Dwarf Birch, and covers over 80 percent of the area. Fire has been a common scourge there, the last extensive fire (1926) burning most of the unit. Fire seems to have occurred commonly in the past, also, for in 1898 Captain Glenn, in the report of his trip eastward from the head of the Nelchina River, states,

> "We entered what we called the 'burned district' which seemed to extend as far as the country is visible toward the Copper River, and to the northward almost to the Alaska Range. This district was evidently burned a great many years ago, as none of the Indians we encountered remembered it as being in any other condition as it is at the present time."

For the most part the dominant spruce is the black (Picea mariana), but some stands of white spruce occur here and there.

Lichen growth in this area is in poor to fair condition, largely because of heavy caribou usage and frequent fires. Few climax stands have been found, and at most sites examined the secondary species are dominant. The lichen mat generally is matted and trampled in appearance and the height usually is less than 1.5 inches.

This area has been a favored wintering ground in the past, although it has not been used to any extent during the past three years. Migrations through Isabel and Mentasta Passes during the 1920's and early 1930's probably brought caribou to the Lake Louise Flat in winter, but the numbers of animals wintering there is unknown. Since that time the Flat has remained an important one for winter grazing.

Unit 14: Sheep Creek.

This portion of the range lies adjacent to Units 10 and 11 in the southwest corner. It is bounded on the west by the Alaska Railroad, on the south by the Kashwitna River, and on the east and north by the Sheep and Talkeetna Rivers. These boundaries enclose about 900 square miles, or about 5 percent of the total. The drainage of Sheep

Creek occupies a central position in the unit.

The eastern half of this area consists of high, rugged mountains, and the western, of gentle slopes that progress downward from timberline to the Susitna River. The altitude ranges from 300 feet on the west to 8,000 on the east, with an average elevation of about 3,000 feet. Snowfall is heavy, but the winds are moderate, and the western half clears of snow rapidly in the spring. All drainage is to the Susitna River.

None of this area has been examined to determine the vegetation types present, but a few aerial observations are available. The western third of the unit consists of Spruce and White Birch, interspersed with more boggy, poorly drained areas. To the east of these stands, between 2,000 and 3,000 feet, occur extensive areas of Calamagrostis. Farther to the east the Heath becomes dominant.

The lichen growth is not known. Lack of caribou usage, however, suggests that some portions may contain climax stands of lichens.

Caribou seldom have been reported in the area during the past twenty years, although apparently they were present there commonly before that. The winter of 1958-59 marked the first time in the recorded present (since 1948) that moderate numbers (3,000) of caribou had been sighted there.

Unit 15: Chickaloon River-Caribou Creek.

This section of the range represents the southern limits of the Nelchina caribou. The unit is bounded on the west by the divide separating Granite Creek from Kings River, on the south by the Matanuska and Nelchina Rivers, on the east by the Little Nelchina River, and on the north by Units 11 and 12. The area totals about 1,300 square miles, or about 7 percent of the total.

The terrain is composed of rugged mountains, well drained, with narrow, steep-sloped valleys. The altitude ranges from 600 feet along the lower Matanuska River to 8,500 in the north, averaging about 4,000 feet. Snowfall and winds are of moderate intensity. All drainage is to the Matanuska River, except for the eastern portion which drains to the Copper River via the Nelchina River.

Spruce extends along the southern boundary and up the various streams to about 3,000 feet. Aspen-Poplar occurs sporadically along

the streams, and Willow is a common type on most drainageways. Heath probably is the dominant type for the area, interspersed with Sedge bog or meadow. Fescue occurs in the easternmost portion of the unit, and Dwarf Birch is common.

The eastern one-third (east of Caribou Creek) contains excellent stands of climax or near-climax lichens, predominantly Cladonia alpestris and C. rangiferina. Little is known about the remaining area.

During the past ten years of observations the area has supported caribou mostly during the summer, and most of these have been bulls. Frequently in the fall large bands would be present in the eastern section, near Eureka, but these soon returned northward. Last winter, 1958-59, marked the first time that a major portion of the herd wintered in this unit. No information presently exists to indicate a heavy usage before 1948.

Range Unit Analysis

The present program seeks to examine each of the units described above as completely as possible in order to determine the various facets described under TECHNIQUES USED. Last summer's field work began late due to other projects and various delays, and the month and a half available did not permit as great a coverage as intended. Sites within Units 2, 4, 5, 6, 8, 9, 12, and 13 were checked, but only 2, 5, 6, and 9 were examined thoroughly enough to permit a general evaluation. Additional information, from Dr. Hanson's work in 1957 and from aerial observations, allowed Units 12 and 13 to be evaluated, also.

Present information concerning the specific food requirements and preferences of caribou is not sufficient to allow an evaluation of the actual condition or carrying capacity of the range. Lichens are of prime importance as winter forage and most analyses of reindeer and caribou ranges have been based upon these plants. Yet sedge has proven to be an important forage plant in winter, also, and constitutes most of the winter food of some reindeer herds (e.g., those on Nunivak and St. Matthew Islands). Until the relative importance of the various winter foods is determined more conclusively, the writer believes it premature to designate an area as poor or fair merely on lichen growth alone. In lieu of so designating range condition he has formulated "stages of lichen succession" to classify the lichen growth occurring in the areas examined. Such a classification, together with the quantitative data gathered by the transects, actually does assess the

availability of lichen forage, yet does not presuppose a "condition".

Stages of Lichen Succession.

Li chen succession has been grouped into five stages: I. Primary, II. Early, III. Medial, IV. Late, and V. Climax. In addition, Stage I has been divided into a) Dry Sites and b) Damp Sites, and II and III, into Dry, Damp, and c) Mesic Sites; IV and V are considered mesic. "Dry" refers to well drained areas on m ineral soil, often exposed to wind, the vegetation progressing from bare ground; "Damp", to poorly drained areas, the vegetation progressing from bog and marsh conditions; and "Mesic", to those areas intermediate to the previous two and representative of the "climax" environment.

This tentative classification is based upon information extracted from Dr. Hanson's report, W3R, 12(4), from the writer's field notes of 1957 and 1958, and from I. V. Larin's (et al.) Forage Plants of the Meadow and Pasture Lands of the U. S. S. R., as translated by Nicholas Hedlesky. The five-stage classification remains general, for not enough quantitative work has been done for a more exact breakdown. Undoubtedly, changes will occur as more data are gathered.

Stage I: Primary.

a) DRY SITES--

Lichen Cover: 0 to 3.
Average Height: 0 to 1/2 inches
Dominants: Bare ground, crustose lichens, and funnel-shaped lichens (Cladonia coccifera, etc.).
Associated Species: Alectoria ochroleuca, Cornicularia divergens, Cetraria nigricans, Sphaerophorous globosus, and various foliose lichens (mostly on rock).

b) DAMP SITES--

Lichen Cover: 0 to 3
Average Height: 0 to 1 inch.
Dominants: Sedge marsh, sphagnum, moss, crustose lichens, and Cladonia gracilis.
Associated Species: Cetraria cucullata, Cladonia degenerans, and various foliose lichens.

Stage II: Early.

a) DRY SITES--

Lichen Cover: 2 to 4.
Average Height: 1/2 to 1 inch.
Dominants: Alectoria ochroleuca, Cornicularia divergens, Cetraria nivalis, and funnel-shaped lichens (Cladonia coccifera, etc.).
Associated Species: Sphaerophorus globosus, Cetraria nigricans, C. islandica, C. richardsonii, Thamnolia vermicularis, Cladonia degenerans, C. sylvatica, and Stereocaulon spp.

b) DAMP SITES--

Lichen Cover: 2 to 4.
Average Height: 1/2 to 1 1/2 inches.
Dominants: Cladonia gracilis, C. uncialis, C. deformis, Cetraria cucullata, C. delisei, and various foliose lichens.
Associated Species: Cladonia rangiferina, C. sylvatica, Cetraria islandica, and C. richardsonii.

c) MESIC SITES--

Lichen Cover: 2 to 4.
Average Height: 1/2 to 1 inch.
Dominants: Cladonia gracilis, C. degenerans, funnel-shaped lichens (C. coccifera, C. pleurota, C. deformis, etc.), Cetraria nivalis, C. cucullata, and Stereocaulon spp.
Associated Species: Cladonia uncialis, C. cornuta, C. amaurocraea, C. sylvatica, C. rangiferina, Cetraria islandica, C. richardsonii, Thamnolia vermicularis, Dactylina arctica, Peltigera spp., and Nephroma spp.

Stage III: Medial.

a) DRY SITES--

Lichen Cover: 3 to 5.
Average Height: 1 to 2 inches
Dominants: Alectoria ochroleuca, Cetraria

islandica, C. nivalis, Cladonia sylvatica, and Stereocaulon spp.

Associated Species: Cornicularia divergens, Cetraria richardsonii, C. chrysantha, Dactylina arctica, Cladonia rangiferina, and C. alpestris.

b) DAMP SITES--

Lichen Cover: 3 to 5.

Average Height: 1 to 3 inches.

Dominants: Cladonia uncialis, C. rangiferina and C. sylvatica (neither, nor both, predominating), Cetraria cucullata, C. islandica, C. delisei, Peltigera spp., and Nephroma spp.

Associated Species: Stereocaulon spp., Thamnolia vermicularis, Dactylina arctica, Cetraria richardsonii, Cladonia amaurocraea, C. deformis, C. gracilis, and C. alpestris.

c) MESIC SITES--

Lichen Cover: 3 to 5.

Average Height: 1 to 3 inches.

Dominants: Cladonia uncialis, C. gracilis, C. sylvatica and C. rangiferina (neither, nor both, predominating), Cetraria cucullata, C. nivalis, C. islandica, and Stereocaulon spp.

Associated Species: Cladonia amaurocraea, C. cornuta, C. deformis, C. alpestris, Cetraria richardsonii, Dactylina arctica, Thamnolia vermicularis, Peltigera spp., and Nephroma spp.

Stage IV: Late.

Lichen Cover: 4 to 6.

Average Height: 2 to 4 inches.

Dominants: Cladonia alpestris, C. rangiferina, and C. sylvatica.

Associated Species: Alectoria ochroleuca, Cornicularia divergens, Dactylina arctica, Stereocaulon spp., Cetraria islandica, C. nivalis, C. cucullata, Peltigera spp., and Nephroma spp.

Stage V: Climax.

Lichen Cover: 5 to 6.
Average Height: Over 4 inches.
Dominants: Cladonia alpestris or C. alpestris and C. rangiferina.
Associated Species: Cladonia sylvatica, Alectoria ochroleuca, Cetraria nivalis, and C. cucullata.

Evaluation of Units Examined.

Transects, field notes, and aerial observations provided the information needed to evaluate most of the range units examined last summer. Fifty-eight transects were run and these were distributed among the units as follows:

Unit 2 - 3	Unit 8 - 4
" 4 - 4	" 9 - 6
" 5 - 21	" 12 - 8
" 6 - 11	" 13 - 1

The quantitative data gathered in regard to lichen growth and distribution provides the basis for only a general evaluation, because to gain a more exact one the transects will have to be distributed among the various vegetation types according to their existing proportion in each unit. The descriptions below summarize what is known about the lichen growth in six of the units, namely Units 2, 5, 6, 9, 12, and 13. A more complete discussion will be possible after all of the units have been examined, for then relative differences will be apparent and a base can be established from which to judge range condition and utilization.

Unit 2. Monahan Flat is composed mostly of vegetation that has advanced or is advancing from marsh and bog conditions. Excellent lichen growth covers much of the area, composed mostly of Group I and II lichens (Table 1), 2 to 4 inches in height. As a whole the area would be classed as being in Stage IIIb in regard to lichens. Much less than one percent of the ground shows evidence of disturbance by caribou. The unit is progressing to the climax stage, and at present contains much lichen forage.

Unit 5. The Deadman Lake region consists mostly of the Heath vegetation type, decumbent and exposed to the wind in most places. Lichen growth has deteriorated noticeably, and the Group I lichens

have been and are being replaced by those of Groups II and III. At present the lichens would be considered as being in a low Stage IIIc, but regressing under heavy caribou use. Of 2,100 linear feet of ground examined by transects, 110.6 feet (5.3 percent) showed evidence of caribou disturbance; this suggests that about 5 percent of the ground cover has been damaged by caribou in this area. This unit shows signs of deterioration, and although much lichen forage remains the lichens could use a rest.

Unit 6. The Tangle Lakes region is comprised mostly of the Dwarf Birch vegetation type, one which probably can withstand more caribou usage than can others. Lichens cover over 50 percent of the ground, and consist mostly of those in Groups I and II, averaging 1 to 3 inches in height. Some sections show signs of moderate caribou use, and as a whole the area would be classed as being in Stage IIIc. The transects covered 1,100 linear feet, of which about 2 percent evidenced damage by caribou. The unit contains much lichen forage, and is progressing under moderate caribou usage toward the climax stage.

Unit 9. The Alphabet Hills are composed mostly of the Dwarf Birch and Heath types, the latter occupying most of the wind-exposed slopes. Lichen growth varies from poor to excellent, comprised of Groups I, II, and III, averaging 1 to 2 inches in height. The western half exhibits moderate deterioration and the eastern half, much less, but the overall condition of the lichens would place the area in Stage IIIc. About 5 percent of the 600 linear feet examined by transects showed evidence of damage by caribou. The unit still contains much lichen forage, but the lichen succession is regressing in some spots and progressing in others--more or less static in total lichen production.

Unit 12. The Kosina Creek-Oshetna River region is primarily a summer range and contains rather poor lichen growth. In general, the area would be classed as being in Stage IIc, with only a few sections still having good growths of Group I and II lichens. Caribou use the region extensively, and the ground cover is damaged in many places. This unit contains little lichen forage, and from all appearances the lichen growth seems to be regressing. Continued heavy usage probably will keep the lichens from developing.

Unit 13. The spruce-covered Lake Louise Flat has been a favored wintering ground in the past, and the heavy use has caused much deterioration in the lichen growth. Group I lichens are being replaced by those of Groups II and III, and the lichen mat has become

matted and cracked. At present the area could be classed as being in Stage IIIb. It is difficult to state whether lichen succession has regressed from a more advanced stage or merely remained more or less static due to fire and caribou usage. Much lichen forage remains, but a rest from fire and caribou would be desirable.

RECOMMENDATIONS

This range work is of the utmost importance to the management of the Nelchina caribou herd and, by extrapolation, to all the herds of Alaska. Most of the recommendations for future work outlined by Dr. Hanson, W3R, 12(4), remain to be solved, and to complete these will require many more years of study. The writer considers the following projects to rate priority in future planning:

1) Percent coverage of the major vegetation types within each of the range units.

2) Determination of lichen cover and conditions within each type within each unit.

3) Establishment of permanent quadrats in all of the range units, as described by Dr. Hanson.

4) Determination of the plants and major vegetation types utilized most by caribou during the various seasons.

Prepared by:

Ronald O. Skoog
Wildlife Management Biologist

Approved by:

Sigurd T. Olson
Acting Supervisor, Game Restoration

Date: April 30, 1959

JOB NO. 5--Winter Range Utilization--Nelchina Herd.

PERIOD COVERED: November 1, 1958, to April 30, 1959.

OBJECTIVES

1. To determine quantitatively the plant associations utilized most by caribou during their winter feeding.

2. To determine the food plants most frequently sought and eaten by caribou during the winter months.

3. To determine the percentage of ground actually disturbed and the amount of vegetation destroyed by the "pawing" of caribou during their winter feeding.

TECHNIQUES USED AND FINDINGS

No work was done on this job during the past fiscal year. The cessation of Federal Aid activities as a function of the U. S. Fish and Wildlife Service, scheduled for June, 1959, cancelled all extensive field work.

Prepared by:

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Wildlife Management Biologist

Approved by:

Sigurd T. Olson
Acting Supervisor of Game Restoration

Date: April 30, 1959