RECENT OCCUPATION OF THE ALBERTA ASPEN PARKLAND ECOREGION BY MOOSE

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ABSTRACT: Recent occurrence, population trends, productivity and management were documented for a relatively new and expanding population of moose (*Alces alces*) in the Alberta Aspen Parkland Ecoregion (AAP). Observations of moose were first recorded in the western portions of the AAP during aerial inventories for deer during winter 1973/74. Over the next 10-17 years, moose migrated 100 - 175 km eastward, being first observed in eastern Wildlife Management Units (WMU's) by 1983 and 1991. For 6 WMUs, where data were available, the mean density at time of initial observation was very low (0.03/km^2; range 0 .01 - 0.04 km^2) of surveyed habitat. For the same WMUs and techniques, inventories conducted during 1992/93 - 1995/96 estimated mean densities of 0.18/km^2 (range 0.09 - 0.30/km ^{2}). Productivity was high. Sex/age proportions were 86 calves and 40 bulls/ 100 cows (n = 267) for moose with no hunting season. Between 1982 and 1994, 957 public complaints related to moose were registered in 3 Alberta Fish and Wildlife District offices central to moose habitat in the AAP. There was a trend toward increasing complaints in later years. Overall, 48% of complaints were related to road-killed moose or other accidents/mishaps, 35% were related to illegal or legal hunting activities, 13% were related to property damage, and 4% were related to other factors including native hunting and sightings of moose. In response to public concerns about increasing moose populations, limited entry hunts for antlered or antlered and antlerless moose were implemented in 22 of 33 WMU's in the AAP between 1986 and 1996.

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Moose (*Alces alces*) enjoy a circumpolar distribution occupying boreal areas throughout North America, Europe and Asia (Peterson 1974). In Alberta, moose have traditionally been located primarily in the foothills and boreal mixedwood areas and in habitat associated with boreal lowlands and sub-alpine habitats (Stelfox and Stelfox 1993). Starting in the 1970s, moose numbers expanded into the Alberta Aspen Parkland Ecoregion (AAP) of south-central Alberta. This ecoregion has long been regarded as prime habitat for white-tailed deer (*Odocoileus virginianus*); moose have been rare here during the era of post European settlement.

This paper documents the expansion of moose range into the AAP. Data on occurrence, densities, sex and age composition, public complaints/concerns and management are presented.

STUDY AREA

The AAP covers approximately 52,000 km^2 or 7.9% of Alberta (Strong and Leggat 1992) (Fig. 1). It is bound on the north by the boreal forest, on the west by the boreal foothills, and on the south by the grasslands. This habitat extends through portions of Alberta, Saskatchewan, Manitoba, Minnesota and North Dakota (Rowe 1972). Although trembling aspen (*Populus tremuloides*) has been the dominant tree species in recent history, the soils developed beneath grassland vegetation. Prior to European settlement, when fires were more common, much of the area was dominated by grassland (Strong 1977). Common shrubs include willow (*Salix* spp),chokecherry (*Prunus virginiana*), Saskatoon-berry (*Amelanchier alnifolia*) and red osier dogwood (*Cornus stolonifera*).

Most of the AAP has level-to-undulating

terrain. Major rivers with associated valleys and tributaries include the North Saskatchewan, Battle and Red Deer. Total annual precipitation is about 400 mm with average summer temperatures of 14.4°C. The southern portion of the AAP is drier and supports less woody vegetation than the northern areas. Relative to the boreal mixedwood the AAP is warmer during summer and winter, and is slightly wetter in the summer.

Presently, less than 5% of the original AAP exists as natural habitat (Wallis 1987). The area represents one of the most productive agricultural regions of the province. Most of the native vegetation has been replaced by agricultural activities related to the production of cereal crops, oil seeds and livestock.

Native habitat persists in riparian areas in locations of relatively hilly terrain, and in numerous small parcels throughout the AAP. A few blocks of native habitat remain largely intact including portions of Canadian Forces Base (CFB) Wainwright (WMU's 728/730) which is 600 km^2 in size.

METHODS

Data on moose population parameters were collected from routine aerial inventories for white-tailed deer and mule deer (*Odocoileus hemionus*) by Alberta Natural Resources Service. Population trend data in the form of moose densities/km^2 of inventoried habitat were available for 6 WMUs which had been inventoried at least 2 times (2-16 times) over the period of moose population expansion and growth. These 6 WMUs (220, 208, 166, 204, 202, and 728/730) were utilized to express changes in moose density over time. Actual estimates of population numbers, which involves extrapolations beyond inventoried areas, were not presented, as confidence intervals were either unavailable or very broad given small sample sizes. The exception was WMU's 728/730 where the inventory technique utilized allowed direct extrapolation.

Aerial inventories were conducted during winter months and with complete snow cover. At CFB Wainwright (WMU's 728/730), a similar inventory technique was utilized each year which consisted of flying a helicopter about 100 m above transects spaced 800 m apart with observers searching a 300 m strip on either side of the helicopter. During 4 years when inventories were conducted (including the initial inventory in 1983 when moose were first observed and the 3 inventories conducted during 1989-90 through 1995-96 when most of the population growth occurred) the majority of the WMU's were covered using this technique. However, for the 5 inventories conducted during 1983-84 through 1987-88, only 50 km^2 (8.3%) of the WMU's were covered.

Aerial inventory techniques utilized in the other 5 WMU's were variable up until winter 1984-85 when a stratified random block survey procedure was adopted. Prior to 1984-85, a variety of block and transect survey designs were employed, usually in the areas of best habitat. Stratification involved assigning each 2.6 km^2 block in each WMU a ranking based on the % of the block covered with native trees and shrubs (Froggatt, unpubl.). For example, blocks with 75-100% coverage of trees and shrubs was classified as Stratum 1, while blocks with 0-12% coverage was Stratum 5. The number of 2.6 km^{2}blocks in each stratum which were inventoried was determined with the assistance of a computer program and depended on the targeted level of confidence desired for the deer inventory (Jacobson and Cook 1978).

Typically, a higher proportion of the best strata was inventoried and a lower proportion of the poorest strata was inventoried, given the relative abundance of this type of habitat. These inventories were typically flown with high-winged, 4-seat aircraft (usually a Cessna 172 or 182) with 4 parallel passes per 2.6 km^2 block. In WMU 220, a combination of fixed-wing and helicopter inventories were uti-

lized each year.

Sex and age composition was determined during aerial inventories when conditions were suitable. Prior to 15 December adult moose were sexed by the presence or absence of antlers (Timmermann 1993) combined with other techniques including vulva patch (Mitchell 1970), body size and colouration. After 15 December, presence or absence of the vulva patch was the main technique utilized and was only employed when helicopters were utilized. Calves were distinguished from adults on the basis of size and body shape and colouration. For this analysis, sex and age data from WMUs in the AAP, in addition to the 6 WM's mentioned above, were utilized when available.

Details on complaints/occurrences regarding moose and the public were obtained from the Animal Incident Reporting System maintained by Alberta Natural Resources Service. Data were analyzed for 3 Natural Resources Service, Fish and Wildlife districts (Red Deer, Camrose, and Stettler) located in prime moose range in the AAP for the period 1982 through 1994.

RESULTS

Aerial inventory data indicate that moose were first observed in western portions of the AAP during winter 1973-74. Over the next 10-17 years moose spread eastward, being first observed in the two easterly WMU's in 1983 and 1991 (Table 1). Although quantitative data are unavailable for the northern edge of the AAP, moose began occurring in these WMU's (258, 260), by the late 1970s and had spread to adjacent units to the south (WMU's 254, 256) by the late 1980s (B. Rippin pers. comm.). Moose were always considered to be present in the boreal areas to the north and west of the AAP. Mean densities at time of initial observation for the 6 study WMU's were very low at 0.03/km^2 (range 0.01 - 0.04/km^2) (Table 1). The most recent inventories of the same WMU's indicate a mean density of 0.18 km^2 (range 0.09 - 0.30 km^2) on inventoried habitat, with increases in density ranging from 2-15 times.

WMUs 728/730 (CFB Wainwright) and 220 were inventoried the most frequently (Fig. 2). The mean finite rate of increase for the Wainwright population during 1983

Table 1. Trends in density (moose/km^2) and first occurrence of moose on inventoried habitat in the Aspen Parkland Ecoregion of Alberta.

WMU[1]	65[2]	73[2]	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
220	0		<u>02</u>[3]			.01			.08				.19	.13			.12			.10				.30	
208		0			<u>.01</u>							0	0			.03			.04			.09			
166															0			<u>.04</u>				.15			.15
204															0			<u>.04</u>					.09		
202													0								<u>.02</u>				.12
728/730	0	0	0	0	0		0	0	0	0	0	<u>.02</u>	0	.03	.07	.05	.09				.15				.30

[1] WMU = Wildlife Management Unit.

[2] 8 inventories conducted in WMU 220 between 1965-1973 - no moose observed.

6 inventories conducted in WMU 728/730 between 1965-1973 - no moose observed.

0 = inventory conducted, no moose observed.

[3] First observation of moose - moose/km^2.

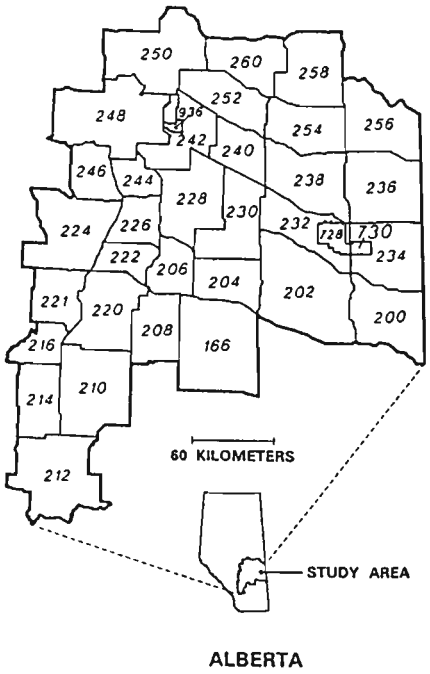

Fig. 1. The Alberta Aspen Parkland Ecoregion and locations of Wildlife Management Units.

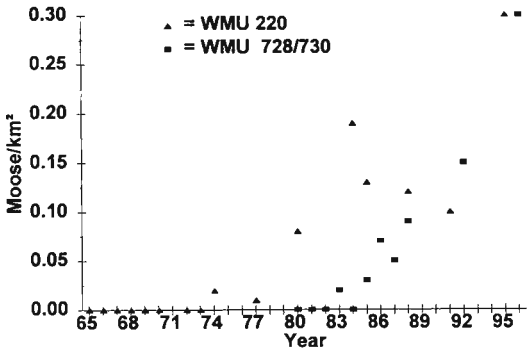

Fig. 2. Trends in densities of moose from aerial surveys conducted in Wildlife Management Units in the Albera Aspen Parkland Ecoregion.

through winter 1995-96 was 1.24 where the population increased from about 12 to 180 over 13 years. In WMU 220, moose increased from 0.02/km^2 to 0.30/km^2 between 1973-74 and 1994-95. The mean finite rate of increase from 1973-74 to 1984-85 (hunting was initiated in 1986) was 1.13, with about 400 moose in this WMU by 1994-95.

For all WMU's with data there were 86 calves/100 cows and 40 bulls/100 cows (n = 267) with no managed hunting (6 WMU's - 12 inventories) and 74 calves/100 cows and 47 bulls/100 cows among moose subject to hunting (6 WMU's - 6 inventories).

Between 1982 and 1994 a total of 957 public complaints were registered at 3 Alberta Fish and Wildlife district offices located central to moose populations in the study area (Fig. 3). Complaints increased over time and approximated increases in moose numbers. Overall, 48% of complaints were related to vehicle-killed moose or other accident/mishaps (found wildlife), 35% were related to illegal or legal hunting, 13% were related to property damage caused by moose, and 4% were related to other factors including sightings of moose and native hunting.

Hunting seasons were initiated in 22 of 33 WMUs in the AAP between 1986 and 1996, causing some controversy. In WMU 230 more than 200 residents signed a petition asking for a moose hunt, while in WMU 166, more than 50 asked that a planned hunt be postponed. Hunts were only initiated after consultation with rural municipalities (Counties and/or Municipal Districts) and following public meetings where the proposed management was discussed and debated. All hunts were conducted on a limited entry or

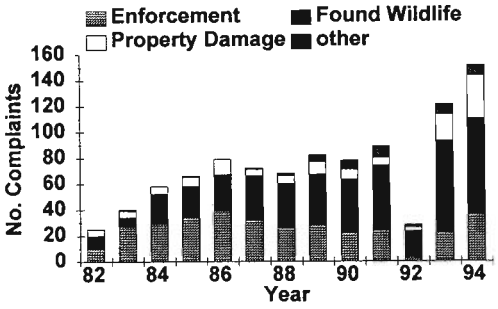

Fig. 3. Summary of public complaints regarding moose at three Alberta Natural Resources Service - Fish and Wildlife Offices in the Alberta Aspen Parkland Ecoregion.

draw basis (i.e., only a fixed number of permits were available) and antlered and antlerless harvests were managed separately. Initially, permits were restricted, and in 7 WMUs where the population was very small or data was limited, only antlered hunts were offered.

Moose populations increased after hunting in 2 of 3 WMUs where data were available. In WMU 220, initiation of hunting for both antlered and antlerless moose in 1986 (with an objective of harvesting 10% of the population as males and 10% as antlerless) was associated with relatively stable densities over the next several years (Fig. 2). However, by 1994-95 densities of 0.30 /km^2 occurred, well above pre-hunt levels. In WMUs 728/730, harvest of calves and antlered moose (harvest objective was 15% and 20% of pre-hunt bull and calf numbers) , beginning in 1994, did not negatively impact this rapidly growing population (Fig. 2). Beginning in 1993, hunting in WMU 166 appeared to stabilize this population at about 0.15 moose/km^2 of inventoried habitat.

DISCUSSION

Although most of the AAP has been modified for agricultural production, the native trees and shrubs which remain are very suitable for utilization by moose (Allison 1972, LeResche and Davis 1973, Peek 1974, and Nowlin 1978). The area contains no noticeable occurrence of predators larger than coyotes (*Canis latrans*) (Bjorge, unpubl.) and has a relatively high number of humans and their roads, barbed wire fences, and large areas of farmland. Yet moose appear to have adapted well to this environment and to reproduce at a rate which allows for population growth.

Several factors likely played key roles in the expansion of moose into the AAP including suitable food and cover, an absence of predators, increasing moose populations in boreal areas of Alberta during the 1960s (Stelfox and Stelfox 1993) and possibly a change in attitude of rural residents resulting in less illegal harvest. Poaching of individual moose in the AAP prior to establishment of the population in the 1970s occurred (K. Wood, pers. comm.). It is noteworthy that expansion of moose populations into aspen parkland habitats has also occurred during the 1970s, 1980s and 1990s in other provinces and states, including Saskatchewan (A. Schmidt, pers. comm.), Manitoba (L. Bidlake, pers. comm.), North Dakota (J. MacKenzie, pers. comm.), and Minnesota (Phillips *et al.* 1973, and Berg and Phillips 1974).

Rates of population increase in this study were relatively high. Keith (1983) reviewed moose populations with adequate food and few predators and found finite rates of increase averaging 1.23 (range 1.15 - 1.30). Moose in the current study were near this rate of increase in WMU's 728/730 and in WMU 220. In this study, it is expected that ingress and reproduction likely played a role in population growth. Although population growth has been quite rapid, densities in the AAP are relatively low compared to moose in the boreal foothills and boreal mixedwoods of Alberta where densities are 0.5 - 1.50/km^2 (Stelfox and Stelfox 1993). Densities elsewhere have ranged from 0.20/km^2 in southern Quebec to > 4.0/km^2 in Newfoundland (Bergerud and Manual 1969). Densities in boreal regions of extreme northern Alberta approximated those found in this study (Lynch unpubl.).

Cow-calf ratios from this study during winter were relatively high, located between the high of 106 calves/100 cows documented by Rolley and Keith (1980) in the Alberta boreal mixedwoods and a low of 17 calves/100 cows on Isle Royale (Peterson 1977). The proportion of bulls among yearlings and adults in this study seemed relatively low for those populations not subject to managed hunting. Lynch (1973) and Rolley and Keith (1980) also observed a similar pattern. Rolley

and Keith (1980) attributed their results to a differentially higher egress of bulls and sex-specific differences in distributions. These results could also be explained by greater mortality of males.

It is not surprising that the number of public complaints increased as the moose population grew. It is noteworthy that the largest category of public complaint consisted of "found wildlife". Most (80% of the sample of 50 which were looked at in detail) were moose that had been killed by vehicle collision, and the number of occurrences in this category increased with time. Accidents between moose and motor vehicles have been documented in several studies (Franzmann 1978, Child 1983, Oosenbrug *et al.* 1986, Bangs *et al.* 1989). Bangs *et al.* 1989 found that motor accidents were a primary mortality factor for moose on the Kenai Peninsula. In the AAP, moose-vehicle accidents and the resulting public safety and property damage were the main concerns of the public.

Hunting was initiated in the majority of WMU's in the AAP to curb population growth and help minimize associated problems. In at least 2 of the 3 WMU's in this study, where the impact of hunting on populations could be assessed, populations continued to grow at a relatively high rate following initiation of hunting. Harvest goals need to be increased to meet population objectives, but managers must remember to consider non-consumptive users (Todd 1980) and to strive to achieve optimal population levels for all.

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