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Game Management Unit 13 Ptarmigan Population Studies

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SUMMARY

Ptarmigan are the most wide-ranging and abundant upland game bird in Alaska. All 3 species of ptarmigan are found in Game Management Unit 13. Willow ptarmigan (*Lagopus lagopus*) are the most common and widespread, making up an estimated 65–70% of the population. Rock ptarmigan (*Lagopus mutus*) make up 25–30%, and white-tailed ptarmigan (*Lagopus leucurus*) are <10% (Taylor 1994).

Since 1990 there has been considerable concern and some disagreement over the status of ptarmigan in Unit 13. The impacts of late winter (February and March) hunting and recreational snowmobile use on ptarmigan populations and the need for more restrictive regulations are poorly understood and the basis for most disagreements.

The goal of this research has been to determine a way to assess impacts of late winter hunting and recreational snowmobile use on Unit 13 ptarmigan populations. Objectives for this 2-year portion of the study were to evaluate ptarmigan territorial male/breeding pair count sites and censusing techniques, to collect hunter-killed ptarmigan carcasses to obtain sex and age composition data, and to evaluate methods of sexing birds from wing measurements.

During the second week of May 1998 and 1999, we conducted multiple ptarmigan territorial male/breeding pair counts at 5 road-accessible sites in Unit 13B. Counts at 3 sites were done on foot, and 2 were conducted using highway vehicles stopping at prearranged posts. Results with good counting conditions showed consistency among techniques.

Willow ptarmigan numbers in Unit 13 have increased for several years and now appear to be stable at high density. Rock ptarmigan numbers were low but substantially increased during this period, reaching moderate density.

Ptarmigan sex and age harvest data are influenced by the segregated distribution of ptarmigan in winter and hunters' transport methods. Once willow ptarmigan are grouped by age, a wing chord or an eighth primary feather measurement can be used to sex birds with 93% reliability.

Key words: aging, rock ptarmigan, territorial male counts, willow ptarmigan.

CONTENTS

INTRODUCTION

Ptarmigan research in Unit 13 began in 1992. A synopsis of work and results from 1992 through 1996 were presented in Taylor (1999). Based on results of this work, it was decided that 2 more years of data collection should be conducted to evaluate methods being tested. This final report includes earlier data from 1997 and covers work done from January 1998 through May 1999.

Late winter (February and March) ptarmigan hunting is a popular activity in Alaska and has increased exponentially with the growing use of snowmobiles (ADF&G 1996). Impacts from this use are throughout the road system in game management units in Alaska but are most dramatic in Unit 13.

Area management biologists lack practical methods to evaluate ptarmigan population status, including sex and age composition from harvested birds. The focus of this research was to develop and evaluate such methods.

Many northern populations of grouse and ptarmigan demonstrate cyclic fluctuations; that is, their populations significantly increase or decrease in a cyclic pattern repeated at intervals more regularly than if occurring by chance (Keith 1963, Angelstam et al. 1985, Bergerud 1988). Willow and rock ptarmigan populations cycle in most of their native range (Gudmundsson 1960, Watson 1965, Bergerud 1970, Myrberget 1972, Weeden and Theberge 1972, Mossop 1994) with large differences between low and high population years. The ability to assess populations and predict cyclic changes can be beneficial to management biologists.

Choate (1963b), Watson (l965), Bergerud and Mercer (1966), Bergerud (1970), Braun and Rogers (1971), and Myrberget (1972) discuss the use of breeding pair/territorial male counts for censusing ptarmigan populations. These methods provide total counts for small (usually <2 km^2) count areas. Over time they provide trends in the breeding population, making it possible to

predict cyclic changes. They do not, however, provide density estimates that can be applied to a *large* area for estimating ptarmigan numbers.

Pelletier and Krebs (1997) tested a line-transect method for estimating ptarmigan densities. The authors believed this method provided good results with moderate population numbers. However, this method is slow, labor-intensive, costly in remote areas, and demanding with respect to data collection and analysis. These same researchers (Pelletier and Krebs 1998) evaluated aerial surveys of ptarmigan. This method did not provide consistent results between years and is expensive.

We tested variations of the total count method done on foot or with the use of a highway vehicle. A qualified individual could do these counts in ≤3 hours per count area.

GOALS AND OBJECTIVES

The primary goal of this research was to determine a way management biologists, with limited resources, can assess impacts of late winter hunting and recreational snowmobile use on ptarmigan populations.

Based on the results of research done in 1992–96 (Taylor 1999), we determined that breeding pair counts, through the identification of territorial males, should be conducted for at least 2 more years. We believed this was necessary to verify if these counts could be used to assess population changes. In addition, I continued to collect sex and age data from harvested birds to get a statistically significant sample size.

The specific objectives for this final phase of the project are listed:

1 Evaluate ptarmigan breeding pair/territorial male count sites and censusing techniques in Unit 13B.

2 Obtain sex and age composition data by examining hunter-killed ptarmigan carcasses of birds harvested in late winter.

3 Evaluate methods of sexing birds from wing measurements.

4 Examine food habits of ptarmigan harvested in late winter.

STUDY AREA

This study was conducted in Unit 13, which is bordered by and includes portions of the Alaska Range on the north, the Talkeetna Mountains on the west, and the Chugach Mountains on the south. The Copper River forms the eastern boundary. Major drainages within Unit 13 include the upper Susitna, Gulkana, Gakona, Chistochina, Nelchina, and upper Matanuska Rivers. Highway vehicle access is limited to 4 major road systems that traverse Unit 13: the Richardson, Glenn, Parks, and Denali Highways. However, numerous trails make much of Unit 13 accessible by all-terrain vehicles in summer and fall and snowmobiles in the winter.

Skoog (1968) reported vegetation types for Unit 13 and described 36% of the unit as subalpine habitat. Willow ptarmigan prefer subalpine, sparsely timbered or treeless areas with willow-lined waterways. They also prefer level ground or gentle to moderate slopes and luxuriant plant growth with shrub height usually 1–3 meters. Rock ptarmigan prefer treeless subalpine to alpine areas and moderate slopes vegetated with sparse shrubs <1 meter in height (Weeden and Ellison 1968). Unit 13 contains a substantial portion of the ptarmigan habitat available to upland bird hunters in Southcentral Alaska. Harvest data was collected from the entire unit.

Breeding pair/territorial male counts were conducted in Unit 13B in the northern portion of Unit 13. We established 5 ptarmigan breeding pair count sites (Fig. 1). Three sites were in heavily hunted areas, and one was on the plateau north of McCallum Creek and east of the Richardson Highway. A gravel road to the transmitter site on the plateau provides access to the latter site. Rock ptarmigan use habitat along the top of the bluff on the western and northern boundary of the site. Willow ptarmigan are just above tree line at the base of the bluff on the west side and scattered in the patches of willow brush in the remainder of the area. The second site was located between milepost 10–14 of the Denali Highway. Willow ptarmigan are on both sides of the highway associated with small willow-lined drainages or scattered patches of willow and alder. Rock ptarmigan are primarily in open steep terrain along the north side of the highway. The third heavily hunted site contains only willow ptarmigan. The site consists of willow-lined drainages that cross the Denali Highway between mileposts 15 and 16.

Both of the 2 less impacted sites were located on Maclaren Summit along the Denali Highway between mileposts 29–33.5 and 34–36. Willow ptarmigan were on both sides of the highway in the willow-dominated flats. Rock ptarmigan were along the ridge on the south side of the highway.

METHODS

Bergerud and Mercer (1966) tested direct counts with 1 or 2 observers using a bird dog, and *becking* counts with several stationary observers listening and documenting territorial male willow ptarmigan. Scottish researchers refer to the territorial calling of male red grouse (*L. l. scoticus*) as *becking* (Watson and Jenkins 1964: 149). We combined these methods and used tape-recorded calls to elicit responses from territorial male rock and willow ptarmigan. Conversations with D. Mossop, Yukon biologist, guided me in the selection of the count sites. The basic criteria used in selecting a site were 1) an area containing a minimum of 2 km^2 of good breeding habitat, 2) the presence of at least 6 territorial males, and 3) proximity to the road system.

During the second week of May, we counted territorial male ptarmigan at 5 sites (Fig. 1). We attempted to conduct counts at each site a minimum of 3 times. All counts were conducted in the morning starting approximately one half hour before sunrise or in the evening ending just before sunset. The 3 sites done on foot were surveyed by walking established routes that take ≤3 hours to complete. The other 2 sites were roadside count areas located between mileposts 10–14 and 29–33.5 of the Denali Highway (Fig. 1). Highway vehicles were used, making preplanned stops at 0.5-mile intervals. A few counts were done in late May to compare results with earlier counts.

Each individual conducting counts used tape-recorded calls of territorial male rock or willow ptarmigan for the appropriate site. The recorded calls were played at each stop on roadside counts and at 250- to 300-meter intervals along routes walked to elicit responses from males in the area. At each stop, a short series of calls was played, followed by a 2-minute wait. If there was no response, this procedure was repeated once prior to moving to the next stop. All ptarmigan observed or heard within 400 meters were plotted on a map. If territorial males responded by flying to the recorded call, attempts were made to plot the bird's location at the point of origin or center of its territory and to look for a female. Snowshoes were used when necessary.

Weather conditions were critical to the success of surveys. Ptarmigan are most active and vocal with sunny and calm conditions (Mossop 1988: 360). The birds are usually inactive during cold snowy weather, and cannot be heard when winds exceed 10 knots.

In February and March we collected ptarmigan carcasses from hunters in Unit 13. This was done by direct contact of hunters in the field or by hunters coming into the Glennallen or Palmer area offices. A Ptarmigan Hunter/Harvest Survey form (Appendix) was used to record the date and the area hunted, the number of birds observed and harvested, and the method of transportation used to access the hunt area and while hunting. I grouped carcasses by species and then by age, using pigmentation of the 3 outer wing primaries (Bergerud et al. 1963, Weeden and Watson 1967, Braun and Rodgers 1971). Both the left and right wing chord (distance from the outside in the bend of the carpal joint to the tip of the longest primary on a folded wing) were measured, and both of the eighth primaries were pulled and measured. I determined sex by examining each carcass for an ovary or testes and each crop was examined for food content.

RESULTS

Counts of territorial males/breeding pairs of willow and rock ptarmigan are documented in Table 1 for 1998 and Table 2 for 1999. Multiple counts were conducted at each of the 5 sites in Unit 13B (Fig. 1). We conducted counts on 11–14 May in both years. During this period we rated weather conditions from poor to good in 1998 and fair/good to excellent in 1999 (Tables 1 and 2).

Weather conditions caused the greatest variability in count data. Counts declined proportionally with diminishing conditions. Given like conditions, there was no apparent difference between early morning and evening counts at any of the sites. With one exception, the counts conducted in the later part of May were not as productive, and the males that did respond were not as aggressive.

Although we had better counting conditions in 1999 then in 1998, at least 1 count conducted in each of the 5 count sites in 1998 was rated "good" (Table 1). Comparing data from 1998 to 1999 shows willow ptarmigan counts increased slightly in 3 count areas but remained stable in the other 2. Rock ptarmigan counts were much higher at all 4 sites where they were found (Tables 1 and 2).

Hunters harvesting ptarmigan in Unit 13 during the last 2 months of the season (February and March) provided carcasses. We determined species, sex, and age for 265 carcasses shot in 1998 and 153 taken in 1999. Because all but a few of these birds were willow ptarmigan, the species data were pooled. These data were grouped by transportation methods used, those using snowmobile or airplane versus those using highway vehicle/snowshoes to access the hunt area (Table 3). This was done to compare differences in the harvest from lower elevation, roadside areas (highway vehicle/snowshoes) to higher elevation areas (snowmobile/airplane). In 1998 there was very little difference in sex and age of birds taken by the 2 groups. In 1999, however, 66% of birds taken by hunters hunting near maintained highways were female, while females composed only 26% of the birds shot by hunters in more remote areas (Table 3). Taylor (1994, 1999) documented similar results.

Juveniles made up 46% of the 265 ptarmigan carcasses examined in 1998 and 42.5% of 153 examined in 1999 (Table 3). This compares with 43% (n = 200) in 1993, 51% (n = 295) in 1994, 59% (n = 184) in 1995, and 49% (n = 211) in 1997 (Taylor 1999).

A summary of willow ptarmigan wing chord and eighth wing primary measurements tabulated by sex and age are provided in Table 4. These data indicate that once birds are segregated by age, either wing chord measurement or the length of the eighth primary feather can be used to determine the sex of the bird with 93% reliability. If the wing chord is ≥19.2 cm in an adult or ≥19.0 cm in a juvenile, it is a male. If the length of the eighth primary feather is ≥16.1 cm in an adult or ≥15.9 cm in a juvenile, it is a male. Using a discriminant analysis model (Johnson and Wichern 1988) to develop an equation to classify the birds to sex based on the wing measurements only reduced the error by 1% in adults and had no benefit in juveniles (Figs. 2 and 3).

From 1997 through 1999 a total of 533 willow ptarmigan crops from birds shot in Unit 13 in late winter (primarily February and March) were examined for food content (Table 5). Willow (*Salix* spp.) buds and twigs were found in 98.7% of these and usually composed >75% of the total content of each crop. Dwarf birch (*Betula nana* or *glandulosa*) buds were the next most common winter food item. They were found in 46.5% of the crops but usually made up <20% of the total content. Overwintering berries, primarily blueberry or bilberry (*Vaccinium uliginosum*), lowbush or mountain cranberry (*V. vitis-idaea*), and crowberry (*Empetrum nigrum*), and leaves of mountain avens (*Dryas octopetala*) begin to appear in mid to late March with the percent of crop content varying considerably but usually <50%.

I also examined 21 rock and 27 white-tailed ptarmigan crops collected during February and March in Unit 13 (Table 5). All of the rock ptarmigan crops contain dwarf birch buds that, with the exception of a few birds collected in late March, constituted 80 to 100% of the contents. Two-thirds of the birds have willow buds or stems, but these items usually made up <10% of the contents of a crop. As with willow ptarmigan, rocks shot in late March are often feeding on blueberries, crowberries, lowbush cranberries, and/or mountain avens leaves.

The whitetails have the most varied winter diet consisting primarily of dwarf birch buds, alder (*Alnus crispa*) catkins, and willow buds and stems. Of 27 crops examined, dwarf birch buds were found in 81.5% and alder catkins in 40.7% and constituted 50 to 100% of the total contents of a

crop. Willow buds and stems were in 33.3% of the crops but made up <15% of the total contents. As with the other species, overwintering berries were utilized when they became exposed in late winter, along with lowbush cranberry leaves.

DISCUSSION

From 1994 through 1997 willow ptarmigan populations in Unit 13B were increasing (Taylor 1999) and continued to increase in 1998. By 1999 they were at a high density and their numbers in good breeding habitat appear to have peaked, while still showing some increase in more marginal habitat (Table 6) .

Rock ptarmigan populations in Unit 13B were at low density in 1992 (Taylor 1994) and remained low through 1997 (Taylor 1999). Their numbers began to increase in 1998 and showed a significant increase in 1999 (P <0.001) (Table 6), reaching moderate densities.

The territorial male count data are effected by several variables, including time of year, time of day, current weather conditions, amount of snow cover, and procedural methods. We can address or control most of these but of course have no control over current weather conditions that can greatly impact our results. Counts should only be attempted when conditions are "good" to "excellent"; that is, sky clear to partly cloudy, winds calm to <5 knots, and no precipitation. Multiple counts should be conducted at each site.

While testing the census techniques in late May, on several occasions I witnessed willow ptarmigan males with females that failed to respond or made slow, weak responses to the *becking* call tape. Unlike other grouse and ptarmigan species, the male willow ptarmigan remains with the female through the incubation period and assists in brood-raising (Johnsgard 1983). Because incubation can begin in late May, willow ptarmigan males may be shifting behavior from bold territorial defensive activities to secretive incubation-related activities. Regardless of the reason, late May appears to be beyond the optimum period for censusing ptarmigan.

The roadside counts using vehicles and prearranged posts at 0.5-mile intervals provided consistent results when counting conditions were good to excellent. This technique has several advantages. It requires less time to complete, is more consistent (*becking* call is played at established posts), and is not affected by the amount of snow remaining (snow may limit off-road access). The major disadvantage is Alaska's limited road system severely limits where this technique can be employed.

It would be beneficial to be able to access 1 or more remote sites to provide control data to compare to sites being heavily impacted by human activities. However, due to the highly variable "break-up" conditions that occur during the optimal period for conducting these counts (10–15 May), accessing remote sites is often futile. We examined remote sites accessible only by aircraft in Units 13B and 13C, but conditions in mid-May and additional costs precluded adding either of these sites to our sample (Taylor 1999). Fortunately in Unit 13 there are areas of good breeding habitat along the central portion of the Denali Highway where human impact on wintering ptarmigan populations using this habitat is minimal.

The ptarmigan hunting season in most of the highway system game management units in Alaska runs from 10 August through the end of March. Hunting pressure is light on family groups in August and September. The heaviest hunting activity is in February and March. During the winter ptarmigan congregate into large flocks of 15 to 75 birds, occasionally numbering up to a few hundred and segregated by sex and age (Weeden 1964, Mossop 1988). Flocks containing predominantly adult males with some juvenile males tend to remain at higher elevations above tree line near their breeding territory. Flocks containing adult and juvenile females and some juvenile males range farther from breeding areas to lower elevations often below tree line (Irving et al. 1967). Heavy harvest of one segment of the population can occur depending on hunter distribution, leading to biased sex and age data. In earlier research in Unit 13, I found that hunters along highway-accessible areas shot a much higher percentage of females and juveniles and those hunting in remote areas took more adult males (Taylor 1999).

Sex and age composition data collected in 1998 does not appear to be affected by this distribution (Table 3). Not all hunters accessing areas with snowmobiles hunt in higher elevation areas near breeding habitat, and some highway vehicle/snowshoe hunters can access ptarmigan near breeding habitat in the mountain passes of the Glenn, Parks, or Richardson Highways. The major samples collected in 1998 came from atypical areas, which probably accounts for the more even distribution (Table 3).

The 1999 harvest data clearly show a difference between hunters hunting along maintained highways (66% juveniles, 66% females) versus those hunting in remote areas (32% juveniles, 26% females) (Table 3).

The percent of juveniles in the harvest of primarily willow ptarmigan in Unit 13 has been slowly decreasing since it peaked in 1995 (Taylor 1999). It appears willow ptarmigan populations have probably reached a peak in their natural cycle and will soon begin declining.

Based on a sample of almost 500 carcasses, I was able to accurately determine the sex of a willow ptarmigan from either the wing chord or eighth primary feather measurements with 93% reliability. My results are similar to Bergerud et al. (1963) who achieved 91% accuracy on determining the sex from wing chord measurements on an unaged sample of 262 willow ptarmigan shot in Newfoundland in September. However, these results are quite different from results obtained by Canadian researchers, whose wing chord and primary 8 measurements of willow ptarmigan had considerable overlap between sexes (Gruys and Hannon 1993). They only achieved 82% reliability in identifying the sex using a discriminant analysis of wing chord length with either the primary 8 or the outer rectrix length (n = 200). I do not have an explanation for the difference in measurements between willow ptarmigan shot in Unit 13 in February and March and those from Chilkat Pass, British Columbia taken in April and May.

The winter diet information obtained during this project (Table 5) agrees with findings of other Alaskan studies reported in the literature. Research on willow ptarmigan by West and Meng (1966), Irving et al. (1967), and Weeden (1969) all found *Salix* spp. buds and twigs to be the predominant winter food item with dwarf birch buds the only other commonly used plant. These researchers also reported that dwarf birch usually composed a small percent of the total volume or weight of the crop contents. The only North American citing that lists a genus other than *Salix*

as the most important winter food item for willow ptarmigan is Peters (1958) research conducted in Newfoundland. He found the winter diet to consist almost exclusively of buds and twigs of *Vaccinium* spp., buds and catkins of *Betula* spp. and *Alnus* spp., and buds of sweet gale (*Myrica gale*). Peters (1958) indicated buds and twigs of the common blueberry (*V. angustifolium*) are by far the most important winter food. This plant species is very abundant on the Newfoundland barrens and is often the most abundant for up to 20 years following a fire.

Rock ptarmigan also switch to the buds, twigs, and catkins of dwarf birch and willow in the winter. Even given my small sample size, the results agreed with Weeden (1969) and Moss (1974), whose much larger samples from Interior Alaska found dwarf birch to be the predominant and often exclusive food item through most of winter. Occasionally willow and rarely alder are the only other plants used by rock ptarmigan during winter.

White-tailed ptarmigan in the southern portion of their range use willow buds and stems, often exclusively, as their primary diet (Quick 1947, Choate 1963*a*, May and Braun 1972). However, in Alaska Weeden (1967) reported results similar to mine, with dwarf birch buds and alder catkins being the most common winter foods. This is the case even where several *Salix* spp. are readily available.

Weeden (1969: 277) thought the change from winter to spring diet occurred in mid to late May for both willow and rock ptarmigan. In Unit 13, my results indicate the change to overwintering berries and leaves begins in mid to late March for all 3 species. There may be a period (late March to late May) where considerable overlap in seasonal diet occurs, depending on snow cover and thawing conditions.

RECOMMENDATIONS

Territorial male/breeding pair counts can provide an estimate of ptarmigan density and, if done annually, an indication of population trends. Each site should be set up along established routes with permanent listening posts and counted at least twice during the optimum period (10 to 15 May). Counts should be done at sunrise or just prior to sunset playing *becking* calls at each post. Counts should only be attempted when good conditions prevail (see comments in Discussion Section). Multiple count sites that include controls in lightly impacted areas should be established to provide a comparison with potentially heavily impacted areas.

Collecting only wings from willow ptarmigan can provide both age and sex data with reasonable reliability. However, managers need to know where and when birds were taken to assess possible biases related to winter distribution.

Many years ago Weeden (1963) listed as future concerns for ptarmigan managers the effects of increased human populations, increased numbers of hunters, increased access, and decreased availability of big game hunting opportunity. All of these concerns are now facing us, but the most dramatic is increased access to winter ptarmigan habitat. We have seen a very large increase in the use of snowmobiles, especially by recreational snowmobile users, on ptarmigan wintering areas in Unit 13 (ADF&G 1996: 21, Woodbury 1999). Most biologists believe the obvious decline of ptarmigan populations in Hatcher Pass in Unit 14A and the Caribou Hills in Unit 15C are directly related to human activities in these important ptarmigan wintering/breeding

areas. We should be attempting to monitor these activities where they occur on important ptarmigan wintering or breeding habitats.

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Appendix

PTARMIGAN HUNTER/HARVEST SURVEY

Hunter's name _____ Date _____

Address _____
_____

Phone number: Home _____ Work _____

Date(s) hunted _____

Location: Unit/Subunit _____ Specific _____

Estimated distance from the highway: _____ miles

Habitat: alpine ___ willow basin ___
timber ___ river bottom ___

Transportation:

To the hunt area:	Within the hunt area:
___ Highway vehicle	___ Snowshoes
___ Snowmobile	___ Snowmobile
___ 4-wheeler/ATV	___ 4-wheeler/ATV
___ Airplane	___ Walking (without snowshoes)
___ Other _____	___ Other _____

Number of ptarmigan harvested _____ Species _____

Estimated number of ptarmigan observed: Number of flocks _____
Size of flock(s) _____

Sex and age composition:

	Adult	Juvenile
Male		
Female		