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SHEEP LOSSES ON GRIZZLY BEAR RANGE

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The Endangered Species Act requires federal agencies to avoid jeopardizing the continued existence of classified species. Following the federal listing of the grizzly bear (*Ursus arctos horribilis*) as threatened in 1975, the Targhee National Forest, Idaho, began monitoring grizzly bear predation on sheep grazing within forest allotments adjacent to Yellowstone National Park. Program objectives were to record, 1) the date and location of grizzly bear depredations on sheep, 2) the sex and age of grizzly bears that killed sheep, and 3) the number of sheep lost to grizzly bears and other causes. This report summarizes information obtained in 1976–77 on 5 sheep allotments.

STUDY AREA AND METHODS

The sheep-grazing allotments monitored were south (Squirrel Meadows) or east (Two Top) of Yellowstone National Park. Vegetation in both areas has been described by Steele et al. (1977). Allotments were visited 2–3 times weekly throughout the grazing season. Sheep losses were determined by checking sheep bedgrounds and grazed areas for carcasses, and through discussions with herders. Cause of death was determined by examination of carcasses. Both grizzly and black bears (*Ursus americanus*) kill and consume sheep as described for the brown bear (*Ursus arctos*) in Norway (Mysterud 1975). Size and characteristics

of bear tracks were used to differentiate between black and grizzly bear predation.

Sheep-killing black bears were trapped and destroyed by herders, permittees, and U.S. Fish and Wildlife personnel. We notified the U.S. Fish and Wildlife Service and Interagency Grizzly Bear Study Team when grizzly bears were killing sheep. These agencies trapped individual problem bears for radio-collaring. The Study Team subsequently monitored the bear's activities.

RESULTS

Sheep Losses.—Total losses averaged 3.7% of 15,707 sheep grazed on the monitored allotments and ranged from 1.1 to 8.7% among the bands of sheep (Table 1). The average number of sheep per band was 2,224 and the average number of sheep lost per band was 82. Losses were caused by black or grizzly bear and coyote (*Canis latrans*) predation, disease and/or poisonous plants, and poor herding techniques.

Black Bear Predation.—Three of 3, and 3 of 4 allotments monitored in 1976 and 1977, respectively, had sheep killed by black bears (Table 1). The 196 sheep killed by black bears represented 34% of the sheep lost and 1.3% of the sheep grazed. Black bears killed sheep throughout the grazing season, but most frequently during mid-July–mid-August (Fig. 1). They killed 1–7 sheep per incident.

Thirty-one black bears were killed on

Table 1. Sheep losses on 5 Targhee National Forest grazing allotments in 1976 and 1977.

Allotment ^a	Number of sheep on allotment	Loss per cause of mortality											
		Sheep lost		Black bear		Grizzly bear		Coyote		Disease and poisonous plants		Herding activity	
		N	%	N	%	N	%	N	%	N	%	N	%
Dog Creek (1976)	2,058	142	7	59	41	21	15			10	7	52	37
South Boone (1976)	2,150	38	1.3	20	53							18	47
Squirrel Meadows (1976)	2,185	40	1.7	11	27	15	38	2	5	3	8	9	22
Squirrel Meadows (1977)	2,430	37	1.5	23	62			4	11	8	22	2	5
	2,030	65	3.2	31	48	10	15	5	8	9	14	10	15
Middle Bitch Creek (1977)	2,095	183	8.7	52	28	8	4	21	12	2	1	100	55
Jesse-Dry Creek (1977)	2,759	71	2.6			30	42	1	2			40	56
Totals	15,707	576	3.7	196	34	84	14.6	33	5.7	32	5.6	231	40.1

^a All except the Jesse-Dry Creek allotment are in the Squirrel Meadows area.

allotments monitored during the study (Table 2). Herders and permittees shot (16) and snared (6) 22 bears while an additional 9 bears were snared by U.S. Fish and Wildlife Service personnel.

Grizzly Bear Predation.—Two of 3, and 3 of 4 allotments monitored in 1976 and 1977, respectively, had sheep killed by grizzly bears (Table 1). The 84 sheep killed by grizzly bears represented 14.6% of the sheep lost and 0.5% of the sheep grazed. Grizzly bears killed sheep most frequently from early August to the end of the grazing season (Fig. 1). Black and grizzly bear predation was occasionally concurrent.

Six grizzly bears were identified as sheep killers. Four were radio-collared and released at the trapping site. A 5th (#1) broke the snare cable and escaped (Table 3). Ages of these bears ranged from 2.5 to 9.5 years. In 1977, the grizzly bear or bears that killed sheep in Squirrel

Meadows area were not trapped or otherwise identified.

Only 1 radio-collared grizzly bear (#2) was monitored throughout the 1976–77 grazing seasons. This bear ranged onto sheep allotments in the Squirrel Meadows area both years. It was not determined if he killed more sheep after being collared, although he was frequently located near sheep.

Grizzlies that killed sheep usually took 1–3 sheep every several days. In 3 separate incidents, 13, 9, and 8 sheep were killed by grizzly bears over 14-, 7-, and 4-day periods. Predation ended in each instance when sheep were moved out of the area. In another incident, 30 sheep were killed or injured in 1 night by 2 young female grizzlies. Both patterns of predation were also observed for the brown bear in Norway (Mysterud 1975).

Additional Loss Factors.—Approximately one-half of all losses documented

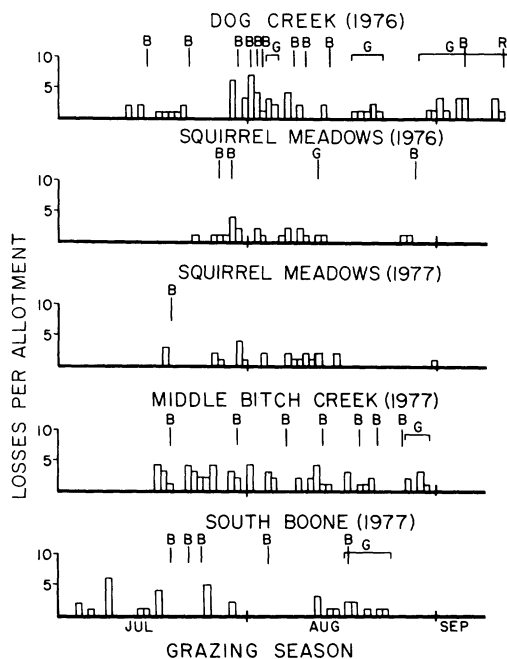


Fig. 1. Sequence of sheep losses and black bear removals on 4 sheep allotments, Targhee National Forest. Two allotments, South Boone (1976) and Jesse-Dry Creek (1977) were excluded due to the low intensity of monitoring. "G" indicates grizzly bear depredation, "B" indicates a black bear killed, and "R" indicates a black bear snared and released.

during the grazing season (296 sheep) were attributed to predation by coyotes, disease and/or poisonous plants, or poor herding techniques (Table 1). The latter factor included sheep unaccounted for at the end of the grazing season. The potential for sheep straying from the band was high on these allotments, which are heavily forested. Both individual and small groups of sheep were frequently observed scattered throughout the allotments.

DISCUSSION

Grizzly bear predation was 1 of 5 causes of sheep mortality on the allotments monitored. Grizzly bears killed more than twice as many sheep as did coyotes

Table 2. Black bears removed from monitored sheep allotments on the Targhee National Forest, 1976-77.

Allotment and year	Male	Female	Totals
Dog Creek, 1976	8	1	10 ^a
Squirrel Meadows, 1976	1	2	3
South Boone, 1976	3	2	5
Squirrel Meadows, 1977	1		1
South Boone, 1977	5		5
Middle Bitch Creek, 1977	5	2	7
Totals	23	7	31 ^a

^a Sex of 1 individual was not recorded.

or disease and/or poisonous plants, and less than one-half the number taken by black bears or lost through herding activities. The number of sheep killed by grizzly bears during the study, however, only serves to show that losses during any predation incident can be extensive. This study began 1 year after the grizzly bear was listed as a threatened species, and thus subjected to more restrictive predator control activities. It is probable that control of sheep-killing grizzlies in previous years had reduced their predation potential. Additionally, death or trapping injuries eliminated 2 sheep-killing grizzlies from the allotments during the study.

The management value of the monitoring program lies in the strengthening of previous assumptions of Murie (1948) and Knight and Judd (1980) that the grizzly bear is an opportunistic feeder. Any individual of the Yellowstone population can learn to readily exploit an available food source provided by domestic livestock just as easily as habituating to garbage dump food sources. Livestock-killing grizzly bears on the Targhee National Forest in 1976 and 1977 included a range of ages as well as both sexes. Forest records of past predator control also include grizzly bear sow-cub groups.

The assumption that many individuals of the Yellowstone grizzly bear popula-

Table 3. Grizzly bears snared following sheep depredations on the Targhee National Forest.

Allotment	Date snared	Sex	Age (years)	Subsequent history
Dog Creek	Jul 1976	M (#1)	6–8	Recaptured in Yellowstone National Park 1 year later
Squirrel Meadows	Aug 1976	M (#2)	9.5	Monitored 2 grazing seasons
Dog Creek	Aug 1976	M (#3)	2.5	Died shortly after radio-collaring
Jesse-Dry Creek	Sep 1977	F (#4)	2.5	Sheep-grazing season had ended at the time of collaring
Jesse-Dry Creek	Sep 1977	F (#5)	2.5	Sheep-grazing season had ended at the time of collaring

tion have the potential to develop live-stock predation behavior is compatible with the widespread nature of the grizzly bear–sheep conflicts. Grizzlies killed sheep on all monitored allotments at some time during the study, and on the majority of allotments each year.

The study highlighted 3 management concerns associated with the grazing of domestic sheep within occupied grizzly bear habitat. The 1st is that bear–live-stock conflicts will reoccur as new individuals learn to exploit livestock as a food source. The 2nd deals with the cumulative predator load if each offending individual is not removed. Without continual removal of depredating grizzly bears, livestock losses can be expected to increase above levels observed in the study. The 3rd management concern deals with the vulnerability of grizzly bears to man-caused mortality when they become habituated to taking livestock. This increased vulnerability is due to the ease with which sheep-killing bears can be trapped, as well as the increased bear–human contact potential that results from their predation activities. Grizzly bear vulnerability to trapping at sheep carcass sites was indicated by the high trapping success of the U.S. Fish and Wildlife Service Predator Control Agent. He succeeded in snaring 5 of the 6 grizzly bears

that killed sheep during the study. His failure to trap the 6th individual was likely due to this bear's prior near-capture by a herder. Grizzly bears appear to have a strong tendency to return to a carcass for at least a 2nd feeding. The greater the number of livestock killed, the greater will be the length of this vulnerability period.

The increased bear–human contact potential for sheep-killing grizzly bears occurs as both bear and herder localize their activities around the same resource, the sheep. The most likely area for contact are bedground areas where sheep remain for the night. All grizzly bear–sheep predation incidents during the study occurred on sheep bedgrounds, either during the night or early morning. These bedgrounds are frequently guarded by herders at night, for predator control purposes, or the herder moves to these areas each morning to locate the sheep. During the study, herders encountered both black and grizzly bears feeding on carcasses on bedgrounds.

Given that recurring predation problems can be expected when sheep are grazed within occupied grizzly bear habitat, and that grizzly bears are highly vulnerable to man-caused mortality, it is important that the livestock permittees are

willing to deal with such problems in a cooperative and positive manner. Otherwise these grazing areas can result in a continual mortality drain on the Yellowstone grizzly bear population. If the latter situation occurs, livestock should be removed from occupied grizzly bear habitat.

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FOOD HABITS OF BADGERS IN EAST CENTRAL MINNESOTA

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Previous food habit studies of badger (*Taxidea taxus*) in Michigan (Dearborn 1932), Iowa (Errington 1937, Snead and Hendrickson 1942), South Dakota (Jense 1968), Utah (Lindzey 1971), Alberta (Salt 1976), and Idaho (Mesick and Hornocker 1981) emphasized the importance of fossorial, semifossorial, and burrow-visiting mammals. In addition, seasonal variation in diets have been noted (Snead and Hendrickson 1942, Jense 1968, Salt 1976). The objectives of my study were to examine the food habits of badgers in east central Minnesota.

STUDY AREAS

This study was conducted at the Cedar Creek Natural History Area (CCNHA)

and at the Sherburne National Wildlife Refuge (SNWR) in Minnesota. CCNHA is 48 km north of Minneapolis, in Anoka and Isanti counties. SNWR is 48 km west of CCNHA and 70 km northwest of Minneapolis. Both study areas are within a region physiographically known as the Anoka Sand Plain, a 2,200 km² triangular, alluvial sand plain of glacial origin (Cooper 1935). The topography is flat to gently rolling. Both study areas include tall grass prairies, cultivated fields, deciduous and mixed coniferous uplands, marshes, creeks, rivers, and numerous pothole lakes. At both areas, wooded uplands, wetlands, and fields occur in approximately equal proportions.

METHODS

Burrows and sites of predation by radio-marked badgers were examined periodically for scats as were dens located from the ground and from an airplane. Badger scats were identified using any 2 or more of the following criteria: location

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