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Yukon Wildlife Branch

Dall sheep in the Richardson Mountains

— distribution, abundance and management concerns —

Manfred Hoefs

February 1978

DALL SHEEP IN THE RICHARDSON MOUNTAINS
- DISTRIBUTION, ABUNDANCE AND MANAGEMENT CONCERNS -

MANFRED HOEFS
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YUKON GAME BRANCH REPORT NO. 78-2

TABLE OF CONTENTS

INTRODUCTION

The Dempster Highway, a 300-mile highway connecting Dawson City in the Yukon Territory with Inuvik on the Mackenzie Delta, is nearing completion. It is scheduled to open for through-traffic in 1979.

Considerable controversy arose about the continuing construction during the last few years when it became known that this highway may have a significant impact on the wildlife population along its route - particularly on the migration and winter range use of the Porcupine caribou herd - and when environmentalists and other concerned interest groups became aware of the fact that no thorough environmental impact assessment had been made about this major construction project. Opposition to the completion of this project grew even stronger, when plans were made public to use the Dempster route for a possible lateral gas pipeline to connect the gas fields in the Mackenzie Delta area with the proposed Alaska Highway Gas Pipeline.

Very little quantitative information exists about wildlife populations along the Dempster Highway route. This past season, 1977, marked the beginning of cooperative studies between the Yukon Game Branch and the Federal Department of Indian Affairs and Northern Development, Northern Roads and Airstrips Division, with the objective to eventually fill these gaps in our knowledge. Studies that began in 1977 cover a reconnaissance of raptor nesting sites along the Dempster route, the initiation of a major behaviour study on the Porcupine caribou herd and its relation to the Dempster Highway, and, lastly, a survey of

Dall Sheep populations in the Richardson Mountains. The completion of these studies as well as others on grizzly and fur bearers, which are still in the planning stage, will help to finalize and implement a management plan for the Dempster Highway. This management plan will attempt to strike an acceptable compromise between the intended use of this highway - traffic - on the one hand, and the conservation of wildlife and the traditional life style of native people in the area, who still depend on wildlife for their livelihood, on the other.

The study reported on here deals with the Dall Sheep populations in the Richardson Mountains. While Dall Sheep also inhabit other areas along the Dempster Highway - for instance portions of the Ogilvie Ranges, it was felt that those in the Richardson Mountains have priority at this time, since the highway is now under construction through the Richardson Mountains, and two large contractor's camps will be located in that area for the next 18 months.

This assessment of the Dall Sheep populations in the Richardson Mountains has tried to satisfy the concerns of two agencies: D.I.A.N.D., Northern Roads and Airstrips Division, is interested in sheep populations in proximity to the highway route, particularly the construction area, and in recommendations on how to minimize possible adverse effects of the highway on these animals.

The Yukon Game Branch is interested in the distribution and abundance of sheep over the entire Richardson Mountains, as part of their territory-wide inventory of big game. They are concerned not only about possible impacts by the Dempster Highway, but also about excessive hunting pressure in the northern Richardson Mountains. Simmons (1973) made an evaluation of native harvest of the sheep on the Mt. Goodenough

area and concluded that the harvest was in excess of the sustainable yield and predicted a population decline if control measures were not implemented by the N.W.T. Game Branch. Mt. Goodenough is in the N.W.T. and not under the jurisdiction of the Yukon Game Branch; but it is known that the sheep that winter around Mt. Goodenough move west in spring and up to 160 have been counted on the Yukon side of the border in summer and fall. This sheep population is therefore an "inter-territorial" resource, and the Yukon Game Branch has some responsibility in assuring that it is properly managed.

The objectives of this investigation were, therefore, the following:

a) Carry out surveys, review the literature and consult with other biologists familiar with the area from other investigations, to assess the distribution and abundance of Dall Sheep in the Richardson Mountains.

b) If possible, define discrete populations and delineate their ranges.

c) If sheep are located in proximity to the Dempster Highway route, make recommendations regarding highway construction and management.

d) Re-evaluate the concerns expressed by Simmons (1973) regarding overharvesting of sheep in the northern Richardson Mountains.

e) Evaluate whether the present Yukon hunting regulation allowing for a 3 months open sheep season in Game Management Zone 1 is justified.

f) Make recommendations regarding further studies, if such are necessary.

In this cooperative study, the Federal Government contributed $15,000 in Operation and Maintenance money, primarily to cover aircraft rental and the purchase of aircraft fuel, and the Game Branch contributed staff, equipment, and about $5,000 Operation and Maintenance funding for surveys in the northern Richardson Mountains.

METHODS AND MATERIALS

The information presented in this report is based on aerial surveys conducted by the writer during the 1977 season, a review on existing reports for the area, and personal communication with other biologists, who have worked in the area previously, primarily in connection with other studies on the effects of proposed pipeline routes on the Porcupine caribou herd.

The Yukon Game Branch conducted surveys in the British Mountains from July 21 to August 20, 1977, for birds of prey and sheep, and from September 4 to 20, 1977, for caribou and sheep. During the July - August surveys, a Bell 206A (Jet Ranger) of Trans North Turbo Air Ltd. was used. The pilot was Lorne Osborn. Sheep surveys at this time were carried out by the writer with assistance of Lenard Mychasiw and Wayne Nelson, both temporary summer employees of the Yukon Game Branch. During September surveys, a Hiller 12E helicopter of Yukon Air was

contracted. The pilot was Jan Blancke. During these surveys the writer was assisted by Ted Wagner of the Yukon Game Branch. Additional information was obtained by biologists Don Russell and John Russell, who surveyed in southern Richardson Mountains for caribou distribution in February, 1978.

Since flights were combined whenever possible to save costs, it is diffidult to calculate how many hours were flown specifically on sheep surveys, but the following is a close estimate: 25 hours with the Bell 206 in July, and 15 hours with the Hiller 12E in September. In addition, half of the ferry time of both these aircraft from their Whitehorse base had to be financed from the sheep study budget.

During sheep surveys in the northern Yukon the navigator, who was also principal observer, was seated to the left of the pilot. The area to be surveyed was divided into physiographic divisions on a 1:250,000 scale topographic map. Each survey unit was then covered by flying around it in a counter-clockwise direction at an elevation appropriate to the prevailing relief. This means that the elevation of the aircraft and the distance of it from the mountain were such that the observers could keep surveillance over the slopes as well as over the ridge tops and plateaus. Wherever this was not possible with one pass, several were made at different altitudes. The route flown and the observations made were marked on the map. An intercom system between the principal observer, his assistant and the pilot allowed a verification of all sightings; and if there was disagreement, another overflight was made. Nowlan *et al* (1977) essentially used the same method in his surveys of the Mt. Goodenough Dall Sheep population

in the northern Richardson Mountains, and refers to it as "drainage-pattern flight techniques."

Since this study deals primarily with an assessment of distribution and abundance of sheep in the Richardson Mountains, a tentative delineation of populations and ranges, and with an evaluation of the possible impact of the Dempster Highway on the sheep, and only secondarily with population dynamics, only a very crude classification of the sheep observed was made.

Sheep were divided into three categories: a) mature rams (these include all rams of three years of age and older); b) members of nursery bands - for the sake of brevity referred to as "ewes" on flight notes - (which includes ewes, yearlings, and two-year old rams); and c) lambs. This broad classification could usually be accomplished by one overflight, thereby preventing unnecessary disturbance of the sheep, which are very sensitive to harassment by helicopter. Detailed flight notes were written up after each survey, and those dealing specifically or mostly with sheep are attached as an appendix to this report.

When outlining the ranges for the populations on the attached maps, not only direct observations but also previous information on sheep distribution was taken into account, as well as indirect evidence such as trails and droppings. The numbers on the maps refer to the numbers observed in the respective locations.

CLASSIFICATION USED DURING AERIAL SURVEYS:

Band of "mature" rams, which are usually occupying different parts of the range than "nursery" bands during summer and fall.

"Nursery" band, which may consist of ewes, yearlings, young rams and lambs. In this case only ewes and lambs.

RESULTS AND DISCUSSION

DALL SHEEP IN THE SOUTHERN RICHARDSON MOUNTAINS

A. THE CANYON CREEK POPULATION

A small sheep population occupies the southern extremity of the Richardson Mountains. Its range has been tentatively outlined on the map attached. It is bordered approximately by the following prominent landmarks: Mount Richards (+3107) in the southwest, an unnamed peak (+3849) in the east, and by another unnamed peak (+3667) in the northwest. The range has a size of about 200 sq. mi. It is drained by Canyon Creek and a number of unnamed tributaries as well as by the headwaters of Doll Creek. The outline of this population's range was determined by three flights into the area (July 24 - 25/77 and February 11/78) and by consulting caribou biologists who have made surveys in the area in years past (Lortie, Russell - personal communication, and DeBock in Renewable Resources Consulting Services, 1971).

Only 19 sheep were located during summer surveys, four mature rams, ten ewes, yearlings and young rams, and five lambs. Nineteen sheep were located on February 11, 1978, 5 rams, 6 ewes, 1 yearling and 5 lambs, plus 2 unclassified sheep. This population is not only small but also widely dispersed. The only 'concentration area' is a canyon cut by Canyon Creek through the narrow eastern portion of the Richardson Mountains, where 14 sheep were located during one of the flights. The steep canyon walls, consisting of folded sedimentary rocks, serve as escape terrain, some winter range on the south-facing sides and most

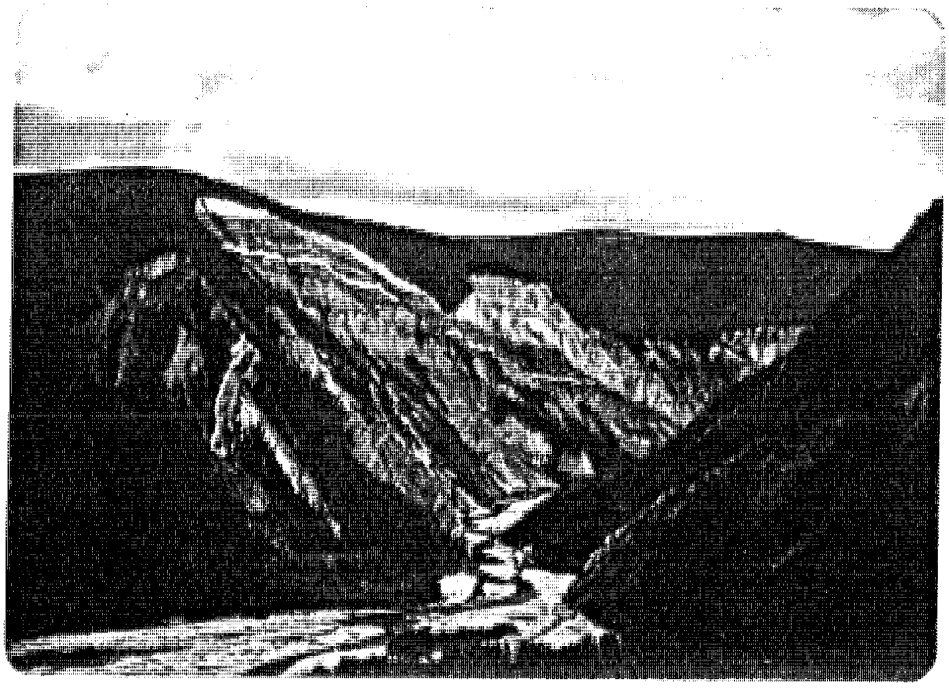
likely lambing areas. At least no other area as suitable and characteristic was located in this population's range. Most of the terrain is made up of gently-rolling hills much more suitable for caribou than for sheep. Additional good sheep habitat - even though very limited in size - is found farther to the southeast, particularly in the headwaters of Doll Creek. The number of sheep counted in this area has always been small. Lortie (personal communication) saw about a dozen. DeBock counted 13 in 1971. Considering the lack of winter range in this area in close proximity to escape terrain, I doubt whether the total sheep population will be higher than 25 to 30 animals.

It appears to be a distinct population, since it has been observed in the general area off and on for the past six years, and sheep are known to be traditional animals and not 'wanderers'. The nearest population to the north - the Mt. Cronin population - is more than 30 miles away.

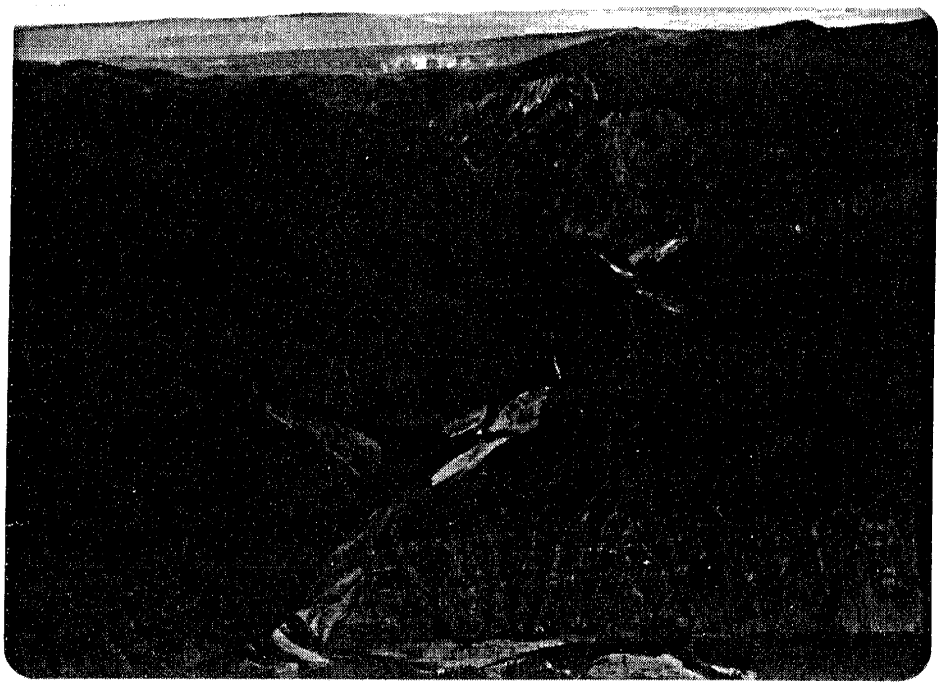
As far as is known, this little population is at present not hunted, even though hunting is legally possible and three small lakes within the population's range make it accessible by float plane. It is recommended to close the sheep season in this area until it is known what kind of sustainable hunting pressure such small, northern populations can be exposed to.

It is doubtful that the Dempster Highway will have any adverse effect on this small population, since its only known 'critical' area - the canyon - is about 20 miles away from the road, and the intervening country is forested and difficult to cross. Disturbance of low-flying aircraft during lambing time is a possibility, but could be handled by regulation.

HABITAT OF "CANYON CREEK" DALL SHEEP POPULATION



Canyon photographed from west. Steep cliffs provide escape terrain, some patches of winter range and most likely lambing sites.



Canyon photographed from east. The gentle slopes above the Canyon (left side of photo) are used as summer range.

B. THE MT. CRONIN POPULATION

A medium-sized sheep population occupies the central portion of the Richardson Mountains. Its range, outlined on the attached map, is similar in extent to that of the Canyon Creek population - about 200 sq. mi. - and is bordered by the following physiographic features: the headwaters of the Rock River and those of an unnamed tributary to the Road River in the south, Vittrekua River and an unnamed tributary to the Rock River in the north. It extends across the entire Richardson Mountains Range, which at this location is only about 12 miles in width.

A small winter range of the population was located along the creek draining into the Road River, and it is therefore realistic to assume that this is a discrete population, and not part of the northern sheep population that winters around Mt. Goodenough. The fact that not only rams were located here - which may migrate over long distances, but also ewes with lambs, supports this conclusion.

Two surveys were made of this population. The best survey was made on July 25, 1977. Fifty-eight sheep were classified as follows: eight mature rams, and 37 ewes, yearlings and young rams accompanied by 13 lambs. Since this population is at present not exposed to any kind of hunting pressure, except for the occasional sheep that may be taken by Ft. McPherson caribou hunters, it is reasonable to assume that at least some rams were missed during our surveys. Based on sex ratios in other unhunted populations it is reasonable to estimate that there will be at least 20 rams in this population, separate from nursery bands. The total population is, therefore, assumed to be at least 70 animals.

In contrast to the remaining northern sheep to be dealt with, the Mount Cronin, as well as the Canyon Creek population discussed before, remain in Yukon year around. This may become an important factor in future management of these herds.

In contrast to the Canyon Creek population and the more northern sheep, this population will most definitely be affected by the Dempster Highway unless certain regulations are implemented in time. The Dempster Highway route skirts the western boundary of this population's range, several sheep were located within four miles of the route, and could easily be observed from the road because of the open terrain. This portion of the Dempster Highway is located above timberline. Few, if any, sheep populations in the Yukon are so accessible from the road, since the altitude of the road (2000') and the height of the sheep ranges (3000') necessitate a climb of only 1000' which every hunter in good physical condition can handle in one or two hours. This situation is made worse by the fact that the distribution of these sheep over their range during the hunting season is considered traditional in unhunted populations (Geist, 1971a). The mature rams occupy the western portion of the range close to the highway while the nursery bands range farther to the east. They are ten or more miles away from the highway route and should therefore not be affected at this time (July - August).

A small winter range was located on the ~~west~~ east side of the range along one of the Tetlit creeks draining into the Road River. One ewe was seen in the creek bottom, which is unusual for this time of year (July), unless no water is available at higher elevation or a mineral lick is located in that area. The type of terrain did not allow

landing and inspection of the area. However, this winter range is too small to support the entire population. Surveys at this time of the year did not lend themselves to the locating of winter ranges, lambing areas or mineral licks, even though some information could be obtained if time permitted work on the ground.

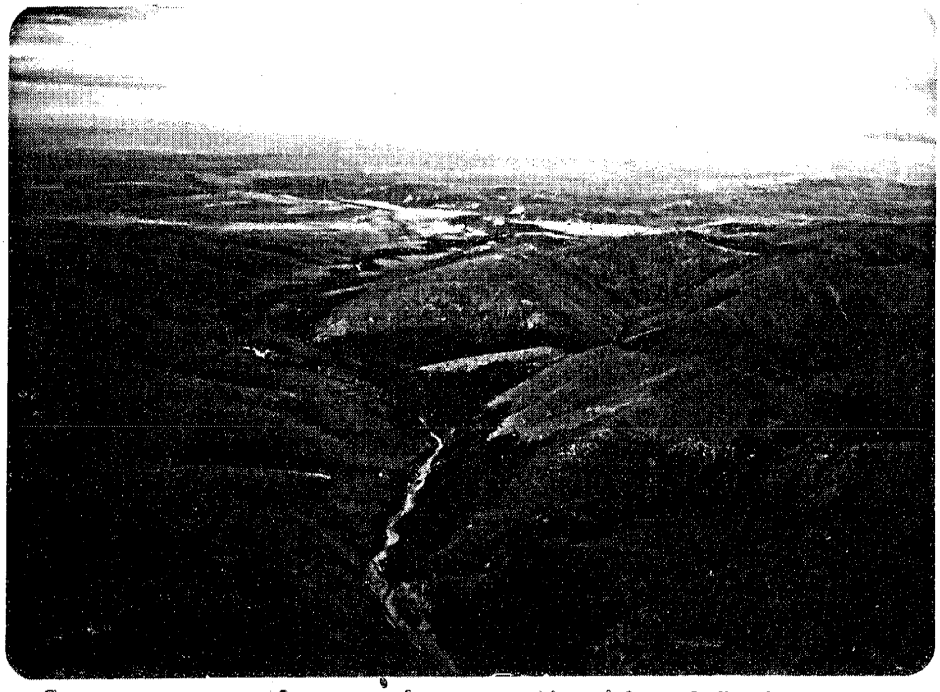
The possible effects on this population by the Dempster Highway, presently under construction in this location, will be dealt with in another section of this report.

For a number of reasons, it is recommended that the Yukon Game Branch includes this small population in their group of "study" populations, which are monitored annually to assess productivity, winter mortality and population trends.

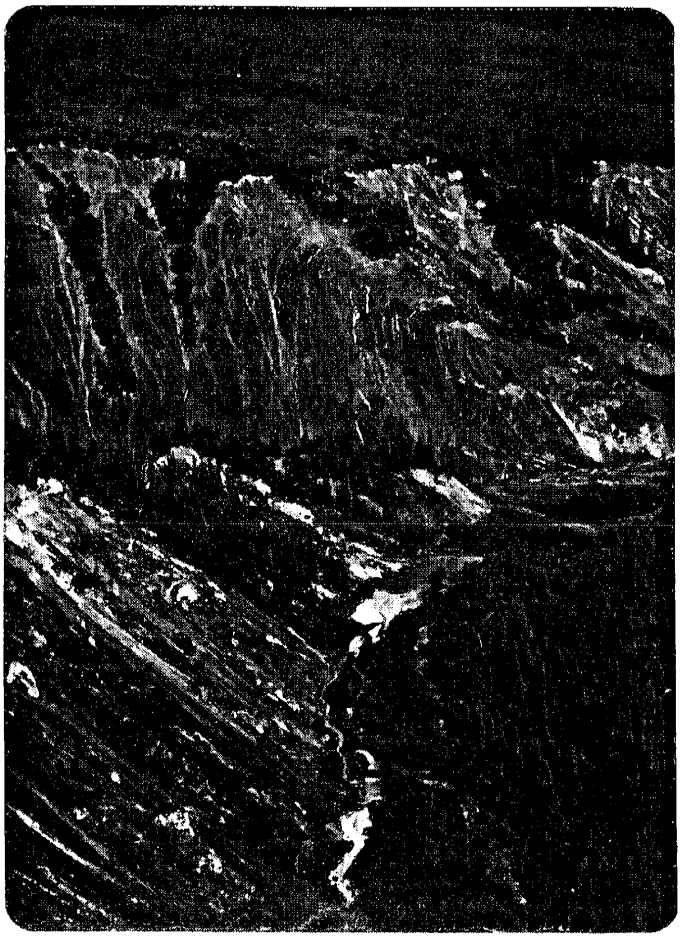
1) It has not been subject to hunting, therefore we are dealing with a naturally-balanced system.
2) It is the northern-most sheep population in the Yukon which consists entirely of "resident" sheep. Sheep in the northern Richardsons are for the most only summer visitors from the N.W.T., and those in the British Mountains spend part of their time in Alaska.

   Experimental work with these sheep can therefore be done without objections from outside agencies.
3) As already pointed out, it is the only sheep population in the Richardson Mountains which may be adversely affected by the Dempster Highway, continuous monitoring of their performance is therefore important, and further studies in relation to the Dempster Highway are recommended in another section of this report.

HABITAT OF "MT. CRONIN" DALL SHEEP POPULATION



Summer range of rams along north side of Rock River close to Dempster Highway route.



One of the winter ranges of this population along a creek draining into the Road River.

This is also the location of a mineral lick.

4) The accessibility of this population provided by the Dempster Highway makes this proposed monitoring a relatively cheap undertaking. A lot of work can be done by hiking.

DALL SHEEP IN THE NORTHERN RICHARDSON MOUNTAINS

It has been known for a long time that Dall Sheep occupy parts of the northern Richardson Mountains, since the native people of Aklavik and, to a lesser degree, those of Ft. McPherson occasionally hunt them incidentally to their annual winter excursion into caribou country. However, little was known about the size of the population and the extent of its range until the early 1970's, when several counts were made in the area in connection with proposed pipeline routes. DeBock (Renewable Resources Ltd., 1971) surveyed the area in July, 1971. He lumped all the sheep encountered north of the Rock River and obtained a total number of 337 with the following breakdown: 43 rams, 94 ewes, 12 yearlings, 82 lambs and 196 unclassified sheep. However, on the map showing the sheep distribution he divided this total known sheep range into three distinct sub-ranges: a large one located north of Rat Pass and extending from Bell River in the west eastward to the Mackenzie Delta, a small one south of Rat Pass and another small one just north of the Rock River. Nowlan *et al*, 1977, made several counts during 1972 and 1973 and lumped all the sheep of the northern Richardson Mountains, but excluded those of the Rock River area. His highest count was made during July 12 - 14, 1972, when he

observed a total of 450 sheep with the following classification: 105 rams, 208 ewes, 14 yearlings, 89 lambs and 34 unclassified sheep. The count by Nowlan *et al* (1977) is still the highest ever obtained for the area. Additional counts over part of the area were made by Simmons (1973) and by Hoffman (1974). Based on count by Nowlan *et al* (1977), Simmons (1973) estimates the total population size in the northern Richardson Mountains at 500 in summer 1972. Since some of these counts extended over much larger areas in search of caribou, they have been fairly reliable in delineating the extent of the sheep range in the northern Richardson Mountains. It is known that Mt. Goodenough is an important winter range of the population, that the northern extremities of the sheep range are the Willow River and the headwaters of Cache Creek and Fish River and that the Bell River is a fairly good western boundary. Sheep are also found south of Rat Pass at least to the headwaters of a river, which drains into the Bell River about four miles northeast of Lapierre House. On some maps this river has been erroneously referred to as Rat River. This unnamed river, which will tentatively serve as the southern boundary of the sheep range in the northern Richardson Mountains is about eighteen miles north of the Dempster Highway crossing. The nearest band of sheep on this range was during our 1977 summer surveys twenty-six miles north of the Dempster Highway. It is, therefore, reasonable to say that there will be no direct impact of the Dempster on these northern sheep populations.

This distribution based on counts in the early 1970's has essentially been verified during our 1977, July and September surveys, with a few minor exceptions. We do know now that sheep cross the Bell River at least in summer. Mossop (1974) observed 23 nursery sheep and 5 lambs crossing the Bell River from west to east about five miles north from its junction with the creek that drains Summit Lake. On September 7, 1977, when returning from a caribou survey in the Cache Creek area the writer and Ted Wagner of the Yukon Game Branch, saw a band of about twelve sheep on a mountain range some twelve miles west of the Bell River. The location is marked on the accompanying map and its approximate coordinates are as follows: 137° 16' west and 67° 52' north. On the other hand, no sheep were located in the headwaters of Cache Creek or Fish River, even though sheep were hunted in these areas in the late 1960's and early 1970's by natives from Aklavik (Simmons, 1973). Our best count for this area north of the Dempster Highway crossing, based on July and September surveys, was 242 sheep with the following classification: 53 rams, 134 ewes plus yearlings, and 55 lambs. Of these sheep, 182 were observed north of Rat Pass and 60 south of Rat Pass and a total of 58 were on the west side of the Yukon/N.W.T. boundary on July 27, 1977. It is difficult to estimate how high the total population is at present. We have used survey techniques that have proven successful and reliable on many previous sheep counts, and we have covered the area which previous investigators have outlined as the range of the "Mt. Goodenough"

population. During caribou and falcon surveys we have covered many of the surrounding areas. It is unlikely that we missed many sheep. I do not think that there are 500 sheep in the area. An optomistic and hopeful estimate may be 300.

Previous investigations have lumped all these sheep together and referred to them as the "Mt. Goodenough" population. I think this is unrealistic. Enough information is available to show that there is more than one population, even though populations are not as well defined as those in the southern Richardson Mountains and considerable mixing may take place at certain times of the year.

There are many ways in which a population can be defined. If genetics and evolution are considered important it could be defined as a number of sheep sharing the same rutting area and are separated at that time from other such rutting areas. However, when it comes to sheep, the use of winter ranges and lambing areas is more practical. Most lambing areas are associated with winter ranges and most sheep, at least the nursery bands, return to it every winter. During 1972, the total sheep number in the northern Richardson Mountains was estimated at 500 (Simmons, 1973). However, Nowlan (1977) estimated that only about 150 to 180 sheep used the Mt. Goodenough area as winter range. November (20 - 23, 1973) and March (13 - 22, 1973) surveys showed that the other sheep were found widely dispersed to the west as far and beyond the Yukon boundary. Some were located south of Rat Pass.

Surveys carried out during lambing time by Nowlan *et al*, 1977, show the same pattern of distribution. The 1972 survey showed at

least 222 ewes and yearlings, however, observation during lambing time in spring, 1973 documented a high of only 83 ewes and yearlings, using the Mt. Goodenough area as lambing ground. It is, therefore, reasonable to predict that we are dealing here with more than one population, even though the one using the Mt. Goodenough area as winter range and lambing ground is definitely the most important one and the largest.

I have tentatively divided these sheep into two populations: a large one - numbering perhaps 220 to 240 animals at this time - occupying the extensive area north of Rat Pass - essentially from Mt. Goodenough in the east to the Bell River and beyond in the west, and have referred to it as the "Mt. Goodenough" population, and a smaller one using the area south of Rat Pass and numbering perhaps 70 to 80 sheep. It has been referred to as the "Mount Millen" population because this prominent peak is within this population's range.

The arbitrary decision to make the sheep south of Rat Pass into a distinct population is based on the following reasoning:

a) Sheep have been observed in this area in every survey at different times of the year.

b) According to Simmons (1973) the Aklavik native people may take sheep in late winter incidental to caribou hunts at that time. He cites Sheep Creek as one of the important areas where sheep are taken, and where a known total of 62 have been taken between 1968 to 1973. Sheep Creek drains part of the range of the "Mt. Millen" population. This is further evidence that sheep winter in the area.

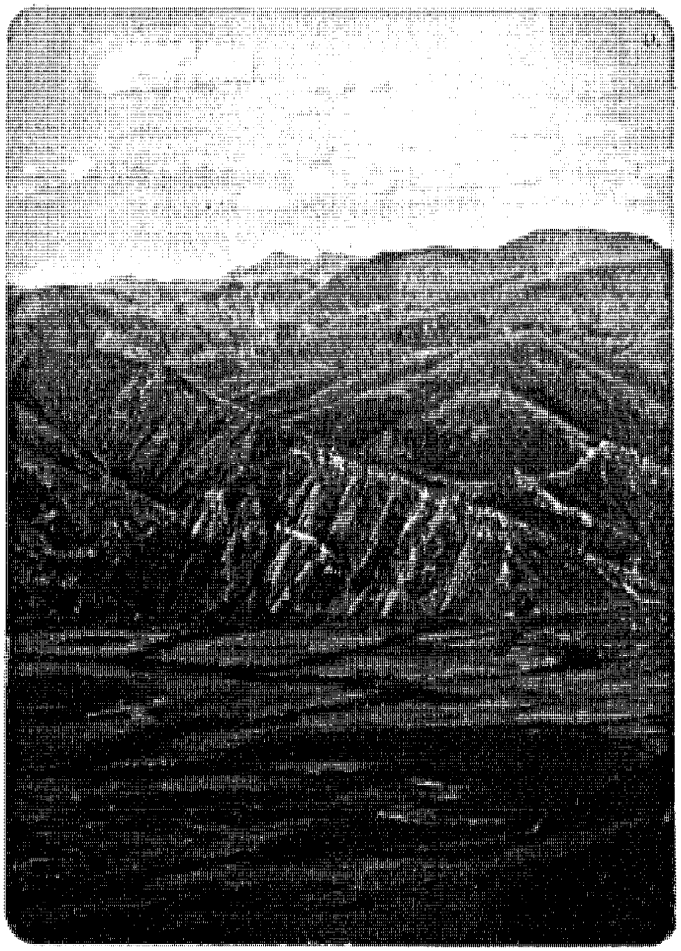
c) The distance between the summer distribution of these sheep and the Mt. Goodenough winter ranges and lambing areas is between 35 and 50 miles. It is highly unlikely that migrations of these magnitudes are undertaken by these sheep. The longest known annual migration distance for Dall Sheep is that of the Tonzona River population in Alaska which migrates thirty miles (Jones *et al*, 1965).

d) The structure of this sheep population - 20 rams, 27 ewes and yearlings and 13 lambs - is a natural, "complete" structure. It does not indicate that the sheep ranges south of Rat Pass are either ram or nursery summer grounds.

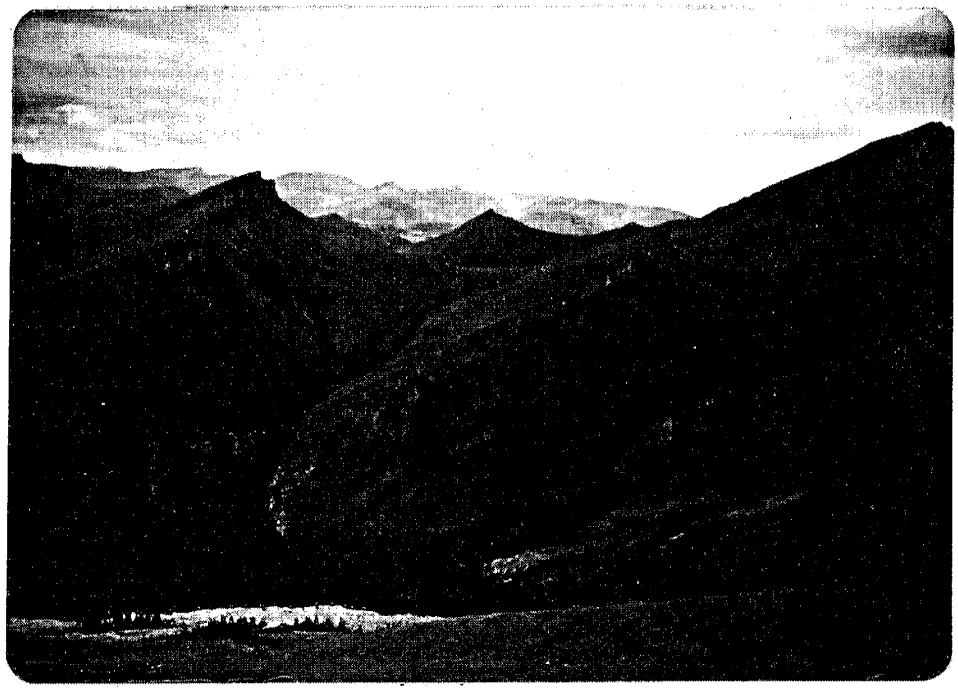
e) DeBock (Renewable Resources, 1971) also separates this population's range from the larger range north of Rat Pass.

f) Evidence has been presented, based on total counts and on the number of sheep using Mt. Goodenough for wintering and lambing, that we are dealing with more than one population. While the crossing of Rat Pass from north to south and vice versa is by no means impossible for sheep, it is more dangerous and therefore less likely than the crossings of any of the water courses that drain the large area north of Rat Pass. The wide valley of the Pass, its lakes, and marshes, make it a very distinct boundary.

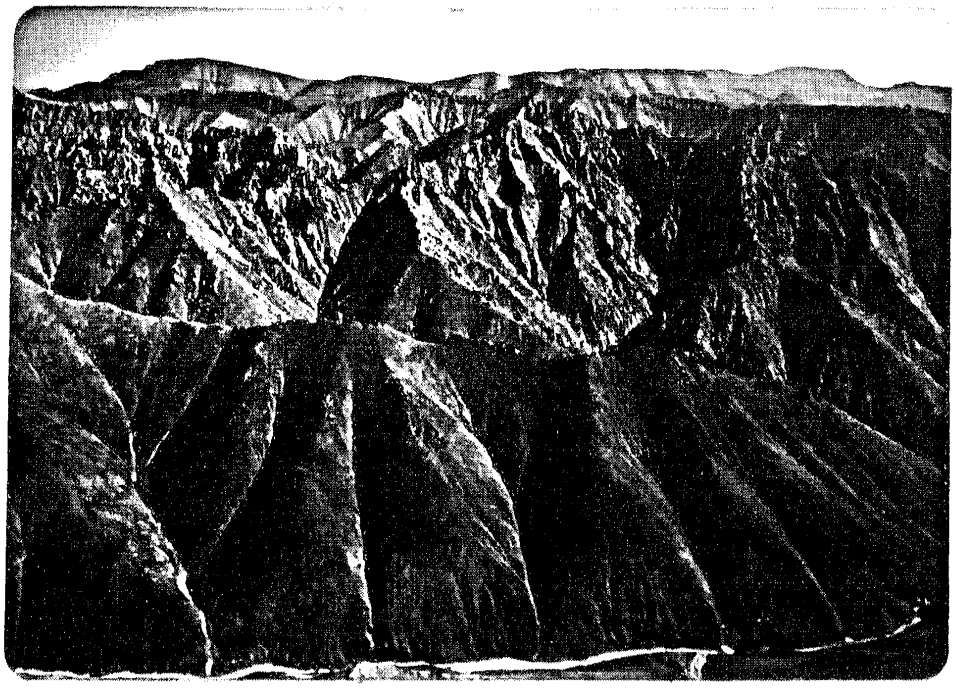
SHEEP RANGE SOUTH "RAT PASS"



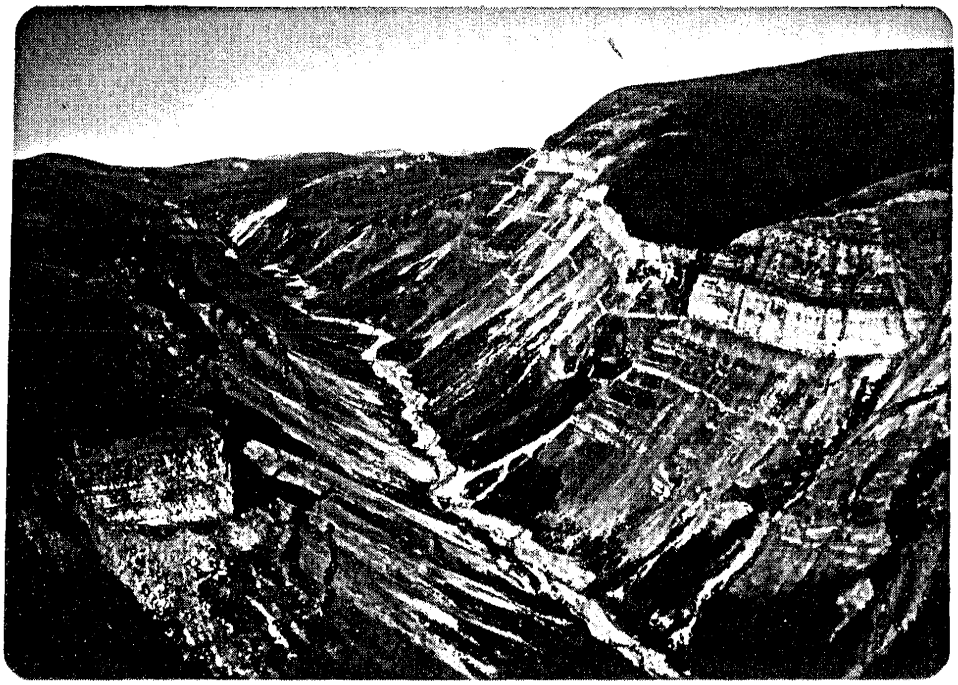
Sheep utilizing these mountains may be part of the "Mt. Good-enough" population; or may be year-round residents of the area and part of the "Mt. Millen" population.



HABITAT OF "MT. GOODENOUGH" DALL SHEEP POPULATION



Western-most summer range, along headwaters of Bell River west of "White Mountains".



One of the important winter ranges of this population in Mt. Goodenough area.

The question may be asked, "why so much 'fuss' about population definition?" The reason is that the Yukon Game Branch is concerned about these northern sheep. Their numbers have decreased during these last five years and this decrease appears to be the result of over-harvesting. Much more refined management methods may become necessary, with the assigning of quotas and similar techniques, which can only be done at the population level. A separate section of this report deals specifically with this management concern.

In summary, the sheep of the northern Richardson Mountains have been divided tentatively into two populations and the following table summarizes the relevant parameters.

Population	Location* of range	Numbers Counted ♂♂	♀+yrl.	lbs.	sum	Total Number Estimated
"Mt. Goodenough"	North of Rat Pass	33	107	42	182	220 - 240
"Mt. Millen"	South of Rat Pass	20	27	13	60	70 - 80

*See attached maps for detail.

PRODUCTIVITY OF THE SHEEP POPULATION

Productivity can be defined as the recruitment into the adult population of animals of breeding age. Sheep in most populations studied reached sexual maturity at 2.5 years of age and have their first lamb when they are three years old. In some high quality populations, or in

captive sheep that obtain highly nutritious supplementary feed, breeding age may be reached when the animals are eighteen months old. Our crude classification, which only divided the population into adults and lambs and did not separate the yearlings, does not allow us to assess productivity. However, birth rate also is a good indicator of population quality and is often indicative of recruitment or productivity. Table 1 summarizes the classifications obtained for the four "tentative" populations described in this assessment. For comparison counts made in previous years by Nowlan *et al* (1977) and by DeBock (Renewable Resources, 1971) are given, as well as counts done on other - more southern - sheep populations during this past season. The "Canyon Creek" population data are not used in this discussion since they are known to be incomplete. I have also great hesitations in using DeBock's (Renewable Resources, 1971) data of the Mount Goodenough population for the following two reasons: a) a significant portion of the population (106 sheep) was not classified. It is known that ewes with lambs have a tendency to form bands while ewes without lambs also group up. There is, therefore, a good possibility that DeBock's classified count was not representative. b) There appears to be some contradiction between DeBock's data collected during the summer of 1971, and Nowlan's data collected from the same population in 1972. DeBock came up with the unusually high lamb to ewe ratio of 87:100, the highest that I am aware of from extensive literature reviews, while during the following summer Nowlan established a yearling to ewe ratio of only 7:100. If both these counts are reliable, then the 1971 lamb crop was completely wiped out. More than 90% of the lambs alive in July, 1971, had died by July, 1972.

TABLE I: Structure of the Richardson Mountains Sheep Populations compared to Previous Assessments, and compared to those of other Yukon Sheep Populations during the Same Years.

POPULATION	SURVEY DATE	RAMS	EWES**	LAMBS	TOTAL	LAMBS 100 EWES**	OBSERVER
Mt. Goodenough	July 27/77	26	94	35	155	37:100	Hoefs
Mt. Goodenough	Sept 16/77	33	107	42	182	39:100	Wagner
Mt. Millen	July 26/77	20	27	13	60	48:100	Hoefs
Mt. Cronin	July 25/77	8	37	13	58	35:100	Hoefs
Canyon Creek	July 25/77	4	10	5	19	50:100	Hoefs
Mt. Goodenough	July 12-14/72	105	222	89	416	40:100	Nolan & Kelsall (1977)
Mt. Goodenough & Mt. Millen	Summer 1971	43	106	82	213*	77:100	Renewable Resources Consulting Services (1971)
White Mountains (Central Yukon)	July 30/77	8	21	10	39	48:100	Hoefs
MacArthur (Central Yukon)	July 30/77	14	38	13	65	34:100	Hoefs
Miners Range (Southern Yukon)	Aug. 19/77	23	89	27	139	30:100	Hoefs
Sifton Range (Southern Yukon)	Aug. 18/77	28	57	26	111	46:100	Hoefs

** "ewes" includes yearlings as well as young rams (usually only 2-year olds) that were in nursery bands.

* In this survey there were 106 unclassified sheep, the inclusion of which might have changed the structure of the population.

Natality rates, expressed as lambs per 100 ewes (ewes includes yearlings), in the Richardson Mountains sheep ranged from 35:100 for the "Mt. Cronin" population to 48:100 for the "Mt. Millen" population in 1977. The best count done for the "Mt. Goodenough" population on September 16, 1977 revealed a ratio of 39:100. This is almost identical to the ratio obtained by Nolan *et al* (1977) in 1972 for the same population with 40:100. These birth rates are comparable to those of four study populations in the central and southern Yukon, which are monitored every year and are shown in Table 1 for comparisons. As the following review of the literature will reveal these ratios are average to fair, but a note of caution is appropriate. As least in the southern Yukon we experienced an exceptional mild winter in 1976/77 and reproductive performance of sheep as well as of other ungulate population was also exceptionally good. We do not know anything about the winter conditions in the Richardson Mountains during 1976/77, but it is advisable not to consider the 1977 lamb crops as average and normal. They may have been exceptional too.

A survey of the literature indicated that there is great variation in the reproductive performance of different northern sheep populations, and of the same population in different years. The following brief review cites some examples to demonstrate the ranges observed.

One of the highest birth rates observed is that of a Stone sheep population in northern British Columbia. Luckhurst (1973) reported an average lamb:ewe ratio of 74%, in which two year old ewes were included. He estimated that the ratio of lambs to ewes in

reproductive age may have been as high as 91%. Egorov (1967) observed a 74% ratio in Snow sheep in Yakutia. Simmons (personal communication) found a lamb to ewe ratio of 69% in the Mackenzie Mountains. Scott *et al* (1950) reported a ratio of 70% for sheep populations on the Kenai Peninsula in Alaska. Palmer (1941) observed a 66.9% ratio in the Mt. Hayes area of Alaska. Erickson (1970) and Jones (1963) found ratios of 63.5% and 50% respectively in the Dry Creek area of Alaska. A number of investigators observed ratios of around 50%. Murie (1944) in Mt. McKinley Park, Alaska: 50% and 49% in 1939 and 1940 respectively; Jones (1965) on the Kenai Peninsula: 54%; Nichols and Smith (1971) in the Dry Creek area: 55% and Jones (1965) in the same area, only 39%.

The range of variation between different years in the same population can be appreciated from Rausch and Jones (1966), who observed a ratio of 50.2% and 67.4% in 1962 and 1963 respectively in the Chisana-Nabesna area of Alaska, and from Pitzman (1969), who reported 64% and 43.8% for 1966 and 1967 respectively, for a sheep population on the Kenai National Moose Range. Pitzman's (1969) percentages are a true indication of natality rates, since he did not include two year old ewes in the calculation. The writer observed the lambing performance of the Sheep Mountain Dall Sheep population in Kluane National Park during 1969 to 1973 inclusive. During these five years, the best lamb crop was observed in 1971 with 47 lambs per 100 "nursery sheep" and the lowest in 1973 with 28 lambs per 100 "nursery sheep". "Nursery sheep" includes yearlings and two year olds (Hoefs, 1975).

The lowest ratios observed came from Cherniavski (1962) with 28.8% for Snow Sheep from the Koryak Highlands (Siberia), and from Nichols and Heimer (1972) for two areas in southern Alaska. They observed on Surprise Mountain ratios of 14% and 18% in 1970 and 1971 respectively, and in "Copper Landing Closed Area" 21% and 38% in the same years.

Comparisons to these data would classify to reproductive performance of the Richardson Mountains sheep populations as average. However, as already pointed out, recruitment into the adult population has not been investigated, and it is the latter we must know, if we want to compute the sustainable yield levels these populations could be exposed to. The only two "yearling" counts made so far - DeBock in 1971 with a yearling to ewe ratio of 13:100 and Nowlan in 1972 with a ratio of only 7:100 are very alarming in this respect.

DURATION AND TIMING OF LAMBING PERIOD

It is generally accepted by biologists that lambing is one of the most critical periods of the annual life history cycle of a sheep population. If a population is threatened by man-made developments, it is, therefore, of utmost importance that the lambing areas are located and the lambing periods established, so that construction activity can be routed and scheduled in a manner to minimize possible adverse affects on the population. As already pointed out, the "Mt Cronin" population is the one most directly affected by the location of the Dempster Highway, and therefore in most urgent need for assessment.

Manpower and budget restrictions did not allow us to locate the lambing ground and establish the lambing period, but extrapolations are possible as far as the latter is concerned. Nolan *et al* (1977) made an attempt to determine the lambing period of the Mt. Goodenough population in the spring of 1973. They surveyed the known lambing grounds on May 19, May 26, and June 20, 1973. Their lamb:adult (ewes and yearlings) ratios for these three survey dates were 16:100, 28:100 and 32:100. They concluded that lambing in the study area apparently began about May 15 and was estimated to extend to about June 15, with the peak of lambing probably occurring in late May. While three surveys may not be enough to determine these parameters with certainty, they are adequate to detect the trend.

The only detailed population study on sheep in the Yukon was done by the writer on the Sheep Mountain population in Kluane National Park (Hoefs, 1975). The lambing period of this population was monitored in detail during 1971 and 1972. In 1971 the first two lambs were born on May 2, the last lamb on June 2. In 1972 the first lamb was born on April 30 and the last lamb on June 2. If we define as "peak" of the lambing period the day when half of the year's lambs have been born, it was May 19 in 1971 and May 18 in 1972. The third week of May was in both years the week when most lambs were born.

Table 2 summarizes the progression of lambing on the Mt. Goodenough population and compares it to that of the Sheep Mountain population. Even though the observation dates for Mt. Goodenough are not as closely spaced as those from Sheep Mountain, it is reasonable to estimate then the lambing period is about 10 - 14

TABLE 2: PROGRESSION OF LAMBING PERIOD IN MT. GOODENOUGH POPULATION COMPARED TO SHEEP MT. POPULATION

Dall Sheep Population	Year of lambing	Observed lamb:ewe* ratios April 30	May 2	May 19	May 26	June 2	June 20	Author
Mt. Goodenough	1973	--	--	16:100	28:100	?	32:100	Nolan *et al* (1977)
Sheep Mt.	1971	--	2:125	23:125	46:125	50:125	50:125	Hoefs (1975)
Sheep Mt.	1972	1:122	1:122	24:122	33:122	40:122	40:122	Hoefs (1975)

* ewe includes yearlings and two-year olds.

days later in the Mt. Goodenough population.

A review of the lambing periods of Alaskan sheep population also indicates that there appears to be a positive correlation between the latitude of a sheep population's range and the "lateness" of the season when the lambs are born. This makes sense, since lambs will be born at the time of the year most advantageous for their survival, and there is at least a two week delay in the phenological progression between Sheep Mountain and Mt. Goodenough. Observations made of lambing in the Ogilvie Mountains by outfitter S. Reynolds (personal communication, as well as cites by Nolan, 1977), support this correlation. The first lamb was observed on May 9, 1973. S. Reynolds' outfitting area is about 300 miles north of Sheep Mountain, where the first lambs are born around May 1st (Hoefs, 1975) and 200 miles south of Mt. Goodenough were the first lambs are born around May 15 (Nolan *et al*, 1977).

The writer also observed during five lambing periods (1969 - 1973) that these periods are very predictable in time for a given population with little if any variation from year to year. The time of lambing is determined by the time of conception (rutting period) and not by the weather during the lambing period.

Keeping in mind the geographical correlation described above and the observed absence of significant annual variation, it is reasonable to predict that the lambing period around Mt. Cronin, being located about 100 miles south of Mt. Goodenough, will be very similar to the "Mt. Goodenough population"; with first lambs born and peak periods reached perhaps two or three days earlier.

SHEEP DENSITIES - RICHARDSON MOUNTAINS

The attached Table 3 summarizes the sheep densities observed on Richardson Mountains ranges and compares it to other Yukon, Alaskan and N.W.T sheep ranges.

The two tentative populations in the northern Richardson Mountains occupy together a total known area of about 1,000 square miles. It is estimated that there are at present perhaps 300 sheep in both these populations given a density of 0.30 sheep per square mile or one sheep per three square miles of range.

The same density was observed on the range of the Mt. Cronin population in the southern Richardson Mountains, where an estimated seventy sheep occupy about 200 square miles. The Canyon Creek population has not been included in this discussion since population size and extent of range are at present little more than an educated guess.

These densities are very low compared to those reported for other areas in the Yukon and Alaska. Even when the northern Richardson Mountains sheep population stood at 500 (Simmons, 1973), their density was only 0.50 sheep per square mile. Most good sheep populations in the southern Yukon and Alaska have densities of three to four sheep per square mile. An exceptional high density of eight sheep per square mile has been reported in the Steele Creek area in Kluane National Park (Hoefs, 1973). On the other hand, Simmons (1969) reports a very low density of 0.34 sheep per square mile for two game management zones (12 and 19) in the Mackenzie Mountains of the

TABLE 3 DENSITIES OBSERVED ON DALL SHEEP RANGES

Population or Area	Survey date	Estimates total population size	Total range size in square mile	Year-round sheep densities	Authors
Northern Richardson Mts., "Mt. Goodenough" and "Mt. Millen" populations	1977	300	1000	0.30	Hoefs, 1977 (present study)
"	1972	500	1000	0.50	Simmons, 1973
Southern Richardson Mts., "Mt. Cronin" population	1977	70	200	0.29	Hoefs, 1977 (present study)
Mackenzie Mountains, N.W.T. GMZ 12 & 19	1969	94*	450	0.34 **	Simmons, 1969
Kluane Range "Sheep Mt." population	1969-1973	250	64	3.9	Hoefs, 1975
Kluane Park "Donjek Range"	1972-1973	1200	250	4.8	Hoefs, 1973
Kluane Park "Steele Creek" population	1972-1973	400	50	8.0	Hoefs, 1973
Yukon GMZ 5 ***	1975	4600	3000	1.5	Hoefs, 1975 b
Crescent Mt. Kenai, Alaska	1970	287	82	3.5	Nichols & Smith 1971
Copper Landing Kenai, Alaska	1970	311	81	3.8	Nichols & Smith 1971
Mt. Hayes area Alaska	1940	915	265	3.5	Palmer, 1941

* This is an actual count, no total population estimation given
** This is the average density, the range is from 0.00 to 0.72
*** Game Management Zone 5, includes several population in Ruby, Nisling and Dawson Ranges

Northwest Territories. However, many of the sub-units in these game management zones surveyed had no sheep at all. Those which did have sheep populations probably had higher densities. Those zones also support resident mountain caribou populations, which may reduce the carrying capacity of the area for sheep by competition for summer range.

Density is not a very useful management statistic. For it to be reliable, requires a good knowledge of the total range a population uses, which often takes years of observation to determine. Many total ranges may include substantial sections which are never used by the animals. For instance, we did not observe any sheep in the "White Mountains", which are within the total range of the "Mt. Goodenough" population. Perhaps the sheep use this area at other times, but the lack of vegetation makes this doubtful. The animal numbers also vary considerably within a year and between years. Ungulate populations are usually highest in early summer after the periods of births are completed, and are lowest in late winter. Productivity and winter mortality differ between years and result in population fluctuations. Lastly, density data for one species may not necessarily reflect the carrying capacity of the land. There are areas in the southern Yukon where sheep share their range with goats, and there are many areas which sheep co-inhabit with mountain caribou or barrenground caribou at least at certain times of the year. Sheep in the Richardson Mountains may share their range with caribou of the Porcupine herd. During the 1977 survey such range sharing was observed for the "Mt. Goodenough" population in July, August and September.

With these factors in mind, density figures must be interpreted very carefully. Nevertheless, the densities observed in the

Richardson Mountains are low. This can be expected since - all other factors being equal - biological productivity decreases with latitudes. I do not agree with the following statement made by Watson *et al* (1973): "Dall Sheep range does not decrease in quality at higher latitudes. In fact, low precipitation and extreme cold helps to limit snow depth and crusting, permitting unrestricted movement in many areas during the winter months." Such a sweeping statement should be substantiated in more detail. There are other limiting factors than the few climatological ones mentioned.

Winter observations show that these northern sheep are just as concentrated on winter ranges as those in southern populations. They do not make use of this opportunity of "unrestricted movement into many areas". Extreme cold may help to prevent crusting but it also increases the radiative heat loss by the sheep, thereby forcing them to use up their fat reserves at a faster rate. The growing season is shorter in the north and therefore, the time when highly nutritious forage is available. It is this highly nutritious forage that sheep must have to be able to store fat for the winter. Long hours of darkness - or even continuous darkness for sometime - may be a handicap in the locating of feeding areas and in the avoidance of predators.

Considerable more work needs to be done on these northern sheep, particularly with respect to winter behavior and physiology, before we can made a valid comparison between northern and southern sheep ranges.

MANAGEMENT PROBLEMS

A) Potential Impact of the Dempster Highway on the "Mount Cronin" Dall Sheep Population

Of the four sheep populations in the Richardson Mountains, whose ranges have been tentatively outlined in this report, only the "Mt. Cronin" one comes into direct contact with the Dempster Highway. The ~~eastern~~ western boundary of this populations' range is paralleled by the Dempster route at least between the Rock River crossing in the south (Mile 269) and the crossings of an unnamed tributary to the Rock River (Mile 278) in the north, for a distance of about nine miles. Further studies may show that this population ranges even farther to the south, perhaps as far as Mt. Hare, since the physiography is very similar. However, we have, so far, no evidence of this.

This portion of the Dempster Highway is as yet not completed. Construction companies are working on this unfinished section from the north as well as from the south, and the tentative completion date is the summer of 1979.

This sheep population may, therefore, be effected, not only by the increased access provided through this highway, but also by the construction activity itself. The impact on the sheep may be direct or indirect. The latter type includes such activities as destruction of critical wintering ranges, mineral lick sites, migration routes and perhaps lambing areas. Unfortunately only one of these critical areas is known, therefore, no recommendations regarding highway routing or borrow pit locating are possible at this time.

Direct impacts include various forms of harassment, increased hunting pressure and the various stimuli accompanying construction activity, if such activity is within sight, or smelling and hearing distance of the sheep. Into the latter category belong the noise and smell of heavy machinery, the movements of vehicles, the lights illuminating construction sites and camps, and most importantly, infrequent, unexpected loud noises like rock blasting or the passing by of a helicopter.

There is general agreement that sheep are more sensitive to disturbance than other large mammals which may come into contact with construction activities (Foothills, 1976; McCourt *et al*, 1974; Interdisciplinary Systems, 1977). Experimental work was done on the effects of noise disturbance on Dall Sheep in the Mt. Goodenough area in the northern Richardson Mountains by McCourt *et al*, 1974. The investigators set up a sound simulator which imitated the noise of a gas compressor station. They found that the sheep changed their regular bedding and feeding periods, that they changed their range within one mile of the sound simulator. McCourt *et al*, 1974, conclude their findings as follows: "Reactions to helicopter and sound simulator noise disturbance can probably be extrapolated to potential disturbance by construction equipment. Therefore, besides the need for caution in the selection of compressor station sites, the location of borrow pit sites and the timing of construction in the vicinity of a Dall Sheep range will have to be carefully planned". From this experiment it is reasonable to conclude that sheep will adversely react to construction activity with a noise level comparable to that of a gas compressor station at least one mile on either side of the pipeline right-of-way, and that this "corridor of negative response" will be considerably wider than two miles with noise levels

of a greater magnitude, for instance those accompanying rock blasting.

Of equal, if not greater concern to the wildlife manager, however, are the disturbances created in the back-country far beyond the narrow construction corridor - since disturbance by construction activity itself can usually be minimized by proper scheduling of such activities. Disturbance of the sheep in the back-country could be created by large numbers of people invading it on foot or by the use of all-terrain vehicles and snowmobiles, but most importantly by the use of aircraft, particularly that of helicopter. Sheep appear to be particularly sensitive to noise disturbance. Geist (1975) speculates that loud noises frighten sheep as well as other mountain ungulates because they can resemble sounds made by decending avalanches and rock slides.

Aircraft disturbance of wildlife is generally recognized as a major concern accompanying development activities in remote areas (Foothills, 1976; Geist, 1971b; Klein, 1973). This problem is particularly severe with social animals like sheep and caribou (Foothills, 1976; Calef and Lortie, 1973; McCourt and Horstman, 1974; Surrendi and DeBock, 1976; Calef, DeBock and Lortie, 1976). It is also generally agreed upon that helicopters frighten animals more than fixed-wing aircraft (Klein, 1973; McCourt *et al*, 1974).

"The direct effect of harassment is usually flight by the animals which may result in excessive expenditure of energy, possible injury or accidental death, fragmentation of social structures (including separation of mothers and offspring), withdrawal from critical habitat and decreased reproductive performance " (Foothills, 1976). Disturbance during winter can be particularly harmful. Because the nutritional status of pregnant ewes influences the conditions of lambs at birth and their survival, harassment and displacement from winter ranges can severely depress birth rates and increase mortality

(Geist, 1971b, 1971c). Disturbances on lambing areas can have similar results (Interdisciplinary Studies, 1977).

Considerable experimental work has been done on the effects of aircraft on caribou (McCourt *et al*, 1974; Surrendi and DeBock, 1976; Calef, DeBock and Lortie, 1976). There appears to be general agreement that aircraft overflights in excess of 1000 feet do not disturb caribou. Sheep are known to be much more sensitive than caribou, even though no experimental work has been done to enable us to recommend safe overflight altitudes. What little is known on this subject has been summarized by Interdisciplinary Studies (1977) as follows: "The anticipated increase in irregular aircraft overflights, especially of helicopters, is expected to cause moderate disturbance in alpine and subalpine areas of the corridor in both summer and winter. This will be a problem especially if efforts are made to observe sheep closely from aircraft. Lenarz (1974) found 85 percent of sheep reacted to a nearby FH-1100 helicopter. McCourt *et al* (1974) found helicopter operating near sheep caused temporary range evacuation, displacement of bedding activities and changes in the regularity and distribution of activities. A greater use of talus slopes by sheep was also observed during the period of helicopter disturbance. Similarly, Price (1972) and Reynolds (1974) found sheep reacted to helicopters up to 1km away. A helicopter flight over a band of sheep caused visible disturbance and agitation for nearly half an hour. The most serious effect was observed when a helicopter at low altitude circled a band of sheep (Price, 1972). Irregular aircraft traffic produces much greater disruption than regular, frequent flights (Geist, 1975)."

However, it should also be pointed out that sheep can habituate to strange, but frequent and harmless, stimuli (Geist, 1975). From National Parks like Banff and Jasper we know that sheep as well as other big game species have got accustomed to large numbers of people, to roads and the heavy traffic. There are reports from Alaska of Dall Sheep living in active strip mines (Geist, 1975). The secret behind these observations is that sheep have learnt that people are harmless in these areas. This process of habituation, however, is a very slow and gradual one; too slow a behavioral response to make use of during the construction phase of the Dempster Highway. On the other hand, however, these abilities of sheep could and should be made use of after the highway is completed. By preventing hunting and by controlling the influx of hikers in a manner which would result in a very slow and gradual build-up, these sheep will habituate to people and traffic and will become one of the attractions of this road. The open country and the low mountains along the Dempster in this area are ideally suited to provide good visibility to the traveller.

The following recommendations are made to prevent adverse effect of Dempster-related activities on the "Mt. Cronin" sheep population:

1. Take immediate steps to establish whether the unfinished portion of the Dempster, and associated planned borrow pits, airstrips, etc. come into close contact with "critical" segments of sheep range, like mineral licks, lambing areas or winter ranges, and important migration trails.

2. If investigations show that this is the case, make recommendations as to the routing of the road, the locations or borrow pits, etc. and to the timing of construction activities to prevent or minimize the destruction of such

critical areas and the direct disturbance of sheep using them.

3. Stop the hunting season on sheep in the area.

4. Stop construction workers from hiking into the back-country in this area.

5. Restrict the use of aircraft, particularly helicopter to direct flight along the Dempster corridor at an altitude of at least 2000 feet above the height of the mountains.

B) Mt. Goodenough and Mt. Millen populations and hunting pressure

In 1972, N. Simmons made an assessment of the status of Dall Sheep in the northern Richardson Mountains and expressed concerns about the possibility of overharvesting of these sheep by the native villagers of Aklavik and Ft. McPherson (Simmons, 1973). Simmons recommended to the N.W.T. Fish and Wildlife Service to assess annually hunter success by area, dates and locations of kill, and sex and ages of the animals taken. Simmons also suggested to monitor the abundance and reproductive performance of the sheep and to discuss with the native hunters and trappers associations the possibility and the consequences of overharvests. Simmons had found that the annual take of sheep had more than doubled from 1968 to 1973 and was in 1973 11% in excess of the assumed annual increment rate of the population. Based on surveys done by Nowlan *et al* (1977), Simmons estimated the total sheep population at 500 at that time.

During our July, 1977, survey we only located 242 sheep, and it is doubtful whether more than 300 sheep inhabit this range at present. We are certain that the sheep population has declined over this 5-year period, and we are convinced that hunters' kill has been a contributing factor.

We do not know how important a factor it was, since detailed data on harvest statistics or sheep population parameters for that 5-year period are not available. Table 4 summarizes the information on harvest statistics we could obtain. Simmons' (1973) data are based on interviews with hunters; the other sources list "recorded" harvests. These are incomplete because of incomplete returns of licenses. The variations between these data sources are too great to allow us to venture any assessment.

I am inclined to believe Simmons' figure for 1972/73 and Hawkin's for 1976/77. Simmons did his survey in 1972/73 and the hunters interviewed probably remember what sheep were shot that season, while the information for previous years is probably less reliable. For the same reasons, I think that Hawkin's 1976/77 statistics are fairly good. We do not know what happened in the three intervening years. The recorded kill is low, but is based on perhaps only 50% license returns. There is the possibility of a true reduction in harvest because of the concerns expressed by N. Simmons in 1973, but there is also the possibility of not reporting the harvest or underestimating it intentionally for the same reason. The performance of the sheep population points to the latter.

It is unfortunate that recommendations made by Simmons in 1973 were not implemented.

While we cannot, with certainty, point to overharvest as the reason for population decline we can venture an educated guess.

I cannot support Simmons' (1973) assumption that equates a yearling increment of 11% into the adult population with a safe removal rate - a higher harvest rate, as was the case in 1973, would result in a population decline. I think that a 11% harvest rate could result in a population decline and that a harvest rate of around 5% would be more realistic and maintain the population at a given level.

TABLE 4. Harvest Statistics for Dall Sheep of the Northern Richardson Mountains.

Winter	(1) Cleghorn 1977	(2) Simmons 1973	(3) Stephenson 1978	(4) Hawkins 1978	(5) Estimated Total Kill
1966/67	23	-			25
1967/68	5	25			28
1968/69	59	16			65
1969/70	25	30			33
1970/71	33	39			43
1971/72	22	40	22		44
1972/73	34	62	30		68
1973/74	6		6		?
1974/75			6		?
1975/76			21		?
1976/77	40			49 - 54	59

(1) Letter of W.G. Cleghron, Chief of Northern Roads and Airstrips Division, Ottawa, to Yukon Conservation Society (See Appendix).

(2) Simmons (1973): Dall's Sheep harvest in the Richardson Mountains, Northwest Territories. Canadian Wildlife Service.

(3) Letter of B. Stephenson, N.W.T. Fish and Wildlife Service to M. Hoefs (See Appendix).

(4) Letter of R. Hawkins, N.W.T. Fish and Wildlife Service to M. Hoefs (See Appendix).

(5) Estimated total harvest is an educated guess based on the highest reported kill for that year plus an assumed 10% crippling loss.

My reasoning is based on the following facts:

1) Simmons' (1973) figure of a yearly recruitment of 11% is based on his population studies of sheep in the Mackenzie Mountains. Recruitment rates for only two years are available for the northern Richardson Mountain sheep, and they are much lower than 11%. DeBock (Renewable Resources, 1971) established a yearling to ewe ratio in 1971 of only 13:100, which works out to be about 5% yearlings in the total population, and Nowlan *et al* (1977) established an even poorer ratio in 1972 with 7 yearlings per 100 ewes, or a yearling segment in the entire population of about 3%.

2) We cannot equate yearling recruitment with safe removal rate. Sheep are not shot as soon as they reach yearling age; it would be disastrous to the population if they were. Simmons (1973) classified the hunters' harvest of 188 sheep into 65 rams, 86 ewes and 37 unclassified juveniles. Only the latter group of 37 were most likely yearlings, since most hunting took place in late winter. This is only about 20% of the total number of animals shot. The others were adult ewes and rams of varying ages, most likely a random or representative fraction of the adult population structure, since native hunting is for meat and not for trophies. The average age of these sheep will most likely be comparable to the average age of the adult population, perhaps around 5 years, since our data support that on the one hand, recruitment is low; while on the other hand, selective trophy hunting has not removed old rams.

Natural mortality takes place between the yearling age group and the 5-year old cohort. We do not know this mortality rate is in this population. In the Sheep Mountain population in Kluane Park it was 12% (Hoefs, 1975). In any event, the fact that the average age of the sheep shot is higher than yearling age, reduces the sustainable yield this population can be exposed to a lower rate because of natural mortality.

3) The fact that there appears to be a higher number of ewes shot than rams makes things worse. Simmons (1973) lists 86 ewes shot for 65 rams. This practice cuts into the breeding stock with the result that sustainable yield rates referred to above may not be applicable since the anticipated recruitment rate does not take place.

4) I am personally of the opinion that northern sheep populations are usually stable, with natural mortality balancing recruitment rate. A number of sheep populations are annually monitored in the Yukon, and we are not aware of any drastic fluctuations. It appears that the size and the quality of winter ranges determine population sizes. Hunting mortality, particularly if it affects the entire population and is not restricted to old rams, whose remaining life expectancy is low, is additive to natural mortality and not compensatory.

We are, therefore, dealing with a greatly increased mortality rate in this population. In order to remain stable this would have to be compensated for by an equally high recruitment rate. In contrast to moose or deer, sheep have few options open to accomplish this.

Natality can not be boosted up by an increase in twinning rate. It is highly unlikely that the age of sexual maturity could be lowered from three to two years. What is possible, but needs to be documented for this population, is that the survival of the lambs to recruitment age becomes greater as the population density decreases.

With these facts in mind, I am convinced that a 5% harvest rate is all this population can be exposed to. It is unfortunate that the population statistics as well as the harvest figures are incomplete; otherwise the effects of a 11% vs 5% harvest rate could be tested.

It is recommended that hunting of the Mt. Millen population be halted. Sheep in this population appear to spend most of their time in the Yukon, and the Yukon Game Branch should have some say in this matter. It is one of the objectives of the Yukon Game Branch to harvest populations on the basis of sustainable yield.

The Mt. Goodenough population is under the jurisdiction of the N.W.T. Fish and Wildlife Service. All we can do is to recommend that concerns expressed by Simmons in 1973 are taken seriously and that his recommendations are implemented.

SUMMARY AND RECOMMENDATIONS

1) The Dall Sheep in the Richardson Mountains have tentatively been divided into four populations: Two occupying the southern Richardson Mountains - south of the Dempster Highway crossing - and two inhabiting the northern Richardson Mountains.

2) The populations are named after prominent land marks within their ranges and the estimates of population sizes are at present (1977) as follows:

"Mt. Goodenough"	population:	220 - 240 sheep
"Mt. Millen"	"	70 - 80 sheep
"Mt. Cronin"	"	65 - 70 sheep
"Canyon Creek"	"	25 - 30 sheep

3) While indirect effects of the Dempster Highway on all four populations are possible because of improved access, only the "Mt. Cronin" population could be directly affected, if mitigative measures are implemented in time. The Dempster Highway parallels the western boundary of this population's range for at least nine miles and perhaps for as much as 20 miles.

4) Immediate assessments are recommended for the Mt. Cronin population to determine critical areas such as winter ranges, locations of mineral licks, lambing grounds and migration routes in proximity to the highway, which is in this location as yet not constructed (1978). Based on these studies mitigative measures can be recommended to minimize adverse effects of construction activities on these sheep.

5) It is recommended to terminate the hunting season on sheep in the Richardson Mountains (Game Management Zone 1) for the following reasons. The three populations under jurisdiction of the Yukon Game Branch are very small and no studies have so far been done to determine what kind of harvest removal rate - if any - these northern populations could be exposed to.
The Mt. Cronin population should be managed for non-consumptive use (aesthetics, sight-seeing, photography and scientific study).

6) Our reconnaissance indicates that the sheep in the northern Richardson Mountains have declined and that over-harvesting was most likely a contributing factor. It is recommended that all hunting is stopped in the "Mt. Millen" population, whose range is mostly under Yukon jurisdiction, until this population has recovered to former levels. The "Mt. Goodenough" population is under the jurisdiction of the N.W.T. Fish and Wildlife Service. It is suggested that recommendations made by Simmons as early as 1973, with respect to the precarious state of these sheep, should finally be implemented.

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ACKNOWLEDGMENTS

I am grateful to the following people for directly assisting with this investigation and for making available supplementary information: B. Stephenson and R. Hawkins of the N.W.T. Fish and Wildlife Service for providing harvest statistics; D. Mossop, G. Lortie, J. Russell, D. Russell and W. Nelson of the Yukon Game Branch and M. Dennington and D. Nowlan of C.W.S. for making available unpublished information, and to T. Wagner and L. Mychasiw for their very capable help with the fieldwork. The reliability and flying skill of our two helicopter pilots, Lorne Osborn of Trans North and Jan Blancke of Yukon Air was greatly appreciated. Last but not least we are thankful to Dr. V. Hume, D.I.A.N.D., Northern Roads and Airstrips Division, for making federal funds available to assist with this investigation. Dr. G. Hartman, Director of the Yukon Game Branch, edited an earlier version of this report.

APPENDICES

1. Letter of B. Stephenson, N.W.T. Fish and Wildlife Service to M. Hoefs regarding sheep and caribou harvest statistics (March 1, 1978).
2. Letter of R. Hawkins, N.W.T. Fish and Wildlife Service to M. Hoefs regarding sheep harvest information (February 23, 1978).
3. Letter of W.G. Cleghorn, Northern Roads and Airstrips Division, to M. Williams, Yukon Conservation Society, regarding sheep harvest in the Richardson Mountains.
4. Flight note on sheep survey by D. Mossop, August 28, 1974.

5. Flight notes on sheep surveys by M. Hoefs:
   5a - July 22, 1977
   5b - July 25, 1977
   5c - July 26, 1977
   5d - July 27, 1977

6. Flight note on sheep survey by T. Wagner, September 16, 1977.

7. Flight note on sheep survey by D. Russell, February 15, 1978.

8. Map of Richardson Mountains showing sheep distribution (attached in folder).

GOVERNMENT OF THE NORTHWEST TERRITORIES
CANADA

PLEASE QUOTE

FILE 15 005 035
15 005 006

Yellowknife, N.W.T.
X1A 2L9

1 March 1978.

Dr. Manfred Hoeff,
Assistant Director,
Wildlife Branch,
Gov't. of the Yukon Territory,
Box 2703
Whitehorse, Yukon Territory.
Y1A 2C6

Sheep and Caribou Harvest Statistics

Dear Manfred:

Sorry for the delay in providing this meagre amount of information. I have been procrastinating in the hope of verifying and up-dating the data but this does not seem possible. For instance the returns for 1976-77 are not all in, and in 1974-75 we had only 47% return for Inuvik and Fort McPherson and 63% from Aklavik.

I understand that you have received some information from our Regional Superintendent at Inuvik which may assist you in your interpretation of these data.

Reported kill by General Hunting Licence holders:

Dall's Sheep

	1976-77	1975-76	1974-75	1973-74	1972-73	1971-72
Aklavik	-	20	6	6	30	22
Ft. McPherson	-	-	-	-	-	-
Inuvik	-	1	-	-	-	-

Caribou

Aklavik	24	145	917	775	674	614
Ft. McPherson	291	304	757	365	621	509
Inuvik	136	134	344	273	195	139

.....2

Resident Hunter Kill
(no Dall's Sheep taken by resident licence holders)

Caribou

	1976-77	1975-76	1974-75	1973-74	1972-73	1971-72
Aklavik	-	4	15	17		
Ft. McPherson	-	2	24	27		
Inuvik	6	5	5	1		

Prior to 1973-74 the kill was not broken down according to settlement.

I hope that this information will be of some use to you.

Yours truly,

B. Stephenson,
Supervisor,
Management Studies,
Fish and Wildlife,
Department of Natural and
Cultural Affairs.

CC. Regional Superintendent,
Fish and Wildlife Service,
Inuvik, N.W.T.

GOVERNMENT OF THE NORTHWEST TERRITORIES
CANADA

REFERRAL MEMO

15 005 035 | 2

1.

Manfred Hoefs, Yukon Game Branch	FROM: Ron Hawkins, Reg. Supt. NWT Fish & Wildlife Service
ON: Y. Terr. Govt., Whitehorse, YT.	LOCATION: Inuvik, NWT.
	DATE: 23 FEB 78

T Sheep Harvest Info.

NTS Manfred: Feast your eyes on our glutted file. This is the sum total of our offerrings, re- your request for 1973-77 info. I have asked that ellowknife (Bruce Stevenson) forward copies of anything pertinent they ay have. Sorry for the skimpy input.

Ron.

Y

(6/70)

TO ORIGINATE:
HAND OR TYPEWRITE MESSAGE - REMOVE PART 2 (FOLLOW-UP COPY) AND FORWARD BALANCE OF SET

TO REPLY:
WRITE REPLY, SNAP SET - RETAIN PART 1 AND RETURN PART 3

GOVERNMENT OF THE NORTHWEST TERRITORIES
CANADA

PLEASE QUOTE
FILE 63 003 095

Yellowknife,N.W.T.,
X0E 1Ho

13th September 1973

REGIONAL DIRECTOR,
INUVIK

Attention: Regional Game Management Officer

Dahl Sheep Kills - Mackenzie Delta

BACKGROUND

As you are aware we have been concerned about the possibly excessive Dahl Sheep kill by native hunters from Aklavik. This situation was originally reported to this office by Panel 10 of the Canadian Committee for the International Biological Program who were documenting a proposed reserve site in that area. Theefforts of your field staff to collect kill data havebeen most helpful in reviewing this situation. A copy of the draft report by Dr. Simmons is attached. It is confidential due to its preliminary nature and should be treated as such.

DATA

Briefly, the following data is relevant:

1. Kill Data

(a)	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73
Kill	25	16	30	39	40	62
No.of hunters			9	9	9	12

The above reflects an increasing kill, particularly last year, with essentially the same number of hunters involved. A three fold increase has occured since 1968-69 when kill by location was first available. It is of special interest that since 1968-69 almost 40% of the kill has been by two individuals (Messrs. J. Lennie & J. Carmichael).

....2

Aklavik, N.W.T.
XOE OAO

June 21, 1977

Measurements and recordings taken of Dall Sheep by General Hunting Licence holders this past winter 76/77 from Black Mountain.

Species	Sex	Approx. Age	Horn Measurements Left Length	Left Base	Right Length	Right Base	Horn Spread
Dall Sheep	M	7+	94 cm	34.5	95.5	34.0	69 cm
" "	M	3+					
" "	M	9+	102.5	37.0	100.0	35.5	71.5 cm
" "	M	7+	97.8	36.0	96.5	36.0	70.5 cm
" "	M	5+	81.0	32.0	80.5	32.0	63.5 cm

Also taken and jaws and teeth collected (enclosed)

Dall Sheep	M #1AK	28.5	28.0	
" "	F #2AK	17.0	21.0	
" "	M #3AK	23.0	23.5	
" "	F #4AK	21.0	21.0	
" "	M #5AK	26.0	27.0	
" "	F #5AK			
" "	M #7AK			
" "	M #8AK			
" "	F #9AK			
" "	F #10AK			
" "	F #11AK			
" "	F #14AK			

The following two were found in our warehouse - they have been cooked

Dall Sheep F #12AK

" " M #13AK

The following animals were known to be taken but no specimens obtained

Dall Sheep 6 females - 2 were apparently carrying fetus, these animals were taken around the end of February;

4 males were also taken around this time

Approximately 20-25 more animals were taken throughout the winter but could not collect any specimens or contact the hunters at the time to record what they took, if it weren't a big ram than they were all female to most hunters.

Indian and Northern Affairs | Affaires indiennes et du Nord

OTTAWA, Ontario K1A 0H4
May 30, 1977.

Your file Votre référence

Our file Notre référence

Mr. M. Williams,
President,
Yukon Conservation Society,
P.O. Box 4163,
Whitehorse, Y.T.

Dear Mr. Williams:

Thank you for your letter concerning the Dempster Highway and access to the Richardson Mountains.

Dall sheep have been hunted in the area of the Richardson Mountains for many years, and certainly long before the Dempster Highway was built. There is a tendency for people to resort to hunting dall sheep when they cannot find caribou. Most of the hunting for sheep is out of Aklavik by native people. Since hunting of dall sheep is restricted to people with general hunting licences, only a few non-natives and métis can take advantage of the privilege. The following figures show the recorded harvest since 1965-66; the total harvest is unknown.

YEAR	ANIMALS KILLED
1965-66	5
1966-67	23
1967-68	5
1968-69	59
1969-70	25
1970-71	33
1971-72	22
1972-73	34
1973-74	6
1976-77	40

At present there is no legislation preventing people from using snowmobiles to hunt in the Northwest Territories, nor from exporting meat provided they have a licence. The extent of the operation of flying carcasses from the Mobile Oil airstrip that you mentioned in your letter is being investigated.

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You made reference to a migration of caribou across the highway right-of-way in the unfinished section in the Richardson Mountains south to the Oglivie River. We were aware of this migration as well as the migration of another group of caribou across a finished portion of the road in the Northwest Territories earlier this month.

My Division has very recently received a request for support for a study of Dall sheep in the area of the Dempster from the Yukon Game Branch. This is the first time that the Branch has indicated that such a study is necessary. Money in this year's budget for environmental studies has already been allocated. However, the proposal is being given serious consideration, and we hope that a way of helping the study to be undertaken will be found.

From a practical point of view, it is not possible to deny access along the length of the Dempster. Already, residents in the Northwest Territories have complained because right-of-way was limited during construction last winter. This, and the current land claims issue makes it difficult to deny access of native people to land which they claim as theirs.

We recognise the significance of the Richardson Mountains for wildlife, but we believe that good management will help to ensure there is minimal interference with the animals when the road is opened in 1979.

Yours sincerely,

W. G. Cleghorn

W. G. Cleghorn,
Chief,
Northern Roads and
Airstrips Division,
Northern Affairs Program.

SHEEP SURVEY - Richardson Mountains, Summit Lake area

DATES:	August 24, 1974	August 28, 1974
PILOTS:	Kim Carswell	Charles Sorgard
OBSERVER:	D. Mossop	
SEARCH TIME:	2.0 hours	3.5 hours (total: 5.5)
WEATHER:	Clear	Some rain, clearing

Area searched:

Mountains to the west of the Bell River from five miles north of the junction with the creek running from Summit Lake, the east and south slopes. South of Summit Lake, the 3 first major creeks to their sources on the N.W.T. border. Two Oceans Creek and the next creek east in the N.W.T. were also surveyed. North of Summit Lake, the mountains east of the Little Bell River were surveyed only on their west slopes, and all mountains between the Bell and Little Bell rivers were surveyed. The area surveyed is approximately 175 square miles. The search route was mapped.

Sheep were found both north and south of Summit Lake although no nursery sheep were seen in the southern section. On August 24, 23 nursery sheep and 5 lambs were seen apparently crossing the Bell River from west to east about 5 miles north from its junction with the creek draining Summit Lake. Ewes and lambs were seen scattered

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in small groups throughout the mountains between the Bell and Little Bell rivers on the 28th. These were as follows:

GROUP	# NURSERY SHEEP	# LAMBS
1.	7	2
2.	3	0
3.	5	1
4.	6 (1 ram, calf)	0
5.	2	1
6.	3	2
TOTAL	26	6

A group of 6 large rams was seen southeast of Summit Lake and two other large rams were seen on a mountain east of the Little Bell River.

Coverage of this area should be considered of moderate intensity. The distance from a fuel supply made it impossible to spend the required time searching. In future years perhaps a fuel supply at Summit Lake would alleviate this problem.

Caribou were seen scattered in small groups throughout the area. A larger herd of approximately 1,000 animals was seen on the eastern fringes of the Richardson Mtns. on the 24th. Bull caribou were first seen shedding antler velvet here on the 28th.

WILDLIFE SURVEY IN DEMPSTER HIGHWAY AREA ON JULY 22, 1977

A reconnaissance flight was made with a Jet Ranger (206A) helicopter piloted by Lorne Osborn over the Ogilvie and Richardson Mountains in close proximity to the Dempster Highway. We flew a total of 7.0 hours, starting at 0815 to 1530 hours primarily to locate raptors and nesting sites, but we also checked up on the various fuel caches deposited for this survey and we kept an eye open for big game species, particularly sheep and caribou.

The fuel drums were located as ordered at Klondike, Ogilvie and Eagle river camps, as well as at Summit Lake. For this flight raptor expert Wayne Nelson served as navigator and recorder, while M. Hoefs and Len Mychasiw were observers. The weather was mostly overcast, with some sunshine as well as some showers. Our flight route started at Mile 42 Camp and extended along the west sdie of the Dempster to Summit Lake, while the return flight was done along the east side of that road.

The Dempster Highway is completed from the N.W.T. side all the way to the border, while construction on the Yukon side is completed about 20 miles past the Eagle River crossing. The summary will only discuss the big game species seen, thus Wayne Nelson will report on the raptors observed and the nest sites located.

One band of nursery sheep consisting of 7 adult and 2 lambs was located in the Ogilvie Mountain only about 6 miles west of the Dempster and about 5 miles north of the Ogilvie River. Two years ago two rams had been shot in this general area during the caribou season, after having crossed the Ogilvie River as well as the Highway near Mile 130. These two rams must have been members of this small population. No other sheep were observed in close proximity to the Highway. A total of 50 sheep in 5 different bands were located in the Richardson Mountains, north and south of the Dempster Highway Pass. One band of 6 rams were seen in the headwaters of Two-ocean Creek just 4 miles south of Summit Lake. Two bands of nursery sheep, numbering 14 and 6

respectively were located near Mount Millen some 16 miles south of Summit Lake and about 24 miles north of the Dempster Highway Pass. The other two bands of nursery sheep (about 1 dozen each) were located about 4 miles northeast of Mount Cronin, some 8 miles west of the proposed Dempster Highway location and some 20 miles south of the Dempster Highway Pass across the Richardson Mountains. The locations are shown (in red) on the accompanying map.

No caribou were located in the Richardson Mountains but one band of 4 mature bulls was seen in the Ogilvie Mts. just a couple of miles north of the Klondike camp (Mile 42). Other big game observations include 3 moose in shallow ponds and 1 grizzly bear in the Richardson Mountains.

Manfred Hoefs,
Asst. Director.

GAME SURVEY IN THE SOUTHERN RICHARDSON MOUNTAINS ON JULY 25, 1977

A total of 7.5 hours of helicopter time was spent today on a reconnaissance of sheep and raptors in the southern Richardson Mountains.

The area covered extended along the Dempster Highway from the Peel River in the south to the Dempter Highway crossing in the north, a distance of about 80 to 90 miles. A general survey had been carried out before and today's flying concentrated on those areas known to support sheep.

The morning flight (10:00 to 13:00) was done by Len Mychasiw and Wayne Nelson, while the afternoon flight (1425 to 1900) was done by M. Hoefs and Wayne Nelson. The Jet Ranger was piloted by Lorne Osborn. The weather was hot and calm with excellent visibility all day.

It appears now that two small sheep populations inhabit the southern Richardson Mountains. The southern one occupies the canyon area along Canyon Creek and may total 25 to 30 animals. Sheep were located in 4 separate bands with the following composition:

(1) 3 rams (mature)
(2) 1 ram (mature) 4 nursery sheep 2 lambs (in canyon area)
(3) 3 nursery sheep 1 lamb
(4) 3 nursery sheep 2 lambs (8 miles east of canyon)

The total known population therefore is 19 sheep, consisting of 4 rams (mature), 10 nursery sheep, and 5 lambs. It is possible that a few more sheep may have been missed, but judging from the size of the winter range along Canyon Creek, it cannot possibly support more than 25 to 30 animals. It is therefore assumed that our count is fairly reliable.

The second small dall sheep population in the southern Richardson Mountains is found in the general area of Mount Cronin and to the east of it for a distance of about 12 miles. A winter range and perhaps mineral licks was located along the headwaters

of a creek draining into Road River, east of the Richardson Mts. The distance of this winter range from the proposed Dempster Highway route is about 18 miles, and the nearest sheep band was seen only 3 miles from the Dempster Highway route. Most nursery sheep on the eastern half of this range, while the rams were located around and north of Mt. Cronin. A total of 7 bands were observed with the following composition:

(1) 22 nursery sheep 8 lambs (spread out over 1 mile)
(2) 2 nursery sheep (on winter range along Creek)
(3) 9 nursery sheep 2 lambs
(4) 1 ewe 1 lamb
(5) 3 nursery sheep 2 lambs
(6) 4 rams (3 legal, one young)
(7) 4 rams (3 legal, one young)

Total 8 rams, 37 nursery sheep, 13 lambs = 58 sheep

Not all rams, particularly young ones, could be found, and it is therefore reasonable to assume that the total population size will be around 70 at least.

While the Dempster Highway itself does not traverse the assumed range of this small population, the access provided by this road makes this population very vulnerable. In this particular area the highway is constructed above timberline and very little climbing is involved (1000 to 1500 feet) to get to the sheep.

NOTE: We observed for about 3 minutes an immature Golden Eagle diving at a ewe and her lamb. The lamb stayed under the mother during these attacks.

Manfred Hoefs,
Asst. Director.

SHEEP SURVEY OF THE RICHARDSON MOUNTAINS ON JULY 26, 1977

A total of 1.5 hours were spent surveying that portion of the Richardson Mountains located between the Dempster Highway crossing in the south and the Summit Lake valley (Rat Pass) in the north. Only the northern half of this range, located between a broad valley at a latitude of about 67° 22' north in the south, and the Summit Lake valley in the north, is Sheep Range.

We flew between 1130 and 1300 hours, the weather was sunny with some wind from the south. Lorne Osborn piloted the Jet Ranger (Bell 206A), Len Mychasiw and M. Hoefs served as observers and recorders.

Sheep were located in three distinct clusters, at least 2 of which appear to be distinct populations, since they were separated by more than 10 miles.

The first bunch occupied the mountains surrounding the headwaters of Two-ocean Creek and may range as far as east of Sheep Creek. A total of 31 sheep were located here consisting of 5 mature rams, 18 nursery sheep and 8 lambs. About 10 miles southeast of this population we located a band of 10 rams (8 legal and 2 young ones) - about 6 miles inside the NWT - which may or may not be part of this same population.

The other small population inhabit the range around Mount Millen. We only located three bands consisting of 5 rams (4 legal and 1 young), 9 nursery sheep and 5 lambs. The total count in the area of the northern Richardson was therefore 60 sheep, consisting of 20 rams, 27 nursery and 13 lambs. The band located closest to the Dempster Highway Pass, was about 30 miles north of the transportation route.

NOTE: We also saw 9 caribou (bulls) on a snow patch about 4 miles north of Mount Millen. This is the first sign of Porcupine caribou in the Richardson Mountains during our survey.

Manfred Hoefs,
Asst. Director.

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SHEEP SURVEY IN NORTHERN RICHARDSON MOUNTAINS ON JULY 27, 1977

A total of about 7 hours was flown with a Jet Ranger in the Richardson Mountains north of Rat Pass. After a general reconnaissance of 3 hours for sheep and birds of prey in the morning, about 4 hours were flown in the afternoon in area known to support sheep.

The TNTA helicopter was piloted by Lorne Osborn, Len Mychasiw and M. Hoefs served as observers and navigators. The weather was sunny, clear all day, with a fairly strong wind from the south.

The area intensively surveyed for sheep is bordered by Rat Pass in the south, Bell River in the west, approximately the 60° lat. in the north and Mt. Goodenough in the east. Within this area the "White Mountains" do not appear to support any sheep. This range appear to consist of limestone, which must be very porous. While there are many cliffs in the range, there is practically no vegetation to speak of. In this range sheep were only located along the eastern fringes.

In the remainder of the survey area sheep were widely dispersed. Small groups were found as far west as the Bell River, and a few were still near their winter range south of Mount Goodenough. Most sheep however were found in the mountains around the headwaters of Fish Creek and Scho Creek.

A total of 19 different bands were found totalling 155. The composition was as follows: 26 mature rams; 94 ewes, yearlings and young rams (2-year olds) and 35 lambs. We also saw about 350 caribou (appear to be mainly bulls) east of the White Mountains.

Manfred Hoefs,
Asst. Director.

SHEEP SURVEY - RICHARDSON MOUNTAINS - SEPTEMBER 1977

This survey was a continuation of the survey conducted for moose and caribou by Wagner and Hoefs earlier.

Dr. Hoefs left Old Crow Thursday, 15 September via Northward. Myself and Jan Blancke the pilot remained to try and complete this survey.

Friday, 16 September 77:

Weather improved somewhat. We left for Summit Lake at 7:45. The ceiling here was still quite low so we surveyed caribou while waiting for it to lift. The classification went as follows:

1) 14 bull caribou
2) 9 female caribou with 1 calf
3) 86 bull caribou, 88 female with 6 calves

Total: 100 bull, 97 female, 7 calves

This small sampling has no significance of its own but may be added to the data collected by Hoefs earlier.

The flight lines on the accompanying maps are quite irregular because of the very poor weather we were flying in. It must be noted that because of the conditions we did not necessarily count all the sheep on a given range. Indeed on Mt. Goodenough many sheep were observed which subsequently escaped into the clouds before accurate classification could be executed. These results then are only a general indication of the sheep populations here and are most assuredly not complete:

4)	No rams,	8 ewes	4 lambs
5)	" "	2 "	2 "
6)	" "	4 "	2 "
7)	" "	7 "	3 "
8)	" "	16 "	6 "
9)	3 rams	6 "	3 "
10)	No rams	2 "	2 "
11)	1 ram	4 "	2 "
12)	4 rams	No "	No "
13)	25 bull caribou	56 unclassified caribou	

(we returned to Summit Lake for fuel at 13:50 then flew the range directly north of Summit Lake)

14)	3 rams	5 ewes	2 lambs
15)		2 "	1 "
16)	Sow grizzly with 2 cubs		
17)		2 "	1 "
18)		1 "	1 "
19)		6 "	3 "
	Sow grizzly with 2 cubs		
20)	Caribou kill (photographed)		
21)		5 ewes	2 "
22)		9 "	3 "
23)		6 "	2 "
24)		2 "	2 "
25)	3 rams		
26)	7 rams		
27)	2 rams		
28)		11 "	
29)	1 grizzly		
30)	1 "		
31)	2 "		
32)	refuel; 1 grizzly		
33)	1 very large rame 40"+		
	1 very large grizzly		
34)		5 ewes	1 lamb
35)	4 rams		
36)		4 "	1 "
37)	2 rams		

This completed our work for this day counting 182 sheep in total; 33 rams, 107 ewes, 42 lambs and 9 grizzlies.

We were down by weather again until 20 September when we left for Dempster Highway. We flew to Summit Lake to refuel and attempted to

survey for sheep but only flew 3/4 hour before weather forced us to cease. We did however classify the following sheep:

1) 4 rams 3000'

2) 2 rams 15 ewes 4 lambs 3400'

3) 1 ram

We then proceeded to Dempster via Bell River and Eagle River.

We successfully called a moose by imitating a cow call indicating they are in the midst of the rut. The caribou however have shown no rut activity as of this date. The bulls and cows still being segregated and no sparring between bulls observed.

This quite incomplete survey of sheep would indicate that there is a substantial population of sheep here and the Branch should undertake to accurately assess this population in the future.

We observed a surprising number of grizzlies considering the small areas covered. This may warrant further studies also.

There is also quite a lot of activity at Summit Lake itself. Without exception every time we were there there were other aircraft or camp there. This has been brought to the attention of the enforcement section. There is in all likelihood considerable use of this lake as an access to these mountains by N.W.T. residents with the subsequent possibility of contraventions of our Game Ordinance.

Ted Wagner
Wildlife Branch

Government of the Yukon Territory

BOX 2703, WHITEHORSE, YUKON Y1A 2C6 TELEPHONE 403-667-5811 TELEX 0368260

OUR FILE 3997-9
YOUR FILE

TO: Manfred Hoefs

15 February 1978.

FROM: Don Russell

RE: Sheep surveys in southern Richardson Mountains - Feb. 11/78.

On February 11, 1978, John Russell and myself conducted a sheep survey in the southern Richardson Mountains in a Bell Jet Ranger 206B helicopter. Total flying time from base camp (Mile 118 Dempster Highway) was 4.2 hours.

The accompanying map shows location of sheep observed. Details of the six (6) observations points are given below.

Observation	Rams	Ewes	Yearlings	Lambs	Unclassified
2		2	1	2	
3		2		1	
4	4				
5		1		1	
6	1	1		1	2
TOTAL:	5	6	1	5	2

At observation point 1 an eagle's nest was recorded.

A pair of gyrfalcons were observed at point 6.

In an area located at point 6, we stopped to refuel. The following field notes were taken.

The area, typical of sheep wintering habitat was at 2900 feet elevation, windy and an air temperature at 13:50 of -10°C. The snow cover over most of the area was 0 - 6 inches.

Vegetation recorded:

Dryas integrifolia
Dryas octopetala
Saxifraga tricuspidata
Rhododendron lapponicum
Salix reticulata
Petasites sp.
Gentiana sp.

/2

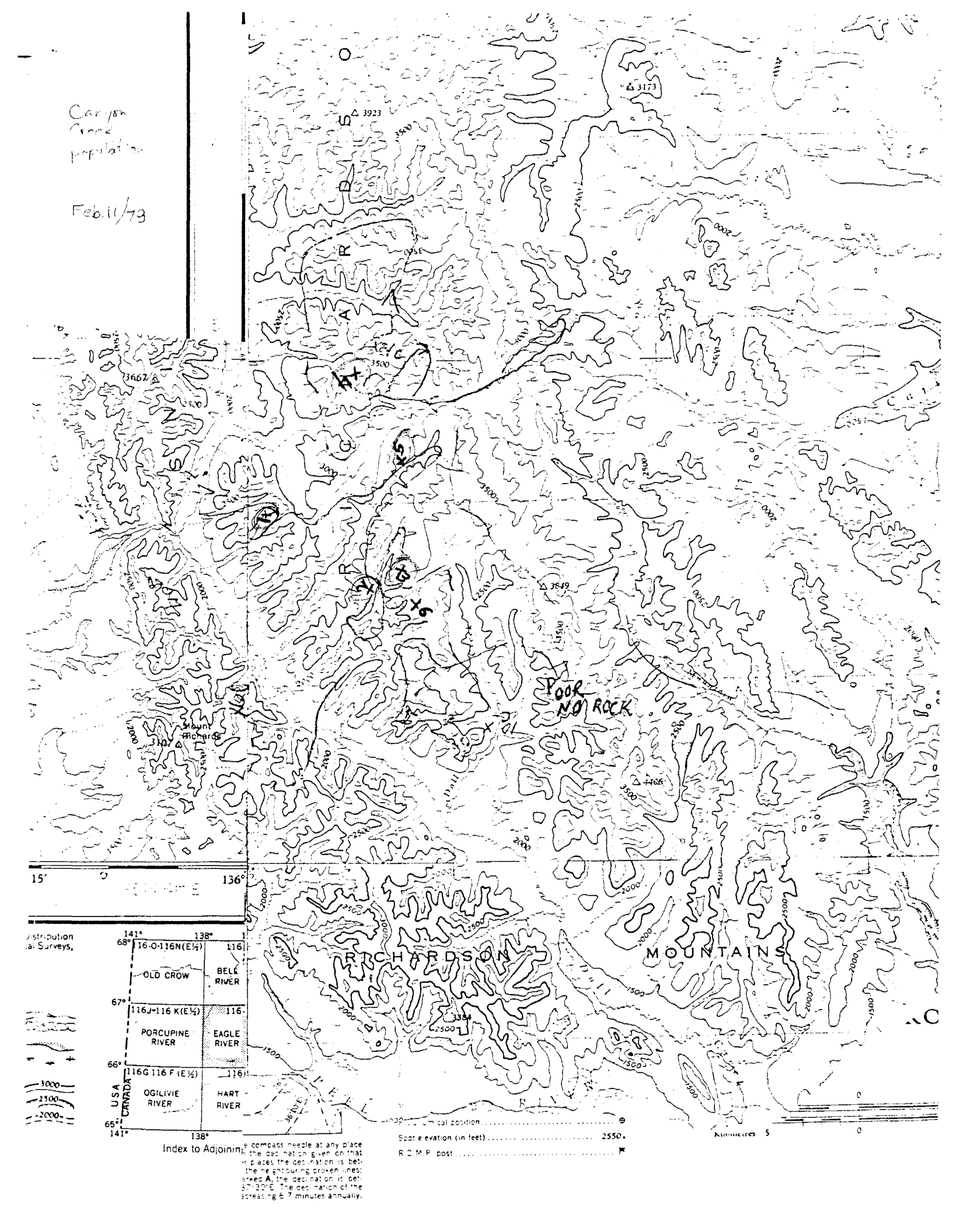
Vegetation (cont'd):
Arctostaphylos rubra (or *alpinum*)
Vaccinium uliginosum
Salix sp.
Calamagrostis canadensis
Cassiope tetragona
Vaccinium vitis-idaea
Picea glauca
Larix laricina
Carex sp. (2 - 3 species)
Cetraria islandica
Cetraria cucullata (not positive)
Alectoria ochrolenca

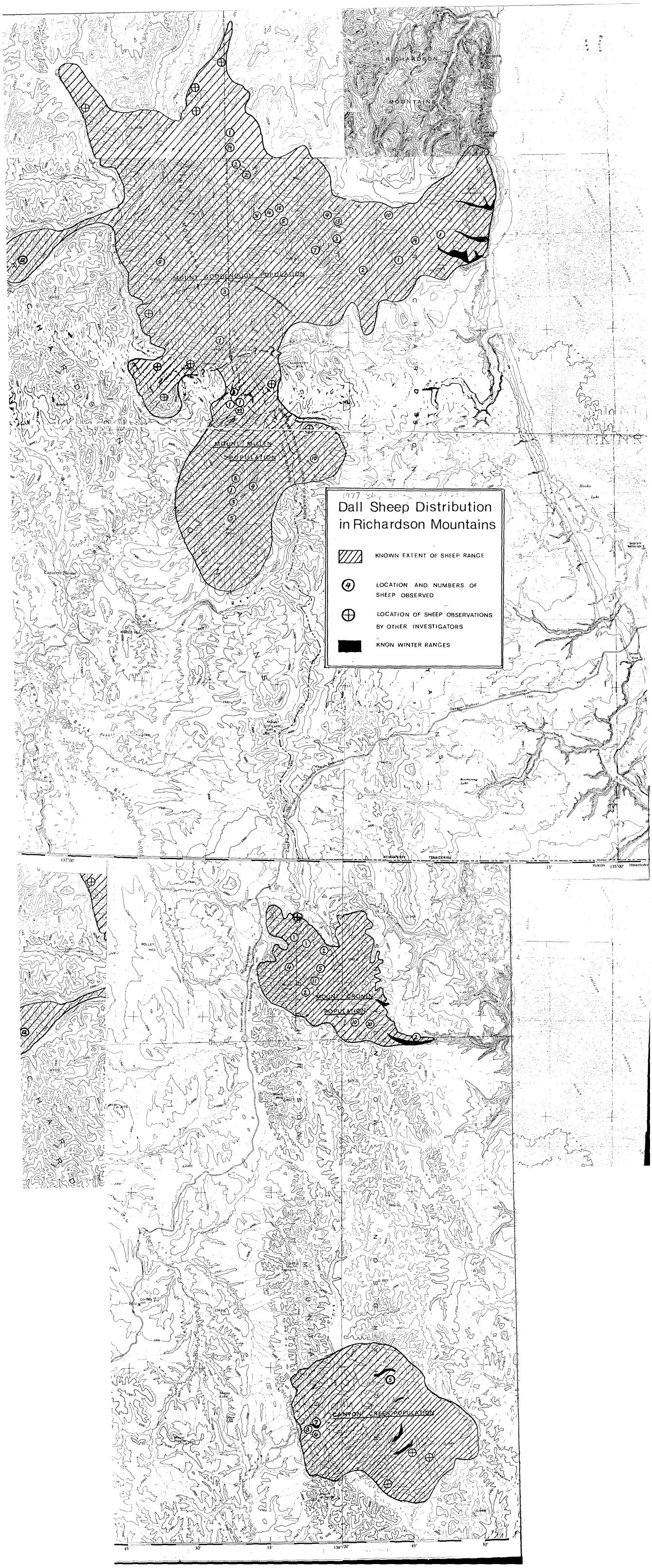
It was interesting that a *Carex* sp. pulled out from under the snow had ¼ - ½ inch sprouts already.

The animals appeared to be utilizing the *Salix* and *Carex*.

Don Russell,
Habitat Biologist.

DR/bg
cc: John Russell
Dave Mossop


Carpenter Creek population
Feb. 11/73
POOR NO ROCK
RICHARDSON MOUNTAINS
Mount Richards
3667
3923
3173
3649
3384
136°
15'
141°
138°
68°
67°
66°
65°
OLD CROW
BELL RIVER
PORCUPINE RIVER
EAGLE RIVER
OGILVIE RIVER
HART RIVER
116-O-116N(E½)
116J-116 K(E½)
116G 116 F (E½)
USA
CANADA
Index to Adjoining
Spot elevation (in feet) 2550.
R.C.M.P. post
Kilometres 5
0


RICHARDSON
MOUNTAINS
MOUNT GOODENOUGH POPULATION
MOUNT MILLEN
POPULATION
MOUNT CRONIN
POPULATION
CANYON CREEK POPULATION
1977
Dall Sheep Distribution
in Richardson Mountains
KNOWN EXTENT OF SHEEP RANGE
LOCATION AND NUMBERS OF
SHEEP OBSERVED
LOCATION OF SHEEP OBSERVATIONS
BY OTHER INVESTIGATORS
KNON WINTER RANGES
Lapierre House
Husky
Lake
137°00'
YUKON TERRITORY
135°00'
136°00'

Gov't. of Yukon, Box 2703, Whitehorse, Y.T.