

RESTORATION OF MOOSE SEX RATIOS AND AGE CLASS
STRUCTURES VIA ANTLER RESTRICTIONS AND LIMITED ENTRY
ANTLERLESS SEASONS IN THE EAST KOOTENAY
SUB-REGION OF B.C.

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Abstract: Following a long period of liberal bulls only seasons interrupted by three successive years of short open seasons on cows and calves (1967, 1968, 1969), major changes have been made in moose management strategies in the East Kootenay Sub-region of southeastern British Columbia. Hunting seasons for bulls were shortened and delayed to the post rut period in 1982; antler size and conformation restrictions first imposed in 1973 were increased in 1982 and a short, pre-rut Limited Entry antlerless season was opened in 1982. It is hypothesized that the regulations will increase both the conception rate and the productivity of the population by increasing the bull component and the mean age

of bulls and decreasing the cow component

Moose populations have been managed extensively in the East Kootenays since the early 1900's. Except for brief antlerless seasons in 1967, 1968 and 1969, a bulls only regulation has been in force. Annual hunting seasons for resident and non-residents varied in length from one to three months with a provincial bag limit of one moose or one elk. Although harvest levels remained fairly consistent from at least 1950 the effect of hunting bulls while protecting cows in the absence of any significant natural predation was to significantly reduce both the age class structure and the proportion of bulls. In the meantime, the cow population was allowed to become stagnant.

The problem of a distorted sex ratio was perceived in the mid 1960's. Calf production was lower than desired and in some years the rut appeared to be extended beyond normal. In an attempt to correct these problems, short antlerless seasons were opened in 1967, 1968 and 1969 (Demarchi, 1970). However, these seasons were terminated as they resulted in uneven hunter distribution causing excessive local over-harvesting. The B.C. Fish and Wildlife Branch did not develop the capability for Limited Entry hunting until 1976. In the absence of an effective means of managing the female component, measures were initiated to reduce the bull harvest in an attempt to restore the sex ratio and age structure of the bull component. Seasons were shortened, beginning in 1971 from three months to two months and then in 1974 to one

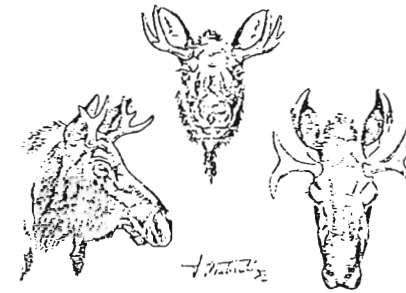
month. In addition, in 1974 an antler restriction was imposed which was intended to reduce the harvest of yearling bulls and thus increase recruitment to 2.5 years (Figure 1). However, no significant reduction occurred in the number of bull moose harvested as the proliferation of access and readjustments in hunter effort kept pace with hunting restrictions.

Beginning in 1982 the short pre-rut hunting season was replaced by a short post-rut hunting season and the antler restriction was increased to protect 2.5 year old bulls (Figure 2). Additionally, a short, pre-rut Limited Entry antlerless moose hunting season was inaugurated in 1982. Bulls with spike antlers were included in the Limited Entry season because of the difficulty of distinguishing them from cows in the field.

We are presently in the process of measuring the impacts of these regulation changes and are not yet able to form firm conclusions.

STUDY AREA

The study area is the East Kootenay sub-region of southeastern British Columbia and includes Management Units 4-01 to 4-05, 4-20 to 4-26 and 4-34 to 4-36 (Figure 3). These areas encompass 36,870 square kilometers of primarily mountainous terrain. Moose populations and distributions are limited by the quantity and quality of winter habitat



*Bulls only with at least one branched or palmated antler, the longest of which is longer than the ears or a minimum of 10 inches.

Figure 1. Diagrams of bull moose which show minimum legal antlers as per the 1974 to 1981 East Kootenay hunting regulations (above average East Kootenay yearling bull).



*Bulls with at least one palmated antler, the longest antler being longer than 12 inches and from which produced a brow line or brow palm which is at least 6 inches in length.

Figure 2. Diagram of bull moose which show minimum legal antlers as per the 1982 and 1983 East Kootenay hunting regulations (above average East Kootenay 2.5 year bull).

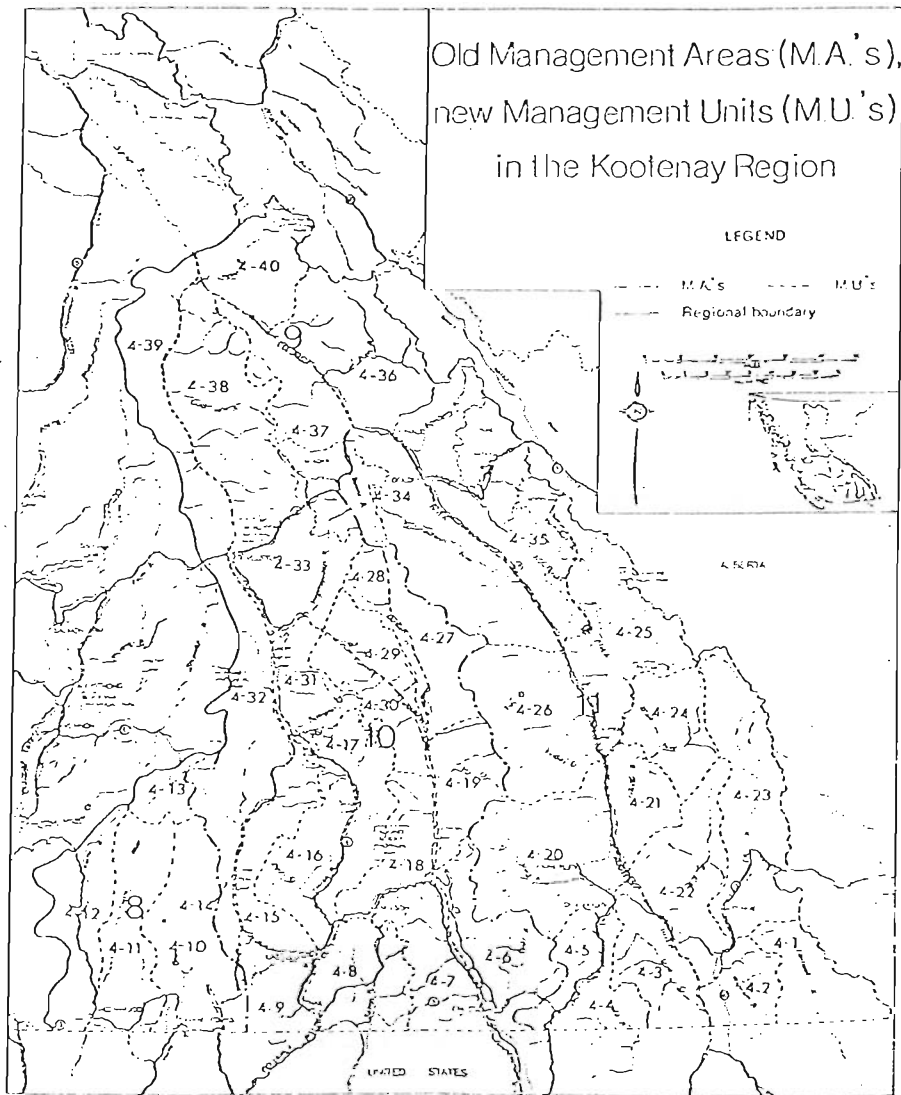


Figure 3. Old and new management areas in Region IV.

that is available during periods of deep snow (Demarchi, 1970). Unlike other ungulate species that winter either at lower or higher elevations, moose winter range occurs at the lower edges of the sub-alpine spruce/fir zone.

METHODS

Hunter Sample Returns, aerial flights, old game check information and Voluntary Tooth Return Data were analysed. Hunter Sample Data has been collected since 1950. After each hunting season a percentage of all the hunters who purchased moose licences are randomly chosen to answer a hunting questionnaire. The results are analysed and summarized by Management Unit and Region to produce estimates of harvest, hunter days and number of hunters. Using this data, estimates of active hunter and harvest success can be calculated.

Up to 1979, similar data was obtained through compulsory game checks which were eliminated in 1980 due to the cost of maintaining such checks. Data obtained at game checks was replaced by a voluntary tooth return program.

Aerial surveys done by helicopter have been annually conducted for the Flathead (M.U. 4-01) and Elk Valley (M.U. 4-23) drainages during late February and early March. The greatest percentage of counts were done by complete searches of the main stem valleys as most of the moose occur there and as the area does not lend itself to stratified random block-type surveys.

Since 1980, Voluntary Tooth Return cards have been distributed to hunters as they purchase their licences. Hunters are requested to remove a lower front incisor with root for cementum layer analysis directly after harvesting an animal. Teeth were aged to within one year by grinding and counting cementum layers with the aid of a dissecting microscope. The resulting data improved the degree of accuracy in determining the age structure of the annual harvest over that obtained from game checks.

RESULTS

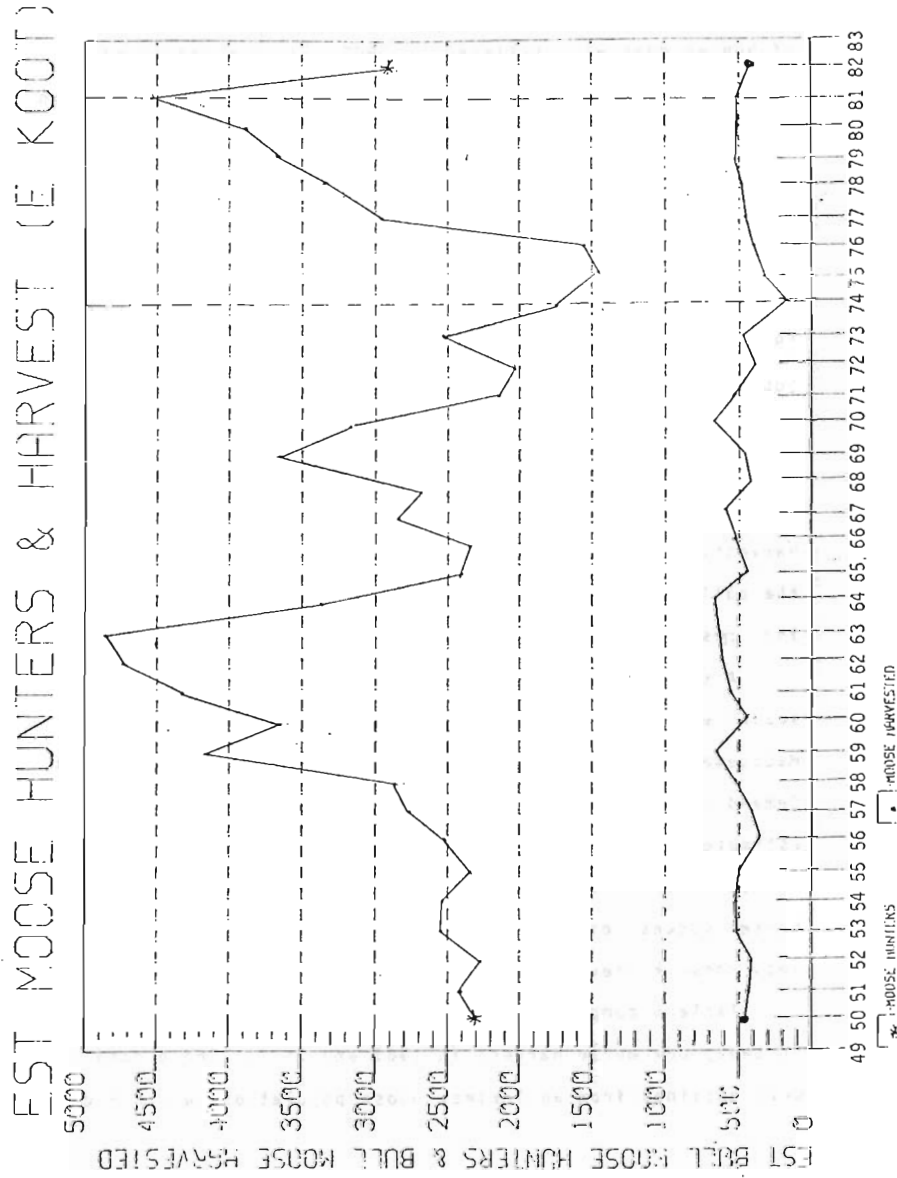
Table 1 and Figure 4 show uncorrected estimated numbers of moose hunters and moose harvested from 1950 to 1982. (Original hunter sample estimates include kill location coding errors which were not corrected for and which vary from 5 percent to 25 percent per year). Hunter numbers exhibited an increase from 2,305 in 1950 to a peak of 4,846 in 1963. This was followed by a rapid decline with minor fluctuations to a low of 1,468 in 1975. Hunter numbers then recovered to 4,534 in 1981 and sharply declined to 2,889 in 1982.

The number of bull moose harvested was correlated with hunter numbers and thus followed the same trends. The peak harvest, 683, was reached in 1970 with a low of 164 in 1974. Number of hunters per moose harvested varied from 4.0 in 1971 to 10.5 in 1974 and averaged 6.2 hunters per moose.

Table 1. Estimated number of moose hunters and bull moose harvested in the East Kootenay from 1950 to 1982. (Hunter Sample estimates uncorrected.)

Year	No. Hunters	Bulls Killed	Hunters/Moose Harvested	Percent Hunter Success	Regulations
1950	2305	490	4.7	21	O P E N S E A S O N (2 - 3 months)
1951	2418	440	5.5	18	
1952	2280	424	5.4	19	
1953	2544	519	4.9	20	
1954	2541	521	4.9	21	
1955	2340	503	4.7	22	
1956	2524	366	6.9	15	
1957	2767	404	6.9	15	
1958	2876	535	5.4	19	
1959	4142	642	6.5	16	
1960	3667	451	8.1	12	
1961	4323	549	7.9	13	
1962	4732	601	7.9	13	
1963	4846	630	7.3	13	
1964	3495	663	5.3	19	
1965	2398	445	5.4	19	
1966	2314	543	4.3	24	
1967	2830	583	4.9	21	
1968	2656	411	6.5	16	
1969	3656	455	8.0	13	
1970	3183	683	4.7	22	
1971	2127	530	4.0	25	
1972	2025	390	5.2	19	
1973	2523	476	5.3	19	
1974	1718	164	10.5	10	
1975	1468	304	4.8	21	
1976	2024	392	5.2	19	
1977	2947	439	6.7	15	
1978	3328	488	6.8	14	
1979	3667	512	7.2	13	
1980	3883	505	7.7	13	
1981	4534	518	8.8	11	
1982	2889	409	7.1	14	
	2669	484	6.2	17	

POST RUT SEASON—
AND MORE REST-
PACTIVE ANTLER
REGULATION
(1 month)



Determination of estimates of hunter effort in terms of hunter days was initiated in 1976. Hunter effort steadily increased from 11,854 in 1976 to 25,482 in 1981 and then declined to 16,767 in 1982 (Table 2).

Numbers of hunter days per moose harvested followed the same trend and varied from 41 days to 63 days with a mean of 51 days per bull moose harvested.

Table 3 shows the age class distribution of the 1980, 1981 and 1982 East Kootenay bull moose kill from voluntary tooth returns. Both the number and proportion of 2.5 year bull moose killed were markedly reduced in 1982 compared to 1980 and 1981, while the proportion of bulls in almost all age classes 3.5 years and older increased and the number harvested remained approximately unchanged. The mean age of the bull moose harvest increased from 3.6 and 3.9 in 1980 and 1981 respectively to 4.7 years in 1982.

After 12 years of closed seasons, an antlerless moose season was reintroduced on a limited entry basis in 12 Management Units in 1982. The results are shown in Table 4. Demand exceeded available permits by more than 25 times. An estimated 71 hunters hunted 215 days and harvested 50 cows 1.5 years and older and eight juvenile moose for an average hunter success of 75 percent and 3.7 hunter days per antlerless moose killed.

Table 5 compares the age class distribution of East Kootenay cow moose harvest in 1967 and 1982. These data were obtained from antlerless moose populations which had

Table 2. Estimated number of moose hunters, hunter days and bull moose harvested in the East Kootenay from 1976 to 1982 (Hunter Sample coding errors corrected).

Year	Hunters	Hunter Days	Bulls Killed	Hunters/Moose Harvested	Hunter Days/Moose Harvested	(Hunter Effort) Hunter Days/Hunter	Percent Hunter Success
1976	1523	11854	289	5.6	41	7.3	18
1977	2187	17532	393	5.6	45	8.0	18
1978	2406	19421	383	6.3	51	8.1	16
1979	2820	22219	458	6.2	49	7.9	16
1980	2929	24906	470	6.2	53	8.5	16
1981	3074	25482	407	7.6	63	8.3	13
\bar{x}	2507	20236	400	6.3	50	8.0	16
1982	2118	16767	298	7.1	56	7.9	14
\bar{x}	2451	19740	385	6.4	51	8.0	16

Table 3. Age Class distribution of 1980 to 1982 East Kootenay bull moose kill from voluntary tooth returns*.

YEAR	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5+
1980	No. Returns	2	21	10	7	2	1	2			1
	Percent	4.4	45.7	21.7	15.2	4.4	2.2	4.4			2.2
	No. Harv.	21	215	102	71	21	10	21			10
1981	No. Returns	8	15	12	5	6	4	5	1		
	Percent	14.3	26.8	21.4	8.9	10.7	7.1	8.9	1.8		
	No. Harv.	58	109	87	36	44	29	36	7		
1982	No. Returns	(4)**	7	15	11	6	4	2	2	2	1
	Percent	7.3	12.7	27.3	20	10.9	7.3	3.6	3.6	3.6	1.8
	No. Harv.	22	38	81	60	32	22	11	5	11	5

* Number harvested based on corrected Hunter Sample.

** Includes two yearling bulls taken by limited entry permit holders during "antlerless" moose season.



Table 4. Analysis of the 1982 and 1983 Limited Entry Antlerless Moose Seasons in the East Kootenay.

M.U.	No. L.E.H. Permits Available 1982 '1983	Number Applicants 1982	Number Applicants 1983	Estimated Number Hunters 1982	Estimated Number Moose Killed Fem. 1982	Estimated Number Moose Killed Juv. 1982	Estimated Number Hunter Days 1982	Percent Hunter Success 1982
4-01	14	323	435	13	11	0	26	85
4-02	4	82	94	3	1	1	7	67
4-03	3	102	128	2	2		6	100
4-04	4	67	99	4	4		16	100
4-05	4	92	114	4	3		5	75
4-20	6	229	292	6	2		26	33
4-22	7		159					
4-23A	12	653	839	11	9		50	82
4-24	4		73					
4-25	4		70					
4-26A	4	109	108	4	1	1	5	50
4-26B	4	68	85	4	4		6	100
4-34	20	291	404	20	12	6	68	60
TOTAL	75	2016	2900	71	50	8	215	75

Table 5. Age Class Distribution of 1982 East Kootenay cow moose kill from voluntary tooth returns. Distribution of cow moose ages for the South East East Kootenay from 1967 and 1982.

		1.5	2.5	3.5+	TOTAL NUMBER AGED
KOOTENAY	1967	% 15	11	74	75
	1982	% 16	12	72	25



been protected for more than 60 and 12 years respectively. Despite small sample sizes age class structures of the kills were similar for the two years.

Classified counts obtained in late winter indicate slight increases in the mean bull and calf components between 1969 and 1973 and 1974 and 1981. However, the application of a "t" test revealed no significant differences between the two periods ($p < .05$) (Table 6).

DISCUSSION

The system of protecting most yearling and 2.5 year old bull moose and harvesting bulls greater than three years is almost opposite to the management regime being applied in the Omineca sub-region (K. Child, pers. comm.). However, as East Kootenay moose tend toward the Shiras sub-species (Emery and Shackleton, 1983) and possess smaller antlers than their more northern counterparts, the system of shooting small bulls while limiting the harvest of larger bulls as being practiced in Omineca sub-region would be more difficult to apply in the East Kootenay.

The shortened pre-rut bull moose season combined with the 10-inch antler restriction between 1974 and 1981 appears only to have prevented the situation from deteriorating further despite a 115 percent increase in hunter effort over the same period. While the bull harvest was markedly reduced in 1982 the effects on the population of increasing the antler

Table 6. Moose Population Ratios S.E. East Kootenay from 1968 to 1982 (M.U.'s 4-01 and 4-23).

M.U.	Year	Sample Size	Ratio		
			Bulls	Cows	Calves
4-01	68/69	63	24	100	42
	70	53	28	100	38
	and 71	98	31	100	47
4-23	72	82	45	100	60
	73	59	19	100	66
	\bar{x}	71	31	100	51
	74	21	30	100	80
	75	96	37	100	72
	76	38	38	100	43
	77	9	40	100	40
	78	21	25	100	50
	79	48	46	100	50
	80	42	38	100	62
	81	55	68	100	52
	\bar{x}	41	43	100	57

restriction to include most 2.5 year olds, the delaying of the bull moose season to the post-rut period and the limited entry antlerless season have not been measured to date. However, it is anticipated that both the proportion of bulls in the population and the number of cows bred during the first estrus will increase. The effects of these regulations will continue to be monitored.

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