Tulita Area Moose Survey
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SUMMARY

Monitoring the size and reproductive success of moose populations are important aspects of ensuring a continued sustainable harvest. The Tulita moose study area was first set up in 1993 in consultation with the Fort Norman Hunters and Trappers Association. Using a standard technique for surveying moose, the 1993 survey estimated the population in the study area to be between 162 and 244 moose. The same survey area was flown five years later in 1999, resulting in an estimated count of 204 to 310 moose. This information, combined with hunter harvest information, led to an estimate that approximately 6% of the moose population within the study area is being harvested. This is less than the target sustainable harvest level for moose, which is considered to be 8%. Although the technique used in these surveys is an accepted and common method of estimating moose populations, other less expensive options may be more effective.

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INTRODUCTION

Moose (*Alces alces andersonii*) are a source of subsistence food throughout the year for hunters and their families in Tulita. Popular moose hunting areas for the community include islands in the Mackenzie, Keele, and Redstone Rivers; Willow Lake; and along the Mackenzie River Valley. These areas are accessible from Tulita by boat, snowmobile, aircraft, or by vehicle during the short winter road season.

Moose in the Tulita area were first systematically surveyed in 1980 by Brackett et al. (1985). That aerial survey recorded a density of 5 moose per 100 square kilometer (km^2) within a 506 km^2 area between Tulita and the Sans Sault Rapids along the Mackenzie River. The study area for the survey described in this report was first used by Norm MacLean in 1993 and has been used for all subsequent surveys (Figures 1 and 2). The purpose of these surveys is to determine long-term moose population trends and characteristics and to collect useful information for effective local management of moose.

METHODS

This moose survey follows a standard design developed by Alaskan moose biologist Bill Gasaway (1986). The study area is divided into 124 study blocks with an average size of 20 km^2. Initially, a reconnaissance flight of the study area is flown in a Cessna 206 fixed-wing aircraft. During the reconnaissance, observers record all locations of moose, moose tracks, and woodland caribou (*Rangifer tarandus*) on 1: 50,000 topographic maps. The data from the reconnaissance flight is then used to stratify the study area into sections of high, medium, and low densities of moose. This allows the census, which is flown in a helicopter, to focus on those areas with the most moose, which improves the quality (precision) of the estimate we obtain for the number of moose in the study area. The survey is done in January - February when cold temperatures and snow depth combine to cause moose to move into the major river valleys.

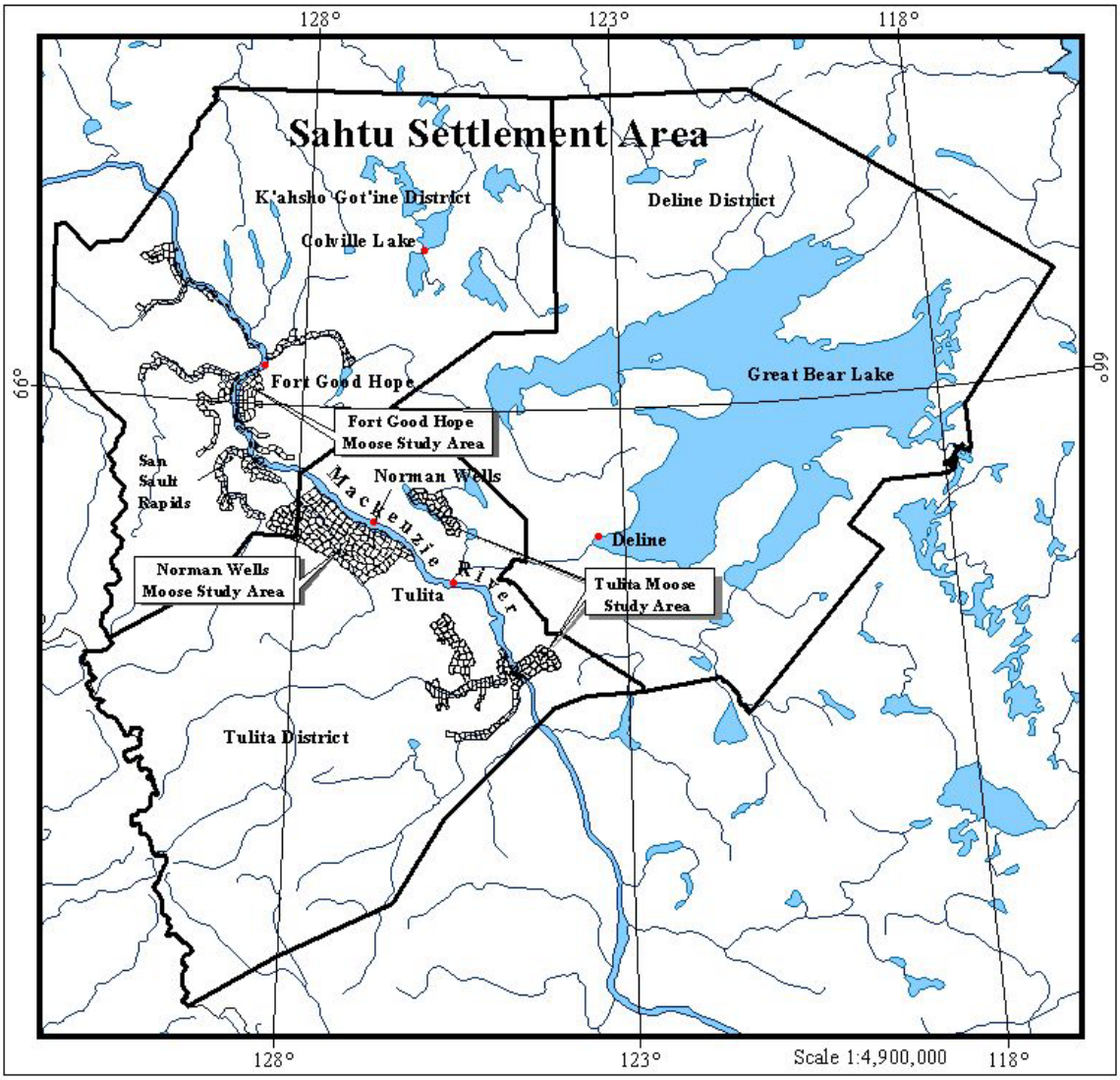

Figure 1. Moose survey areas within the Sahtu Settlement Area

Study Area

The study area was set up in consultation with the Fort Norman Hunters and Trappers Association in 1993 (MacLean 1994). The area was chosen to cover the most important moose hunting areas for the community. The study area covers approximately 2450 km^2 and is divided into two main sections: 1) south of Tulita along the Mackenzie, lower Keele, and Redstone Rivers, and 2) north of the community in the Kelly and Willow Lake areas (Figure 2).

Within the study area is a patchwork of deciduous regeneration from forest fires. These are prime moose feeding areas, composed of willow, dogwood, aspen, poplar, and birch - all preferred browse species for moose (Jingfors et al. 1987). Since 1964, 54% of the study area has been burned, of which 25% occurred in 1998 alone (Figure 2).

Further details of the study area are described in Veitch et al. (1995).

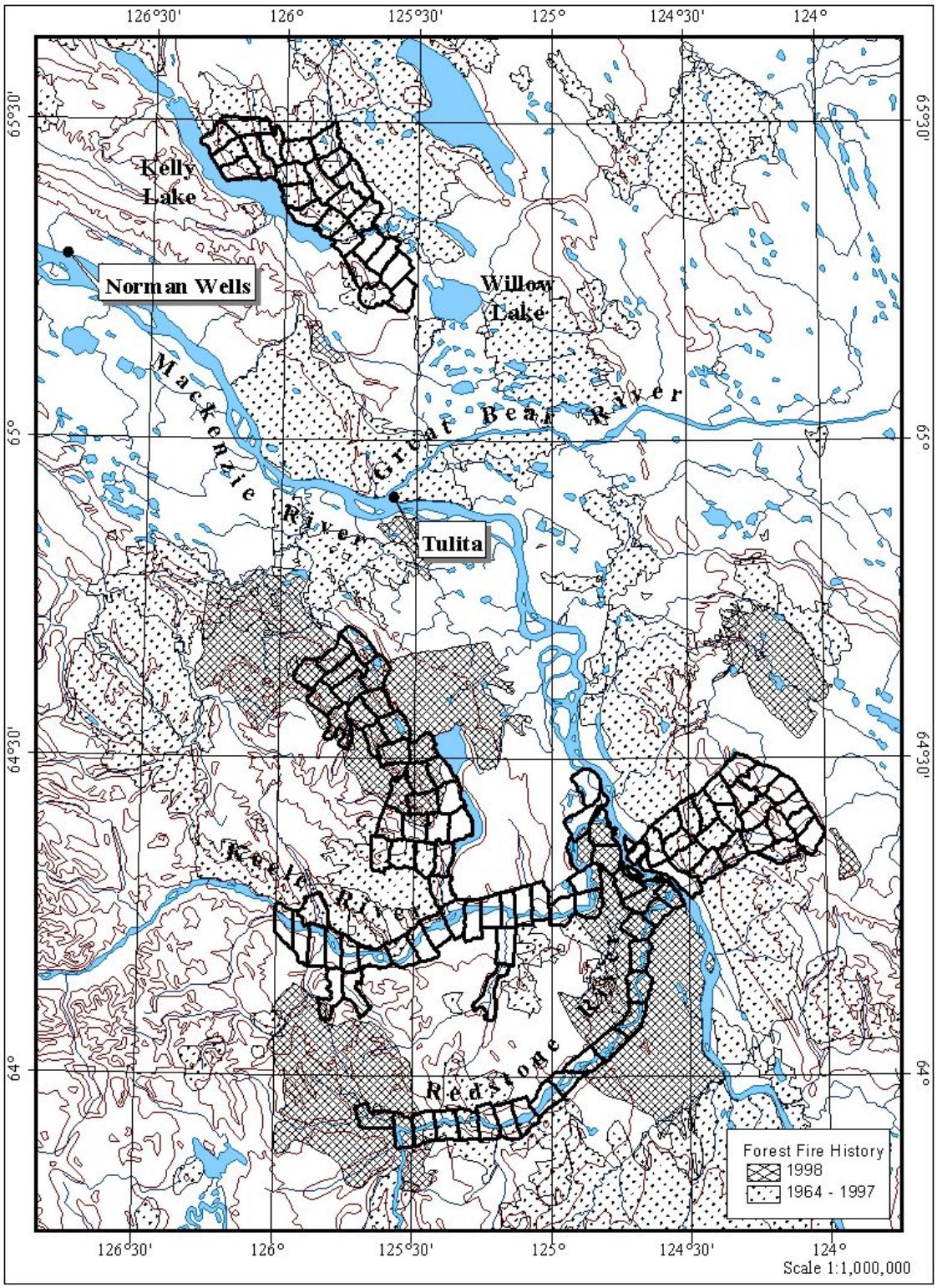

Figure 2. Tulita moose study area showing the two main sections and the related forest fire history of the area (1964 -1998).

Reconnaissance and Stratification Flights

Both the reconnaissance and census flights were flown during January 1999. The reconnaissance was flown at 100 m above ground level at 160 km/hr. Following the reconnaissance, all blocks were assigned to one of three density strata: high ($\geq$9 moose or tracks), medium (3-8 moose or tracks), and low ($\leq$ 2 moose or tracks) (Figure 3).

Census

Forty of the study blocks were then surveyed from a helicopter. All of the high-density blocks were surveyed, 53% of the medium-density, and 21% of the low-density blocks.

All sightings and locations of moose and other wildlife species were recorded. Based on such characteristics as antler size and configuration, vulva patch, bell, and body size, we classified moose as medium or large bull, cow, or calf. Yearlings were classified as adults.

The general habitat-type was recorded for each moose or group of moose observed. We classified habitats as: stunted spruce forest, spruce forest, creek bottom, burn, and willow/alder as per Latour (1992) and MacLean (1994).

Classification

Bull moose were classified by the presence of one or two antlers, or pedicel scars from where both antlers had been dropped. Females were classified by the presence of a light-coloured vulva patch. Some single cows may have been classified as bulls if the vulva patch was not seen. Classification of moose by age and sex is more problematic in January than in November before the bulls drop their antlers.

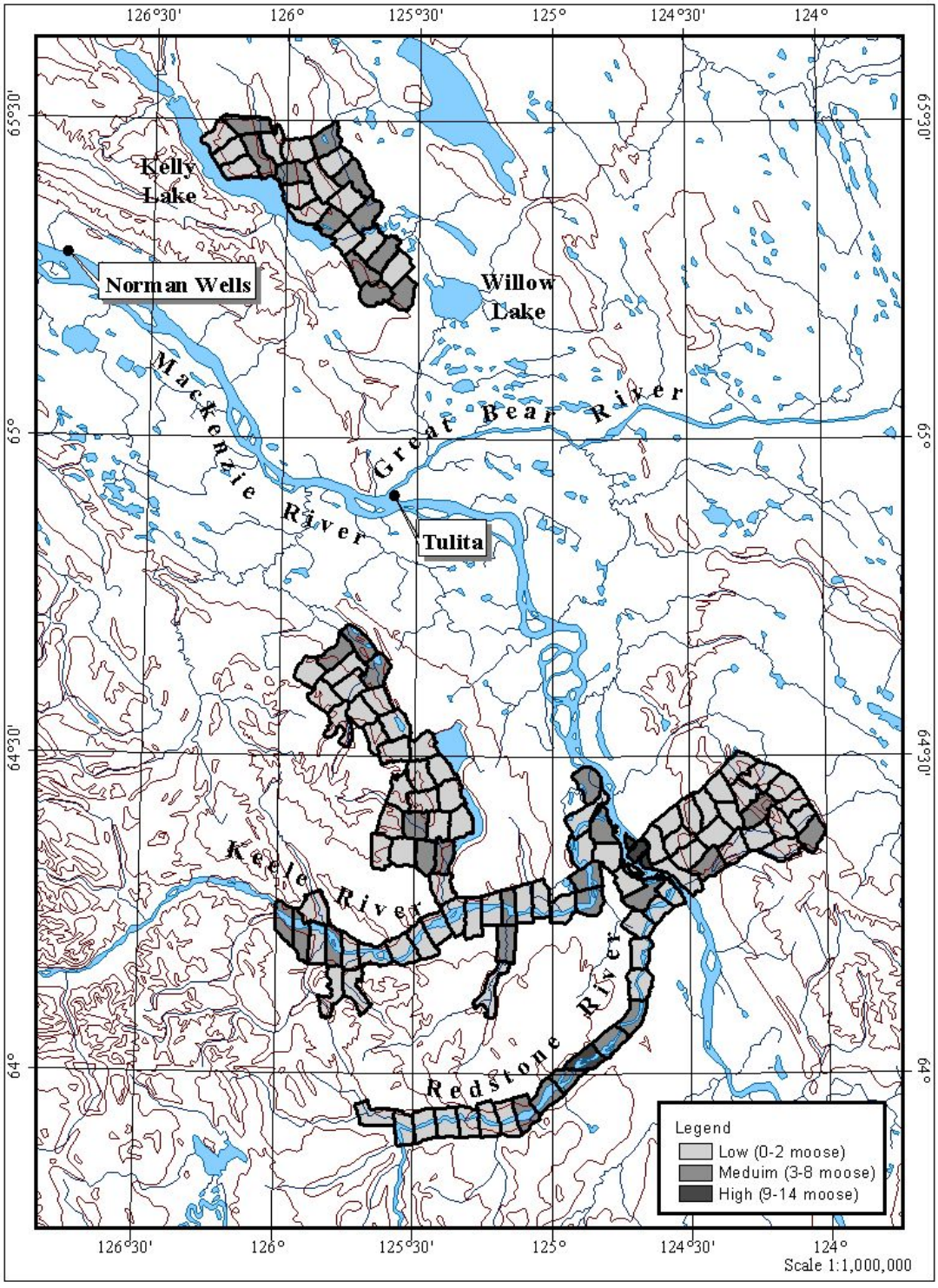

Figure 3. Moose density strata as determined from a reconnaissance flight for the Tulita area moose study area, January 1999

RESULTS AND DISCUSSION

Weather Conditions

Fresh snow over the entire study area provided good survey conditions. A moderate snowfall of 8 cm between 15 and 19 January, prior to the start of the stratification survey, was sufficient to partially fill-in old tracks. On the last day of the survey, there was a light snowfall. During the 7 days it took to complete the survey (including the reconnaissance flight), moose were able to move freely throughout the study area across the relatively thin snow cover.

Temperatures ranged from –5 ° to -24° C. Sky conditions were generally overcast, without precipitation. Winds were calm to light during the entire survey. Legal flying time with daylight started at 0945 h and ended at 1720 h on January 21. Contrast was poor before 1120 h during low-angled light, as sunrise did not occur until about 1100 h. Light conditions varied throughout the survey but were generally good for moose classification.

Reconnaissance and Stratification

After the reconnaissance flight 2 blocks were classified as high density, 36 as medium density, 36 as medium density, and 86 as low-density (Table 1; Figure 4). We then flew 39 of 124 total blocks in a helicopter, representing 32% of the study area. Classification of blocks from the reconnaissance flights was similar to the densities documented during the helicopter census: 21 blocks (54%) remained the same, ten blocks (26%) decreased, and eight blocks (21%) increased (Table 1; Figure 4).

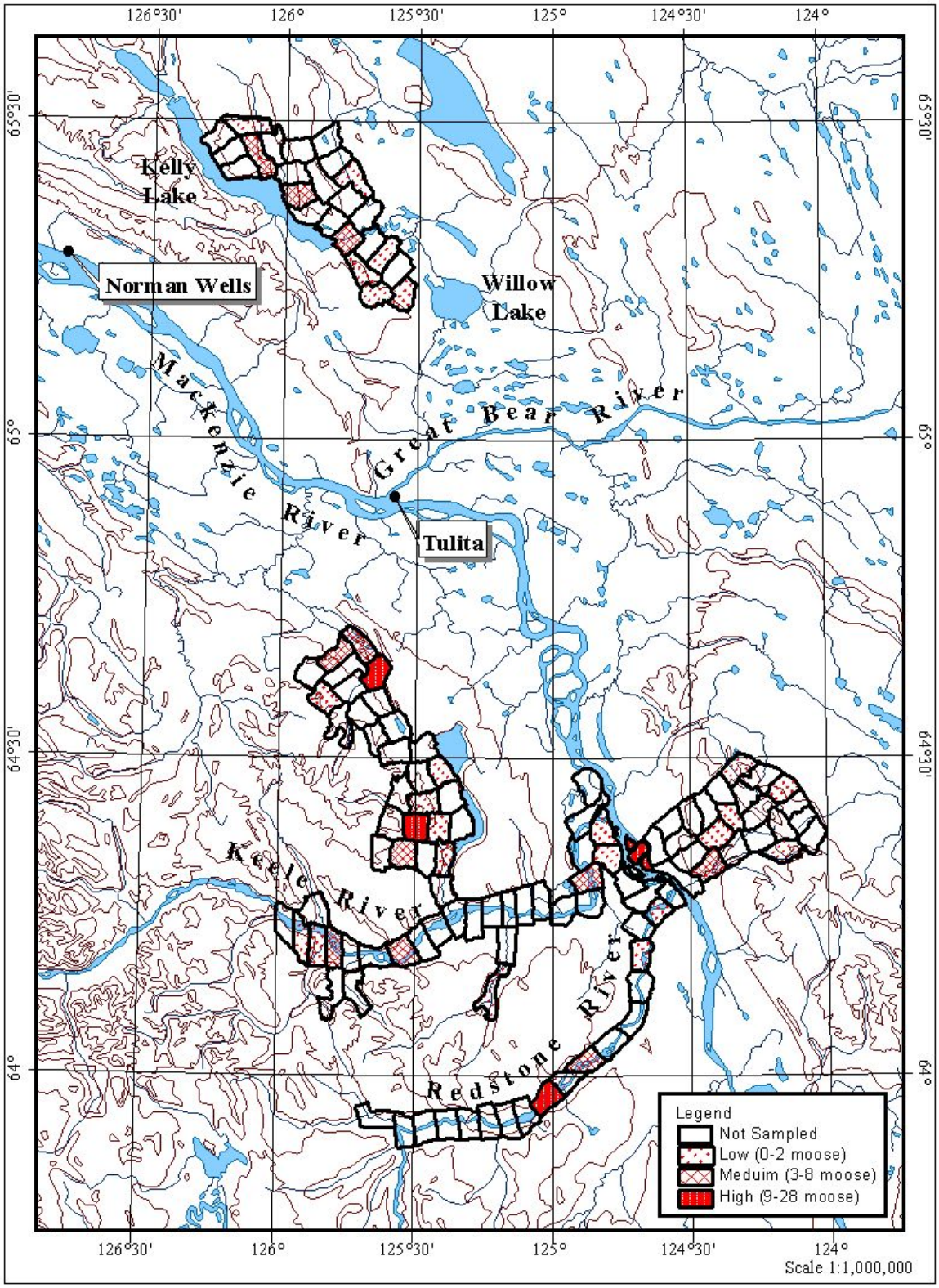

Figure 4. Relative moose densities in censused study blocks within the Tulita moose study area, January 1999

Population Estimate

There were an estimated 257 ± 53 (90% Confidence Interval) moose in the study area, or 204 to 310 moose. The overall density of moose was 11 moose per 100 km^2 (Table 2). Sixty percent of moose observed were bulls. We estimated there were 44 calves and 151 bulls per 100 females, respectively. Twin calves accompanied 3% of all cows observed; 49% of cows were with a single calf.

Table 1. Search intensity and sampling effort during the Tulita area moose survey, January 1999

	Stratum			
	High	**Medium**	**Low**	**Total**
Area (km^2)	33	698	1719	2449
No. of Study Blocks (S.B.)	2	36	86	124
No. of S.B. Surveyed (%)	2 (100)	19 (53)	18 (21)	39 (32)
Surveyed (km^2) (%)	33 (4)	381 (50)	356 (46)	70
Search Intensity (min/km^2)	1.4	1.2	1.1	1.2

Table 2. Tulita area moose population density and composition, January 1999

	Stratum			
	High	**Medium**	**Low**	**Total**
Density (moose/100 km^2)	98	16	8	11
Observed No. Bulls (%)	15 (47)	35 (51)	12 (57)	62 (51)
Observed No. Cows (%)	12 (37)	23 (34)	6 (29)	41 (34)
Observed No. Calves (%)	5 (16)	10 (15)	3 (14)	18 (15)
Observed Total No. Moose (%)	32 (27)	68 (56)	21 (17)	121
Estimated Total No. Moose	32	118	107	57± 53
Coefficient of Variation (%)	12			

The mean group size was 1.9 ± 0.8 moose in 65 groups (Table 3); the largest group observed was 8 moose found in willow/ burn habitat type. The distance between groups of moose within study blocks varied, with groups generally clustered near willow patches.

Population Characteristics

The 1999 estimated number of moose in the Tulita area of 204 to 310, is not a significant change since the last survey estimate of 162 to 244 moose in 1993 (Table 3).

Table 3. Comparison of moose census results from the Tulita moose study area 1999 (this study) versus 1993 (MacLean, 1994)

	November-93	January-99
Total Study Area (km^2)	2462.7	2449.4
Area Surveyed (km^2)	886.6	769.1
% Of Study Area Surveyed (km^2)	36	32
No. Of Study Blocks	124	124
No. Of Study Blocks Surveyed	45	39
Search Intensity (min / km^2)	0.8	1.2 ± 0.2
No. Of Moose Seen		121
Mean Group Size	2.2 ± 1.1	1.9 ± 0.8
Bulls: 100 Cows	100	151
Calves: 100 Cows	60	44
% Cows With Twins	8	3
Population Estimate (90% C.I.)	203 ± 41	257 ± 53
Density (Moose / 100 km^2)	8	11
Est. Annual Moose Harvest Rate (%)	17	6
Est. Annual Moose Harvest Tulita	40-50	45 -55

Some cows were likely classified as bulls during this survey; consequently, our estimated ratio of 44 calves per 100 cows may be an overestimate.

Within the study area, high-quality moose habitats are anticipated as areas that have burned in the last 10 years; therefore, moose numbers within the study area are predicted to remain stable, or possibly increase. This should allow the population to meet the growing subsistence needs of Tulita residents.

Distribution

Local knowledge of moose habits provided by the Tulita Renewable Resources Council (RRC) suggested that this survey be postponed from November (when moose surveys are typically flown) until January. In January, colder temperatures and increased snow depth cause moose to congregate in traditional winter ranges along major river valleys in the study area.

The largest habitat type within the study area was forest that burned within the last 30 years. The highest density of moose was in willow 'flats' along the Mackenzie River. Most of the moose were found in burned areas and willow habitat where available browse is abundant and likely of high quality (Figure 5). It is common knowledge for hunters and biologists that moose take advantage of new growth on recently burned stands in the boreal forest.

We classified 69% of the study area as having a low density of moose. Very few moose or moose tracks were seen in the large tracts of very recent burn (less than 2 years since fire) and closed mature spruce forest. Only 9% of all moose sighted from the helicopter were in spruce forest; however, it should be noted that observers are more likely to underestimate moose in dense cover. Moose have seasonal preferences for habitat types, e.g., old forest is preferred bedding cover and feeding during severe winter periods.

The average elevation of each density stratum: 280 m, 250 m, and 320 m in high, medium, and low-density strata respectively, was calculated using GIS. Most moose were found in the lower elevation (medium-density strata); however, the relationship between moose density and elevation remains inconclusive.

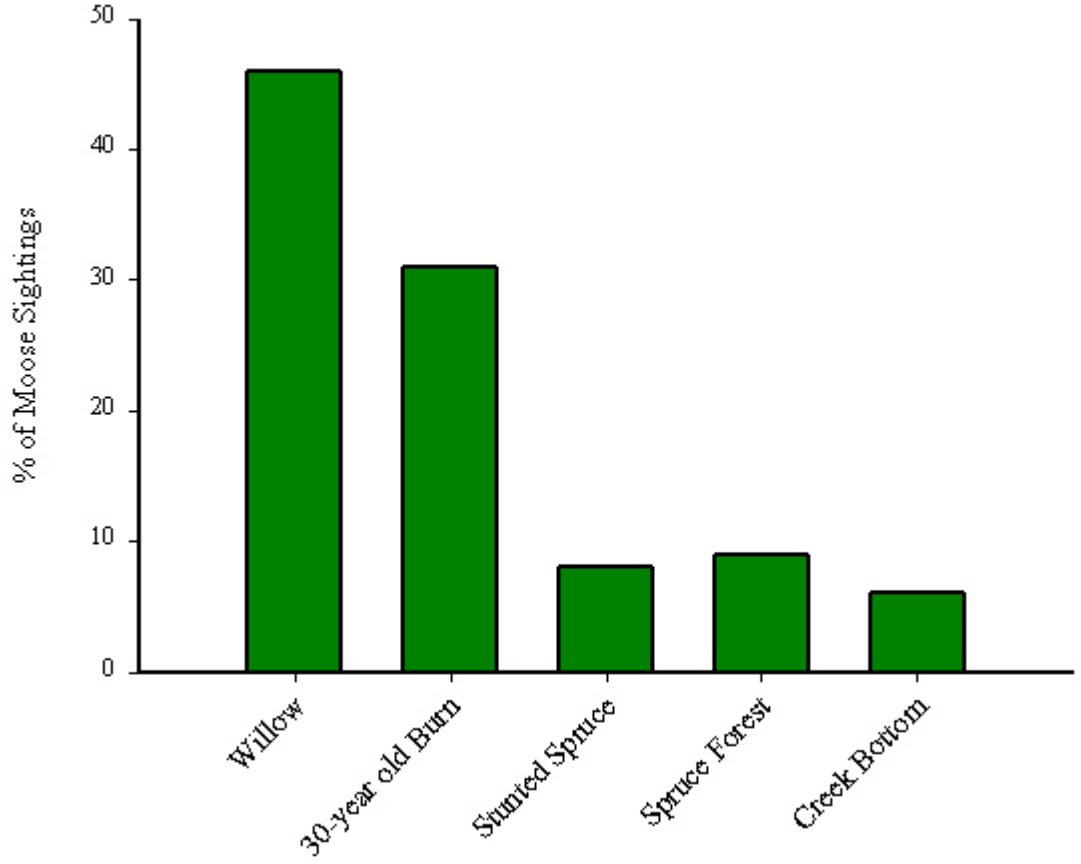

Figure 5. Moose sightings by habitat types for the January 1993 Tulita area moose survey

Harvest

Between January and September 1997, Tulita's Renewable Resources Officer (RWED), Louis Marion, recorded hunter-killed moose by hunter's name, location of kill-site, kill-date, and moose sex and age class (calf / adult). General Hunting Licence (GHL) holders harvested an estimated 32 to 50 moose during that period. Resident hunters (RHL) from Tulita did not harvest any moose from 1992 – 1997 (Louis Marion, RWED, Tulita, NT, personal communication). In 1998, the Sahtu Renewable Resources Board (SRRB) initiated the Sahtu Settlement Harvest Study to document harvest levels by participants of the *Sahtu Dene and Metis Comprehensive Land Claim* and determine their basic-needs levels for moose and other harvested species.

There were at least 15 successful moose hunters from Tulita in 1997. Most hunters took more than one moose in that year; the most taken by a single hunter was six. Fifty percent of the moose harvested in 1997 were adult males (Table 4). Hunters did not report age or sex for 41% of their reported moose harvest. Most moose (94%) were harvested in the fall (01 Sep to 30 Oct) and winter (01 Nov to 31 Mar) in 1997 (Figure 6). Harvest records were not collected for October – December 1997; however, L. Marion estimated that 17 moose were harvested then. The majority (82%) of moose harvest was along the Mackenzie River (Table 4).

Of all moose harvested by Tulita GHL holders in 1997, about 29% were taken within the boundaries of the Tulita moose study area.

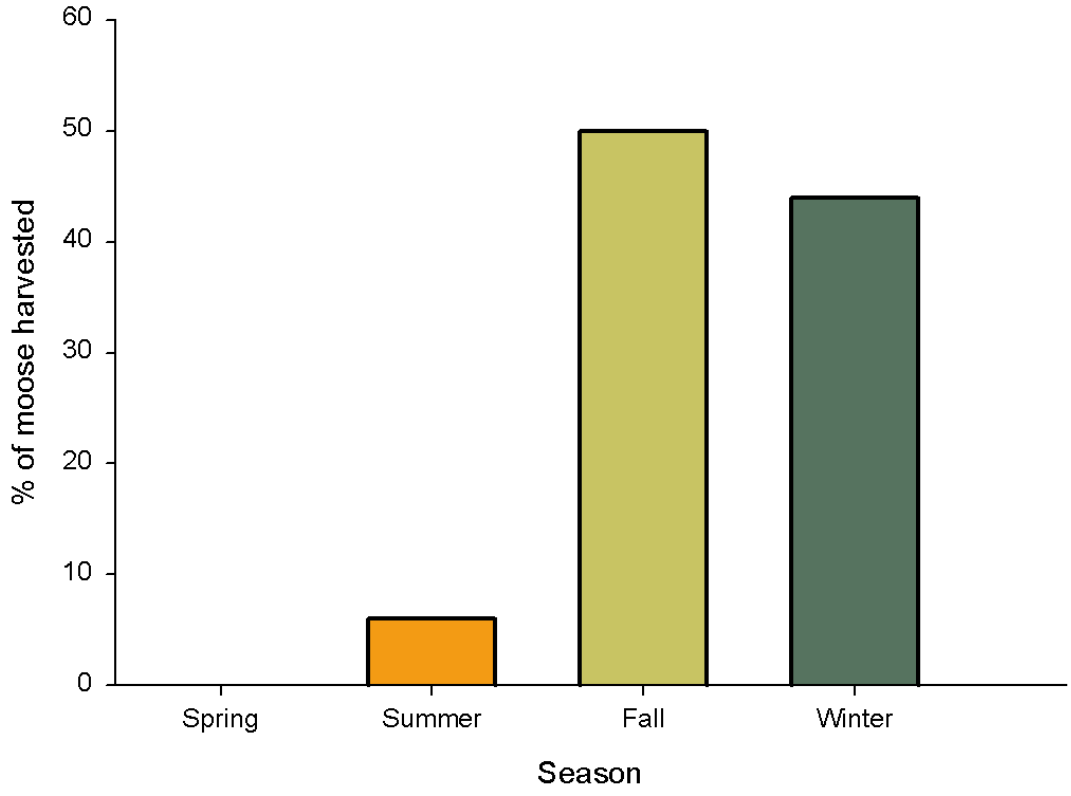

Figure 6. Season of harvest for moose taken by Tulita General Hunting Licence Holders, 1997 (SRRB 2002).

Table 4. Location, ages, and sex of moose harvest, Tulita, Jan. – Nov.1997

Location	Calf (≤1-yr)	Cow (≥1-yr)	Bull (≥1-yr)	Unknown	Total
Mackenzie River (%)	0	3	13 (81)	10 (77)	26 (82)
Keele River	0	0	3 (19)	0	3 (9)
Redstone River	0	0	0	2 (15)	2 (6)
Unknown	0	1 (8)	1 (3)		
Total	0	3 (9)	16 (50)	13 (41)	32

Predation / Other Wildlife

All observations of wolves (*Canis lupus*) and boreal woodland caribou were recorded during the survey. Wolves were seen in 7 (18 %) of the study blocks. Wolves were feeding on dead moose in two blocks: one moose was of an unknown sex and age and the other was an adult bull (study blocks 81 and 38; Fig. 2).

Some studies have shown that predation by both black and brown (grizzly) bears can be significant on young moose and may limit the growth of low-density moose populations (Ballard 1992). Wolves are another major predator of calf and adult moose. Low densities of moose are common in ecosystems where wolves, black bears, and brown/grizzly bears co-exist with a light to moderate moose harvest (Gasaway et al. 1992).

Twenty-eight boreal woodland caribou were seen within six study blocks; these blocks were composed mainly of mature spruce habitat. Observations and signs of other wildlife included: red fox, river otter, goshawks, ptarmigan, and several flocks of sharp-tailed grouse.

Possible Sources of Bias

The search intensity of this survey (about 1.2 min per km^2) was similar to other moose surveys in the Mackenzie Valley. A snowfall prior to the stratification survey greatly increased sightability of the moose tracks. Light conditions were generally favourable,

especially for the low-density stratum where most of the study blocks were surveyed during bright light conditions.

Our population size estimate must be considered a minimum estimate because aerial surveys invariably undercount populations of moose in full and partially forested habitats (Caughley 1974; LeResche and Rausch 1974). Factors that affect the sightability of moose in aerial surveys include: search intensity, aircraft type, cloud cover, habitat cover type, observer experience, airspeed, and altitude (Bisset and Rempel 1991; Le Resche and Rausch 1974; Caughley 1974).

Classification of bulls and cows in January is more difficult than during November surveys, as males generally shed their antlers after late November (Timmerman and Buss 1997). Our ratio of 151 bulls to 100 cows is probably an overestimate and may be attributed to misclassification. Moose hunters from Tulita tend to select adult males over adult females or calves (Table 4) and 84% of the reported moose taken in 1997 were of this age and sex class. Therefore, the skew in sex ratio towards bulls is difficult to explain other than by misclassification.

The observed number of cows with twins decreased from 8% in 1993 to 3% in 1999. However, calf mortality between November and January may account for this difference. An accurate twinning rate for the population (an indicator of productivity) cannot be obtained in January or November surveys, as calves are born in May - June and most studies have found calf mortality to be highest in the first 6 months of life.

HARVEST AND MANAGEMENT RECOMMENDATIONS

Tulita Moose Harvest Levels

Based on hunter harvest information and population estimates from this survey, we estimate that the harvest rate from the Tulita moose population is between 3.5 - 7% or approximately 6%. This rate is considerably less than the estimated rate in 1993 of 17% and can be considered within sustainable limits. Wildlife managers suggest that hunter harvest rates should not exceed 8% of the moose population each year. However, the 6%

harvest rate is also a minimum estimate, as it does not include moose harvested by hunters from outside Tulita, illegal harvest, or wounding loss.

The concern over potential increases in moose harvest related to increased local demands for Fort Good Hope and Norman Wells moose populations may also become applicable to Tulita in the future. Upon completion of the Harvest Study, the SRRB will determine a claimant basic needs level for moose and harvest allocation if required.

Moose Habitat Needs

For the Tulita area moose population to sustain or increase its numbers to meet the anticipated increasing subsistence needs levels, moose require an abundance of high-quality habitat. Moose populations generally increase in response to forest regeneration (new habitat) that occurs following a fire (Peek et al. 1976; Schwartz and Franzmann 1991). It is necessary to maintain a mosaic of different aged post-burn habitats among older growth forests to support a stable moose population. The Tulita study area has extensive recently burned areas and we found the highest moose densities in regenerating willow habitats.

Moose Survey Technique

Methods need to be re-examined to determine if the current ‘Gasaway method’ is the most appropriate. Although the technique provides a population estimate, in areas with low-density moose populations such as Tulita, these estimates are often inaccurate. If

management decisions are to be based on population trends, then other survey techniques may be more cost effective and appropriate.

If the current practice of aerial surveys to inventory moose populations is used it should continue with a 5-year interval between surveys. The next survey of the Tulita study area moose population should occur November 2004 to January/February 2005.

In future Gasaway surveys, a reconnaissance flight prior to the helicopter survey will not be necessary as results of the two previous surveys and a classified vegetation map of the study area can be used to stratify the study area. This would avoid the problem created by stratifying based primarily on observations of tracks, eliminate weather-related delays between stratification and the census, reduce the total amount of time required for the survey, be safer, and be less costly.

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