THE IMPACT OF BLACK BEAR REMOVAL ON MOOSE CALF SURVIVAL IN EAST-CENTRAL SASKATCHEWAN.

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Abstract: Twelve black bears (Ursus americanus) were removed from a 90 km² study area in May-June 1983 and 26 others from a different 130 km² area in May-June 1984 to evaluate the impact on moose (Alces alces andersoni) calf survival. Moose composition surveys flown in September 1983 revealed 80 calves/100 mature (2.5 yrs +) cows within the project area compared to 40 for the control. For 1984, 87 and 39 calves/100 mature cows were estimated to be in the removal and non-removal areas respectively.

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A sex- and age-selective moose harvesting program designed to increase harvest pressure on calves while at the same time

reducing the kill of cows, was introduced to Saskatchewan hunters in the fall of 1977 (Stewart 1978). This was similar to the highly successful Swedish management program which capitalized on the reproductive potential of maintaining a high proportion of mature breeding cows in the population to stimulate herd growth. The Saskatchewan effort was successful in altering harvest structure, but failed in achieving population growth six years after its initiation (Stewart 1983). A number of different factors, including forest road access, unregulated harvest, tick (Dermacentor albipictus) infestation and predation, have been postulated as responsible for this lack of a population response in specific regions of the province (Stewart 1985). In east-central Saskatchewan the estimated early winter ratio of calves/100 cows (including yearlings) declined from 60-80 in the mid 1970's to 30-40 by the late 1970's/early 1980's and some form of reproductive failure was hypothesized. In March 1981, rectal palpations were performed on 16 mature cows, 15 of which were determined pregnant, carrying an estimated 131 fetuses/100 mature (2.5 yrs +) cows. Aerial surveys conducted in June that year revealed estimates of 100 calves/100 mature cows compared to only 32 calves/100 cows by September (Kowal and Runge 1982).

Predation by black bears was suspected at least partially responsible for the high calf losses as survey observers had frequently reported bears associated with calving areas. This belief was strengthened by Schelgel (1976) in Idaho and

Franzmann and Peterson (1978) and Franzmann et al. (1980) in Alaska who had reported a high incidence of black bear predation on radio-collared neonatal elk (48%) and moose (40%) calves respectively. A similar telemetry study conducted in east-central Saskatchewan in May-July 1982 resulted in black bears being suspect for the death of 6 of 12 post-capture cow-bonded calves marked with small mortality sensitive ear-attached radio transmitters (Beaulieu 1984).

The objective of the current investigation is to assess the impact of spring black bear removal on moose calf survival in Saskatchewan.

STUDY AREA

The project area is broadly defined by the Saskatchewan River Delta encompassing 7,000 km² in east-central Saskatchewan (Fig. 1). The delta is a complex of shallow lakes, deep marshes, fens, spruce bogs and numerous creeks and rivers with elevated banks and well developed upland forests. A detailed description of biophysical and vegetative features of the region is provided by Brewster and Stewart (1980). The area is divided into two wildlife management zones (WMZ's 60 and 61) for administrative purposes. West-centrally within WMZ 61, a 90 km² area referred to as the Bearhead Marsh was selected for one of the bear removal projects. Similarly, a 130 km² (Lobstick Lake block) area in the southeast of WMZ 60 was the site of the second

Table 1. Moose observed during composition surveys east-central Saskatchewan, 1983-84.

WMZ	Survey Block	Date	Yearling Bull	Adult Bull	Yearling Cow	Adult Cow	Calves	Total
60	Lobstick Lake	Oct.84	3	19	3	39	34	98
	Perimeter	Oct.84	9	19	9	41	22	100
	Control	Oct.84	4	14	4	51	20	93
	WMZ 60	Dec.84	22	66	22	180	93	383
61	Bearhead Marsh	Sept83	1	14	1	25	20	61
	Control	Sept83	2	33	2	53	21	111
	WMZ 61	Dec.83	18	59	18	200	101	396
	Bearhead Marsh	Oct.84	11	35	11	58	30	145
	Control	Oct.84	3	4	3	21	14	45
	WMZ 61	Dec.84	9	37	9	97	54	206

Table 2. Moose sex/age composition in east-central Saskatchewan, 1983-84.

WMZ	Survey Block	Date	Bulls/ 100 Cows	Calves/ 100 Mature Cows	(Y/Y+A) *100	% Mature Cows Without Calves	Twinning Rate (%)
60	Lobstick Lake	Oct.84	52	87	10	23	10
	Perimeter	Oct.84	56	54	30	46	0
	Control	Oct.84	33	39	12	55	27
	WMZ 60	Dec.84	44	52	15	33	9
61	Bearhead Marsh	Sept83	58	80	5	40	33
	Control	Sept83	64	40	5	60	0
	WMZ 61	Dec.83	35	51	12	56	17
	Bearhead Marsh	Oct.84	67	52	24	54	11
	Control	Oct.84	29	67	19	43	16
	WMZ 61	Dec.84	43	56	13	51	14

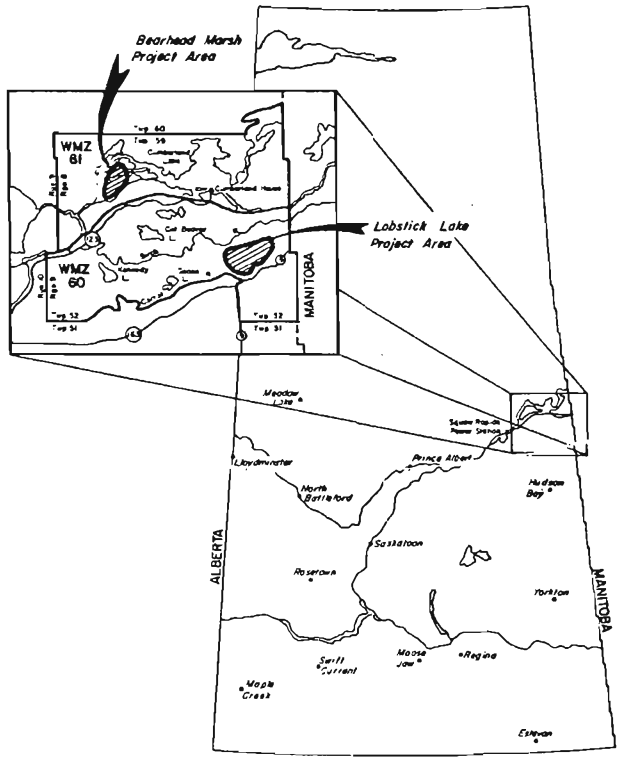


Figure 1. Bear removal project study areas in east-central Saskatchewan, 1983-84.

bear removal project (Fig. 1).

METHODS

An extensive network of footsnares were established at 55 bait stations throughout the Bearhead Marsh study area in May-June 1983. Snares were checked daily and all captured bears shot. Trapping continued until early June, at which time capture efficiency declined sharply. The next spring, on the Lobstick Lake block, the capture techniques included aerial and ground shooting, strychnine poisoning, and foot snaring.

An intensive search, moose composition survey using two observers plus pilot in a Bell 206 Jet Ranger helicopter was conducted within the Bearhead Marsh area during mid-September 1983 to provide estimates of bulls/100 cows and calves/100 mature cows. A survey was also flown throughout other portions of WMZ 61 to obtain comparative data on productivity. Bulls were classified as yearlings (Y) or adults (A) by antler size and configuration. Yearling cows were not segregated by observers, but estimates were derived using the assumption that an equal number of yearling bulls and cows occupied each survey area. The survey was repeated in October 1984 using a Robinson-22 (R-22) single passenger helicopter. The same type of aircraft was also used for the Lobstick Lake survey in October 1984. In addition to an intensive search for moose on the 130 km^2

block, observers classified all moose seen within 3.2 km of the project boundary to determine whether or not any "edge" effect existed. Productivity data was also gathered on moose throughout WMZ 60 with which to compare against the bear reduction block. Additional sex/age information was available from the early winter zone surveys conducted each December.

Bears taken in 1983 were aged by tooth cementum techniques while those removed in 1984 were judged to be cubs, yearlings, or adults (not implying sexual maturity) from measurements of total length, heart girth, and neck circumference.

Chi-square contingency table analysis was employed to test for statistical differences between removal and control areas identified in this study according to techniques described by Steel and Torrie (1960).

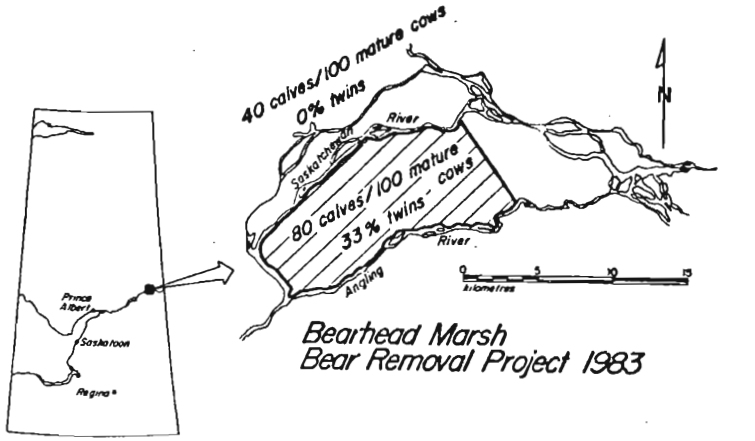
RESULTS

Seven adult males, four adult females and one male cub were trapped from the Bearhead Marsh in 1983 for a harvest density of 0.13 bears/km^2. Of the 26 bears taken from the Lobstick Lake block (0.18/km^2) in 1984, there were 12 adult and 2 yearling males, 5 adult females, 1 yearling female and 6 cubs (5 male, 1 female).

Sixty-one moose (0.68/km^2) were counted within the Bearhead

Marsh area in September 1983, resulting in an estimate of 58 bulls/100 cows and 80 calves/100 mature cows (Tables 1 and 2, Fig. 2). This compares to 64 bulls/100 cows and 40 calves/100 mature cows for 113 moose classified in other portions of WMZ 61. The higher ratio of calves/100 cows within the removal area was highly significant (x^2=9.00; p 0.02). Forty percent of the mature cows within the bear reduction area were without calves compared to 60 percent for moose in the rest of the zones. One-third of the cows with calves within the Bearhead Marsh block had twins; no twins were observed with cows in the remainder of the zone. One year later, in October 1984, comparable ratios were 67 bulls and 52 calves/100 mature cows (n=145), in the Bearhead Marsh. Statistical significance could not be detected between this calf/cow ratio and that of 1983 (x^2=1.36; p 0.24).

In October 1984, only 23 percent of the mature cows were observed without calves for the Lobstick Lake area compared to 46 percent within the 3.2 km perimeter and 55 percent for the remainder of the surveyed zone (Table 2); productivity estimates were 87, 54, and 39 calves/100 mature cows for the three areas respectively (Fig. 2). The difference in calf/mature cow ratios were highly significant between the Lobstick Lake and the control area (x^2=5.20; p 0.02), and less so for the Lobstick Lake and 3.2 km perimeter (x^2=1.89; p 0.12). Twinning rates were observed to be higher outside the bear removal area.



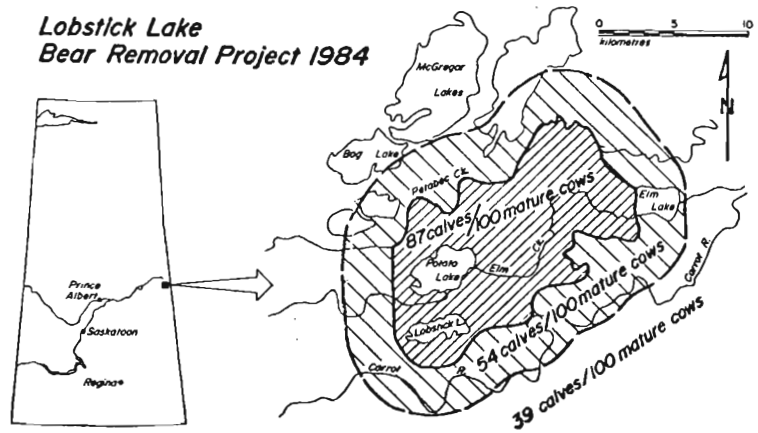


Figure 2. Impact of black bear removal on moose calf survival on the Bearhead Marsh and Lobstick Lake project areas.

DISCUSSION

Statistically significant improvements in the cow/calf ratios three to four months following black bear removal were demonstrated for each of the Bearhead Marsh and Lobstick Lake project areas. For the Bearhead Marsh, there were 40 calves/100 mature cows more than estimated for the remainder of WMZ 61, while the Lobstick Lake block had 48 calves/100 mature cows more than the rest of WMZ 60. Assuming a minimum post-partum peak of 100 calves/100 mature cows, predation rates were estimated to be at least 40 percent for the Bearhead Marsh and 48 percent for the Lobstick Lake block. These minimum rates fall well within the estimates calculated by Schlegel (1976) for elk calves in Idaho and Franzmann and Peterson (1971) and Franzmann et al. (1980) for moose in Alaska. The existence of an "edge" effect at the Lobstick Lake block was suspected as 33 calves/100 mature cows fewer were observed within the 3.2 km perimeter.

The removal of black bears from the small 90 km^2 Bearhead Marsh study area did not provide lasting relief from calf losses as calf/mature cow ratios declined again in 1984. Schlegel (1976) also reported a decline in survival within a removal area 18 months following reduction. However, he was live trapping and transplanting bears, some of which were known to have returned to their former territories.

On the positive side, from a management perspective, the proportion

of yearlings (Y)/yearling and adult moose (Y+A) appeared to improve within the Bearhead Marsh project in 1984. In September 1983, yearlings comprised only 5 percent of the Y+A animals observed; the December WMZ 61 estimate was 12 percent. In October 1984, the Bearhead Marsh estimate was 24 percent compared to 13 percent for the December 1984, WMZ 61 estimate. The increase in the proportion of yearlings on the Bearhead Marsh between September 1983 and October 1984 was highly significant (x^2=4.72; p 0.03). The control area data from the remainder of WMZ 61 surveyed in October was not compared owing to the small sample size (n=31). The improvement in the yearling cohort will increase the number of breeding females for the 1985 rut and should allow absolute production to climb in the spring of 1986. Whether or not this results in an absolute increase in the number of calves surviving to three to four months of age is unknown.

Kemp (1976, cited by Young and Ruff 1982) removed 23 adult male black bears over two years from a 218 km² study area in Alberta which had an estimated pre-reduction population of 80 bears; the population estimate increased to 175 bears one year following removal. Ingress of subadults and increased subadult survival were considered responsible for the rapid population increase. If this scenerio were repeated at the Bearhead Marsh site, it may account for the decline in calf survival in 1984, but would also suggest that specific sex/age classes of bears may not be involved in predation. However,

other parts of the Saskatchewan moose range support what are believed to be high density bear populations which are heavily hunted compared to the Saskatchewan River Delta and yield estimates of 60 to 80 moose calves/100 cows during December surveys. This may suggest that repeated harvest pressure on bears may in some way be important to reducing the level of calf predation.

Is predation on moose calves a learned activity, and if so, when in a bear's life does he learn it? Is it accomplished through trial and error and therefore represents an activity practiced by only a few animals, or is it knowledge passed on to young bears while in association with the sow? Ballard et al. (1981) concluded that all adult brown bears were preying upon ungulates in the same proportions regardless of family status. Schwartz et al. (1983) reported that black bear predation did not appear to be associated with any particular sex or age class of black bears for the Kenai Peninsula. Although not statistically significant, they did observe single adult females to have the highest ungulate kill rate and sows with young the lowest. However the ratio of calves/adult moose killed was 3:1 for sows with cubs compared to 1.9:1 for single adult females

Understanding the mechanisms of bear behaviour are important if effective long-term bear management programs to reduce predation on young moose calves are to be developed. Hunting

and trapping in the spring invariably results in the harvest of sex-age classes heavily skewed towards mature males. If predation on moose calves were largely a learned activity, then mature females may serve as the reservoir for transmission of this behaviour in the population. If true, rates of predation would decline only among heavily hunted populations where a greater absolute number of females are harvested each year. This increased level of adult female harvest would result in younger bear populations and indirect selection against bear predation on moose calves. The answer and solutions to this complex problem revolve around an improved understanding of bear behaviour and population dynamics.

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