A SURVEY OF DALL'S SHEEP IN ZONE E/1-1, NORTHERN MACKENZIE MOUNTAINS

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ABSTRACT

A survey of Dall's sheep in Zone E/1-1, northern Mackenzie Mountains, conducted in June 1988 resulted in a total of 717 >1 year old sheep being observed in the 4956 km^2 survey area (48% of entire Zone E/1-1). A lamb:nursery sheep (includes yearlings) ratio of .48 indicates high productivity and is similar to the lamb:ewe ratios of other studies. The nursery sheep:ram (approx. halfcurl and larger) ratio was 1.6, in general agreement with Yukon and Alaska populations. Sheep density varied considerably across Zone E/1-1, although group size was the same across the Zone. Ewes with lambs banded together in larger groups than did ewes without lambs. Nursery groups were significantly larger than ram groups regardless of whether lambs were included in the analysis. Extrapolations from the number of sheep in the survey area to the entire Zone E/1-1 suggests that the present take of fullcurl rams is within the safe allowable for maintaining a sustained harvest of fullcurl rams.

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INTRODUCTION

Inventory of Dall's sheep (*Ovis dalli dalli*) in the Mackenzie/Richardson mountains has progressed in a sporadic fashion and largely in response to the possibilities of increased harvest (Barichello et al. 1987) or local disturbance related to industrial development (Nolan and Kelsall 1977, Hoefs 1978, Case 1989). Detailed research on demography and range use by Dall's sheep was conducted in the central Mackenzie Mountains (Simmons 1982, Simmons et al. 1984) and, most recently, in the Richardson Mountains (Barichello et al. 1987).

This report presents the results of an aerial survey of Dall's sheep done in the northern part of the Mackenzie Mountains (Zone E/1-1). The purpose was to obtain data on the numbers, distribution, and composition of sheep in this zone which could be compared with similar data obtained in areas to the north and south (Barichello et al. 1987, Case 1989). The sheep in Zone E/1-1 have been harvested for the last 15 years primarily by outfitted non-resident hunters, the large majority of whom take full curl rams. The number taken has gradually increased from 10-15 rams ten years ago to about 25 rams presently. The harvest by subsistence and resident sport hunters has been negligible over this period.

STUDY AREA

The survey area lies at the north end of the Mackenzie Mountains and is drained by the Arctic Red and Mountain rivers (Fig. 1). Proceeding from north to south, the area becomes progressively more rugged. A range of low, rounded 'foothills' extends across the entire north edge of the study area. The Canyon Ranges lie centrally followed by the Backbone Ranges to the south along the continental divide (Yukon border). Major valleys in the northern portion are vegetated by an open spruce forest (*Picea* spp.). Further south into the Backbone Ranges, forest cover dwindles and the major valleys are generally unforested, although extensive cover of low shrub (*Betula* spp., *Salix* spp.) persists. Upper valleys in both the central and southern parts of the study area are unforested and extensive shrub growth occurs mainly along watercourses. Alpine meadow development is varied depending on aspect, elevation and geology. Small, permanent glaciers occur in the extreme south of the study area close to the continental divide.

No climatic data exist for the northern Mackenzie Mountains. Annual precipitation is 25-30 cm with most rainfall in July and August in the central Mackenzie Mountains and the average frost-free season is only 70 days although frost can occur at any time of year (Simmons et al. 1984). Mean annual temperature is -9° C in the Richardson Mountains (Barichello et al. 1987) immediately to the north of the study area.

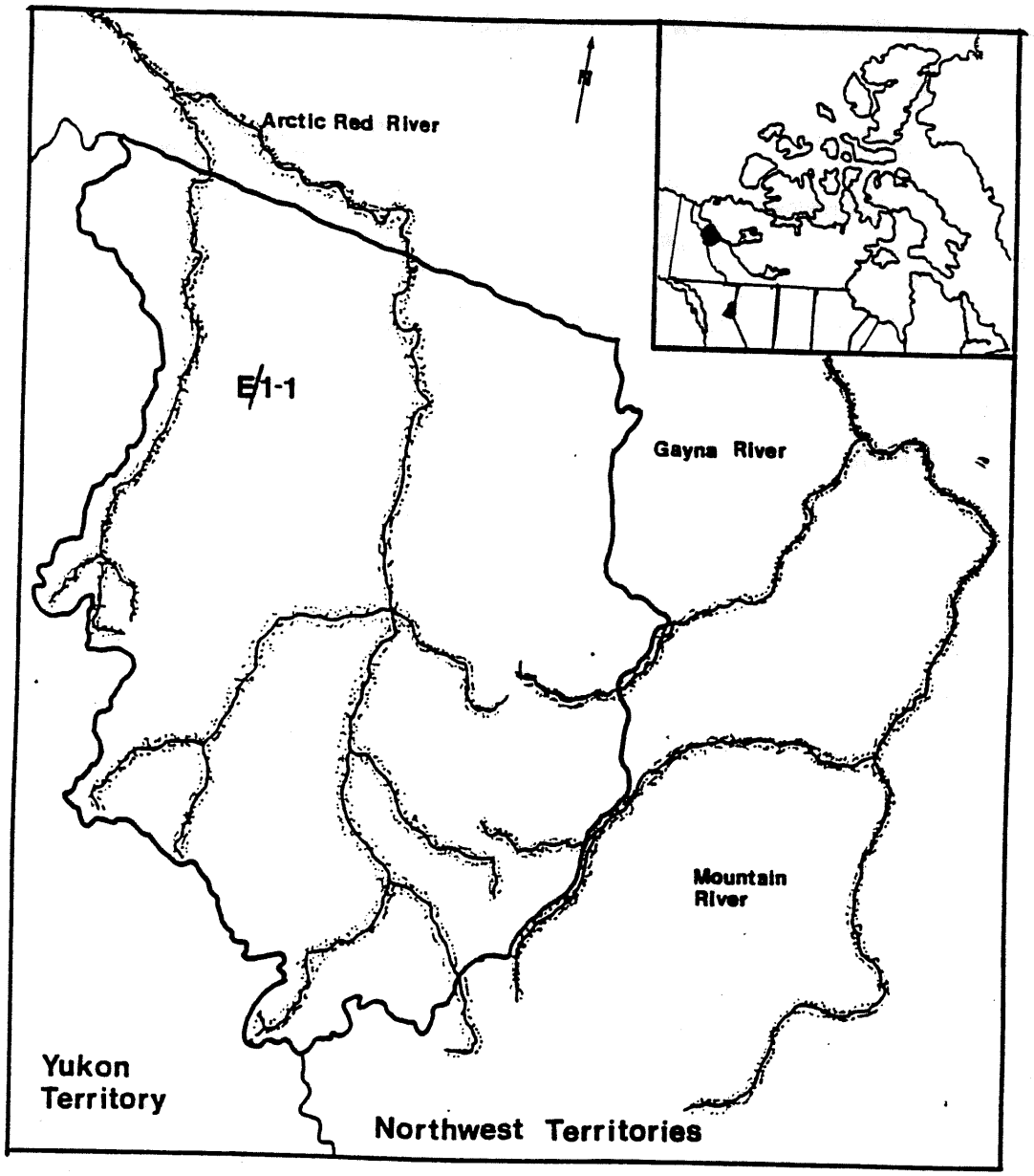

Fig. 1. The surveyed area within Zone E1-1, northern Mackenzie Mountains.

Moose (*Alces alces*) occur at low density primarily in the major, forested valleys. Woodland caribou (*Rangifer tarandus tarandus*) are found mainly in summer throughout much of the study area and at varying elevations. These caribou are thought to winter in the Wernecke Mountains, Yukon (Farnell, pers. comm.). Grizzly bears (*Ursus arctos*), wolves (*Canis lupus*), and wolverines (*Gulo gulo*) are also found throughout much of the area.

MATERIALS AND METHODS

This survey was conducted during 19-22 June 1988 using a Bell 206B helicopter. Two observers, seated in the right and left rear seats, passed observations on to a navigator/recorder seated in the left front seat of the helicopter and these were plotted directly onto 1:250,000 maps. Sheep were classified according to the following categories: ewes, lambs, yearlings, halfcurl rams, three-three-quarter curl rams, and fullcurl rams. Rams were classified according to the standard lateral eyeline technique (Fig. 2). An attempt was made to classify yearlings according to the criteria of Geist (1971), but in most of the analysis here they were pooled with ewes (henceforth termed nursery sheep) because of the difficulty in separating the two when observed from an aircraft. Groups of sheep are referred to as either ewe groups or ram groups depending on which was the majority in the group.

The survey was of the contour type in which the helicopter followed, as closely as possible, the relief of a given mountain block usually from a distance of 100-200 m. All side valleys, large and small, as well as any associated basins were searched in this manner. The exact altitude and distance from the mountainside depended on the terrain and where the likelihood of encountering sheep was thought to be greatest, for example alpine meadows with nearby rough escape terrain.

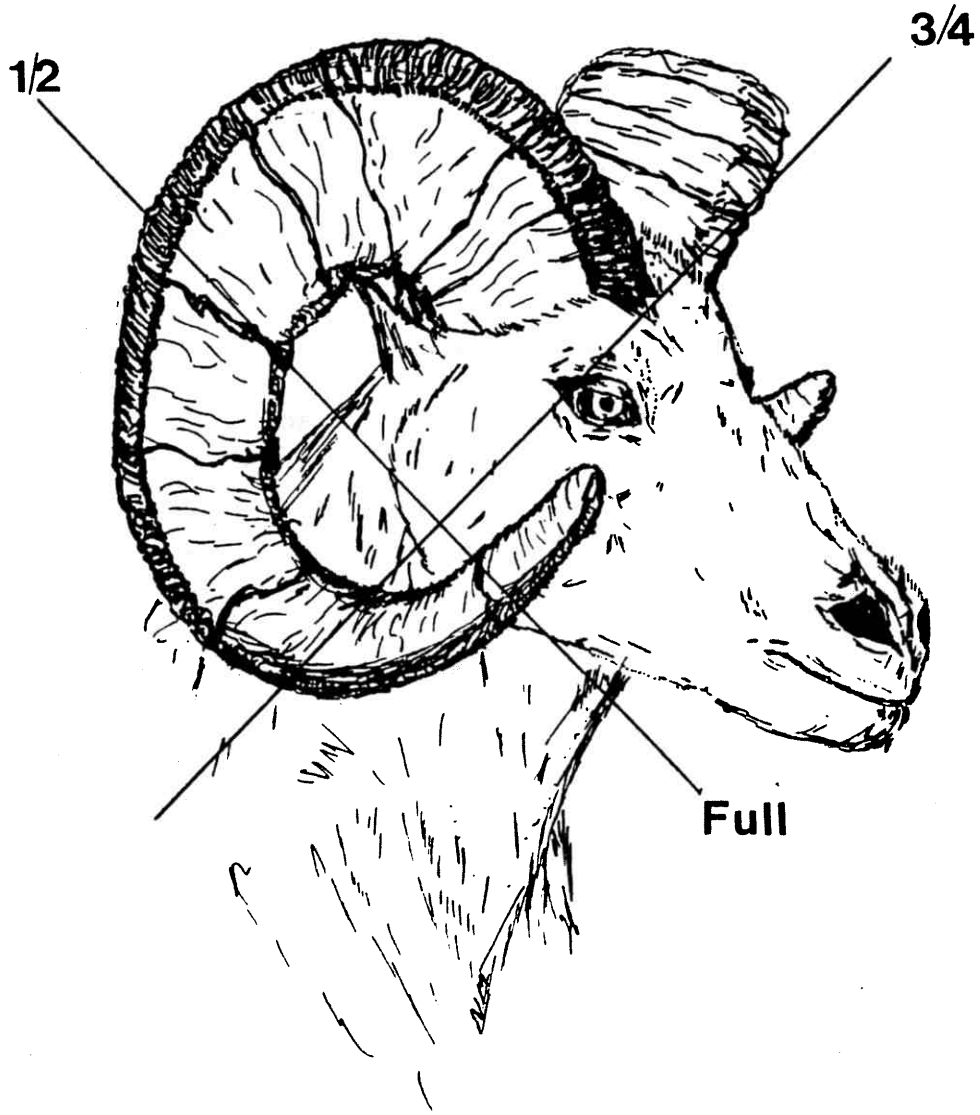

Fig. 2. Classification of Dall's sheep rams using the lateral eyeline technique.

RESULTS

The exact locations of all observations of sheep are on file at the Department of Renewable Resources, Norman Wells. The analysis here is a summary of these observations and persons wishing more detailed information on the distribution of sheep during this survey should contact the above office for possible release of this information.

The survey area comprised 48% of Zone E/1-1 (4,956/10,366 km^2) (Fig. 3). Budgetary constraints and fuel limitations restricted the amount of area that could be surveyed within the Zone. The survey area was divided, post hoc, into three sub-areas (Fig. 3) corresponding to the front range, or foothills (sub-area 1), the central ranges (sub-area 2), and the back ranges (sub-area 3). A total of 934 sheep was observed during 35 hrs. of flying time in all three sub-areas (Table 1). The number of sheep encountered per kilometre flown varied considerably among sub-areas. Relatively few sheep were encountered in sub-area 1. The encounter rate was highest in sub-area 2. Similarly, the density of sheep varied among the three sub-areas with sub-area 1 having the lowest and sub-area 2 the highest density. The overall density of sheep in the survey area was .19/km^2 (or, 1 sheep/5.3 km^2).

The nursery sheep:ram (halfcurl or larger) ratio was 1.6:1. The lamb:nursery sheep ratio was .48:1 and lambs comprised 23% of the observed sheep. For comparison, if just the number of ewes counted during the survey is used, the ewe:ram ratio was .99:1 and

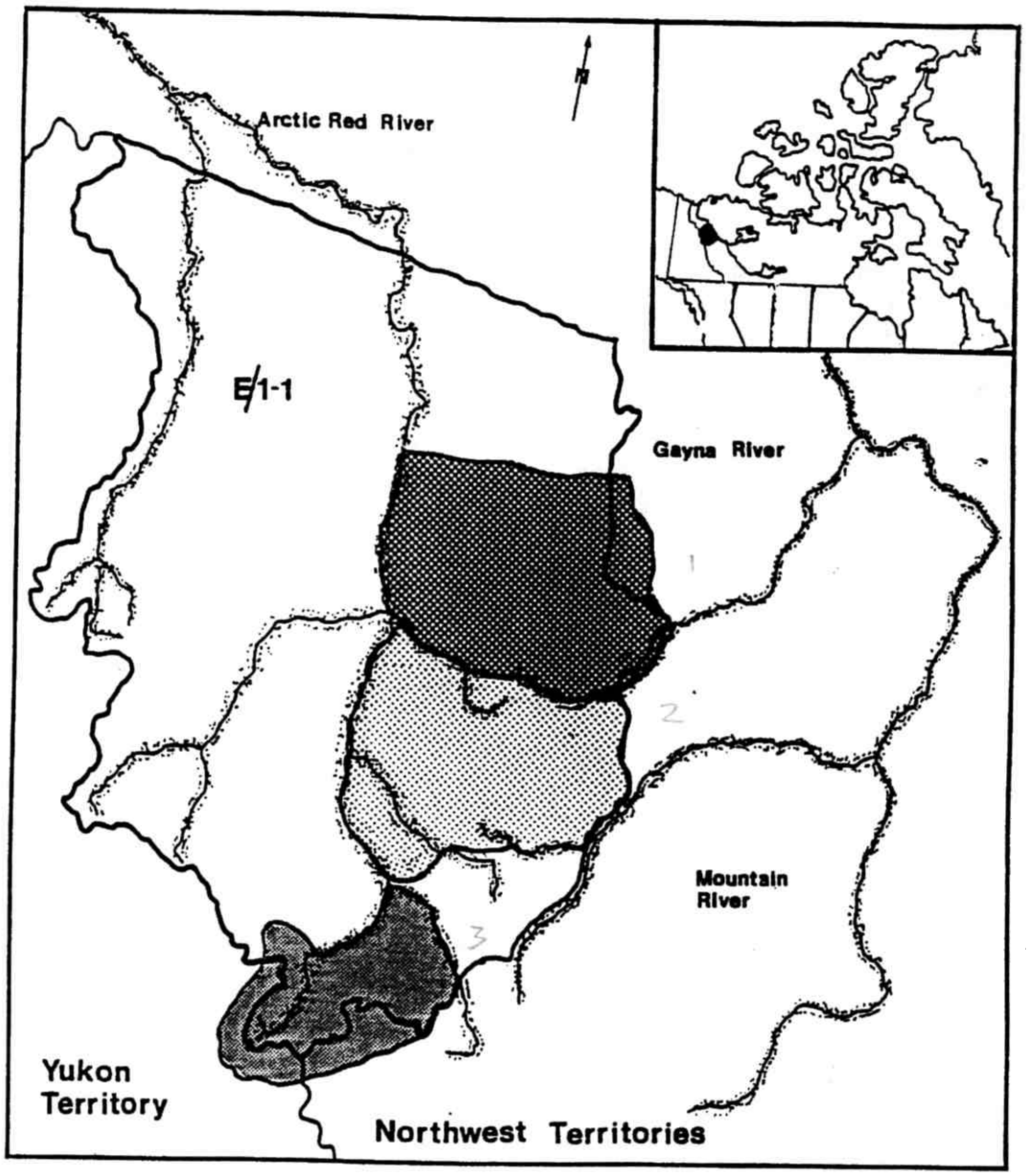

Fig. 3. The three sub-areas within the surveyed area.

Table 1. The numbers of sheep, sheep encounter rate, and density of sheep for each of the three survey zones.

	Number of sheep observed						
Sub-area	Ewes	Lambs	Yearlings	Rams	TOTAL	Sheep/km	Sheep/km^2 flown
1	16	10	14	71	111	.79	.05
2	203	167	119	140	629	1.71	.34
3	49	40	47	58	194	1.27	.19
Tot.	268	217	180	269	934		

the lamb:ewe ratio was .81:1. As stated earlier, however, because of the strong likelihood that errors were made in separating out all yearlings, the ewes:ram and lambs:ewe ratios were between .99-1.6:1 and .48-.83:1. Fullcurl and three-quarter curl rams comprised 7% and 9% of the observed sheep, respectively. Of the total rams observed, 25% were fullcurl or larger and 57% were approximately three-quarter curl or larger (i.e. rams which could be legally harvested) (Table 2). All three sub-areas were similar in the proportions of the three ram classes observed (Table 2).

Ewe groups with lambs comprised 86% of the total ewe groups observed. Ewe groups with lambs were significantly larger than ewe groups without lambs ($t=-3.19$, $P<.01$)(Table 3). If lambs are excluded from the analysis then ewe groups with lambs still had significantly more non-lambs than did groups without lambs ($t=-2.47$, $P<.02$). Ewe and ram groups comprised 51% and 49% of the 174 groups seen during the survey, respectively. Ewe groups, both with and without lambs, were significantly larger than ram groups ($t=1.81$, $P<.02$)(Table 2). If just the number of sheep one year old and older in each group type is considered, there was still a significant difference between the two groups ($t=2.18$, $P<.05$). The average size of ewe and ram groups was 4.4(3.4) and 3.1(2.6), respectively. Only 8% of the ewe groups were observed to contain rams, halfcurl or larger. Of the ram groups which had one or more rams (n=88), 32, 44, and 55% had full, three-quarter, and halfcurl rams, respectively. Of the observations of lone rams, 35%, 22%, and 44% were of full, three quarter, and halfcurl rams, respectively.

Restricted sample size precluded a full comparison of the three zones. The three zones were, however, not significantly different in mean group size ($F=2.26$, $P>.05$).

Table 2. Proportion of rams in each of the three horn size classes.

Sub-area	Proportion of rams in class (n)		
	1/2	3/4	Full
1	40%(28)	34%(24)	26%(18)
2	44%(58)	30%(41)	26%(34)
3	47%(27)	29%(17)	24%(14)
All sub-areas	43%(113)	32%(82)	25%(66)

Table 3. Group size characteristics for sheep across the entire survey area. All means all groups including single sheep.

Group type	n	mean group size(s.D.)	minimum size	maximum size
All	174	5.2(5.1)	1	36
Groups with Lambs	78	7.7(6.1)	2	36
groups with-Out lambs	14	2.4(1.4)	1	5
rams only	71	3.3(2.7)	1	13

DISCUSSION

The highest density of Dall's sheep occurred in sub-area 2. The encounter rate of sheep during the survey (i.e. sheep/km flown) was also highest in sub-area 2. This indicates that the highest density was not a result of greater survey effort in that zone. Group sizes within each sub-area, however, did not reflect the large differences in density among the three sub-areas. There was no difference in group size among the sub-areas.

The lamb:nursery sheep ratio observed in this survey (.48) was in general agreement with values presented by a number of authors from the Yukon (Hoefs and Barichello 1984), Alaska (Nichols 1978, Heimer and Watson 1986), and areas in the southern Mackenzie Mountains (Ferguson et al. 1985, Case 1989). In the central Mackenzie Mountains, Simmons et al. (1984) reported .60 lambs/ewe and immediately north of the present study area, in the Richardson Mountains, Barichello et al. (1987) reported .31-.40 lambs/ewe. These latter two studies separated ewes from yearlings and two year olds; therefore, the results of the present study are similar. The above results indicate that Dall's sheep in the Mackenzie Mountains have productivity comparable to areas further west.

The nursery sheep:ram ratio (1.6:1) appears similar to other populations, both hunted and non-, or lightly, hunted. At the extreme north and south ends of the Mackenzie Mountains, Barichello et al. (1987) found 1.3 ewes/ram and Case (1989) found 1.8 nursery sheep/ram. Hoefs and Bayer (1983), in an unhunted Yukon population, found 1.2 ewes/ram, and in Alaska an unhunted population had 1.5 ewes/ram and a hunted population had 1.7 ewes/ram (Heimer and

Watson 1986). It should be noted, however, that these studies compared ewes to rams which would result in lower values than if just nursery sheep were used as in the present study.

Density values, especially comparisons among studies, must be treated cautiously. In the present study, density was based on the total surveyed area. Other studies (e.g., Simmons et al. 1984, Barichello et al. 1987) give densities considerably higher than the present study, but they appear to have based their calculations on the amount of available sheep habitat (e.g., alpine tundra). It is difficult to refine density calculations any further, without knowing exactly what constitutes 'available sheep habitat' in the northern Mackenzie Mountains.

Extrapolating the observed number of Dall's sheep to the entire Zone E/1-1 results in a population estimate, including lambs, of 1953 sheep and, when lambs are excluded, 1499 sheep. This estimate assumes that the remaining, unsurveyed portion of Zone E/1-1 (52%) supports the same density of sheep as does the surveyed portion. Also, this extrapolation does not consider the possible observer error estimated as low as a 10% underestimation by Barichello et al. (1987) and as high as a 25% underestimation by Heimer and Watson (1986). Estimates obtained from these results are, therefore, conservative.

The recent harvest level of approximately 25 fullcurl rams each year represents 4.5% of the estimated number of rams (all horn sizes) in Zone E/1-1 (562 rams) or, 2% of the total estimated population of sheep in Zone E/1-1. This values falls within the accepted safe harvest level for Dall's sheep of 3-4% of the total adult population (Hoefs 1978, Barichello et al. 1987). The 25

fullcurl rams also represent 20% of the estimated number of fullcurl rams in Zone E/1-1.

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PERSONAL COMMUNICATIONS

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