ALASKA DEPARTMENT OF FISH AND GAME REPORT

Divison of Wildlife Conservation, Published December 1999

STUDY TITLE: Sharp-Tailed Grouse Habitat Study in Eastern Interior Alaska

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PERIOD: 10 September 1998–30 June 1999

SUMMARY

The Alaskan sharp-tailed grouse (*Tympanuchus phasianellus caurus*) is the most northern ranging of the 6 subspecies of sharp-tailed grouse in North America. High densities inhabit eastern Interior Alaska, particularly in Game Management Unit (GMU) 20D. During September 1998 and May 1999, 45 (34 males, 11 females) sharp-tails were captured and radiomarked to investigate seasonal dispersion, home range, and habitat utilization in the Tanana Valley. Of the 45 grouse, 29 were captured during the fall of 1998, and was classified as unknown; 13% shed transmitters, and 11% was active.

Individual grouse were monitored using radiotelemetry to identify habitat use. Habitat data collected during the summer season revealed that a juxtaposition of open fields bordering early to mid successional deciduous habitats were important for cover, food, nesting, and brood rearing. Insects and berries were identified as important foods during midsummer and early fall. Crop analysis of birds killed in September revealed that kinnikinnick berry (*Arctostraphylos uva-ursi*) and grasshoppers (*Melanoplus* spp.) constituted 80% of the sharp-tailed grouse diet. During late fall, sharp-tails migrate out of the agriculture project and disperse into subalpine areas composed of muskeg, recent burned areas, black spruce (*Picea mariana*), and shrub where they stay during the winter season. Grouse were located in windswept plateaus up to 732 meters, along edges of kettle lakes, and black spruce forests bordering the Tanana River. Feeding observations identified dwarf birch (*Betula* spp.) leaves and catkins as the primary winter food. Berries were selected when available.

The sharp-tailed grouse habitat study in GMU 20D is ongoing. Additional grouse will be captured during fall 1999. These birds will be used to better understand sharp-tailed grouse winter habitat use. Winter habitat investigations will be conducted until late April 2000.

Key words: aspen/willow forests, catkins, Delta Agriculture Project, dwarf birch buds, goshawks, habitat utilization, Interior Alaska, kinnikinnick berry, land clearing, low-bush cranberry, sharp-tailed grouse, subalpine, *Tympanuchus phasianellus caurus*.

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BACKGROUND

The Alaskan sharp-tailed grouse is one of four indigenous grouse species in Alaska and is considered one of the least common of Alaska's upland game birds (ADF&G 1978). The sharp-tail is nonmigratory, but exhibits local migration and has historically occupied suitable habitats throughout the Yukon River drainage, foothills, and valleys of the Koyukuk, upper Kuskokwim, Tanana, and Copper River basins (Sidle 1986). Eastern Interior Alaska, especially the Shaw Creek-Delta Junction and Tanacross-Tok-Northway areas, has long been known for relatively consistent production of sharp-tailed grouse (Weeden and Ellison 1968). Moderate to high densities are in GMU 20D, especially near the Delta Agriculture Project where this research is focused (Figure 1).

Few estimates of historical abundance exist for sharp-tailed grouse in Alaska. Knowledge concerning seasonal habitat requirements, habitat preference, and population ecology has not been fully documented. Through field observations, hunters and biologists have contributed much of the knowledge available concerning sharp-tailed grouse ecology, and this anecdotal evidence indicates that habitat availability and quality influence grouse abundance. Alaskan sharp-tails use an array of early to mid succession habitat types, including recently burned woodlands, agriculture fields, alpine shrub, and mixed aspen/willow forests associated with mid succession. Preliminary observations from this research indicate that a mosaic of early to mid succession, openland habitats over large areas can provide high-quality habitat that can sustain a large population of sharp-tailed grouse (Raymond 1998).

Of the 6 subspecies of sharp-tailed grouse in North America (Johnsgard 1983), the *caurus* strain is most similar to the subspecies *T. p. campestris* of Michigan, Wisconsin, and Minnesota (Kessel 1981). Both races occupy habitats that contain woody cover within successional vegetation associated with disturbed areas. Habitat studies in Wisconsin identified vegetation types that were frequently used, which included grass-shrub, shrub-grass, shrub, open conifer forest, sedge meadow, shrub marsh, and cropland (Gratson et al. 1990). Like *T. p. campestris*, the Alaskan sharp-tailed grouse use a variety of seasonal habitats.

Early observations from this research indicate that agriculture lands adjacent to disturbed natural wild habitats are necessary to support high densities of sharp-tailed grouse. Other studies identified that grouse use cultivated fields for feeding and nesting, but these were considered "poor" habitats (Lee 1936, Parker 1970, Pepper 1972), except when they were adjacent to wild-land habitats, which can support grouse by providing additional food and cover during fall and winter (Baumgartner 1939, Hamerstrom and Hamerstrom 1951, Amman 1957, Hilman and Jackson 1973, Kessel 1981). Giesen (1997) identified seasonal movements, home ranges, and habitat used by radiomarked Columbian sharp-tailed grouse (*T. p. columbianus*) in Colorado. He found that the Columbian race selected hay fallow fields during summer and preferred mountain shrub habitats in winter. Kessel (1981) wrote that grouse habitat requirements in Alaska vary somewhat with season, but relative openness of woody canopy, presence of grass/sedge ground cover, and good protective cover by grasses, shrubs, muskeg, and tussock are essential habitat components.

The earliest known studies of sharp-tailed grouse in Alaska began in 1963. Weeden (1965) provided information on distribution, general habitat use, food habits, and hunter harvest. These early studies were limited to general observations because of the inability to capture, radiomark, and follow individual birds. Recent innovations in capturing and radiomarking have enabled the collection of detailed information on individual grouse.

Weeden (1965) reported that sharp-tailed grouse populations flourish when their habitats are disturbed and rejuvenated periodically by fire, land clearing, and river action. These conditions exist in the study area, where frequent forest fires, land clearing, and geographic proximity to large drainages have created habitats that can support high densities of sharp-tails. During the spring/summer season (April through September), Alaskan sharp-tailed grouse have been observed in aspen/willow and aspen/spruce windrow habitats associated with open agriculture fields in areas where kinnikinnick berry and low-bush cranberry (*Vaccinium vitis-idaea*) are found in high densities. During the fall/winter season (October through March) sharp-tails have been observed in subalpine shrub, burns, and muskeg habitats dominated by dwarf birch.

In September 1998, this research was initiated to better understand sharp-tailed grouse distribution and their habitat utilization within portions of GMU 20D in eastern Interior Alaska.

OBJECTIVES

Alaskan sharp-tailed grouse may range greater distances than initially realized, and the extent of their range is still under investigation. Understanding habitat utilization during the fall migration and winter residency is the focus of this study with peripheral habitat data being contributed from summer, fall, and spring seasons. The objectives are 1) to determine home range and distribution of grouse from locations of initial capture to winter habitats, 2) to determine habitat utilization during their movements, and 3) measure habitat at known grouse locations to distinguish grouse use of ground, horizontal, and vertical vegetation. Objectives may be further defined and modified after establishing and meeting with a graduate committee.

STUDY AREA

The approximately 56,658-ha study area is located in eastern Interior Alaska within GMU 20D, 17 km east of Delta Junction. The area is bounded on the west by the Delta River, extends east to the Gerstle River, northwest to Shaw Creek and Goodpaster Flats along the Tanana River, and south to approximately 63°40′ N latitude. Glacial outwash plains and alluvial plains are dominant in the southern portion of the study area. These broad outwash plains were formed by the Alaska Range glacier deposition during the Pleistocene era (Schoephorster 1973). Low stabilized sand dunes occur on the outwash plains, especially near major steams and rivers. The area is composed from deposits of course sand and gravel material of the Delta moraine, which is characterized by a low relief of kettle and kame topography. The Granite Mountains rise sharply to an elevation of approximately 1829 m along the southern boundary. The Tanana River and its tributaries serve as the main drainage for the entire region.

Most of the region is wooded, although large tracks have been cleared for human use. Extensive stands of aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*), and white spruce (*Picea glauca*) are common in well-drained sites within the study periphery. Dense stands of black spruce (*Picea mariana*) generally grow in poorly drained sites, and other vegetation such as mosses, sedges, and low-growing shrubs cover much of the mesic environment. The agriculture project comprises mostly young deciduous aspen and willow, Conservation Reserve Program (CRP) grass, and crops such as barley (*Hordeum vulgare*) and oats (*Avena sativa*). The average age of the deciduous stands in the agriculture project is indicative of human-caused land clearing initiated in the early 1980s (Glen Franklin, ADNR, personal communication).

Approximately 28,329 ha of cleared land are allocated to the Delta Agriculture Project consisting of private and public-owned parcels that range between 405 and 2428 ha (Glen Franklin, ADNR, personal communication). These agricultural parcels have become important sharp-tailed grouse habitat areas and are focal to seasonal high densities between early May and late September. Bands of intermittent windrows and burn piles of young aspen, willow (*Salix* spp.), and shrubs provide important cover and food for grouse during courtship, nesting, and brood-rearing.

The study area has a continental climate typical of the Interior Basin of Alaska. The climate is characterized by extreme seasonal variations in temperature and by low precipitation. Temperature extremes range from 35°C in summer to minus 52°C in winter, with annual precipitation ranging between 27.94 cm to 40.64 cm (Schoephorster 1973). Approximately one-half of the annual precipitation comes in June, July, and August in the form of showers, and total annual snowfall is approximately 91.44 cm.

METHODS

Sharp-tailed grouse were live-captured and fitted with radio transmitters during 2 capture periods (fall of 1998 and spring 1999). Actual capture took place on private and public lands within the agriculture project and nonagricultural lands bordering the project. Traps were set along windrows, burned areas, open fields, and in known lek (breeding) sites where sharp-tailed grouse were in concentrated groups (Raymond 1998).

Prior to fall 1998, few attempts were made to live capture sharp-tailed grouse in Alaska. Because little information exists concerning capture history, it is reasonable to assume that the first successful capture of sharp-tailed grouse in Alaska was accomplished during this study. In the contiguous United States, capture periods ranged between midwinter and spring lekking (Hillman and Jackson 1973, Sexton 1979, Kobriger 1980, Marks and Marks 1987, Cope 1992, Sjogren 1996, Giesen 1997). For this study, the fall capture period was chosen because of brood dispersion (Brown 1965, Cadwell 1976, Kessel 1981) and flock aggregation during mid to late fall (Marshall and Jensen 1937, Baumgartner 1939, Hart et al. 1950, Amman 1957, Symington and Harper 1957, Brown 1965, Kessel 1981) and because of movement and availability of birds in windrow habitats. We assumed that grouse captured during this time would have the greatest survivability going into winter. In May 1999, grouse were captured around dancing grounds during the lekking period. Captured birds from this period were followed during the summer season.

Grouse were captured using 1 or 2 15 x 4-m drift fence leads with attached walk-in funnel traps (Toepfer et al. 1988). Leads and traps were placed perpendicularly or diagonally across windrows to intercept walking grouse. Drift fences were 45.72 cm high, made from 2.54-cm mesh chicken wire. All trap locations were recorded with a Global Positioning System waypoint using a hand-held Garmin 45 coordinate data recorder. Trapped birds were released at the point of capture.

We radiofitted captured birds with small necklace-style radio transmitters (Holohil Systems, model R1-2BM). Necklace-style transmitters were selected (instead of back-mounted or poncho-mounted transmitters) for the following reasons: 1) easy and quick mounting which results in low stress to the birds, 2) transmitters ride near the crop where the bird is used to the extra weight, and 3) reduced survival of sharp-tailed grouse has been attributed to back-mounted and poncho radio transmitters (Marks and Marks 1987).

Transmitters were manufactured with a battery life of 24 months. Transmitter weights between 13.9 g and 16.0 g were used. Lighter transmitters were used during the first year of the study. Due to poor transmitter range (1 km), the 13.9 g transmitters were replaced during the second year of study with the heavier radio transmitters. Heavier radio transmitters were more efficient in receiving signals at greater distances, up to 2.5 km on the ground and 5 to 6 km from the air. A 20-cm long antenna protruded from the rear of the neckband and lay along the mantle between the bird’s scapulas, reducing the chance of the antenna hindering wing action.

Captured grouse were weighed, aged, and sexed. Weights were obtained using a 1-kg Pesola hanging hand scale, and age was determined to the extent possible by outer primary feather wear. Larger and heavier grouse showing primary feather wear in conjunction with full growth of the eighth primary was classified as an adult. Crown feather and tail feather pattern determined sex (Henderson et al. 1967, Johnsgard 1983). Females were identified from transverse barring pattern on the central tail feathers and from alternating buff and dark brown crossbars; males were identified from solid dark brown crown feathers and linear markings running along the lateral sides of the central tail feathers (Johnsgard 1983). Multicolored leg bands with serial numbers were attached to the birds’ legs for further identification.

Radiomarked grouse were tracked using a two-element “H” style antenna and Advanced Telemetry Systems or Telonics receiver. We used radiotelemetry to monitor individual movements of grouse, estimate home range, and identify habitat-use patterns. We followed radiomarked grouse throughout the course of the study and measured and documented both general and specific habitat types at individual bird locations.

Ground tracking was by foot and by four-wheel drive trucks, all-terrain vehicles, and snowmobiles. We used fixed-wing aircraft (PA-18) and an R-22 helicopter during aerial tracking. We located grouse signals from the air and plotted using GPS waypoints. Aerial coordinates were ground-truthed using radiotelemetry to locate and flush grouse on the ground. Once a flush location was identified, habitat vegetation was measured by measuring ground cover, horizontal cover, vertical cover, and stem density.

Thirty-meter line transects positioned over the flush site identified ground cover at 1-m point intervals. We measured vegetative structure (horizontal and vertical cover), shrub species composition, and ground cover composition at random sites and grouse-flush sites using a dimensionless-point target method (Collins 1997) during the summer season. A 2 cm by 1.5 m staff with 2 9-cm cored plastic balls mounted on the staff was used as a “dimensionless-point target” that was forced in the ground over a flush site to measure horizontal shrub cover (Collins 1997). The target was observed from 10 systematically distributed points around the staff from a predetermined sight radius of 6 m. Each flush sample was equal to 1 data point. Only ground cover and stem density were measured during fall, winter, and spring when vegetation was in transition.

Percent cover surrounding the target was calculated as (number observed) ÷ (number observed + number obscured) x 100 (Collins 1997). Vertical cover was determined by sighting through a densiometer mounted on a 1.5-m staff to identify presence or absence of vegetation ≥1.8 m. A habitat/survey form was used to record the date, grouse frequency, age and type of succession, percent and type of ground cover, percent and type of horizontal cover, percent and type of vertical cover, height of vegetation, estimated age of vegetation, and stem density of vegetation 1 m high.

Random points within the study area were plotted on a topographic map (scale 1:63,360), and agriculture tracts and roads were used to locate these random points in the field. Trap locations were considered as flush locations and were included in the flush habitat sample. Once in the general area, random distances (0–30 m) were paced following cardinal compass directions. Grouse flush sites were used as the focal point of nonrandom habitat measurements.

Four field succession types were identified and described within the agriculture project. These 4 field types include active hay field, active barley field, fallow hayfield, and fallow barley field (Bill Collins, ADF&G, personal communication). Active hay fields were those fields dominated by brome (*Bromus* ssp.) grass that were actively being cultivated. Likewise, active barley fields were those fields actively being used for barley production. Fallow hay fields were those fields undergoing early old-field succession, where brome grass was dominant, but early signs of succession was apparent with the invasion of fireweed and other species in low densities. Fallow barley fields were in more advanced stages of old-field succession, presumably due to lack of perennial cultivation, leaving fields open to reestablishment of native species. Aspen and willow to 2 m were dominant and throughout fallow barley fields with lower densities of other plant species. In these fields, barley was in low density or absent.

Habitat types have not been fully classified or mapped. Tentatively, 10 habitat classes (aspen forest, aspen/willow forest, aspen/willow/spruce forest, black spruce forest, field, upland shrub, upland open, burn, alpine, and muskeg) have been identified. Habitat classifications may be further described (modified) and recorded after identifying and adding habitat types each time a radiomarked grouse is located.

RESULTS

During fall 1998 and spring 1999, 45 sharp-tailed grouse (34 males and 11 females) were live-trapped and equipped with radio transmitters. In September 1998, 29 grouse were captured in 6 agriculture tracts of which 15 were adults and 14 were juveniles (Table 1). Home range movements for both adults and juveniles were similar. Data for these 2 age classes will be pooled when an analysis technique is developed. In May 1999, 16 grouse were captured on 5 dancing grounds (Table 2). Hunt mortality, predation, shed radios, and radio failure resulted in loss of data from 15 grouse that were captured in 1998 and 8 grouse captured in 1999. These birds were eliminated from the study.

Sharp-tailed grouse capture history in the Delta Agriculture Project for the period 17–25 September is presented in Table 1. From the 1998 capture data, 72% were males and 28% were females. The mean weight of 21 male grouse was 758 ± 20 grams at 95% confidence interval (CI); mean weight of the 8 female grouse was 687 ± 55 at 95% CI.

Sharp-tailed grouse capture data from the Delta Agriculture Project and 1408 Road during 7–22 May 1999 are presented in Table 2. From the 1999 capture 81% was male and 19% was female. The mean weight for 13 males was 721 ± 28 at 95% CI, and for 3 females it was 663 ± 79 at 95% CI.

For both capture periods, 76% was male and 24% was female. The mean weight for 34 males was 748 ± 14 at 95% CI, and the mean weight for 11 females was 680 ± 38 at 95% CI. This compares to an average weight of 951 grams for males (n = 236) and 815 grams for females (n = 247) over the range of the species (Nelson and Martin 1953, Johnsgard 1983).

The status of sharp-tailed grouse captured in the fall of 1998 and spring of 1999 is presented in Table 3. Signal days are used to estimate the time that individual grouse were active or still had attached transmitters. Adding up the days from the last verified radio contact until a shed transmitter or grouse carcass was recovered provided total signal days. The last location and date applies to the general location where individual grouse were last heard or seen. Numbers of contacts were those times that radiotelemetry recorded signals during surveys over the course of the study or until mortality or shed transmitters were found.

Seven grouse were lost during 13 September through 31 December 1998. Grouse 1 and 3 slipped their transmitters and hunters killed 5, 12, and 14; a predator killed number 28 and number 18 died of starvation. From 1 January through 6 May 1999, the following transmitters were recovered and the grouse were classified as mortalities: 6, 10, 11, 16, 25, and 26. By mid-April, the transmitter on grouse 20 was shed and recovered.

Of the 29 grouse captured in September 1998, only grouse numbers 7, 17, 22, and 27 survived to mid-May 1999. Grouse 7 was heard and observed along the western portion of Tract B in late April, but was heard only once more in late May. The status of grouse 7 is unknown. Grouse 17, a female, was observed on a nest. On 22 May, grouse 17 was recaptured and fitted with the heavier but more efficient radio transmitter (freq. 153.122). On 21 July 1999, the badly mangled transmitter of grouse 17 was recovered in Tract O, approximately 0.75 km north of the nest site. The transmitter was damaged either by a mowing machine or it was chewed by an animal. It is unknown whether grouse 17 or any of her clutch survived. On 19 May, grouse 22 was tracked to Tract A and its transmitter was shed and recovered. The status of 22 is unknown. Twenty-seven was last observed on 18 May, west of Kristen Rd., between Barley Way and Hanson Rd. Radiotracking has not located 27 and its status is unknown. The following 11 grouse have never been heard or located since their initial capture: 2, 4, 8, 9, 13, 15, 19, 21, 23, 24, and 29.

Of the 16 grouse captured in the spring of 1999, grouse numbers 38, 39, and 42 have died since 22 May. Avian predators probably killed all 3. Grouse 34, 37, and 40 shed their transmitters; 32, 33, 35, 36, and 41 were labeled as status unknown; 30, 31, 43, 44, and 45 were tracked on active mode into late August 1999.

Sharp-tailed grouse succumb to a high rate of mortality from predators, hunters, and natural causes. Of the 29 grouse radiomarked in 1998, 0% is active, 14% shed collars, 38% is listed as mortality, and 48% is classified unknown. Hunters killed 10% of the birds. By September 1999, of the 16 grouse captured in the spring of 1999, 31% is active, 25% shed collars, 19% is listed as mortality, and 25% is classified unknown.

Three females (17, 36, and 37) were observed on nests. Grouse 17 was observed twice on her nest that contained 5 eggs on 16 May and 11 eggs on 20 May. Grouse 36 was observed on a ground nest 51.8 m west of its capture site. By 12 June the nest was abandoned with no evidence of eggshells. On 21 July transmitter 36 was located on mortality mode in Tract C-1. The transmitter was suspended in a spruce tree in a wide windrow. On 15 September the transmitter was recovered. It appeared that the neckband on the transmitter separated and was shed. On 17 May, grouse 37 was tracked to its nest in Tract E-1. The nest was located on the south side of a 1.8-m high slash burn pile. The grouse flushed, exposing 6 eggs. On 12 June 37 was located and flushed from its nest exposing 8 eggs. However, the transmitter was not attached to the bird. The transmitter was located at the base of the burn pile 1.2 m from the nest site. By 12 July the nest was abandoned. Eggshells left in the nest indicate that all chicks hatched. A fourth female, grouse 32, was not observed on a nest but was observed with a brood of at least 4 chicks on 22 July.

We examined 70 grouse carcasses donated by hunters in September. These examinations verified the accuracy of field sex identification using feather morphology as an indicator of sex when compared to internal sex organs. Results showed that the field method of sex identification was 100% accurate. Additionally, we examined donated crops to identify food utilization during late

August and early September. Five specific and 1 general food type were found from crop analysis, which included kinnikinnick berries, grasshoppers (*Melanoplus* spp.), low-bush cranberry, barley, blueberry (*Vaccinium uliginosum*), and unidentified green leafy vegetation.

Predominant food types in hunter-donated grouse crops are presented as general percentages in Table 4. These food types represent only those foods utilized by sharp-tailed grouse within a narrow and specific period. Additional crops from grouse harvested in late October and November contained dwarf birch buds, which made up 35–100% of the crop contents. Winter observations show that grouse inhabit windswept subalpine and open burn habitats where dwarf birch is widespread. We believe that dwarf birch buds and catkins constitute a high percentage of the sharp-tailed grouse winter diet.

Data collection is ongoing. Eighty-five habitat sample locations (51 random, 34 flush) were collected over a 4-month period (12 May–15 September). A third capture attempt will be conducted in mid-September to increase the sample size of grouse to be followed through the winter season. Analysis of all telemetry locations will be presented on completion of this study.

DISCUSSION

Generally, sharp-tailed grouse in Alaska are smaller, compared to mean weights of grouse throughout the range of the species. The lower mean weights may be attributed to the smaller sample size collected for both male and female Alaska grouse (males: n = 34; females: n = 11) compared to the larger sample size of birds collected throughout the range of the species (males: n =236; females: n = 247) (Nelson and Martin 1953). Further, the Alaskan mean weights include adults and juvenile weights of both sexes. In their sample size, Nelson and Martin present mean weights of males and females without stating age.

Sharp-tailed grouse exhibit biannual local migrations. Between early April and early May, grouse move into the Delta Agriculture Project where males establish individual territories and gather in groups on lekking grounds and breed with females. Between late September and late October, sharp-tails migrate from the agriculture project and disperse into muskeg, recently burned areas, and alpine habitats where they remain during the winter season.

Data documenting movements between breeding ranges and winter habitat for Alaskan sharp-tailed grouse are limited. From this study, we found that spring and summer movements of Alaska sharp-tailed grouse were usually confined near breeding areas. Surviving males captured during the spring of 1999 remained within 2.5 km from their breeding (lek) grounds and 3 females nested within 2 km of the dancing arena after breeding, which coincides with the findings of Amman 1957, Evans 1961, Lumsden 1965, Sisson 1976, and others. The small sample size, rate of mortality, radio transmitter loss, transmitter failure, and loss of study birds have delayed meaningful summer home range data. The intent is to pool all the radiotelemetry data to calculate annual and individual home ranges. Average annual home range for individual grouse has yet to be determined in this study.

There are several home range calculation methods that can potentially be applied to this research. Giesen (1997) calculated home range size of Columbian sharp-tailed grouse using the McPaal software package; individual home range was calculated using the minimum convex polygon (Mohr 1947, Giesen 1997), and the 95% ellipse was used to estimate the total area used by all radiomarked grouse. Home range data included all observations from capture to time of mortality. Sjogen (1996) mapped and calculated home range of prairie sharp-tailed grouse using the minimum convex polygon method and identified seasonal and annual home range size of individual birds using Geographic Information System (GIS) software.

Researchers have led extensive studies on sharp-tailed grouse habitat use in the contiguous United States, but no studies have been accomplished in Alaska. Although there are similarities in habitat utilization between the sharp-tail races, it is expected that Alaska sharp-tails exhibit differences unique to the Alaska strain.

Marks and Marks (1987) reported movements of 4.5 km to wintering habitats for Columbian sharp-tailed grouse in Idaho. The distribution and availability of winter food and cover, especially buds and fruits of deciduous trees and shrubs (Giesen and Connelly 1993, Giesen 1997), may determine the extent of movement between summer wintering range. Grange (1948) reported that sharp-tails in Wisconsin utilize snow burrows in spruce forests in winter, and Amman (1957) documented that buds and catkins of birch and aspen were important food items during winter.

In Alaska, Weeden (1965) classified sharp-tailed grouse winter habitat as areas that include burned areas, muskegs, spruce forests, and shrub in subalpine habitats up to 732-m elevation. One grouse from this study was found 29 km from its capture location in a subalpine plateau at 732 m. Alaska sharp-tailed grouse have been observed in windswept alpine plateaus and around glacier kettle lakes in muskeg, indicating that these habitats constitute a portion of the winter habitat. Anecdotal diet observations suggest dwarf birch buds and catkins are the primary food for grouse during the winter season. Future winter habitat studies are expected to verify and add to sharp-tailed grouse winter season habitat use and diet.

Habitat data were collected between May and September 1999. Most grouse flush site habitat sampling was collected in the Delta Agriculture Project. Grouse were found in windrows, burned areas, or agriculture fields. Mid-succession windrows ranged between 5- and 30-m wide with an estimated average tree age of 10 years; standard aspen/willow vegetation dominated. Most windrows were adjacent to fields of varying field succession and width. The large number of grouse observations in this habitat type indicated that grouse require a juxtaposition of mid-succession aspen/willow vegetation for cover, food, nesting, and brood rearing during summer. Additionally, habitat sampling indicates that kinnikinnick berry is an important food item. Grouse were often located in windrows that contained large patches of kinnikinnick berries and low-bush cranberry. Blueberry patches were found less frequent but were also classified as an important component of grouse diet, especially during late summer.

When available, insects, particularly grasshoppers, constitute a large proportion of the sharp-tailed grouse summer diet. Grasshoppers were found in large numbers in grouse crops that were examined in 1998. Grasshoppers generally cycle every 2 years (Steve DuBois, ADF&G, personal communication), and in 1998 they were found in high densities. In 1999, grasshopper densities were extremely low. Between May and September 1999, the principal investigator observed no grasshoppers.

In comparison to 1998, grouse densities declined in 1999. Numbers may have been down due to several contributing factors, such as natural population cycles, weather (e.g., accumulation of unseasonable snow fall in early May 1999), poor insect productivity, and increased predation from avian and mammalian predators that are high in response to high numbers of snowshoe hares (*Lepus americanus*). Although no harvest records exist, harvest was probably elevated due to high hunting pressure in 1998. Snow probably serves as an insulating component for grouse survival in Interior Alaska. During the winter of 1998–1999, lower than average snowfall was recorded, which may have affected grouse survival. Additionally, colder spring weather may have reduced grouse reproduction and clutch survival, resulting in fewer females nesting and smaller brood size.

Radio transmitters provide the best means of assessing sharp-tailed grouse movements, habitat use, and mortality. Attachment of markers such as radio transmitters can alter individual bird behavior and survival. In Idaho, Marks and Marks (1987) documented that radiofitted grouse had a high rate of mortality from avian predators. They found that raptors were the primary cause of grouse mortality, particularly by goshawks (*Accipiter gentiles*), which selectively preyed on radiomarked grouse. It is possible that grouse exhibited differences in their behavior due to transmitter attachment during this study, which may have affected their survival. However, general observations of those surviving birds indicate that transmitters do not hinder flight, reproduction, or their movement on the ground.

Observations and habitat sampling showed that radiomarked grouse avoided black spruce forests. The study birds exhibited consistent preference for standard aspen/willow forests, burned areas, and open grass habitat types during the summer season. Farmland openings and roads were used occasionally. Sharp-tails probably used roads as a source of grit to aid digestion.

A method for measuring habitat quality within sharp-tailed grouse range and identifying management needs will be attempted using the Habitat Suitability Index model for Alaska sharp-tailed grouse (Meints et al. 1992, Giesen 1997). The model assumes different types of habitats are limiting factors, such as winter, and it assumes that habitat preference of grouse are known within a particular temporal and spatial scale, and that the habitat within that scale is positively related to the overall habitat quality (Giesen 1997). Wildlife managers can implement programs needed for specific habitats (e.g., winter cover) by measuring quality and types of habitats that are available within a specific distance of grouse activity areas.

The sharp-tailed grouse study in GMU 20D is ongoing. A fall capture will be conducted in mid-September to increase the sample size of radiomarked grouse. Grouse will be radiotracked through the winter season to document home range, habitat preference, and winter habitat utilization. Investigations will be conducted to identify winter habitat preference, and the results will be presented in a future report.

ACKNOWLEDGMENTS

This project was funded primarily by State of Alaska Capital Improvement Project funds with additional support provided by the Ruffed Grouse Society and Safari Club International. I want to thank Bill Taylor for his assistance during the trapping seasons and guidance throughout the project, sharing his experience and knowledge of the study area. Bill Collins freely gave his time as a consultant and was instrumental in providing habitat sampling techniques. Nick Steen contributed his time, airplane, and skill to fly aerial surveys, and Steve DuBois supplied equipment, logistical support, and flew aerial surveys.

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