AN EXAMINATION OF UNREGULATED HARVEST OF SHIRAS MOOSE IN IDAHO

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Abstract Substantial levels of unregulated Shiras Moose (Alces alces shirasii) harvest were documented in Idaho. Approximately seven percent of moose populations studied in Idaho were removed annually due to poaching, accidental hunter kill, and Native American harvest. The age and sex composition of these harvested moose significantly differ from the composition estimated from live populations. Over 80% of the recorded unregulated mortality occurred from September to November. Unregulated harvest equalled or exceeded legal hunter harvest in eash area. Recent increase in human access was associated with recent increase in unregulated moose mortality.

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Mortality factors that significantly impact moose populations are numerous and diverse. Predation (Peterson 1977, Chatelain 1950), regulated hunter harvest (Lykke 1974, Cumming 1974, Bergerud et al. 1968), disease (Anderson 1972, Anderson and Lankester 1974), motor vehicles and railway trains (Franzmann 1978) have all been documented as important contributing factors in regulating moose populations. Poaching, in-season illegal kills, and crippling loss can also account for substantial mortality of big game animals (Connolly 1981, Teer 1984, Torgerson and Porath 1984, Karns et al. 1974, Crighton 1981, Dodds 1974).

Unregulated mortality such as poaching, crippling loss, illegal kill during open season and Native American hunting is especially difficult to quantify. Studies based on intensive ground searches documented crippling loss of white-tailed deer (Odocoileus virginianus) ranging from 0-175% of legal harvest (Nettles et al. 1977). Crippling loss and illegal kill of mule deer (Odocoileus hemionus) during hunting season ranged from 8% (Stapley 1971) to 92% (Welch 1974) of the legal harvest. Vilkitis (1968) documented that wildlife enforcement personnel detected only 4% of known poaching violations in Idaho. Similarly low detection of poaching incidents was reported for New Mexico (Pursley 1977).

Moose are especially easy targets for unregulated harvest because of their large size and lack of wariness to humans in the woods and along roads. Ritchie (1978) first documented extensive unregulated Shiras moose harvest in Fremont County, Idaho due to poaching, in-season illegal kills, and Native American hunting. Subsequent studies in Idaho suggested that unregulated mortality was substantial on local moose populations near Elk City (Pierce 1983) and Soda Springs (Kuck 1984).

Although the three studies presented here were not originally designed to specifically address the problem of unregulated harvest of moose, it soon became apparent that these types of human caused mortality may have the single most important, and least acknowledged impact on moose populations in Idaho. We recognize that accurate and reliable estimates of unregulated mortality are difficult to obtain. Therefore we present this review as simply an insight into the magnitude of the problem.

STUDY AREAS

Fremont County

Fremont County occupies 5,200 sq. km. in the northeastern corner of southern Idaho adjacent to Montana, Yellowstone Park, and Wyoming. Elevations range from 1,500 to 3,000 m. The terrain varies from relatively flat to mountainous. It is extensively roaded and few places are more than two miles from a road. Sagebrush (Artemesia tridentatta), lodgepole pine (Pinus contorta) and Douglas fir (Pseudotsuga menzesiil) are the principal cover types.

Moose became established in Fremont County before the turn of the centrury and reached peak numbers about 1955 when annual counts averaged 540 moose. Trend counts showed a decline in moose numbers over the next two decades and counts averaged only 220 moose by the early 1970's (Ritchie 1978). The population appeared to be recovering by 1980 and 452 moose were observed during the 1982-83 winter (Ritchie, unpub. data).

Agriculture is the primary industry in southern Fremont County, while tourism, outdoor recreation and timber harvest predominate in the

north. There has been extensive logging and firewood cutting since the 1960's due to widespread dieoff of lodgepole pine. Fremont County is rather sparsely populated but is within easy driving distance of population centers to the south such as Idaho Falls and Pocatello.

Elk City

The 118,000 ha study area was located on the Nez Perce National Forest surrounding Elk City, Idaho (45 50' N, 115 28' W). The study area is mountainous with elevations ranging from 600 m to 2700 m. Most of the land is covered with coniferous forest of the grand fir (Albies grandis) and subalpine fir (Abies lasiocarpa) vegetation zones and others (Steele et al. 1976).

Moose have been abundant around Elk City since at least 1862. Populations have remained relatively stable since that time. Densities were recently estimated at 0.9 moose/square mile (Pierce 1983).

Timber harvest in the region has been on the increase since 1960, and until recently has been limited to areas surrounding the residential areas. Consequently, road density and human access have also been restricted. Over 30% of the study area is further than two miles from an open road. The current human population in the study area is approximately 500 year round residents (1 person/236 ha).

Soda Springs

The Soda Springs study area cover 24,500 ha in southeastern Idaho, between Soda Springs (45 9' S. 115 42' E) and the Wyoming border. This area is a rich phosphate resource area and the area incorporates approximately 35% of this country's known phosphate resources. The need for increased use of phosphate as fertilizer, as the world's population grows, virtually guarantees development of these resources. Seventeen surface mines are currently in operation. Current strip-mining techniques utilize long, narrow pits, often along ridges, with steep high walls. Ore is transported by large trucks, railroad, or slurry lines to processing plants in Soda Springs or elsewhere.

The study area ranges from 1,700 m to 3,000 m in elevation. Vegetation in the area is transitional between Great Basin vegetation to the south and Rocky Mountain to the north. The vegetation cover

types display a heterogeneous complex of three prominent groups: 1) sagebrush-grasslands, 2) aspen and tall shrub deciduous forest, and 3) coniferous forests. These types can be highly interspersed.

METHODS

Reports of moose mortality in Elk City and Fremont County were obtained from personnel of the Department of Fish and Game, U.S. Forest Service and local residents and sportsmen. Carcasses were examined whenever possible to determine cause of death and age class. Ages were grouped into calf, yearling and adult as determined by dentition (Passmore et al. 1955). Sex was determined by presence/absence of antlers or antler protuberances on skull, and by genitalia when possible. Probable cause of death was classified as legal hunter harvest, Native American harvest, illegal poaching, accidental (collision with motor vehicles, drowning, etc.), natural (parasites and diseases, predation) and unknown.

Legal hunter harvest was determined by questionnaires given to sportsmen who drew permits in the study areas. There were many times probable cause of death could not be determined. Remains that were along roads and were obviously either Indian or poacher harvest were collectively grouped into the category illegal harvest.

Moose mortality in the Soda Springs area was determined solely from the fate of radio collared animals. Twenty free-ranging moose were captured and collared with radio transmitters. These animals were followed for the equivalent of 29 moose years. Radio instrumented moose that died were examined as soon as detected. Moose were assumed to have been illegally killed or else died from crippling loss when the animal died during or close to hunting season. The collar was often found hidden or destroyed.

Mortality data were analyzed to test the hypotheses that unregulated harvest of moose was evenly distributed throughout the year, and that sex and age composition of the unregulated harvest did not change during different seasons. Both hypotheses were tested using the G-test, (Sokal and Rohlf 1969), alpha = 0.05.

RESULTS AND DISCUSSION

Recorded annual mortality averaged 20% and 10% of the estimated resident moose populations in Fremont County and Elk City, respectively (Table 1). Legal hunting accounted for 41% and 25% of the known losses in these two populations. Between 26 and 60 moose permits were issued annually in Fremont County and 10-12 in the study area surrounding Elk City. Hunter success was greater than 90%.

Table 1. Summary of recorded moose mortality according to known causes on three study areas in Idaho, 1969-1980.

Cause of Mortality	Fremont County (1969-1975) N	Percent	Elk City (1979-1980) N	Percent	Soda Springs (1978-1981) N	Percent
Legal Hunter	31	41	10	25	-	--
Illegal	24	32	21	50	6	86
Indian Harvest	5	7	6	15	-	--
Accidental	7	9	2	5	-	--
Natural	7	9	1	3	1	14
Unknown	2	3	0	0	-	--
TOTAL	76		40		7	

1. Ritchie 1978; study period 1969-1975, from examination of marked and unmarked carcasses. Approximate resident moose population = 380 animals.

2. Pierce 1983; study period 1979-1980, from examination of marked and unmarked carcasses. Approximate resident moose population = 430 animals.

3. Kuck 1984; study period 1978-1980, mortality of radio collared animals, from a total of 20 moose marked (duration of telemetry period = 29 moose years).

4. The average number of carcasses found dead during each year of the study.

5. The total number of radio-collared moose found dead.

Unregulated harvest (including Indian and illegal) consistently accounted for over 50% of the annual recorded mortality in all three study areas. A significant increase in unregulated harvest took place during fall (Table 2). Over 80% of the recorded mortality occurred from September to November. Only 4% of the unregulated mortality took place from December - April.

Table 2. Sex Age Composition of Unregulated Harvest by Season 1969-1980.

	SEASON								
	May-August			September-November			December-April		
Sex-Age Class	N	%	Relative Ratio	N	%	Relative Ratio	N	%	Relative Ratio
Male	4	15	29	62	51	137	1	17	33
Female	14	54	100	45	37	100	3	50	100
Calf	8	31	57	14	12	31	2	33	66
Unknown	--	--	--	14	--	--	-	--	--
TOTAL	26			135			6		

Significantly more males and fewer calves relative to females composed the unregulated harvest during fall than at any other time in the year (Table 2). The bull:cow:calf ratios of the unregulated harvest (Table 2) differed from the ratios estimated for the live populations of Elk City (61:100:30, Pierce 1983) and Fremont County (70:100:62, Ritchie 1978). The proportion of bulls in the unregulated harvest was greater than expected during the fall and less than expected from December - August.

The significant changes in the unregulated harvest that occured during the fall can be attributed to two factors. First, fall is a period of increased human outdoor activity, as more people are out gathering firewood and hunting. Indians and poachers may focus their efforts during fall in order to minimize attention drawn to them and/or to store up supplies for the oncoming winter. People on roads with guns are a common sight during fall. Poachers would have a harder time hiding their intentions during summer months.

A second reason for the observed increase in unregulated harvest and especially of adult males was the incidental kills, associated with the legal sport hunters. Hunters frequently killed moose while hunting other big game species, especially elk (Cervus elaphus).

Most moose were killed near roads. Over 70% of the carcasses examined were less than 400 meters from an open road, while 16% were further than 800 m from an open road. These percentages were undoubtedly affected by an increased reporting rate associated with carcasses along a road, although the magnitude of this bias was not known. Moose killed incidental to legal sport hunting were generaly more apt to be further from a road than other forms of unregulated harvest. Approximately 75% of the moose that were killed further than 800 m from a road were shot during the height of the general elk season in October. Ritchie (1978) documented a reduction in incidental kill of moose with changes in elk hunting seasons that dispersed hunting pressure.

It is a fair assumption that the recorded mortality underestimated the actual mortality. Natural mortalities are hard to locate and often overlooked. Poachers are secretive and are apt to hide any remains from a kill. They also tend to hunt on private lands and on remote stretches of roads. These facts make poaching mortality difficult to quantify. Treaty Indians that have rights to hunt on unoccupied lands belonging to the United States may take game without restriction and are not required to report their take. Consequently, our estimates of unregulated harvest due to Indians is also underestimated (see Ritchie 1978).

Assuming our estimates of moose numbers in two of the study areas (Table 1, Pierce 1983, Ritchie 1978) reflect a relative approximation of the true population size, between 5 and 10% of the resident populations were removed annually by the recorded unregulated harvest. Reported recruitment rates of moose populations range from 8-29% (Simkin 1965, Mercer 1974, Peek et al. 1976, Schladweiler and Stevens 1973). Estimated recruitment to the moose populations in Idaho were 16%, and 9-15% in Elk City (Pierce 1983) and Fremont County (Ritchie 1978), respectively. Using these figures the recorded unregulated mortality alone accounted for over 50% of the annual recruitment. Unregulated mortality coupled with legal hunter harvest clearly has the potential to adversely impact Idaho moose populations.

Unregulated moose hunting was impacting some Fremont County moose herds by the late 1950's. A noticeable reduction in moose numbers was evident by 1957 following five years of rather liberal moose hunting (110 either-sex permits/year average). Moose hunting was restricted to bulls only, thereafter, and permit numbers reduced to an average of only 20/year from 1960-66, but population levels in the northern and western parts of the County continued downward (Nielson and Shaw 1970). These areas were already well roaded and were the same areas preferred by the Shoshone-Bannock Indians from the Fort Hall Reservation for moose hunting. Increasing numbers of elk attracted more hunters and Richard Wilson of the Idaho Department of Fish and Game recalls that high losses of moose were evident during elk hunts

in the late 1950's (personal communication to Ritchie). Logging created more access and associated human activity during the next two decades. Unregulated harvest continued to work against a recovery of the moose population even though permit numbers were greatly reduced.

It is noteworthy that the Fall River moose herd in southeastern Fremont County also declined in the late 1950's, but had recovered to mid-1950 population levels by 1970 (Ritchie 1978). Three factors had helped insulate this herd from the impacts of unregulated hunting: 1) The incidental kill of moose by elk hunters was comparatively low in that area, 2) the Indians rarely hunted there, and 3) many of these moose spent the summer and fall months in Yellowstone Park where they were better protected from hunting.

It has only been in the last decade or so that heavy unregulated hunting of moose has occured in the Elk City area. A study conducted in the late 1950's indicated that the majority of Nez Perce Indians hunted deer and elk (Buss and Daugherty 1958). Not one of the 98 respondents in the study hunted moose. Hunting pressure was limited to the land west of the Elk City Study area, an area with numerous logging roads. Hunting activity by Indians has increased substantially since about 1970. Jealousy over Indian rights by non-Indians may also be responsible for an increase in poaching of moose in local areas.

It is no coincidence that the recent period of increased unregulated harvest is also associated with a dramatic increase in human accessibility. Until recently the road into Elk City was a narrow dirt road, winding along the river for 60 miles from Grangeville. Now the road is much wider and is well paved. This improvement alone makes it easier for non locals to drive back to Elk City and its surrounding road system. Residents in the area have noted a substantial increase in traffic and in harvested animals along these roads.

Illegal harvest in the Soda Springs area may be directly related to industrial development (Kuck 1984). Paralleling development are increases in human population size, density of secondary roads, and increases in road use.

There is no hard evidence to indicate that moose populations along these heavily exploited areas is declining. The fact that moose are seen less frequently along roads may reflect a shift in habitat use patterns by the resident moose. Still, more animals are being killed than before and this is correlated with an increase in human access. Intensive hunting along road systems in Alaska and Newfoundland substantially decreased roadside resident moose populations (LeResche 1974 and Bergerud et al. 1968, respectively). Goddard (1970) concluded that sustaining moose numbers in heavily hunted areas is

dependent on the productivity of the resident population. Individuals from adjacent unhunted areas did not disperse and fill the vacancies created by harvesting. These data indicate that as development continues in the study areas the moose population will be affected. As new logging roads are created it will be necessary to regulate the human access in order to minimize this impact. A road management program emphasizing closure of "temporary" secondary roads is essential. The timing of road closures is critical in determining the effectiveness of a limited access program. Reduced access during fall may cause poaching and Indian Harvest to simply shift to earlier summer months. If so, road access should be limited earlier in the year.

Several changes were made after 1974 which substantially reduced unregulated mortality of Fremont County moose: 1) all Fremont County moose hunts were closed for several years beginning in 1977, 2) changes in elk seasons and better hunter cooperation reduced the detected harvest of moose by elk hunters approximately 80 percent (Ritchie, unpub. data), 3) the Targhee National Forest has restricted access by closing some roads following logging, and 4) the Sho-Ban Tribe has closed big game hunting to tribal members during the summer and restricted harvest to bulls. The Nez Perce National Forest, recognizing the negative impacts of increased access on local moose populations, has developed road management plans designed to reduce unregulated mortality in high moose use areas.

The findings of our studies in Idaho point out the importance of considering unregulated harvest when setting hunting seasons and evaluating impacts of land development on resident Shiras moose populations. Options available to state wildlife agencies will be limited by Indian and illegal harvest levels. Stiff penalties are needed to deal with poachers. New poaching "hotline" programs will help to reduce out of season harvest. When potential exists for substantial illegal harvest incidental to legal sport hunting, wildlife management agencies should develop a media program to educate the hunters about the problem. The ability to retain moose populations with increasing land development will require the voluntary cooperation of local residents and sportsmen, Indian Tribal Councils, and the appropriate wildlife management agencies.

Literature Cited

Anderson, R.C. 1972. The ecological relationships of meningeal worm and native cervids in North America. J. Wildl. Dis. 8:304-310.

Anderson, R.C. and M.W. Lankester. 1974. Infections and parasitic diseases and arthropod pests of moose in North America. Canad. Natur. 101:23-50.

Bergerud, A.T., F. Manuel, and H. Whalen. 1968. The harvest reduction of a moose population in Newfoundland. J. Wildl. Manage. 32(4):722-728.

Buss, I.O., and R.D. Daugherty. 1958. The effects of hunting by the Nez Perce Indians on big game populations in northern Idaho. Res. Studies of the State College of Washington. 26(3):119-157.

Chatelain, E.F. 1950. Bear-moose relationships on the Kenai Peninsula. Trans. N. Amer. Wildl. Conf. 15:224-234.

Connolly, G.E. 1981. Assessing Populations. In Mule and Black-tailed deer of North America. ed. O.C. Wallmo of University of Nebraska Press, pp. 287-346.

Crighton, V.F.J. 1981. The impact of treaty indian harvest on a Manitoba moose herd. 17th N. Amer. Moose Conf. and Workshop, pp. 56-63.

Cumming, H.G. 1974. Moose management in Ontario from 1948 to 1973. Can. Nat. 101:673-687.

Dodds, D.G. 1974. Distribution, habitat, and status of moose in the Atlantic provinces of Canada and northeastern United States. Can. Nat. 101:51-65.

Franzmann, A.W. 1978. Moose. in Big Game of North America, ed. J.L. Schmidt and D.L. Gilbert. Stackpole Books. pp. 67-82.

Goddard, J. 1970. Movements of moose in a heavily hunted area of Ontario. J. Wildl. Manage. 34(2):439-445.

Karns, P.D., H. Haswell, F.F. Gilbert, and A.E. Patton. 1974. Moose management in the coniferous-deciduous ecotone of North America. Can. Nat. 101:643-656.

Kuck, L. 1984. Impacts of phosphate mining on mule deer, elk, and moose in Southeast Idaho. Final report PR Project #W-160-R, Idaho Fish and Game, Boise. Vol. 1, 399 pp.

LeResche, R.E. 1974. Moose migrations in North America. Nat. Can. 101:393-415.

Lykke, J. 1974. Moose management in Norway and Sweden. Can. Nat. 101:723-735.

Mercer, W.E. 1974. Recruitment rates of Newfoundland moose. 10th N. Am. Moose Conf. and Workshop. 37-62.

Nettles, V.F., F.A. Hayes, and W.M. Martin. 1977. Observation on injuries in white-tailed deer. Proc. Ann. Conf. Southeast. Assoc. Game and Fish Comm. 30:474-480.

Nielson, A.E. and W.M. Shaw. 1970. A helicopter-dart gun technique for capturing moose. Idaho Fish and Game Department. 37 pp. (Mimeog.).

Passmore, R.C., R.L. Peterson, and A.T. Crinigan. 1955. A study of mandibular tooth-wear as an index to age of moose, pp. 233-238. In R.L. Peterson. North American Moose. Univ. Toronto Press. 280 pp.

Peek, J.M., D.L. Urich, and R.J. Mackie. 1976. Moose habitat selection and relationships to forest management in northeastern Minnesota. Wildl. Monogr. 48 65 pp.

Peterson, R.D. 1977. Wolf ecology and prey relationships on the Isle Royale. Nat. Park Serv. Monogr. Ser. No. 11. 210 p.

Pierce, D.J. 1983. Food habits, movements, habitat use and populations of moose in central Idaho and relationship to forest management. M.S. Thesis, Univ. Idaho, Moscow. 205 pp.

Pursley, D. 1977. Illegal harvest of big game during closed season. Proc. West. Assoc. Game and Fish Comm. 57:67-71.

Ritchie, B.W. 1978. Ecology of moose in Fremont County, Idaho. Idaho Fish and Game. Wildlife Bulletin No. 7, 33 pp.

Schladweiler R., and D.R. Stevens. 1973. Reproduction of Shiras moose in Montana. J. Wildl. Manage. 37(4):535-544.

Simkin, D.W. 1965. Reproduction and productivity of moose in northwestern Ontario. J. Wildl. Manage. 29(4):740-750.

Sokal, R.R., and F.J. Rohlf. 1969. Biometry. W.H. Freeman and Company, San Francisco. 776 pp.

Stapley, H.D. 1971. Deer illegal kill and wounding loss. Final report, P.R. Project #W-65-R-18, J A-8. Utah Div. Wildl. Resour., Salt Lake City, 7 pp.

Steele, R., S.F. Arno, and R.D. Pfister. 1976. Preliminary forest habitat types of the Nez Perce National Forest. U.S.F.S. report, Inter. Nat. Forest and Range Exp. Station. 71 pp.

Teer, J.G. 1984. Lessons from the Llano Basin. pp. 261-29 In White-tailed Deer: Ecology and Management. ed. L.K. Halls, Stackpole Books.

Torgerson, O. and W.R. Porath. 1984. Midwest Oak/Hickory Forest. pp. 411-426. In White-tailed Deer: Ecology and Management. ed. L.K. Halls, Stackpole Books.

Vilkitis, J.R. 1968. Characteristics of big game violators and extent of their activities in Idaho. M.S. Thesis, Univ. of Idaho, Moscow. 202 pp.

Welch, R.D. 1974. Illegal kill and crippling loss of deer during regulated hunting seasons. Final report P.R. Project #W-93-16. New Mexico Dep. Game and Fish, Santa Fe. 14 pp.