POPULATION SIZE AND COMPOSITION OF MOOSE WEST OF NORMAN WELLS

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ABSTRACT

A stratified random block survey of moose (*Alces alces*) was conducted over a 2993 km^2 area west of Norman Wells, NWT during 14-25 November 1989. Moose density within this area was .15 moose/km^2 and the estimated population was 435±139 (90% C.I.). There were 57 calves/100 cows, 42 yearlings/100 cows, and 100 bulls/100 cows. The twinning rate was 11%. This moose population appears to have maintained the relatively high levels of productivity identified by earlier workers and has remained stationary over the six years since it was last surveyed. The late autumn distribution of moose was similar to that observed in the previous survey. The number of resident hunters in Norman Wells has declined substantially over the last six years and the annual removal of approximately 15 moose by resident and native hunters is within the safe, allowable harvest.

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INTRODUCTION

Moose are the most important big game species in the Norman Wells area, both in terms of the number of hunters seeking this species and the amount of meat obtained. Unlike Barren-Ground and Woodland caribou, moose are available close to Norman Wells all year round and can be effectively hunted along waterways or inland, depending on the season. Families with general hunting licence holders are proportionally fewer in Norman Wells than in other communities in the Sahtu District, and they generally account for fewer than 10 moose each year. General hunting licence holders can take moose at any time of the year, but the majority are taken during the early autumn. On the other hand, resident hunters are proportionally greater in Norman Wells and of the 48 resident hunting licences sold to residents of Norman Wells in 1989, 36 (75%) included moose as one of the intended species. Resident hunters can take moose from September-January inclusive.

Most hunting of moose by residents of Norman Wells occurs west of Norman Wells in the area of the Canol Road, Heart Lake, Carcajou River valley, Hoosier Ridge, and around Three Day Lake. Because of the proximity of this area to Norman Wells, and a rapidly growing human population during the 1982-85 oilfield expansion and pipeline construction, concerns were raised about possible excessive harvest of moose in this area (Jingfors et al. 1987). In November 1984, a population estimate of 465 ± 90 (90% C.I.) moose was obtained in a 3200 km^2 block which included the above areas. At the same time,

the need for more intensive ecological work on this moose population was identified (Jingfors et al. 1987). Subsequently, a study of movements and productivity was conducted on moose in the above area from 1985-88 (Stenhouse and Kutny in prep.). Although they concluded that this moose population exhibited relatively high productivity, Stenhouse and Kutny (in prep.) raised some concern about possible high predation on calves, especially newborns, and the high incidence of parasitism (*Echinococcus granulosus*). The present study, therefore, was designed to obtain a current population estimate for moose in the same area as Jingfors et al. (1987) and after the greater hunting pressure of the mid-1980s. This study was also intended to obtain data on productivity and population composition which could be compared with the earlier results of Jingfors et al. (1987) and the recent conclusions of Stenhouse and Kutny (in prep.).

STUDY AREA

The study area limits were almost identical to those of Jingfors et al. (1987). The 2993 km^2 area was bounded by Patricia Island and Doris Lake in the northwest, the Mackenzie Mountains in the southwest, Mirror Lake and Halfway Islands in the southeast, and the Mackenzie River in the northeast (Fig. 1). The study area was described previously by Prescott et al. (1973) and Jingfors et al. (1987). It consists largely of gently rolling terrain rising up gradually from the Mackenzie River and covered mainly by open boreal forest. Black spruce (*Picea mariana*) predominates, however, in better drained areas white spruce (*Picea glauca*), balsam poplar (*Populus balsamifera*), trembling aspen (*Populus tremuloides*), and white birch (*Betula papyrifera*) are found. Dense stands of shrubbery favoured by moose as browse (*Salix* spp., *Alnus* spp.) occur along the many small streams and larger rivers in the area and at certain places along the shoreline of the Mackenzie River and associated islands. Numerous ponds and small lakes dot the area. The mean temperature is +8°C and ranges between -34°C and +22°C. Annual precipitation occurs as rain (200 mm) and snow (1200 mm). Aside from a winter road in 1985-86, there has been no road access into the study area although numerous seismic lines criss-cross it.

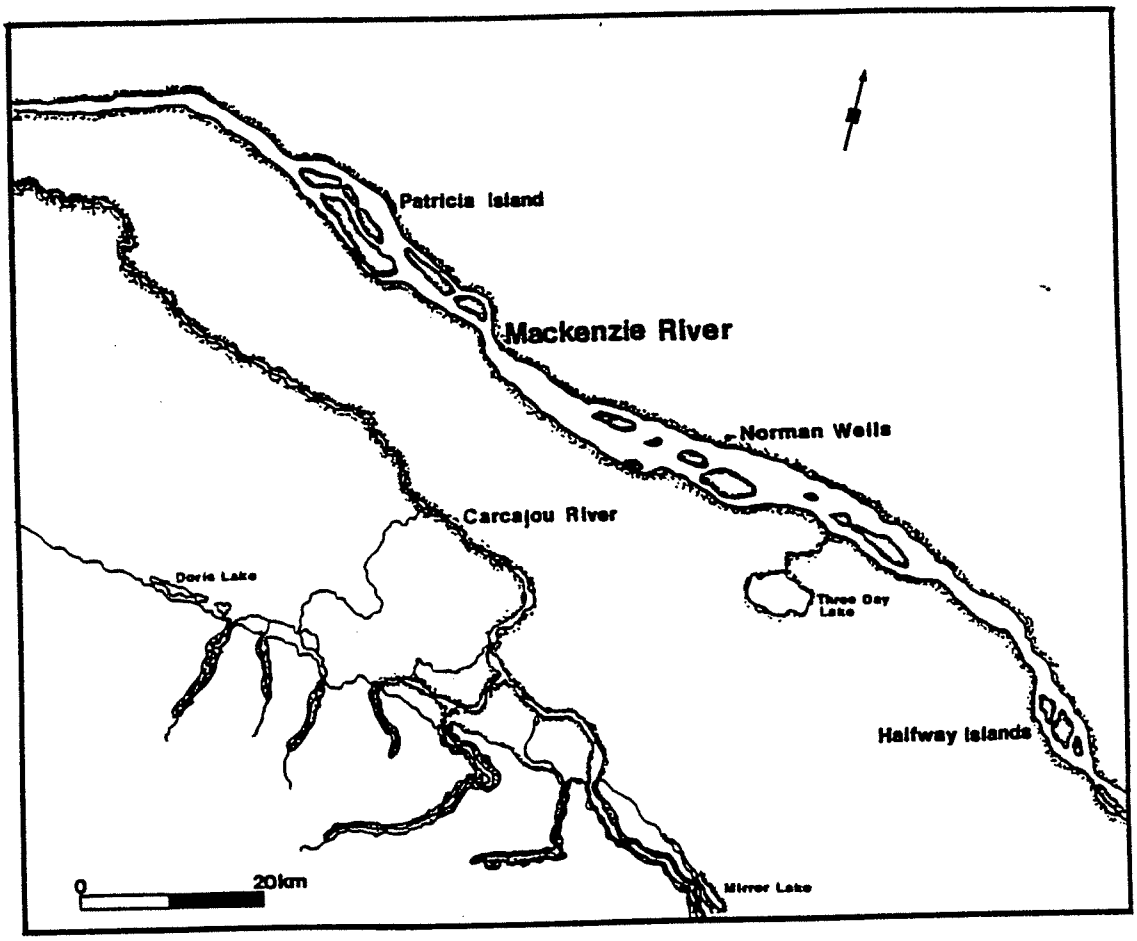

Figure 1. The study area west of Norman Wells.

METHODS

A stratified block sampling design as described by Gasaway et al. (1981, 1986) was used in this study. Briefly, the study area was divided into sampling units using, as much as possible, natural features such as watercourses, ridgelines, and lakeshores. The sampling units were all about 20 km^2 in order to improve the precision of the final population estimate. In fact, the sampling units used here were almost identical to those of Jingfors et al. (1987).

Reconnaissance flights in a Cessna 185, with two observers in the back seat and a navigator/recorder in the front, were then made over all the sampling units. The aircraft flew at 100m agl. and 160 kph. Two passes were made over each sampling unit and the locations of all moose and moose tracks were plotted directly onto 1:50,000 maps. Following the reconnaissance, the sampling units were stratified according to high, medium, or low moose density based on the combined total number of moose and moose tracks seen in each sampling unit ($\geq$10=high; 3-9=medium; $\leq$2=low).

Surveying of moose in all of the high density sampling units and a randomly chosen number of medium and low density sampling units was done using a Bell 206B helicopter. All the high density sampling units were surveyed in order to reduce sampling variance in the high density stratum. The same observers were used as in the reconnaissance. Parallel transects, .5 km apart, were followed perpendicular to the long axis of each sampling unit and all

sightings of moose were recorded. At the same time, moose were classified (small, medium, or large bull; cow; yearling bull; calf). Antler size and configuration and body size were the criteria used for this classification. No attempt was made to identify yearling cows, but in the analysis a 1:1 ratio of yearling bulls:yearling cows was assumed, therefore, the total number of yearlings in the population could be inferred.

The vegetation type was recorded in which each moose, or group of moose, was observed. The following vegetation types were identified: stunted spruce forest, spruce forest, creek bottom, burn, willow/alder, and cutline.

No specific determination of sightability was obtained in this study as outlined by Gasaway et al. (1986). However, in June 1989 it was determined that 16 radio-collared cow moose remained in the study area (Stenhouse and Kutny in prep.). The proportion of these cows resighted during the present survey (November 1989) was used as a measure of sightability, with the assumption that the 16 cows were alive and still in the study area.

The analysis was performed using the program MOOSEPOP developed by D. Reed of the Alaska Department of Fish and Game. This program follows the methodology of Gasaway et al. (1986).

RESULTS

Survey Characteristics

The reconnaissance was conducted during 14-15 November 1989 and the census during 16-25 November. Conditions were generally clear and cold and during the entire survey only three days were lost because of poor weather. Temperatures ranged from -35°C to -20°C and winds were light. Snow cover was complete over the study area although total accumulation had only reached 30 cm by late November.

The study area was composed of 132 sampling units covering an area of 2993 km^2. A total of 8 hrs of flying was required for the initial reconnaissance of the area followed by 28 hrs for the actual census. Sampling intensity varied among the three strata (Table 1) and the overall sampling intensity, or proportion of the study area covered by surveyed sampling units, was 26%. Search intensity was similar among the three strata (1.3, 1.4, and 1.3 min/km^2).

Population Characteristics and Distribution

There were an estimated 435 $\pm$ 139 (90% C.I.) moose in the study area. The overall density was .15 $moose/km^2$; densities varied from .12 to .33 $moose/km^2$ between the low and high density strata (Table 2). There was a greater proportion of bulls in the medium

Table 1. Sampling effort and search intensity in the survey area west of Norman Wells, November 1989.

	Stratum			
	High	Medium	Low	Totals
No. of sample units (s.u.)	11	45	76	132
No. of sample units sampled	11	11	13	35
% of s.u. sampled	100	24	17	
Search intensity (min/km^2± s.d.)	1.3±.27	1.4±.22	1.3±.24	

Table 2. Moose population density and composition west of Norman Wells, November 1989.

	Stratum			
	High	Medium	Low	Total
Population estimate	84	160	191	435±139 (90%C.I.)
Density (moose/km^2)	.33	.16	.12	.15
Estimated bulls	29(35%)	66(52%)	81(59%)	175±79
Estimated cows	36(44%)	53(42%)	81(38%)	170±53
Estimated calves	19(20%)	33(6%)	29(3%)	81±38

and low density strata, cows were spread evenly across the three strata, and calves were much more concentrated in the high density stratum. There were 57 calves/100 cows in the study area and 42 yearlings/100 cows. The overall bull/cow ratio was 100/100 (this includes yearlings of both sexes). The twinning rate was 11% (3/28 cows with calves). Mean group size was 1.75 $\pm$ .75 and group size did not vary significantly among the three strata (F-test, P>.05, d.f.=89).

During stratification, high density sampling units (>10 moose and/or tracks observed) occurred in the middle of the study area, in the northwest corner, and in the southeast corner (Fig. 2). Medium density sampling units surrounded the high density area in the middle of the study area and were scattered across the remainder of the study area (Fig. 2). During the census, two sampling units in the middle of the study area were of high moose density (>10 moose observed) as was a sampling unit along the southeast edge of the study area (Fig. 3). Medium and low density sampling units were scattered throughout the study area.

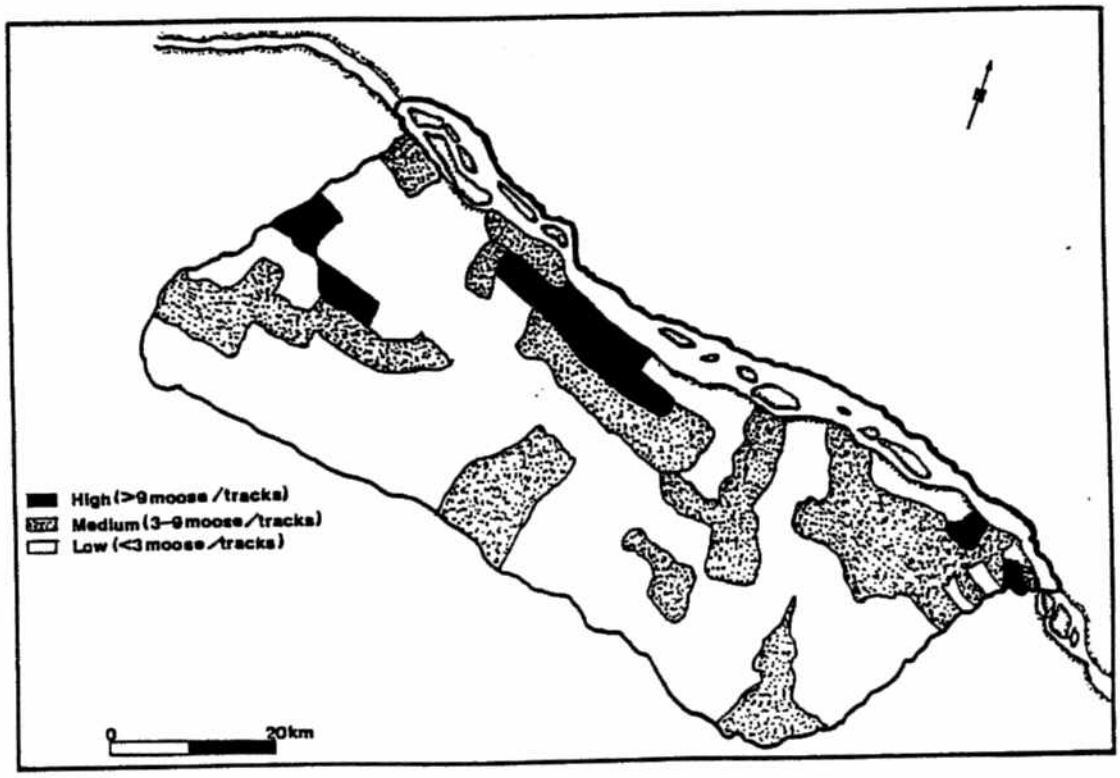

Figure 2. Distribution of high, medium, and low density sampling units following stratification (density based on observation of moose and tracks).

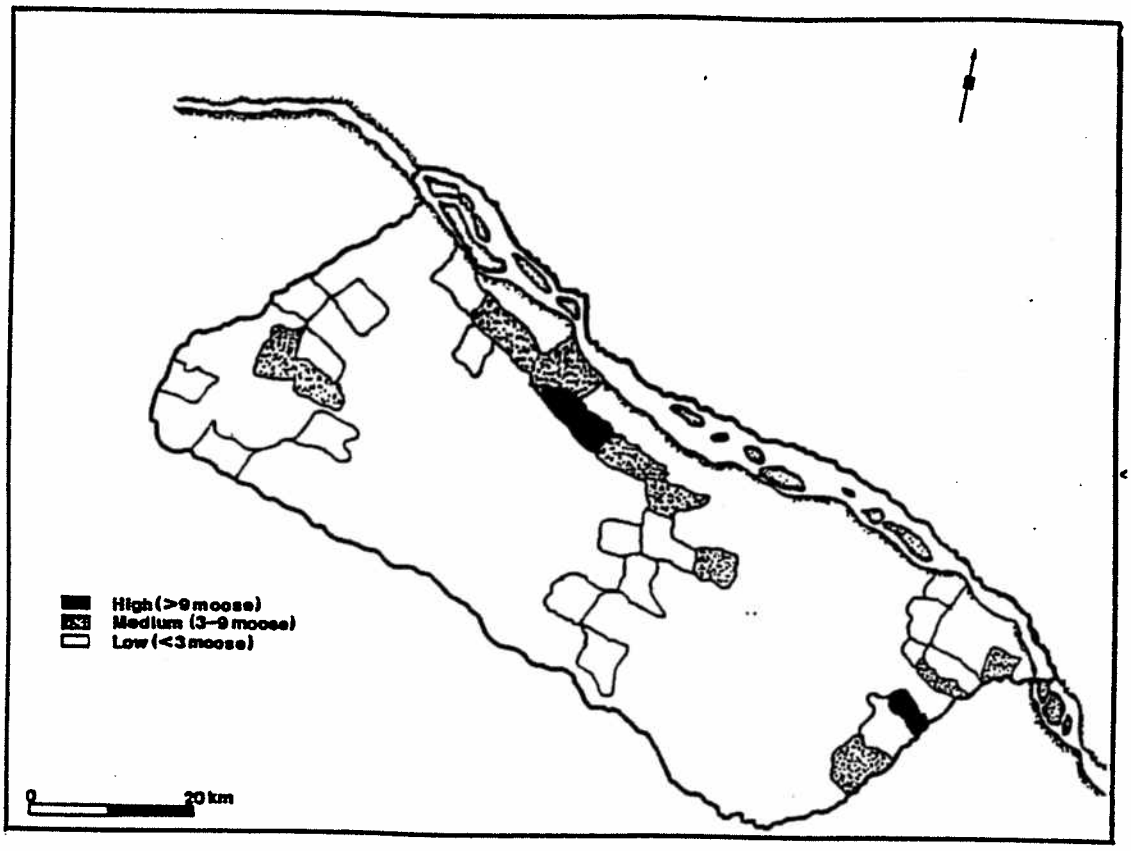

Figure 3. The location of randomly selected, censused sampling units and the density of moose in each (density based on observation of moose only).

DISCUSSION

Observability and Classification

The search intensity of this survey (approx. 1.3 min/km^2) compared closely with other moose surveys (Gasaway et al. 1986, Jingfors et al. 1987). The complete snow cover over the study area aided in the observability of moose. These factors, and the resighting of 6/16 (38%) of the radio-collared cows on the study area compared to the 26% sampling intensity indicates that observer error was likely low in this survey.

Except for two large bulls which had each dropped one antler near the end of the census period, moose retained their antlers throughout the survey period. Mis-classification of bulls as cows, therefore, was likely not a factor in this survey.

Population Characteristics

The number of moose in the area west of Norman Wells (435$\pm$139) has remained unchanged since the last survey in 1984 (Jingfors et al. 1987). Although the count by Jingfors et al. (1987) was marginally greater (465$\pm$90 moose), their study area was also slightly larger (3200 vs. 2993 km^2). The densities of moose within the three strata were nearly identical between the two studies although the confidence limits were wider in the present survey. This difference likely reflects error in the stratification during

the present survey. For example, only 18% of the high density strata actually contained >10 moose during the intensive searches, only 45% of medium density strata contained 2-9 moose, and only 52% of low density strata contained <2 moose. The initial stratification was based on tracks as well as moose sightings. An abundance of tracks but few actual sightings in some sampling units may have indicated a shifting of moose distribution during the survey and rapidly changing densities within particular sampling units.

Moose in the study area appear to be maintaining the high level of productivity also found by Jingfors et al. (1987). The calf/cow ratio (57/100) was equivalent to that of Jingfors et al. (1987) and the yearling/cow ratio (42/100) exceeded that of Jingfors et al. (1987)(12/100). Jingfors et al.(1987), however, felt that their identification of yearlings may have been in error due to observer inexperience. The ratios of both calves and yearlings to cows compare with the upper range of values reported for moose from the Northwest Territories and a variety of North American locations (summarized by Jingfors et al. 1987). The bull/cow ratio (100/100) was also high compared to other areas in North America although surveys in other regions of the Northwest Territories have reported similarly high values (Treseder and Graf 1985). This ratio would likely ensure that all available estrus cows in the population are bred (Crete et al. 1981) as was found during more intensive study of adult cows within the study population (Stenhouse and Kutny in prep.).

Distribution

The highest density of moose was found in the central part of the study area and corresponded to a 20 yr burn; 39% of all moose sighted during this survey were in burns having occurred during the last 20 years although these burns cover only 7% of the study area. Jingfors et al. (1987) also recorded the highest densities in the central part of the study area, although in the present survey the high density sampling units were at somewhat lower elevations closer to the Mackenzie River. In contrast to Jingfors et al. (1987), few moose were observed on islands in the Mackenzie River, although within a month of the survey numerous moose were observed (pers. obs.) and reported on several of these islands. If moose were delayed in moving onto these islands in November 1989 the reasons were not apparent.

Use and Management

Jingfors et al. (1987) expressed some concern about the increasing number of resident hunters in Norman Wells during the 1982-85 oilfield expansion in the Mackenzie Valley and possible over-hunting of moose in the Norman Wells area. However, since then the number of resident hunters has declined from approximately 90 in 1985 to 36 in 1989, and only 10 hunters in 1989 obtained a moose with no obvious skewing toward any one sex or age class. Add to this a take of 5 moose by general hunting licence holders from

Norman Wells and the resulting 15 moose amounts to only 3% of the total population.

Given the apparent stationary nature of this moose population over the last five years, the continued high levels of productivity, the unlikelihood of any major industrial activity in the area across the river from Norman Wells, and the reduced take by resident hunters there are no major management concerns for moose in the Norman Wells area at this time. Future industrial activity (e.g., gas pipeline) in the Norman Wells area, however, will necessitate continued close monitoring of moose hunting conducted west of Norman Wells.

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