



Effects of Hunting on Rock Ptarmigan Along the Steese Highway

by Robert B. Weeden

ALASKA DEPARTMENT OF FISH AND GAME



**EFFECTS OF HUNTING ON ROCK PTARMIGAN
ALONG THE STEESE HIGHWAY**

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Alaska Department of Fish and Game
Game Technical Bulletin No. 2
July 1972

Financed through Federal Aid in Wildlife Restoration Project W-17-R

ACKNOWLEDGEMENTS

M. Thomas Dean, 1960
Rodney Herrick, 1961-1962
David Hatler, 1963
James Erickson, 1964
John Trent, 1965-1966
Philip Headley, 1967
Jerry McGowan, 1968-1969
Dale Haggstrom, 1968
Sandra Kogl, 1968

These people, most of them former students in wildlife at the University of Alaska, have contributed a great deal to all phases of the Department's research on ptarmigan. Phil Headley, Dale Haggstrom, and Sandra Kogl, through their long hours at the hunter checking station in 1967 and 1968, obtained the information on harvest that is so important to this report. I deeply appreciate their help.

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INTRODUCTION*

Every summer from 1959 to 1969 I watched ptarmigan in the high country northeast of Fairbanks along the Steese Highway. This research was funded by the Alaska Department of Fish and Game with money from the Federal Aid in Wildlife Restoration Act. My assistants and I watched cocks defend their territories, observed hens raise their young, and saw ptarmigan gather into great flocks in early fall. Our main purpose was to record and interpret changes in behavior, productivity, and survival that seemed most closely related to the rise, fall, and recovery of breeding populations. Out of general interest we watched hunters pursuing ptarmigan in the fall, but for many years I believed that hunters were a negligible factor in the lives of ptarmigan in the area. Very recently I realized that fall hunting often affected the ratio of young to old cocks in spring, and in 1968 awoke to the possibility that spring hunting could reduce breeding stocks.

These belated thoughts led to a reevaluation of hunting as it might affect interpretation of our data on population changes. Very soon I realized that the information I was studying could be of real value to the Department's management program, not so much because of any current problems but in view of the anticipated growth of Fairbanks. If a few hunters can have visible effects on the age structure and numbers of ptarmigan, it seems likely that two or three or ten times as many hunters would create situations requiring regulatory changes or other managerial action.

In this report I first sketch the present hunting situation in the Eagle Summit area of the Steese Highway (that is, how ptarmigan are hunted, when they are sought, and what kinds and numbers are shot). Next I focus on the ptarmigan themselves to show how hunting influences their aggregate composition and numbers. Finally, I discuss some potential management questions and try to provide a choice of answers—or at least point out how some of the answers can be obtained.

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THE STEESE HIGHWAY PTARMIGAN HUNTER

Ever since the turn of the century men have traveled between the Yukon and the Chena: across the Birch Creek lowlands out of Circle City, up Crooked and Mammoth creeks to Eagle Summit, westward down Eagle Creek and up Twelvemile Creek to Twelvemile Summit, down the long grade of the Chatanika River, and over Cleary Summit to Fox and Fairbanks. For 25 years they walked in summer and rode behind horses or dogs in winter. Then in 1927 the last stretch of Steese Highway was completed at Miller House and the days of walking were over.

The Steese was a working man's road for 20 years. When placer mining lost the battle to inflation, however, tourists and hunters began to make up the bulk of the Highway's traffic. The same sort of change occurred in the 1940's for hunting. Before World War II caribou, moose, and ptarmigan were sources of meat for hungry miners. In the late 40's and early 50's the dwindling numbers of market and larder hunters were swamped in a tide of recreationists from Ladd Field, Eielson Air Force Base, and the booming town of Fairbanks, all driving the Steese to intercept the anticipated fall movement of caribou. Records are sparse, but very likely there were more individual hunters along the Steese in the ten years from 1945 to 1954 than ever before or since.

A noticeable decline in numbers of hunters occurred late in the 1950's and in the first years of the present decade. This probably resulted from: a) a decline in the defense-associated boom in Fairbanks; b) the opening of the Denali Road in 1958 and the road to Healy in 1965; c) increasing use of airplanes and swamp buggies for hunting in the Alaska Range; and d) the declining frequency of caribou movements across the Steese in fall.

For at least six or eight years the general pattern of hunting has stayed the same on the upper Steese Highway, although the number of hunters and their success has varied with such things as the availability of caribou in the area and the supply of ptarmigan. In the following section, I will try to describe this pattern and give some details about the ptarmigan killed.

Seasonal Patterns

Ptarmigan hunting begins—officially—on either the 10th or 20th of August in Game Management Unit 20, in which Eagle Summit lies. Opening day on the Steese is a far cry from "The Twelfth" in Scotland, when gunners man the butts on the red grouse moors, and it bears no resemblance to the holiday atmosphere on the first day of pheasant shooting in the Dakotas. No fanfare, no bustle; you might sit on a warm rock above the highway most of opening day and hear nothing but the berries ripening. Only 11 parties of hunters were recorded at our checking station during opening week in 1968. (In 1967 only four parties stopped during the first two weeks of the season—mainly because the road was washed out from August 12 to 18.)

Throughout August ptarmigan steadily combine into larger and larger flocks. Broods meet and join other broods, and brood aggregations attract small parties of old males and unsuccessfully-nesting females. In the warm days of early and mid-August the birds are quiet and hard to find. Sometime in the last few days of August, or very early in September, the weather turns cool; perhaps a blustery north wind bumps a few snow-laden clouds into Eagle Summit, and overnight the reddish glow of kinnikinnik leaves is snuffed

out by a thin white blanket of snow. Then the ptarmigan seem to come alive. They begin to call and display to each other during the early morning feeding period. The flocks get bigger as if by magic, and fly from ridge to valley or valley to slope at any excuse.

Simultaneously the hunters begin to appear in greater numbers. This increase is partly due to the improved ptarmigan hunting (in 1968, 44 out of 81 parties stopping at the checking station said they came up the Steese primarily to look for ptarmigan), but is also a reflection of the rising urge of sportsmen to go out prospecting for moose or caribou.

In September the tundra vegetation becomes "winterized," the ptarmigan flocks reach peak size (commonly in excess of 100 birds per flock in the larger aggregations), and, in the last part of the month, snow becomes a permanent part of the scene. Ptarmigan hunting is potentially at its best. Whether it is good or not depends on daily weather conditions and the general abundance or scarcity of birds.

About the last of September the State Department of Highways announces its intention to stop maintenance on the Steese Highway, effective usually between October 8-15. Many of those who shoot ptarmigan in August and September are actually sightseers or lightly-motivated hunters; these usually disappear from the scene early in October. Hunters with courage or four-wheel-drive vehicles ignore the official closure. These people continue to hunt until drifting snow closes Twelvemile Summit (mile 85), but in most years only hunters on snowmobiles get beyond the approaches to Eagle Summit after the end of October.

The general seasonal pattern, then, includes a slow opening in August, a period of rising and relatively high interest in September, sustained interest but somewhat fewer hunters in October, and a weather-dictated end to the harvest sometime late in October or November.

Daily Patterns

As one would expect in an area 100 miles or more from the homes of the hunters, there is a strong tendency for hunters to be out in force on weekends. The day-by-day tally of birds shot in 1967 and 1968 (Table 1) shows that half or more of the ptarmigan harvested from the Steese highlands were taken on Saturdays or Sundays.

Table 1. Percentage of total harvest of ptarmigan for 1967 and 1968 taken on each day of the week.

Year	Total Birds	Percentage of Ptarmigan Shot by Day						
		Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
1967	273	13.5	9.9	19.0	3.7	5.5	23.5	24.9
1968	912	1.3	3.1	5.5	14.0	3.7	29.8	42.5

Hunting Methods

We have no statistical details about the way people hunt ptarmigan on the Steese, but the following generalities describe the situation fairly accurately.

There are some avid upland bird hunters in Fairbanks, and most of them try to spend at least one weekend a season in the alpine areas of the Steese Highway. A few own and use bird dogs, but most do not. The main thing which sets this group apart is their general willingness to hunt for birds even when they don't see any while driving. They range out from one-quarter mile to two miles from the highway, but almost never go farther. Almost all of them use shotguns.

The dyed-in-the-wool bird hunter, however, is greatly outnumbered by people who come prepared to shoot birds only if they see or hear them from the road. Perhaps the best measure I have of this is an indirect but fairly conclusive one: the rapidly decreasing chance of having a hunter shoot a banded ptarmigan the farther from the road we caught the bird. Any local ptarmigan is at least twice as likely to end up in a hunter's pocket if it lives within a half-mile of an access road, as compared to a bird living farther away (Table 2). Band returns from birds caught a mile or more from the road occur mostly because the birds wander towards the road after banding, not because the hunters go after them.

Table 2. Percentage of bands returned by zone of banding, 1960-1968.

Zone	Sex, Age	No. Caught	No. Shot	Percent Shot
A (up to 1/2 mile from the Steese or access road)*	Male, Adult	228	53	23.2
	Female, Adult	354	37	10.5
	Chick	597	61	10.2
B (1/2 to 1 mile from a road)	Male, Adult	159	16	10.1
	Female, Adult	236	10	4.2
	Chick	401	12	3.0
C (over 1 mile from a road)	Male, Adult	123	11	9.0
	Female, Adult	209	7	3.3
	Chick	412	17	3.2

* See Appendix I for a map of these zones.

The casual shooters of ptarmigan also use shotguns more often than rifles, but a fair number do shoot birds on the ground with small caliber rifles.

Except for highway vehicles, very little mechanized equipment is now used by ptarmigan hunters at Eagle Summit. I have never seen tracked vehicles used there. One or two parties of big game hunters use trucks equipped with huge tires (swamp buggies) to go

BIRDS IN THE BAG

up neighboring Golddust Creek each year to a hunting camp; they take a few ptarmigan en route. Snow machines were used rarely in the fall at Eagle Summit through 1968 but 5 to 15 were in use some days at Twelvemile Summit when caribou were available. In the spring of 1968, when, for the first time, the Steese Highway was drivable in late March and April, hunters did use snowmobiles commonly.

BIRDS IN THE BAG

Total Number Harvested

Our data are sparse and hard to interpret because no attempt was made until 1967 to find out how many ptarmigan were shot along the Steese in general or at Eagle Summit in particular. In 1953 a checking station was operated the entire month of September at Fox (mile 11), and personnel there tallied 238 successful parties with 2,426 ptarmigan. These birds came from all of the ptarmigan habitat on or near the Steese: Twelvemile Summit, Eagle Summit, and Harrison Summit, the latter being on a mining road eight miles from Miller House. The total season kill (including August and October) at Eagle Summit probably was at least 2,000 ptarmigan. In 1954 the checking station moved to Faith Creek (mile 69), and in an unspecified period tallied 1,428 ptarmigan. The following year 226 ptarmigan were shot by 23 parties of hunters checked during eight weekend days in late August and mid-September. In 1961 a comparable bag (233 ptarmigan) was achieved by 40 parties hunting during 40 days from August 20 to the end of September.

Our intensive efforts in 1967 and 1968 gave a much more complete record of the season. The checking station was open daily for at least 16 hours each day from August 10 to October 9 (1967) and October 13 (1968). Station attendants could determine in most cases where the birds had been taken. Because of the flood of August 12-15 in Fairbanks, hunting pressure was unusually light in 1967 throughout the season. The complete absence of caribou until October made hunting less attractive too. A total of 221 ptarmigan came through the station, 185 of them rock ptarmigan. Twenty-seven parties took these rock ptarmigan. All but 22 of the birds were from Eagle Summit.

Ptarmigan were somewhat more abundant in 1968, but the increase in harvest recorded was mostly due to the presence of more hunters. During that season 80 parties reported 929 rock ptarmigan, and 11 parties took 33 willow ptarmigan. A very large proportion of the birds (651 rock ptarmigan) was taken by 51 parties hunting off the Eagle Summit study area. Since the average bag per party was more off the area (12.8 birds) than on it (8.2 birds), this probably indicates somewhat lower ptarmigan on the study area—an idea supported by our spring counts of territorial cocks.

In general, therefore, the total harvest of ptarmigan from the upper Steese Highway probably has fluctuated annually between 100 and 4000 birds, with bags in most years totaling 400 to 1000 birds. It is hard to convert this into a harvest per unit of area, but some idea can be gained by assuming that hunters get most of their birds in a strip two miles wide in areas where roads climb above timberline. This would include a total of 28 square miles: 22 square miles at Eagle Summit, including the area made accessible by the road to Berry Camp on Eagle Creek, and six square miles along the old mining roads south of Miller House (mile 115). This suggests a harvest of 14 to 36 ptarmigan per square mile in these "average" years. I will try to wring some meaning from this estimate later in this report.

Hunting Success

Because of the casual way many people approach ptarmigan hunting, the only good way to identify a ptarmigan hunter is by finding out if he shot any birds. Using this as a criterion, one can see that the number of ptarmigan bagged per successful party varied from year to year (Table 3). One would logically expect this variation to stem from changes in the abundance of ptarmigan, but the data we have for comparison show a poor relationship between fall densities of ptarmigan at Eagle Creek and the number of birds shot by successful hunting parties (Table 3). However, information for years prior to 1967 is of doubtful reliability, and judgment should be withheld until better data are available.

Table 3. Ptarmigan shot per successful party.*

Year	Birds Per Party	Estimated Fall Pop.**
1953	10.2	(very high)
1955	9.8	(high)
1960	5.1	475
1961	5.8	860
1963	4.5	580
1964	7.8	450
1966	7.3	470
1967	8.2	495
1968	10.6	510

* These parties averaged 2.0 hunters in 1960, 2.2 hunters in 1967 and 1968.

** Total number estimated in early August in 15 square miles.

The average number of birds in possession in 1968 (10.6) suggests that few people shot a bag limit (20 per hunter per day). Checking station records show that only three of the 80 successful parties of hunters shot their limit of ptarmigan (Table 4). The legal limit obviously was more of a hypothetical than actual restriction on the hunters, even in a year of relatively high bags.

Sex and Age of Birds Shot

Our best data on the kinds of ptarmigan shot in fall come from the 1968 checking station, when enough birds were handled to allow a week-to-week comparison (Table 5).

There was an overall harvest of one adult per 1.29 juveniles. Except for one week in August when few birds were handled, there were more juveniles shot, relative to adults, before September 21 than after that date. In 1968 my reckoning at Eagle Creek indicated that there should have been one adult for every 1.76 first-year birds early in August. The sample hunters took from August 10 to August 23 contained one adult per 1.90 young. These data suggest that hunters took juveniles in about the proportion in which

Table 4. Percentage of total legal bag actually shot by ptarmigan hunters, 1968.

Percent of Legal Bag Taken	No. of Parties	Percentage of Total Parties
1-10	30	38
11-20	18	23
21-30	8	10
31-40	5	6
41-50	8	10
51-60	4	5
61-70	2	3
71-80	1	1
81-90	1	1
91-100	3	4

they existed in the total population at that time. Later in the season the proportion of young in the bag dropped to around 1.2 per adult. This could reflect either a relatively high natural mortality among juveniles, or an increasing vulnerability of adults stemming from behavioral and habitat changes. The sharp drop in proportion of juveniles early in October is probably due to the movement of adult hens, young females, and some young males away from breeding areas to lower wintering grounds. Most of the birds remaining in the high country by mid-October are males, with a high proportion of adults.

Males comprised about half the kill (51 percent) in 1968. However, 55 percent of the 269 adults were males, whereas only 46 percent of the 295 juveniles were males. I think adult cocks are somewhat more vulnerable to hunting in fall than hens because: a) they are noisier; b) they are more often alone, and lone birds tend to be easier to approach than groups; and c) they are not as wary early in the season as females are. The relative scarcity of males among bagged juveniles is harder to explain. When pursuing ptarmigan in autumn, I have noticed that young females tend to be in the rear of running flocks and are more easily caught in nets (or shot) than other birds. Our information is not conclusive, however. There may be more female chicks hatched than males, or their survival during summer could be better--and this could vary annually.

The various involuntary biases that hunters show in their harvest of the several sex and age classes of ptarmigan do not seem very strong. By and large, aggregate ratios for the entire autumn hunting season indicate that hunters take birds in about the proportion they occur in the population.

Source of Ptarmigan Harvested

One question of key importance is how big an area is supplying the ptarmigan shot by Eagle Summit hunters. Common sense suggests that the idealized picture is one of concentric rings around Eagle Summit, representing successively less important sources of supply outward from the center (Appendix II). The data in Table 2, already used to illustrate the small area worked by hunters, indicate a rough approximation of this idealized situation. Birds banded close to the Highway are shot more often than ptarmigan caught up to three miles from the road.

Table 5. Sex and age of rock ptarmigan examined at the Steese checking station, 1968.

Week	<u>Birds of Known Age</u>		<u>Birds of Known Sex</u>		Ad. M	<u>Known Sex and Age</u>		Juv. F
	<u>Total Adults</u>	<u>Total Juveniles</u>	<u>Total Males</u>	<u>Total Females</u>		<u>Ad. F</u>	<u>Juv. M</u>	
Aug. 10-16	47	80	54	38	31	15	22	22
Aug. 17-23	13	34	15	22	4	8	10	14
Aug. 24-30	11	10	34	29	4	7	7	3
Aug. 31-Sept. 6	18	24	19	16	9	6	10	10
Sept. 7-13	63	77	63	74	33	30	30	44
Sept. 14-20	57	74	63	63	33	24	30	39
Sept. 21-27	28	29	26	35	11	17	12	16
Sept. 28-Oct. 4	-	-	-	-	-	-	-	-
Oct. 5-11	21	21	21	21	10	11	11	10
Oct. 12-14	<u>16</u>	<u>5</u>	<u>18</u>	<u>3</u>	<u>14</u>	<u>2</u>	<u>4</u>	<u>1</u>
	274	354	313	301	149	120	136	159

HUNTING PRESSURE

These data can be used to give an idea of the relative contribution to the hunter's bag of each zone. For example, if the percentages of banded adult males shot are 23, 10 and 9 (Table 2) for Zones A, B, and C, then if unit densities of resident ptarmigan were uniform throughout all zones, banded (and unbanded) resident males shot by hunters would be in the proportion 23:10:9. Converting this to a percentage, 55 of every 100 resident males would come from Zone A, 24 from B, and 21 from C. (Statistically, the difference between A and B, or A and C, is significant at the 1 percent level). Among adult hens, 59 percent of harvested residents come from areas within one-half mile of the road, 22 percent from one-half to one mile away, and 19 percent from one to three miles away. Similar figures for chicks are 62, 19, and 19 percent for zones A, B, and C.

Thus it appears that 55 to 60 percent of the resident ptarmigan that are shot lived within one-half mile of an access road the summer before they were shot. Slightly more than 20 percent come from an area one-half to one mile out, and slightly under 20 percent spent the summer still farther away, up to three miles or so.

But this only pertains to ptarmigan living near the road. What proportion of the birds taken by hunters came from still farther away? Over the whole 1968 season, hunters probably shot 60 to 65 of the 510 or so resident ptarmigan living (in summer) on the Eagle Creek area. This figure was calculated from band returns and estimated proportions of residents banded in 1968. The total known harvest from the study area, however, was 278 birds (data from hunters reporting at the check station). Thus only 23 percent of the birds shot had lived on the area in the summer. Many of the residents "escaped" by moving farther away from the road during the customary wandering period in September. Many new ptarmigan moved into the area from some distance away, providing the bulk of the season's harvest.

As one would expect, relatively more resident ptarmigan are shot early in the season. Fairly direct evidence comes from 1968 band returns. Hunters took 19 banded and 42 unbanded adults from August 10 to September 7. Since we banded 68 percent of the resident adults on the area in 1968, nine of the 42 unbanded birds probably were also residents, for a total of 28 out of the 61 shot. Thus, almost half of the adults (46%) shot up to September 7, and perhaps the same percentage of juveniles, had lived at Eagle Creek during the past summer.

In summary, my best estimate is that about three ptarmigan out of every four shot along the Steese Highway were raised at least two miles from the Steese. Of those living within the two-mile limit, 50 to 60 percent lived within one-half mile of the highway or one of its access roads. We have no good idea how far the nonresident ptarmigan have moved by the time they get close to the Steese. We have one instance of a bird, banded at Eagle Creek, being shot the same year at Twelvemile Summit (15 air miles). I have recorded only one case of a bird being shot eight miles from point of banding.

HUNTING PRESSURE

So far I have only described the kinds of ptarmigan shot by hunters: their sex, age, total numbers per season and per bag, and residence status. The next step is to relate numbers shot to numbers available.

Hunters provided the means to estimate hunting pressure at Eagle Creek through their reports of banded birds. Before 1967 hunters were alerted to the presence of banded

ptarmigan by news releases and signs along the highway near Eagle Summit, but we depended on their willingness to mail reports to us or to come into the office personally. The bright colors of the bands insured that hunters would know that they had shot a banded bird. Checking station operations in 1967 and 1968 made it easier for hunters to report band recoveries, and I think we learned of more of the harvested banded birds those years.

The calculations ignore pre-season mortality because no quantitative evaluation of this factor is available. I judge that fewer than five percent of adults banded in summer die before the hunting season. Losses of banded chicks probably were higher (perhaps 10 to 15 percent), but most chicks were banded two to three weeks before hunting, so the time interval involved was short. (However, see Appendix III for data showing no difference in the probability of getting a band return from chicks banded early and from chicks banded late in the season.) Actual hunting losses certainly are higher than my figures indicate, because of both pre-season mortality and nonreporting of bands.

Direct Returns from Adult Ptarmigan

A yearly summary of direct returns of banded rock ptarmigan, from 1960 to 1968, is in Table 6. The first obvious feature of the data is that more of the males are shot than females every year. As was discussed in an earlier section, the total harvest of adult males is only slightly higher than that of adult females; it is when one considers local or resident adults that the disproportionate harvest of cocks shows up. Part of the reason is that adult males stay near their summer haunts throughout the hunting season, whereas the old females migrate in late September. Appendix IV gives supporting evidence, showing that hunters shoot banded males in similar numbers each month through October, but that only six percent of the band returns from hens occur in October. The higher vulnerability of cocks, based on their behavior, was discussed earlier. This contributes to the higher rate of return of old males.

Table 6. Direct returns of banded adults, Eagle Creek, 1960-1968.

Year	No. (%) of Adult Males	No. (%) of Adult Females
1960	2(8)	0
1961	7(15)	1(2)
1962	5(7)	1(1)
1963	10(13)	6(6)
1964	7(14)	1(2)
1965	5(10)	3(7)
1966	13(50)	10(14)
1967	6(17)	3(6)
1968	13(27)	10(16)
Av.	(16)	(6)

EFFECTS OF HUNTING ON PTARMIGAN

Another noticeable thing about the data is the variation in direct returns from year to year. The only sustained trend seems to be a general increase in rate of return in recent years. Among both sexes, direct returns from 1960 through 1964 were lower, on the average, than returns from 1965-68. Most of the increase, I think, is due to changes in our effort to get band returns. We made a special effort in 1966 to use news media to let hunters know about the banding program. We also placed posters in all lodges along the Steese Highway, and erected three signposts on and around Eagle Summit. By chance, a herd of caribou wandered up to the Steese Highway in September, attracting unusual numbers of hunters to the area. Thus, we could not measure the effect of the informational campaign alone, but I am convinced that it did have some influence on the number of unreported bands. The 1967 and 1968 check station operations likewise improved reporting rates.

Direct Returns From Chicks

Yearly percentages (and numbers) of direct band returns from chicks are: 1960, 4% (3); 1961, 4% (5); 1962, 1% (1); 1963, 6% (11); 1964, 11% (6); 1965, 1% (2); 1966, 8% (15); 1967, 9% (24); 1968, 5% (10). The mean annual rate for these years was 6%, the same as for adult hens.

Considering that the estimates of direct returns probably are low, I think it is fair to say that the average annual harvest of resident adult males, which approaches 20 percent, could have noticeable effects on population size or makeup. There would appear to be much less chance that hunting affects the adult female or juvenile segments of the population. In the next section of this report I will explain what evidence we have to show that hunting really does influence population attributes.

VISIBLE EFFECTS OF HUNTING ON PTARMIGAN POPULATIONS

Evidence From Eagle Creek

I looked for two kinds of effects: on total numbers in the breeding population, and on the composition of the breeding stock.

Influence on abundance: If hunting is done mostly near roads, and if hunting influences spring stocks, one would expect fewer pairs close to the Steese Highway and Eagle Creek spur road than farther away. This effect should be especially noticeable following particularly heavy fall hunting pressure. I tested these ideas by recording the number of territorial cocks each year by zone, using the same zones as for measuring vulnerability to hunting. The results are in Table 7.

Excluding areas above 3800 feet elevation, where ptarmigan rarely have territories, the arbitrary zones A-C comprise 37, 34 and 29 percent, respectively, of the total study area. Zone A had more than its share of territorial cocks in all years except 1965, when it had as many as expected under a uniform distribution pattern, and 1968, when it had fewer. Zone B had about as many as expected except possibly 1961, when only 27 percent of the territories were in that zone. The area farthest from the road, Zone C, had consistently fewer territories than expected except in 1965 (when the percentage was exactly as predicted from uniform distribution) and in 1968 when it had more than expected.

Table 7. Number of territorial cocks by zone, 1960-1968.

Year	Zone A		Zone B		Zone C	
	No. of Cocks	Percent of Total	No. of Cocks	Percent of Total	No. of Cocks	Percent of Total
1960	38	42	33	37	17	21
1961	76	57	36	27	22	16
1962	69	41	65	38	36	21
1963	68	48	48	34	24	18
1964	55	50	37	34	17	16
1965	24	36	23	35	19	29
1966	35	44	24	30	21	26
1967	44	45	34	35	20	20
1968	28	27	39	37	38	36

Since Zone A averaged 6 percent more cocks than expected over the whole span of the study, there is no basis for suggesting that hunting consistently lowered spring densities close to the road. Even after the 1966 season, when at least half of the resident adult males were taken in fall by hunters, there was no decrease in the proportion of territories that zone contained next spring. Furthermore, the sharp drop in proportion and total number of males observed in the spring of 1968 did not follow an unusually high fall harvest.

An odd thing apparently did happen between 1967 and 1968 (Table 7): this was a sharp drop in territorial cocks in Zone A while, at the same time, Zone B had slightly more cocks and Zone C had almost twice as many. Furthermore, on two adjacent study areas in upper Ptarmigan and Golddust creeks, each three miles or more from the Steese Highway, spring densities of males rose 74 and 58 percent from 1967 to 1968. To me this indicates that the drop occurring in Zone A was counter to the general upward trend in areas away from the road. Circumstantial evidence points to spring hunting as being the culprit.

As I mentioned in the introduction to this report, no one shot ptarmigan at Eagle Summit in March or April in the years 1960 to 1967 because the road was not passable. In March 1968, however, the Department of Highways cleared snow from the entire Steese Highway. Hunters were quick to take advantage of this. By early April a number of ptarmigan—some banded ones, too—had been shot on the study area. The Regional Game Supervisor issued a field announcement April 5, closing this area to ptarmigan hunting. Department personnel patrolled the area on weekends for the rest of the month, after which all legal bird hunting ceased throughout the Interior. Nevertheless there were ptarmigan shot on the area throughout April and May, and even up to early June. The total number taken is not known, but we do know that nesting hens and territorial cocks were shot by people driving along the highway.

It seems very likely, therefore, that spring hunting did reduce the number of breeding pairs along the road at Eagle Creek. One wonders just how this reduction was brought about. In 1966 I had shot nine of 28 cocks counted May 18 in the Ptarmigan Creek area, but when I returned 12 days later there were 29 males on the same area, indicating

EFFECTS OF HUNTING ON PTARMIGAN

that (in some years, at least) territorial males could be replaced by other birds from adjacent areas even when pairs were firmly mated and eggs were being laid. So we are left with a number of explanations to ponder:

1. There may not have been any "surplus" of extra males available in 1968 to replace cocks shot by hunters;
2. There may have been some extra birds, but not enough;
3. There may have been enough extra birds, but their urge to take up territories may have waned before illegal hunting stopped;
4. It may have been the shooting of hens, not cocks, which was critical; we know nothing about the presence of "surplus" hens available to replace lost breeders.

One further thought may be useful: Female ptarmigan are moving back to breeding areas throughout April, and therefore hens shot on a given hill in April are likely to be transients. The critical hunting at Eagle Creek in 1968 might have occurred in May.

The main point, of course, is that whereas fall hunting has not appeared to influence subsequent spring densities, our single experience with hunting in April and May justifies a closer look at spring hunting as it may affect breeding densities.*

Influence on composition of breeding populations: Our knowledge of the relative proportion of males and females in spring is not very good because it is hard to get a direct count of hens. In our spring census we usually see three cocks for every hen we find, although intensive work later in summer invariably turns up many more females. As a rule our studies usually suggest that there are slightly more males than females (perhaps five percent more) most years when nesting begins. In 1961, and again in 1967, there seemed to be as many hens as cocks in late May. However, we do not have good enough data to make a careful test for a relationship between hunting and spring sex ratios.

We can distinguish yearling males and females from older ptarmigan in spring by the amount of dark pigment on their outer wing feathers (Weeden and Watson, 1967). This provides the opportunity to estimate age ratios in the breeding population, by sex. Since we know that fewer adult females (especially local or "resident" females) than adult males are shot at Eagle Creek, we have a two-way test of the question as to whether hunting affects spring age ratios: 1) Are there relatively more yearling ptarmigan on territories close to the road system than farther away? and 2) Are there more yearlings among males than among females?

Once again it is handy to use the "zoning" method to test the first question. Summarizing all captures of adults in the nine-year study (Table 8), I find that in both cocks and hens there tend to be more first-year birds close to the highway (Zone A) than farther away. As was true when we analyzed band returns (Table 2), the main difference is between Zone A and Zone B, not between Zones B and C. The drop in percentage

* 1969 brought confirmation of this point. The Highway opened April 17, simultaneously with an announcement closing Eagle Summit to ptarmigan hunting. Illegal hunting persisted to early June. Pairs seen near the Highway in April "disappeared" steadily.

Table 8. Age of adults by zone of residence, 1960-1968.*

Zone	First-Year Males	2+ Males	First-Year Hens	2+ Hens
A	86 (71%)	35	122 (56%)	97
B	56 (53%)	49	62 (45%)	77
C	44 (49%)	46	72 (46%)	83
Pooled Sample	186 (59%)	130	276 (52%)	257

* Mainly from 1963 to 1968, because before 1963 the only way we could tell the age of a mature ptarmigan was through banding.

of yearlings is greater from Zone A to Zone B among males (18 percent) than females (11 percent), which is what would be expected from the fact that more adult cocks are shot than adult hens.

The second question is whether there are more yearlings among males than females. The answer seems to be yes. In every zone, there were more young birds among cocks than hens. The difference became progressively less (15 to 8 to 3 percent in Zones A-C, respectively) the farther from a road the sample was taken. We need, but do not have, a sample from five miles or more from a road, to see whether the difference disappears in essentially unhunted populations.

Further evidence that hunting is the cause of the observed differences in age ratios was obtained in 1966 through 1968. In the fall of 1966 hunters reported shooting slightly over half of the adult males banded that year. They returned only 15 percent of the banded adult hens, however. The following spring 82 percent of all cocks caught were yearlings, but only 60 percent of the sample of breeding hens were first-year birds. Hunting pressure was much lighter in the fall of 1967, but unusual spring hunting occurred in 1968, as discussed previously. Once again, more of the cocks we caught in 1968 (86 percent) were yearlings than of the hens (57 percent).

It seems clear that hunting does influence age ratios among breeding ptarmigan. The question is how this effect is brought about. The best explanation may be that in an unhunted population old birds dominate the competition for breeding space and exclude some young ptarmigan. This competition may take place in autumn, as Watson (1967) found for red grouse in Scotland, and the birds that get the good pieces of ground then may survive better through the winter than birds that get poorer ground or none at all. Thus, when hunters shoot these established birds, either in fall or spring, there is a "vacancy" available for a less aggressive bird to move into. Our banding work at Eagle Creek showed that older male and female ptarmigan are very likely to return to their former breeding grounds if they live through the winter, whereas the first-year birds move around. It is logical to expect that old birds, if shot, would be replaced by young birds. This would skew the age ratio toward yearlings in hunted populations.

Evidence From Experiments

The things we can learn about the effects of hunting on ptarmigan numbers are limited, at Eagle Creek, by the fact that the Department does not control the number of hunters

MANIPULATING THE HARVEST

or the proportion of birds shot. To get around this limitation, we established two areas well away from the Steese Highway, but in the general vicinity of Eagle Summit, where experimental hunting could be done. On one area of about five square miles (Ptarmigan Creek) we decided to make spring censuses in 1967, 1968, 1969, and 1970. Each fall, 1967 through 1969, 40 percent of the estimated autumn population would be shot by Division of Game biologists. Spring counts would be made in 1967 through 1970 in the other area (Golddust Creek, four square miles), but no ptarmigan would be shot there. The number of birds to be shot at Ptarmigan Creek was determined by applying the same rate of summer population gain to the spring densities observed there, as was discovered each year during studies at Eagle Creek.

The removal aspect of the experiment was accomplished successfully, mainly through shooting in mid-August and early September. The four spring censuses were made as planned. The results (Table 9) suggest strongly that the controlled-level hunting had no bearing on subsequent spring populations. The conclusion to be drawn from the work is that when hunters shoot birds in autumn from a small area surrounded by productive but un hunted habitat, removal of 40 percent of the birds does not change the normal trend in populations. If anything, the data suggest that ptarmigan numbers rose faster between 1967-68 on the shot area than on areas that experienced no hunting or lesser hunting pressure.

MANIPULATING THE HARVEST

Ptarmigan hunting at Eagle Summit currently results in annual harvests on the order of 5 to 20 percent of the fall population. This modest harvest is limited by: a) limited participation in bird hunting by Alaskan hunters; b) late-fall closure of the Steese Highway; and c) slight use of snowmobiles. Any or all of these elements could change, and with that in mind I will discuss potential management problems.

Excessive Harvest

At Eagle Summit there are usually as many or more ptarmigan per unit area in May within one-half mile of the Steese Highway as in the area one-half to two miles off the road. If counts showed lower densities close to the highway, and especially if this was coupled with comparatively high proportions of first-year birds near the road, managers would be warned of excessive harvests the previous year.

One of the first steps to consider would be to open the season later in the fall. Openings of September 1 or September 10 would not reduce the total harvest greatly, but would result in significantly fewer local birds being taken. The sparing of resident adults might result in better spring populations the next year. This step could be effective only if no hunting was allowed in spring, however. Currently the season remains open until April 30. March closures would ensure that the pressure was taken off local breeding stock. If the season closed by March 1, few territorial cocks would have been shot. A closure on March 30 would allow some males to be shot on territories, but their places very likely would be taken in April and May by yearlings. Few females would be taken, since hens begin to show up in breeding habitats about the first of April.

Another approach might be to retain long seasons, but to prohibit hunting along the road. A one-quarter-mile closure would effectively reduce harvests, if enforced, because it would dampen the enthusiasm of a majority of erstwhile ptarmigan hunters who shoot birds only if they see them from the road.

Table 9. Spring counts on three units of ptarmigan habitat near Eagle Summit, Steese Highway, 1967-70.

Area	Sq. Miles	Treatment	No. Territorial Males			
			1967	1968	1969	1970
Golddust Creek	4	No hunting	60*	95	81	81
Ptarmigan Creek	5	40% shot in fall 1967-69	57	99	98	94
Eagle Creek	15	Uncontrolled hunting	98	120**	113	102

* Expanded from a count of two-thirds of the area.

** Adjusted to compensate for effects of illegal spring hunting.

SUMMARY

Overharvest of Males Only

If the Steese were maintained March 1 to November 30, up to 50 percent more cocks than hens might be shot even if hunting pressure remained quite light. If managers felt this situation needed correcting, a number of choices are available. First, the bag limit could be reduced after October 1 to five per day. Second, the season could be closed March 1. Third, the season could be closed in the month of October only, allowing good harvests of both sexes in August and September and allowing snowmobile enthusiasts to enjoy winter hunting in November and March.

Decreased Recreational Quality

Quality recreation is a personal matter, of course, but game managers do have an obligation to foster hunting methods that have general support from the public. Biologists know that allowing people to hunt ptarmigan by throwing ptarmigan eggs in the air and shooting them could be controlled so as not to "hurt the population" of ptarmigan, but there are tacit sanctions against that sort of hunting that we all perceive and obey.

Present regulations are very permissive--and should be as long as people stay out of each other's hair. Increased crowding could cause some distasteful situations to arise, however, and we should be prepared to meet or forestall them. Some suggestions follow that can be used singly or in combinations that different situations demand:

1. Urge or require the use of dogs.
2. Urge or require the use of shotguns (in preference to rifles).
3. Make people walk by closing areas close to roads.
4. To forestall complaints about ptarmigan being too young, open seasons on September 1 (when chicks are 75 to 80 percent of adult weight most years) or as late as September 30 (chicks are 90 percent or so of adult weight).
5. Encourage skis or snowshoes in preference to snowmobiles.
6. Reduce crowding by a) providing access to new areas, b) publicizing little-known areas, or c) weekend permit systems to limit participation on days of greatest crowding.

SUMMARY

In 1927 the Steese Highway connected Fairbanks with Circle City, opening up several pieces of alpine country to hunters. The popularity of these areas reached a peak about 1950. Since Department studies began in 1959 ptarmigan country has been relatively uncrowded with hunters, although rumors of good caribou hunting have occasionally and temporarily increased bird-hunting pressure. Fall hunting has begun August 10 or 20 in the last decade, and had been brought to an early close by official highway closures or drifting snow in October. Only twice--in 1968 and 1969--did the highway open up in spring early enough to allow hunters to travel to Eagle Summit before the season closed April 30.

At least half of the ptarmigan shot are taken on weekends. Half of the hunters come up the highway with plans to hunt birds, although the best way to identify a ptarmigan

hunter is by looking in his game bag. Most hunters walk only a short distance to get ptarmigan, which means that a bird summering within one-half mile of the Steese Highway is about twice as likely to be shot as one living farther away. Few snowmobiles were in use through 1969 in the Eagle Summit area.

Most years about 400 to 1000 rock ptarmigan are shot along the upper Steese Highway, or about 14 to 36 birds per square mile of accessible habitat. Successful parties of hunters (mean of two hunters per party) get from 4 to 11 ptarmigan per trip. Very few people—about 5 percent in 1968—shoot a bag limit of 20 ptarmigan per day. Ptarmigan of different sex and age classes are shot in nearly the proportion in which they occur in the population, although an unconscious selection of adult males occurs. Most of the ptarmigan that hunters shoot in fall are transients, having moved three miles or more before getting close to the Steese Highway. In 1968 only 23 percent of the ptarmigan harvested up to October 13 had lived, that summer, within three miles of the road. Up to 50 percent of the birds shot in August are local residents, however.

Upwards of 20 percent of the old cocks living at Eagle Creek are shot each fall, although one year (1966) at least half were shot. Hunting pressure on adult hens and local chicks is lighter, averaging 6 percent. Analyses of spring distribution and densities of breeding pairs suggested that this hunting pressure has had little effect on subsequent breeding numbers, but that the removal of old males (and their replacement by surplus yearlings) often skews the age distribution among males. Only in two years, 1968 and 1969, did we have evidence that hunting reduced breeding densities along the road. This was probably due to spring hunting (April and May) rather than fall hunting.

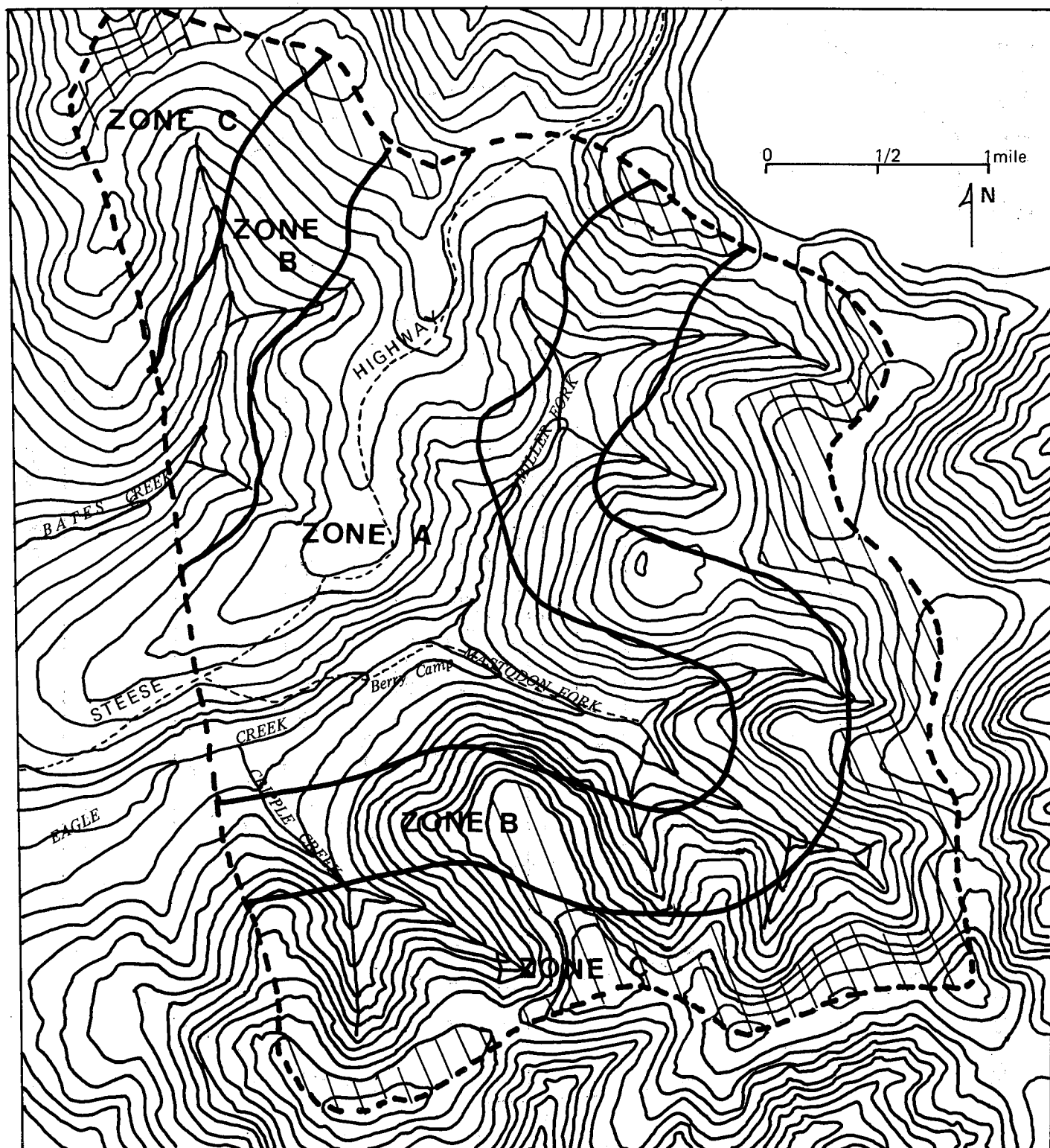
By comparing spring populations in an unhunted area with those in an area from which 40 percent of the fall population was shot in 1967 and 1968, we learned that spring breeding stocks were unaffected by hunting pressure of that magnitude.

A variety of techniques are available to the game manager to manipulate harvests or maintain the quality of recreation derived from ptarmigan hunting at Eagle Summit. These are discussed in the text.

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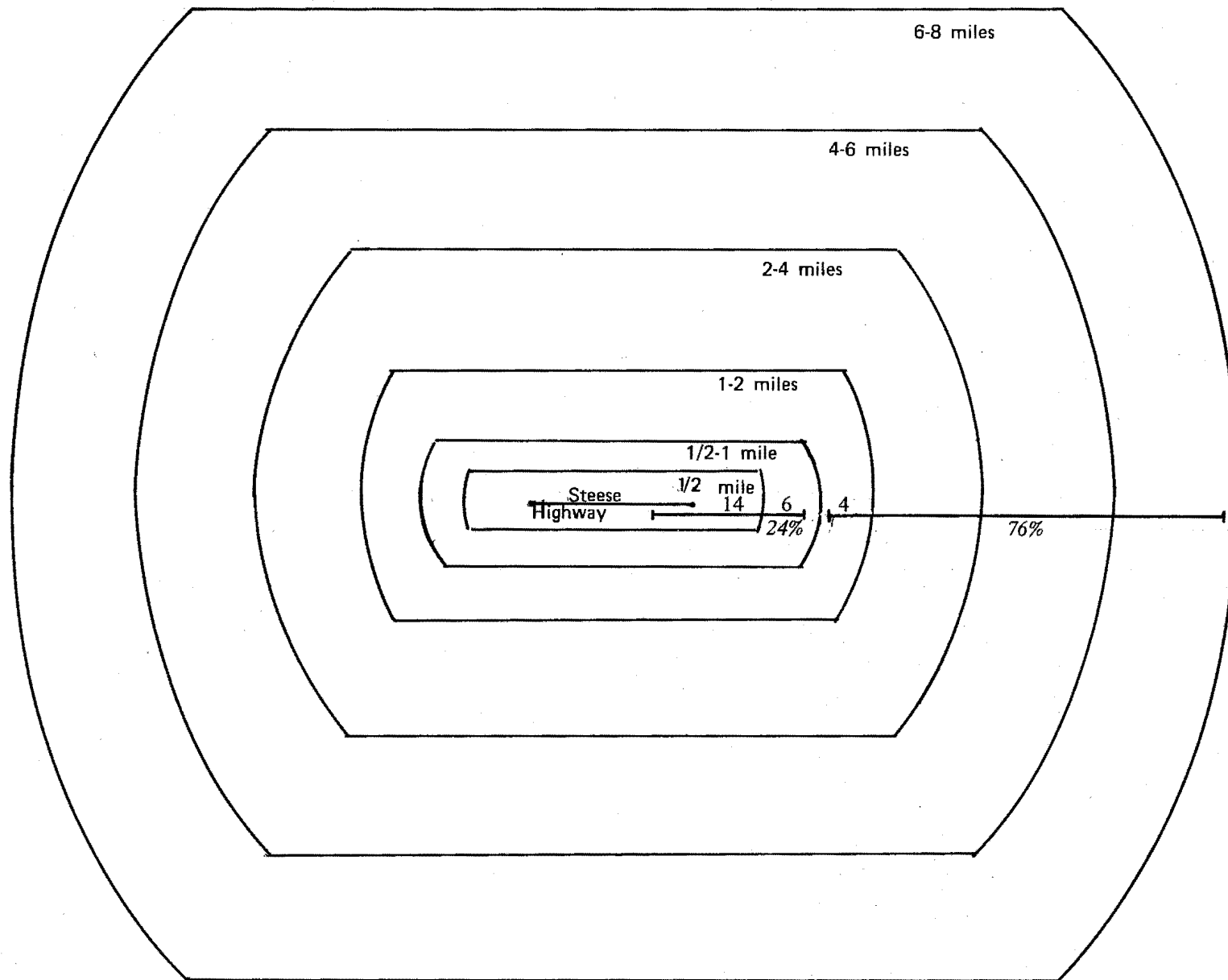
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APPENDIX I



ZONES USED IN MEASURING THE EFFECTS OF HUNTING ON LOCAL PTARMIGAN POPULATIONS' (Hatched areas above 3700' not used by territorial cocks.)

APPENDIX II



PERCENTAGE OF PTARMIGAN IN HUNTER'S BAGS FROM VARIOUS DISTANCES AWAY FROM THE STEESE HIGHWAY.

APPENDIX III

It would seem logical that because of summer mortality, relatively few chicks from groups banded early in the summer would be reported by hunters. However, a summary of four years of data (1963, 1966, 1967, 1968) does not support this hypothesis.

Days From Banding to Start of Hunting	Number Banded	Number Shot	Percent Shot
0-10	121	10	7
11-20	231	13	6
21-30	311	22	7
31-40	165	10	6
41-50	62	5	8

Chick mortality from hatching to early August has varied between 10 and 40 per cent. A good fraction of this mortality occurs in the first two weeks, before chicks are big enough to band. Nevertheless it is surprising that there isn't even a small difference in hunter returns, related to the time interval between banding and hunting.

APPENDIX IV

Proportion of Banded Adult Ptarmigan Shot
at Eagle Summit, by Month and Sex
1960-1968

Month	No. Banded Males Shot (uncorrected)	No. (%) Males Shot (corrected)*	No. Banded Females Shot (uncorrected)	No. (%) Females Shot (corrected)*
August	22	37 (28)	25	42 (49)
September	45	45 (34)	38	38 (45)
October	34	51 (38)	3	5 (6)
November	2	-	0	-

* Season opened on August 10 in five years, on August 20 in four years; there were, on the average, 18 days of hunting in August. Hunting occurred throughout September each year. Road Maintenance ceased most years on or about October 10. I have arbitrarily used an average of 20 days of hunting in the Eagle Summit area in October. Thus, August and October data are increased to estimate number of returns if a full 30 days were available each month. The two cocks shot in November are ignored.