Wildlife Management Report ADF&G/DWC/WMR–2021–1

Status of Grouse, Ptarmigan, and Hare in Alaska, 2019 and 2020

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Alaska Department of Fish and Game Division of Wildlife Conservation

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Cover Photo: ©2016 ADF&G. Rock ptarmigan (*Lagopus muta*) chick in Interior Alaska. Photo by Heather McFarland.

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Introduction

Species considered small game in Alaska are defined by the Alaska Department of Fish and Game (ADF&G), Division of Wildlife Conservation (DWC) for regulatory purposes as grouse, ptarmigan, and hare. Alaska has 7 species of grouse and ptarmigan (Tetraonidae; Storch 2000) including ruffed (*Bonasa umbellus*), sharp-tailed (*Tympanuchus phasianellus*), sooty (*Dendragapus fuliginosus*), and spruce grouse (*Falcipennis canadensis*); and rock (*Lagopus muta*), white-tailed (*L. leucurus*), and willow ptarmigan (*L. lagopus*). In addition, Alaska has 2 species of hare (Leporidae) including Alaska (*Lepus othus*) and snowshoe hare (*L. americanus*). All 9 species of small game can be legally harvested in Alaska with liberal seasons and bag limits for all Game Management Units (Unit; Fig. 1).

RUFFED GROUSE

Ruffed grouse reside in Interior, Southcentral, and small localized areas of Southeast Alaska near large river mouths (e.g., Stikine and Taku rivers). Ruffed grouse are native to mixed forest areas in the Interior and portions of Southeast. Ruffed grouse were translocated to the Matanuska-Susitna Valley (Mat-Su; Fig. 2) in the late 1980s and to the Kenai Peninsula in the mid-1990s, from populations near Anderson (Steen 1995, 1999). In the Mat-Su, translocated populations have expanded their range to include the entire lower Susitna River basin (just south of Cantwell), west to the southern slopes of the Alaska Range, south of Tyonek in west Cook Inlet, and up the Matanuska River (east of Chickaloon). On the Kenai Peninsula, translocated populations have expanded their range very little, and only a handful of birds have been observed on the Kenai Peninsula in the past 5–10 years. The cause of this is unknown; however, the more maritime climate and predominance of spruce may influence population growth and range expansion.

Population monitoring of ruffed grouse prior to the 1990s was primitive, done primarily through hunter questionnaires. To provide a better indication of the status of these species throughout their range, DWC initiated spring breeding surveys near Palmer (Unit 14A), following translocation in 1992, near Anderson in 1993 (Unit 20C), Delta Junction in 2008 (Unit 20D), Tok in 2014 (Unit 12), and Fairbanks in 2016 (Unit 20B). Spring breeding surveys have also been conducted intermittently on the Kenai Peninsula, near Fairbanks, and in the McGrath area. Over the last decade, wings collected from harvested ruffed grouse have provided information on harvest composition and brood production from various populations. Other work done in coordination with the Ruffed Grouse Society and the Founding Forty has focused on habitat modification projects intended to provide greater hunting and viewing opportunities near Fairbanks, Delta Junction, Tok, and the Mat-Su.

SHARP-TAILED GROUSE

Sharp-tailed grouse reside in Interior Alaska and portions of the upper Copper River basin. They are typically observed in the upper Koyukuk River, Tanana River, middle and upper Yukon and Kuskokwim rivers, and at lower elevations along portions of the Wrangell–St. Elias Mountains. However, observations have also been made of sharp-tailed grouse in the upper Nenana River, areas west and north of Glennallen (Units 13A and 13D), and areas in Southwest Alaska, where

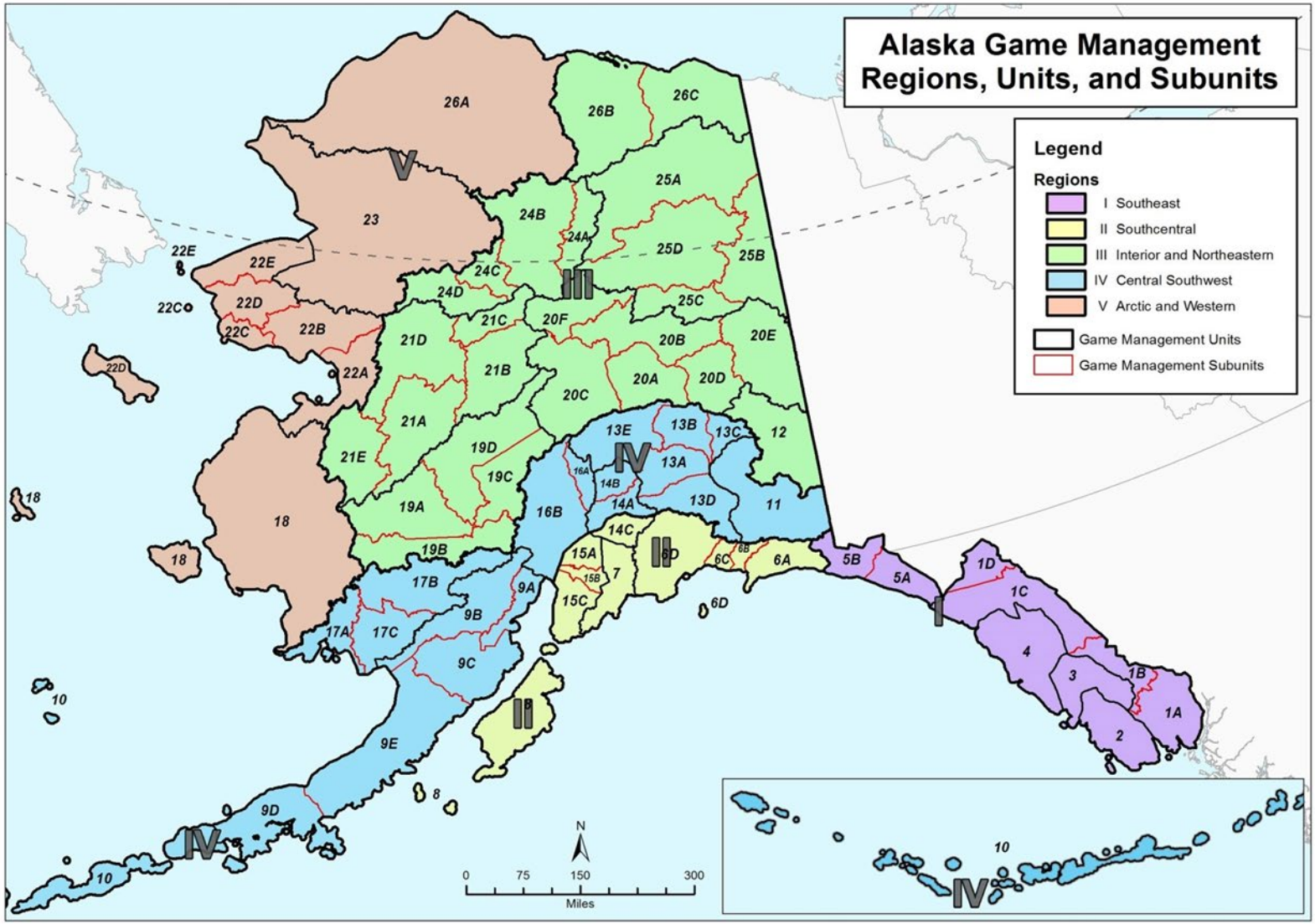

Figure 1. State of Alaska Game Management Units.

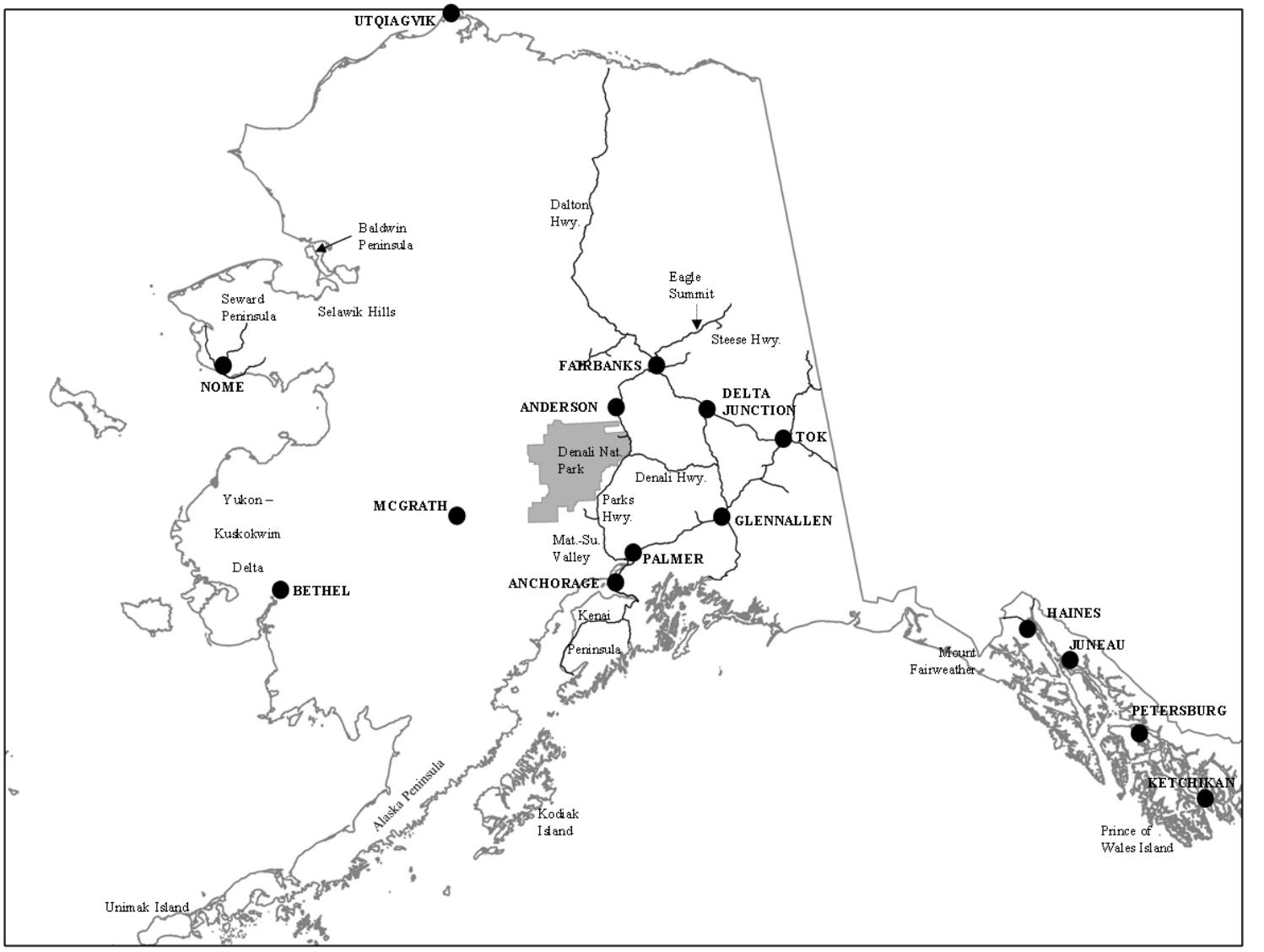

Figure 2. Alaska road system and general locations at which abundance surveys or research studies were completed or field observations were made. Locations are referred to in this report.

they are much less abundant. Sharp-tailed grouse prefer recently burned areas, open grass-shrub habitat, agricultural lands, sparse shrub-spruce at timberline, and muskegs.

Early monitoring of sharp-tailed grouse was done primarily through hunter questionnaires. Biologists working for DWC established spring breeding surveys for sharp-tailed grouse in Interior Alaska near Tok in the early 1960s. These roadside surveys were later expanded to other areas near Delta Junction and Manley Hot Springs (Unit 20B) in the early 1980s. Between the early 2000s and 2013 DWC was limited to conducting spring breeding surveys of sharp-tailed grouse in Delta Junction on the Delta Junction Agricultural Project (DJAP). Since April 2013, with the help of the University of Alaska-Fairbanks (UAF) Cooperative Extension Service and volunteers, efforts were made to identify additional leks near Delta Junction and Tok. Several lek sites near Tok have been identified and have been monitored annually since 2014. Like ruffed and spruce grouse, wings collected from harvested sharp-tailed grouse over the last decade have provided valuable information on juvenile production. In addition to population monitoring, there have been several research projects (Raymond 2001, Paragi et al. 2012) that have taken place in the DJAP that have furthered our understanding of seasonal habitat selection of sharp-tailed grouse.

SOOTY GROUSE

Sooty grouse (formerly known as blue grouse) is the largest of the grouse species in Alaska and resides in the coastal rainforest of Southeast, from approximately Mount Fairweather south, including Units 1 and 3–5 (Zwickel and Bendell 2004; Fig. 1). However, this grouse is not found on Prince of Wales Island (Unit 2) or immediately adjacent islands. Male sooty grouse are often found in Sitka spruce (*Picea sitchensis*), mountain (*Tsuga mertensiana*) and western hemlock (*T. heterophylla*) emitting a low, guttural "hoot" during the breeding season.

Historically, monitoring of sooty grouse was done primarily through hunter questionnaires and wing collections from hunters. Beginning in April 2015, spring breeding surveys were established near Juneau (Unit 1C) and Petersburg (Unit 3) along trails and roadways and will be continued annually to monitor changes in breeding abundance. In April 2019, additional survey routes were created in Haines (Unit 1D) and Ketchikan (Unit 1A).

SPRUCE GROUSE

Spruce grouse is the most ubiquitous grouse species in Alaska. This grouse is found throughout most of forested Alaska, with the exception of Southeast Alaska, where spruce grouse occur only on Prince of Wales Island and immediately adjacent islands. Spruce grouse are often observed in mature white spruce (*P. glauca*) and paper birch (*Betula papyrifera*) woodlands and occasionally in black spruce (*P.mariana*) bogs.

To supplement information gathered through hunter questionnaires, roadside surveys of spruce grouse were initiated on the Steese Highway northeast of Fairbanks and along the Taylor Highway northeast of Tok in 1965 (Ellison and Weeden 1966). The surveys continued until funding for small game projects declined around the mid-1970s. Around the same time, DWC supported a graduate student who conducted research on spruce grouse on the Kenai Peninsula

(Ellison 1972). Spruce grouse is a very difficult species to assess using more traditional methods like spring breeding surveys or summer brood surveys due to their inconspicuous mating displays. As a result, less has been known about spruce grouse population abundance and productivity. However, beginning in fall 2019, DWC initiated a fall roadside evaluation survey method in the Mat-Su (Units 14 and 16). This method takes advantage of spruce grouse early morning "graveling" behavior along rural gravel roads. Counts are completed before (<10 August) and during the fall hunting season. In addition, much is learned about spruce grouse production through hunter harvested wing collections. After the fall 2020 counts, the survey data will be reviewed to evaluate the effectiveness of the technique and provide recommendations on the best method moving forward.

ROCK PTARMIGAN

Rock ptarmigan is the second most abundant ptarmigan species in Alaska and can be found throughout the state, including the Aleutian Islands and Southeast Alaska. Rock ptarmigan typically inhabit higher elevation habitat, more exposed rock faces, scree slopes, and alpine ridges. Alpine areas with abundant dwarf birch (*B. nana* and *B. glandulosa*) provide good habitat and are likely places to observe rock ptarmigan.

Population monitoring and research was initiated at Eagle Summit (Unit 25C) on the Steese Highway by DWC in the late 1950s to better understand life history and population ecology of rock ptarmigan (Weeden 1965b). Concern over the potential impacts of hunting on the easily accessible ptarmigan population near Eagle Summit led to additional research in the early 1970s (McGowan 1975). Lack of funding in the 1980s brought the rock ptarmigan monitoring program at Eagle Summit to an end, and further information on rock ptarmigan populations was gleaned using wing collection and hunter questionnaires. Declines in rock ptarmigan populations along the Denali Highway in the 1990s led to concerns of potential overharvest by hunters. This concern prompted DWC to initiate spring breeding surveys along the Denali Highway (Units 13B and 13E) in the late 1990s. As more resources became available, monitoring programs were initiated along the Steese Highway near 12-mile and Eagle summits, near Donnelly Dome (Unit 20D), and Isabel Pass (Unit 13B), and most recently at various locations throughout the Kenai Mountains (Units 7 and 15A, 2013), within Denali National Park (DNP, Unit 20C, 2014), and near Mount Fairplay (Unit 12, 2015). Since 2013, the statewide Small Game Program (SGP) has completed 2 rock ptarmigan research studies examining movement, mortality, and breeding success within Unit 13B (Merizon et al. 2018) and near Eagle Summit (*In prep*). The study near Eagle Summit has also completed annual spring breeding surveys within the study area formerly used by researcher Robert Weeden in the 1960s and early 1970s. Beginning in spring 2018, the SGP in cooperation with UAF has initiated a third research study examining rock ptarmigan reproductive ecology and population productivity between Eagle Summit and the Denali Highway (Unit 13B) populations (*In Prep*).

WHITE-TAILED PTARMIGAN

White-tailed ptarmigan is the smallest species of ptarmigan and inhabits high elevation alpine habitat within the Alaska Range and south through Southeast Alaska. White-tailed ptarmigan are very rarely confirmed north or west of the Alaska Range. However, periodically white-tailed

ptarmigan are reported harvested by hunters along the western Alaska Range, near the South Fork of the Kuskokwim River. On one rare occasion, a white-tailed ptarmigan was harvested near Whitefish Lake (Units 19A in 2016). This species is endemic to North America and populations can be found in high alpine portions of Southeast Alaska, coastal British Columbia, and the western United States south to New Mexico.

Due to their more remote and relatively inaccessible habitats, monitoring of spring breeding abundance of white-tailed ptarmigan is difficult. Information recorded on white-tailed ptarmigan populations has been obtained primarily through hunter questionnaires and wing collection from hunters.

WILLOW PTARMIGAN

Willow ptarmigan is the most common and abundant ptarmigan species in Alaska, occurring in most alpine and subalpine non-forested habitats throughout the state. However, this species is not found in the Aleutian Islands west of Unimak Island or the islands off the west coast of Alaska. Willow ptarmigan are commonly found in montane valley bottoms and along rivers where willow (*Salix* spp.) shrubs are abundant.

As with the other grouse species, early monitoring of willow ptarmigan was done through hunter questionnaires and by wing collections. Early research conducted in the 1960s by DWC provided managers with a better understanding of life history and population ecology of willow ptarmigan (Weeden 1965b). Declines in rock ptarmigan populations along the Denali Highway in the 1990s led to concerns of potential overharvest of ptarmigan (including willow) by hunters. This concern prompted DWC to initiate spring breeding surveys of both rock and willow ptarmigan along the Denali and Richardson highways in the late 1990s. As more resources became available, monitoring programs were initiated along the Parks Highway near Broad Pass and at several locations near Anchorage, Fort Greeley, and most recently at various locations in the Kenai Mountains (2013), DNP (2014), and Mount Fairplay (2015). Between 2013 and 2015, in cooperation with UAF and the Alaska Energy Authority, the SGP completed a 3-year research study to examine the ecology and distribution of willow ptarmigan adjacent to the proposed Susitna–Watana Hydroelectric Project (Susitna–Watana Project) site in the upper Susitna River (Frye 2020).

ALASKA HARE

Alaska hare is one of the most poorly understood game species in the state. The species ranges from the Baldwin and Seward peninsulas to the lower Yukon and Kuskokwim river (YK) deltas and throughout the Alaska Peninsula (Figs. 1 and 2). The Alaska hare inhabits coastal lowlands, alder (*Alnus* spp.) and willow thickets, and wet meadows.

Beyond information received from hunter questionnaires there have been no active programs aimed at long-term population monitoring of Alaska hares. Research initiated in fall 2012 by DWC and UAF examined the genetic variability of the species throughout its range (Cason et al. 2016). This study has provided a strong first step toward documenting and understanding the

species range throughout Alaska in addition to the genetic diversity of the species within that range.

Beginning in spring 2017, the DWC initiated efforts to evaluate capture techniques with the goal of attaching radio collars to captured hares. Also beginning in fall 2017, DWC initiated a series of village tours to discuss Alaska hare observations, historical abundance, and hunting patterns with rural residents throughout the range of the Alaska hare. Beginning in summer 2018 DWC in cooperation with UAF initiated a graduate research project to examine movement and mortality of Alaska hares as well as test and develop an effective abundance monitoring technique that could be employed throughout western Alaska. This project is ongoing.

SNOWSHOE HARE

Snowshoe hares are found throughout Alaska although they are much less abundant in Southeast Alaska. They commonly inhabit mixed spruce forests, wooded swamps, and brushy areas that provide good cover from predators.

Early monitoring of snowshoe hare populations was from information received from hunter questionnaires. Since the late 1990s DWC has monitored population fluctuations of snowshoe hares by performing twilight roadside counts along the Richardson, Parks, Steese, Denali, and Alaska highways.

SMALL GAME PROGRAM

The interest in promoting Alaska's small game species as a valuable resource has resulted in further growth and development of the SGP. The SGP objectives are diverse and comprehensive. In addition to education and outreach, the primary objectives of the SGP are 2-fold: One, document population status and understand the dynamic ecology of Alaska's small game species. This is completed by monitoring harvest composition, conducting spring breeding and summer brood surveys, and evaluating population productivity, particularly for those species that are heavily used by hunters along road systems. Two, develop research efforts to better inform management concerns and the Alaska Board of Game (BOG) hunting regulatory process.

Spring breeding survey, harvest composition, brood survey data, observations, and information provided in this report are for use by DWC staff to manage harvest and inform decisions on the status of various small game populations within their areas as well as to inform the hunting public. These data will inform DWC's use of its discretionary authority, within seasons specified by the BOG to adjust bag limits to restrict or liberalize harvest.

This report details the activities conducted by the SGP between regulatory years (RY) 2018 and 2019 (regulatory year begins 1 July and ends 30 June, e.g., RY18 = 1 July 2018–30 June 2019). The brood survey results from summer 2020 are also provided. Specifically, this report addresses 1) the harvest composition from the seasons addressed, 2) status of monitored grouse, ptarmigan, and snowshoe hare populations, 3) management concerns, 4) recent BOG regulatory changes; 5) current research, and 6) future work. Information will be provided by species within each of 7 sections of the report representing unique geographic regions of the state. These regions include

1) Fairbanks and Interior road system (FIRS), 2) Alaska Range, 3) Southcentral Road System, 4) Kenai Peninsula, 5) Western Rural, 6) Alaska Peninsula, and 7) Southeast Alaska.

Methods for Population Monitoring

SPRING BREEDING SURVEYS

Critical to the management of Alaska's small game is an understanding of spring breeding abundance, particularly of heavily exploited populations and those adjacent to the road system. Beginning in mid-April each year, numbers of breeding male grouse and ptarmigan are counted at fixed survey locations (Pierce et al. 2012) from the Steese Highway in the Interior to Ketchikan in Southeast Alaska (Fig. 2). This provides useful indices from which populations can be monitored and which management action can be taken, if warranted. Snowshoe hares are also counted in the same areas for the same purpose.

Spring breeding behavior of many tetraonids allows a means to index annual breeding abundance and the eruptive nature of grouse and ptarmigan populations (McBurney 1989, Taylor 1992, Zwickel and Bendell 2004, Haddix 2007, Pierce et al. 2012). In Alaska, male ruffed, sharp-tailed, and sooty grouse, as well as willow and rock ptarmigan, perform conspicuous springtime territorial displays. Male spruce grouse and white-tailed ptarmigan also perform a springtime display, but it is one that is not easily located or viewed, making monitoring of spring breeding abundance through this behavior more challenging. These 2 species are monitored through wing collections, periodic site visits to areas where fall harvest occurs, and reports from DWC biologists, hunters, and outdoor enthusiasts. White-tailed ptarmigan are also monitored through summer brood surveys near Hatcher Pass (Unit 14A).

The spring breeding season for grouse and ptarmigan in Alaska occurs from mid-April through late May (Weeden 1965b, Taylor 2013). Due to the geography of Alaska, limited road system, poor access off the road system in the spring, and staff limitations, the SGP has been largely restricted to monitoring species in accessible areas in which breeding behaviors can be observed. The SGP has focused on those populations that are either heavily exploited by hunters, in popular outdoor recreational areas, or live very close to large urban areas or road systems and so afford consistent and reliable access from year to year. However, efforts have been made to establish remote, fly-out only survey locations for a variety of species to begin evaluating whether our road-system surveys adequately reflect the unit or subunit population trend. A more detailed description of the methods used for each specific species is included under the appropriate species section.

Ruffed Grouse

From mid-April to mid-May, male ruffed grouse exhibit a spring breeding behavior known as drumming. Males attempt to attract breeding females by standing on a prominent log, stump, or subtle rise on the forest floor and flap their wings adjacent to their nearly upright body, making a sound like that of a quickening drum beat. Typically, male ruffed grouse have a preferred drumming post that is within an early successional trembling aspen (*Populus tremuloides*) or other mixed hardwood stand (McBurney 1989).

Survey methods used for ruffed grouse have been developed to be consistent with state and national techniques (McBurney 1989, Taylor 1992). In Alaska, drumming typically peaks between 15 April and 15 May. Survey routes generally have consisted of 10 to 12 stops along a trail or rural road. At each stop, an observer listened for drumming males for 4 minutes. All drums and their direction from the observer were recorded. Attempts were made to survey each route 2–4 times during the breeding season. Spring breeding data are reported here as the average number of individual drumming males per listening post or stop for a given survey location with associated confidence intervals calculated using bootstrap methods. Previous reports documented the total count of drumming males per survey area. Roadside and trail transects through known ruffed grouse habitat were established in Anderson (1993), Delta Junction (2008 and 2016), Cooper Landing on the Kenai Peninsula (2007), Palmer (1992), Fairbanks (2016), and Tok (2014 and 2016) and have been completed annually since their inception (Merizon and Carroll 2019, Taylor 2013).

Sharp-tailed Grouse

Male and female sharp-tailed grouse return to lek sites (communal breeding display areas) during the breeding season from mid-April through mid-May. Females are often observed, though their presence is highly variable as their behavior near leks can be cryptic. Male counts form the basis of springtime breeding estimates as they consistently return to lek sites every spring. Spring breeding survey data are reported as average number of males per lek. Leks are generally visited by observers 2–3 times during the peak of the breeding season. Males were distinguished from females by their engorged yellow supercilium (eyebrow), vocalizations, foot stomping, tail rattling, and body posturing. In Alaska, lek sites generally have been located in 1) open areas, including recent burns and cleared agricultural fields, 2) along roads, or 3) within 1–2 m of balsam poplar (*P. balsamifera*), willow, or aspen regeneration that occurs after a burn or clearing. During lek visits the peak of daily activity occurred 1 hour prior to sunrise and generally continued for 2 to 3 hours. Leks were approached quietly on foot and males were counted. A lek is defined here as ≥ 1 male observed displaying at a site during 2 consecutive years. A lek is considered inactive or abandoned when no males are observed displaying for 5 consecutive years. Inactive leks are not included in the analyses, and only leks surveyed in consecutive years are included in the analyses. Sample sizes and relative abundance estimates for this report may differ from previous reports for several reasons: 1) only leks surveyed in consecutive years are included here and 2) leks included the analyses in previous reports may not have met our revised definition of a lek.

Lek sites have been monitored for male sharp-tailed grouse abundance near Delta Junction since 1997 and near Tok since 2013.

Sooty Grouse

Male sooty grouse begin breeding activity in late March in Southeast Alaska; however, the peak of the breeding season generally occurs between mid-April and mid-May. Males utilize the acoustic characteristics of montane valleys to broadcast repeated hooting calls, typically from Sitka spruce or mountain hemlock near the alpine.

Beginning in April 2015, survey transects were created along hiking trails and roadways near Juneau and Petersburg to monitor the spring breeding abundance of males. In addition, survey transects were created in Ketchikan and Haines in April 2019. Survey transects consisted of 6–20 stops much like the design of ruffed grouse surveys. They were completed either on foot or with the use of a highway vehicle. Spring breeding survey data are reported as the average number of males heard per survey stop by area or region (e.g., Mitkof Island). Surveys were repeated 2–3 times during the peak of breeding activity. The average for each area was calculated by using the peak count for each survey transect for that season. Prior to the creation of these survey transects in 2015, no formal, systematic survey was completed for sooty grouse in Southeast Alaska.

Spruce Grouse

The springtime display of male spruce grouse in Interior and Southcentral Alaska is quiet and inconspicuous, making it difficult to locate displaying males. Males in Southeast Alaska have been heard and observed making wing claps while displaying, making them slightly easier to locate; however, due to a low population density and limited staff time, DWC has not been able to establish spring survey routes for this population. While displays are difficult to monitor, the presence of both male and female spruce grouse throughout the state has been noted by DWC staff during spring fieldwork, and these observations have proven to correlate with fall abundance.

Rock Ptarmigan

Male rock ptarmigan defend breeding territories through vocalizations and display flights beginning in early April. Territories typically occur in high elevation alpine areas, often adjacent to stands of dwarf birch on exposed montane slopes and ridges (Weeden 1965b).

To assess spring breeding abundance of rock ptarmigan, observers used a broadcast call of a territorial male played at between 5 and 15 stops along designated survey transects (Choate 1963 Watson 1965; Bergerud and Mercer 1966; Bergerud 1970; Braun and Rogers 1971; Taylor 2000, 2013). Surveys were completed by either driving a highway vehicle along rural, high elevation roadways or walking on foot. Responding males were counted only within a 0.4 km (0.25 miles) radius of each stop along the route. Spring breeding survey data are reported as the average number of males recorded per survey stop by area or region (i.e., eastern Denali Highway). Surveys are repeated 2–3 times during the peak of breeding activity.

White-tailed Ptarmigan

The springtime displays of male white-tailed ptarmigan are more difficult to monitor than those of other ptarmigan species in Alaska and the SGP is currently not completing spring breeding surveys for them. Access to the high alpine ridges and peaks on which they breed is very poor in Alaska because there are few roads to these areas and the high mountains are frequently covered in deep snow and prone to avalanche during breeding season. Based on field observations in Alaska, male and female white-tailed ptarmigan disperse during the summer months (post breeding) and are rarely found together. However, flocks of white-tailed ptarmigan are found in the alpine in late September and October.

Willow Ptarmigan

Like male rock ptarmigan, beginning in April and continuing through late May, male willow ptarmigan vigorously defend breeding territories through calling and display flights. These territories are typically set up in transitional shrub habitat between the subalpine and alpine in willow and dwarf birch stands (Weeden 1965b). Willow ptarmigan spring breeding abundance is assessed and reported using the same methodology as for rock ptarmigan.

SPRING-SUMMER COUNTS

Alaska Hare

Currently, there are no active programs aimed at long-term population monitoring of Alaska hares. This species is one of the least accessible small game species to view and hunt, yet it is often harvested opportunistically by trappers and remote winter travelers in western Alaska. DWC is currently assessing various techniques that if found successful could be employed regionally to estimate abundance. This survey technique evaluation will take 1 to 2 more years (2021–2022) before it could be deployed throughout the species range in Alaska.

Snowshoe Hare

Snowshoe hare populations are subject to large cyclic fluctuations that normally occur over a 9- to 10-year period (Krebs et al. 1987, 2001; Taylor 2013). The SGP does not estimate population size but rather monitors population fluctuations. Population monitoring is done by completing early morning roadside counts of snowshoe hares along the Richardson, Parks, Steese, Denali, and Alaska highways. The SGP has also relied upon numerous partners to assist in monitoring statewide hare populations, including the National Park Service, other agency partners, and private individuals, to obtain data and other information.

SUMMER BROOD SURVEYS

Brood surveys have been used by numerous state and federal fish and wildlife agencies to monitor population trends and productivity (brood size and density) of various galliform species (including grouse, quail, turkey, and pheasant) throughout North America (Autenrieth et al. 1982, Guthery and Mecozzi 2008, Merizon and Carroll 2019, Hansen et al. 2015). However, limited funding and staff availability can make these surveys difficult to achieve. Often state agencies can partner with other government agencies, conservation organizations, or dog-training groups to complete surveys. In addition, statewide wing collection efforts from hunter-harvested grouse and ptarmigan offer complimentary data on harvest composition, productivity, harvest location, and species that generate the greatest hunter effort (Merizon and Carroll 2019, Hansen et al. 2015). The use of trained pointing dogs has been found to be one of the most effective and efficient techniques for locating cryptic grouse broods that dwell in open habitats (Dahlgren et al. 2010, 2012; Guthery and Mecozzi 2008).

Since 2016, the SGP has partnered with numerous volunteers and their highly trained pointing dogs on an annual basis to complete summer brood surveys. Surveys were completed along

designated transects for sharp-tailed grouse (Delta Junction) and rock and willow ptarmigan (Eagle Summit, Denali Highway, and Hatcher Pass). Dogs were evaluated for steadiness prior to completing surveys and were used to locate broods. Observers counted number of chicks and adults, and recorded brood locations. These data have proven to be useful to assess population productivity and abundance immediately prior to the hunting season in August.

FALL GROUSE COUNTS

Spruce grouse are a difficult species to monitor through other standardized methods utilized by the SGP such as spring breeding surveys or summer brood surveys (methods employed for other grouse and ptarmigan species in Alaska). Their breeding displays are virtually silent and inconspicuous and because of the dense forest habitat in which they reside it is difficult to accurately monitor them with the use of pointing dogs and traditional brood survey techniques. Therefore, a roadside survey method was created and employed in late summer/early fall 2019 to begin collecting baseline information on spruce grouse throughout the Mat-Su. Particular concern arose in 2019 due to the extent of an ongoing spruce bark beetle infestation throughout the Mat-Su valley and Kenai Peninsula. This infestation has severely affected mature white spruce (*P. glauca*) throughout Units 14A, 14B, and 16. Data collected through these surveys will better inform managers, hunters, and the regulatory process in the future. Ruffed grouse and snowshoe hare are also counted during these surveys.

WING COLLECTIONS

In order to understand annual grouse and ptarmigan harvest composition and population productivity, the SGP continues an effort to collect hunter-harvested wings and tail fans of all species of grouse and ptarmigan (Tables 1 and 2). In addition, the SGP attempts to collect the heads of harvested ptarmigan. By examining these samples, biologists can determine age (juvenile or adult), sex, and verify species of harvested birds (Bergerud et al. 1963, Weeden and Watson 1967, Szuba et al. 1987, Gullion 1989, Dinsmore and Johnson 2012). This is a very cost- and time-effective way for the SGP to index harvest composition and a second method through which to estimate population and brood production from the previous breeding season. To promote future wing collections, SGP has free wing envelopes available at most ADF&G offices throughout the state.

Grouse wings were used to determine age by examining the stage of molt and primary feather (P) wear. For spruce grouse only, calamus (feather shaft) diameter of P1 was measured (Szuba et al. 1987) to determine age. For ptarmigan, wings were used for one or more purposes, including to 1) determine age by examining the degree of pigmentation on P8, P9, and P10 (Bergerud et al. 1963, Weeden and Watson 1967); 2) estimate sex by measuring P8 length; or 3) estimate sex by measuring wing chord length (Merizon 2012, Taylor 2013). Grouse rectrices (tail feathers) were used to determine sex (Henderson et al. 1967, Schulz 1983). Heads from fall (August through early October) harvested ptarmigan were used to verify species and verify sex by examining plumage characteristics prior to completing their fall molt.

Table 1. Total number of hunter-harvested wings collected statewide from grouse and ptarmigan by Game Management Unit, Alaska, regulatory year 2018.

Game Mgmt.	Grouse				Ptarmigan			
Unit (GMU)	Ruffed	Spruce	Sharp-tailed	Sooty	Willow	Rock	White-tailed	Total
1	0	0	0	32	2	5	0	39
3	0	0	0	17	1	0	0	18
4	0	0	0	19	0	0	0	19
7	0	45	0	0	3	0	0	48
9	0	1	0	0	2	0	0	3
12	0	1	9	0	0	0	0	10
13	0	6	13	0	126	1	0	146
14	8	27	0	0	49	18	15	117
15	0	78	0	0	10	0	1	89
16	0	6	0	0	1	0	0	7
20	11	90	64	0	3	19	0	187
22	0	0	0	0	123	0	0	123
25	0	0	0	0	15	15	0	30
Total	19	254	86	68	335	58	16	836

Note: Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2018 = 1 July 2018–30 June 2019).

Table 2. Total number of hunter-harvested wings collected statewide from grouse and ptarmigan by Game Management Unit, Alaska, regulatory year 2019.

Game Mgmt.	Grouse				Ptarmigan			
Unit (GMU)	Ruffed	Spruce	Sharp-tailed	Sooty	Willow	Rock	White-tailed	Total
1	0	0	0	36	6	0	0	42
7	0	125	0	0	76	0	6	207
9	0	5	0	0	0	0	0	5
13	1	4	9	0	172	3	0	189
14	24	61	0	0	66	41	33	225
15	0	56	0	0	0	0	0	56
16	1	1	0	0	1	0	0	3
18	0	0	0	0	16	0	0	16
20	30	93	107	0	2	1	0	233
22	0	0	0	0	65	0	0	65
Total	56	345	116	36	404	45	39	1,041

Note: Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2019 = 1 July 2019–30 June 2020).

Summer 2018–Summer 2020 Climate Patterns and Breeding Seasons

Near normal temperatures and precipitation were recorded for Southcentral, Interior, and portions of Western Alaska during the spring and summer of 2018. However, much like the summer of 2016 and 2017, Southwestern Alaska (including Dillingham, Bethel, and the YK Delta) experienced cool and wet conditions throughout much of summer 2018 that likely contributed to poor chick survival. Also, portions of the Alaska Range and the Chugach and Talkeetna mountains experienced cool, wet, and snowy conditions during late June and early July that likely had a strong negative impact on rock, white-tailed, and willow ptarmigan chick survival.

Record warm fall temperatures and overall lack of snow were experienced from Utqiagvik to Homer through October 2018 (Hollander, Anchorage Daily News, 22 October 2018). Warm temperatures also contributed to an unusually late sea ice freeze-up in the Bering and Chukchi seas. Some snow was experienced in Anchorage and Fairbanks in late October and November; however, mild temperatures continued until mid-December for much of the state. This likely contributed to higher mortality for many grouse and ptarmigan populations across Alaska that were unable to take advantage of snow roosting for thermal protection and predator avoidance.

Between mid-December 2018 and February 2019 near normal temperatures and snowfall occurred for Southcentral and Interior Alaska. However, as has occurred since 2013, Southwestern Alaska received unseasonably warm temperatures, rain, and strong wind. North of the Yukon River, temperatures remained below freezing and very high snowfall was documented on the Seward Peninsula.

The mild winter of 2018–2019 concluded with record setting warm temperatures and early snowmelt in March throughout most of the state (DeMarban, Anchorage Daily News, 4 April 2019). The majority of the Interior and Southcentral was completely snow free by mid-April which greatly contributed to increased wildfire risk in those areas. As a result of the early snowmelt and rapid increase in daytime high temperatures, plant phenology and subsequent peak spring breeding activity of grouse and ptarmigan was approximately 4 to 10 days early throughout most of Alaska.

Beginning in 2017 and accelerating in 2018 and 2019, a growing spruce bark beetle (*Dendroctonus rufipennis*) outbreak has severely affected large stands of mature (≥ 15 cm diameter) white spruce throughout Southcentral and the Kenai Peninsula. Much of the Susitna and Matanuska river watersheds have been severely affected in addition to portions of the Anchorage bowl. This may have a strong negative effect on spruce grouse populations throughout Southcentral and the Kenai Peninsula over the coming years and have severe risk of wildfires in affected areas.

ADF&G field personnel observed high densities of both avian and terrestrial predators during spring 2019. These observations were widespread throughout much of the state. Higher predator densities are likely explained by snowshoe hare populations at or nearing their 10-year peak in many areas of the state.

Beginning in early June and continuing throughout July and early August 2019, much of the state set record high temperatures coupled with very dry conditions. Warm and dry conditions during this time have been correlated with high chick survival for both grouse and ptarmigan (Moss 1985, Baines 1991, Moss et al. 2001, Loneux et al. 2003, Summers et al. 2004, Ludwig et al. 2010, Viterbi et al. 2015, Wann et al. 2016, Wegge and Rolstad 2017). Portions of the Alaska Range had several heavy rain events in early August 2019; however, this occurred late enough in the brood rearing period to likely have minimal impact on chick survival.

Spring through mid-July 2019 across Alaska experienced above average to record high temperatures and extremely dry conditions. Numerous all-time high temperatures were set throughout the state including Anchorage (32°C) and Bethel (37°C; Boots, Anchorage Daily News, 9 July 2019). This contributed to fish, krill, mussel, and seabird die offs across the state, fueled an intense wildfire season burning an estimated 2.5 million acres, and ultimately set a record as the warmest year recorded in Alaska (Krakow, Anchorage Daily News, 9 January 2020). As a result of the warm dry conditions, grouse and ptarmigan chick survival was likely high in all monitored locations and likely average to high for other locations across Alaska.

Near average temperatures and precipitation returned for much of fall 2019 across the state. However, like fall 2018, above average temperatures and low snowfall returned and continued from late-October to mid-December contributing to an unusually late sea ice freeze-up in the Bering and Chukchi seas (Parrott, Anchorage Daily News, 19 October 2019). Some snow was experienced in Anchorage and Fairbanks in late-October and November; however, conditions remained mild through mid-December for much of the state. This pattern, also observed in fall 2018, likely contributed to higher mortality for many grouse and ptarmigan populations across Alaska due to their inability to take advantage of snow roosting opportunities in many areas.

Also, like the winter of 2018–2019, normal temperatures returned in mid-to-late December 2019 along with frequent snow events. For the month of January 2020, temperatures dropped well below average throughout the state and remained near to below normal through March 2020 accompanied by heavy snowfall.

Significant snow fell in western Alaska, the central and eastern Interior, the Alaska Range, and the Chugach and Talkeetna mountains between February and April 2020. Despite near normal temperatures returning in late March and April causing melt, deep snow and cooler temperatures in the mountains continued through early May 2020. In Southwestern Alaska, there was a very rapid warm up causing flooding in the YK Delta. From Southeast to the Interior snow melt, plant phenology, subsequent peak spring breeding activity of grouse and ptarmigan was either near normal or up to 7 days delayed when compared to the previous 5-years.

Beginning in early June and continuing throughout July and early August 2020, much of the state experienced average to above average precipitation and average to below average temperatures. However, areas of the Alaska Range and Interior experienced well above average precipitation and cool temperatures during the average hatch period for most grouse and ptarmigan populations. As a result, Alaska's 2020 fire season was well below the average (650,000 acres) at 181,120 acres (Williams, Anchorage Daily News, 6 September 2020). High water and flooding were persistent for many small streams and rivers in the Interior and Alaska Range regions through late July 2020.

Statewide Summary

Highly variable climate patterns across Alaska between 2019 and 2020 resulted in localized differences in grouse and ptarmigan abundance. Between June and early July 2020 many areas of Southcentral, the Interior, and the Alaska Range experienced very wet and cool conditions. This weather pattern and the high abundance of avian and terrestrial predators due to the recent snowshoe hare population high, likely had a negative to strongly negative influence on many grouse and ptarmigan populations throughout the state.

Ruffed grouse throughout Alaska generally remain at or near the low of their 7- to 10-year population cycle peak statewide. Spring breeding surveys near Palmer, Delta Junction, Anderson, and Tok reflect low populations.

Sharp-tailed grouse abundance was likely stable or slightly increasing in 2019. Field reports throughout 2019 and early 2020 suggest average numbers of sharp-tailed grouse were observed by hunters throughout their range including Tok, Delta Junction, and areas along the Taylor Highway. However, spring breeding surveys in 2020 suggest sharp-tailed grouse abundance has declined in the Interior. Field reports and observations throughout summer and fall 2020 suggest that generally fewer sharp-tailed grouse were observed.

Spring breeding surveys for sooty grouse have been completed since 2015. Overall, data between 2015 and 2019 documented fairly stable populations throughout monitored populations in Juneau and Petersburg. In 2020, a sharp decrease in abundance was documented in Juneau and on Mitkof Island (Petersburg). However, an increase in abundance was documented on Douglas Island. No surveys were completed on Kupreanof Island in 2020. Hunters generally reported seeing and harvesting fewer birds during the 2019–2020 season throughout the Southeast region.

Currently, there is no systematic statewide population monitoring for spruce grouse. However, due to concerns over the widespread effects of spruce bark beetles, in August 2019, DWC initiated a fall early morning roadside count of spruce grouse in the Mat-Su. Spruce grouse generally appeared to have below average abundance along the road system based on field observations and hunter reports in 2020. Overall, brood production appeared to be lower than average in 2020 based on field observations with the exception of the Kenai Peninsula where fall spruce grouse abundance was higher than average. In portions of Southwest Alaska, recent reports suggest abundance has been increasing slightly in locations like King Salmon and Dillingham.

Rock ptarmigan populations throughout much of the road system decreased in 2019 and 2020 compared to the recent 5-year average. However, populations near Eagle Summit and the Kenai Peninsula were above the long-term average in 2020. Field observations from Southwest Alaska suggest modest growth of local populations that have been depressed for over 5 years. Based on brood surveys and observations throughout summer 2020, rock ptarmigan populations are expected to be below to well below average throughout Southcentral, the Kenai Peninsula, and the Alaska Range.

Very little is known about white-tailed ptarmigan abundance throughout their range in Alaska. Most of the harvest occurs near high alpine road systems (Hatcher and Thompson passes) and

alpine hiking trails throughout Southcentral and the Kenai Peninsula. Generally, very few hunters report harvesting white-tailed ptarmigan due to the difficulty in accessing their high alpine habitat. Overall, abundance is expected to be below average in RY20 much like rock and willow ptarmigan.

Willow ptarmigan abundance throughout much of the state had been steadily increasing through 2018, however, beginning in 2019 and continuing in 2020 many populations have declined. Record high spring breeding abundance was documented throughout the Alaska Range and Southcentral in 2018. Due to cool temperatures and heavy rain in late June and early July 2020, willow ptarmigan populations, like rock ptarmigan, likely suffered high chick mortality throughout Southcentral, Kenai Peninsula, and the Alaska Range. As a result hunters can anticipate below to well below average populations of willow ptarmigan.

Snowshoe hare abundance is highly variable depending on the location within the state. Populations in the Interior are 1–2 years past the population peak and have declined to low abundance throughout this region. Snowshoe hare abundance in Southcentral is at or just past the population peak. Populations on the Kenai Peninsula are expected to reach their population cycle peak in 2021 or 2022. The snowshoe hare population appears to be a strong driver in statewide grouse and ptarmigan population abundance (Carroll and Merizon 2017). As snowshoe hare densities begin increasing, specialist and generalist predator populations also increase in abundance. As a result, in the past, we have documented a rapid decline in Alaska grouse and ptarmigan populations during previous hare highs. This decline in grouse abundance is currently being observed throughout much of the state and is being exacerbated by recent cool and wet weather in spring/summer 2020.

Alaska hare is one of the least well known of the small game species in Alaska. Overall, this species remains at low abundance throughout its statewide range with harvest being reported throughout many small coastal villages in Western and Southwest Alaska. The SGP and other DWC staff embarked on a new, multi-year research study beginning in 2018 to try and learn more about this species' life history and develop a long-term monitoring technique to begin tracking abundance and distribution.

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Fairbanks and Interior Road System

For purposes of this report the FIRS region encompasses Units 12, 19–21, 24, 25, 26B, and 26C (Fig. 3). Specifically, the region extends southwest of Aniak (Units 19 and 21), northwest of Huslia (Unit 24), northeast of Deadhorse to the Canadian border (Unit 26), and southeast of Northway (Unit 12). The region includes 8 major highways (Dalton, Elliott, Alaska, Richardson, Parks, Steese, Taylor, and Glenn highways). The range of habitat is somewhat diverse from mixed deciduous species and black spruce that dominate the landscape to alpine and tundra habitats of the Brooks Range and North Slope. The network of major highways allows for relatively easy access along or adjacent to road corridors; however, there is a large portion of the region that is inaccessible save for small aircraft or boat. Locations near Fairbanks and Delta Junction are popular for both ruffed and sharp-tailed grouse hunting due to the forest composition (mixed aspen) and frequency of wildfires that provide appropriate habitat. Spruce grouse are found widely in forested habitats. Ptarmigan hunting is also popular in this region at higher elevations along the Steese, Elliott, and Richardson highways. Sooty grouse and Alaska hare are not found in this region.

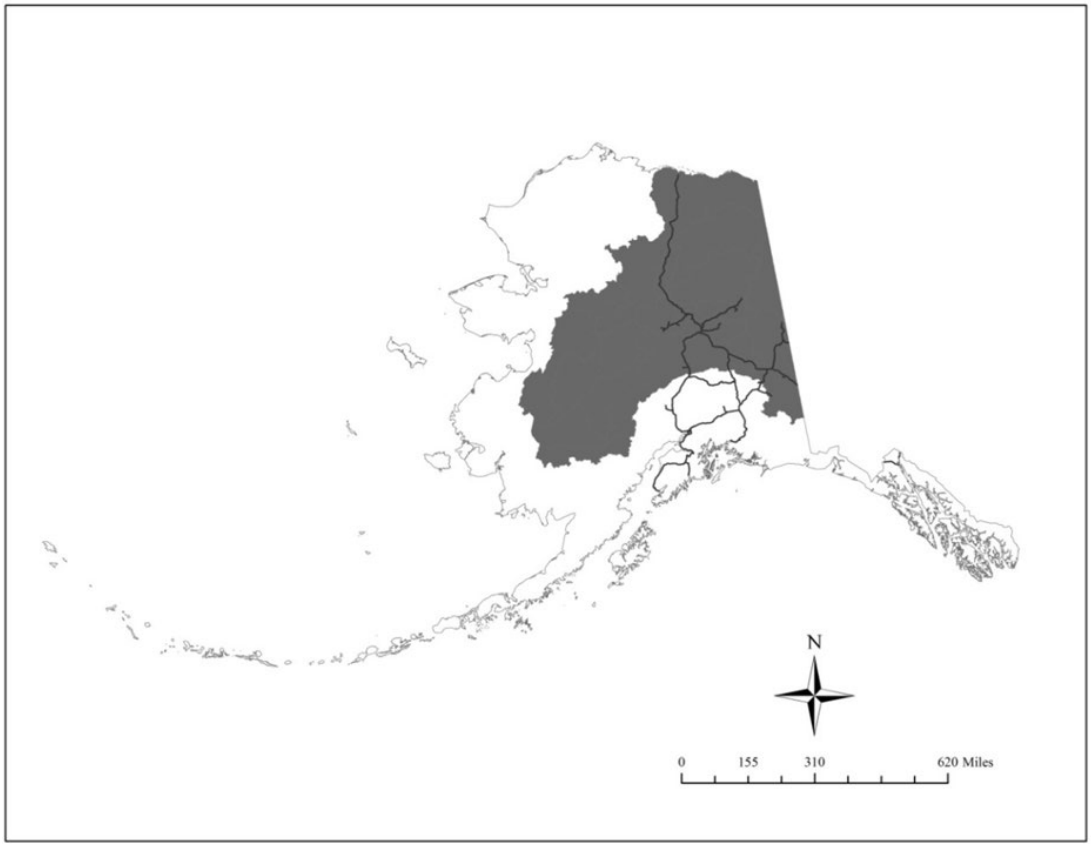

Figure 3. Map of the Fairbanks and Interior road system region, Alaska.

BOARD OF GAME

In March 2020 the BOG voted to change the daily bag limit (from 15 per day, provided that there are not more than 5 are sharp-tailed grouse, to 5 per day) and total possession limit (from 30 in possession, provided that not more than 10 in possession are sharp-tailed grouse, to 15 in possession provided that not more than 10 in possession may be either ruffed or sharp-tailed grouse) for grouse in a portion of GMU 20D (that portion lying west of the east bank of the Johnson River and south of the north bank of the Tanana River). There was strong public support among local advisory committees and bird dog organizations for the reduction in the bag and possession limits.

RUFFED GROUSE

Spring Breeding Surveys

The SGP and collaborators completed drumming counts from 27 April to 9 May in 2019 and from 27 April to 13 May in 2020 in survey locations on state and military lands near Clear Air Force Station (AFS), state lands near Fairbanks, military lands near Eielson AFS (Yukon Training Area-YTA), state (Delta Junction Bison Range, DJBR) and military lands (Delta Training Area, DTA and Gerstle River Training Area, GRTA) near Delta Junction, and state lands near Tok. Survey conditions in both years for all drumming counts in the FIRS region were generally good with temperatures ranging from approximately -9.3°C to 19.8°C and winds generally light to moderate (range: 0 kph to 20.4 kph). Count data suggest that numbers of ruffed grouse likely peaked near Clear AFS in 2017 and have remained low for the past 3 years (Table 3). Data from Fairbanks suggest a decline in ruffed grouse numbers since 2017; however, it is unclear if 2017 was a peak year as no data is available from before 2017. Data from military land near Eielson Air Force Station (AFS) suggest numbers started to decline in 2016 and have remained very low for the past 3 years. Count data from locations in the Eastern Interior near Delta and Tok suggest ruffed grouse numbers likely peaked 1–2 years earlier in 2015 or 2016 and have remained low for the past few years (Tables 4 and 5). Throughout the FIRS region ruffed grouse counts suggest numbers have remained near the cyclic low in the species 7- to 10-year population cycle.

Table 3. Mean number of male ruffed grouse estimated per listening post (stop) with bootstrap 95% confidence intervals for survey routes near Clear Air Force Station (AFS), Fairbanks, and on military lands in the Yukon Training Area (YTA) within the greater Fairbanks and Interior road system (FIRS), Alaska, 2012–2020.

	Clear AFS		Fairbanks		YTA	
Year	Mean	95% CI[a]	Mean	95% CI[a]	Mean	95% CI[a]
2012	0.06	0.03–0.10	–	–	0.32	0.14–0.50
2013	NS[b]	NS[b]	–	–	0.06	0.00–0.16
2014	0.16	0.08–0.27	–	–	0.30	0.00–0.70
2015	0.17	0.11–0.24	–	–	0.40	0.10–0.75
2016	0.24	0.12–0.37	–	–	0.53	0.05–1.03
2017	0.34	0.23–0.48	0.85	0.58–1.10	0.26	0.08–0.50
2018	0.02	0.00–0.06	0.45	0.20–0.75	0.00	0.00–0.00
2019	0.07	0.02–0.12	0.18	0.05–0.35	0.00	0.00–0.00
2020	0.01	0.00–0.03	0.23	0.08–0.38	0.00	0.00–0.00

[a] CI = confidence interval.

[b] No survey was conducted at Clear AFS in 2013 because deep persistent snow along survey routes precluded surveys.

Table 4. Mean number of male ruffed grouse estimated per listening post (stop) with bootstrap 95% confidence intervals (CI) for survey routes on state and private lands (Quartz Lake and Nistler), military lands (Donnelly Training Area (DTA) and Gerstle River Training Area (GRTA)), and on all routes combined near Delta Junction within the greater Fairbanks and Interior road system (FIRS), Alaska, 2012–2020.

	Quartz Lake		Nistler		DTA		GRTA		All Delta routes	
Year	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
2012	–	–	–	–	0.46	0.21–0.73	0.38	0.19–0.58	0.42	0.26–0.58
2013	–	–	–	–	0.31	0.08–0.58	0.23	0.08–0.38	0.27	0.14–0.43
2014	–	–	0.17	0.00–0.38	0.67	0.35–1.08	0.08	0.00–0.25	0.32	0.16–0.50
2015	–	–	0.50	0.25–0.75	0.83	0.52–1.15	0.35	0.15–0.60	0.57	0.40–0.74
2016	0.42	0.21–0.64	0.46	0.17–0.76	0.62	0.38–0.83	0.35	0.12–0.60	0.47	0.34–0.60
2017	0.25	0.07–0.49	0.38	0.15–0.67	0.34	0.13–0.59	0.06	0.00–0.19	0.26	0.16–0.38
2018	0.05	0.00–0.14	0.21	0.04–0.42	0.02	0.00–0.06	0.05	0.00–0.12	0.08	0.03–0.14
2019	0.11	0.00–0.30	0.28	0.08–0.50	0.04	0.00–0.12	0.00	0.00–0.00	0.11	0.04–0.18
2020	0.18	0.05–0.34	0.17	0.03–0.31	0.06	0.00–0.17	0.04	0.00–0.12	0.11	0.05–0.18

Table 5. Mean number of male ruffed grouse estimated per listening post (stop) with bootstrap 95% confidence intervals (CI) for survey routes on state lands near Tok and on all routes combined near Tok within the greater Fairbanks and Interior road system (FIRS), Alaska, 2014–2020.

	River Road		Alaska Hwy		Mudslinger		All Tok routes	
Year	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
2014	0.19	0.04–0.38	–	–	–	–	0.19	0.00–0.39
2015	0.50	0.29–0.69	–	–	–	–	0.50	0.25–0.68
2016	0.97	0.56–1.36	0.68	0.38–1.03	–	–	0.82	0.55–1.09
2017	0.31	0.14–0.58	0.47	0.15–0.84	0.19	0.05–0.39	0.34	0.19–0.51
2018	0.06	0.00–0.17	0.00	0.00–0.00	0.05	0.00–0.15	0.03	0.00–0.09
2019	0.11	0.00–0.22	0.09	0.00–0.23	0.10	0.03–0.18	0.10	0.04–0.17
2020	0.07	0.00–0.22	0.18	0.03–0.33	0.05	0.00–0.10	0.10	0.03–0.18

Wing Collections

There were 11 ruffed grouse hunter-harvested wing samples collected from the FIRS region in RY18 and 29 collected during RY19 (Table 6). Most of the wings were collected from Units 20B and 20D, which are the most accessible units in the FIRS region. Small sample sizes in 2018 make it difficult to draw any strong conclusions about the proportion of juveniles in the harvested population in that year and possible changes in the proportion of juveniles between 2018 and 2019.

Table 6. Total number and proportion of juvenile ruffed grouse with binomial 95% confidence intervals (CI) based on harvested wing collections from within the Fairbanks and Interior road system region, Alaska, regulatory years 2011–2019.

Regulatory year[a]	Units	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI
2011	20C, 20D	6	17	1	24	0.74	0.52–0.90
2012	20B, 20C, 20D	8	17	0	25	0.68	0.46–0.82
2013	20A, 20B, 20C, 20D	9	7	1	17	0.44	0.20–0.70
2014	20A, 20B, 20C, 20D, 20E	20	35	1	56	0.64	0.50–0.76
2015	20A, 20B, 20C, 20D, 20E, 25D	28	93	0	121	0.77	0.68–0.84
2016	20B, 20C, 20D	16	41	0	57	0.72	0.58–0.83
2017	20A, 20B, 20C, 20D	39	94	0	133	0.71	0.62–0.78
2018	20B, 20C, 20D	1	10	0	11	0.91	0.59–0.99
2019	20B, 20D	6	23	0	29	0.79	0.60–0.92

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2011 = 1 July 2011–30 June 2012).

Habitat Improvement Work

Between 2017 and 2020, the SGP in collaboration with Division of Forestry and through financial support from the federal Wildlife Restoration Program and the Founding Forty, a nonprofit statewide conservation group, completed a habitat modification project near Delta Junction for the benefit of grouse breeding and brood rearing habitat. Over 400 acres of habitat was crushed with a roller chopper. Habitat selected for crushing was predominately made up of aspen and willow trees as these species are quick to respond to disturbance with vigorous growth. Within several years, regrowth from these tree species provides excellent breeding and brood rearing habitat for grouse. The SGP plans to complete additional habitat work in the area if and when additional funds become available. A map of the habitat work, as well as other habitat work completed throughout Interior and Southcentral Alaska, is available on the SGP's website at www.smallgame.adfg.alaska.gov under the "Habitat Projects" tab.

Research

Winter weather has long been thought to play a role in ruffed grouse population cycles. Winters characterized by cold temperatures and deep snow are thought to provide adequate cover for both predator avoidance and thermoregulation. Several studies have found winter weather variables (e.g., winter temperature and precipitation) or anomalies in these variables to be correlated with ruffed grouse abundance (Pomara and Zuckerberg 2017, Zimmerman et al. 2008). However, no work has been completed in Alaska to examine the relationship between winter weather variables and ruffed grouse abundance. Therefore, with financial support from the nonprofit

conservation group Founding Forty and Wildlife Restoration Program funds, the SGP initiated a project to evaluate the relationship between winter weather variables and ruffed grouse abundance. The project is a collaboration between the DWC and an outside investigator, Dr. Glen Liston (InterWorks Consulting LLC), who has developed a spatially-explicit SnowModel that can calculate snow distribution and depth and snow cover duration (among other variables) across a specified area using meteorological data (Liston and Elder 2006). Winter weather variables of interest such as: snow depth, length of core snow period, start and end dates of the core snow period, and precipitation during the core snow period (among others) were estimated from 1993 to 2019 using the SnowModel, which incorporates meteorological and snow data from nearby weather stations as well as incorporates data from Moderate Resolution Imaging Spectroradiometer (MODIS). Using Generalized Linear Mixed Models (GLMMs) we evaluated the relationship between these variables and other weather variables and annual drumming counts of ruffed grouse, which is an index of ruffed grouse abundance. Final results of this research will be available in an upcoming report on the SGP's website at www.smallgame.adfg.alaska.gov under the "Research & Reports" tab.

SHARP-TAILED GROUSE

Spring Breeding Surveys

Spring lek counts of male sharp-tailed grouse occurred 16–29 April 2019 and 15 April to 4 May 2020 near Delta Junction and Tok. Lek counts were conducted on private (DJAP), state (DJBR), and military lands (DTA and GRTA) near Delta Junction and on state lands near Tok. Prior to 2020 lek counts on military lands were conducted by contractors for the United States Army. However, U.S. Department of Defense funding for wildlife surveys on military lands was reduced in 2018 and eliminated in 2020 and lek surveys on military lands were completed by SGP staff. Survey conditions were generally good, with relatively cool weather and mostly light to moderate winds in both 2019 (temperature range: -10.6°C to 3.2°C; wind range: 0.0 kph to 7.9 kph) and 2020 (temperature range: -10.5°C to 4.7°C; wind range: 0 kph to 11.3 kph). The average number of males estimated per lek on the DJAP and DJBR appears to have been highest in 2017 with declines observed in 2018 and 2020 (Table 7). The 2020 estimate is also far below the 5-year average (3.30 males observed per lek). The average number of males estimated per lek on military lands near Delta dropped below the 5-year average in 2018 but was above the 5-year average in 2019 and 2020 (4.33 males observed per lek).

Data from Tok suggest the 2020 estimate for the number of males per lek is below the 5-year average (4.43 males per lek). However, yearly estimates from leks near Tok suffer from relatively low precision due to the small number of known leks monitored. When feasible additional effort will be expended to find new lek sites near Tok. Across all leks visited within the FIRS region a decline in the average number of males estimated per lek was observed in 2018 and the current estimate for 2020 is well below the 5-year-average (3.71 males observed per lek).

Table 7. Mean number of male sharp-tailed grouse estimated per lek with bootstrap 95% confidence intervals (CI) from surveys of leks near Delta Junction within the Delta Junction Agricultural Project (DJAP) and on the Delta Junction Bison Range (DJBR), leks on military lands within Fort Wainwright-Donnelly Training Area (DTA), Fort Wainwright-Gerstle River Training Area (GRTA), and Fort Greely, leks near Tok, and all leks combined within the Fairbanks and Interior road system region (FIRS), Alaska, 2007–2020.

	DJAP/DJBR			DTA/GRTA/Fort Greely			Tok			All leks combined		
Year	Leks	Mean	95% CI	Leks	Mean	95% CI	Leks	Mean	95% CI	Leks	Mean	95% CI
2007	15	4.33	2.80–6.00	3	8.67	1.00–22.00	–	–	–	18	5.00	3.22–7.61
2008	21	3.81	2.57–5.24	3	6.33	0.00–16.00	–	–	–	24	4.04	2.58–5.83
2009	24	2.25	1.25–3.38	3	7.67	0.00–16.00	–	–	–	27	2.81	1.56–4.44
2010	25	2.48	1.36–3.64	6	6.17	2.67–11.00	–	–	–	31	3.19	1.93–4.55
2011	26	2.58	1.58–3.73	8	7.25	3.75–11.38	–	–	–	34	3.65	2.35–5.24
2012	23	2.39	1.17–3.74	8	4.38	1.63–7.88	–	–	–	31	3.00	1.77–4.32
2013	19	3.47	1.63–5.90	8	4.13	2.13–7.00	–	–	–	27	3.67	2.22–5.45
2014	22	4.09	2.64–5.77	4	6.25	3.75–9.00	–	–	–	26	4.42	3.08–5.88
2015	22	4.45	2.86–6.18	11	3.32[a]	1.45–5.55	2	2.50	1.00–4.00	35	4.09	2.88–5.36
2016	22	4.14	2.41–6.32	12	3.79	2.08–5.75	3	4.00	1.00–8.00	37	4.00	2.65–5.58
2017	26	4.62	3.19–6.23	15	4.33	2.20–7.13	5	4.40	0.80–10.80	46	4.55	3.25–5.95
2018	26	2.73	1.58–4.08	16	3.75	1.94–5.63	6	5.67	1.67–11.67	48	3.07	2.12–4.10
2019	24	3.33	2.04–4.91	17	4.88	3.06–7.18	6	4.67	0.50–9.67	47	3.98	2.85–5.34
2020	24	1.79	0.92–2.83	15	4.60	2.60–7.00	6	3.40	0.00–7.17	45	2.89	1.90–4.05

Note: Sample sizes and relative abundance estimates for this report may differ from previous reports for several reasons: 1) only leks surveyed in consecutive years are included here and 2) leks included the analyses in previous reports may not have met our revised definition of a lek.

[a] Sampling effort in 2014 was limited to 4 leks due to an increase in time spent on other wildlife surveys by contractors on military lands near Delta Junction. Three of the 4 leks visited are the largest known leks on military lands. Counts on just these 4 leks likely biased the count high in 2014, therefore the decline observed in 2015 is likely a result of that sampling bias.

It is important to note that although the average number of males observed per lek on military lands (DTA, GRTA, and Fort Greely) appears to have been markedly higher in earlier years (2007–2011) compared with those on the DJAP and DJBR, this is likely due to a sampling bias. This sampling bias occurs for a couple of reasons: 1) leks monitored in earlier years were few and likely sites with the largest aggregations of males, which makes them easier to find, and 2) an increase in sampling effort leads to an increase in the number of leks being monitored over time. These two issues inherently lead to a negative bias in the estimate over time (Hagen 2011).

Brood Surveys

Since 2016, the SGP has completed sharp-tailed grouse brood surveys near Delta Junction with the help of volunteers and their trained pointing dogs. Volunteers and their dogs walked predetermined transects while the dog located grouse, the dog handler controlled their dog, and a second person recorded biological and distance (distance of group from transect line) data. These data provide important demographic information (e.g., ratio of juveniles per adult, average brood size, birds/km) to managers prior to the hunting season. In 2019 surveys were conducted during 20–21 July. Survey conditions in 2019 were generally good with temperatures averaging 20.0°C (range: 14.0°C to 26.0°C) and winds averaging 1.0 kph (range: 0 kph to 6.9 kph). In 2020, surveys were conducted 24–26 July. Survey conditions in 2020 were generally good with temperatures averaging 13.4°C (range: 8.9°C to 20.6°C) and winds averaging 1.3 kph (range: 0 kph to 10.3 kph). Small sample sizes preclude any strong conclusions from the data; however, the data suggests that chick production and survival were likely good in 2019 but poor in 2020 (Table 8). Good production in 2019 was likely a result of higher breeding densities of sharp-tailed grouse in the spring as well as dry, warm weather during the early part of the brood rearing period in June 2019; whereas poorer production in 2020 was likely a result of low breeding densities of sharp-tailed grouse in the spring and wet weather during June 2020.

Table 8. Number of sharp-tailed grouse chicks observed per brood group within Unit 20D near Delta Junction, Alaska, 2016–2020.

Year	Sample size (*n*)	Mean (chicks/brood)	Range (chicks/brood)
2016	6	3.3	2–5
2017	8	3.9	1–8
2018	2	1.0	1–1
2019	6	5.2	3–8
2020	2	1.0	1–1

Wing Collections

There were 73 hunter-harvested sharp-tailed grouse wing samples within the FIRS region during RY18 and 107 wing samples during RY19 (Table 9). Based on wing donations the proportion of juveniles in the population declined from 2017 to 2018 suggesting poor recruitment of juveniles into the fall population. However, data from 2019 suggest an increase in the proportion of juveniles in the total harvest indicating excellent recruitment of juveniles into the fall population. This may in part due to dry conditions experienced across much of the Interior in June of 2019. Weather conditions during the month of June coincide with the hatch and early brood-rearing

period of sharp-tailed grouse and have been found to be important to the survival of grouse chicks (Moss 1985, Baines 1991, Moss et al. 2001, Loneux et al. 2003, Summers et al. 2004, Ludwig et al. 2010, Viterbi et al. 2015, Wann et al. 2016, Wegge and Rolstad 2017).

Table 9. Total number and proportion of juvenile sharp-tailed grouse with binomial 95% confidence intervals (CI) based on harvested wing collections within the Fairbanks and Interior road system region, Alaska, regulatory years 2011–2019.

Regulatory year[a]	Unit	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI
2011	20D	20	35	1	56	0.64	0.50–0.76
2012	20B, 20D	18	31	0	49	0.63	0.48–0.77
2013	19D, 20D, 20E	11	9	0	20	0.45	0.23–0.68
2014	12, 20B, 20D, 20E, 25C	37	60	2	99	0.62	0.51–0.72
2015	20B, 20D, 25D	32	57	0	89	0.64	0.53–0.74
2016	20B, 20D	24	58	0	82	0.71	0.60–0.80
2017	12, 20B, 20D, 20E	60	99	1	160	0.62	0.54–0.70
2018	12, 20B, 20D	39	34	0	73	0.47	0.35–0.59
2019	20D	27	80	0	107	0.75	0.65–0.83

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2011 = 1 July 2011–30 June 2012).

SPRUCE GROUSE

Spring Breeding Surveys

Currently, DWC has no spruce grouse population assessment projects within the FIRS region. Hunters reported seeing relatively few spruce grouse broods while afield in the FIRS region during RY18 and RY19.

Wing Collections

There were 90 hunter-harvested spruce grouse wing samples collected within the FIRS region during RY18, and 93 collected during RY19 (Table 10). Based on wing samples the proportion of juvenile spruce grouse in the population declined in RY18 suggesting poor juvenile recruitment into the population. In RY19 juvenile recruitment appeared to improve slightly from 2018.

ROCK PTARMIGAN

Spring Breeding Surveys

In the FIRS region, rock ptarmigan roadside counts were completed from 28 April to 18 May in 2019 and from 28 April to 15 May in 2020. In 2019, surveys were completed near Donnelly Dome along the Richardson Highway, at Mount Fairplay along the Taylor Highway (Unit 20E), near 12-mile Summit and Eagle Summit along the Steese Highway (Unit 25C), and along a portion of Primrose Ridge in DNP (Unit 20C). The same surveys were completed in 2020 except

Table 10. Total number and proportion of juvenile spruce grouse with binomial 95% confidence intervals (CI) based on harvested wing collections within the Fairbanks and Interior road system region, Alaska, regulatory years 2011–2019.

Regulatory year[a]	Unit	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI
2011	20B, 20D	4	13	0	17	0.76	0.50–0.93
2012	12, 20B, 20C, 20D, 24B, 25C	25	44	1	70	0.63	0.51–0.75
2013	12, 19D, 20B, 20D, 20E	19	43	0	62	0.69	0.56–0.80
2014	12, 20B, 20C, 20D, 20E, 25C	22	61	3	86	0.73	0.63–0.83
2015	12, 20B, 20C, 20D, 20E, 25D	46	149	0	195	0.76	0.70–0.82
2016	12, 19D, 20B, 20C, 20D, 20E	29	78	0	107	0.73	0.63–0.81
2017	20A, 20B, 20C, 20D, 20E	52	108	0	160	0.68	0.60–0.75
2018	20B, 20C, 20D, 20E	45	45	0	90	0.50	0.39–0.61
2019	20A, 20B, 20D	35	48	10	93	0.58	0.46–0.69

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2011 = 1 July 2011–30 June 2012).

for those near 12-mile Summit or Eagle Summit along the Steese Highway. In most years roadside counts were conducted once and therefore no estimate of precision in the numbers are available. However, repeat counts have been conducted at Mount Fairplay and the data suggest that rock ptarmigan numbers likely haven't changed dramatically since the decline observed in 2018 (Table 11). It is important to note the small sample size (n = 7) results in large confidence intervals. The maximum counts from surveys where repeat counts were not available (Donnelly Dome, 12-mile, Eagle Summit, and Primrose Ridge) were used as a relative index of abundance for each area. Results from these surveys suggest ptarmigan populations may be relatively stable at low density near Donnelly Dome and relatively stable at higher density near Primrose Ridge in DNP. Surveys were completed near 12-mile and Eagle Summit in 2019 but not in 2018 and 2020. However, a separate spring survey conducted near Eagle Summit indicate numbers of ptarmigan have very likely increased from 2019 to 2020 (see below).

Table 11. Mean number of male rock ptarmigan estimated per listening post (stop, n = 7) with bootstrap 95% confidence intervals (CI) for survey route near Mount Fairplay in Unit 20E within the Fairbanks and Interior road system region, Alaska, 2015–2020.

Year	Mean (males/stop)	95% CI
2015	0.57	0.14–1.14
2016	1.10	0.57–1.52
2017	1.29	1.00–1.57
2018	0.52	0.19–0.86
2019	0.67	0.33–1.00
2020	0.57	0.29–0.90

In addition to roadside surveys, in 2015 the SGP began conducting spring breeding surveys of territorial males within a 33.3 km^2 area near Eagle Summit (Weeden 1965a) as part of a larger research project using conventional distance sampling methodology (Buckland et al. 2001). Observers walk survey transects and record the number of breeding males seen and distance

from the observer on the transect to the bird. Distance measurements allow researchers to calculate a detection function, which accounts for birds not seen during the survey and increases the reliability of the abundance estimate. Unlike most other surveys that the SGP conducts, the rock ptarmigan survey near Eagle Summit provides an estimate of density or abundance rather than a relative index of abundance. Data presented here is from 2016 through 2020 only due to changes made in survey methods between 2015 and 2016. Density of male rock ptarmigan within the study area near Eagle Summit decreased from 2016 to 2017 from 2.04 males per km^2 to 1.48 males per km^2 (Table 12). No survey data was collected in 2018 so no inference can be made in changes in density or abundance between 2017 and 2019. Surveys conducted in 2019 and 2020 indicate densities of male rock ptarmigan increased from 1.80 males per km^2 to 2.45 males per km^2.

Table 12. Mean number of territorial male rock ptarmigan estimated per square kilometer with 95% confidence intervals (CI), sample sizes (*n*) used to estimate yearly detection functions, and detection function models (DF) using conventional distance sampling methodology within a study area adjacent to the Steese Highway within the Fairbanks and Interior road system (FIRS) region, Alaska, 2016–2020. Yearly detection function models were chosen using standard model selection procedure (e.g., lowest AIC score).

Year	Mean (males/km^2)	95% CI[a]	*n*	DF Model
2016	2.04	1.28–3.25	53	Uniform + cos
2017	1.48	1.05–2.08	61	Half normal
2018	NS[a]	–	–	–
2019	1.80	1.16–2.80	53	Half normal
2020	2.45	1.71–3.51	50	Half normal

[a] No survey.

Brood Surveys

In 2019 surveys were attempted during 26–27 July; however, a complete survey of the area was not possible due to weather. In 2020 surveys were completed 7–9 August. Survey conditions in 2020 were excellent with temperatures averaging 12.0°C (range: 6.7°C to 19.7°C) and winds averaging 1.8 kph (range: 0 kph to 8.0 kph). The total number of broods seen and the average number of chicks observed per brood in 2020 was similar to 2018 (Table 13).

Wing Collections

A total of 34 hunter-harvested rock ptarmigan wing samples were collected within the FIRS region during RY18 and only 1 wing sample in RY19 (Table 14). It is difficult to make meaningful inferences about differences in annual juvenile production based on the low sample sizes and we recommend caution in drawing strong conclusions from these numbers alone.

Research

Concern by both members of the public and SGP staff over low abundance of rock ptarmigan observed prior to and during spring surveys in 2014 along the Steese Highway prompted efforts to study this important game species. Previous research in the area (Weeden 1965a) provided an

Table 13. Number of rock ptarmigan chicks observed per brood group within a study area on the Steese Highway within the Fairbanks and Interior road system, Alaska, 2016–2020.

Year	Sample Size (*n*)	Mean (chicks/brood)	Range (chicks/brood)
2016	4	6.3	2–13
2017	5	3.2	1–6
2018	7	3.4	1–7
2019[a]	–	–	–
2020	7	3.9	1–5

[a] Incomplete survey due to inclement weather.

Table 14. Total number and proportion of juvenile rock ptarmigan with binomial 95% confidence intervals (CI) based on harvested wing collections within the Fairbanks and Interior road system region, Alaska, regulatory years 2011–2019.

Regulatory year[a]	Unit	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI
2011	20B	10	9	0	19	0.47	0.24–0.71
2012	20B, 20D, 25C, 26B	21	26	0	47	0.55	0.40–0.70
2013	20B, 25C	0	6	0	6	1.00	0.54–1.00
2014	25C	7	4	0	11	0.36	0.11–0.69
2015	20B, 25C	2	5	0	7	0.71	0.29–0.96
2016	20B, 25C	1	5	0	6	0.83	0.36–1.00
2017	20B, 20D, 25C	6	15	0	21	0.71	0.48–0.89
2018	20B, 20E, 25C	10	24	0	34	0.71	0.53–0.85
2019	20B	0	1	0	1	1.00	0.03–1.00

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2011 = 1 July 2011–30 June 2012).

incentive and a means to compare our research findings with historical data. To better understand changes in rock ptarmigan abundance, movement patterns, and survival rates along the Steese Highway near Eagle Summit, the SGP initiated a 3-year research project in spring 2015. This study was extended in 2018 to include data collection on movements and overwinter survival of juvenile (young-of-the-year) rock ptarmigan. From 2015 to 2019, SGP and DWC staff captured 245 (129 females, 64 males, and 52 young-of-the-year) rock ptarmigan and fitted 231 (128 females, 57 males, and 46 young-of-the-year) with VHF radio transmitters to document movement patterns, survival, and nest success of this heavily hunted population. Preliminary data suggest movements generally differed by sex. Yearling and adult males remained on or very near the breeding grounds throughout the year. However, yearling and adult females dispersed varying distances (up to 170 km) away from the breeding grounds to where they spent much of the winter months. These data are consistent with other studies that have documented differences in sex-specific dispersal rates (Weeden 1964, Gruys 1993, Warren and Baines 2007, Hornell-Willebrand et al. 2014, Merizon et al. 2018). Further analysis on seasonal movements and survival is underway and will be available in an upcoming report on our webpage at www.smallgame.adfg.alaska.gov under the "Research & Reports" tab.

In 2018 DWC received funding and initiated field work for a graduate research project that would build on ongoing research at Eagle Summit as well as completed research along the Denali Highway (Merizon et al. 2018; Unit 13B). It aims to compare the reproductive ecology of rock ptarmigan near Eagle Summit and along the Denali Highway. Estimates of nest initiation rates, clutch size, nest success, sex ratio at hatch, and brood survival will be compared between the 2 populations. Two years of field work (2018–2019) were completed in the summer of 2019 and data is currently being analyzed by a MS student at UAF.

WILLOW PTARMIGAN

Spring Breeding Surveys

In the FIRS region, willow ptarmigan surveys were completed from 28 April to 9 May in 2019 and from 28 April to 11 May 2020. Surveys occurred along a portion of the DNP road just west of the Savage River, on military lands within the DTA near Delta Junction, and near Mount Fairplay along the Taylor Highway. All surveys were conducted by SGP staff and student volunteers from the University of Alaska Fairbanks Student Chapter of The Wildlife Society in 2019 and 2020.

Within the DNP, spring breeding abundance of willow ptarmigan appears to have increased each year since 2015 (Table 15). Willow ptarmigan abundance within the DTA appears to have remained relatively stable at low density. Further east willow ptarmigan abundance near Mount Fairplay likely declined for several years following the high observed in 2017; however, in 2020 numbers appear to be increasing.

Table 15. Mean number of male willow ptarmigan per listening post (stop) with bootstrap 95% confidence intervals (CI) from survey routes within Denali National Park (DNP) along the park road, at Mount Fairplay in Unit 20E, and on Fort Wainwright-Donnelly Training Area (DTA) near Delta Junction within the Fairbanks and Interior road system region, Alaska, 2014–2020.

	DNP Park Road (13 stops)		DTA (17 stops)		Mount Fairplay (12 stops)	
Year	Mean (males/stop)	95% CI	Mean (males/stop)	95% CI	Mean (males/stop)	95% CI
2014	0.77	0.31–1.31	0.04	0.00–0.12	–	–
2015	0.77	0.54–1.04	0.22	0.10–0.35	0.58	0.25–1.00
2016	1.12	0.69–1.50	0.06	0.00–0.14	0.50	0.22–0.81
2017	1.46	0.77–2.27	0.18	0.07–0.29	1.25	0.86–1.70
2018	1.79	1.28–2.36	0.06	0.00–0.18	0.31	0.14–0.50
2019	2.38	1.95–3.00	0.14	0.04–0.27	0.42	0.11–0.75
2020	2.88	2.31–3.42	0.26	0.09–0.47	0.64	0.36–0.94

Wing Collections

A total of 18 hunter-harvested willow ptarmigan wing samples were collected within the FIRS region during RY18 and only 2 wing samples were collected during RY19 (Table 16). It is

difficult to make meaningful inferences about differences in annual juvenile production based on these low sample sizes and we recommend caution in drawing conclusions from these counts.

Table 16. Total number and percent juvenile willow ptarmigan with binomial 95% confidence intervals (CI) based on harvested wing collections within the Fairbanks and Interior road system, Alaska, regulatory years 2011–2019.

Regulatory year[a]	Unit	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI
2011	20B, 20C, 20D	8	10	0	18	0.56	0.31–0.78
2012	20B, 20D, 25C	5	4	0	9	0.44	0.14–0.79
2013	19C, 25C	2	2	0	4	0.50	0.07–0.93
2014	20E, 25C	2	7	0	9	0.78	0.40–0.97
2015	20B, 25C	0	1	11	12	–	–
2016	20B, 20D, 25C	3	2	0	5	0.40	0.05–0.85
2017	12, 20B, 20C, 25C	6	10	0	16	0.63	0.35–0.85
2018	20E, 25C	7	11	0	18	0.61	0.36–0.83
2019	20A, 20B	1	1	0	2	0.50	0.01–0.99

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2011 = 1 July 2011–30 June 2012).

SNOWSHOE HARE

Abundance Surveys

Roadside counts of snowshoe hares were conducted from 16 April to 3 May 2019 near Delta Junction, Tok, and Anderson, on 13 May 2019 along the Steese Highway and in late June near Donnelly Dome. In 2020, roadside counts were conducted from 15 April to 6 May near Delta Junction, Tok, and Anderson. In addition to the roadside counts conducted by the SGP, DNP researchers have maintained an index of hare abundance since the late 1980s.

Snowshoe hare populations in Alaska and northern Canada exhibit 9- to 10-year population cycles (Krebs et al. 2013). The most recent peak in the snowshoe hare cycle for the eastern Interior was in 2017 or 2018 and for the most recent peak for the central Interior was in 2018 or 2019 (Table 17).

Table 17. Interior snowshoe hare population survey data broken up by region within the greater Fairbanks and Interior road system (FIRS), Alaska, 2005–2020. All data is reported as the maximum number of snowshoe hares observed per count area unless otherwise noted.

	Western Interior		Eastern Interior				
Year	DNP[a]	Anderson[b]	Delta Junction[c]	Delta BBS[d]	Donnelly BBS[e]	Tok[f]	Steese[g]
2005	6.25	–	–	57	10	–	–
2006	25.20	–	–	129	NS[h]	–	–
2007	26.20	24[h]	109	96	50	–	21
2008	28.25	82	91	89	21	–	14
2009	40.57	27	54	87	14	–	8
2010	32.86	10	37	18	12	–	3
2011	9.60	4	16	7	3	–	1
2012	0.48	3	27	8	3	–	0
2013	0.04	NS	NS	5	1	–	0
2014	0.53	NS	4	8	1	–	1
2015	0.48	1[i]	4[i]	6	4	–	NS
2016	0.53	7	28	32	14	–	3
2017	6.29	23	72	52	26	42	19
2018	10.75	105	55[j]	32[k]	28	56	NS
2019	11.60	34	31	7	0	0	1
2020	8.60	3	6	NS	NS	0	NS

Note: NS = no survey.

[a] Denali National Park (DNP) count survey is conducted by the National Park Service (C. McIntyre, personal comm.). This is the number of snowshoe hares seen per hour during field work.

[b] This is a roadside count near Anderson conducted by DWC staff and it includes 4 roadside count areas.

[c] This is a roadside count near Delta Junction conducted by DWC staff and it includes 3 roadside count areas.

[d] The Delta Junction Breeding Bird Survey (BBS) hare count is conducted by other agency biologists and it includes one historical BBS route.

[e] The Donnelly Dome Breeding Bird Survey (BBS) has been conducted by Delta Training Area (DTA) personnel or other agency biologists and it includes 1 historical BBS route.

[f] This is a roadside count near Tok conducted by DWC staff and it includes 2 roadside count areas.

[g] This is a roadside count along the Steese Highway conducted by DWC staff and it includes 1 roadside count area.

[h] Three of the 4 survey routes were counted.

[i] Two of the 3 survey routes were counted.

[j] Gusting winds during survey.

[k] Partial survey.

♦ ♦ ♦

Alaska Range

For purposes of this report the Alaska Range region includes Units 9B, 9A, 11, 13C, 13B, 13E and 16B (Fig. 4). This area includes the Denali Highway, and portions of the Richardson and Parks highways. The Alaska Range region is largely an alpine area composed of willow, dwarf birch, and subalpine spruce forests; however, mixed spruce and hardwood forests dominate several lowland areas of the Susitna River valley and Wrangell–St. Elias National Park. There are numerous small water bodies, large rivers, steep rocky vegetated hills, tall peaks, and glaciated mountains. This region is accessible by road, boat, air, and off-road vehicle for recreation and hunting. The Denali Highway, in particular, is an area that receives significant grouse and ptarmigan hunting pressure during the fall and late winter (Merizon and Carson 2013, Merizon et al. 2015). Sooty grouse are not found in this region.

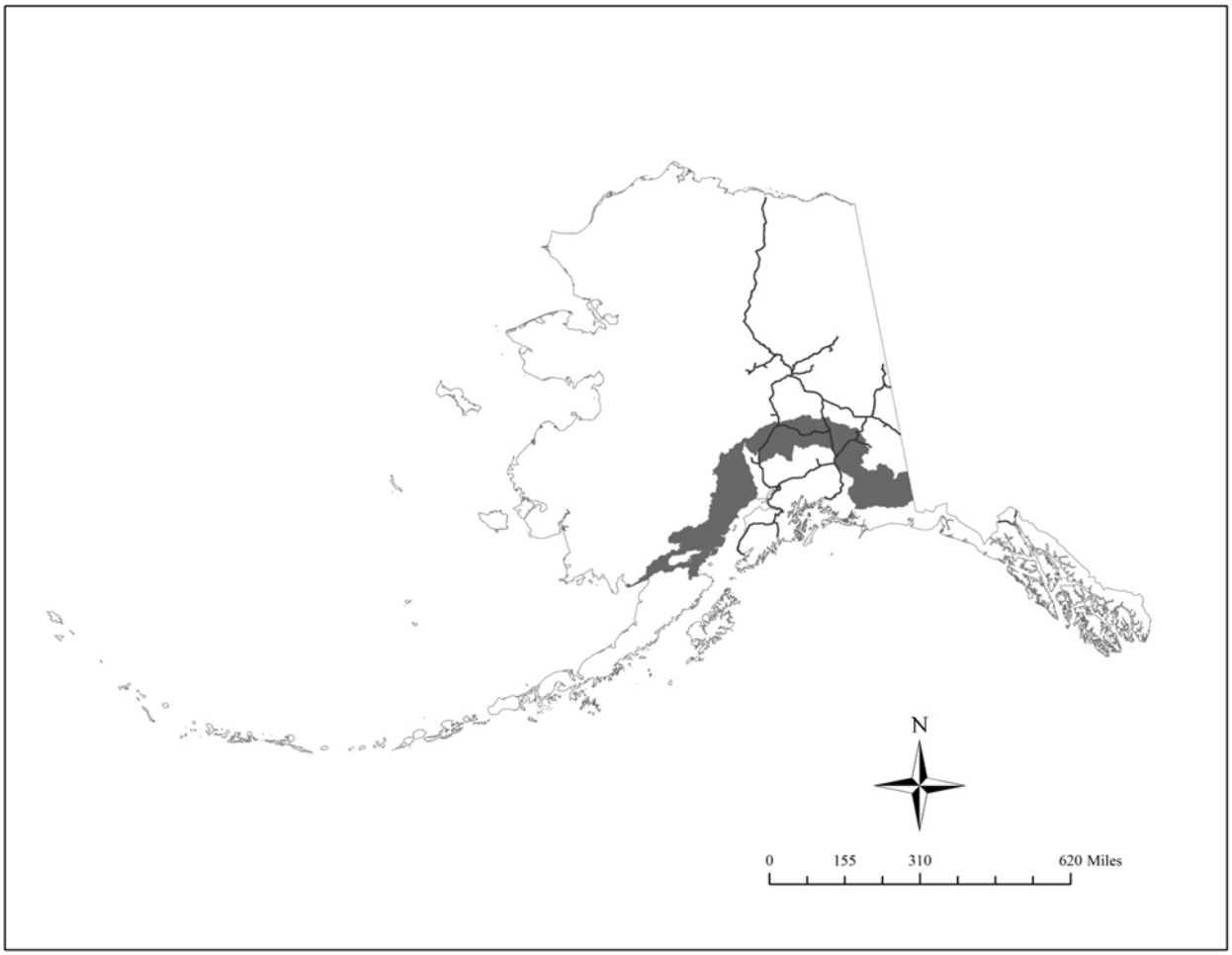

Figure 4. Map of the Alaska Range Region.

RUFFED GROUSE

Currently there are no ruffed grouse spring breeding or brood survey efforts within this region. Ruffed grouse do breed within this region and are harvested and observed each year, although infrequently.

SHARP-TAILED GROUSE

Spring Breeding Surveys

Currently, there are no sharp-tailed grouse spring breeding or brood survey efforts within this region. However, sharp-tailed grouse are routinely observed during breeding season in April and May as well as during the winter by local outdoor enthusiasts in the upper Nenana and upper Copper rivers as well as the eastern Talkeetna Mountains.

Wing Collections

Zero (0) sharp-tailed grouse wings were collected by hunters during RY18 or RY19 in the Alaska Range. Low harvest in this region is a primarily a function of limited access to the best sharp-tailed grouse habitat in this region.

SPRUCE GROUSE

Spring Breeding Surveys

Currently there are no spruce grouse spring breeding or summer brood survey efforts within this region. Based on hunter reports and DWC staff field observations, spruce grouse abundance in most of the Alaska Range region was average to high during RY18 and RY19. However, reports closer to Dillingham and King Salmon suggested slightly higher abundance of spruce grouse than in the recent past.

Wing Collections

Three (3) spruce grouse wings were collected by hunters during RY18 and 2 during RY19 in the Alaska Range. No inferences can be provided regarding juvenile production with small sample sizes. If larger sample sizes are collected over future years, comparisons will be possible.

ROCK PTARMIGAN

Spring Breeding Surveys

Rock ptarmigan spring breeding surveys occurred between 27 April and 15 May in 2019 and between 5 and 21 May in 2020 at 4 survey locations (Unit 13B; Table 18). Counts of the mean number of breeding male rock ptarmigan observed per stop were lower in 2019 (0.19 males/stop) than 2018 (0.32 males/stop,). However, the 2020 estimate appeared to be up slightly (0.27 males/stop) from 2019. Due to difficulty in accessing rock ptarmigan spring breeding locations

in late April and May, there are currently no other survey locations for rock ptarmigan in this region.

During the RY18 and RY19 hunting seasons along the Denali Highway, hunters reported seeing and harvesting average to fewer-than-average numbers of rock ptarmigan in this region.

Table 18. Mean number of spring breeding male rock ptarmigan per listening post (stop, n = 43) with bootstrap 95% confidence intervals in Unit 13B, Alaska, 2014–2020.

	Mean	Confidence Intervals	
Year	(males/stop)	Lower	Upper
2014	0.60	0.46	0.82
2015	0.34	0.23	0.45
2016	0.72	0.51	0.93
2017	0.37	0.11	0.75
2018	0.32	0.08	0.55
2019	0.19	0.08	0.30
2020	0.27	0.06	0.52

Brood Surveys

Between 23–24 July 2019, and between 22–23 July 2020, DWC completed the brood surveys for rock and willow ptarmigan in the Alaska Range region. Only 1 rock ptarmigan brood was observed in 2020 along 26 km of transects in this region. Despite a few previous observations, rock ptarmigan were not anticipated in large numbers along the selected survey locations. Merizon et al. (2018) documented that rock ptarmigan in Unit 13B tend to rear broods in areas distant from road-accessible locations and at high elevation (≥ 1,200 m). Accessibility is very important to efficiently and reliably enumerate and estimate brood sizes each year. Moving forward, the SGP will focus brood survey efforts on willow ptarmigan.

Wing Collections

Zero (0) rock ptarmigan wing samples were collected from hunters during RY18 and only 1 sample was collected during RY19 in the Alaska Range region.

Research

Beginning in April 2018, the SGP and UAF initiated a 2-year (2018–2019) reproductive ecology research project on rock ptarmigan. This study has been led by a UAF Master of Science graduate student with assistance from the SGP and is designed to compare the reproductive ecology and early chick survival for rock ptarmigan between Unit 13B and Unit 25C (Eagle Summit-Steese Highway). This study will allow SGP staff to refine their understanding of reproductive ecology and population productivity of this popular and heavily hunted small game species. Field data collection efforts have been completed and a final report is anticipated to be available by Fall 2021.

WHITE-TAILED PTARMIGAN

Spring Breeding Surveys

Currently, no spring breeding surveys for white-tailed ptarmigan are conducted anywhere in the state. White-tailed ptarmigan densities are typically low where they occur, and their habitat selection makes this one of the more challenging small game species to pursue in Alaska.

Wing Collections

Zero (0) white-tailed ptarmigan wings were collected by hunters during RY18 and RY19 in the Alaska Range region.

WILLOW PTARMIGAN

Spring Breeding Surveys

Willow ptarmigan spring breeding surveys occurred between 27 April and 17 May 2019 and between 25 April and 21 May 2020 at 7 survey locations (Table 19). The 2019 spring breeding estimate for Unit 13B (1.29 males/stop) decreased from 2018 (2.31 males/stop); however, both 2019 (1.29 males/stop) and 2020 (1.32 males/stop) estimates remained near the recent 5-year (1.7 males/stop) and 10-year (1.3 males/stop) averages. In Unit 13E the 2019 spring breeding estimate increased (1.35 males/stop) from 2018 but then decreased steeply in 2020 (0.25 males/stop).

Table 19. Mean number of spring breeding male willow ptarmigan per listening post (stop) with bootstrap 95% confidence intervals in Units 13B and 13E in the Alaska Range region, 2014–2020.

	Unit 13B			Unit 13E		
	Mean	Confidence Interval		Mean	Confidence Interval	
Year	(males/stop)	Lower	Upper	(males/stop)	Lower	Upper
2014	0.85	0.34	1.31	0.67	0.56	0.79
2015	1.04	0.74	1.29	0.57	0.53	0.60
2016	1.76	1.43	2.04	0.95	0.89	1.00
2017	1.13	0.89	1.45	0.74	0.57	0.90
2018	2.31	1.68	2.94	0.60	0.53	0.67
2019	1.29	1.04	1.60	1.35	1.27	1.43
2020	1.32	1.00	1.59	0.25	0.08	0.42

Brood Surveys

Between 23 and 24 July 2019, and between 22 and 23 July 2020, the SGP completed brood surveys for rock and willow ptarmigan in the Alaska Range region (Table 20). Surveys of 2 separate locations were completed along the Denali Highway with numerous survey transects at each location. Average willow ptarmigan brood size increased in 2019 to 6.7 chicks per brood from 3.4 chicks per brood in 2018. This is likely a result of very favorable weather conditions for

the 2–4 weeks post hatch in June and early July 2019. However, brood size in 2020 dropped to 1.5 chicks per brood. The number of broods per survey kilometer increased from 0.2 broods per km (n = 12 km) in 2018 to 0.5 broods per km (n = 19 km) in 2019 but then dropped sharply in 2020 to 0.1 broods per km. With increased volunteer support in 2020, additional transects were added. In 2020, volunteers documented fewer broods on more survey kilometers further underscoring the low chick survival in this region, which was very likely the result of poor post-hatch weather pattern.

Table 20. Number of willow ptarmigan chicks observed per brood group within Units 13B and 13E within the Alaska Range, 2016–2020.

Year	Sample Size (n)	Mean (chicks/brood)	Range (chicks/brood)
2016	5	4.3	1–6
2017	16	5.9	1–13
2018	6	3.4	1–5
2019	12	6.7	2–13
2020	2	1.5	1–2

Wing Collection

The number of hunter-harvested willow ptarmigan wing samples collected within the Alaska Range region totaled 102 during RY18 and 172 during RY19 (Table 21). The proportions of juveniles appeared to be down in RY18 compared to RY17. However, the proportion of juveniles in RY19 was up compared to RY18. These data support brood survey results that documented low chick survival during summer 2018 but high chick survival and recruitment into the hunted population in summer 2019. The summer of 2019 had very favorable warm and dry conditions during a critical period of chick survival (late June through July). Hunters reported average willow ptarmigan densities during RY19 in this region.

SNOWSHOE HARE

Abundance Surveys

Currently, there are no snowshoe hare survey locations within the Alaska Range region. However, despite the lack of survey data, snowshoe hare abundance peaked in 2019 and during spring and summer 2020 has begun to decline based on DWC, hunter, and other outdoor enthusiast observations.

ALASKA HARE

Abundance Surveys

Currently, there are no Alaska hare survey locations in the state. However, Unit 9 is one of the Units that has been and will continue to be included in an ongoing research project that will

examine movement and mortality, and attempt to develop a long-term abundance survey technique for this species (see also 'Western Rural').

Table 21. Total number and proportion of juvenile willow ptarmigan with binomial 95% confidence intervals (CI) based on harvested wing collections within the Alaska Range region, regulatory years 2011–2019.

Regulatory year[a]	Unit	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI
2011	9, 13, 16	67	79	0	146	0.54	0.46–0.62
2012	9, 13, 16	39	28	2	69	0.41	0.30–0.54
2013	9, 13, 16	146	103	0	249	0.41	0.35–0.48
2014	9, 13, 16	30	27	0	57	0.47	0.34–0.61
2015	9, 13, 16	46	70	0	116	0.60	0.51–0.69
2016	9, 13, 16	67	97	0	164	0.59	0.51–0.67
2017	9, 13, 16	37	58	0	95	0.61	0.51–0.71
2018	9, 13, 16	62	40	0	102	0.39	0.30–0.49
2019	9, 13, 16	70	102	0	172	0.59	0.52–0.67

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2018 = 1 July 2018–30 June 2019).

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Southcentral Road System

For purposes of this report the Southcentral road system includes Units 6, 13A, 13D, 14, and 16A (Fig. 5). This area includes the heavily populated Anchorage Bowl, including Eagle River and Chugiak, and the Mat-Su metro area of Wasilla and Palmer. It also includes Cordova, Glennallen, Talkeetna, and Valdez and many other smaller communities. This region is a mix of lower elevation, mature mixed hardwood-spruce forest, alpine slopes and peaks, and coastal rainforest. There are numerous small water bodies, small creeks, and large rivers. The region is highly accessible by road, air, boat, and off-road vehicle for recreation, tourism, and hunting. Sooty grouse and Alaska hare are not found in this region.

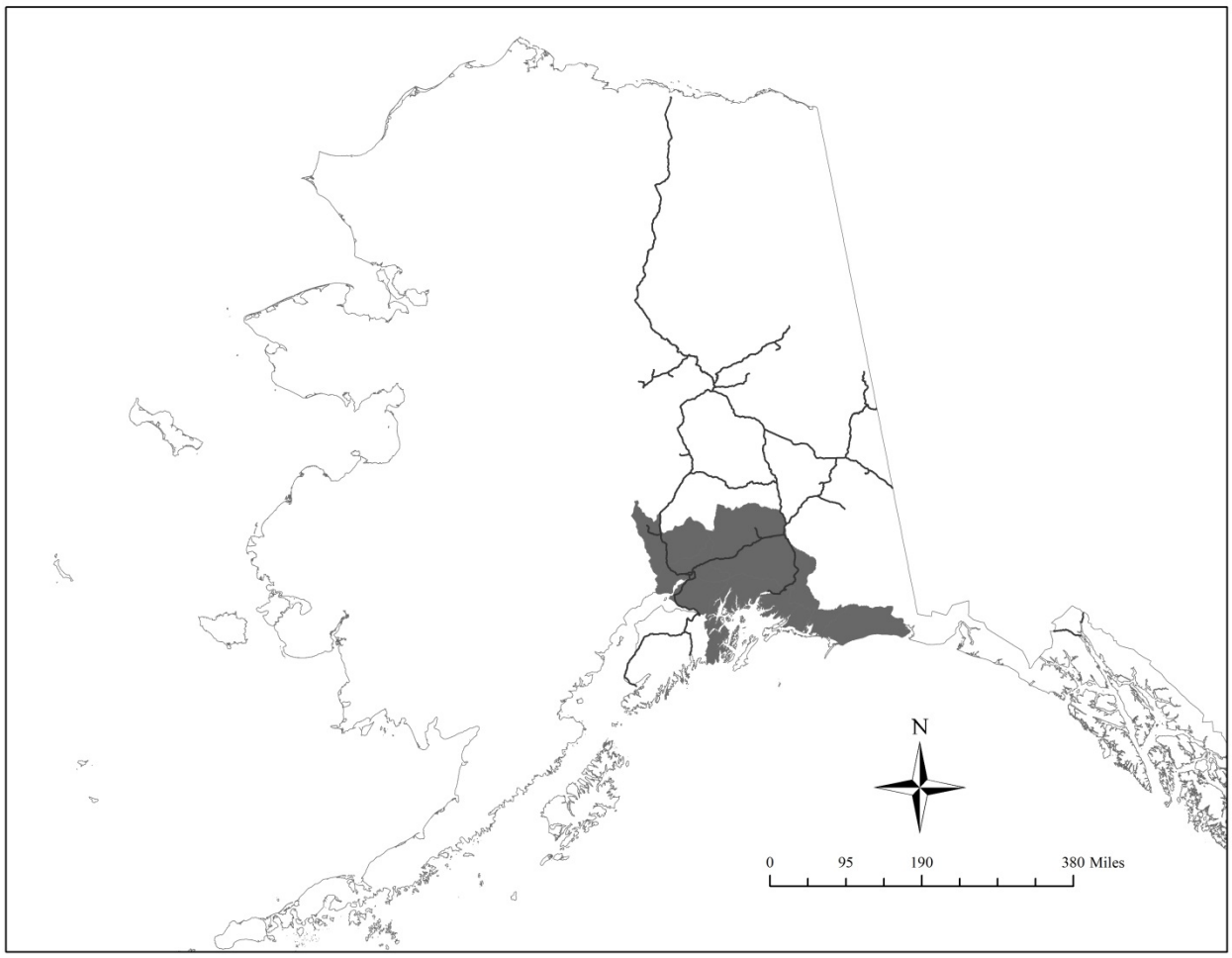

Figure 5. Map of the Southcentral road system, Alaska.

RUFFED GROUSE

Spring Breeding Surveys

The SGP's ruffed grouse spring breeding surveys in Palmer and the Matanuska Valley Moose Range (Unit 14A) occurred between 15 April and 12 May 2019 and between 18 April and 16

May, 2020 (Table 22). The spring breeding estimate in 2019 was similar to 2018. However, the 2020 spring breeding estimate declined (0.04 males/stop) from 2019 (0.13 males/stop). Survey conditions in 2020 were near average with lingering snow at the beginning of the survey season and plant phenology behind the recent 5-year average; which was warmer than normal. Drumming survey effort was increased in 2020 as a result of consistently low survey results and many routes were completed 4 to 5 times.

Table 22. Mean number of spring breeding male ruffed grouse (drummers) per listening post (stop, n = 48) with bootstrap 95% confidence intervals in Unit 14A, Alaska, 2009–2020.

	Mean	Confidence Interval	
Year	(drummers/stop)[a]	Lower	Upper
2009	0.17	0.09	0.25
2010	0.15	0.08	0.22
2011	0.16	0.00	0.29
2012	0.07	0.01	0.12
2013	0.15	0.08	0.25
2014	0.14	0.05	0.24
2015	0.28	0.24	0.32
2016	0.21	0.13	0.30
2017	0.17	0.08	0.29
2018	0.16	0.08	0.25
2019	0.13	0.55	0.21
2020	0.04	0.02	0.08

[a] Between 2009 and 2014 a total of 4 survey routes (33 listening posts) were utilized in the estimate. Two additional survey routes were added in 2015 for a total of 48 listening posts.

Due to increasing human noise along historic routes in the Mat-Su, in 2013 SGP and local DWC staff began exploring new areas throughout the Mat-Su to create additional spring breeding survey routes. Beginning in spring 2015, SGP created and began conducting surveys along 2 additional routes northeast of Palmer that are less impacted by human noise and disturbance. Survey results since 2015 include the new routes.

Since translocated ruffed grouse were released in Southcentral during the early 1990s, a typical 8- to 10-year population cycle has not been observed. However, since the low of 2012, it does appear that a traditional ruffed grouse population cycle may be beginning. A high was observed in spring 2015 with a steady decline likely reaching a cyclical low in 2020. A steady population increase over the next 2–3 years will be further confirmation that the Mat-Su ruffed grouse population is beginning to cycle like populations in the Interior of Alaska and throughout its range in the lower 48 states.

Fall Counts

Early morning roadside counts of ruffed and spruce grouse were initiated in late-summer and fall 2019 in an effort to begin monitoring primarily spruce grouse populations as it relates to the wide spread spruce bark beetle infestation. Pre-hunting season surveys (<10 August) were completed

between 31 July and 9 August, 2019 and in-season surveys were completed between 26 September and 13 October, 2019 in Units 14A, 14B, and 16A. Ruffed grouse were enumerated throughout survey area; however, having only 1 year of data, no inferences can be made regarding trends. These surveys will be continued in future years allowing another means to monitor ruffed and spruce grouse population trends in the Mat-Su.

Wing Collections

Eight (8) hunter-harvested ruffed grouse wing samples were collected during RY18 and 26 during RY19 in the Southcentral road system region (Table 23). It is difficult to make meaningful inferences with low sample sizes; however, summer 2019 weather conditions were likely very favorable for chick survival as reflected in the RY19 proportions.

Table 23. Total number and proportion of juvenile ruffed grouse with binomial 95% confidence intervals (CI) based on harvested wing collections within the Southcentral road system region, Alaska, regulatory years 2011–2019.

Regulatory year[a]	Unit	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI
2011	13,14	4	1	0	5	0.20	0.01–0.40
2012	13,14	2	2	0	4	0.50	0.07–0.93
2013	13,14	8	19	0	27	0.70	0.50–0.86
2014	13,14	4	13	0	17	0.76	0.50–0.93
2015	13,14	8	21	0	29	0.72	0.53–0.87
2016	13,14	6	22	0	28	0.79	0.59–0.92
2017	13,14	9	22	0	31	0.71	0.52–0.86
2018	13,14	3	5	0	8	0.63	0.24–0.91
2019	13,14	4	22	0	26	0.85	0.65–0.96

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2018 = 1 July 2018–30 June 2019).

SHARP-TAILED GROUSE

Currently there are no sharp-tailed grouse breeding or brood survey efforts within this region. Historically, sharp-tailed grouse have always been present in Units 13A and 13D and they are harvested or observed each year.

Beginning summer and fall 2017 through fall 2019, sharp-tailed grouse became increasingly and repeatedly observed by hikers, hunters, and bird enthusiasts as far south as Anchorage, Point McKenzie, the Susitna Hayflats, and throughout the Hatcher Pass area (north of Palmer). Throughout the winter and spring of 2019 outdoor enthusiasts continued reporting observations online and in person to SGP staff in Palmer and Anchorage. Reports were verified with photos and detailed location information. The SGP staff will continue to monitor the recent movement of sharp-tailed grouse further into the Southcentral road system region and continue to provide updates in future reports. If spring lek locations are identified, SGP staff will make efforts to monitor those leks annually.

SPRUCE GROUSE

Beginning in summer 2016 and continuing into spring 2020, a spruce bark beetle outbreak has dramatically affected the forest composition throughout Southcentral Alaska and the Kenai Peninsula. This most recent outbreak in the Southcentral road system region could have a potentially significant impact on the spruce grouse population that heavily utilizes mature white spruce for foraging and overwintering habitat.

Spring Breeding Surveys

Currently there are no spruce grouse spring breeding or summer brood survey efforts within this region. Based on field observations and hunting reports from within Units 14 and 16 road-accessible areas, densities of spruce grouse appeared to be high during fall 2019. Many hunters reported seeing abundant spruce grouse within the entire Southcentral road system region during RY19. However, based on field observations in spring and summer 2020, spruce densities appear to be lower than average.

Fall Counts

Early morning roadside counts of spruce and ruffed grouse were initiated in late-summer and fall 2019 in an effort to begin monitoring Mat-Su spruce grouse populations as it relates to the wide spread spruce bark beetle infestation. Prehunting season surveys (<10 August) were completed between 31 July and 9 August, 2019 and in-season surveys were completed between 26 September and 13 October, 2019 in Units 14A, 14B, and 16A. Spruce grouse were found to be common and abundant throughout the survey area; however, having only 1 year of data no inferences can be made regarding trends. These surveys will be continued in future years allowing another means to monitor spruce and ruffed grouse populations in the Mat-Su.

These surveys also estimated the severity of the beetle infestation along designated survey routes. All routes in Units 14B and 16A were estimated to have between 60% and 100% beetle killed white spruce > 23 cm in diameter. Large white spruce are the preferred roosting and forging habitat for spruce grouse in Southcentral Alaska between October and April. Surveys also estimated between 10% and 70% beetle killed white spruce <23 cm along designated survey routes.

Wing Collections

Thirty-seven (37) hunter-harvested spruce grouse wing samples were collected during RY18 and 66 during RY19 (Table 24). The proportion of juveniles in the harvest modestly decreased from RY17 (64%) to RY18 (46%). Overall juvenile production appears to be lower than average since RY18.

Table 24. Total number and proportion of juvenile spruce grouse with binomial 95% confidence intervals (CI) based on harvested wing collections within the Southcentral road system region, Alaska, regulatory years 2011–2019.

Regulatory year[a]	Unit	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI
2011	13, 14, 16	15	18	0	33	0.55	0.36–0.72
2012	13, 14, 16	32	38	0	70	0.54	0.42–0.66
2013	13, 14, 16	16	25	0	41	0.61	0.45–0.76
2014	13, 14, 16	25	39	0	64	0.61	0.48–0.73
2015	13, 14, 16	23	59	0	82	0.72	0.61–0.81
2016	13, 14, 16	21	52	0	73	0.71	0.59–0.81
2017	13, 14, 16	22	39	0	61	0.64	0.51–0.76
2018	13, 14, 16	20	17	0	37	0.46	0.29–0.63
2019	13, 14, 16	31	33	2	66	0.50	0.37–0.63

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2016 = 1 July 2018–30 June 2019).

ROCK PTARMIGAN

Spring Breeding Surveys

Rock ptarmigan spring breeding surveys occurred on 13 May 2019, and on 30 April and 13 May 2020 in Unit 14C. The 2019 spring breeding estimate for rock ptarmigan in Unit 14C declined (0.43 males/stop) from 2018 (1.14 males/stop). However, the 2020 spring breeding estimate was up (0.71 males/stop) to near the recent 5-year (0.66 males/stop) and 10-year average (0.73 males/stop).

Due to SGP and other DWC staff schedules and persistent strong winds along the survey route, spring breeding surveys were conducted only once in 2019 (Table 25). When surveys could not be completed multiple times during the breeding season, we used the maximum count as our index of abundance.

Table 25. Mean number of spring breeding male rock ptarmigan per listening post (stop, *n* = 7) with bootstrap 95% confidence intervals (CI) in the Southcentral road system region, Alaska, 2014–2020.

	Mean	Confidence Intervals	
Year	(males/stop)	Lower	Upper
2014	0.64	0.48	0.80
2015	1.00	–	–
2016	0.43	–	–
2017	0.29	–	–
2018	1.14	–	–
2019	0.43	–	–
2020	0.71	–	–

[a] With only one survey completed each year it was not possible to calculate confidence intervals 2015–2020.

Throughout this region in the winters of 2019 and 2020, hunters reported seeing and harvesting slightly fewer than average rock ptarmigan near popular hunting locations in the Chugach and Talkeetna mountains.

Brood Surveys

The SGP completed brood surveys for rock, white-tailed, and willow ptarmigan on 21 and 30 July 2019 near Hatcher Pass. Due to weather and low volunteer participation, surveys were not completed in 2020. In 2019, average chicks per brood was 4.0, which was an increase from 2018 (2.0; Table 26). In 2019, surveys were repeated twice within the last 2 weeks of July in an effort to increase the confidence of our results. These surveys will be continued annually so that meaningful comparisons can be made regarding annual population productivity.

Table 26. Number of rock ptarmigan chicks observed per brood group within the Southcentral road system region, 2016–2020.

Year	Sample Size (*n*)	Mean (chicks/brood)	Range (chicks/brood)
2016	3	6.7	2–12
2017	1	2.0	2
2018	2	2.0	1–3
2019	3	4.0	1–10
2020	NS	NS	NS

Note: NS = no survey.

Wing Collections

Nineteen (19) hunter-harvested rock ptarmigan wing samples were collected during RY18 and 43 during RY19 (Table 27). Despite the small sample sizes, the proportion of juveniles likely declined between RY17 (60%) and RY18 (21%) but increased again in RY19 (42%). The vast majority of the samples for both years were harvested in Unit 14C as in years past.

Table 27. Total number and proportion of juvenile rock ptarmigan with binomial 95% confidence intervals (CI) based on harvested wing collections within the Southcentral road system region, Alaska, regulatory years 2011–2019.

Regulatory year[a]	Unit	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI
2011	13, 14	4	4	0	8	0.50	0.16–0.84
2012	13, 14	15	4	0	19	0.21	0.06–0.46
2013	13, 14	19	10	0	29	0.34	0.18–0.54
2014	13, 14	17	20	0	37	0.54	0.37–0.71
2015	13, 14	5	10	0	15	0.67	0.38–0.88
2016	13, 14	20	6	0	26	0.23	0.09–0.44
2017	13, 14	6	9	0	15	0.60	0.32–0.84
2018	13, 14	15	4	0	19	0.21	0.06–0.46
2019	13, 14	25	18	0	43	0.42	0.27–0.58

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2018 = 1 July 2018–30 June 2019).

WHITE-TAILED PTARMIGAN

Spring Breeding Surveys

Currently there are no spring breeding surveys for white-tailed ptarmigan established in Alaska. Very little breeding, population productivity, or mortality data are available for white-tailed ptarmigan in Alaska. Observations and limited reports of white-tailed ptarmigan in specific locations in the Alaska Range, Talkeetna, Chugach, and Kenai mountains indicate a continued presence of low to moderate densities at each location. These observations are inadequate to determine if white-tailed ptarmigan numbers in Alaska periodically cycle. Long-term studies on hunted and unhunted populations in Colorado found extensive population fluctuations with evidence of a low amplitude, natural cycle (C. Braun, Wildlife Biologist, Grouse, Inc., personal communication).

To date, it appears the white-tailed ptarmigan's mostly inaccessible habitat has kept harvest by humans relatively low in most of its range in Southcentral Alaska. However, white-tailed ptarmigan often rely on their cryptic plumage to avoid predation rather than fleeing and are thus very approachable. This behavior exposes them to potentially high harvest rates in areas with high hunter densities. In the future, if additional harvest pressure is exerted on white-tailed populations near urban centers, additional management tools may need to be employed to avoid overexploitation.

Brood Surveys

The SGP completed brood surveys for rock, white-tailed, and willow ptarmigan on 21 and 30 July, 2019 near Hatcher Pass. Due to weather and poor volunteer participation, surveys were not completed in 2020. One survey route was completed near Hatcher Pass in which white-tailed ptarmigan reside and in 2019 only one brood of 8 chicks was observed. Brood surveys for white-tailed ptarmigan are not completed anywhere else in the state. As a result of these very low sample sizes it is difficult to make any meaningful inferences regarding early chick survival of white-tailed ptarmigan in this region. However, additional effort is being planned in the Anchorage Bowl and Kenai Mountains in future years. These surveys will be continued annually, and efforts will be made to create additional survey routes, provided sufficient volunteer support exists.

Wing Collections

Fifteen (15) hunter-harvested white-tailed ptarmigan wing samples were collected during RY18 and 33 during RY19 (Table 28). Between RY13 and RY18 the proportion of juveniles in the harvest was generally stable despite the low sample size. However, in RY19, the proportion of juveniles appears to have declined from RY18.

Through 9 years of collecting white-tailed ptarmigan wings (almost entirely from Units 14A and 14C), it appears that overall juvenile recruitment into the white-tailed ptarmigan hunted population is lower on average than juvenile recruitment for rock or willow ptarmigan. That conclusion may be more influenced by the low annual sample size; however, it could also be

explained by the more extreme high-elevation habitats in which white-tailed ptarmigan reside. Typically, this is a low- to moderately-abundant species throughout Alaska.

In RY18 and RY19, the majority of the wing samples were harvested in Unit 14A (southern Talkeetna Mountains). Few other reports from hunters or outdoor enthusiasts were available regarding abundance and presence of white-tailed ptarmigan.

Table 28. Total number and proportion of juvenile white-tailed ptarmigan with binomial 95% confidence intervals (CI) based on harvested wing collections within the Southcentral road system region, Alaska, regulatory years 2011–2019.

Regulatory year[a]	Unit	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI
2011	13, 14	17	21	2	40	0.53	0.38–0.71
2012	13, 14	9	3	0	12	0.25	0.05–0.57
2013	13, 14	16	7	0	23	0.30	0.13–0.53
2014	13, 14	20	18	0	38	0.47	0.31–0.64
2015	13, 14	34	35	0	69	0.51	0.38–0.63
2016	13, 14	19	17	0	36	0.47	0.30–0.65
2017	13, 14	9	9	0	18	0.50	0.26–0.74
2018	13, 14	5	10	0	15	0.67	0.38–0.88
2019	13, 14	20	13	0	33	0.39	0.23–0.58

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2018 = 1 July 2018–30 June 2019).

WILLOW PTARMIGAN

Spring Breeding Surveys

Spring breeding surveys of willow ptarmigan occurred between 24 April and 17 May, 2019 and between 21 April and 12 May, 2020 in Unit 14C (Table 29).

The 2019 spring breeding estimate for willow ptarmigan in Unit 14C was down from 2018. However, the 2020 spring breeding estimate increased slightly from 2019. Hunters generally reported seeing average to fewer than average willow ptarmigan in the southern Talkeetna and western Chugach mountains during the fall and winter of 2018–2019 and 2019–2020. One survey route in Unit 14C recorded zero breeding males in spring 2019. However, the 2020 regional estimate (1.28 males/stop) was very near the recent 10-year average (1.31 males/stop).

Brood Surveys

The SGP completed brood surveys for rock, white-tailed, and willow ptarmigan on 21 and 30 July, 2019 near Hatcher Pass in which 2 survey routes were completed near Hatcher Pass. Zero willow ptarmigan were recorded along either route in 2019. Due to weather and poor volunteer participation, surveys were not completed in 2020. The SGP is evaluating the effectiveness of these routes to enumerate and estimate willow ptarmigan brood size. Additional survey routes will be examined in July 2021 and may be used to either supplement or completely replace existing routes.

Table 29. Mean number of spring breeding male willow ptarmigan per listening post (stop, n = 18) with bootstrap 95% confidence intervals in the Southcentral road system region, Alaska, 2014–2020.

	Mean	Confidence Interval	
Year	(males/stop)	Lower	Upper
2014	1.13	1.09	1.17
2015	0.88	0.17	1.58
2016	1.21	0.33	2.08
2017	2.13	0.83	3.42
2018	2.33	0.50	4.17
2019	0.88	0.00	1.75
2020	1.28	0.72	1.83

Wing Collections

Seventy-four (74) hunter-harvested willow ptarmigan wing samples were collected during RY18 and 80 during RY19 (Table 30). The proportion of juveniles in RY18 likely declined compared to RY17. However, the proportion of juveniles increased in RY19 compared to RY18 to the long-term average (60%). Warm and dry weather patterns in summer 2019 were likely very favorable for the higher chick survival estimates.

SNOWSHOE HARE

Abundance Surveys

Currently, there are no snowshoe hare survey locations within the Southcentral Road system region. However, based on DWC staff observations and hunter reports snowshoe hare abundance is likely very high to slightly past peak in spring and summer 2020. Snowshoe hares are well past peak in the Interior and will begin to decline, potentially quickly, throughout the Southcentral Road system region in the next 1–2 years (2021–2022). The snowshoe hare population cycle generally occurs from north to south in Alaska and the Southcentral region is generally 1–2 years behind the FIRS region.

Table 30. Total number and proportion of juvenile willow ptarmigan with binomial 95% confidence intervals (CI) based on harvested wing collections within the Southcentral Road System region, Alaska, regulatory years 2011–2019.

Regulatory year[a]	Unit	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI
2011	6, 13, 14, 16	60	85	0	145	0.59	0.51–0.67
2012	6, 13, 14, 16	85	68	1	154	0.44	0.36–0.53
2013	6, 13, 14, 16	46	32	0	78	0.41	0.30–0.53
2014	6, 13, 14, 16	32	49	0	81	0.60	0.49–0.71
2015	6, 13, 14, 16	29	61	0	90	0.68	0.57–0.77
2016	6, 13, 14, 16	31	29	0	60	0.48	0.35–0.62
2017	6, 13, 14, 16	44	66	0	110	0.60	0.50–0.69
2018	6, 13, 14, 16	44	30	0	74	0.41	0.29–0.53
2019	6, 13, 14, 16	30	50	0	80	0.63	0.51–0.73

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2018 = 1 July 2018–30 June 2019).

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Kenai Peninsula

For purposes of this report the Kenai Peninsula region includes Units 7 and 15 (Fig. 6). This area includes the communities of Cooper Landing, Homer, Kenai, Seward, and Soldotna, as well as many smaller communities. This region includes a wide variety of montane coastal spruce forest, mixed lowland spruce-hardwood forests, subalpine shrub, and alpine habitats. There are numerous small and large water bodies, creeks, and large rivers. This region is highly accessible by road, air, boat, and off-road vehicles for recreation, tourism, and hunting. Sharp-tailed and sooty grouse and Alaska hare are not found in this region.

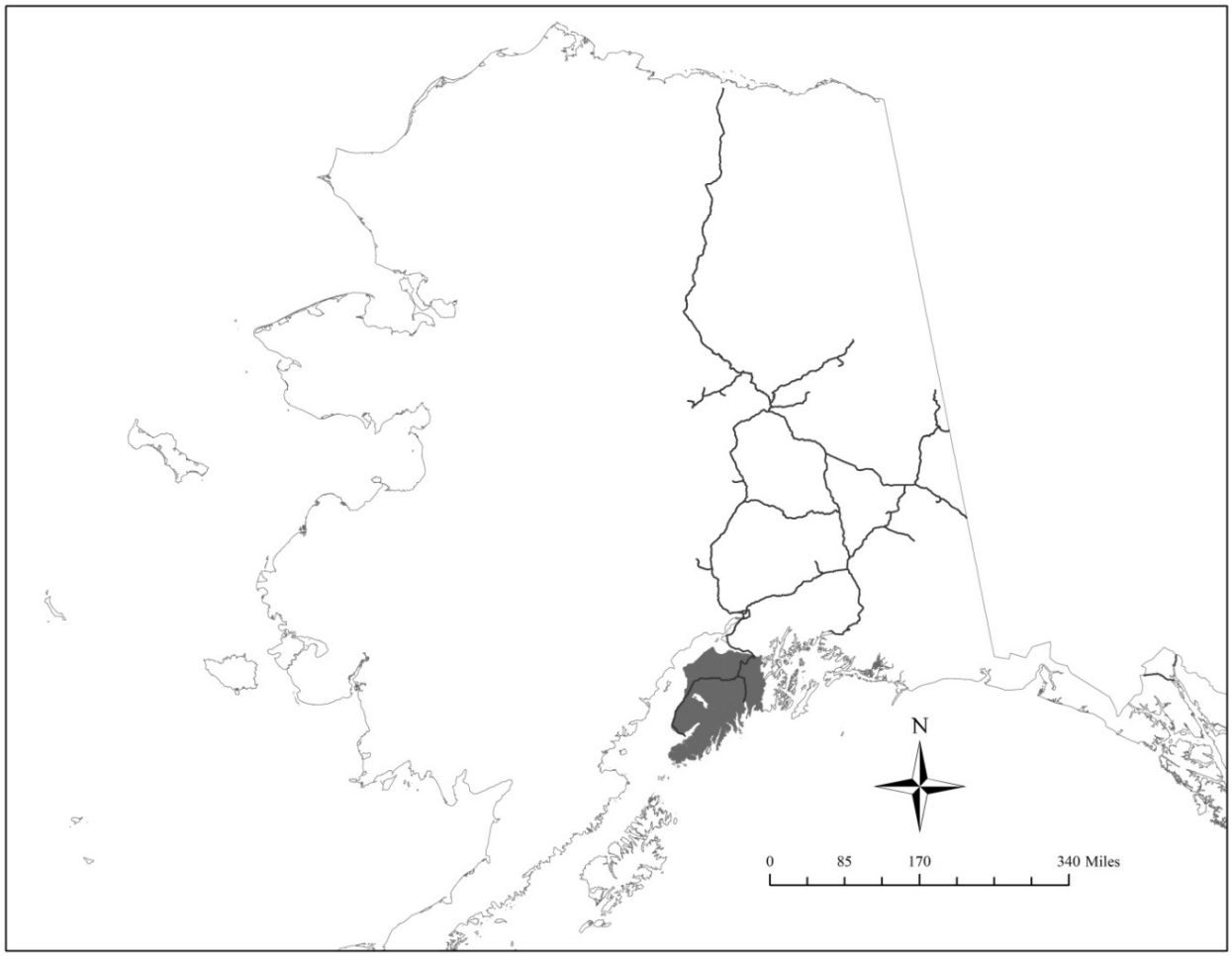

Figure 6. Map of the Kenai Peninsula region, Alaska.

RUFFED GROUSE

Spring Breeding Surveys

Very few ruffed grouse have ever been observed or harvested on the Kenai Peninsula based on staff observations from the recent past and hunter reports.

The ruffed grouse population on the Kenai Peninsula continues to persist 25 years after the translocation there although the population remains at low density. The SGP asks for any help in reporting observations of ruffed grouse on the Kenai Peninsula. Reports can be submitted via e-mail at the SGP web page (www.smallgame.adfg.alaska.gov).

Wing Collections

No ruffed grouse wings were collected from the Kenai Peninsula during RY18 or RY19. Ruffed grouse abundance on the Kenai Peninsula is expected to remain low. Hunters who harvest ruffed grouse on the Kenai Peninsula are asked to please provide a report of location and a wing sample. Contact information can be found on the title page of this report or on SGP's website at www.smallgame.adfg.alaska.gov.

SPRUCE GROUSE

The ongoing spruce bark beetle infestation on the Kenai Peninsula persisted through 2020. This infestation has impacted numerous stands of mature white spruce and as a result may have significant impacts to the foraging and overwintering habitat for spruce grouse on the Kenai Peninsula; this may have a long-term negative impact on population abundance in affected areas.

Spring Breeding Surveys

Currently there are no spruce grouse breeding or brood survey efforts within this region. Spruce grouse abundance on the Kenai Peninsula was relatively high throughout RY18 and RY19, based on hunter reports and DWC staff field observations.

Wing collections

One hundred twenty-three (123) hunter-harvested spruce grouse wing samples were collected during RY18 and 179 in RY19 (Table 31). The proportion of juveniles in RY18 (44%) was lower than in RY17. The proportion of juveniles increased in RY19 (72%), which was likely a result of the warm dry summer that was ideal for chick survival.

Table 31. Total number and proportion of juvenile spruce grouse with binomial 95% confidence intervals (CI) based on harvested wing collections within the Kenai Peninsula region, Alaska, regulatory years 2011–2019.

Regulatory year[a]	Unit	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI
2011	7, 15	27	54	0	81	0.67	0.55–0.77
2012	7, 15	59	33	0	92	0.36	0.26–0.47
2013	7, 15	73	49	0	122	0.40	0.31–0.49
2014	7, 15	49	54	0	103	0.52	0.42–0.62
2015	7, 15	46	69	0	115	0.60	0.50–0.69
2016	7, 15	22	67	1	90	0.74	0.64–0.83
2017	7, 15	50	65	0	115	0.57	0.47–0.66
2018	7, 15	69	54	0	123	0.44	0.35–0.53
2019	7, 15	51	128	0	179	0.72	0.64–0.78

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2018 = 1 July 2018–30 June 2019).

ROCK PTARMIGAN

Spring Breeding Surveys

Volunteers and DWC staff conducted spring breeding surveys between 19 April and 18 May, 2019 and between 25 April and 13 May, 2020 throughout the Kenai Mountains (Table 32). Overall rock ptarmigan spring breeding estimates increased in 2019 (0.49 males/stop) and again in 2020 (0.69 males/stop) compared to 2018 (0.38 males/stop). All but 1 survey location on the Kenai Peninsula are primarily in willow ptarmigan habitat; however, rock ptarmigan can be heard and recorded along several of the routes in the Kenai Mountains. Access through deep snow is a chronic issue when trying to enumerate spring breeding abundance of rock ptarmigan in the Kenai and Chugach mountains of the Kenai Peninsula.

Table 32. Mean number of spring breeding male rock ptarmigan per listening post (stop, *n* = 21) with bootstrap 95% confidence intervals in the Kenai Mountains in the Kenai Peninsula region, Alaska, 2015–2020.

	Mean	Confidence Intervals	
Year	(males/stop)	Lower	Upper
2015	0.18	0.10	0.25
2016	0.25	0.19	0.31
2017	0.75	0.50	1.00
2018	0.38	0.25	0.50
2019	0.49	0.17	0.81
2020	0.69	0.63	0.75

Both DWC staff and outdoor enthusiast observations suggest that juvenile production was poor for rock ptarmigan in the summer of 2020. Much like other locations throughout Southcentral

and the Alaska Range, a cool, wet weather pattern in late June and July 2020 likely resulted in poor chick survival.

Wing Collections

No hunter-harvested rock ptarmigan wings were collected during RY18 or RY19 on the Kenai Peninsula.

WHITE-TAILED PTARMIGAN

Spring Breeding Surveys

Currently there are no white-tailed ptarmigan breeding or brood survey efforts within this region. Dall sheep (*Ovis dalli*) hunters and hikers reported observing fewer adult and juvenile white-tailed ptarmigan throughout the Kenai and Chugach mountains during summer 2020. Similar to rock ptarmigan (above), June 2020 weather patterns likely had a negative effect on chick survival and subsequent abundance.

Wing Collections

One (1) hunter-harvested white-tailed ptarmigan wing sample was collected during RY18 and 7 during RY19. The small sample size makes it difficult to make any meaningful inferences.

WILLOW PTARMIGAN

Spring Breeding Surveys

Volunteers and DWC staff conducted spring breeding surveys between 19 April and 18 May, 2019 and between 25 April and 13 May, 2020 in Units 7, 15A, and 15B (Table 33). The mean number of males observed per stop in 2019 (0.55) declined from 2018 (0.78). Spring breeding abundance in 2020 was virtually unchanged (0.58 males/stop) from 2019. In 2020, all survey routes were visited at least twice and 2 routes were visited either 3 or 4 times.

Similar to rock and white-tailed ptarmigan, DWC staff and outdoor enthusiast observations suggest that juvenile production was poor for willow ptarmigan in the summer of 2020. Much like other locations throughout Southcentral and the Alaska Range, a cool, wet weather pattern in late June and July 2020 likely resulted in poor chick survival.

Table 33. Mean number of spring breeding male willow ptarmigan per listening post (stop, n = 56) with bootstrap 95% confidence intervals in the Kenai Peninsula region, Alaska, 2015–2020.

	Mean	Confidence Intervals	
Year	(males/stop)	Lower	Upper
2015	0.30	0.03	0.73
2016	0.29	0.08	0.51
2017	0.90	0.38	1.60
2018	0.78	0.20	1.37
2019	0.55	0.30	0.78
2020	0.58	0.26	0.91

Wing Collections

Only 13 hunter-harvested wings were collected in RY18 and 63 in RY19 (Table 34). The small sample size makes it difficult to make any meaningful inferences. However, in RY19 the proportion of juveniles (56%) was similarly higher than RY18 as compared with other rock and willow ptarmigan populations across the state. This further supports that summer 2019 weather patterns were likely conducive to high chick survival.

Table 34. Total number and proportion of juvenile willow ptarmigan with binomial 95% confidence intervals (CI) based on harvested wing collections within the Kenai Peninsula region, Alaska, regulatory years 2011–2019.

Regulatory year[a]	Unit	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI
2011	7, 15	0	5	0	5	1.00	0.48–1.00
2012	7, 15	17	27	0	44	0.61	0.45–0.76
2013	7, 15	9	25	0	34	0.74	0.56–0.87
2014	7, 15	10	9	0	19	0.47	0.24–0.71
2015	7, 15	10	14	0	24	0.58	0.37–0.78
2016	7, 15	6	6	0	12	0.50	0.21–0.79
2017	7, 15	2	9	0	11	0.82	0.48–0.98
2018	7, 15	9	4	0	13	0.31	0.09–0.61
2019	7, 15	28	35	0	63	0.56	0.42–0.68

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2018 = 1 July 2018–30 June 2019).

SNOWSHOE HARE

Abundance Surveys

The SGP does not have any snowshoe hare population assessment projects on the Kenai Peninsula. Based on hare pellet counts on the Kenai Peninsula completed by the United States Fish and Wildlife Service (USFWS), population density peaked in 2011, remained high during winter 2011–2012, and began to drop in summer 2012. Pellet counts suggest that snowshoe hare continued to decline during summer 2013. USFWS pellet counts were not continued beyond

2013. However, Kenai Peninsula hare densities likely reached the population cycle low in 2015–2016. Based on DWC staff and hunter observations throughout the Kenai during spring 2020, snowshoe hare are increasing and in some locations are very abundant. This population is likely to peak between 2021 and 2022.

The snowshoe hare population cycle typically occurs from north to south and the Kenai Peninsula often peaks 2–3 years after the FIRS region and 1–2 years after the Southcentral road system region.

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Western Rural

For purposes of this report the Western Rural region includes Units 17, 18, 22, 23, and 26A (Fig. 7). Specifically, this region encompasses an area that extends from northern Bristol Bay near Dillingham (Unit 17) north to Utqiaġvik (Unit 26A). The dominant habitats in this region are tundra, wetlands, and pockets of mixed white and black spruce along major river corridors. With the exception of the Nome road system, recreational access within the Western Rural region is limited to boat, snowmachine, or small aircraft. Rock and willow ptarmigan are an important subsistence resource for many hunters within this area. Spruce grouse are also a popular small game species in this region, where they are locally abundant in white spruce forests. Alaska hare are found only within this and the Alaska Peninsula regions. Sooty grouse, and white-tailed ptarmigan are not found in this region. Sharp-tailed grouse are rarely observed within this region.

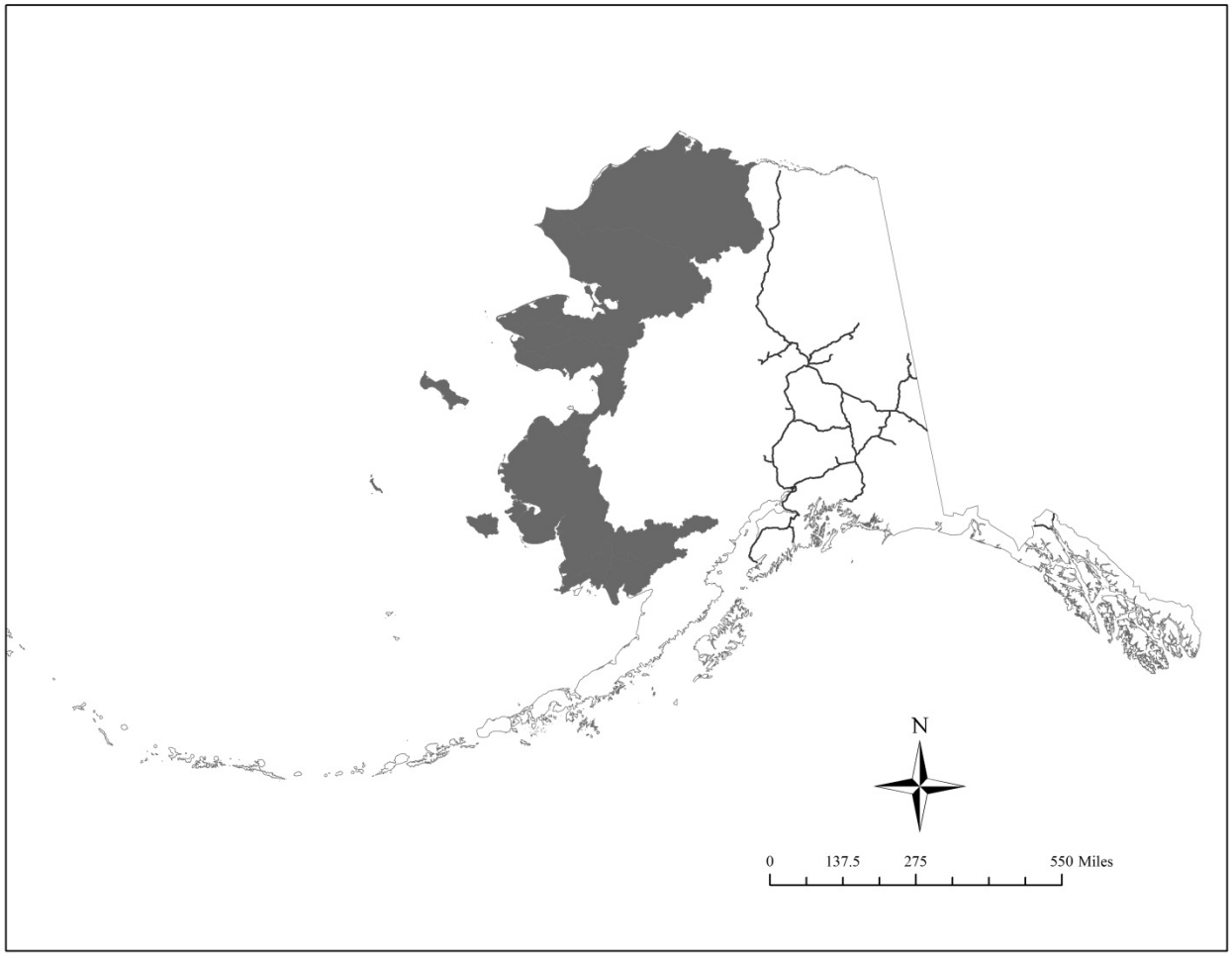

Figure 7. Map of the Western Rural region, Alaska.

BOARD OF GAME

In January 2020, the Alaska Board of Game (BOG) convened their meeting in Nome and addressed several small game related regulatory proposals. During that meeting, the BOG created a season (1 August to 31 May), daily and annual bag limit (2 daily, 6 season total), and a salvage requirement (hide or meat for human use) for Alaska hare in Units 18, 22, and 23 beginning in RY20.

During the same meeting the BOG also reduced the daily bag and possession limits for ptarmigan in Unit 18. Beginning in RY20 hunters will be allowed to harvest 15 ptarmigan per day with 30 in possession.

RUFFED GROUSE AND SPRUCE GROUSE

Spring Breeding Surveys

Currently, there are no population assessment projects for either ruffed or spruce grouse in the Western Rural region. Based on DWC staff observations, spruce grouse have appeared to increase slightly near Dillingham, King Salmon, and the forested areas of the YK Delta since the lows between 2016 and 2018. Summer 2019 climate patterns were likely very conducive to high chick survival with conditions warmer and dryer than normal throughout the region. However, patterns during summer 2020 were likely less conducive to chick survival and may impact overall recruitment into the hunted populations.

Wing Collections

No hunter-harvested spruce grouse wings were collected in RY18 or RY19.

ROCK PTARMIGAN

Spring Breeding Surveys

Beginning in spring 2018, DWC staff in Nome created and initiated 2 new spring breeding surveys for rock and willow ptarmigan along the Nome road system. However, due to the location of the surveys, they are only used to estimate willow ptarmigan spring breeding abundance. If reliable access allows, in the future DWC may look for and create a route that would focus more on rock ptarmigan spring breeding habitat that is generally located at slightly higher elevation.

Based on DWC staff observations from near Bethel (Unit 18) and Dillingham (Unit 17) rock ptarmigan abundance continues to remain low. This trend is likely the result of poor weather conditions experienced over the last few years during both the summer (cool temperatures and wet conditions) and winter (warm temperatures and low snowfall). However, recent DWC staff reports from Bethel suggest that abundance may have increased over the past year across the YK Delta. DWC staff and hunter observations suggest slightly higher abundance than in the recent

past. Summer 2020 climate patterns were likely less conducive to chick survival and thus recruitment into the hunted population for RY20.

Wing Collections

No hunter-harvested rock ptarmigan wings were collected in RY18 or RY19.

WILLOW PTARMIGAN

Spring Breeding Surveys

Beginning in spring 2018, DWC staff in Nome created and completed 2 new spring breeding surveys for willow ptarmigan along the Nome road system. Surveys were completed between 17 and 23 May, 2019 and between 4 and 15 May, 2020 in Unit 22C (Table 35). Overall, the monitored population near Nome has remained very stable between 2018 and 2020 based on these surveys. Relative to other monitored willow ptarmigan populations across Alaska population in Unit 22C consistently has high spring breeding abundance. Unit 22 hunters reported high willow ptarmigan abundance throughout RY18 and survey results from spring 2019 support those observations. However, in fall 2019 hunters reported seeing far fewer willow ptarmigan than in the recent past. Summer 2019 and 2020 climate patterns were less conducive to chick survival and thus recruitment into the hunted population for RY20 was likely low. As a result hunters throughout the Western Rural region should expect continued low willow ptarmigan abundance as observed in the recent past.

Table 35. Mean number of spring breeding male willow ptarmigan per listening post (stop, *n* = 56) with bootstrap 95% confidence intervals in the Western Rural region, Alaska, 2018–2020.

	Mean	Confidence Interval	
Year	(males/stop)	Lower	Upper
2018	1.79	0.89	2.70
2019	1.65	1.45	1.85
2020	1.73	1.25	2.20

DWC staff observations from near Dillingham (Unit 17) suggest willow ptarmigan numbers continue to remain low, as they have been since 2016. However, reports from Bethel in winter and spring 2020 suggest willow ptarmigan abundance may have increased slightly and DWC staff reported seeing more birds throughout the lower YK Delta during this period.

Researchers with the Peregrine Fund completed willow ptarmigan surveys on the Seward Peninsula in 2019 and plan to complete another year of surveys in 2021 (D. Anderson, Peregrine Fund, Director, personal communication) in coordination with a gyrfalcon study. Analysis is ongoing and final conclusion will be provided in future reports.

Wing Collections

SGP collected 123 hunter-harvested willow ptarmigan wing samples in RY18 and 83 in RY19. All samples from RY18 were collected from along the Nome road system and do not reflect the entire Western Rural region. The majority of the samples collected in RY19 were also harvested along the Nome road system; however, 16 samples were collected in Unit 18. The proportion of juveniles in the harvest remained high through RY18 (Table 36). However, the proportion of juveniles in RY19 declined, further supporting hunter and DWC staff observations of lower abundance.

Table 36. Total number and proportion of juvenile willow ptarmigan based on harvested wing collections within the Western Rural region, Alaska, regulatory years 2012–2019.

Regulatory year[a]	Unit	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI[b]
2012	18, 22, 23, 26A	90	131	0	221	0.59	0.52–0.66
2013	22C, 23, 26A	74	94	0	168	0.56	0.48–0.64
2014	22C	54	56	0	110	0.51	0.41–0.61
2015	22C	38	90	0	128	0.70	0.62–0.78
2016	22C	27	82	0	109	0.75	0.66–0.83
2017	22C	52	131	0	183	0.72	0.64–0.78
2018	22C	38	85	0	123	0.69	0.60–0.77
2019	22C	34	49	0	83	0.59	0.48–0.70

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2018 = 1 July 2018–30 June 2019).
[b] CI = confidence interval.

ALASKA HARE

Alaska hares are endemic to Alaska, and are only be found in Western Alaska (including the Alaska Peninsula regions north to Kotzebue). Currently, there are no active programs aimed at long-term population monitoring of Alaska hares. This species is one of the least accessible small game species to view and hunt, yet it is often harvested opportunistically by trappers and rural residents in Western Alaska.

Despite the lack of long-term monitoring efforts, in 2018 the SGP in collaboration with ADF&G's Threatened, Endangered and Diversity (TED) program embarked on a 5-year study evaluating movement patterns and assessment of the efficacy of various monitoring techniques. In February 2020, DWC was successful in capturing and radiocollaring an Alaska hare in Unit 17. This individual has provided consistent movement data from the affixed GPS equipped telemetry collar. Additional capture and collaring efforts were halted in mid-March but will be initiated in Units 17 and 22 as COVID-19 travel restrictions allow.

The extraction of genetic material from fecal pellets will likely become a very useful management tool as a method to track localized long-term population trends. In total, 850 fecal pellet samples have been genotyped (450 samples in the past year alone) across their range and in one study site an individual hare has been sampled in 3 consecutive years. Approximately 250 miles of transects have been created via snowmachine in the Nome area and were sampled 2

times last year. If this method continues to be effective, DWC may employ this method across the range of this species to gain better insight about localized population trends. Through this study, DWC is poised to learn a great deal about this poorly understood and reclusive species. This study provides the first individual GPS movement information for this species. Future updates on Alaska hares and the status of the species will be provided in future reports.

Based on field observations throughout its range, populations continue to remain well below what was historically observed in the 1950s and 1960s. It remains uncertain whether this has been a long-term decline or a mid-century crash with a continued low but stable population in recent years. Many long-term residents report much lower abundance throughout the species' historical range.

SNOWSHOE HARE

Currently there are no snowshoe hare population assessment projects being conducted in this region. However, DWC staff reports suggest snowshoe hare abundance is patchy throughout the region. It appears that snowshoe hare abundance on the Seward Peninsula and upper Kuskokwim River drainages has declined from the highs observed in 2018 and 2019 with the exception of small isolated patches (e.g., interior Seward Peninsula) with willow habitat where densities remain elevated. Hare abundance is high in areas in the southern portion of the region (e.g., near Bristol Bay).

Alaska Peninsula

For purposes of this report the Alaska Peninsula region includes Units 8, 9C, 9D, 9E, and 10 (Fig. 8). This area includes the communities of Cold Bay, Dutch Harbor, King Salmon, and Kodiak. The region includes coastal tundra, steep volcanic mountains, isolated islands, and small isolated spruce forests. There are numerous large lakes, and small water bodies and creeks. This region is bordered by Bristol Bay and the Bering Sea to the north and the Pacific Ocean and Gulf of Alaska to the south. This region is remote with no widespread road system and access is largely limited to aircraft or boat.

Willow and rock ptarmigan are the predominant small game species in this region. Willow ptarmigan do not occur west of Unimak Island; however, rock ptarmigan occur throughout the Alaska Peninsula and the Aleutian Islands to Attu Island. Ruffed, sharp-tailed, and sooty grouse; and white-tailed ptarmigan are not found in the Alaska Peninsula region.

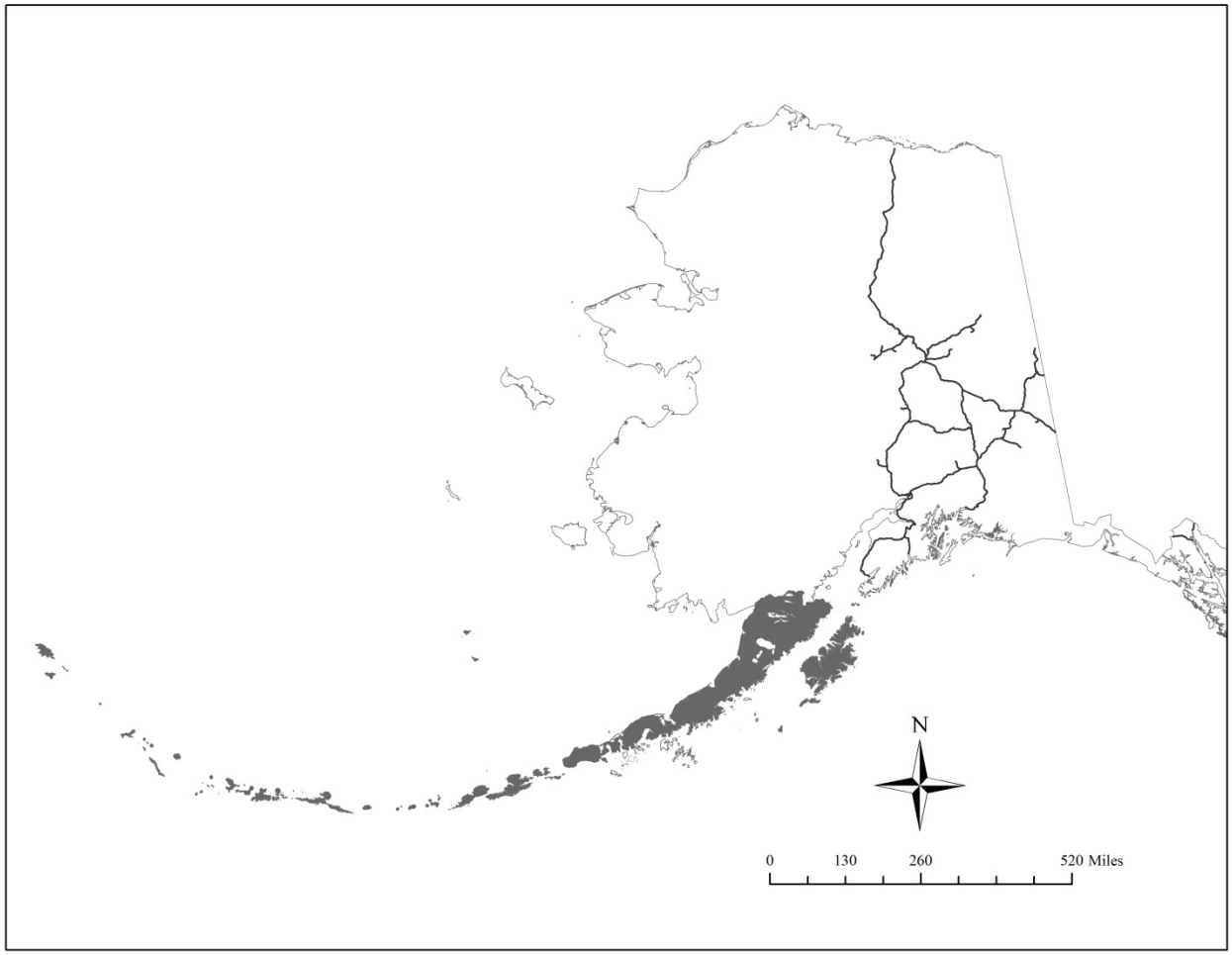

Figure 8. Map of the Alaska Peninsula Region, Alaska.

SPRUCE GROUSE

The extent of spruce grouse distribution in this region is currently unknown and DWC does not have any population assessment projects within the Alaska Peninsula region. DWC staff report much higher abundance of spruce grouse in winter and spring 2020 near King Salmon than in the recent past (Dave Crowley, Area Management Biologist, King Salmon, personal communication).

ROCK PTARMIGAN AND WILLOW PTARMIGAN

Spring Breeding Surveys

Currently, there have been no ongoing, long-term rock or willow ptarmigan spring breeding or brood survey efforts within this region. Based on observations from DWC staff, hunters, and rural residents within Unit 9, it appears that overall rock and willow ptarmigan abundance remains below normal; however, several reports suggest higher densities of both species in certain areas of the Alaska Peninsula.

Summer and winter weather patterns between 2014 and 2019 were very poor for rock and willow ptarmigan throughout the region. The Alaska Peninsula experienced cool and wet spring and summer periods, particularly during the critical early brood rearing period (mid-June through early July) when chicks are most vulnerable to these types of weather patterns. In addition, the Peninsula experienced unusually warm, wet, and largely snow-free winters. Therefore, snow burrowing for thermal protection and predator avoidance has not been available throughout the lower elevation areas (<800 m) and may have resulted in increased overwinter mortality. However, summer 2019 was warmer and drier than normal which is more conducive to high chick survival. Winter 2019–2020 was also more typically cold and snowy which is more conducive to over-winter survival. Summer 2020 weather patterns were similar to those observed over the recent past with wetter and cooler temperatures, a pattern that generally leads to lower chick survival. Willow and rock ptarmigan populations in the Alaska Peninsula region are expected to remain below the long-term average.

Wing Collections

Only 2 hunter-harvested willow ptarmigan wing samples were provided in RY18 and 0 in RY19, making inferences about juvenile production impossible. No rock ptarmigan wing samples were provided in either RY18 or RY19.

ALASKA HARE

Alaska hare can only be found in the Western Rural and Alaska Peninsula regions. Currently, there are no active programs aimed at long-term population monitoring of Alaska hares. This species is one of the least accessible small game species to view and hunt, infrequent harvest often occurs opportunistically by trappers and rural residents in Western and Southwestern Alaska.

Despite the lack of long-term monitoring efforts, in 2018 the SGP embarked on a 4–5 year study evaluating movement patterns and assessing the efficacy of various monitoring techniques. In February 2020, DWC was successful in capturing and radiocollaring an Alaska hare in Unit 17. This individual has provided consistent movement data from the affixed GPS equipped radio collar. Additional capture and collaring effort will be initiated in Units 17 and 22 as COVID-19 travel restrictions allow.

Using genetic analysis of fecal pellets is showing promise as a method to track localized long-term population trends. If this method continues to be effective, DWC may employ this method across the range of the species to gain better insight about localized population trends. Through this study DWC is poised to learn a great deal more about this poorly understood species. Future updates on Alaska hare and the status of the species will be provided in future reports.

Based on field observations throughout its range, populations continue to remain well below what was historically observed in the 1950s and 1960s. It remains uncertain whether this has been a long-term decline or a mid-century crash with a continued low but stable population in recent years. Many long-term residents report much lower abundance throughout the species' historical range.

SNOWSHOE HARE

Currently, DWC has no population assessment project for snowshoe hare in the Alaska Peninsula region. Based on recent DWC staff observations in 2020, snowshoe hare abundance is very high throughout the northern and central peninsula.

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Southeast

For purposes of this report the Southeast region includes Units 1–5 (Fig. 9). This area includes the coastal communities of Haines, Juneau, Ketchikan, Petersburg, Sitka, and Yakutat, as well as numerous smaller communities. This region is a temperate rainforest composed of a network of small to large islands covered largely by Sitka spruce, and mountain and western hemlock. Sooty grouse is the most popular and abundant small game species in the region. Some montane alpine habitat is found on the highest coastal peaks, providing habitat for willow, rock, and white-tailed ptarmigan. This region is accessible predominantly by air and boat. Ruffed grouse and snowshoe hare occur only at very low densities, primarily near large river deltas (i.e., Alsek, Stikine, and Taku rivers). Sharp-tailed grouse and Alaska hare are not found in this region.

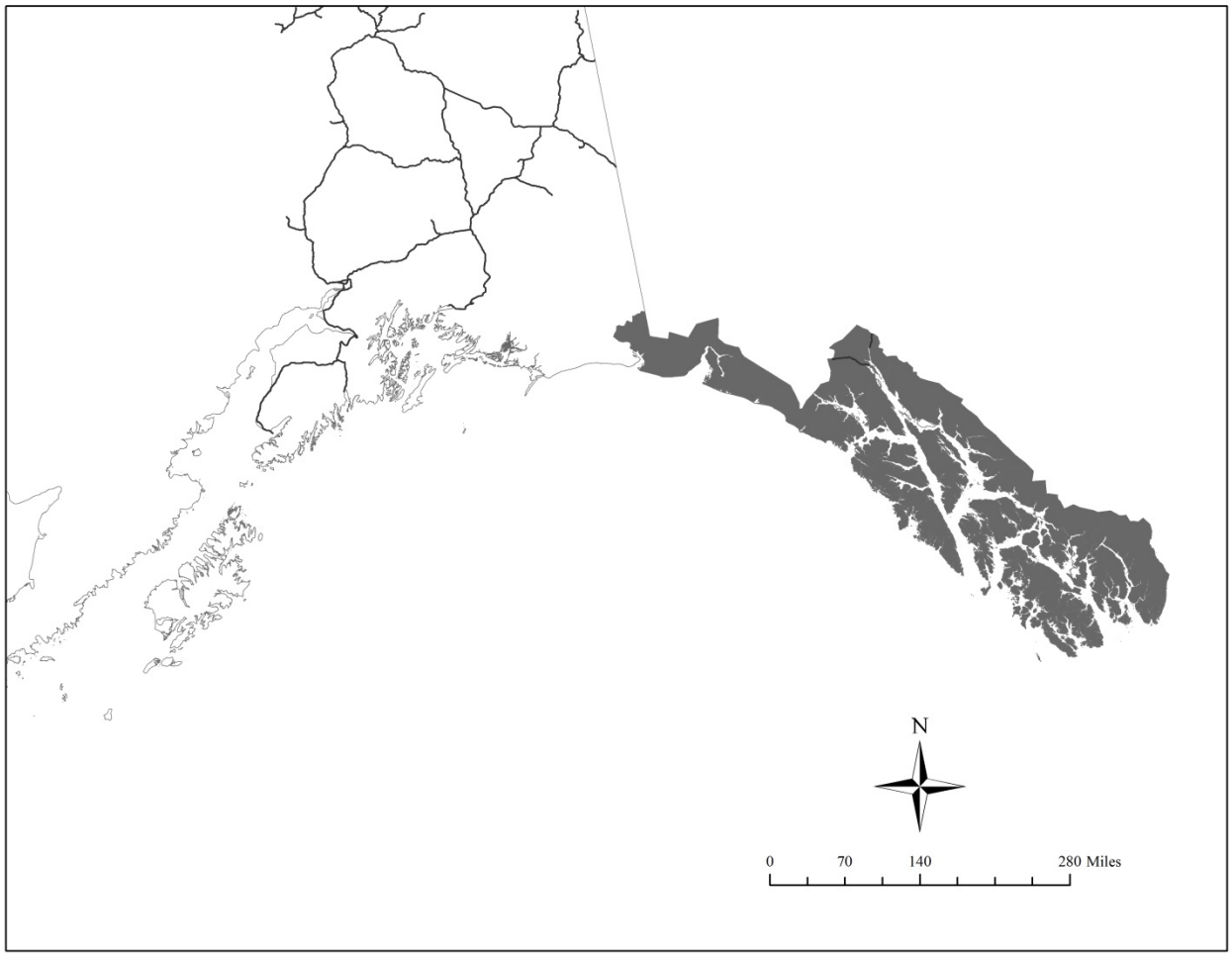

Figure 9. Map of the Southeast region, Alaska.

RUFFED GROUSE

Currently there are no ruffed grouse breeding or brood surveys within this region. Although ruffed grouse exist in the Southeast region, their distribution is restricted to the large river deltas (Alsek, Stikine, and Taku rivers) where alder, willow, and black cottonwood (*P. trichocarpa*)

occur. Currently, abundance in these locations is unknown; hunters and outdoor enthusiasts periodically report observing ruffed grouse.

SOOTY GROUSE

Spring Breeding Surveys

Spring breeding surveys were completed between 6 April and 14 May 2019, and between 10 April and 15 May 2020 (Table 37). The spring breeding estimate for sooty grouse in Unit 1C increased in both 2019 and 2020 from 2018. In Unit 3, spring breeding estimates decreased in 2019 and estimates in 2020 appeared to be far less than those of 2019. Due to COVID-19 travel restrictions and persistent snow throughout Mitkof and Kupreanof islands in Unit 3, surveys on Kupreanof Island were not completed in 2020. All other prior survey results for Unit 3 spring breeding estimates included surveys on Kupreanof Island

Beginning in 2019, volunteers in Haines created and completed 2 new sooty grouse spring breeding survey routes along the Haines area road system (Unit 1D). Those surveys estimated lower density in the Haines area than other locations in 2019. However, due to COVID-19 travel restrictions, those surveys could not be completed in 2020. DWC plans to continue completing those surveys in the future.

Beginning in 2020, DWC staff created and completed 3 spring breeding surveys in the Ketchikan area (Unit 1A; Gravina and Revillagigedo islands). Overall, surveys for 2020 estimated similarly low spring breeding densities found in Unit 3. The DWC plans to continue completing those surveys in the future.

Wing Collections

Sixty-seven (67) hunter-harvested sooty grouse wings were collected during RY18 and 36 in RY19 (Table 38). The proportion of juveniles in RY18 remained low (45%) as also documented in RY17 (45%). However, in RY19 the proportion of juveniles increased (61%). Most hunters reported fewer grouse during RY19 than in the recent past within popular hunting areas. Densities remained high in more remote portions of the region.

Harvest composition data for sooty grouse are dissimilar and difficult to compare to other grouse and ptarmigan data in Alaska. The overwhelming majority of the harvest on this species occurs from mid-April to mid-May and is predominantly composed of males due their conspicuous breeding behavior (hooting). The majority of harvest on all other Alaskan grouse species occurs between mid-August and late-October when the proportion of juveniles in the harvest is higher than in the spring due to natural mortality patterns in most tetraonid populations.

Table 37. Mean number of spring breeding male sooty grouse per listening post (stop) with bootstrap 95% confidence intervals in Units 1C and 3 in the Southeast region, Alaska, 2015–2020.

	Unit 1D-Haines[a]			Unit 1C-Juneau			Unit 3-Petersburg[b]			Unit 1A-Ketchikan[c]		
	Mean	Confidence Interval		Mean	Confidence Interval		Mean	Confidence Interval		Mean	Confidence Interval	
Year	(males/stop)	Lower	Upper	(males/stop)	Lower	Upper	(males/stop)	Lower	Upper	(males/stop)	Lower	Upper
2015	–	–	–	1.81	1.46	2.29	1.51	1.03	1.99	–	–	–
2016	–	–	–	1.93	1.42	2.47	2.41	2.00	2.83	–	–	–
2017	–	–	–	1.13	0.81	1.46	2.29	1.78	2.80	–	–	–
2018	–	–	–	1.00	0.60	1.49	2.00	1.29	2.68	–	–	–
2019	0.72	0.54	0.90	1.32	0.88	1.82	1.68	1.02	2.43	–	–	–
2020	NS[d]	–	–	1.35	0.81	2.05	0.46	0.23	0.58	0.59	0.20	1.17

[a] The Unit 1D surveys were initiated in 2019.
[b] Due to COVID-19 travel restrictions and persistent snow throughout Mitkof and Kupreanof islands, surveys on Kupreanof Island were not completed in 2020. All prior survey results for Unit 3 spring breeding estimates included surveys on Kupreanof Island.
[c] The Unit 1A surveys were initiated in 2020.
[d] NS = no survey.

Table 38. Total number and proportion of juvenile sooty grouse with binomial 95% confidence intervals (CI) based on harvested wing collections within the Southeast region, Alaska, regulatory years 2012–2019.

Regulatory year[a]	Unit	Adult	Juvenile	Unk	Total	Proportion of juveniles	95% CI
2012	1, 3, 4	24	17	0	41	0.41	0.26–0.58
2013	1, 3, 4	1	8	0	9	0.89	0.52–1.00
2014	1, 3, 4	28	15	0	43	0.35	0.21–0.51
2015	1, 3, 4	12	5	0	17	0.29	0.10–0.56
2016	1, 3, 4	25	33	1	59	0.56	0.42–0.69
2017	1, 3, 4	23	19	0	42	0.45	0.29–0.61
2018	1, 3, 4	37	30	0	67	0.45	0.33–0.57
2019	1, 3, 4	14	22	0	36	0.61	0.43–0.77

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2018 = 1 July 2018–30 June 2019).

SPRUCE GROUSE

There is a small population of spruce grouse that resides only on Prince of Wales Island and the immediately adjacent islands. This population of spruce grouse is believed to be that of the subspecies (*F.c. franklinii*) that has distinct plumage and size differences from the subspecies found throughout the remainder of Alaska (*F.c. canadensis*, Dickerman and Gustafson 1996). However, genetic analysis of samples collected from this population failed to make a firm distinction between the Southeast population and the mainland Alaska population (Neraas and Tallmon 2008). Currently, SGP has no population assessment project in or wing collections from spruce grouse in the Southeast region.

ROCK, WHITE-TAILED, AND WILLOW PTARMIGAN

Currently, SGP has no breeding or brood surveys for rock, white-tailed, or willow ptarmigan in this region. The extent and distribution of these 3 species within the Southeast region are unknown; however, they are observed and harvested by hunters in the higher elevation subalpine or alpine areas of most islands and mainland.

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Other Small Game Program Projects

Volunteers are a critically important component of the statewide SGP. As a result, SGP staff have been able to take advantage of local knowledge and contacts, collect more geographically comprehensive information, and provide a much greater benefit to the statewide hunting public. Since 2015, nearly 3,000 volunteer hours have been accrued between assistance with spring breeding and summer brood surveys, voluntary hunter reports, and assistance prospecting for new survey locations. The total has continued to grow and from 2016 through July 2020, a total of 600 hours were accrued annually to help the SGP complete its core mission. If you are interested in assisting the SGP please contact the small game biologist in Palmer or Fairbanks.

Between 2015 and 2019, the SGP has partnered with nonprofit conservation groups to complete habitat modification projects in Tok and Delta Junction. These projects directly benefit ruffed and sharp-tailed grouse breeding, nesting, and brood rearing habitat. They also provide benefits to other species that depend on early successional habitats, including moose, snowshoe hare, and a variety of passerines and small mammals. Hunters can find maps of habitat projects near Delta Junction, Tok, as well as Palmer, and Fairbanks on the SGP website: www.smallgame.adfg.alaska.gov.

Management Implications

Recent research on movements and survival of rock ptarmigan within Unit 13B (Merizon et al. 2018) documented seasonal movements that differed by sex where adult males remained very near breeding grounds throughout the year yet adult females and juveniles made much larger movements (10–95 km) to areas where they remained throughout the winter. Nevertheless, adult females and yearlings showed high breeding and natal site fidelity during spring movements in which they would often return to the same breeding or natal area each spring. The same seasonal movement patterns were observed in radio-tagged rock ptarmigan within Unit 25C with adult males remaining on or very near breeding grounds and adult females and yearlings making larger movements to areas where they typically remained throughout the winter (Carroll and Skinner *In prep*). These findings are consistent with other studies that have documented differences in sex- and age-specific dispersal distances in ptarmigan (Weeden 1964, Gruys 1993, Warren and Baines 2007, Hornell-Willebrand et al. 2014, Frye 2020).

Studies conducted in Alaska that have documented differences in sex and age-specific dispersal in ptarmigan have also confirmed that ptarmigan occupying areas easily accessible to hunters (i.e., adjacent to highways or secondary roads) have higher mortality rates than ptarmigan occupying remote areas that are largely inaccessible (Weeden 1972, Merizon et al. 2018, Frye 2020) and concluded that hunting is at least partially responsible for the higher mortality rates of willow ptarmigan occupying accessible areas (Frye 2020). However, the same research suggests that spatial mixing of ptarmigan in the fall and early winter likely reduces the population-level effect of higher mortality rates in more accessible areas because not all ptarmigan that are shot in accessible areas are year-round residents (Weeden 1972, Frye 2020).

Mortality as a result of late winter and spring hunting of ptarmigan has largely been determined to be additive mortality for grouse and ptarmigan. This means that a bird shot in late winter or early spring likely would have survived to the breeding season if it had not been shot. Unlike the

lower 48 states and most of Scandinavia, Alaska has very liberal season dates for grouse and ptarmigan that stretch into late March and even into April in some areas. As stated above, these long seasons likely lead to some additive mortality for some species, especially ptarmigan, whose life histories and open habitat make them more sought after when the daylight returns in the early spring. Indeed, research in Alaska has provided evidence of additive mortality on local populations that are easily accessible and harvested late in the season (Frye 2020). However, the same research suggests that these easily exploitable populations are likely sustained by immigration of nonresident ptarmigan from surrounding areas in autumn and again in the spring. Several studies in Scandinavia have also demonstrated the importance of immigration of ptarmigan into exploited areas that have relatively high harvest rates resulting in additive mortality (Smith and Willebrand 1999, Pedersen et al. 2004, Sandercock et al. 2011).

Spring breeding surveys of male rock ptarmigan were conducted annually (2016–2020) within a 33.3 km^2 study area adjacent to the Steese Highway near Eagle Summit in Unit 25C using conventional distance sampling methodology (Buckland et al. 2001). This survey methodology has proven to be a robust way of estimating abundance of animals when certain assumptions are met. The behavior and life history of male rock ptarmigan make them a good candidate for this type of survey. Estimates of abundance suggest the population of male rock ptarmigan near Eagle Summit has fluctuated between a low of 49.4 males (95% CI = 35.2 to 69.4) in 2017 and a high of 81.7 males (95% CI = 57.0 to 117.1) in 2020. It will be very interesting once several more years of data are available to compare if the current male population ever reaches numbers seen in the 1960s where in the same study area the population reached a peak of 170 males in 1962 (Weeden 1965a). If not, it may be that late season hunting is at least partially responsible.

Alaska remains unique from the lower 48 states and Scandinavia in terms of hunting access for the majority of hunters since they are somewhat constrained by the limited road system. Merizon et al. (2018) stated it appropriately, “Managing ptarmigan [in Alaska] really comes down to which scenario hunters prefer, ample time [and] opportunity through longer seasons with the likelihood harvest may be diminished due to the effect of late-winter hunting on ptarmigan populations, or shorter seasons with the higher likelihood of more birds on the landscape”. From recent BOG decisions in 2018 it looks as though there may be growing public support for the latter.

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