ABUNDANCE AND DISTRIBUTION OF MOOSE IN THE SOUTH SLAVE RIVER LOWLANDS, NWT, NOVEMBER, 1986

RON GRAF

AND

RAY CASE

DEPARTMENT OF RENEWABLE RESOURCES

GOVERNMENT OF THE NORTHWEST TERRITORIES

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ABSTRACT

A random, stratified block survey was conducted in November 1986 in the southern portion of the Slave River Lowlands which is hunted by the people of Fort Smith, Northwest Territories. An initial reconnaisance was conducted from a fixed-wing aircraft. The area was stratified and then the areas of different densities were sampled using a helicopter. Overall we sampled 15.7% of the area. Based on the 131 moose observed from the helicopter and a sightability correction factor of 1.173, an estimate of 485 ± 95 (S.E.) was obtained with a Coefficient of Variation of 0.20. The overall density of moose ranged from 0.07 to 0.38 moose per km^2 with an average of 0.11. The estimated sex ratio was 67 bulls:100 cows, while the estimated calf ratio was 63.5 calves:100 cows and the twinning rate was 22.2%. We also observed 12 wolves, many bison and 3 white-tailed deer.

We concluded that, although the density of moose in the area is low compared to other northern areas, there is no danger of extirpation. The exact factors causing this low density are not known.

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INTRODUCTION

Moose (*Alces alces*) are one of the most important wildlife species available to the people living south of the treeline in the Northwest Territories (Treseder and Graf 1985). Many parts of the Fort Smith and Inuvik regions have reasonable access to barren ground caribou (*Rangifer tarandus groenlandicus*), but this is not so in the South Slave and Deh Cho areas. In these areas the annual fall moose hunt is considered one of the major events of the year and draws people back to the land whether they are employed in traditional resource harvesting or the wage economy. For those full-time trappers who spend several months away from the community on their traplines, the moose is their primary source of protein throughout the winter.

The Slave River Lowlands (SRL) were identified in 1983 as an area where moose were considered moderately abundant for the Northwest Territories, but which were probably being overharvested (Hawley, pers. comm.) (Figure 1). Based on the above statement and the lack of good harvest data, Treseder and Graf (1985) in a review of the status of moose in the Northwest Territories recommended that the status of the population be evaluated as soon as possible. As the SRL is hunted by two different communities, Fort Smith in the south and Fort Resolution in the north, and because the total area would be too large for one survey, only the south SRL was surveyed in the first year (Figure 2). Our objectives were to obtain estimates of abundance, sex and age composition, calf:cow

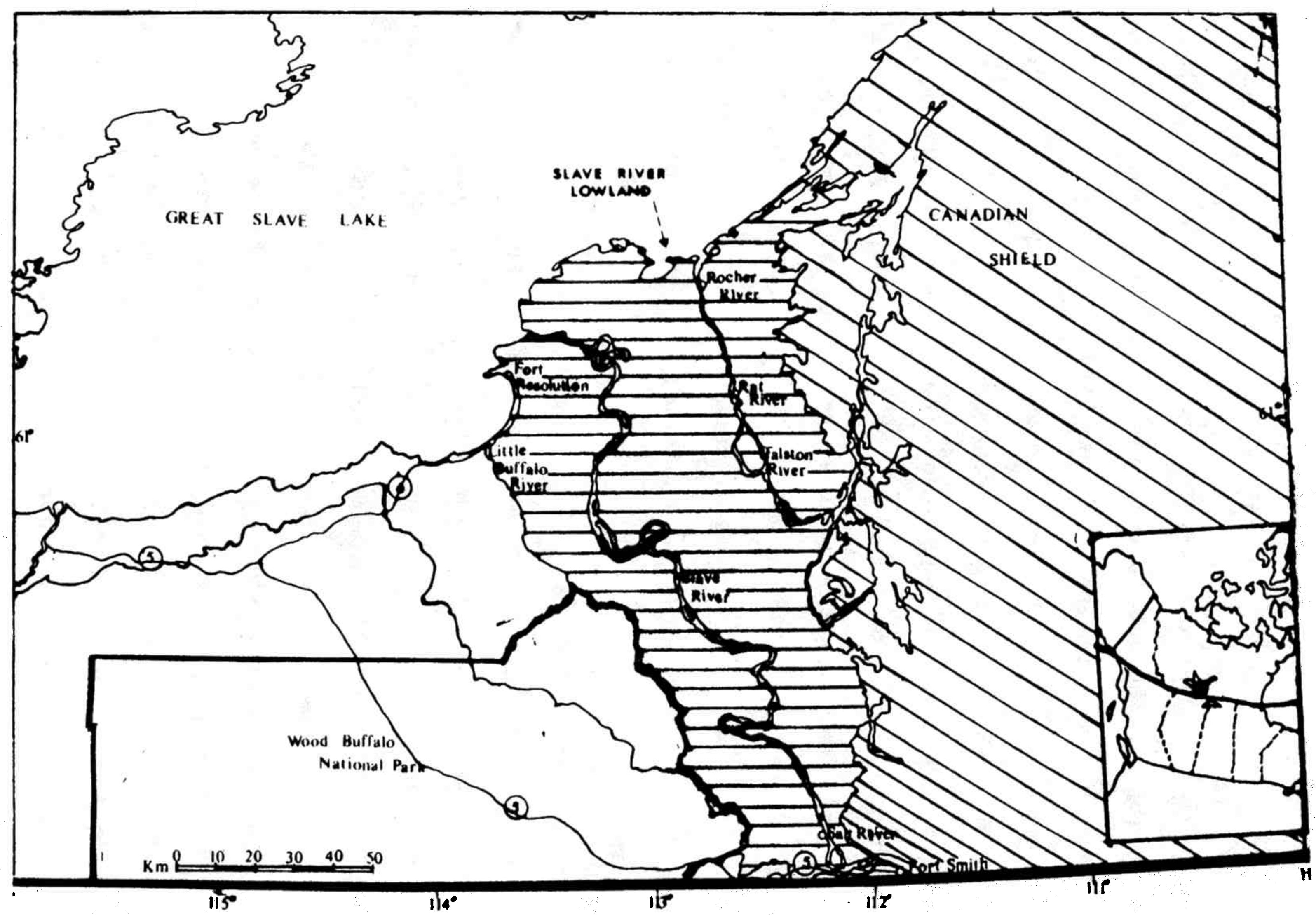

Figure 1. Location of the South Slave area and the Slave River Lowlands.

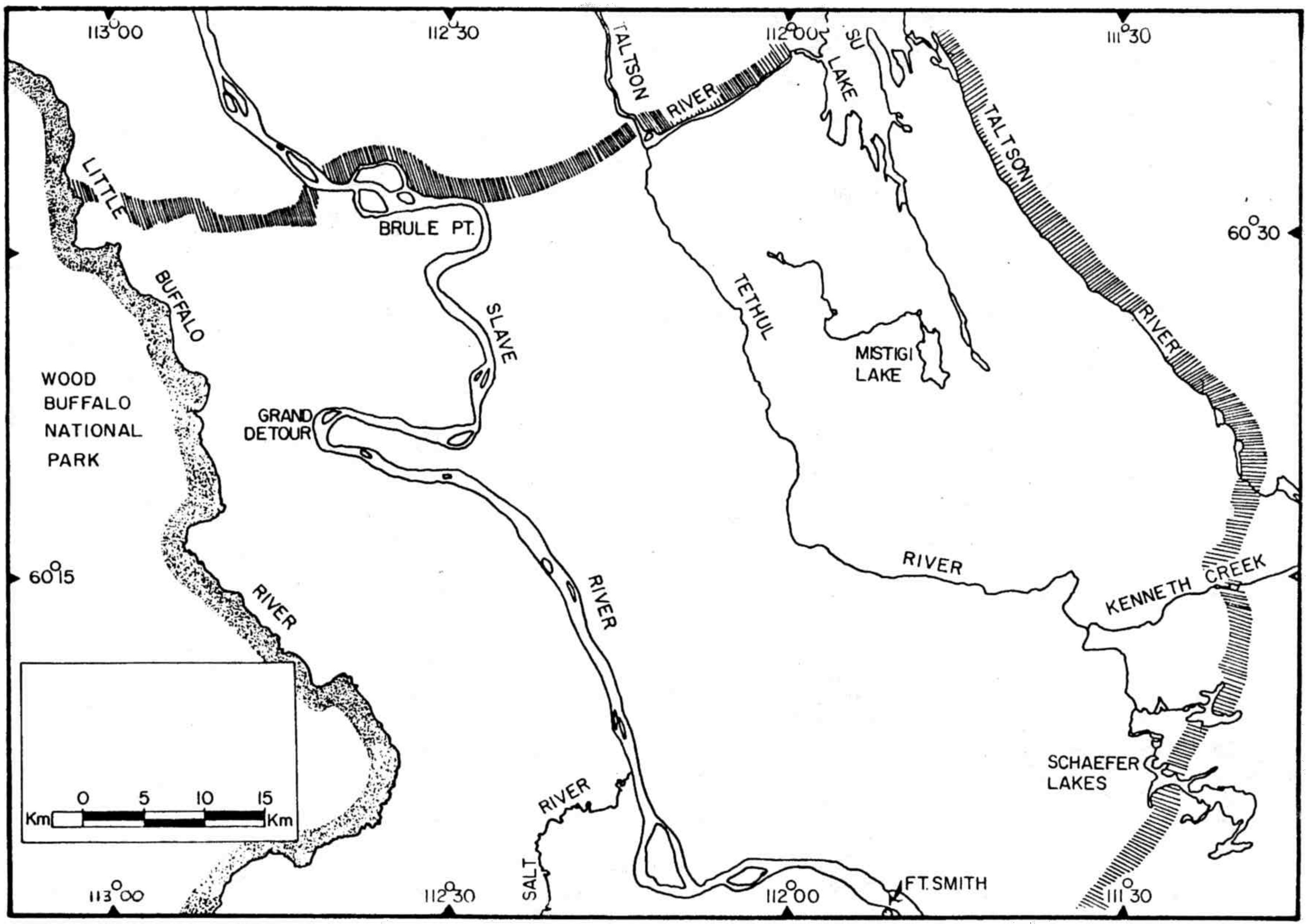

Figure 2. South Slave River Lowlands study area, November 1986.

ratios, density and distribution.

STUDY AREA

The SRL is a comparatively productive area for the NWT in terms of wildlife habitat. It encompasses a ribbon of alluvial soil, 40 to 60 km wide which straddles the Slave River from Fort Fitzgerald in northern Alberta to the delta at Fort Resolution on Great Slave Lake (Figure 1) (Day 1972). Wood Buffalo National Park and the Little Buffalo River border the SRL on the west while the rock outcrop of the Canadian Shield forms an easily recognizable border on the east. The alluvial flats of the SRL are covered by meadows, shrublands and forest. Many tree species are found in the Lowlands including white spruce (*Picea glauca*), black spruce (*P. mariana*), balsam poplar (*Populus balsamifera*), trembling aspen (*P. tremuloides*), jack pine (*Pinus banksiana*), lodgepole pine (*P. contorta*) and tamarack (*Larix laricina*) (Rowe 1972). Willows (*Salix* spp.) dominate the shrublands, while the wet and dry meadows support many different species of grasses and sedges (Rowe 1972).

In addition to a moose population, the Lowlands also support the hybrid wood/plains bison (*Bison bison bison/athabascae*), and have both wolves (*Canis lupus*) and black bears (*Ursus americanus*) as predators. Sightings of white-tailed deer (*Odocoileus virginianus*) and coyote (*Canis latrans*) are common.

The 1986 study area was limited to that part of the SRL which is used for hunting by the people of Fort Smith. It was bounded on the north by Point Brule and Tsu Lake, on the west by the Little

Buffalo River (the Park boundary), on the south by the 60th Parallel and on the east by the Talston River (Figure 2).

METHODS

The procedures followed for this survey are based on Gasaway et al. (1986). The survey area was divided into 277 Sample Units (SU's) of approximately 20 km^2 on 1:50,000 scale topographical maps. The boundaries were based on streams, rivers and roads and other easily recognizable topographical features (Figure 3).

From November 11-13, 1986 we conducted a reconnaisance of the entire survey area in a Cessna 185 to determine the relative densities of moose in the area (Figure 4). This initial survey was conducted at an altitude of 100-150m above ground level (agl) at a speed of approximately 130 Kph. In both the fixed-wing aircraft and the helicopter used subsequently, the navigator (senior author) was seated in a front seat while two observers were seated in the back seats. We followed transects in an east/west direction approximately 4 km apart in an attempt to cross each SU twice (Figure 4). Each time a moose was observed we circled the animal to determine whether or not it was accompanied by other moose and to obtain sex and age data. We also recorded moose tracks and other animal sightings.

The survey area was then stratified into zero, low, medium and high density areas based on the reconnaisance survey (Figure 5).

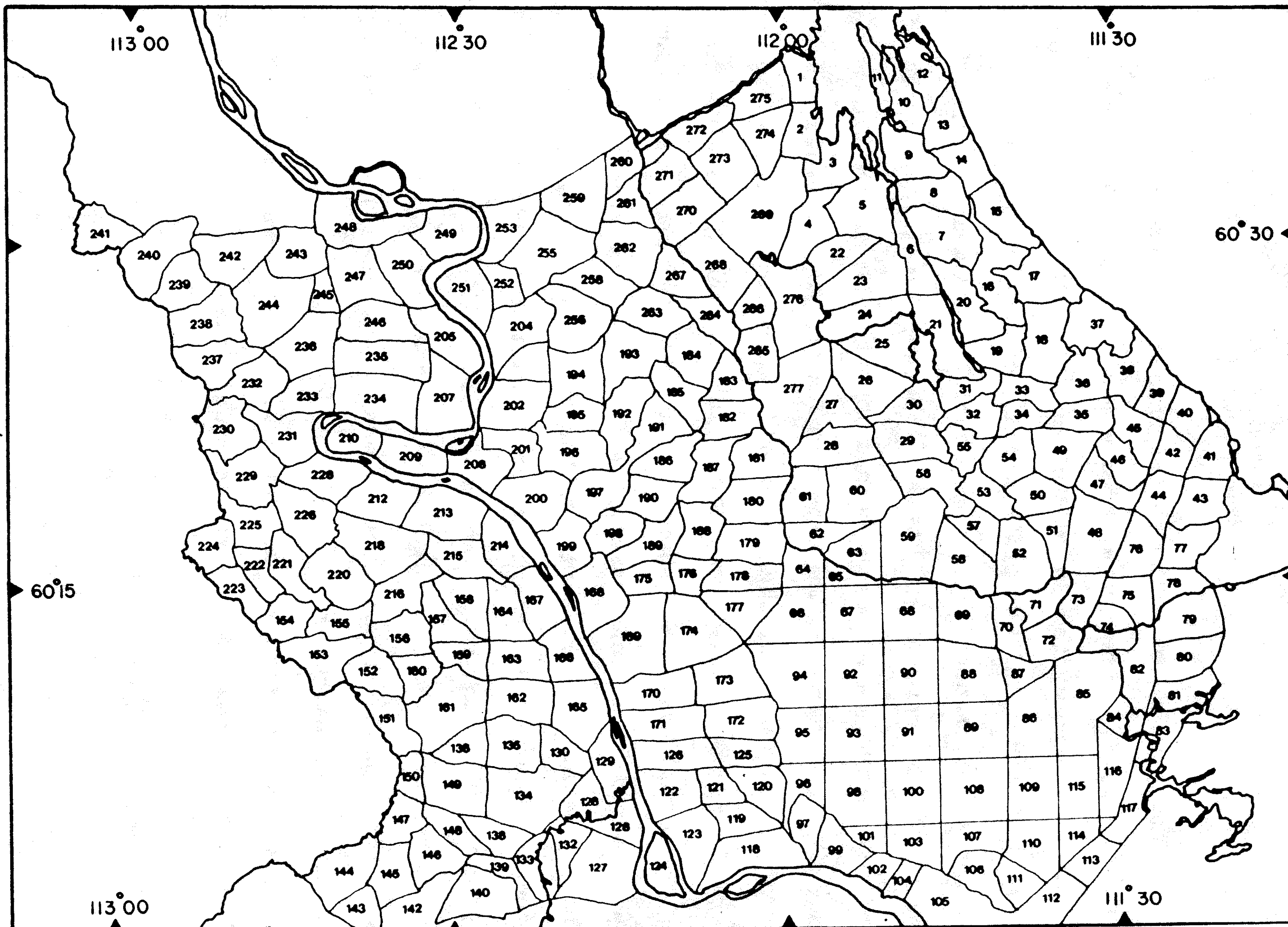

Figure 3. Location of the numbered Sample Units (SU's) in the South Slave River Lowlands study area, November 1986.

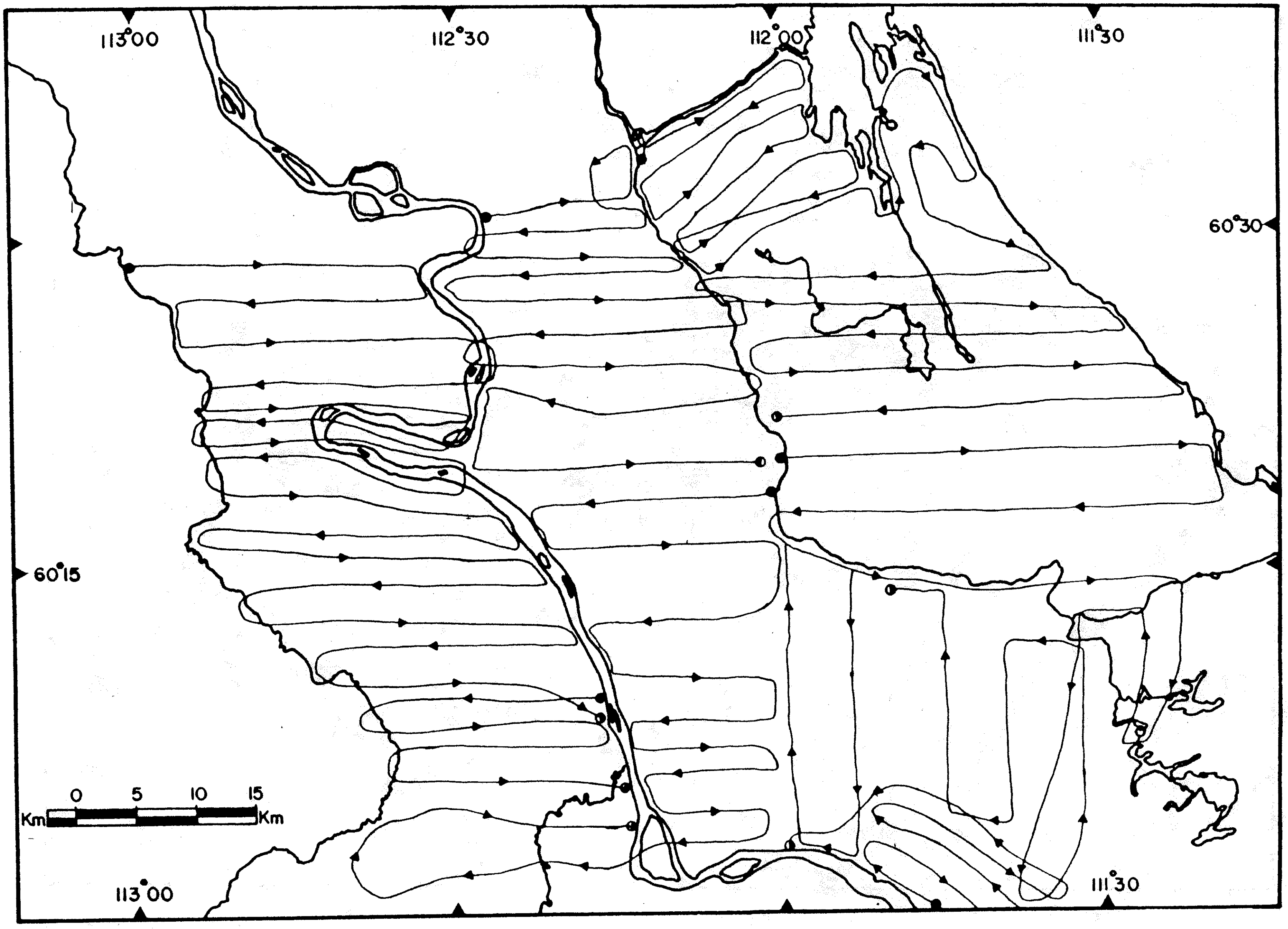

Figure 4. Flight path of the fixed-wing aircraft during the reconnaisance phase of the survey.

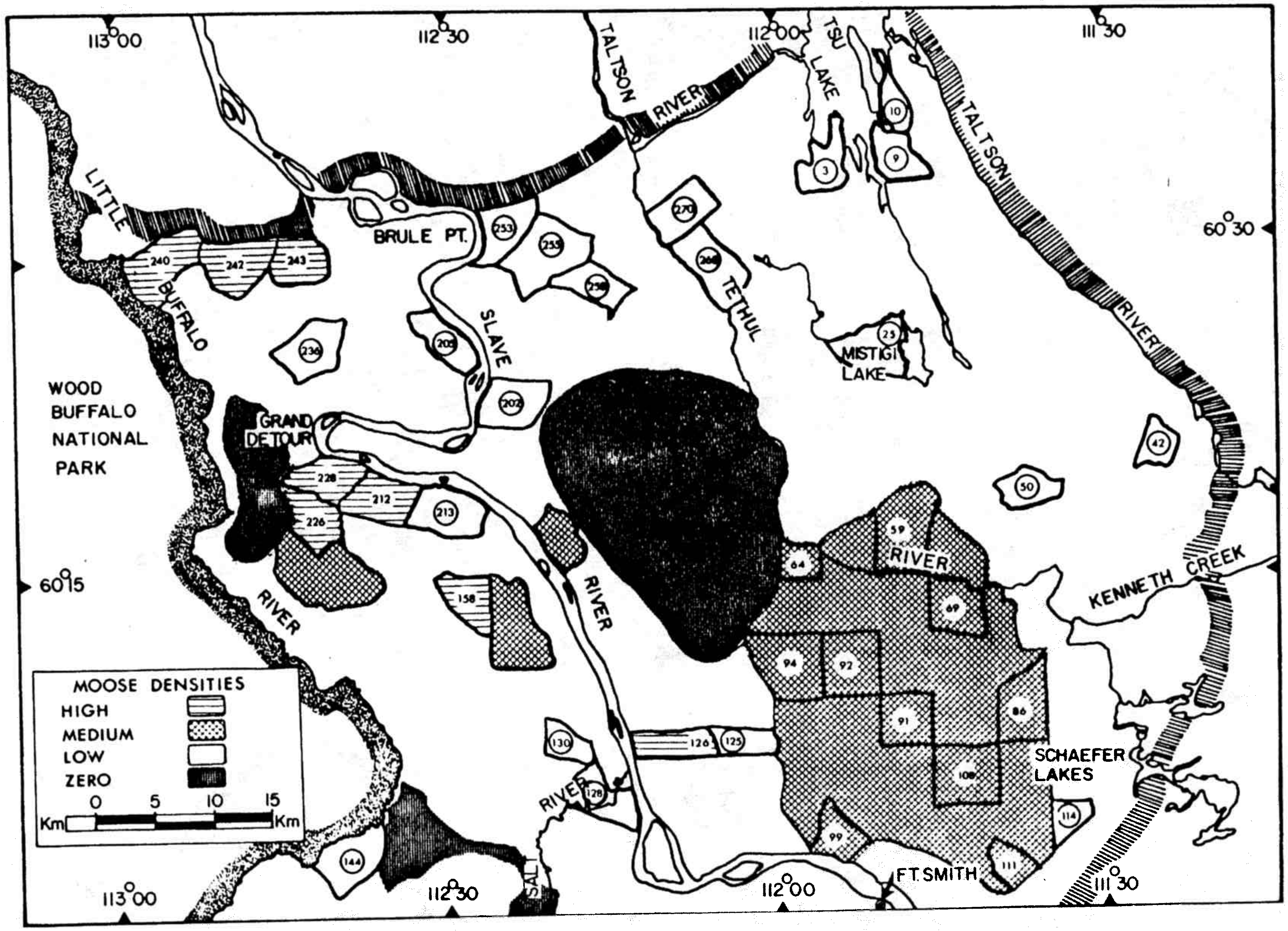

Figure 5. Stratification of the survey area and the Sample Units surveyed.

The zero density areas were removed from further consideration in any of the estimation analyses. Using a Bell 206 Jet Ranger helicopter from November 15-20, 1986, we counted all of the moose in selected SU's. As there were only eight high density SU's, we searched all of those first. For the medium and low density areas, we chose which SU's were to be searched using a random number generator from an Apple II computer. Once we began searching low and medium density areas, we would do an evening check of the precision of our estimate by analyzing the data on an Apple II computer using a program prepared by the second author which followed Jolly's method 2 for unequal sample sizes (Jolly 1969). In this way we were able to determine our current Coefficient of Variation (CV). We then added our best guess of the next day's results to predict its effect on the CV. Then we decided whether to expend further effort on medium or low density areas or to terminate the survey.

Using the helicopter we would search a particular SU completely for all of the moose and other wildlife in it. This was usually accomplished by flying back and forth across the SU so that no portion was missed. When a moose was located the animal would be circled by the helicopter to check for other animals and to determine its sex and age. Sex determination was based on antlers and vulva patches, with some reference to facial colours (Oswald 1982). Yearling bulls were identified on the basis of antler development and size (Oswald 1982). Certain broad habitat characteristics of the area in which the animals were found were also recorded and the location was recorded on the 1:50,000 map.

On March 24, 1987 and March 8 and 9, 1988 we conducted classification flights using a helicopter to age and sex all the moose we were able to find in the south SRL study area and the area immediately north (mid-SRL). We covered some of both high and medium density areas as well as all areas passed over during the ferry flights. Sex was determined by examining the vulva patch and face colour, while age was determined by size and behaviour (Oswald 1982).

RESULTS

A total of 14.6 hours of flying time was used for reconnaisance in the fixed-wing aircraft and a further 28.5 hours in the helicopter counting the moose within the chosen sample units. The survey took from November 11 to November 20, 1986 with two days lost to weather and other problems. During the survey there was approximately 15cm of snow on the ground in Fort Smith and the temperatures ranged from -14 to -24 degrees Celsius. Ice fog and low cloud were encountered regularly. The winds were light throughout the survey.

Based on the reconnaisance flights, we stratified the area into 30 zero, 201 low, 38 medium and 8 high density moose areas. The zero density areas were two large prairies totalling 463 km^2 in which we found no moose or signs of moose (Figure 5 and Table 1). We counted all the moose in a total of 39 SU's (15.7%) and calculated an estimate of 485 $\pm$ 95 (S.E.) moose, with a CV of 0.20 (Table 1). This estimate includes sightability factors of 1.02 and 1.15 (Gasaway et al. 1986). Densities ranged from 0.07 to 0.38 moose per km^2 in the low and high density areas respectively, and averaged 0.11 moose per km^2 for the 4,379 km^2 study area (excluding the zero density areas). We found that 55.1% of the observed adult cows were accompanied by calves. The number of calves per 100 cows was estimated at 63.5 for the whole area, with a twinning rate of 22.2% (the proportion of cows with twins compared to the total number of cows with calves). The ratio of bulls (including

Table 1. Characteristics of the south Slave River Lowlands moose population, November 1986.

Characteristic	Stratum High	Stratum Medium	Stratum Low	Stratum Zero	Total	Non-zero Total
Area (km^2)-	171.8	746.5	3,460.4	463.3	4,842.0	4,378.7
# of SU's-	8	38	201	30	277	247
# of SU's Sampled-	8	11	20	0	39	39
% of SU's Sampled-	100	28.9	10.0	0	-	15.9
Search Intensity- (min/km2)	1.2	1.2	1.2	0	-	1.2
Pop'n. Est.-	66	160	259	-	485	
Variance	0	*564	*5670		9039	
S.E.	0	*23.8	*75.3		95.1	
C.V.	0	0.15	0.29		0.20	
Density (moose/km^2)	0.38	0.21	0.07		0.10	0.11
Bulls per 100 cows-	137.0	88.2	46.2		67.2	
Calves per 100 cows-	57.9	88.2	53.8		63.5	
Twinning Rate- (sets of twins)	16.6 (1)	36.4 (4)	10.0 (1)		22.2 (6)	

Note: Estimates, densities and variances have been adjusted for sightability except where indicated by "*". Age and sex ratios are based on the number of animals estimated, not just observed. Number of bulls includes yearling bulls. There were two moose observed of unknown sex or age. Twinning rate is the proportion of cows with twins to total cows with calves.

yearlings) to 100 cows was 67.2 (Table 1). On November 16, 17 and 19 we found one bull each day which had only one antler.

We also observed 12 wolves, many bison and 3 white-tailed deer.

DISCUSSION

The visibility of the moose was only fair as there was little snow (15-25cm) and not all of the dark ground vegetation and bases of willows and bushes were covered. However, this study area is quite open relative to heavily forested moose habitat such as the Liard Valley, so overall moose visibility was sufficient. Navigation in the lowlands was difficult due to the lack of topographical features. Ice fog and cloud associated with the open water from the rapids in the Slave River and from the open water in Great Slave Lake resulted in flat light conditions. This further hampered navigation. We can only assume that navigation errors will cancel each other out as we have been unable to identify any biases which may direct these unmeasureable errors.

The distribution of moose in the study area was rather disjunct. We found no moose in the immeditate vicinity of Fort Smith. This moose "vacuum" around the community is not unexpected considering the relatively large numbers of secondary roads in the area allowing good access for hunters. We found few moose on the Canadian Shield portion of the study area even though fire suppression crews often report moose there in the summer months (Bergman, pers. comm.). The large area designated as medium density just across the Slave River from Fort Smith and other portions of the Lowlands may be wintering areas for these moose who normally spend the summer on the adjacent Canadian Shield.

Most of the high density areas were located in recent burns. This is not to say that all previously burned areas were found to have high densities of moose. Several of the high density areas were also quite close to roads or good skidoo trails but had numerous fallen logs which would make snowmachine travel or even walking within these burned areas extremely slow and hazardous. The spatial relationships between burns of different ages and densities of moose throughout the Slave River Lowlands from Fort Smith to the Great Slave Lake will be dealt with in a future report.

Our search intensity of 1.2 minutes per km^2 (Table 1) is low compared to the 1.6 of Jingfors et al. (1987) in their helicopter portion near Norman Wells or to the 1.5 to 1.9 recommended by Gasaway et al. (1986). However, Gasaway et al. (1986) are basing their recommendations on more heavily forested areas and using a fixed-wing aircraft. The Norman Wells area (Jingfors et al. 1987) is more heavily forested than the Slave River Lowlands and required more intensive searching. The amount of time spent circling observed moose will depend upon the densities found and our lower search intensity somewhat reflects our lower density of moose.

Gasaway et al. (1986) suggest that determining a good sightability correction factor (SCF) for low density areas is generally not worth the expense as the probability of moose occurring in an intensively searched area of about 5 km^2 is quite low. Instead they suggest using the mean from other surveys which have occurred in similar habitat. We have, therefore, chosen data from Tanana Flats and Lower Nowitna which are both described as lowland flats with large areas of shrubs (Gasaway et al. 1986, Table 7, p. 35). These data result in a mean observed SCF of 1.15 times a constant SCF of 1.02, yielding a final population estimate SCF of 1.173.

Our survey resulted in an estimate of 413±79(S.E.) and a CV of 0.20, with densities ranging from 0.06 to 0.33 moose per km^2 (Table 1). These densities remain low compared to other northern areas, even to other areas in the Northwest Territories (Table 2). Our estimate adjusted with the population SCF results in an estimate of 485±95 with densities ranging from 0.07 to 0.38.

The sex and age composition of the animals throughout the study area varied with density. The highest ratio of bulls:cows was found in the high density area followed by the medium and then by the low density areas (Table 1). This is similar to the results found by Jingfors et al. (1987) at Norman Wells, which varied with their results in the Fort Good Hope area. Most calves were found in the medium density area, followed almost equally by the high and low density areas (Table 2). Again, this was similar to the Norman Wells area, but differed from the Fort Good Hope area (Jingfors et al. 1987).

One of the first parameters to examine in a population which is at a level lower than expected is recruitment. Moose calves in the study area were being produced and surviving to early winter at rates equal to or higher than most other northern populations (Table 2). Both the calves/100 cows ratio and the twinning rate signify reasonable reproductive rates and good initial calf

Table 2. Comparison of estimated moose population characteristics in the Northwest Territories and adjacent areas.

Area	Time of Survey	Density (moose/km2)	Bulls/ 100/cows	Calves/ 100/cows	Twinning Rate[a]
<u>Northwest Territories</u>					
SRL	Dec(81)[b]	0.05	120	64	?
			(Hawley pers. comm.)		
South SRL	Nov(86)	0.10	67	63	22%
			(This study)		
Norman Wells	Nov(84)	0.15	76	44	10%
			(Jingfors et al. 1987)		
Ft. Good Hope	Nov(84)	0.13	79	61	18%
			(Jingfors et al. 1987)		
Liard Valley	Feb(79)	0.13	?	31	?
			(Donaldson and Fleck 1980)		
Liard Valley	Nov(85)	0.12	77	75	20%
			(Case in prep.)		
Liard Valley	Nov(86)	0.07	121	100	47%
			(Case in prep.)		
<u>Alberta</u>					
Northeast	Jan(76)	0.22	35	25[c]	0%
			(Hauge & Keith 1981)		
<u>Yukon</u>					
Francis Lake	Nov(87)	0.19	55	69	5%
			(Jingfors 1988)		
(Eastern) Liard East	Oct-Dec	0.14	79	51	13%
			(Jingfors and Markel 1987)		
<u>Alaska</u>					
Tanana Flats	Nov(78)[e]	0.18	?	61[c]	14%
			(Gasaway et al. 1983)		
Tanana Flats	Nov(83)[e]	0.48	36	40[c]	?
			(Jennings 1985)		

[a] The proportion of cows with twins to total cows with calves.
[b] Based on a total sample of 70 moose.
[c] Based on cows≥ 30 months old and, thus, excludes yearling cows.
[d] Before wolf removal.
[e] After wolf removal.

survival. These rates also suggest that the level of nutrition for the female segment of the population was sufficient (Franzmann and Schwartz 1985). Therefore, the low density levels of the population do not appear to be a result of poor nutrition, low reproductive rates or low early calf survival.

High mortality of calves in late winter does not seem to occur as we observed a ratio of 20.4 yearling bulls/100cows. We have assumed that yearling bulls and yearling cows have survived at the same rate, and therefore the figure would double to 40.8 yearlings/100 cows. However, as our observers did not have many years of experience, we should be careful interpreting these data because estimating the number of yearling bulls can be difficult.

In March 1987 and March 1988 we found 47 calves/100 cows and 39 calves/100 cows, respectively. These data support the high yearling:cow ratio found in November 1986. Therefore, low survival in late winter does not appear to be causing the relatively low density of moose found in the study area.

Long cold winters have been suggested as a reason for the lower densities of moose found in the Northwest Territories (Dickinson and Herman 1979). The low densities found in this study area are even lower than those found in other areas in the NWT, northern Alberta, Yukon and Alaska. The severity of winters would probably be reflected through lower reproduction and survival in moose, especially survival in the younger cohorts. Considering the high reproductive and survival parameters recorded above, it does not seem likely that severe winters are the cause of the lower densities.

Low survival of adults as a result of predation could also be a cause of low population density (Larsen et al. 1987). However, concurrent with low adult survival, one would expect to find low calf and yearling survival as these are usually the most vulnerable cohorts. We did not find this, which suggests that predation alone is probably not holding these moose at low densities.

Hunting mortality can often be a major cause of low moose densities (Hauge and Keith 1981, Gasaway et al. 1983). Unfortunately, we have insufficient harvest data available on this population to reach a conclusion.

There are no immediate management concerns with the south Slave River Lowlands moose population. Hawley (pers. comm.) may have been correct in suggesting that the moose are being held at low densities because of a high harvest and the kill still may be too heavy for the population to increase. We cannot support or refute the hypothesis that the harvest is too heavy because harvest data are not available. The moose are being completely hunted out only in the immediate vicinity of the community - a situation one would expect to find throughout the Northwest Territories. In the study area the moose are not in danger of being extirpated; however, the densities in some parts of the study area could probably be increased if the users wished to do so.

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PERSONAL COMMUNICATIONS

Mr. Berny Bergman, Renewable Resource Officer, Government of the Northwest Territories, Box 390, Fort Smith, Northwest Territories, X0E 0P0

Mr. Vernon Hawley, P.O. Box 176, Townsend, Montana, U.S.A. 59644

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