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Status of upland game within Alaska's highway system: A comprehensive report focusing on 2007–2011

William P. Taylor

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Alaska Department of Fish and Game Division of Wildlife Conservation

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Status of Upland Game within Alaska's Highway System: A Comprehensive Report Focusing on 2007–2011

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Cover Photo: Male willow ptarmigan, *Lagopus lagopus*. ©2012 ADF&G/Photo by William Taylor.

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Purpose of this Report

This comprehensive report documents work conducted on upland game within the highway system portions of southern Interior and Southcentral Alaska since the mid-1980s through spring 2011, with emphasis on the last 5 years. The main focus of this work was on spring surveys of grouse, ptarmigan, and hare, specifically sharp-tailed grouse (*Tympanuchus phasianellus*) lek surveys, ruffed grouse (*Bonasa umbellus*) drumming counts, willow (*Lagopus lagopus*) and rock ptarmigan (*L. muta*) territorial male "becking" counts, and snowshoe hare (*Lepus americanus*) direct counts. Additionally, sex and age harvest data were obtained from wings and carcasses of grouse and ptarmigan collected by hunters during the hunting season. Finally, food habits, wing measurements, and weights of grouse and ptarmigan were collected opportunistically.

Introduction

Alaska Department of Fish and Game (ADF&G) research studies and monitoring of upland game bird populations were initiated in the late 1950s by Robert Weeden, who was later joined by Jerry McGowan. Their work focused on life history and population ecology of Interior Alaska grouse and ptarmigan (Weeden 1965). Weeden also supported graduate studies by Larry Ellison, who studied spruce grouse (*Falcipennis canadensis*) on the Kenai Peninsula (Ellison 1972). Work continued through the early 1970s with research on the effects of spring hunting on rock ptarmigan (*Lagopus muta*) along the Steese Highway (McGowan 1975). By the mid-1970s funding for upland game research had ceased. For approximately the next 10 years, very limited data on the status of upland game populations were collected and reported in survey and inventory reports published by ADF&G.

Work on upland game began again in the late 1980s with a translocation of ruffed grouse (*Bonasa umbellus*). Ruffed grouse naturally occur throughout the Interior and in isolated populations in the upper Copper River basin, associated with middle-aged quaking aspen (*Populus tremuloides*) and willow (*Salix* spp.) stands along major drainages. Several large areas of what appeared to be appropriate habitat existed in the Matanuska-Susitna (Mat-Su) valley and on the Kenai Peninsula. Sportsmen groups became interested in establishing ruffed grouse in these areas. After an extensive review process, from 1988 to 1990 ruffed grouse were live-trapped in the Interior and released at 3 locations in the Mat-Su valley, near Palmer (Steen 1995). Subsequent monitoring of the translocated birds indicated ruffed grouse had become established around the release sites and were slowly spreading into adjacent areas.

ADF&G then authorized another translocation onto the northern portion of the Kenai Peninsula. In 1993, population monitoring of ruffed grouse began near Anderson and on Clear Air Force Station (AFS) in the Interior, to determine population status within the natural population cycle of the species. Once the state and federal permitting process was complete and it was determined ruffed grouse were on the increasing phase of their natural cycle, live-capture and translocation were again completed from 1995 to 1997. Birds captured on or near Clear AFS were moved to 3 locations on the Kenai Peninsula (Steen 1999).

At about the same time, it appeared ptarmigan populations were declining. Within Alaska's highway system, some of the most extensive and accessible ptarmigan habitat is located in Game

Management Unit (GMU) 13. Unit 13 is a large GMU located north of the Glenn Highway, south of the Alaska Range, and effectively east of the Parks Highway. By the early 1990s it was apparent that ptarmigan numbers in portions of northern GMU 13 were declining (Taylor 1999). No monitoring of ptarmigan and very little population information were available to determine the extent of these apparent declines.

Hunting may have been a factor. At the time, very liberal ptarmigan seasons and bag limits were in effect and had been for decades with no monitoring of the harvest. Meanwhile, the number of hunters had gone up and some were using technologies that improved hunting efficiency. Beginning with the construction of the oil pipeline in the 1970s and continuing through the present, Alaska experienced a dramatic increase in the human population within the highway system communities, and a corresponding increase in the number of hunters. During this same period, snowmachine technology advanced rapidly, and snowmachines were being used more often in important ptarmigan wintering habitats (Taylor 1999). In 1992, work began to determine the extent of some of these impacts. Paramount among this work was an effort to establish an easy and cost-effective method to monitor ptarmigan population status and density. This work continued through June 1999 and resulted in the survey technique applied to surveys conducted by ADF&G from 1999 through 2011 (Taylor 2000).

Through 1995 very few resources were available for these upland game projects and surveys. In 1996 the Alaska Legislature passed a Capital Improvement Project (CIP) specifically for upland game program use. It funded part of the Kenai Peninsula ruffed grouse transplant and subsequent monitoring of hens that were equipped with radio transmitters. It was also suggested funds be applied to translocating sharp-tailed grouse (*Tympanuchus phasianellus*) into areas previously not occupied by this species. However, at that time, very little was known about the habitat and food requirements of sharp-tailed grouse in Alaska. Therefore, a portion of the CIP funds were designated for the study of Alaska's sharp-tailed grouse by funding a master's degree student through a cooperative agreement with Alaska Pacific University. This study was conducted in the Delta Junction area from 1998 to 2000, and is reported in Raymond (1999) and in Raymond's thesis (2001). Field work on sharp-tailed grouse was continued in the Delta Junction area into 2002 and culminated in a brief report of the management implications (Appendix A).

Upland game surveys on grouse, ptarmigan, and snowshoe hare (*Lepus americanus*), which began at various times in the 1990s, were continued through 2002. From 2003 through 2006 very limited data were collected, mostly by volunteers. In 2007, a short-term nonpermanent, upland game position was created by ADF&G that continued through spring 2011. This seasonal position made it possible to do more extensive survey work.

A summary of grouse and ptarmigan weight data collected from hunter-killed birds or from live birds handled in association with several projects is presented in Appendix B.

Study Area

All research on and surveys of upland game discussed in this report were conducted within the highway system portion of southern Interior and Southcentral Alaska (Fig. 1). Statewide harvest data were collected, most of which came from the road system.

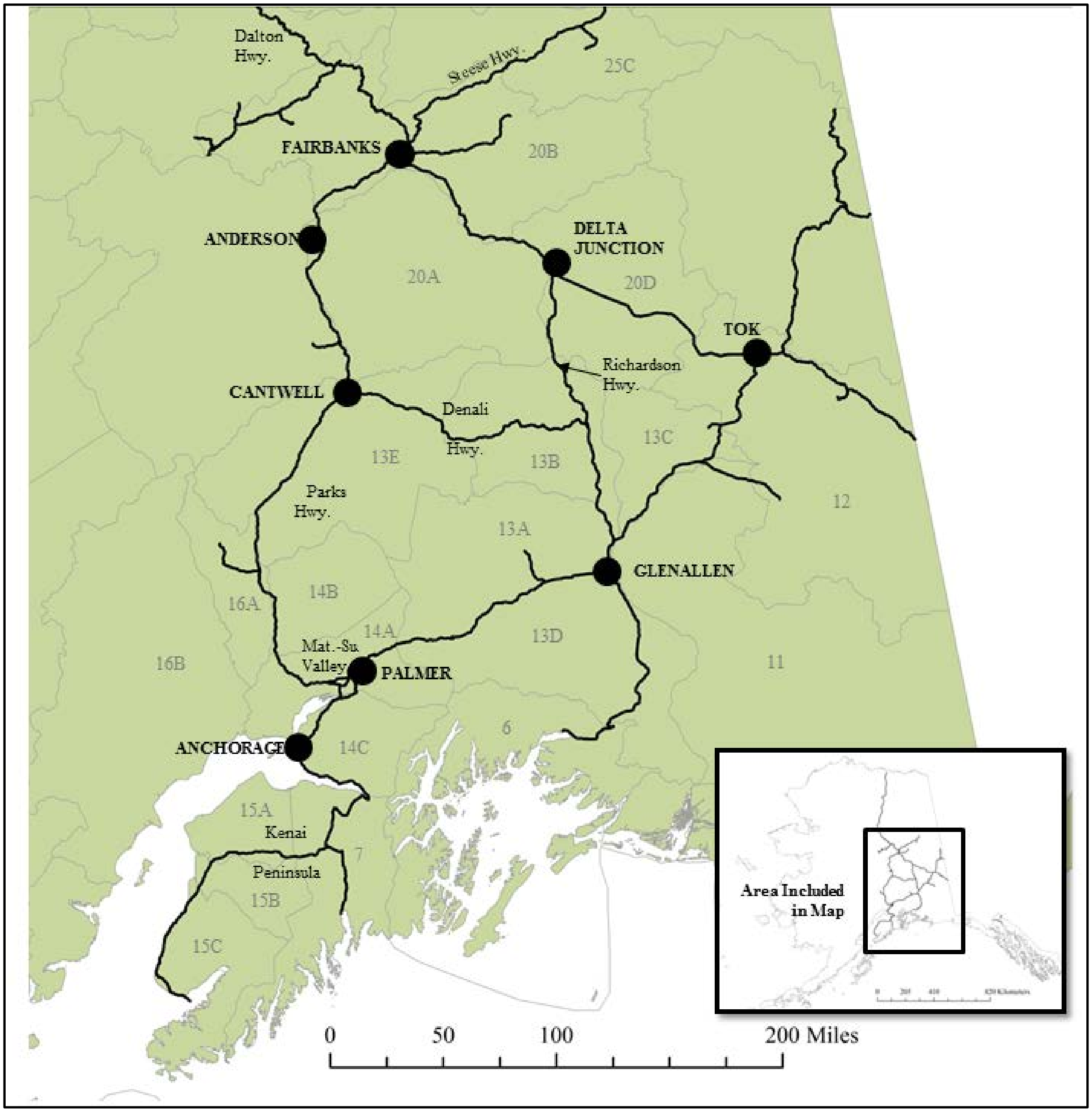

Figure 1. Map of Alaska's highway system in which upland game studies were conducted.

Ruffed grouse drumming counts were conducted in the following areas: 1) Anderson within or adjacent to Clear AFS, 2) Mat-Su Valley, primarily east of Palmer, 3) Tanana and Chena rivers near Fairbanks, 4) east of Delta Junction, 5) Kenai Peninsula east of Sterling, and 6) portions of Ft. Wainwright and Ft. Greely military reservations east of the Tanana River.

Sharp-tailed grouse lek counts were conducted in agricultural areas north and south of the Alaska Highway between Delta Junction and the Gerstle River, and at sites on the portion of Ft. Greely south of Delta Junction and east of the Delta River. Periodic monitoring was also done near

Anderson, Steese Highway east of Central, and Tok, and along the Glenn Highway 20 to 30 miles east of Glennallen.

No specific surveys were conducted for spruce grouse but population data were collected in conjunction with surveys of ruffed and sharp-tailed grouse in both Interior and Southcentral.

Willow ptarmigan (*L. lagopus*) and rock ptarmigan were surveyed in alpine and subalpine habitats (Weeden 1965) adjacent to the highway system. Surveys for willow ptarmigan were conducted at the following locations: 1) Denali Highway at mileposts 15, 52 to 58, and 90 to 97, 2) Parks Highway south of Cantwell from milepost 194 to milepost 208, and 3) Chugach State Park near Anchorage along Powerline Pass Trail and near Eagle River along the South Fork of Eagle River Trail. Data were also obtained from surveys in Denali National Park (C. McIntyre, personal communication). Surveys for willow and rock ptarmigan were conducted simultaneously in the following areas: 1) McCallum Creek Plateau east of the Richardson Highway and 2) Denali Highway from mileposts 9 to 14 and 29 to 36. Surveys for rock ptarmigan were conducted in the following areas: 1) Steese Highway from milepost 84 to milepost 86 on Twelve-mile Summit and milepost 104 to milepost 110 on Eagle Summit, 2) Donnelly Dome south of Delta Junction, 3) Denali Highway north of milepost 12.5, and 4) in Chugach State Park along the ridge between Ship Creek and the South Fork of Eagle River south of Rendezvous Peak.

Surveys for white-tailed ptarmigan (*L. leucurus*) were not attempted due to difficulty in accessing breeding habitats, but periodic explorations of sites within the highway system in the Alaska Range, Talkeetna, Chugach, and Kenai mountains were conducted to document locations of established populations.

Snowshoe hare counts were conducted at several locations in conjunction with grouse or ptarmigan surveys. These counts were conducted in 4 general areas: 1) in GMU 25C along the Steese Highway between mileposts 86 and 104; 2) in GMU 20D along a portion of the Richardson Highway south of Delta Junction, Meadows Road on Ft. Greely, a portion of the Alaska Highway between Delta Junction and the Gerstle River, and Hanson Road; 3) in GMU 20A near Anderson, including the Parks Highway between Clear Road and the Nenana River bridge, the Clear Road, and the Anderson Road; and 4) in GMU 13E near Cantwell along the west end of the Denali Highway and the road into Cantwell. Data were also obtained from surveys conducted by the National Park Service (NPS) in Denali National Park (C. McIntyre, personal communication) and by U.S. Fish and Wildlife Service personnel on the Kenai National Wildlife Refuge (T. Burke, personal communication).

Methods

RUFFED GROUSE

Drumming counts have long been used to assess ruffed grouse populations (Petraborg et al. 1953; Gullion 1966). In Alaska, accessible areas within potential ruffed grouse habitat were used to establish routes with 10 to 12 listening posts spaced approximately 0.5 miles apart. Counts were then conducted during the peak of spring drumming activities from late April through early

May. The counts were conducted during periods of good weather, starting 1 half-hour prior to sunrise or 2 hours prior to sunset. The individual conducting the survey listened for 4 minutes at each post and recorded all the drummers heard during the period (Appendix C). Regardless of how often a specific male drummed, the individual was counted only once. Observations of other ruffed grouse, other grouse species, snowshoe hares, and predators were also recorded. Attempts were made to repeat each route at least twice during the peak period each season.

When there was opportunity to do so, hunter-harvested grouse wings were aged, sex was determined from tails or carcasses, and crops examined for food sources for ruffed, sharp-tailed, and spruce grouse.

SHARP-TAILED GROUSE

Assessment of the sharp-tailed grouse population was accomplished by counting males at lek sites during the peak of breeding activities (Cannon and Knopf 1981; Giesen and Connelly 1993). In Alaska peak breeding activity occurs from mid-April through early May, with activity usually peaking during the last week of April. Display activity at a lek begins prior to sunrise and continues into midmorning before birds begin to disperse. Lek sites were located by listening for one of the several sharp-tailed grouse vocalizations and approached cautiously on foot. Multiple counts were attempted and observations of females, other grouse species, snowshoe hares, and predators were also recorded.

Females were often observed on or near a lek but their numbers varied considerably and many times females may have been in the vicinity but hidden by higher vegetation that usually surrounds a lek site. Therefore, only males at a lek site were consistent and comparable from year to year. Males at leks were easily identified by their enlarged yellow superciliary combs (eyelids), vocalizations, purple air sacs, or dancing displays, which include foot stomping, body positioning, and tail rattling.

SPRUCE GROUSE

The only spruce grouse population data collected during this project were from direct observations recorded in conjunction with surveys conducted for ruffed and sharp-tailed grouse. These observations were restricted due to the limited time spent in appropriate spruce grouse habitat.

To determine the best methods to age hunter-harvested spruce grouse wings collected in the fall and winter, two methods were tested: 1) wear and pigmentation on the outer primaries (P) (Ellison 1968), and 2) the calamus diameter of P1 (Szuba et al. 1987). Alaska spruce grouse are significantly larger than birds found in the southeastern portion of their range in North America (Ellison and Weeden 1979; Szuba and Bendell 1984; Appendix B). Therefore, it was expected that the calamus diameter measurements of P1 might also be larger.

PTARMIGAN

Surveys of territorial male willow and rock ptarmigan were conducted by direct counts using "becking" call (Watson and Jenkins 1964: 149) tapes to elicit responses from the males (Taylor 2000). Counts were done using highway vehicles or on foot.

Wing chord and eighth primary measurements were obtained from willow ptarmigan carcasses of known age and sex to determine if the sex along with the age could be determined when only an individual undamaged wing was available.

Crops were examined for food content from willow and rock ptarmigan shot by hunters during the winter period (October–March). Each crop was examined for an estimated percent of each food type present.

SNOWSHOE HARES

Snowshoe hares were surveyed by direct counts conducted in areas of known hare habitat which had to be driven through when traveling to upland bird survey locations. Most were done near sunrise, but duplicate surveys were occasionally conducted near sunset. Multiple counts for each survey route were attempted.

Results

RUFFED GROUSE

Ruffed grouse drumming count data have been collected in Alaska from 1993 through 2011 (Table 1). In the Interior the most complete counts through this entire period have been conducted near Anderson and Clear AFS; they show substantial cyclic rise and fall in the number of males heard through the years of 2 complete population cycles. In contrast, counts from the recently translocated population in the Mat-Su Valley indicate that population has remained relatively stable with no cyclic tendency (Table 1). The newly established population on the Kenai Peninsula has not done as well; however, a few birds continue to be observed in the vicinity of each of the 3 release sites. Limited harvest data for Interior populations associated with the highway system were also collected (Table 2).

SHARP-TAILED GROUSE

Spring lek count data for sharp-tailed grouse in the Delta Junction/Fort Greely area suggest a gradual population decline from 2007 through 2009, followed by a gradual increase in 2010 and 2011 (Table 3). Numbers of territorial males for this period were low compared to numbers of territorial males observed in the late 1990s (Appendix A). By mid-September birds begin to move from lek and brood rearing areas to wintering areas where dwarf birch (*Betula* spp.) is abundant and available above the snow pack throughout winter. During this transition period their diet changes from berries and green vegetation to dwarf birch catkins (Appendix A). Very limited fall harvest data, primarily from GMU 20D, were collected from 2003 to 2010 (Table 2).

Table 1. Ruffed grouse drumming counts, 1993–2011. Data represent individual birds not density estimates.

Year	Clear AFS	GMU 14A	Ft. Wain.[a]	Chena R.	Delta-Nistler Rd.	Ft. Greely[b]	Ken. Pen.-Skilak	Delta-Ag.
1993	20-21	8						
1994	24	3						
1995	29	10						
1996	34-35	6						
1997	39-41	8						
1998	↓[c]	9						
1999	15-16	10						
2000	7							
2001	7	10						
2002	13-14	3[d]						
2003	21-22							
2004	25-26	6[d]	4					
2005	33-34	11	2[d]	6				
2006	22	11	8	7				
2007	14	10	8	8				
2008	16	10	5	3	7	4	0/2[e]	7
2009	8	9	5	6	3	5		4
2010	1	11	4	2	3	7	0/1	5
2011	9	11	7		3	8		8

Clear AFS and GMU 14A each consist of 4 routes, the remainder have 1 route.

[a] Source: A. Ajmi, Natural Resources/Wildlife, Fort Wainwright.

[b] Source: E. Neipert, Natural Resources/Wildlife, Fort Greely.

[c] Although late spring snow curtailed drumming activity, population was decreasing.

[d] Incomplete survey.

[e] Number of ruffed grouse heard on route versus number heard in nearby area.

Table 2. Percent juvenile estimates from hunter harvested ruffed and sharp-tailed grouse, and willow ptarmigan wings by regulatory year (RY), 2000-2010.

	Interior				Willow Ptarmigan			
	Ruffed Grouse		Sharp-tailed Grouse		Road System		Remote	
RY[a]	*n*	% juvenile	*n*	% juvenile	*n*	% juvenile	*n*	% juvenile
2000					44	34		
2001								
2002								
2003	80	54	32	66				
2004					86	45		
2005	148	69	148	84	91	48		
2006	95	67	123	61	107	25	54	61
2007	94	54	126	70	77	44		
2008					120	33	48	83
2009	19	68	8	38	120	43	100	72
2010			17	47	53	38	85	67

[a] Regulatory year begins 1 July and ends on 30 June.

Table 3. Male sharp-tailed grouse observed on leks in the Delta Junction/Ft. Greely area, 2007–2011.

Lek site	2007	2008	2009	2010	2011
A2-Central	12	12	6	7	3
A2-SW corner	9	7	7	8	9
A2/3	0	0	0	3	1
B-SE, Ag St	4	2	3	2	2
B-NE, S B/W	5	2	0	0	1
B-E central	1	10	9	7	9
B-SW quad	1	0	0	1	1
B-NW corner		3	0	0	1
B-W central			5	1	6
C1-Central	4	4	0	0	0
C2-Central	2	1	2	1	1
E8-Barley Way	0	0	3	4	0
G-NW quad	1	0	0	0	2
H-Knobs	4	1	1	2	4
H-Major		7	7	9	7
H-SW porton	3	1	2	2	0
Robinson-SE	6	3	0	0	0
Robinson-NE	4	1	0	0	1
Robinson-E central		7	7	9	7
1408 Road-Mi 0-2	0	2	0	0	0
I-N section, central		8	0	0	1
L-Central	0	2	4	0	1
L-SW corner					5
O-South	1	1	0	0	0
4B-NW corner	8	6	0	8	6
5-South central		3	4	2	0
TX Range-Sally DZ	22	16	16	17	18
Buffalo DZ	1	3	7	6	12
33 Mi Loop-West primary				7	10
33 Mi Loop-West secondary				4	3
33 Mi Loop-East				4	4
Males/lek	4.19	3.88	2.81	3.31	3.68

SPRUCE GROUSE

Spruce grouse age and harvest data from the Interior and Southcentral were collected from 1997 to 2010 (Table 4). Using wings to age birds by comparing the amount of wear on the outer primaries is reliable for molting birds harvested in early fall, but becomes more difficult and less reliable for birds harvested from late September throughout winter. Conversely, using the distal calamus diameter of P1 to distinguish adults from first-year birds proved quite reliable. With Alaska's larger spruce grouse, it was determined that males with a P1 diameter > 2.4 mm and females > 2.3 mm were adults. Most juveniles have P1 diameters that are ≤ 2.1 mm.

Crop contents collected in the fall from hunter-harvested spruce grouse indicate birds were feeding on berries and other leafy or green vegetation but began to switch over to spruce needles by mid-September. Crops collected in late September through October usually contained only spruce needles. Ellison (1966) found that a large variety of berries can be utilized in early fall by spruce grouse. The prevalence in the diet of these plant species is often associated with their occurrence and availability within the natural habitat of spruce grouse. For example, widespread and common berry-producing species such as lowbush cranberry (*Vaccinium vitis-idaea*) and highbush cranberry (*Viburnum edule*) are commonly utilized by spruce grouse throughout their range. However, five-leafed bramble (*Rubus pedatus*) is rarely utilized but can often be present in crops from birds along Turnagain Arm in a few locations where this berry-producing plant is locally abundant. Northern comandra (*Geocaulon lividum*) and soapberry (*Shepherdia canadensis*) are primarily utilized in specific locations in the Interior, where they are most abundant.

Table 4. Spruce grouse flush and harvest information reported from select hunters, 1997-2011.

	Kenai Peninsula/GMU 14			GMU 20		
Year	% juvenile	*n*	Flushes/hr	% juvenile	*n*	Flushes/hr
1997	75	32	4.3			
1998	65	51	3.4			
1999	50	56	3.9			
2000	49	61	3.0			
2001	48	85	3.0			
2002	63	63	3.0			
2003	50	62	2.9	70	79	0.5
2004	70	97	3.5	65	93	1.4
2005	76	62	3.7	48	98	0.7
2006	43	26		52	74	0.3
2007	58	52		41	102	
2008	36	47	2.5			
2009	44	80	2.1	63	62	
2010	59	65	2.7	30	17	

PTARMIGAN

Willow and rock ptarmigan territorial male count data were also converted into relative density estimates (males/mi^2) for comparison between areas (Table 5). Breeding male densities of willow and rock ptarmigan in GMU 13 and rock ptarmigan in GMU 20D were considerably lower than densities of breeding males of both species observed in Chugach State Park near Anchorage and Eagle River (GMU 14C).

Limited harvest data were collected primarily from hunters hunting along the road system, the majority of which came from northern portions of GMU 13. In addition, harvest data were also collected from locations not accessible via the road system, including the Seward and Alaska peninsulas and western Cook Inlet (Table 2). These data show a large disparity between road-accessible and road-inaccessible locations from 2006 to 2010 in the percent juveniles harvested.

Wing chord and P8 wing measurements were made from approximately 1,020 known-age winter harvested willow ptarmigan collected in GMU 13 from 1997 to 2011 (Table 6). Using only a wing, once the age of the ptarmigan was determined using outer primary pigmentation (Bergerud et al. 1963), the sex could be determined with a high degree of certainty. Wings from adult male willow ptarmigan measured only for wing chord length to distinguish males (≥193 mm) from females (<193 mm) were 90% accurate. If only the P8 length was used, with ≥161 mm for males and <161 mm for females, the results were 94% accurate. However, using both criteria increased the accuracy to 99%. Wings from juvenile willow ptarmigan measured only for wing chord length to distinguish males (≥191 mm) from females (<191 mm) were 89% accurate. When only the P8 length was used to distinguish males (≥160 mm) from females (<160 mm), the results were 93% accurate. Using both criteria increased the accuracy to 95% (Table 6).

Crop contents from 954 willow ptarmigan harvested from October to March were examined for food contents (Table 7). Willow buds and stems or stems alone were in 99% of the crops, usually made up >75% of the total contents, and were the only food source found in approximately half of the crops. Dwarf birch buds, stems, or catkins were found in 48% of the crops, but usually constituted <25% of the total contents, and frequently represented ≤5% of the contents. Berries and green leaves, which made up the remainder of the food items observed (Table 7), can be present in October yet are rarely observed again until mid to late March. When these items were present the percentage of the crop contents they represented varied considerably but was rarely >50% and usually <25%. Crops collected from willow ptarmigan in the winter from other areas in Southcentral Alaska, where their winter range overlaps with mixed birch forest habitat, occasionally contained the catkins of the paper birch (*Betula papyrifera*), but utilization was generally low. In specific areas on the Kenai Peninsula, willow ptarmigan collected in November were feeding exclusively on the buds and stems of dwarf blueberry (*V. caespitosum*), which is found locally in a very limited range in coastal Southcentral Alaska.

The crop contents from a much smaller sample of rock ptarmigan (*n*=53) were also examined (Table 7). Dwarf birch buds, stems and catkins were found in 98% of the crops and usually made up >85% of the contents. Willow buds and stems were found in 64% but usually constituted <15% of the contents. As observed with willow ptarmigan, some of the rock ptarmigan crops collected in October or late March contained berries and green leaves, with the amount varying but usually representing <50% of the total contents.

Table 5. Estimated densities (birds/mi^2) of territorial male willow and rock ptarmigan at spring survey locations, 1997-2011.

		Area	Year														
GMU	Site [a]	(mi^2)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Willow Ptarmigan																	
13B	McCallum RH	2.0	4	6	10						6		3	5	7	8	9
13B	Mi 10-14 DH	2.0	3	6	8	8	3	2	3	5	5	6	3	4	3	5	4
13B	Mi 15 DH	2.0	10	13	12									3	2	3	5
13B	Mi 29-33.5 DH	2.5		4	4		2	2	3	4	4	5	3	3	2	5	1
13B	Mi 34-36 DH	0.75	13	12	17		5	1	1	3	1	8	1	3	3	4	0
13B	Mi 52-58 DH	2.5													0	2	1
13E	Mi 90-93.5 DH	1.875											3	3	4	2	3
13E	Mi 94-97 DH	1.75									3	3	2	2	2	2	2
13E	Mi 194-208 PH	3.0				4		2	0	1	1	3	1	2	2	1	2
14C	Powerline Pass	1.0												13	11	17	18
14C	S Fork Eagle R	0.325												12	9	15	18
Rock Ptarmigan																	
13B	McCallum RH	1.0	4	8	12						2		1	0	1	0	0
13B	Mi 10-14 DH	0.4	0	0	13	8	3	3	0	0	0	3	3	0	0	0	0
13B	Mi 12.5 N DH	2.0														3	4
13B	Mi 29-33.5 DH	0.15		7	13		0	13	7	0	0	0	0	0	7	7	13
13B	Mi 34-36 DH	0.5	2	4	10		0	2	4	2	0	4	0	0	0	2	6
14C	Ship Creek	1.0															6
20D	Donnelly Dome	0.75											1	1	0	1	1
25C	12-Mi Summit	1.0											1	0	0	0	1
25C	Eagle Summit	3.0											2	2	2	1	1

[a] RH - Richardson Hwy; DH - Denali Hwy; PH - Parks Hwy

Table 6. Willow ptarmigan wing chord and eighth primary measurements (mm) grouped by sex and age from birds collected in winter in GMU 13, 1997-2011.

	Adults		Juveniles	
	Males	Females	Males	Females
Wing chord				
Mean	200.3	186.8	196.5	184.8
n	367	233	215	210
Range	188-220	175.5-200	185-210	171-200
Best dividing length	≥193.0	<193.0	≥191.0	<191.0
Error rate	0.090	0.107	0.093	0.119
Percent accuracy	91.0	89.3	90.7	88.1
Primary 8				
Mean	166.3	155.2	163.9	153.4
n	361	235	210	211
Range	157-177.5	145-166	152-177.5	140-164.5
Best dividing length	≥161.0	<161.0	≥160.0	<160.0
Error rate	0.058	0.072	0.105	0.043
Percent accuracy	94.2	92.8	89.5	95.7
Percent accuracy using both wing chord and primary 8 measurements combining males and females:	99.0		95.3	

Table 7. Frequency of occurrence of plants in crops of willow and rock ptarmigan collected in winter (primarily February and March) in GMU 13, 1997-2011.

	Willow Ptarmigan		Rock Ptarmigan	
Plant species	*n*	% occurrence	*n*	% occurrence
Salix spp. (buds, twigs)	947	99.3	34	64.1
Betula nana or *granulosa* (buds, catkins, twigs)	456	47.8	52	98.1
Vaccinium uliginosum (berries)	109	11.4	10	18.9
Empetrum nigrum (berries)	64	6.7	9	17.0
Vaccinium vitis-idaea (berries)	60	6.2	4	7.5
Dryas octopetala (leaves)	27	2.8	7	13.2
Vaccinium vitis-idaea (leaves)	17	1.8	2	3.8
Alnus crispa (catkins)			1	1.9
Empetrum nigrum (tips)			1	1.9
Equisetum sp. (tips)			1	1.9
Unidentified items	2	0.2		
Total crops examined	954		53	

SNOWSHOE HARES

Direct counts of snowshoe hare were conducted in the spring in conjunction with grouse and ptarmigan surveys (Table 8). These counts, along with counts conducted by other agencies, indicate a 9- to 10-year natural cycle with peaks progressing from north to south, and, to a lesser degree, from east to west within the highway system portion of Alaska (Fig. 2).

Table 8. Snowshoe hare counts from four areas within Alaska's road system, 2007-2011.

	GMU 25C	GMU 20D Delta Jct		
	Steese Hwy	Hanson	AK. Hwy	Richardson Hwy
Year	Mi 86-104	Road	Mi 1402-1422	Mi 227-256
2007	21	16	8	85
2008	14	2	3	86
2009	8	1	2	51
2010	3	3	3	31
2011	1	1	1	14

	GMU 13E Cantwell	GMU 20A Anderson/Clear			
Year	Denali Hwy Mi 132-134 & Cantwell Rd	Anderson Road	Clear Road	Parks Hwy Mi 276-280	Parks Hwy Mi 280-283.5
2007	25		5	13	6
2008	16	45	9	20	8
2009	6	11	1	9	6
2010	4	5	0	5	0
2011	4	1	0	3	0

Discussion

RUFFED GROUSE

Ruffed grouse drumming counts do not give an accurate density estimate of ruffed grouse in the area in which they are conducted, as they reflect only 75% or more of the male population within approximately a 250 m radius of each listening post. However, these counts conducted consistently over a period of several years do provide a good indication of the stage of the natural cycle, if the population is increasing or decreasing, and an estimate of the number of grouse that will be available to hunters in the fall.

Several variables can influence drumming count data. Since these counts began in 1993, we have seen no significant difference in counts conducted at sunrise versus sunset, provided good conditions were encountered. Good conditions are characterized by no significant human noises, little or no wind, no precipitation, and temperatures ranging from 25 to 40°F. In 1998 in the Interior, a heavy and persistent late spring snow resulted in very little drumming activity (Table 1), and in other years temperatures well above or below the recommended range resulted in an obvious reduction in activity.

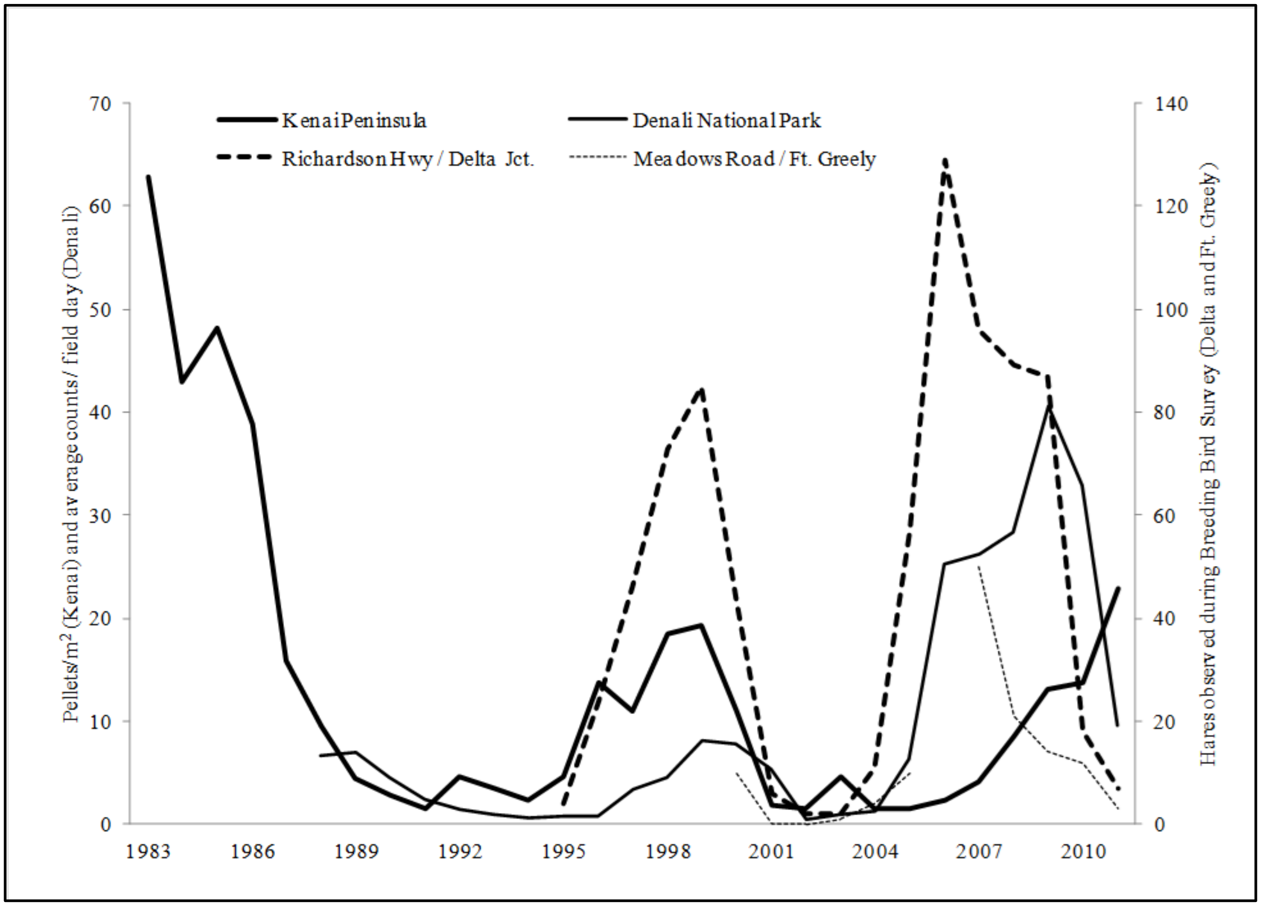

Figure 2. Snowshoe hare population trends from four separate sources within the highway system portion of Alaska, 1983-2011.

Data Sources: Kenai Peninsula – Kenai National Wildlife Refuge - T. Burke; Denali National Park – C. McIntyre; Richardson Hwy / Delta Jct. – S. DuBois; Meadows Road / Ft. Greely – J. Mason.

Male ruffed grouse will occasionally move from their primary drumming site to an alternate site, but this seems to be a rare occurrence and the alternate site is often close to the primary site. Modifications to the habitat, either gradually through vegetation succession or suddenly by fire or human manipulation, can impact grouse densities. It can often be difficult to conduct counts in areas of human habitation due to constant changes to the habitat and noise interference. This has been an ongoing problem in the Mat-Su Valley (GMU 14A), where rapid human population growth and development has and continues to occur. Spring access to trails and some poorly maintained back roads can vary considerably from year to year and annual access must be considered before a route is established.

Most agencies conducting ruffed grouse drumming counts do so by recording and reporting the total number of drums heard at each listening post. An individual male may drum from one to three times or not at all during the four minute listening period, even during the prime periods near sunrise and sunset. In an attempt to remove this variable from the data, we record the number of drums heard along with the compass direction and the estimated distance from the post, and multiple drums from the same bird are counted only once. This reporting method also helps to verify the presence of multiple birds at a listening post when duplicate counts are conducted. In the Interior in years of high densities, listening posts in good habitat will often have 2, occasionally 3, and rarely 4 males heard.

As ruffed grouse populations cycle up or down, the most dramatic changes occur in marginal habitat; therefore, when possible, an area should have multiple drumming count routes which represent both good and marginal habitat.

The Anderson and Clear AFS drumming counts demonstrate an obvious cyclical nature with 5-fold or greater difference between the high and low densities (Table 1). Converting these data and combining them with historical ADF&G data collected using the population index developed by Weeden (1965) provides a 50-year reference of the natural cycle in Interior Alaska. From 1960 through 2011, the ruffed grouse cycle has stayed consistent with the snowshoe hare cycle, with grouse peaking 1 to 2 years prior to the peak in hares (Fig. 3).

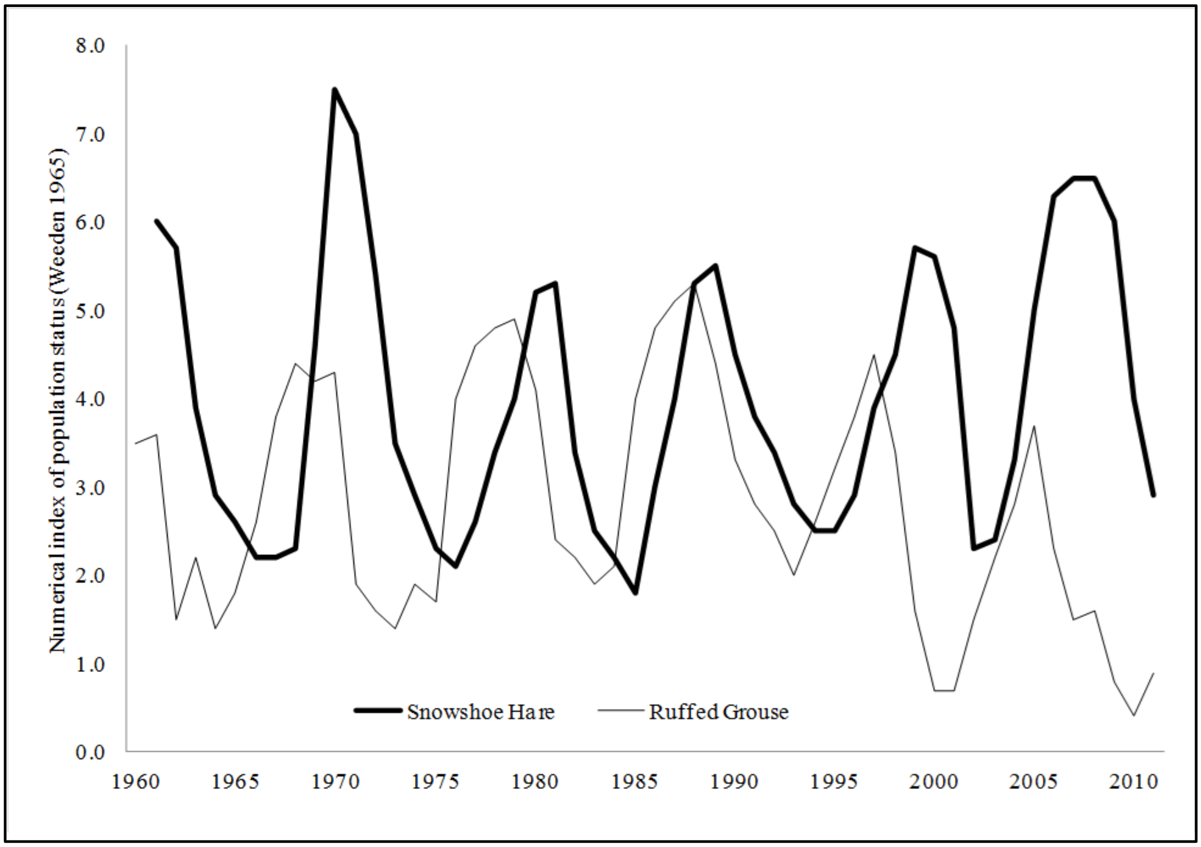

Figure 3. Ruffed grouse and snowshoe hare population status in Interior Alaska, 1960-2011.

Because predator populations of northern goshawks (*Accipiter gentilis*), great horned owls (*Bubo virginianus*), lynx (*Lynx canadensis*), and coyote (*Canis latrans*) tend to remain high at least a year after snowshoe hare populations exhibit a significant decline, it seems reasonable to assume predation is an important factor driving grouse to the levels observed at the low portion of their cycle. Rusch et al. (2000) believed avian predators were responsible for the 8- to 11-year ruffed grouse cycle. They concluded these predators switched to hunting ruffed grouse as hare densities declined. However, a more recent study of predation was inconclusive. Zimmerman et al. (2008) considered predation along with several other possible factors, but could not determine which or if any combination of factors was responsible for the natural cycle of ruffed grouse in Minnesota.

Interestingly, the ruffed grouse population data collected in Interior Alaska from 1960 through 1995 was in synchrony with cycles documented in Minnesota, Wisconsin, and Michigan. However, over the last 15 years this synchrony has slowly reversed, with Alaska's Interior population peak now occurring at the low point in the ruffed grouse population cycle in these Midwestern states.

Reports from qualified observers indicate ruffed grouse in the Mat-Su Valley have slowly continued to expand their range and now occupy areas along the Talkeetna River on the north, near the Matanuska Glacier on the east, around Skwentna to the west, and as far south as the village of Tyonek in western Cook Inlet and the south edge of Anchorage.

The translocation of ruffed grouse to the northern portion of the Kenai Peninsula has not fared as well. Although a limited number of birds have become established and continue to be observed around all 3 release sites, there have been very few reports of ruffed grouse in areas away from the release sites. In the few cases where birds were observed in new areas, they have either failed to become established or their presence has yet to be verified.

SHARP-TAILED GROUSE

Breeding activities of sharp-tailed grouse are also affected by weather conditions, with the greatest activity occurring during dry, clear to partly cloudy mornings. Precipitation, high wind, fog and temperature extremes will adversely affect activity. Sharp-tailed grouse males will continue to dance on lek sites following a snowfall of up to 4 inches, but will not display and may abandon leks if several inches of snow persist for more than a day (Tusji 1992). On a few occasions, following a heavy spring snow event, males have been observed dancing on plowed roads, highways. or runways.

A number of other factors can affect lek count data. As a population decreases in size to the point where only 1 to 3 males are using a specific lek site, the remaining males often show less fidelity to a specific lek, and eventually a lek site may be abandoned. At several locations where historically large, long-term leks were previously located, once the number of males became very low, only single males were observed displaying at locations near one or more females, with the male following the females as they moved from one feeding area to another. If the habitat at or near the lek is dramatically changed by land practices, males may be forced to move to a new site, which can be up to 1 km from the previous site. An example of this was observed in Tract 4-B in the Delta Agricultural Project (DAP; Table 3), where males used 4 different lekking locations between 2007 and 2011. The presence of predators, such as coyote, red fox (*Vulpes vulpes*), northern goshawk, red-tailed hawk (*Buteo jamaicensis*), or northern harrier (*Circus cyaneus*), at or flying over the lek, will cause males to stop activities and often flush the birds off the lek. However, if it is still early in the morning, the males will usually return and continue displaying within 15 minutes after the threat has left the area.

The many forest fires which have occurred in the Delta Junction/Fort Greely area have mostly been beneficial to sharp-tailed grouse. Within 4 to 5 years following a large burn, habitat succession will progress to a stage that attracts sharp-tailed grouse from surrounding areas. Sharp-tailed grouse will continue to use the area for approximately the next 20 years before forest development begins to provide habitat that favors ruffed grouse over sharp-tailed grouse. This transition period favoring sharp-tailed grouse is probably longer in slower succession areas, such as Tok. The large areas which burned in 2004 on either side of the Taylor Highway northeast of Tok and along the Steese Highway near Central are current examples of habitat in early stages of succession with increasing use by sharp-tailed grouse.

Sharp-tailed grouse population densities in the DAP and surrounding areas were estimated to be 4 times higher in the 1990s than current densities. In 2000, densities began declining to the current lows observed between 2007 and 2011 (Table 3). Changes in farming practices appear to be the main cause of this difference. Large-scale land clearing with removal of wind and berm rows resulting in a significant reduction in nesting and brood rearing habitat appears to be the primary cause (Appendix A).

SPRUCE GROUSE

Unlike the wing clapping sounds made by the males of the Franklin subspecies of spruce grouse (*F. c. franklinii*), which occurs in Southeast Alaska, the males of the subspecies occurring over the remainder of Alaska (*F. c. canadensis*) do not produce any wing clapping sounds or vocalizations which can be used to assess breeding male population densities (Boag and Schroeder 1992:7). However, there are roads and trails in good spruce grouse habitat throughout the highway system where displaying males are frequently observed. These areas are usually associated with mixed, mature spruce-hardwood forests near river drainages. If multiple surveys could be conducted within these habitats during early May, it would be possible to get counts of territorial males to therefore assess spruce grouse population trends over time. It appears spruce grouse populations also fluctuate in an approximate 10-year cycle which is synchronous with but usually less extreme than observed in ruffed grouse.

The most practical specimens to collect from spruce grouse hunters to determine age and sex of the harvest are wings and tails. Determining age from wings by comparing the extent of eruption and wear on the outer primary wing feathers is relatively simple on birds shot in August through mid-September. Once the molting of primaries is complete in approximately mid-September, it becomes more difficult to age birds using only a wing. Szuba et al. (1987) found using the calamus diameter of P1 of spruce grouse from Ontario, Canada could reliably separate adults (≥2.05 mm) from juveniles. Examination of P1 feathers from several hundred larger Alaska spruce grouse indicated late fall or winter juvenile birds could also be reliably separated from adults. The calamus diameter is >2.3 mm in adults and ≤2.3 mm in juveniles.

Crop contents collected from birds harvested in the fall indicate spruce grouse switch to feeding exclusively on spruce needles by late September, despite the continued availability of berries and the lack of snow cover often through October and well into November.

PTARMIGAN

Ptarmigan survey results can also be affected by weather patterns, with no precipitation, calm winds, and seasonal temperatures being ideal. The presence or absence of snow does not seem to affect count data. However, late or heavy snow may impact access into or the ability to conduct surveys in some locations. No significant differences have been observed in morning versus evening surveys conducted under similar conditions. Nonterritorial males temporarily present or moving through an area being surveyed can bias counts. Often 2 non-territorial males are observed chasing each other. One or both males may or may not partially respond to the "becking" tape, but in either case will soon leave the area and will not be observed at that site again. Results of becking call surveys conducted during years of high densities are more difficult to interpret due to what could be called the "chain reaction" effect. This reaction occurs when a nearby territorial male responds to the tape by calling and displaying, which then causes one or more males in surrounding territories to also respond, which may in turn stimulate additional males. The observer must carefully locate and record the location of all of these males. However, only males within 250 m of a post are counted. Also, under ideal conditions, a distant male (>250 m) may call briefly in response to hearing the tape but will not fly towards the observer or continue calling. These males are documented but not counted as part of the survey, as they are outside of the standard response zone. The presence of avian predators, including gyrfalcon (*Falco rusticolus*), golden eagles (*Aquila chrysaetos*) and northern harriers will cause ptarmigan to seek cover and fail to respond to the becking call for a period of time, usually ≤15 minutes. Red fox have been observed flushing males from their primary station within their territory.

Habitat changes usually come very slowly to ptarmigan breeding areas with the exception of human-initiated mining, road construction, or other destructive activities. Therefore, long-term trends from specific areas are more reliable than from grouse or snowshoe hare habitats, where fires and vegetation succession can result in significant changes over shorter periods of time.

In June of 2006, the southern Interior, and particularly the central Alaska Range, experienced an extended period of very cold, wet weather conditions. This severe weather occurred over a 10-day period centered on the third week of June, which is also the period most ptarmigan clutches are hatched. These poor conditions were somewhat detrimental to grouse chicks in portions of the Interior, but were extremely lethal to recently hatched ptarmigan broods across the entire length of the Denali Highway and into Denali National Park (C. McIntyre, personal communication). At the elevation of good ptarmigan breeding habitat, this weather pattern started with cold rain and strong winds that continued for several days and culminated in 3 days of heavy wet snow which accumulated to over a foot and persisted for several more days. A sample of 107 willow ptarmigan shot by hunters in GMU 13 during the 2006–2007 season yielded only 25% juveniles, which is the lowest ever recorded for an Alaska ptarmigan population (Table 2).

From 2007 through 2010 the percent juveniles remained relatively low for GMU 13 ptarmigan, when compared to the data collected in remote areas (Table 2). As a result, ptarmigan densities in the central Alaska Range, which were expected to peak in 2008–2009, were up only slightly over the low point in the natural cycle, which occurred in 2002–2003. Willow and rock ptarmigan populations in GMU 13 rebounded some in 2010 and 2011 but are still well below the modest peak observed in 1999 (Table 5).

The reliability of determining the sex of willow ptarmigan harvested in winter (October – March) from GMU 13 using only wing measurements appears to be sufficient to use with age data to properly evaluate the percent juveniles in a population. The P8 measurement was a little more accurate than the wing chord measurement for both adults and juveniles, and is the easiest measurement to make with less chance of variance due to technique. However, using both measurements provided the most accurate data (Table 6). The data are most reliable for adults (99% using both), and useful in evaluating biases associated with the winter sex segregation of ptarmigan.

Willow and rock ptarmigan within the road system utilized willow and dwarf birch, respectively, as their primary winter foods from October through March (Table 7). Winter food availability does not appear to be a limiting factor for either species.

Willow and rock ptarmigan populations in North America fluctuate in an approximate 10-year cycle (Hannon et al. 1998), which has been reported to be in synchrony with the snowshoe hare cycle where these species coexist (Boutin et al. 1995). However, within Alaska's highway system this relationship seems to be more variable. For example, in 1962 ptarmigan peaked 2 years after snowshoe hares peaked. In 1968 and 1978, the ptarmigan peaks were 2 years prior to the peaks observed in hares. In 1989 and 1999, ptarmigan and hares peaked together. The most recent ptarmigan peak (2010) came 2 years after the peak in snowshoe hares. Since winter food for ptarmigan within the highway system portion of Alaska is not a limiting factor, and the synchrony of their cycle with respect to the hare cycle and their mutual predators is variable, it is unclear what mechanisms might be controlling the ptarmigan cycle.

SNOWSHOE HARES

The snowshoe hare 8- to 11-year cycle is the most dramatic of our upland game species. Densities fluctuate 5- to 25-fold each cycle (Hodges et al. 2001), with occasional extremes of ≥100-fold (Bailey et al. 1995). In Alaska many factors influence the amplitude of these cycles, with habitat conditions likely the most important. Highest snowshoe hare densities are found in early succession brush habitat that provides both food and cover. In mountainous subalpine regions near tree line, where willow, alder (*Alnus* spp.), and dwarf birch are the dominant vegetation and successional patterns are much slower, hares will maintain higher densities in small geographic areas regardless of the stage of their cycle. In lower elevation mixed hardwood and spruce forest habitats the cyclic changes are heavily influenced by the vegetation succession in conjunction with the phase of the cycle, with the highest peaks associated with young serial stages. An example of this effect occurred on the Kenai Peninsula in the early 1980s when snowshoe hares peaked at very high levels. In 1969 a major wildfire burned over a large portion of mixed forest in GMU 15A and the vegetation was still in early stages of succession when the hare peak came in 1983 (Fig. 2).

Snowshoe hare count data, from either direct counts or pellet transects (Krebs et al. 1987), are also affected by vegetation changes, which can be very gradual (natural succession) or sudden (fires or mechanical clearing). Direct counts along roads and highways are also affected by current weather conditions, time of day, other traffic in the count zone, and recent modifications to the highway right-of-way. Direct counts are more reliable if multiple counts can be conducted.

Management Implications

Available count data suggest that in the central Alaska Range rock ptarmigan densities reached a brief, very modest peak in 1999. Since then populations in several areas along the highway systems, primarily in GMU 13B, have declined and remain at very low levels (Table 5). Therefore, in 2009 ADF&G biologists recommended and the Board of Game adopted a shortened hunting season for ptarmigan in GMU 13B, closing 30 November instead of 31 March. This action was and continues to be consistent with research that has concluded winter hunting mortality is additive (Ellison 1991; Small et al. 1991; Steen and Erikstad 1996; Smith and Willebrand 1999; Sandercock et al. 2011). Although willow ptarmigan, whose densities were also well below historical levels in this area, seem to be benefitting from this action, rock ptarmigan have yet to respond (Table 5). Future research on the extent and cause of these apparent declines in rock ptarmigan populations is warranted.

Current agricultural practices in the DAP have been detrimental to sharp-tailed grouse populations (Appendix A). However, other large tracts of land in the area can be managed to improve sharp-tailed grouse habitat. The 90,000 acre Delta Junction State Bison Range, which is located south of the Alaska Highway between Fort Greely and the Granite Mountains, is one example. This range is managed by ADF&G primarily for diverting bison (*Bison bison*) from migrating onto grain fields north of the highway prior to the fall harvest. When practical, land management practices should take into account ways to maintain the maximum amount of edge habitat between wind rows and open fields to increase sharp-tailed grouse nesting and brood rearing habitat. Also, on Fort Greely, controlled burns and land clearing practices can be influenced by recommendations from ADF&G staff through biologists working on the reservation to benefit sharp-tailed grouse.

Although snowshoe hares reached very high densities in most of the southern Interior from 2006 to 2009, and moderately high densities on the Kenai Peninsula from 2009 to 2011, hares in the lower Mat-Su Valleys (GMU 14A and B) reached only modest densities. This occurred even though there were extensive areas of early successional habitat available as a result of fires and mechanical clearing of mature forest. Historically hare densities have peaked at much higher levels in this area. As better snowshoe hare densities in GMU 14A and B would be very beneficial to the hunting public, efforts to expand and improve hare populations should be a high priority.

Climate change in Alaska is affecting both flora and fauna. Insect infestations and diseases are significant threats to boreal and coastal forests and have been increasing with the recent increases in mean ambient air temperature. Alaska's forest health is being monitored by the U.S. Forest Service, Alaska Division of Forestry and the University of Alaska-Fairbanks and documented in an annual joint report entitled "Forest Health Conditions in Alaska." With our gradually warming climate this report has documented exponentially increasing acres being damaged by many insect pests and diseases during the last decade. The cool, wet summer of 2008 was an exception with decreases in acres affected by most agents. The reports have documented extensive effects by various insects or diseases on spruce, aspen, birch, willow, and alder, among other plant species. Regardless of whether or not damaging agents actually kill the plant, they obviously are very stressful and likely have negative effects on the nutritional quality of the plant. Many of these plant species are heavily utilized and critical to the survival of Alaska's upland game species. For example, the 2007 report stated the 10-year cumulative area of spruce forest mortality in Alaska from the spruce beetle (*Dendroctonus rufipennis*) exceeded 2 million acres. This beetle-caused mortality has been severe on white spruce (*Picea glauca*) stands throughout Southcentral Alaska. Spruce grouse in this area are totally dependent on white spruce for both food and cover from late September through April.

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Appendices

Appendix A. Management implications for sharp-tailed grouse based on research findings from work conducted in the eastern Interior from 1998 to 2002.

Sharp-tailed Grouse Research

William P. Taylor

The following comments and recommendations are based on fieldwork I conducted in association with Rick Raymond's MS project, which began in the fall of 1998 and ran through April 2000, and work I continued from May 2000 through the spring of 2002.

This work was conducted near Delta Junction. The primary focus was on the Delta Agricultural Project (DAP), but encompassed a much larger area including Fort Greely Military Reservation and lands north of Delta Junction to Shaw Creek Flats and east to the upper drainages of the Healy River.

<u>Winter Range</u>

Winter range varied markedly in general habitat type and elevation. Sharp-tailed grouse utilized subalpine benches across the edge of the Granite Mountains, the north slope of the Alaska Range, and the headwaters of the Goodpaster and Healy Rivers; portions of recently burned areas on Fort Greely and surrounding areas; and muskeg bog areas with islands of black spruce along the Tanana River, on Shaw Creek Flats, and the flats associated with the mouths of the Healy, Goodpaster and Volkmar Rivers. The major similarity all 3 of these markedly different habitat areas had in common was dwarf birch is the most dominant plant found above the snow pack through most of winter.

<u>Lek Habitat</u>

In the DAP lek sites were usually open zones that were elevated above the surrounding terrain. The habitat at lek sites consisted of bare ground or sparse grass < 6 inches in height with very little or no additional vegetation over that height. Occasionally lek sites were in very open areas, like recently mowed Conservation Reserve Program (CRP) fields, several hundred yards from good cover. However, most lek sites were within a few yards of dense cover with considerable over story. Leks found on Fort Greely and along the pipeline corridor were on knobs with bare ground and low subalpine vegetation. The vegetation surrounding the knobs consisted primarily of dwarf birch, willow, grass and scattered small black spruce. Along the Mi 1408 Trail, sharptails used the gravel or bare ground surface of the trail itself or open sparse grass patches within recently burned zones for lek activities.

<u>Nesting and Brood Rearing Habitat</u>

In the DAP hen sharp-tailed grouse used the edges of wind breaks, overgrown burn piles, CRP fields containing thick clumps of grass, and areas of natural cover with dense understory for nest cover. Although dense understory was an obvious nest site requirement, most nests were very close (< 5 feet) to open grass or grain fields. The sharptail hens we radiotagged began laying eggs in early May. Most chicks were hatched around mid June. Broods were most frequently found in the cover of windrows or overgrown areas but were often located along edges of open CRP, natural grass or grain fields where insects and young sprouting vegetation could easily be found.

Migration

Most of the sharp-tailed grouse in this study moved or migrated considerable distances (10 to 40 and occasionally more miles) between winter and summer ranges. All but one of the approximately 70 radiotagged birds left the DAP or surrounding area in mid-October for their wintering area. By November sharptails were established on winter ranges where they stayed relatively stationary until March, when they began moving back to summer ranges. By mid-April most birds were back on their summer range where they also occupied relatively small territories. Sharptails on Fort Greely and other natural habitat areas appear to move much smaller distances between summer and winter ranges.

Diet

Grasshoppers were found to be the most important mid to late summer food item for sharp-tailed grouse. This gradually changes over to the berries of kinnikinnick (*Arctostaphylos uva-ursi*) and lowbush or mountain cranberry (*Vaccinium vitis-idaea*) in the fall. Green leafy vegetation and blueberry (*Vaccinium uliginosum*) berries are also utilized at a much lower rate. Barley grain is another food occasionally used in September and October, but was not a significant item for most of the sharptails. By October birds are moving to winter ranges and shifting to dwarf birch catkins, which provides the bulk of their food source through winter. From November through February the birds feed almost exclusively on these catkins. In March sharptails are still heavily utilizing dwarf birch but also feed on over-wintering berries (blueberry and lowbush cranberry). By mid-April the grouse have moved back to summer ranges and through mid-May were often observed “budding” on aspen leaf buds as they were starting to emerge. Overwintering kinnikinnick berries and emergent green vegetation are also utilized in the spring.

Recommendations

It is very clear winter range is not a limiting factor within the natural range of Alaskan sharp-tailed grouse. The limiting factor of the sharptail population in this study area is nesting and brood rearing habitat. The establishment of the DAP, followed by the poor success of most of the original farmers, and the expansion of the CRP program were a tremendous boon to sharp-tailed grouse. I believe what benefited sharptails the most was the numerous windrows of natural vegetation and berm rows or piles (bulldozed trees and brush pushed into rows or piles overgrown with early succession vegetation) among the CRP and grain fields that created extensive “edge effect.” In addition, many fields were initially cleared and abandoned to gradual plant succession. It apparently takes 20 to 25 years for cleared land to reach a successional stage that is no longer preferred by sharp-tailed grouse and begins being used by ruffed grouse.

Unfortunately, a current farming practice employed by most of the farmers still actively attempting to grow grain is to widen fields by removing windrows or berm rows and piles. This additional clearing has occurred on Tracts C, D, F, N, O, 4 and 5, and on other fields adjacent to the DAP fields. In all cases it has been detrimental to sharp-tailed grouse populations around those areas. Anything that can be done to convince landowners to leave windrows and berm rows or piles in place would benefit sharp-tailed grouse.

I have not observed any sharp-tailed grouse lek, nesting, or brood rearing activities on either the Gerstle or Panoramic Fields on the Delta Bison Range. I believe small changes in management practices could greatly increase the use of these areas by sharp-tailed grouse. Currently there are numerous windrows, but these rows are too narrow, consist of homogeneous sized willow and aspen, and have very little ground cover. Widening the windrows and permitting understory plants to develop along both sides could greatly enhance the habitat quality for sharp-tailed grouse. If additional clearing is done on either of these fields, the cultivated or grass rows should be kept narrow separated by 40–50 feet wide windrows. The center portion of the windrow should remain undisturbed natural habitat. The outside portions should be initially disturbed but then left to form dense ground cover with aspen and willow sprouts. These clearing methods would over time provide good nesting and brood rearing habitat.

In nonagricultural areas wildfires have been very beneficial to sharp-tailed grouse, along with other species that benefit from early successional vegetation stages. Promoting controlled burns and “let burn” policies with fires not threatening human habitation will continue to benefit all of these species.

Appendix B. Weights in grams of Alaska upland birds.

		Adult male			Adult female			Juvenile male			Juvenile female		
Species	Season	*n*	Mean	Range	*n*	Mean	Range	*n*	Mean	Range	*n*	Mean	Range
Ruffed grouse	Fall	40	642.4	520-795	38	581.7	480-665	75	600.0	530-730	81	539.8	425-625
Sharp-tailed grouse	Fall	18	777.2	700-845	11	690.9	625-790	20	741.5	665-820	16	638.1	540-740
Sharp-tailed grouse (adults and yearlings combined)	Spring	37	783.0	690-945	14	689.3	620-880						
Spruce grouse	Fall	15	625.0	585-695	10	614.3	575-650	4	608.7	567-672	6	531.3	460-569
Rock ptarmigan - Attu I.	Late-spring[a]	20	509.7	450-565	33	615.9	540-710	11	516.7	460-590	9	593.7	520-630
Willow ptarmigan	Winter	25	555.9	515-622	21	516.0	450-594	12	555.3	515-630	22	481.8	400-560

[a] All females were gravid with developing eggs. An additional adult male and female were handled in September and weighed 565 and 485 grams, respectively. Data provided by US Fish and Wildlife Service, Alaska Maritime Refuge.

Appendix C. Ruffed grouse drumming count survey form.

RUFFED GROUSE DRUMMING COUNT SURVEY FORM

______________________ Date	______________________ Observer
______________________ Route Name or ID	______________________ General Location

Time: Start ______________________ End ______________________

Weather Conditions (Circle all choices that apply)
Clear Partly cloudy Cloudy Overcast Dry
Drizzle Rain Recent rain Fog Snow

Percent (%) Snow Cover (Circle)
0 10 20 30 40 50 60 70 80 90 100

Noise (Circle 0=none, 10=passing train)
0 1 2 3 4 5 6 7 8 9 10

Plant Phenology (Circle 0=no leaves, 10=complete leaf emergence)

Aspen	0	1	2	3	4	5	6	7	8	9	10
Birch	0	1	2	3	4	5	6	7	8	9	10
Alder	0	1	2	3	4	5	6	7	8	9	10
Balsam Poplar	0	1	2	3	4	5	6	7	8	9	10

INSTRUCTIONS

1. All counts should begin ½ hour before sunrise or 2 hours before sunset. Check newspaper for times.
2. Temperature should range between 25° and 40° F.
3. Do not attempt survey in the rain or in winds exceeding 10 mph.
4. Move 15-20 feet from vehicle for listening.
5. Record any drums heard outside of the listening period or between posts in the remarks section.
6. Record magnetic compass heading (s) from listening post to bird (s) heard drumming and estimated distance.
7. Provide all information requested on survey form.
8. List of equipment: a) Data sheet; b) Pencil; c) Compass; and d) ATV

Beaufort Wind Scale

Smoke rises vertically	no wind
Smoke drifts	1-3 mph
Wind felt on face	4-7 mph
Small twigs in constant motion	8-12 mph
Dust rises, trees sway	no survey

Post	Time or Odometer Setting	Drums Heard in 4 minutes	Compass Heading (s) and Distance (s)	Wind Velocity	Remarks
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					