GAME SURVEYS IN COUTH-CENTRAL YUKON
AND
AN EVALUATION OF THE PRESENT DEGREE OF EXPLOITATION

M. HOEFS
YUKON GAME BRANCH
1974

INTRODUCTION:

In 1973 the Yukon Game Branch started a series of game surveys with the aim to obtain gradually a complete inventory of the Yukon's wildlife resource. Such an inventory is necessary for the proper management of this resource. No intensive surveys have ever been conducted in the Yukon except for a few in areas that do not receive any hunting pressure as in the Kluane Game Sanctuary (Pearson, 1972; Hoefs, 1973, 1974) or in the northern Yukon in relation to a proposed pipeline (Calef and Lortie, 1971; Renewable Resources, 1971). Only $10,000 were available for this first survey and therefore the area selected was of necessity small. Experience indicated that perhaps no other area in the Yukon receives a more intense hunting pressure than the south-central Yukon, a region bordered by the Alaska Highway in the north, the Haines Road in the west, the Carcross Road in the east, and the Yukon - B. C. border in the south. This assumption was recently supported by the return of hunter's questionnaires. Even though this area has a size of only about 4300 square miles, or about 2.1% of the surface area of the Yukon, almost 1/2 of the total number of sheep shot by residents came out of this area as well as about 15% of the moose during the 1973 season. It was therefore realized that an inventory was more urgently needed here than anywhere else.

METHODS AND MATERIALS:

Previous investigations by the writer (Hoefs, 1973, 1974) had indicated that the most appropriate times to do reliable surveys for moose was in late winter (February, March), when 90% of the animals are concentrated in the valleys, and as far as sheep and goats are concerned, the best time is late summer, when all animals are in alpine altitudes well above the tree and shrub zones and when all of the snow has melted away. July and August are appropriate times for such surveys, but as far as this project was concerned, it was limited to June and July since an August survey would interfere with hunting.

Surveys were done with a small helicopter (Bell G-2), on a few occasions a Jet Ranger and a fixed-wing aircraft (Cessna 180) were used. Survey methods used were modified from Giles (1969) to suit our particular terrain types as well as budget limitations. All surveys were done by the writer, at times assisted by various Game Guardians and temporary employees of the Game Branch. Detailed reports for each individual flight are attached as an appendix to this paper and will not be repeated here.

The status of the game animals in the area (moose, sheep, goats, caribou and grizzly) will be discussed individually. Afterward the present degree of exploitation will be evaluated and recommendations for future management will be made.

WINTER MOOSE SURVEYS

Winter surveys were done in late winter when the majority of moose are concentrated at low elevations. The 1972/73 winter was exceptionally mild with little snow. Moose were still seen in the sub-alpine shrub zone throughout December and in early January. By late January most of them had moved into the valleys where they stayed till late March. In early April many moose were again seen at high elevations. It is therefore recommended that all future moose surveys be done in February and March.

The total size of this survey area is about 4300 square miles. Mountains above the 4500 feet contours make up about 1810 square miles. The 4500 feet contour was used as the upper limit of potential moose range, since it is the altitudinal limit of tall shrubs. Even though the odd moose may be encountered on occasion at alpine elevation, above 4500 feet, our observations indicate that most moose stay within the sub-alpine tall shrub zone. Lakes in the area make up 130 square miles.

This leaves a total of (4300 - 1810 - 130) 2360 square miles of potential moose habitat in this intensive survey area. This moose range was divided into three habitat classes (see accompanying Map I for details).

1. Potential moose range with a winter density of one moose per 10 square miles. This range is summer and year-round range of low density.
2. Good moose winter range with densities of one moose per square mile.
3. Critical winter range where moose are very concentrated in late winter with densities of up to two moose per square mile.

The densities were established from counts made during flights over these 3 habitat types, supplemented by information from the Kluane area (Hoefs, 1973).

The following Table I lists the good and the critical winter ranges which are numbered on Map I.

TABLE: I

Critical and Good Moose Ranges in South-central Yukon

Critical moose winter range with densities of up to two moose per square mile.

Number on Map	Location	Size
1	Lower Dezadeash Valley	22.5 square miles
2	Upper Dezadeash Valley	10.0 " "
3	Pond Creek Valley	6.0 " "
4	Mendenhall River flats	22.6 " "
5	North Dezadeash Lake shore	16.7 " "
6	Kluhini River Valley	10.0 " "
7	Southeast Dezadeash Lake shore	6.7 " "
8	Frederick Creek	10.0 " "
9	Frederick Lake	10.0 " "
10	Upper Watson River Valley	15.8 " "
11	Coal Lake flats	4.2 " "
12	Annie Lake flats	6.5 " "
	Sum of	141.0 square miles

Average to good moose habitat with densities of one moose per square mile.

A	Lower Watson River flats	41.6 square miles
B	Middle Watson River flats	20.0 " "
C	Rose Creek area	43.2 " "
D	Kusawa Lake area	20.0 " "
E	Jo Jo Creek area	12.5 " "
F	Mt. Kelvin area	16.0 " "
G	Klukshu River area	23.5 " "
H	Dezadeash River Valley	100.0 " "
I	Ibex River Valley	10.0 " "
	Sum of	287.0 square miles

Based on these habitat sizes, the moose population in this survey area was estimated to be:

280 moose on critical winter range
290 moose on good range
190 moose on the remaining marginal ranges

760 Total

This estimate of 760 moose for the area must be considered conservative. We were not able to fly all regions and more critical and good moose ranges in the area will be located and mapped in the future. The total number of moose in this area may therefore be well between 800 and 1000.

If other areas in the Yukon are similar to this one in distribution of critical, good and marginal ranges and if moose densities are similar, we will have between 30,000 and 40,000 moose in the Yukon and the animal harvest of 1500 and 2000 is insignificant.

SHEEP AND GOAT SUMMER SURVEYS

These surveys were conducted in June and July when the animals are in alpine elevations. The "intensity" of the surveys varied depending on weather conditions, type of terrain, size of area and type of aircraft used. Detailed reports on each survey are attached as an appendix.

As far as sheep and goat surveys were concerned, the area was broken up into 23 physiographic units, on which the populations appear to be more or less discrete, even though some interchange among some of these units is known to take place. All these units as well as the boundaries of the outfitters' areas are shown on the accompanying Map II. Each unit is given a tentative name after a prominent mountain, river or lake in the area or adjacent to it.

No. 1 Dezadeash Range is bordered by the Alaska Highway in the north, the Haines Road in the southwest, and Dezadeash Lake and River in the south and east respectively. 7-01, 02, 03

No. 2 Mt. Kelvin Range is bordered by the Alaska Highway in the north, Dezadeash River in the west, Frederick Lake in the south and Jo Jo Lake in the east. 7-04, 706

No. 3 Jo Jo Lake area is bordered by Jo Jo Lake in the west and the northern portion of Kusawa Lake in the east. 7-05

No. 4 Klukshu Lake area is bordered by the Haines Road in the west and the Takhanne River valley in the east. 7-07

No. 5 Coast Mountains are bordered by Frederick Lake in the north, Kusawa Lake in the east, the B. C. - Yukon boundary in the south, and the Takhanne valley and the Haines Road in the west.

These five units make up Babala's outfitting area.

No. 6 Mount Arkell - Mount Ibex area is bordered by the Alaska Highway in the north, the northern portion of Kusawa Lake in the west; a broad unnamed valley extending from Fish Lake in the east to Kusawa Lake in the west form the southern and eastern boundary.

No. 7 Primrose Mountain is bordered by Rose Lake in the south and west, Rose Creek in the east and a broad, unnamed valley in the north.

No. 8 Mount Granger Range is bordered by the "Fish Lake Valley" in the north, Rose Creek in the west, Coal Lake, Alligator Lake and the headwaters of the Watson River in the south and east.

These three units (6, 7, 8) make up the bulk of Heynen's outfitting area, even though some of the sheep of units 7 and 8 will range into Callison's outfitting area to the south.

No. 9 Sandpiper Creek area is bordered by Kusawa Lake in the north and west, Takhini River in the south, and Primrose River and Rose Lake in the east.

No. 10 Takhini Lake area is bordered by Takhini River and Lake in the north and east, Kusawa River and Lake in the west, and the Yukon - B. C. boundary in the south.

No. 11 Rothwell Glacier Range is bordered by the Takhini River and Lake in the west, a broad valley in the north, Primrose Lake in the east, and the B. C. - Yukon boundary in the south.

No. 12 Mount Skukum Range is bordered by the Watson River in the north, Primrose Lake and River in the west, Wheaton River in the south, and Annie Lake in the east. 7-30

No. 13 Twin Mountain Range is a small range immediately south of Alligator Lake. ~~7-27~~ 7-27

No. 14 Mt. MaCauley Range is bordered by Primrose Lake in the west, Wheaton River in the north, a broad unnamed valley in the east, and the B. C. - Yukon boundary as well as the west arm of Bennett Lake in the south. ~~7-32 33~~ 7-33 1/2, 7-34

No. 15 Tally - Ho Mountain is a small range surrounded in the north and east by the Wheaton River. ½(7-32)

No. 16 Gray Ridge is bordered by the Watson River in the north and east, Bennett Lake in the south and Annie Lake and the lower Wheaton River in the west. 9-03

No. 17 Munroe Lake area is Bennett Lake in the north and east, Partridge River in the west and the B. C. - Yukon boundary in the south. 7-34 -35

No. 18 Montana Mountain is bordered by Bennett Lake in the north and west, Windy Arm of Tagish Lake in the east, and the B. C. - Yukon boundary in the south. 7-36

No. 19 Nares Mountain is bordered by the Carcross - Tagish Road in the north, and by Tagish Lake in the west, south and east. 9-05

No. 20 Caribou Mountain is bordered by the Whitehorse - Carcross Road in the west, the Carcross - Tagish Road in the south, and by Lewes - Tagish Creeks in the north and east.

No. 21 Mt. Lorne - Mt. Lansdowne are bordered by the Whitehorse - Carcross Road in the west, Lewes - and Tagish Creeks in the south, Marsh Lake in the east and the Yukon River in the north.

No. 22 Lime Mountain area is bordered by Tagish Lake in the west, north and east, and by the B. C. - Yukon boundary in the south.

No. 23 Jubilee Mountain is bordered by Tagish Lake in the west, the Carcross - Tagish Road in the north, the Atlin Road in the east, and the B. C. - Yukon boundary in the south.

These fifteen units (9 to 23) are included in Callison's outfitter's area.

Table 2 gives a summary of the numbers of sheep observed, broken down into the various physiographic subdivisions as well as into the three outfitting areas. The table gives the numbers actually observed as well as those estimated based on intensities of surveys, visibility, type of terrain supplemented by interviews of outfitters, guides, hunters and some ground checks by Game Branch personnel. The survey area has an estimated number of about 3000 adult sheep and 840 lambs during mid summer, before the hunting season started.

The overall productivity (lamb to nursery sheep ratio) is 439 : 1217 = 36% which is average to fairly good and is indicative of a stable population setup. In certain areas (i.e. Unit 7) it is 56%, which is exceptional and higher than any ratios observed in Kluane Park (Hoefs, 1974). Table 2 also shows that certain areas around Carcross (Units 18 to 22), which did have sheep in historic times and have the potential to carry a population of perhaps 300 sheep, and were hunted out early in this century for meat hunting, have not yet recovered. The remnant sheep in these units should be given full protection at once, and in certain areas where the sheep have been completely exterminated, reintroductions should be considered. The overall density of the survey area is 3800 sheep per 4300 square miles in mid summer, which is almost 1 sheep per square mile. This compares very favourably to an overall density of 1.5 sheep per square mile in the Kluane Game Sanctuary (Hoefs, 1973), an area which has not received any hunting pressure for the past 25 years. The total number of adult sheep in the different physiographic units has been shown on Map 2. Only these numbers of adult sheep should be considered in management issues, since the annual recruitment (lambs born) is compensated for by winter mortalities and removals by hunting in stable populations.

While for the most part the sheep populations are still near carrying capacity in the survey area, with the exceptions mentioned above, we can, unfortunately not say this about the goats. Table 3 lists the numbers of goats observed to be only 50 and the maximum number estimated to exist as not more than 100. This was a very depressing observation since the range can carry at least 300, based on densities observed in similar areas of Kluane Park (Hoefs, 1973). Goats have reached such low densities in certain areas that their continued existence is threatened, and in other areas, known to have supported goats (Units 16, 23), they have already disappeared. We can attribute the present unfortunate status of the goat population in the area to three factors. Firstly, it is very easy to hunt goats, once they have been located; secondly, this is one of only two areas in the Yukon where goats are found, and thirdly (and most importantly) too liberal hunting regulations for them. Under present Yukon legislation only goats of a horn length of less than 5" are protected. Since this horn size is already reached at the end of the second year, we essentially allow more than 80% of the goats (males and females as well as kids, since the latter has no chance of making it through the winter without its mother) to be subject to legal hunting. By contrast we protect 80% of the members of a sheep population under the present "male only 270° curl" rule. Considering that we have perhaps 15 000 sheep in the Yukon, but less than 500 goats, it is difficult to see the logic behind these regulations.

TABLE: 3

Population Estimates of Goats in South-central Yukon and Kill Statistics for the 1973 Hunting Season

Area	Code	Number of Goats Observed	Number of Goats Estimated	Number of Goats Shot 1973	
				Non-Res.	Residents
Babala's	4	2	2	0	1
	5	15	35	3	5
Callison's	9	1	1	0	0
	10	5	10	0	4
	11	0	5	0	0
	14	0	10	2	1
	17	12	15	0	1
	18	7	10	0	1
	22	8	12	0	2
	Sums	50	100	5	15

TABLE: 6

Age Structure of Goats Shot During the 1973 Season

Age in years	2	3	4	5	6	7	8	9	10	11	12+	Unclassified
Numbers shot	1	2	3	3	0	3	1	1	0	1	2	3

Sum 20

CARIBOU

Caribou are known to have existed in the area in fair numbers in the early portion of this century (Murie, 1935) and fairly frequent collections and sightings of old antlers support Murie's (1935) work. A small band of perhaps 25 to 30 animals was seen during the 1972/73 winter at the headwaters of Rose Creek. At least one bull is known to have been shot in the survey area during the 1972 season. During our surveys we observed caribou signs west of Ibex Mountain in February 1972, but we did not see the animals. The outfitters operating in the area have not shot any caribou in recent years. There is no doubt that the number of caribou remaining is very small and it should not be subject to hunting.

GRIZZLY BEARS

No techniques have yet been developed to do reliable grizzly bear surveys and their management is based on indirect evidence such as bear signs, habitat type and change in hunters success. Only detailed work in relatively small areas where marked bears were used have come up with proper population estimates and density figures (Pearson, 1972).

Some index of abundance, however, can be obtained when comparing the numbers of bears seen during surveys to those obtained from surveys of areas with known bear densities. During the summer of 1972, the writer did a game survey of Kluane Park and counted during 20 hours of helicopter flying a total of 8 grizzlies. During the survey of the south-central Yukon in summer of 1973, a total of about 40 hours were spent with helicopter surveys and only one sow grizzly with a cub were observed. Kluane Park has a known density of 1 grizzly per 10 square miles in the southern half (Pearson, 1972) and an estimated density of about 1 grizzly per 20 square miles in the northern half (Hoefs, 1973). The present survey area does not have salmon streams or large, wide river flats with an abundant growth of Hedysarum mackenzei and Shepherdia canadensis (both factors attributed to the high bear densities in Pearson's area), and therefore its "pristine" density will most likely have been comparable to that of the northern half of Kluane Park (1 bear per 20 square miles). The survey area has a size of 4300 square miles, therefore about 215 bears can be expected to have lived here, before hunting and other types of disturbances came into being. We know that the bears have been severely depleted, but we don't know to what degree. From our own observations and those of outfitters, guides and hunters, I estimate that the numbers of grizzlies remaining in the area does not exceed 100.

THE PRESENT DEGREE OF EXPLOITATION AND RECOMMENDATIONS FOR PROPER MANAGEMENT

MOOSE:

It has earlier been stated that we estimate the numbers of moose in the survey area to be at least 760 and may possibly be as high as 1000. These are late winter estimates after the hunting seasons were completed, after a great portion of the natural winter mortality had come about, but before the new calf crop arrived. This moose population is stable; there have been no recent fires, floods or other major habitat alterations, and therefore the moose number is primarily determined by the size and quality of the winter ranges, which are willow - covered valleys. In such a setup we can expect a temporary buildup of the population to the forthcoming hunting season (August, September) of about 15% to 20%. This percentage takes into account early natural calf mortality. This percentage also is a very crude estimate of the maximum numbers that can be harvested on a sustained yield basis. To remain within "safe" limits, let us consider a 15% recruitment and harvest. Based on the range of the population estimate of 760 to 1000, we can therefore expect a harvest of 105 to 150 moose annually not to deplete the population.

We can at present only estimate the harvest figure for the 1973 season, since only those killed by outfitters have been accurately reported. The kill by non-residents in the survey area was 32 moose. There are 23 general licence holders (trappers) in the area. On the Yukon - wide scale, the hunting success rate of these people is .81 moose/trapper, since they are in the field all the time. Particularly in this area, where they will not find any caribou, they no doubt will be hard on moose. We can therefore expect that each trapper gets his moose on the average, which will add 23 moose to the annual take out of the survey area. The greatest gamble is involved when trying to estimate the numbers of moose taken by resident hunters. We know that 46 have been killed in the 1973 season, because these hunters have reported them on their questionnaires. We do not know what percentage of hunters

that shot moose in the area returned their questionnaires. On a Yukon - wide scale only 30% of the hunters returned their questionnaires, but we know that Whitehorse hunters (these are the ones that primarily hunt in the surveyed area) were more co-operative than i.e. hunters from Faro or Clinton Creek. If we assume that 50% of the hunters that shot moose in the area reported so, then a kill of 92 animals can be attributed to resident hunters. I do think that this figure may be high, but on the other hand that for the trappers may be low, they therefore function in a compensatory manner. It is also known that some moose are shot in the area by Indians for meat at any time of the year (Champagne, Haines Junction, Carcross Road and Annie Lake Road). It is therefore assumed that the kill figures listed here will be within ± 20% of the true numbers shot.

Outfitters	32	moose
Residents	92	moose
Trappers, etc.	23	moose
Sum	147	moose

This estimated kill is very close to the upper limit (150) of the calculated allowable annual harvest. Moose have the ability to somewhat adjust to severe harvesting by increasing their productivity (they can have twins instead of singles; they can start to breed as yearlings instead of as 2 year olds), but there is a limit to this. In northern Ontario and Sweden (Markgren, 1969) moose are in certain areas harvested at a rate of 25%. Such a rate should, however, not be considered in the Yukon. The former areas are dealing with expanding populations because of forestry practices that open up new feeding areas for moose continually, which results in a high incidence of twinning. Also the predators of moose have been reduced in Ontario and have been exterminated in Sweden, therefore these countries have a lower natural mortality rate than the Yukon.

I think that the present harvest, if it is not much greater than the one estimated above, is still within a safe allowable kill, but serious attempts should be made not to further increase it. Hunters should be encouraged to use other areas and this region should definitely not be opened up to an anterless season.

SHEEP:

In contrast to moose we have fairly reliable harvest figures of sheep from the area. Throughout the Yukon the outfitters take up to 80% of the annual sheep harvest and submit detailed reports to the Game Branch. We also have for this season, reliable data on the numbers of sheep taken by resident hunters, since it was advertised a number of times that all sheep and goat horns taken from the survey area have to be handed in to the Game Branch for inspection. Also, each hunter was given a form letter on this subject when he purchased his licence. Additional information was obtained from questionnaires that were sent to all resident hunters and from interviews with a number of people who hunted in the area this season. We are therefore convinced that our harvest estimates on sheep, goats as well as grizzlies are within one or two animals of the numbers actually shot during the 1973 season.

Table 4 lists the total numbers known to have been taken by non-resident and resident hunters in the three outfitting areas of the region surveyed. Table 5 adds to these numbers an assumed number of 4 rams per outfitting area, removed from the population by crippling losses, perhaps some unreported kill and a few shot illegally by trappers in winter.

TABLE:4

Age Structure and Trophy Size of Rams Harvested in South-central Yukon During the 1973 Hunting Season

Area	Type of Hunter	4 - 5*	5 - 6	6 - 7	7 - 8	8 - 9	9 - 10	10 - 11	11 - 12	12 - 13	Unclass.	Sums
Babala's Area	Non-Resident		34 **		35 3/8 38 1/2	38 1/4 36 6/8 40 4/8 32 37 1/4	39 42 41 1/4 33 36 3/4 36 1/4	39 1/4 36 3/4 40 1/4 36		38 3/4		19
	Residents		27 1/2	34 1/2		36	33 3/4				2	6
Heynen's Area	Non-Residents	31 1/4	30 3/4 30 1/4	32 27 1/4	34 1/2 36 3/4	33 1/2 33 1/2	36 3/4 34 1/4	36 1/2 40 34 3/4 39 3/4 34 1/4	40 3/4 40 1/2 36 1/2			19
	Residents		31 30					41 1/4			3	6
Callison's Area	Non-Residents			33 1/8	33 3/4	37 1/4	33 1/2 36 1/2 31	39 1/4 42 38	35 1/2 36 39 37 1/2 43 1/4			14
	Residents			30 1/4 29	29 6/8 36 1/2	35	38 3/4 30 3/4 37 1/2	37 3/4 36 1/2 36			3	14
											Total	78

* Age group of rams shot

** Length of longest horn in inches

TABLE: 5

Present Degree of Exploitation of Dall Rams
in the South-central Yukon

Outfitters' Area	Number of Nursery Sheep	Possible Harvest Levels of Rams (1)			Rams Taken During the 1973 Season			
		1(2)	2(3)	3(4)	Non-Residents	Residents	Others(5)	Totals
Callison's	965	87	57	29	14	14	4	32
Babala's	710	64	42	21	19	6	4	29
Heynen's	420	38	25	13	19	6	4	29
							Sum	90

(1) These are levels based on the principle of maximum sustained yield (see Text for details).

(2) At this level, rams are shot as soon as they become legal (270° curl). They are about 5 years, 4 months old.

(3) At this level rams are taken at an age of 8 to 9 years, when a high percentage of them have reached "full curl" size and about 40% of them are 39 inches or longer.

(4) At this level we are dealing with "trophy hunting" in the true sense of the word. The rams shot are 10 or 11 years old and older, and are "full curl" heads.

(5) These are rams assumed to be taken by hunters or trappers and have not been reported, as well as rams that were crippled, but not recovered.

Since non-resident hunters through outfitters take the majority of rams and since the three outfitting areas show different degrees of depletion, it is necessary to discuss them individually. The present rate of harvest will be evaluated from the point of view of three degrees of depletion (Table 5). Based on the number of nursery sheep in an area it can be calculated how many rams of a given age class are "produced" annually. These calculations are based on the writer's Ph. D. dissertation (Hoefs, 1974); the relevant portion of which is attached as an appendix of this survey report.

At the first level of harvesting, we are dealing with very intense hunting pressure and a severe rate of exploitation. Rams are harvested as soon as they reach the 5 to 6 year age class. At this age no ram has reached 39 or 40" horn length or a "full - curl", but they are legal rams under present Yukon legislation (3/4 or 370° curl). While harvesting at this level will produce the maximum number of rams annually (Table 5), it cannot be classified as "trophy hunting".

At the second level of harvesting a compromise is made between the taking of a large number of rams, but at the same time giving the hunter a chance of bagging a "trophy". A trophy is here arbitrarily defined as a head whose horns are 39" long or more. At this level of harvesting, rams must be allowed to live to the 8 to 9 year age class. Natural mortality has lowered the total numbers of rams available compared to the first level of exploitation by about 50% (Table 5).

At the third level of harvesting we are dealing with "trophy hunting" in the true sense of the word. As it is obvious from Table 4, almost half the rams taken in the 10 to 11 and 11 to 12 year age classes are "trophies" and all are "full curl" rams. The number that can annually be taken at this level is again reduced by about 50% from the previous (2nd) level of harvesting.

Table 5 lists the numbers available in the three outfitting areas at the three levels of harvesting as well as the numbers presently shot.

For several reasons Callison's outfit is outstanding at present. Not only does his area have the largest number of sheep (965 nursery animals), he harvests his area at a very moderate level reflecting true sportmanship and conservation - mindedness. The average age of his harvested rams is 10.5 years, the average size is 37" and 352° curl. This is trophy harvesting. His efforts are somewhat watered down by a large number of residents (14) taken rams in the area, but the total number shot (32) is still very close to the allowable kill at the "trophy" level (3rd level) of 29.

Babala's area has less sheep (710 nursery animals) and is more severely harvested by the outfitter (19). However, he has less competition by resident hunters. The average age of his rams is 9.2 years, but they were on the average more than 37" in size and full curl trophies. The present level of harvest is still in the trophy range but is rapidly approaching the second level of exploitation. If he wants to maintain true trophy hunting in his area, he should reduce the annual kill to about 15, leaving 6 rams for resident hunters.

Heynen's area has the smallest sheep population (420 nursery sheep) and is exploited with a severity that it can be predicted that "trophy hunting" will in very few years be "a thing of the past". No other outfitter shoots animals as young as he does (Table 4). The average length of his rams was 34 7/8" with 340° curl. The total number shot in his area (29) has already passed the second level of exploitation (25) and is approaching the first level (38). To restore trophy hunting in this area, it will be necessary to cut the annual harvest by 50%.

RECOMMENDATIONS:

Under present Yukon legislation, 270° curl as a minimum requirement for a legal ram, no outfitter is doing anything illegal and therefore no restrictions can be imposed. On the other hand, if trophy hunting is the goal and if outfitting areas are advertised to trophy hunters, then the annual take per outfitting area should not exceed the numbers listed in Table 5 under the 3rd degree of exploitation. This would mean that Callison is still alright, Babala should reduce his annual take by about 3 or 4 animals (or 20%), and severe reductions in annual take of about 50% are necessary in Heynen's area, this is assuming that the take by resident hunters remains at the present distribution and level.

In the long run, however, conflicts between residents and outfitters will become more and more severe, if we continue to allow all sheep areas in the Yukon to be exploited by both types of hunters. It is recommended that in the very near future at least one large area be set aside for resident sheep hunters only. This should be done soon, before it is too late. Once an area has been severely depleted it will require 3 to 5 years of complete closure to restore trophy hunting.

Because of its closeness to Whitehorse and easy accessibility it is recommended that the following area be considered as a "resident hunters only" proposal. The area presently held by outfitter Heynen, supplemented by physiographic subdivisions 7 and 13 of Callison's area, subdivision 3 of Babala's area, as well as the southern portion of the Ruby Range, the Sifton Range and the Miners Range out of Hotte's area. Except for Heynen, no outfitters would be severely effected (a 10% reduction in total numbers of sheep per outfitting area is not a great loss) and yet a "resident only" hunting area would be created with about 1000 nursery sheep allowing an annual harvest of about 40 to 45 trophy rams. The annual take by residents is about 60 to 70 sheep, the majority of which could come from this area.

The remaining harvest would be spread over many outfitting areas and therefore the pressure on each outfitting area would be minimal. This arrangement would also enable outfitters to manage their areas better, and in a few cases it may allow them to increase their annual take.

GOATS:

While the present status of moose and sheep over the survey as a whole is still pretty good, we can not say this about the other three big game species in the area, goats, grizzly and caribou. As has been mentioned earlier, we estimate the total number of goats remaining to be at the very most 100 animals. The kill during the 1973 hunting season is known to have been at least 20 (Table 6). That very few goats are left in the area is reflected not only from our surveys but also in the age structure of the animals shot (Table 6), where more than 50% of the goats were young animals (5 years old and less). It is also reflected in interviews with about 80% of the hunters who shot goats this season. Except for 2 out of a total of 12 hunters interviewed, all shot the only goat they saw. This does not say very much for the sportmanship and hunting ethics of the people involved, on the other hand they did not do anything illegal.

RECOMMENDATIONS:

If we want to save the goats in the area, and if a complete closure of the goat season for the time being is considered unrealistic, at least the following restrictions must be imposed immediately: Females with kids must be protected, the mimimum horn length required to qualify as a legal animal must be raised to 8", and the hunting season must be limited to the first two weeks in September. These restrictions will hopefully lower the annual kill to an allowable 4 to 6 animals and will allow the greatly depleted population to gradually recover. Such a buildup should be a fairly fast process since natural reproduction is supplemented by an influx of goats out of B. C., where the hunting pressure is very low, and out of the Kluane Game Sanctuary where goats enjoy complete protection. The carrying capacity of the goat ranges in the survey area is conservatively estimated at 300 goats, and

once the level has been reached we can safely harvest 25 to 35 goats per year.

CARIBOU:

There are only a few dozen caribou left in the area and none was shot in the 1973 season. We do not know why they disappeared, it is highly unlikely that hunting has been the reason.

However, the remaining few should not be subject to hunting; which hopefully will result in a slow buildup of the remnant population. There are a number of good caribou ranges in the area (between Fish Lake and Ibex Mountain; around Vesuvius Hill; the Sandpiper Creek area) and a population of 200 to 300 could be supported. The closing of the area to caribou hunting would not impose any hardships, since none are hunted anyway. Resident hunters have many good areas in the Yukon to chose from, and both outfitters, Callison as well as Heynen, have good caribou populations in the eastern portions of their districts which is not in the area surveyed. Outfitter Babala would not be effected since no caribou have been observed in his area for at least 10 years.

GRIZZLY BEARS:

Our population estimate of possibly 100 bears in the survey area is merely an educated guess, but for various reasons I consider it an optimistic guess. That bears have been over-harvested in the area can be demonstrated clearly by the following calculation. The carrying capacity of the area would support perhaps 215 bears. Pearson (1972) suggests that bears can be harvested at a maximum rate of 7 to 8% annually, while Cowan (1972) shows that most management plans do not allow for more than 3 to 5% of the total population. This low rate of harvesting is a reflection of the very slow reproductive rate of grizzlies. In our area they do not breed until they are 5 years old, they only have one or two cubs,

and the interval between successive litters is 3 years. If we consider an annual harvest of 6% (this being the average between Pearson's (1972) and Cowan's (1972) recommendations), then we could not take more than 13 bears annually (out of 215). We have no complete record of bears killed in the area, except for those killed by outfitters since the year 1965. The average kill by outfitters over this 10 year period was 8 bears, as it was in 1973. In some years the average was exceeded considerably, as in 1965 with 18 bears, and in 1968 and 1972 with 11 bears each. During the 1973 season an additional 4 bears are known to have been killed by resident hunters and accidentally (in self defence). If this ratio of residents kill to outfitters kill was similar in previous years, and we have no reason to believe that it was not, then these bears have been harvested at a rate of 12 per year, not counting trappers kills and poaching. Only a "prehistoric," optimum number of 200 to 250 could have tolerated such a harvest rate. It is therefore reasonable to assume that besides the annual harvestable surplus, some bears were taken every year from the breeding stock, which resulted in a gradual lowering of the population size.

If we have 100 bears now, then we should not take more than 6 annually out of this area. This would sustain the present population, but would not allow it to build up to previous numbers. If we want to restore a higher population, the area should be closed for bear hunting for a while. Natural population increase plus some influx out of B. C. and the Kluane Game Sanctuary would restore optimum densities in perhaps 5 to 10 years.

It is recommended that this area be closed immediately to resident hunters and trappers as far as grizzlies go. This can not possibly impose any hardship on those hunters since they have the rest of the Yukon (98% of it) to hunt bears in. The outfitters are restricted to this area. For the time being a quota of 6 bears annually should be equally divided, giving 2 bears to each outfitter in the area surveys. Both Callison's as well as Heynen's area exceeds the area surveyed considerably and one additional bear per year could be taken there by each of the two outfitters. This again would not impose any hardship, since the total harvest by outfitters was only 8 during the 1973 season. There simply were not more bears around to hunt. One outfitter himself (Babala) reported on the scarcity of bears and suggested restrictions.

SUMMARY

The report given above may reveal a rather pessimistic picture on the status of wildlife in the area surveyed. It must be kept in mind though, that no other area in the Yukon receives such an intense hunting pressure -- this was the very reason for chosing it -- and therefore in no area need restrictions as severe as the ones recommended here be imposed. On the contrary, in many areas the hunting regulations could be liberated.

It is recommended that this surveyed area will be made into a separate management unit in the forth-coming zoning of the Yukon Territory. The restrictions recommended must be imposed at once, otherwise we are taking the risk of completely exterminating certain wildlife species in this area. The restrictions recommended are reasonable and do not impose any hardships on residents or outfitters.

REFERENCES CITED

CALEF and LORTIE (1971): Toward an environmental impact assessment. Appendix I: Wildlife. Report filed with the Environmental Protection Board, Canada.

COWAN, I. McT. (1972): The status and conservation of bears of the world. (1970)
In "Bears, Their Biology and Management."
I. U. C. N. Publication; Morses, Switzerland

GILES, R. H. (1969) ed.
Wildlife Management Techniques
3rd edition revised
The Wildlife Society, Washington, D. C.

HOEFS, M. (1973)
Ecological investigations in Kluane Park,
S. W. Yukon Territory
Report on file with the Canadian Wildlife Service,
Edmonton, Alberta, Canada.

HOEFS, M. (1974) in preparation
Ecological investigation of Dall Sheep and their habitat
Ph. D. dissertation, University of British Columbia,
Department of Zoology.

MARKGREN, G. (1969): Reproduction of moose in Sweden.
Viltrevy 6(3): 127 - 298

MURIE, O. J. (1935): Alaska - Yukon caribou.
North American Fauna. No. 54.
U. S. Department of Agriculture.

PEARSON, A. (1972): Population characteristics of the northern interior grizzly in the Yukon Territory, Canada. In "Bears, Their biology and Management." I. U. C. N. Publication, Morses, Switzerland.

RENEWABLE RESOURCES CONSULTING SERVICES (1971): A study of the Porcupine caribou herd. Report on file with Williams Brothers Canada, Ltd.

APPENDIX

1. Excerpt from: M. Hoefs (1974): "Ecological Investigation of Dall Sheep and Their Habitat," University of British Columbia.
   This thesis has been used to calculate allowable harvest data for Dall rams in this report.

2. Detailed diaries on individual survey flights, which have been used in this report.

Practical Considerations:

It was one of the objectives of this study to come up with recommendations which would help the Game Branch in the conservation and management of this species. Out of the analyses of population dynamics data and related investigations on horn growth, came three issues with practical implications; the first one dealing with sheep censuses and classifications, and the second dealing with horn growth characteristics and the third with optimizing of harvests.

Observations made during game surveys in other areas of the Kluane Game Sanctuary (Hoefs, 1973) and in areas of the south-central Yukon (Hoefs, 1974) indicate that the Sheep Mountain population does not differ in productivity and horn growth characteristics from other populations in the southern Yukon and that management recommendations are therefore applicable to such populations.

a) Sheep Censuses and Classifications:

As pointed out by Nichols and Erickson (1969), it is not possible to obtain an accurate classification of all segments of a sheep population during any one count in one season. It was mentioned earlier that accurate determination of the number of lambs born in a population can only be made by being present on the lambing grounds continuously throughout the lambing period. Yearlings are best counted in late winter shortly before the new lambing period starts. Accurate ram to ewe ratios can only be established after repeated classified counts. However, extensive surveys are usually limited to one count per year for economic reasons.

Even though it is important to know the winter ranges of sheep populations, more accurate surveys -- particularly aerial surveys -- are possible in summer when all sheep are above timberline and above the sub-alpine shrub zone. Such surveys should be done as late in summer as possible when the snow has melted but before new snow falls. In the southern Yukon, the most appropriate time is the second half of July and the first half of August.

Aerial surveys do not lend themselves to great detail in classification; however, when encountering nursery bands, it is always possible to separate lambs of the year from "adult" members of such bands (ewes, young rams, yearlings). In small bands it is often also possible to separate out the young (2 to 3 year old) rams. Members of ram bands should be separated into at least two groups: legal rams and younger animals. Under present Yukon legislation a legal sheep is defined as a ram whose horn curl circumscribes an angle of 270^{o} or more.

To determine the age at which rams become legal, 13 sets of unbroomed horns were measured by methods described in Erickson (1970). It was found that most rams become legal during their sixth growing season (5 to 6 year age group), while some already reach that state at the end of their fifth growing season (4 to 5 age group). Since most hunting takes place in August and September, while the horn growing season is still in full swing, it is reasonable to say that few if any rams in their fifth growing season are legal during those months (Table 14b). Measurements of over 200 sheep skulls by the Yukon Game Branch in fall of 1973, support the data of Table 14b, as long as the skulls originated in the southern Yukon. In the north, for instance in the Ogilvie Mountains, it appears that it takes the rams one year longer to reach legal size. Table 14b shows that "degree curl" is an accurate method to classify rams up to the age of five years. From then on it becomes progressively less reliable because of overlap between age classes and it becomes useless and often misleading in the old age classes (10 years and older). This method of classifying young rams and lumping those of six years and older was used in this study.

A model of an unhunted sheep population was developed as shown in Figure 2. It is based on statistics collected from the Sheep Mountain population and from the life table (Table 12). The model represents observed conditions as far as total numbers, sex ratios, lamb crop, and mortalities are concerned. The sex ratio of adult sheep was set at 94 rams to 100 ewes, 46 lambs are born, the maximum span of life is the 12 to 13 year age class. Some adjustments of the mortality rates of Table 12 could not be avoided to accommodate the desired total numbers (which are

much less than those the life table was based on), the desired sex ratio, and the fact that we are dealing only with "whole" animals here. These adjustments resulted in a few distortions in the old age groups. For instance, the mortality in the 11 to 12 year age class is 86% of two animals, which would leave less than half an animal in the top 12 to 13 year age class. However, a whole animal is shown to indicate the maximum span of life. Errors introduced into the other age classes are much less severe and often function in a "compensatory" manner.

Little data were available for the female component of this model except for the total numbers, the numbers of lambs and yearlings, and the maximum span of life. The slightly unbalanced sex ratio was "created" by a 39% mortality rate in the first year of life, with two more rams dying than ewes. Age specific mortality rates were modified from Bradley and Baker (1967) to accommodate the longer life span. Whether or not the age structure of ewes is exactly as shown here is not important. We are only interested in this connection with the number of ewes in reproductive age (71) and the total number of "mature" ewes which is 100. The model represents the population structure in early June after all the lambs have been born. As far as mature rams are concerned it is also relevant to the forthcoming hunting season (August, September) since hardly any mortality occurs during the summer months (June, July).

There are 81 "mature" rams in this population, these are members of ram bands during the summer, except for a few 2 to 3 year olds. A total of 47 rams have completed their fifth growing season; they will be in their sixth growing season during the upcoming hunting period and will be "legal" rams. Out of these 47 "legal" rams not more than 20 can be described as "good" rams. For lack of a better term "good" rams is here defined as rams in the 8 to 9 year age group and older. As will be discussed later, only this category contains trophy rams, whose horn length reaches 39 or 40 inches and more, and only this category should be subject to harvesting if "trophy hunting" is the objective.

TABLE:

Horn Statistics of Dall rams from the Kluane Game Sanctuary

Collection No.	Years of complete increments	Cause of death + natural; - other	Time of death	Circumference at base (cm)	Annual increments in horn growth in cm. (centimeters) (Only complete increments are considered)												
					1	2	3	4	5	6	7	8	9	10	11	12	13
C 31	13	+	-	31.8	-	-	14.0	13.0	9.8	8.0	5.2	4.5	3.8	3.7	1.2	.6	.5
A 60	13	+	-	33.7	-	-	19.2	14.5	12.8	9.5	7.0	5.0	3.1	3.0	2.0	1.6	1.6
C 47	12	+	Winter 71/72	33.5	-	22.0	16.7	15.4	11.6	9.3	6.0	5.1	3.8	2.2	1.5	1.2	
C 21	12	+	-	31.8	-	20.6	16.5	10.2	9.5	6.6	6.4	5.4	5.1	3.5	2.6	1.8	
C 3	12	+	-	31.1	-	-	17.8	13.3	12.7	6.7	5.1	3.1	3.5	2.5	1.6	-	
A 80	12	+	Oct. '72	31.5	-	-	17.8	13.0	9.2	7.0	5.1	2.8	2.8	1.6	1.0	0.6	
A 79	12	+	Winter 72/73	33.7	-	-	21.6	14.0	11.5	7.6	4.7	2.5	1.9	1.6	2.8	1.9	
A 83	12	+	Winter 72/73	31.5	-	-	17.8	12.3	8.0	6.5	3.5	2.2	2.8	1.7	1.2	-	
A 38	12	+	-	32.4	-	-	19.1	17.1	13.0	10.8	7.0	5.1	2.5	1.9	1.6	0.6	
A 8	12	+	Winter 69/70	34.3	-	-	18.1	14.0	12.4	10.2	6.4	5.4	4.1	2.8	1.3	1.0	
A 37	11	+	-	33.0	-	-	19.1	13.7	8.9	7.3	4.4	3.1	2.2	1.6	-		
A 45	11	+	-	30.0	-	-	18.1	15.5	11.6	7.9	4.7	5.1	2.2	2.2	-		
A 13	11	+	-	33.0	-	-	19.1	14.9	13.3	11.2	8.6	6.7	4.4	2.5	-		
A 9	11	+	-	33.0	-	-	20.5	15.2	13.3	8.6	6.4	4.7	2.2	2.2	1.6		
A 4	11	+	Feb. '70	35.6	-	-	23.5	16.5	10.8	7.6	3.1	2.2	2.2	1.9	1.6		
B 13	11	+	-	32.4	-	-	21.6	13.0	12.1	8.9	6.4	3.8	4.1	2.5	-		
B 6	11	+	-	30.8	-	-	19.1	12.7	10.9	7.6	6.1	5.1	4.4	2.5	-		
A 31	11	-	Sept. '70	34.3	-	-	18.6	14.9	11.8	7.6	5.7	4.4	3.8	3.1	-		
A 40	11	-	Feb. '71	34.0	-	21.3	16.1	12.7	9.8	6.7	5.4	4.7	3.5	2.2	1.0		
A 48	11	-	March '71	31.8	-	23.9	18.1	13.3	10.2	5.7	5.1	4.4	4.1	3.1	2.2		
A 82	11	-	June '71	35.6	10.2	26.4	19.3	15.8	9.5	7.0	3.8	3.5	1.9	2.6	1.6		
A 78	11	+	Winter 72/73	31.8	-	-	17.8	13.7	8.6	7.0	4.4	2.5	2.5	3.5	2.5		
A 64	11	+	Winter 70/71	34.0	7.6	25.5	19.0	12.7	9.5	6.3	4.5	4.2	2.8	2.8	1.9		
C 40	11	+	-	36.0	-	23.0	17.6	13.2	10.0	7.0	5.2	3.1	3.7	2.4	1.5		
C 36	11	+	Winter 71/72	32.3	-	21.0	17.8	13.3	9.0	7.8	4.8	4.4	2.8	2.8	1.5		
C 25	11	+	-	32.1	-	-	16.2	11.2	11.2	8.6	8.6	6.1	4.1	3.5	-		
C 19	11	+	-	31.8	-	-	18.4	13.7	11.5	6.7	5.1	3.8	3.8	2.5	1.9		
A 10	10	+	April '69	31.8	-	-	14.9	12.7	11.5	7.9	5.1	4.4	3.5	-			
A 5	10	-	Feb. '70	34.3	-	-	22.9	17.4	12.1	7.0	4.4	4.1	3.5	2.2			
B 19	10	+	-	35.6	-	25.4	18.8	15.2	12.4	6.7	6.4	4.4	2.8	-			
B 11	10	+	-	32.4	-	-	22.5	14.3	10.8	6.1	4.1	2.8	1.9	-			
B 4	10	+	-	28.5	-	-	18.1	15.9	12.7	8.2	5.1	2.8	1.6	-			
C 46	10	+	Winter 71/72	30.0	-	20.0	16.8	14.5	13.0	5.0	3.2	3.4	3.4	4.8			
A 33	10	-	Sept. '70	33.6	8.6	21.9	17.8	13.2	6.7	5.1	4.7	3.8	2.2	-			
A 52	10	-	Oct. '70	31.2	-	25.4	20.0	14.3	11.8	7.6	5.7	3.1	2.8	-			
A 75	10	+	Nov. '72	33.8	5.2	23.3	17.4	15.2	9.8	10.2	6.7	6.4	5.1	3.8			
A 2	10	+	Fall '70	30.5	-	17.1	15.2	12.4	11.7	8.2	5.7	5.7	5.1	-			
A 62	10	+	Winter 70/71	35.9	-	21.9	15.5	13.7	11.4	6.9	7.3	5.4	3.7	2.5			
A 69	10	+	-	33.5	7.6	23.8	17.1	13.0	12.6	7.1	5.3	4.8	2.8	2.2			
A 42	10	+	Nov. '70	33.8	7.3	22.5	15.2	14.0	10.5	8.9	7.6	6.7	4.1	3.5			
C 39	10	+	Winter 71/72	32.8	-	21.0	15.0	9.0	7.2	6.0	6.3	5.5	5.0	2.7			
C 27	10	+	-	31.1	-	-	16.8	11.5	10.2	5.1	4.1	2.8	2.2	1.3			
C 17	10	+	-	31.1	-	-	17.1	11.5	10.6	8.2	7.6	4.7	3.1	3.1			
C 14	10	+	-	-	-	26.0	18.1	13.0	11.2	9.2	5.7	2.8	2.5	2.2			
C 2	10	+	-	31.1	-	-	16.8	11.5	10.2	5.1	4.1	2.8	2.2	-			
C 34	9	+	-	35.4	-	-	18.0	15.2	8.7	7.2	5.4	4.1	-				
A 23	9	-	Fall '69	33.8	-	-	19.4	14.6	9.5	6.4	6.1	4.4	3.8				
A 22	9	+	-	32.4	-	-	19.1	13.7	11.5	8.9	7.6	5.7	-				
A 7	9	+	Winter 69/70	32.1	-	-	19.7	14.3	10.2	5.7	4.7	3.5	2.2				
B 12	9	+	-	31.1	-	24.8	13.3	12.1	9.5	7.3	5.7	3.3	2.5				
B 10	9	+	-	30.5	-	-	15.5	16.5	18.1	12.4	8.6	6.1	-				
B 5	9	+	-	32.4	-	-	18.4	15.2	11.5	9.2	6.4	6.1	-				
A 29	9	-	Sept. '70	35.9	-	26.0	16.2	14.6	11.2	9.5	6.1	3.8	-				
A 45	9	+	Jan. '71	32.7	-	23.5	19.4	15.2	12.7	8.9	6.1	5.1	3.1				
A 76	9	+	Winter 72/73	33.6	-	20.9	23.0	13.0	11.2	11.2	8.2	5.4	3.1				
A 77	9	+	Winter 72/73	35.0	-	24.8	14.1	14.6	12.1	10.2	7.0	4.7	2.5				
A 81	9	+	Winter 72/73	34.0	-	-	17.8	13.4	10.2	8.2	5.4	5.4	3.1				
A 69	9	+	Fall '70	31.1	-	20.0	16.8	13.3	7.6	6.7	7.0	4.1	-				
A 65	9	+	Winter 70/71	34.9	-	19.7	15.5	11.1	10.8	10.2	5.1	4.1	3.7				
A 66	9	+	Winter 70/71	32.1	-	-	16.8	10.2	8.5	7.0	6.3	6.0	5.1				
A 54	9	+	Winter 70/71	29.8	7.6	16.5	14.9	11.8	9.5	5.1	4.7	3.5	4.4				
C 48	9	+	Winter 71/72	31.5	-	-	16.0	15.2	14.0	12.0	7.0	5.8	4.2				
A 1	8	+	Winter 69/70	31.8	10.2	21.6	17.1	12.1	10.5	7.9	7.0	5.4					
A 61	8	-	June '71	34.9	-	17.5	19.4	15.3	13.0	8.3	6.7	5.6					
A 82	8	+	Winter 72/73	33.0	-	17.4	16.9	11.5	11.8	10.5	6.4	3.8					
A 74	8	+	-	30.5	-	-	19.6	13.2	11.1	7.6	3.8	4.1					
A 56	8	+	April '71	31.5	-	17.1	14.0	12.7	11.5	8.9	7.6	6.7					
A 53	8	+	-	35.6	-	-	17.1	11.5	12.1	9.8	8.2	6.4					
C 26	8	+	-	26.4	-	-	11.5	13.2	11.5	8.6	3.8	2.5					
C 20	8	+	-	-	6.1	18.7	19.4	14.9	8.6	8.6	4.7	3.2					
C 15	8	+	-	33.6	-	16.2	19.1	16.2	13.5	9.2	6.5	3.8					
C 11	8	+	-	29.5	-	-	11.5	10.5	7.0	4.7	5.4	3.5					
C 36	7	+	-	29.7	7.5	20.3	15.3	11.2	6.8	5.5	3.8						
C 18	7	+	-	33.0	-	22.9	13.3	16.5	17.8	12.7	9.2						
C 4	7	+	-	32.4	-	-	20.3	16.2	8.6	7.0	-						
C 1	7	+	-	32.4	-	-	17.1	14.9	7.0	6.1	3.5						
A 6	7	+	Winter 69/70	31.8	-	-	19.7	14.3	8.2	7.6	4.4						
B 3	7	+	-	27.6	-	-	16.5	9.5	2.8	1.6	-						
B 2	7	+	-	32.1	-	-	16.5	14.0	10.8	9.2	-						
C 33	6	+	-	-	-	-	11.2	6.1	6.4	6.1							
C 6	6	+	-	30.8	-	27.0	22.5	13.7	8.2	-							
B 1	6	+	-	33.6	-	23.1	20.3	15.8	10.8	8.6							
A 63	5	+	-	31.1	-	15.9	18.1	16.5	11.1								
C 37	5	+	-	29.0	-	-	17.0	13.6	-								
C 7	5	+	-	26.4	-	24.8	15.8	12.7	-								
C 5	5	+	-	26.7	8.9	22.2	17.1	8.6	-								
A 26	4	+	-	27.0	4.9	25.4	21.3	-									
A 21	4	+	-	21.6	8.6	20.3	16.2	-									
B 15	4	+	-	25.1	-	17.5	15.5	9.2									
A 47	3	+	Feb. '71	22.9	6.4	16.8	17.4										
C 28	3	+	-	24.5	-	22.2	19.1										
B 16	3	+	-	24.8	-	18.8	19.4										

TABLE: 15

HORN STATISTICS OF DALL EWES FROM THE KLUANE GAME SANCTUARY

Collection Number	Years of Complete Increments	Circumference at Base (in cent.)	ANNUAL INCREMENTS IN HORN GROWTH (IN CENTIMETRES) (Only complete increments are considered)												
			1	2	3	4	5	6	7	8	9	10	11	12	13
D 21	13	12.0	-	8.4	6.2	1.5	1.7	1.2	1.4	1.4	0.8	0.7	0.3	0.2	0.3
F 2	12	12.0	4.4	10.1	5.1	3.2	1.6	0.7	1.0	0.6	0.6	0.6	0.3	0.3	
F 1	12	12.7	-	-	5.1	3.5	1.0	0.7	1.0	0.3	1.6	1.6	0.3	0.3	
D 20	9	13.0	4.2	8.4	6.4	3.3	1.8	0.5	0.3	0.5	0.6				
D 19	9	13.0	-	9.8	6.4	2.5	0.6	0.3	0.6	0.3	0.3				
D 8	9	12.3	4.1	9.9	5.7	3.7	1.9	1.0	0.6	0.6	0.3				
D 1	8	13.0	5.4	12.3	2.9	3.5	2.5	2.2	1.6	1.3					
D 6	6	12.7	7.3	11.1	4.1	2.9	2.9	2.5							
D 3	6	12.7	3.2	12.0	6.0	4.1	3.2	2.5							
D 2	6	13.0	5.1	9.5	6.0	4.4	2.2	2.2							
D 7	5	12.0	4.7	10 4	7.3	1.9	2.5								
D 5	5	12.7	4.7	8.6	5.7	2.5	2.3								
D 4	1	7.0	6.0												
		$\bar{X}$	4.9	10.0	5.6	3.1	2.0	1.4	0.9	0.7	0.7	1.0	0.3	0.3	0.3

FIGURE 3

RELATION BETWEEN AGE OF RAMS AND HORN LENGTH

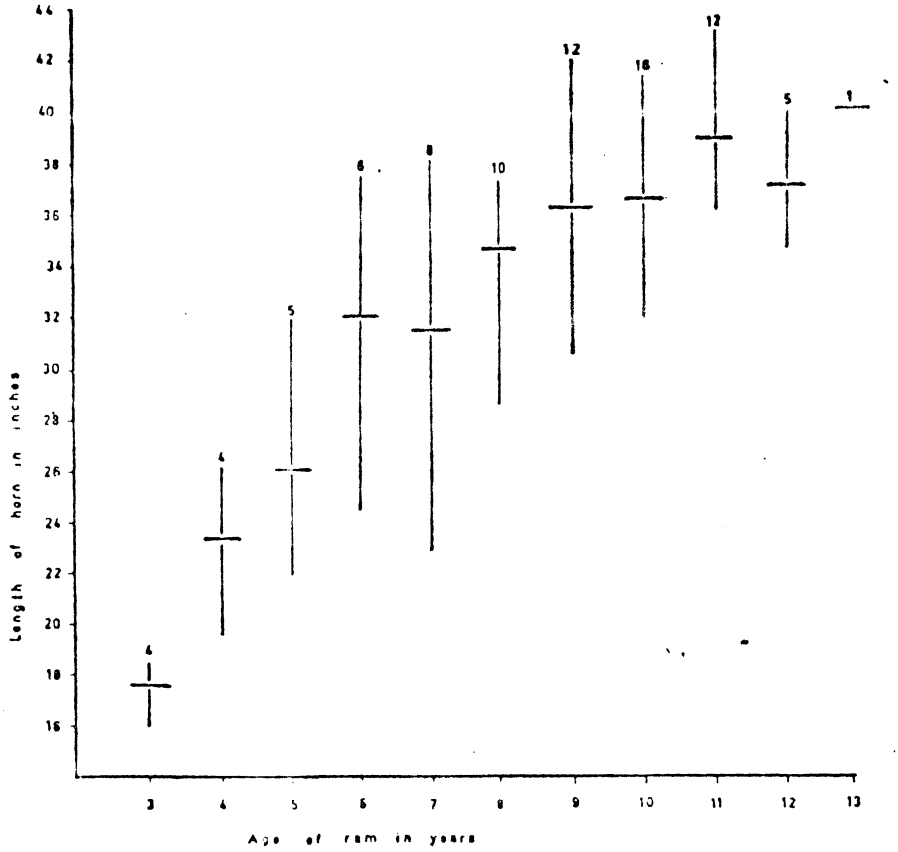


FIGURE 4

RELATION BETWEEN AGE OF RAMS AND HORN BASE

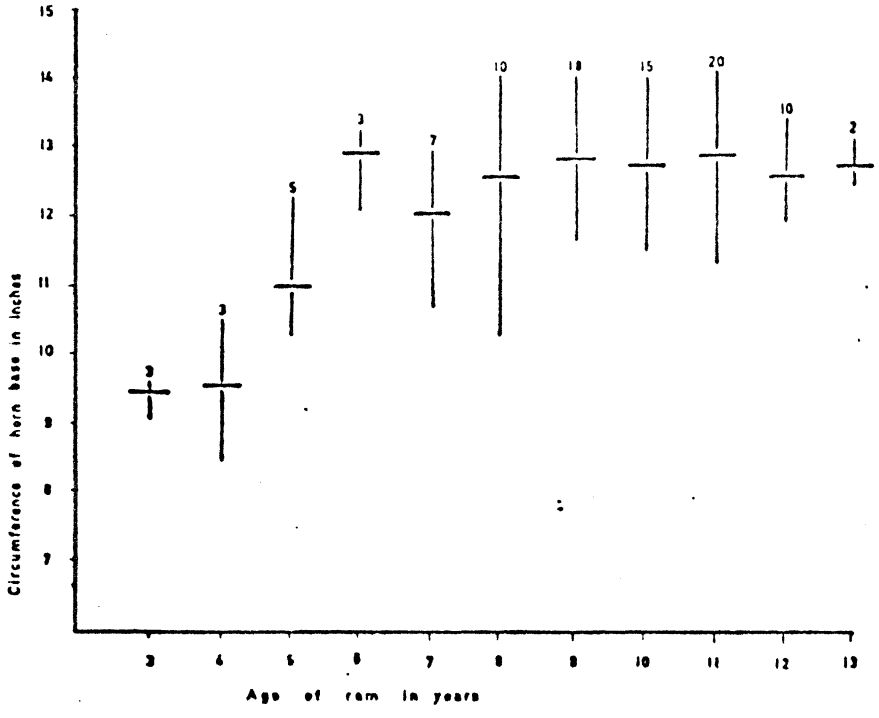


Table: 15

Comparisons of annual increments in horn growth of Dall rams

Age class														
1	2	3	4	5	6	7	8	9	10	11	12	13	Area	
3.8*	15.0	14.8	12.6	10.4	8.9	7.2	6.2	4.6	3.6	2.8	1.9		Brooks Range, Alaska	Source
3.9	16.4	16.3	14.3	11.9	9.6	7.6	6.0	4.4	3.3	2.8			Alaska Range **	
4.1	18.5	16.4	14.0	11.6	9.2	6.9	5.1	3.7	2.7	2.2	1.4		Alaska Range ***	Erickson
4.3	19.2	18.8	15.0	12.0	9.3	6.5	4.6	3.2	2.7				Wrangell Mts. "	(1970)
3.9	16.7	17.7	13.9	11.1	8.5	7.2	5.4	4.1	3.8				Chulitna Area, "	
3.6	18.0	18.2	14.5	11.9	9.3	7.1	5.2	4.2	3.1				Chugach Area "	
5.1	19.9	18.8	14.6	11.5	7.7	6.2	4.9	3.4	2.4				Kenai Area "	
7.9	21.5	17.7	13.2	10.6	7.9	5.7	4.4	3.3	2.6	1.7	1.2	1.0	Sheep Mountain	Hoefs
													Kluane Area, Yukon	Present Study

* Numbers are mean values expressed in centimeters

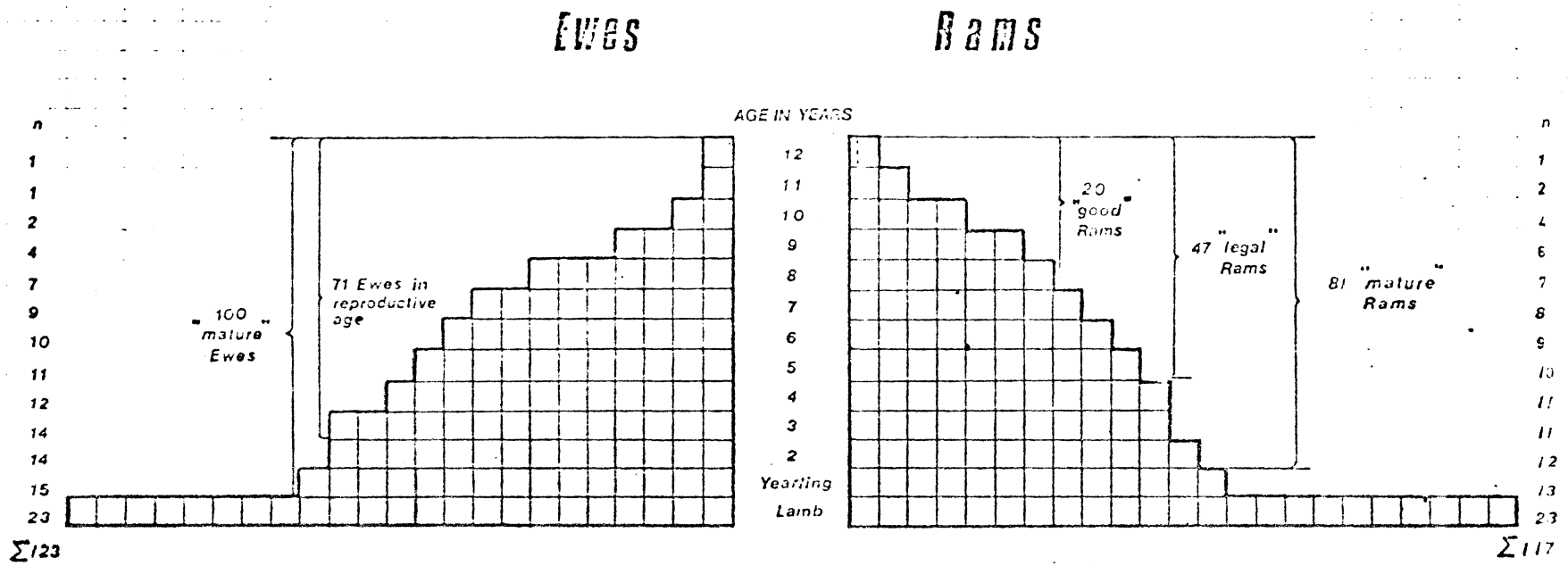
** West of Mt. McKinley Park

*** East of Mt. McKinley Park

Based on this population model the following ratios can be established which are useful in surveys and in calculations of expected trophy "yields". If 4 of the 2 to 3 year old rams (or about 1/3) are with nursery bands then there are 117 "nursery" sheep (ewes, yearlings, and four rams) in this population. Therefore the ratio of "mature" rams to "nursery" sheep is 66:100 in an unhunted population and can be as low as 26:100, if all legal rams have been removed. A ratio lower than this should not be encountered if hunting is the only "artificial" mortality factor. It if does occur it would indicate that the surveys missed ram bands.

In an unhunted population the ratio of "legal" rams to "nursery" sheep is about 40:100; while that of "good" rams to "nursery" sheep is as low as 17:100. Of the 20 "good" rams only about 8 (39%) are "trophies", giving a ratio of "trophy" rams to "nursery" sheep of 7:100.

Figure: 2
STRUCTURE OF SHEEP POPULATION



Explanation:

"mature" ram means males in the 2 to 3 year age group and older, since the great majority of them is found in ram bands.

"legal" ram means males whose horn curl circumscribes an angle of 270° or more.

"good" ram means males in the 8 to 9 year age group and older, since only this category contains trophy heads of 39 or 40 inches length.

TABLE:

Horn statistics of Dall rams from the Kluane Game Sanctuary

Annual increments of horn growth expressed as "degree curl"

(a = increment for the year; b = total degree curl to that age)

Collection Number	Age at death	1		2		3		4		5		6		7		8		9		10		11		12		13	
		a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
A 63	5	30	30	70	100	80	180	50	230	40	270																
A 53	8	-	-	-	70	60	130	50	180	50	230	40	270	35	305	25	330										
A 82	8	-	-	-	-	-	180	-	-	-	270	-	-	-	-	-	330										
A 61	9	30	30	80	110	80	190	50	240	40	280	30	310	25	335	20	355	10	365								
A 54	9	35	35	70	105	55	160	40	200	40	240	35	275	30	305	15	320	20	340								
A 45	9	-	-	-	100	80	180	60	240	45	285	30	315	25	340	20	360	20	380								
C 46	10	-	-	-	110	70	180	45	225	35	260	20	280	15	295	20	315	20	335	25	360						
A 65	10	25	25	90	115	65	180	60	240	40	280	30	310	25	335	20	355	15	370	10	380						
A 70	10	-	-	-	85	75	160	55	215	50	265	25	290	25	315	25	340	20	360	20	380						
A 57	10	25	25	85	110	70	180	50	230	40	270	25	295	15	310	10	320	10	330	5	335						
A 64	11	30	30	90	120	80	200	40	240	30	270	25	295	10	305	20	325	15	340	10	350	10	360				
A 46	11	20	20	70	90	90	180	45	225	25	250	20	270	20	290	20	310	15	325	15	340	10	350				
A 60	13	-	-	-	60	60	120	60	180	40	220	30	250	20	270	25	295	15	310	10	320	15	335	15	350	10	360
	$\bar{X}$,	28	28	79	98	80	171	50	220	40	260	28	287	22	310	20	330	16	345	14	352	12	348	15	350	10	360
Range: upper		35	35	90	120	90	200	60	240	50	285	40	310	35	340	25	360	20	380	25	380	15	360	-	-	-	-
lower		20	20	70	60	55	120	40	180	25	220	20	250	10	270	10	295	10	310	5	320	10	335	-	-	-	-

It is known that hunters select the "largest" rams out of a given band and it is also known that there is a tendency of rams of similar age groups to join up in bands (Geist, 1971), particularly on summer range when sheep are widely dispersed and when the hunting season is on. For this reason the average horn length per age group of these "selected" rams will be greater than the horn lengths of a more randomly selected and therefore more representative sample. This will not be the case anymore in the oldest age groups, since there are very few rams alive and and little choosing is possible. These considerations are reflected in Tables 17 and 18.

However, Table 18 is useful for comparisons of certain aspects. It does support that very few rams are "legal" in their fifth growing season (4 to 5 year age class), that there is an increase of horn lengths with age, that the maximum life span is the 12 to 13 year age class, and that very few trophies are encountered in the legal age classes below the ninth year.

When working out optimum harvest figures the assumption is made that hunting pressure is so intense that the maximum number of rams should be available but at the same time the hunters should have a chance to bag a "trophy". No trophies were encountered below the 8 to 9 year age class in the writer's collection from the Kluane area (Table 17), and therefore, no hunting should be considered below that age group. Starting off with an assumed 100 rams in the 7 to 8 year age class (Table 17) of which none was a "trophy", natural mortality during winter has reduced the total number of rams present to 86, however, 28 of these (33%) have now become "trophies". If these rams continue to live to the 9 to 10 year age class, natural mortality will have reduced their number to 65 of which 25 (38%) are "trophies". To wait a further year would reduce the total number present to 40 because of the heavy natural mortality rate of 39% in this age class. Even though this age group has the highest percentage of "trophies" (42%), only 17 rams fall into this category because of the small total number of rams remaining.

Referring back to our population model (Figure 2) there are 7 rams in the 8 to 9 year age class which could be harvested annually. Of these, 33% or 2 animals can be expected to be "trophies," one may be a 40 inch ram. Converting this into a practical ratio, it can be said that 100 "nursery" sheep (bands of ewes, yearlings and about 1/3 of the 2 to 3 year old males) will produce 6 "good" rams annually, of which two will be "trophies". These 6 rams can be harvested every year on the basis of sustained yield, if they are taken in the 8 to 9 year age class.

If hunting pressure is less intense, as in inaccessible areas where only outfitters operate, preference may be given to rams that "make the book" over a large total number harvested. Under such circumstances harvesting should be limited to the 10 to 11 or even 11 to 12 year age classes. As is obvious from Table 18, the chances of obtaining, 41, 42, 43 inch rams increases with age. However, because of greatly increasing natural mortalities in these age groups, the total number that can be taken annually on the basis of sustained yield becomes drastically reduced.

Inspection of Figure 2 reveals that there are only 4 rams in the 10 to 11 year age class, and only 2 in the 11 to 12 year age class. Therefore, 100 "nursery sheep" will only produce about 3 rams annually in the 10 to 11 year age class, one or two of these will be trophies. However, the chances are increased that these trophies will "make the book".

c) Optimizing of Harvests:

Of greater importance from the practical point of view than the annual increments are the total lengths of the horns and their "massiveness," which is usually expressed as circumference at base and at quarterly intervals, since these characteristics determine the trophy value of a ram. A study of Figures 3 and 4 reveals the following interesting relationship. Both, total length of horns as well as circumference at base show a high correlation with age up to about the eighth year. After this there is no further increase in the circumference at base and additional increases in horn lengths proceed at a very small rate. This relationship has already been described by Simmons (1968) and Wishart (1958). Simmons (1968) measured horn lengths of 159 Dall rams in the MacKenzie Mountains of the Northwest Territories. His curve, showing the correlation between horn length and age, levelled off at the 9 1/3 year of life. Further increases of horn lengths with age were insignificant. Wishart (1958) demonstrated that for Bighorn Sheep this correlation becomes negligible after the eighth year of life, and as far as the correlation between age and circumference at base was concerned his curve reached the asymptote already after the fourth year of life.

These findings must be interpreted cautiously. It is known that the horns of a given ram continue to grow both in length and in circumference throughout the animal's life. The above-mentioned correlations do not dispute this fact. However, great variations are found between rams in horn growth characteristics (Table 14a). The correlations discussed above (Figure 3 and 4, Simmons, 1968; Wishart, 1958) incorporate measurements of many rams. They demonstrate three facts: Firstly, the lengths of the annual increments become progressively smaller with age, as is obvious from Table 14a and 16; Secondly, the probability of brooming increases with age; and Thirdly, rams with a faster growth rate per annual increment of horn die earlier than those with a slower growth rate. Both Geist (1966) and Nievergelt (1966) independently described the latter phenomenon and use it in connection with evaluating ungulate population quality.

With reference to the management of sheep, these findings are useful in computing optimum harvest figures. Earlier discussions of Figure 2 revealed that rams in their sixth growing season and older are "legal" rams, under existing legislation, while those in their ninth growing season and older are "good" rams. This statement must not be taken at face value, since there can be exceptional rams in the 6, 7, and 8 year age groups, while there can be very poorly developed ones in the older age groups. But if a "trophy" is here arbitrarily defined as a set of horns whose lengths are at least 39 inches, then there are no trophies at all in the 6, 7, and 8 year age classes, while 39% of the horns of the 9 year age class and older are trophies. Preference is given to the use of 39 inches over 40 inches minimum length to quality as a "trophy" because 40 inch heads are not only very rare but also very "sporadic" in occurrence, which would make management for them very difficult. In our sample of 46 sets of horns in the 8 to 9 year age class and older, 20% had a length of 40 inches or better. Inspections of a much larger sample size by the Yukon Game Branch of hunter-killed trophies reveal that a percentage as high as 20 is very optimistic (Table 18).

Since the circumference at base (Figure 4) does not change significantly after the 8 to 9 year age class we will restrict further discussion on optimizing the harvest of "trophy" rams to a consideration of horn lengths only. Average horn lengths appear to increase to the oldest age classes, even though the annual rate becomes progressively smaller. However, the advantages gained from this trend from the point of view of harvesting trophy rams, is counteracted by a greatly accelerating natural mortality rate in the old age class.

Table 17 summarizes the relevant statistics necessary to compute optimum harvests. It is based on the assumption that the natural mortality patterns of a hunted population is the same as that of a protected population. We have so far no evidence to dispute this assumption. For comparative purposes, Table 18 is included here, which gives horn length statistics of Dall rams taken during the 1973 hunting season in the southern and south-western Yukon Territory. The following facts must be kept in mind when comparing this Table 18 to Table 17.

Table: 11

Number of "Trophies"[1] in the legal age classes of rams.

Age classes	7 - 8[2]	8 - 9	9 - 10	10 - 11	11 - 12	12 - 13
Sample size	10	12	16	12	5	1
Mortality rate[3]	14%	24%	39%	56%	86%	100%
Numbers present[4]	100	86	65	40	18	3
Percent Trophies[5]	0	33%	38%	42%	20%	100%
Number of Trophies	0	28	25	17	4	3

1. "Trophy" is here defined as a horn length of 39 inches or more
2. The 7 to 8 year age class is used as a starting point since neither the 5 to 6 nor the 6 to 7 year age classes contain trophies, even though they are legal.
3. Based on Table 12
4. For ease of calculation 100 rams were assumed to be present.
5. Based on data for Figure 3.

Table: 6

Horn lengths of Dall rams taken in the southern and south-western Yukon Territory during the 1973 hunting season (Courtesy of Yukon Game Branch)

lasses	4 - 5	5 - 6	6 - 7	7 - 8	8 - 9	9 - 10	10 - 11	11 - 12	12 - 13
	28.8*	30.0 32.5 33.0 32.0	33.8 28.5 32.5 33.3 31.5 35.5 32.7 30.2 33.5	32.0 32.7 35.5	34.0 36.5 35.8 37.5	38.0 35.5 39.3 38.5 33.5	34.5 38.0 39.8 36.7	39.4 34.0	
.ng e	32.0	28.5 32.0	34.5 36.5	32.5 40.0 36.2 34.2	35.5 35.5 35.5 34.5 37.0		37.0 37.2 34.0 34.7	40.0 36.5 39.0 38.0	
t Range nd desh Range		34.0		35.4 38.5	38.3 36.7 40.5 32.0 37.2	33.7 39.0 42.0 41.2 33.0 36.8 36.2	39.2 36.7 40.2 36.0		38.7
h Central kon **	31.2	30.7 30.2	32.0 27.2 33.2	34.5 36.7 33.7	33.5 33.5	36.7 33.7 33.2 36.5 31.0 37.2	36.5 40.0 34.7 39.7 34.2 39.2 42.0 38.0	40.7 40.5 36.5 35.5 36.0 39.0 36.5 43.2	
hern Yukon ct location termined)	27.5 33.7	29.5 33.5 30.2 30.0	36.0 31.0 34.5 39.7	36.5 35.0	30.7 33.7 38.8	32.5 37.5 36.0	34.8 36.5 34.8 40.2 41.2	41.0	
le size	5	13	18	14	19	21	25	15	1
horn lengths	30.8	31.3	32.5	35.2	35.6	36.3	37.4	38.4	38.7
ers > 39"	0	0	1	1	1	4	9	8	0
%	0%	0%	6%	7%	5%	19%	36%	53%	0%
ers > 40"	0	0	0	1	1	2	5	5	0
%	0%	0%	0%	7%	5%	10%	20%	33%	0%
ers > 41"	0	0	0	0	0	2	2	2	0
%	0%	0%	0%	0%	0%	10%	8%	13%	0%
ers > 42"	0	0	0	0	0	1	1	1	0
%	0%	0%	0%	0%	0%	5%	4%	7%	0%
ers > 43"	0	0	0	0	0	0	0	1	0
%	0%	0%	0%	0%	0%	0%	0%	7%	0%

Σ 1

ength of longest horn in inches

ountain ranges bordered by the Alaska Highway in the North,
usawa Lake - the west, The Yukon - B.C. border - the south,

TABLE 2

Summary of Sheep Survey in South-central Yukon

Area	Code	Numbers Observed * Nursery Sheep	Lambs	Rams Legal	Rams Young	Numbers Estimated ** Nursery Sheep	Lambs	Rams Legal	Rams Young
Babala's Area	1	82	30	14	22	200	75	40	50
	2	249	74	20	25	300	100	40	60
	3	50	24	8	15	60	30	10	20
	4	20	10	3	5	30	15	3	5
	5	54	13	15	15	120	40	25	25
	Sum	455	151	60	82	710	260	118	160
Heynen's Area	6	123	46	18	32	7(13-20) 220	100	45	55
	7 *** 7-23	73	41	10	37	7-23 100	60	15	35
	8 7-21	81	31	15	25	(21-24-25) 150	70	30	40
	Sum	277	118	43	94	470	230	90	130
Callison's Area	9	153	50	25	53	7-22 220	75	35	65
	10	0	0	0	0	7-28 50	20	10	15
	11	114	33	0	0	7-29 150	50	25	35
	12	113	50	18	20	7-30 250	100	50	50
	13	55	19	0	2	7-27 55	20	0	5
	14	23	5	2	3	7-33 & ½ of 32 150	60	25	35
	15	0	0	0	0	0	0	0	0
	16	23	10	2	4	9-03 40	20	5	10
	17	0	0	0	0	0	0	0	0
	18	0	0	0	0	0	0	0	0
	19	0	0	0	0	0	0	0	0
	20	4	3	0	3	9-04 10	5	0	5
	21	0	0	0	0	0	0	0	0
	22	0	0	0	0	0	0	0	0
	23	0	0	0	0	0	0	0	0
	Sum	485	170	47	85	925	350	150	220
Totals		1217	439	150	261	2105	840	358	510

* These are the numbers actually observed during aerial surveys supplemented by ground checks in certain areas.

** These are the numbers estimated to be actually present in the areas. They are derived by supplementing the survey data by interviews with the outfitters in the area as well as reliable hunters and guides. They also take into consideration the intensity of the surveys, type of aircraft used, visibility and type of terrain surveyed. These numbers are thought to be within ± 15% of the true numbers.

*** Area (Code No. 7) is partly within Callison's area, therefore the sheep here are split into equal halves between Heynen and Callison.

ernment of the Yukon Territory

, WHITEHORSE, YUKON TELEPHONE 403-667-7811 TELEX 0498260

OUR FILE
YOUR FILE

21st, June, 1973

TO: J. B. Fitzgerald, Director of Game

FROM: Manfred Hoefs, Biologist

RE: Survey Flight June 21st, 1973

From 9:45am to 12:20pm (about 2 hours 20 minutes flight time) a survey was made of the Fish Lake - Ibex Mtn. - Mt. Arkell and Mt. Ingram areas.

We used a small G - 2 helicopter. There was a strong wind, particularly at higher elevations which made the census very difficult. It was impossible to get into certain valleys.

On the high mountain at the southwest end of Fish Lake, a total of 3 different bands were observed totalling: 6 rams (2 legal size); 47 nursery sheep and 14 lambs. It is possible that we missed 3 rams, since we saw a band of 9 on the return flight, but did not have enough gas for a close check.

Only the easternmost part of the Mt. Arkell range was checked stretching from about Mt. Ingram in the north to Mt. Arkell in the south. Sheep were observed in four different localities. They totalled: 12 rams (6 legal size) 65 nursery sheep and 29 lambs.

Because of the bad wind the range was not covered thoroughly and some sheep may have been missed. The Mt. Ibex area was checked last, but no sheep were observed.

Total count for this flight = 18 rams (8 of legal size), 112 nursery sheep (ewes, yearlings and rams to 2 years of age) and 43 lambs.

The ratio of 43 lambs to 112 nursery sheep, or about 38%, is considerable better than the ratio observed on Flat Mt. - Pilot Mt. yesturday.

Manfred Hoefs,
Biologist

ernment of the Yukon Territory

S, WHITEHORSE, YUKON TELEPHONE 403 667-7811 TELEX 0498260

OUR FILE
YOUR FILE

25th, June, 1973

TO: J. B. Fitzgerald, Director of Game

FROM: Manfred Hoefs, Biologist

RE: Survey Flight, June 22nd, 1973

Starting at 1:15pm to 3:15pm (flying time approximately 2 hours and forty minutes) a helicopter survey (G-2) was made of the mountainous area from Mt. Arkell west to Kusawa Lake.

Despite intensive coverage and ideal flying conditions very few sheep were located. A small band of ewes and lambs (11 nursery and 3 lambs) were located on the northernmost extension of this range only a few miles south of the Takhini River. Two single rams (one of legal size) were observed at Kusawa Lake where Primrose River enters this lake. They were at the southern extremity of a small mountain range paralleling the shores of Kusawa Lake. Another band of five rams (4 of legal size) were observed about half way between Mt. Arkell and Kusawa Lake at the south-facing slopes of this mountain range.

It is doubtful that many sheep were missed, since our coverage was fairly detailed. On our return we again flew over Ibex Mountain and - as yesterday - no sheep were found here. There are also no sheep on the Golden Horn Mountain south of Whitehorse. This mountain has no winter range and no escape terrain; however, alpine elevations are continuous from Fish Lake and sheep can conceivably cross over to this mountain.

During a moose survey flight in late winter fourteen mature rams had been observed on winter ranges along Primrose River near Kusawa Lake, not too far from where the two rams were observed on this flight.

Manfred Hoefs,
Biologist.

SURVEY FLIGHT - June 19, 1973

Accompanied by W. C. Sinclair a game count was made from 0930 hours to 1330 hours (about three hours flying time and a one hours lunch break at Carcross) with a B-1 helicopter.

The Mt. Lorne area has good sheep habitat for perhaps fifty sheep, but no sheep nor sheep signs were observed. A grizzly sow with one cub was seen on the mountain south of Mt. Lorne in alpine habitat. This mountain is primarily caribou habitat, it has very little escape terrain for sheep.

Mt. Lansdowne to the southeast was surveyed next. Again this mountain area is primarily caribou habitat, with very few cliffs and no winter range to speak of. No animals were observed.

We proceeded south ward to survey the caribou mountains area north of Carcross. On the northern most knob five large caribou were found at alpine elevation above the Carcross Road. Three were old bulls and the other two either young bulls or cows. Only two young rams, about three years old, were seen on this range. The nursery band that A. J. Squirechuk saw earliest this spring was not found.

Nares Mountain east of Carcross was surveyed next. It has some excellent goat and sheep habitat, both winter range and escape terrain, but only one caribou cow with a calf was observed on the east slope of this mountain.

Going back to Whitehorse we surveyed the "Gray Ridge" along the west side of the Carcross Road. This entire Ridge is excellent sheep and goat habitat, with winter range and escape terrain along the entire west face. We only observed two cow caribou near the southern end of this range, four ewes with two lambs along the west face at sub-alpine elevation, opposite the area where the Wheaton River flows into the valley from the west, three rams (one legal, one four years old, one two years old) also along the west side of the Gray Ridge about one mile north of the nursery band and one more band of three rams, with the same age distribution, on a limestone knob along the east side of Gray Ridge, half way between Needle Mountain and Gillian Mountain. There is a slight possibility that

these two ram bands were the same, but the distance between those two observation point was three miles and it is unlikely that they covered distance is less than fifteen minutes.

Because of strong winds this survey on Gray Ridge was only superfinal and should be done again in calm weather. The range is large enough to support at least one hundred sheep and up to sixty have been observed from the Carcross Road only a few years ago.

Manfred Hoefs,
Biologist.

25, June, 1973

TO: J. B. Fitzgerald, Director of Game

FROM: Manfred Hoefs, Biologist

RE: Survey Flight, June 23rd, 1973

Starting at 9:05am to 12:15pm (about 2.8 hours flying time) an area approximately bordered by Fish Lake in the north, Alligator Lake and Watson River in the south, and Rose Lake in the west was surveyed by helicopter (G-2). The weather was good and most areas were surveyed in great detail.

There are no sheep or sheep sign on Mt. McIntyre. We also did not see any sheep around Mt. Granger, south of Fish Lake, even though this area is covered by many trails. It is possible that the sheep population from the range north of Fish Lake crosses over to this range later on in the summer.

The area between Mt. Granger and Alligator Lake consists largely of alpine, flat plateaus, which are not sheep habitat but would support caribou.

The area between Alligator Lake and Watson River in the south, Rose Creek in the west and a wide valley in the north is excellent sheep habitat and bands were observed in six different locations. Coverage was fairly good, and I assume that 75% of the sheep on this range were located.

The total number of sheep observed on this range was 35 rams (10 of legal size), 81 nursery sheep and 31 lambs. This includes two big bands of 69 nursery with 28 lambs and another band of 30 rams.

Nursery sheep here includes not only yearlings and two year old rams but also a few three year old rams, which was never observed in the Kluane Park.

One of the best sheep ranges discovered so far is the area of some 50 square miles bordered by Rose Lake in the west and Rose Creek in the east and south. Sheep were located in five different areas along the west and south slopes, and the majority of them was at very low elevations, 3500 feet, below tree line, possibly at a lick. The west slopes of this range above Rose Lake, around Primrose Mountain, is excellent sheep habitat with an ideal combination of winter ranges at low elevation, escape terrain and lambing ground in the form of very rugged cliffs above, and extensive summer range directly adjacent to the escape terrain. These sheep do not have to cross any valleys on their annual migration.

A serious attempt should be made to preserve this unique sheep range.

The total number of sheep seen on this range was 47 rams (at least 10 of legal size), 73 nursery sheep and 41 lambs. The nursery sheep included possibly 3 three-year old rams as well as a number of two-year old rams.

The aerial coverage of this area was in great detail, and I assume that we located 90% of the sheep on this range.

Total classification for these two ranges censused today:

82 rams (at least 20 of legal size)

154 nursery sheep (ewes, yearlings, many two-year olds and a few three-year old rams

72 lambs

The lamb to ewe ratio of 72:154 or 47% is the best so far encountered on this summer's surveys. Considering that there were a few three-year old rams in the nursery bands, which had not been observed in other areas, the real lamb crop will be over 50%, which is very good by any standard.

Taking into account the details of the coverage, size of the area and weather conditions, I estimate that the total number of sheep on these two ranges is about 100 mature rams (with perhaps 25 legal sized ones), 200 nursery sheep and 100 lambs.

It is interesting that on today's survey all sheep below the snowline and the great majority of them was at very low elevations, 3500 to 5000 feet.

Manfred Hoefs,
Biologist.

26th, June, 1973

TO: J. B. Fitzgerald, Director of Game

FROM: Manfred Hoefs, Biologist

RE: Survey Flight - June 25th, 1973

From 1:15pm to 3:15pm (2.3 hours flying time) a survey was made by Jet Ranger of the mountain range between Rose Lake and Kusawa Lake. Sheep were encountered in four locations, but only two had substantial numbers. The rams appear to be concentrated around Sandpiper Creek at the north end of this mountain range. A total of 30 rams were found here, of which 15 were of legal size. One single goat was also observed here. A great concentration of nursery sheep and young rams were located on an alpine plateau in the southeastern corner of this range above Primrose River and the southern half of Rose Lake. We observed here 146 nursery sheep (including some young rams) with 48 lambs.

The total number of sheep observed on this range was 42 rams (17 of legal size), 153 nursery sheep with 50 lambs; plus one goat. The coverage was fairly good and I estimate that 90% of the sheep on this range were found. The winter range of this population is mainly along the southern boundary of this range, above the Takhini River and in the Sandpiper Creek area in the northern portion. The west face above Kusawa Lake is extremely steep and rugged with almost no vegetation cover. Not a single animal was observed here. I estimate the total sheep population of this range to be about 50 rams (20 legal size); 170 ewes, yearlings and young rams and 60 lambs.

The lamb to ewe ratio observed 50:153 or 33% is very low, but some three-year old rams were included. A better estimate would be around 40%, since some small lambs were probably overlooked.

During the return flight we surveyed a small mountain range between Alligator Lake and Two-Horse Creek in the north and the Watson River in the south. We found two large nursery bands as well as two isolated young rams. The total population was 2 rams, 53 nursery sheep and 19 lambs. The counts were accurate and so was the survey. I doubt whether any more sheep were on this range at the time. The ratio of lambs to ewes of 19:53 or 36% is poor. No three-year old rams were observed in these nursery bands. There is good winter range along the Watson River south of Twin Mountain as well as opposite Mt. Hodnett. The range is not more than 20square miles in size, and would therefore have a density of about four sheep per square mile. However, I assume that the sheep move off the mountain range later on in the summer. The lack of mature rams on the range supports this assumption.

We did not see any sheep along Coal Lake, but K. Squirechuk and W. Klassen saw 4 mature rams on the mountain northwest of Coal Lake a few weeks ago. These may have come over from Fish Lake. Double Mountain, southeast of Coal Lake, is not sheep habitat, and no animals nor trails were found.

Manfred Hoefs,
Biologist.

TO: J. B. Fitzgerald, Director of Game

From: Manfred Hoefs, Biologist

RE: Game Survey - June 27th, 1973

Accompanied by Roy Reinke a game survey was made in southwestern Yukon in an area bordered by Frederick Lake in the North, Kusawa Lake in the east, Haines Highway in the west and the B.C. - Yukon boundary in the south.

The survey was made by Jet Ranger from 2:00pm to 7:00pm (approximately 4.6 hours flying time). Weather was sunny to overcast, with one short shower.

The coverage on this survey flight varied. It was good in the northern half of this range, where perhaps 70% to 80% of the animals were located. It was not as good in the southern half, because poor weather and a lot of snow on the ground made accurate counts difficult. I estimate that perhaps only 50% of the animals were located.

It is reasonable to say that this area is by far the poorest so far surveyed; large tracts of it, particularly in the south, are completely devoid of wildlife. There is no doubt that the carrying capacity for sheep and goats is lower here than in areas north of Frederick Lake or east of Kusawa Lake, but part of this lack of animals will no doubt be due to hunting along the Haines Road.

Most depressing was the disappearance of goats in this area, which was at one time Yukon's better goat habitat. We only counted a total of 7 goats, one isolated billy in the Pass Creek area, and one nursery band consisting of 4 nannies, 1 yearling and 1 kid, along the west side of Devilhole Creek. There is no doubt that some goats, particularly isolated ones, will have been missed, but I doubt that this entire area has more than 30 to 40 goats left.

About 4 to 5 years ago K. Squirechuk flew part of this area and estimated that there were 50 to 60 goats between Kusawa Lake and the small lakes along the headwaters of Frederick River. He counted over 30 goats just along these headwaters. These goats have all but disappeared. Goat hunting should be stopped immediately until we know exactly how many goats we have left and until these have had a chance to build up again to huntable numbers.

Most of this area is not sheep habitat. There is too much snow and lack of winter ranges. Small bands were located in the following localities: 12 nursery sheep and 3 lambs around Ark Mountain, and 15 nursery sheep plus 5 lambs on the small mountain to the west of Ark Mountain. A band of 15 nursery sheep plus 8 lambs were observed near the headwaters of Pass Creek, on its north side. A total of 7 rams (5 of legal size), 12 nursery sheep and 2 lambs were located on the mountain (+ 7205) south of Frederick Lake, and a small band of 3 young rams on the mountain east of the Takhanne River. On "Klukshu" Mountain south of Klukshuk Lake and along the Haines Highway a total of 8 rams were observed of which 3 were of legal size. Last fall we observed about 30 nursery sheep on this range, but we did not see them on this flight. Because of bad weather the area along the west shore of Frederick River could not be surveyed and some sheep may have been missed here.

The total number of sheep classified was as follows: 18 mature rams (of which 8 were of legal size), 54 nursery sheep (ewes, yearlings and very few young rams) and 18 lambs. This ratio of 18:54 or 33% productivity is very poor. In addition at least 30 nursery sheep are known to use the Klukshuk Mountain, but have not been observed this time.

Considering the details of the coverage, weather and snow conditions I estimated the total number of sheep on this area as about 25 mature rams (10 of legal size), 120 nursery sheep and about 40 lambs. As already pointed out, the goat population is probably not more than 30.

Babcock saw 30+ rams – this area (72 fall) last year; not counting the Klukshuk band.
Babcock also saw 40 goats – Devil's Hole area

Manfred Hoefs,
Biologist.

Starting at 10:30 AM and returning to Whitehorse at 6:00 PM a survey was made of the area bordered by the Wheaton River in the south, the Watson River in the north, Primose River and Lake in the west and Annie Lake in the east.

We stopped at Carcross for lunch and refill, the total flying time was 6 hours.

Even though the Red Ridge and Mt. Hodnett area had a number of sheep trails and some winter range, no sheep were observed here during this survey.

The area south of Mt. Hodnett, which includes the following peaks: Vesuvius Hill, Gold Hill, Pugh Peak and Mt. Perkins, was covered in great detail, bands of sheep were observed in these four locations. The total number of sheep in this area was 105 nursery sheep and 34 lambs. This included a very large band of 70 nursery sheep with 18 lambs, of which a photograph was taken.

A few 3-year old rams were with the nursery sheep, but no mature rams. This lamb ewe ratio is very poor. No mature rams were observed on this range. The coverage of this area was very good, and I estimate that the total number of nursery sheep here does not exceed 120 animals. The mature rams appear to move off to neighbouring areas. The winter range of this population appears to be along the Wheaton River in the northeast corner of this range.

The coverage of the large range around Mt. Skukum was less intense, particularly the southern half could only be surveyed superficially. I estimate that no more than 60% of the sheep on this range were located. Bands were observed in 13 different locations. The total count was 38 mature rams of which about 18 were of legal size, 113 nursery sheep and 50 lambs.

The lambs to ewe ratio was much better than in the other area surveyed, and in one band of 20 nursery sheep with 13 lambs was extremely good. Winter range we located along Primrose River and Primrose Lake and in a few places along the Wheaton River. No goats were observed in this area.

Skukum Creek was not surveyed, and the headwaters of the Wheaton River were only looked at superficially.

Total counts for this survey were 38 mature rams of which perhaps 18 were of legal size, 218 nursery sheep, which includes ewes, yearlings, 2-year old rams and a few 3-year old rams, 84 lambs.

Considering the degree of coverage and intensity of survey I estimate the total number of sheep in this range to be about 50 mature rams, 250 nursery sheep and 100 lambs.

Manfred Hoefs,
Biologist.

GAME SURVEY - July 26, 1973

A helicopter survey (G-2) was made of various areas around Tagish and Bennett Lakes. The weather was sunny but windy. We worked out of Carcross and flew a total of 5.3 hours.

On the way to Carcross Caribou Mt. was checked again, and not a single sheep or caribou was observed this time. The sheep must move off the mountains, presumably to "Grey Ridge" to the west, since Nares Mt. to the south of Caribou Mt., also has no sheep on it. Nares Mt. as well as Caribou Mt. have good winter ranges and excellent excape terrain, and each could easily support at least a population of 50 sheep. However, both mountains can easily be kept under surveillance from Carcross, and according to Kit Squirechuk the Carcross Indians shoot any sheep on these mountains as soon as they show up.

We next surveyed Jubilee Mountain range between Tagish Lake, Taku Arm and Little Atlin Lake. We did not see any animals on this range. For the most part it is caribou terrain, but there are some steep, rugged limestone ridges, particularly along Taku Arm, which would be suitable for goats. I estimate that at least 50 goat could live on this range. We did not see any trails either, so that animals could never have been abundant here.

Lime Mt. range was surveyed next. It is the name arbitrarily given to the area bordered by Taku Arm in the east, Tagish Lake in the north, Windy Arm in the West, and the B.C.-Yukon boundary in the south. No animals were seen in the eastern half of this range. This is a fairly rugged limestone area, which appears to be very dry. Vegetation cover even in alpine areas is very low and scanty. There are no lush alpine meadows. The area has, however, very good escape terrain and some winter range along its south-western border. There were a few trails and two old pellet groups, presumably from goat, were located, while the helicopter was being refuelled. The carrying capacity of this area will be low; but still up to 30 goat should be able to live here. The western portion of this range is better wildlife habitat. It is moister ~~muskier~~ and the vegetation cover more lush. We counted a total of 8 mature goats and 4 kids along Windy Arm in 2 bands on a

high alpine ridge. These mountains are continous into B.C., so that the "Yukon population" is difficult to estimate. However, since the goat we saw were nursery bands, some billy goat should be around somewhere. Perhaps they are south of the border.

Montana Mt. was surveyed next. It is perhaps the best goat habitat so far seen in the Yukon, and it resembles B.C. goat ranges on the Haines Highway. Unfortunately a road leads up this mountain from Carcross and mining scars, old buildings and other remains are found everywhere. People can drive to an altitude of over 6000 feet, and it is therefore no wonder that the goat have almost been exterminated from this area. A small band of six goat and 3 kids are still around and were located above Bennett Lake. This range is continuous into B.C. so that influx as well as emigration of animals will occur.

Along west ~~from~~ Arm goats were only observed between Munroe Lake and Bennett Lake. We saw 7 mature goats and 2 kids. The Partridge River and South Macauley Creek areas are also typical goat country, but on this we saw only trails and a few tracks in the snow. All these ranges are continunous into B.C., which makes population estimates for the Yukon impossible.

We returned to Carcross along the northern shores of Macauley Creek and West Arm. Here we are back into Sheep country. We saw a total of 23 nursery sheep with 5 lambs and 5 rams of which 2 were of legal size in 3 different bands.

Manfred Hoefs,
Biologist.

GAME SURVEY - July 27, 1973

Working out of Carcross we surveyed the area bordered by Bennett Lake, West Arm and B. C. boundary in the south, Primrose Lake in the west and the Wheaton River in the north and east.

The sheep population in this area is small and no goats have been observed.

The area has some good caribou range, in particularly the range extending northward from Stony Mountain, and also Tally-Ho Mt. as well as Mt. Stevens are better suited for caribou than for sheep. These mountains have large alpine Plateaus with rolling physiography, but no escape terrain nor winter range. Three caribou were observed south of Carbon Hill.

The western most portion of the area surveyed, between the headwaters of MaCauley Creek and Primrose Lake is very poor wildlife habitat. Large portions are covered with ice, rugged cliff or scree slopes. No animals were observed here; and only a few trails were seen along the south end of the Primrose Lake, where also one ewe and one lamb was seen, which were, however, on the B.C. side of the boundary.

The remaining area northeast to Becker Creek is fairly good sheep country. Unfortunately a mining road in the Becker Creek area and many scars on the mountains from exploration activities must have had great effects on the sheep population, for we saw very few animals and no legal rams at all.

We saw today two separate bands of sheep, one with 1 ram, 10 nursery sheep and 3 lambs. Reproduction appears to be very poor.

At the southern border of this range, along MaCauley Creek we saw yesterday 3 rams 25 nursery sheep and 5 lambs.

About 20 nursery sheep with lambs were seen on a lick of this range, along the Wheaton River about one week ago.

The coverage during this survey was pretty good and I estimate from 70 to 80% of the sheep were located. I therefore estimate that the total sheep population south of the Wheaton River is probably not better than 100, consisting of perhaps 10 mature rams, 60 to 70 nursery sheep, and possibly 20 lambs.

No goats were found during today's survey. If the odd goat does show up, for instance along the headwaters of the Wheaton River and McCauley Creek, it should be left alone and not shot, so that the goat population in this depoverished area are given a chance to build up.

GAME SURVEY - July 28, 1973 (afternoon)

In the afternoon, between 1:45 PM and 5:00 PM (flying time about 3.4 hours) a survey was made of three mountain ranges in the Champagne area. We used a Bell 47 B-1 helicopter which worked much better in strong wind than the G-1, even though we had an extra passenger.

The first range surveyed is located north of Champagne between Mendenhall River and Cracker Creek. This range consists of three separate units, but only the large western unit had sheep on them. We had also seen sheep on this range in mid-winter; it can therefore, be assumed that these sheep are year-round residents. During this survey all sheep were found at the northern extremity of this range, on gently inclining, north facing meadows. Ram and nursery bands were found together. We saw 11 mature rams, of which perhaps 5 were of legal size, and one large band of 27 nursery sheep with 10 lambs. Coverage was very good, and I doubt that we missed any sheep. The total population is therefore around 50 sheep, and reproduction is fair. This area appears to be well suited for a population study, since these sheep appears to be confined to this range.

The next range covered is located between Cracker Creek and Aishihik River. Unfortunately we could only survey the southern half of this range north to 61¾ latitude. We only saw one band of 7 rams of which three were of legal size. One was a good ram and would measure 40". This range is continuous to the north and t therefore a population estimate was not possible. No ewes were seen, they were probably utilizing the northern half of this range, which has so far not been surveyed.

The last range surveyed today is located between Jo-Jo Lake and Kusawa Lake. This area is excellent sheep habitat, with winter ranges located along the southern and southeastern portion. There is excellent escape terrain above Jo-Jo Lake and also along portions of Kusawa Lake. We located 7 different bands of sheep. The rams were located on the northern portion of this range. We saw a total of 23 mature rams, of which a total of about 8 were of legal size. On the southern half of this range we saw 6 different nursery bands, varying in size from 2 to 36 animals. The total number counted was 50 nursery sheep with 24 lambs. This is an excellent lamb to ewe ratios for this time of year, it is one of the best found during the entire summer surveys. The coverage was very good,

but since this range is fairly large a few sheep will have been overlooked. I therefore estimate the total number of sheep on this area at 25 mature rams, 60 nursery sheep and 30 lambs. Whether or not this population is "discrete" is not known.

Manfred Hoefs,
Biologist.

GAME SURVEY – July 29, 1975 (Morning)

Working out of Champagne an area was surveyed which is bordered by Jo-Jo Lake and Creek in the east, the Shakwak Valley with Frederic Lake in the south and, the Dezadeash River in the West, and the Alaska Highway in the north.

This area is excellent sheep habitat, and the densities observed approach that of Kluane National Park. Unfortunately the weather was not cooperating. We had very strong winds and a considerable amount of low clouds. We used the small G-2 helicopter and it was often not possible to get close to the sheep for accurate classifications. The total flying time was approximately 3 hours for the survey, plus an additional 1.5 hours ferry time from Whitehorse. Because of the weather conditions and the small helicopter coverage was not too good today, but I estimate that about 75% of the sheep on this range were located.

We located bands, in 10 different locations on this range, but the heaviest concentration was found in the northern half of this range. Band size varied from as few as 3 sheep to as high as 70. A total of 41 mature rams were located of which perhaps 20 were of legal size. This is an estimation since we were not able to get close enough to the sheep without helicopter.

We counted a total of 249 nursery sheep (ewes, yearling, two-year old rams plus a few three-year old rams) and 74 lambs. In addition 4 sheep were not classified, most likely they were mature rams.

Because of the great height from which classification had to be made, the lamb count is most likely an underestimation of the true productivity of this herd, and this low lamb to ewe ratio should not be used for comparisons.

Considering the degree of coverage, visibility and flying conditions I estimate that the total population of this area will be about 50 mature rams, 300 nursery sheep and at least 100 lambs, giving a total of 450 sheep as mid summer population for this range.

Manfred Hoefs,
Biologist.

GAME SURVEY - July 29, 1973 (afternoon)

Working out of Haines Junction an area was surveyed which is bordered by the Dezadeash River in the southeast, the Haines Hwy. in the west, and the Alaska Hwy. in the north. This area is officially known as Dezadeash Range. In it ~~we~~ are located a number of lakes at sub-alpine and alpine elevations, large enough to land a float plane on. Granite Lake is one of them. We flew with a G-2 helicopter from approximately 2:00 PM to 5:00 PM. Flying time was about 2 hours, plus an additional 1.5 hours ferry time back to Whitehorse. The weather was just as poor as during the morning survey, and details and degree of coverage were again much effected and not too good. The area did not proof to be as good a sheep range as I had previously assumed. Only the northern half of this range is sheep habitat. This half, however, is as good as any sheep range.

We located 6 different bands of sheep in the northern portion of this range. Only one band of 22 mature rams were located, of which probably 10 were of legal size. The total number of nursery sheep was 82, they had 32 lambs with them. As in this morning's survey the lamb count will be an underestimation because of the conditions of this survey. Another band of 14 unclassified sheep were observed, which most likely were rams. There definitely was no lamb in that band. Taking into consideration the conditions of this survey, I estimate the total number of sheep on this range at about 200, classified as follows: 40 mature rams (perhaps 20 of legal size), 110 nursery sheep and 50 lambs.

In early Aug. '73 Jo Colla saw 33 rams around Mt. Bratnober, in the northeast portion of this range.

Manfred Hoefs,
Biologist.

GAME SURVEY – July 31, 1973

Accompanied by Roy REINKE and Dave MOSSOP, a survey was made with a Jet Ranger of the mountain ranges between Primrose Lake in the east, Takhini River in the north, Kusawa Lake in the west, and the Yukon–B.C. boundary in the south.

This area is split into two equal halves by the Takhini Lake and River. The eastern half, arbritarily referred to as Rothwell Glacier Range, was surveyed first.

Sheep were observed in 8 different bands, mainly above Primrose Lake. We counted a total of 100 nursery sheep with 31 lambs. Coverage was fairly good, and I assume that 80% of the animals were located. There is exchange of animals between this range and Mt. MaCauley Range, across the south end of Primrose Lake. We saw a band of 14 nursery sheep and 2 lambs cross the river going east. This emigration may also account for the lack of mature rams during this survey.

I estimate the total (winter) population of sheep on this range at [illegible] mature rams, 120 nursery sheep and 40 lambs.

Most disappointing was the complete absence of goats, particularly since the Takhini Lake and River country is one of the areas where Outfitter Callison is supposed to get the "odd" goat.

Two goats were shot Aug 2/73 here on mountain near Hendon River

The second portion of the area surveyed, between Takhini Lake, Kusawa Lake and the Yukon–B.C. boundary, has been the poorest area surveyed so far. Not a single animal was observed.

The country is rugged, it has many valley glaciers, cliffs and scree slope, perhaps not more than 10% of it has vegetation cover. Some of the creeks, however, would be suitable for goats. I am convinced that a small goat population of perhaps 50 animals could become established here, if goats were protected for a few years so that they have the chance to build up. They would xxxx naturally move into this area from B.C. in the south, where they are still fairly abundant.

Also exchange into B.C. (of rams)

Manfred Hoefs,
Biologist.

Notes:

Between July 31/73 and Aug. 4/73 Dave Hossop and I were counting sheep in the Sandpiper Creek area.

When flying in along the Tatlatui River from Primrose River Dave saw a large band of sheep (estimated to be close to 100). These must have been the military sheep we saw during our surveys above Rose Lake and Primrose River. On the next day we saw a very large band of military sheep (in excess of 100 animals), along the lower half of Sandpiper Creek. These two military bands could not have been the same, since more than 15 miles distance was between them.

It therefore appears that this range has two distinct populations, one inhabiting the NW Rose half, whose winter range is along Sandpiper Creek and Kaisawa Lake, and one in the southern half, whose winter range is along Primrose River and Rose Lake.

The rams seen during our count totalled 53 in "ram bands". Only about 1/4 of these were of legal size, and none even a "keeper."

Considering our observations it appears that the population on this range is higher than was estimated after our survey.

The true number will be close to 70 mature rams (25 of legal size), 200 military sheep and 75 lambs.