

Bodie Hills sage grouse population and habitat characteristics: Preliminary comparison with management guidelines

Report to the Bi-State Sage Grouse Local Area Conservation Planning Group
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Abstract

Preliminary data from 3 years of sage grouse radio telemetry to identify seasonal movements and habitat use in the Bodie Hills allow some tentative comparisons with habitat and population characteristics described in *Guidelines to manage sage grouse populations and their habitats* (Connelly et al. 2000). The main findings, consistent during these drought years, are of seasonal movements to concentrate predominantly at high elevations near water sources during the summer and in certain mid-elevation sagebrush stands during fall and winter. Nesting was in mixed sagebrush/bitterbrush generally comparing favorably with criteria in the guidelines, with canopy cover unusually high. Sample sizes for demographic data are not sufficient for statistical analysis but suggest survival rates that vary by season, good overwinter survival, low nest initiation rates, high nest success and low nest predation. Applicable management guidelines are noted and it is recommended the study continue, which may reveal actual demographic patterns and – most importantly – other seasonal habitat areas, including those used in wetter years and winters of deep snow.

Introduction

The Bureau of Land Management (BLM) Bishop Field Office, in cooperation with California Department of Fish and Game, has completed the first three years of a radio telemetry study with the primary purpose of identifying seasonal movements and habitat use of sage grouse in and near the Bodie Hills, Mono County, California. In the course of doing so, we have also gathered some data on survival and reproduction. The data presented here are from a small sample (a total of 31 telemetered grouse over the course of 36 months) and are intended only for purposes of preliminary comparison with information given in *Guidelines to manage sage grouse populations and their habitats* (Connelly et al. 2000), to help inform our discussions and actions as the study continues.

The discussion below follows the format and order of headings in the guidelines.

Population Biology

Seasonal movements and home range

Our study began in April 2000, which proved to be the beginning of an unusually dry period. During this time telemetered sage grouse in the Bodie Hills have generally appeared to show the second of four annual migratory patterns mentioned in the guidelines: “distinct summer areas and integrated winter and breeding areas.” The telemetered grouse have nearly all wintered in and near breeding areas (though not always the individual’s own), which are spread out at approximately 8000 feet elevation; and concentrate near water sources, mostly at and above approximately 9,000 feet, from mid-June through early September. This pattern would necessarily be different in years or periods of greater snowfall when snow may completely cover all vegetation in the breeding areas. It is vital that we continue the study to identify where sage grouse go in such a winter. They may also be less reliant on high elevations in wetter summers.

Because the high elevations are centrally located within a ring of breeding areas, the distance between the summer areas and winter/breeding areas is generally <10 km, which would define this population as “nonmigratory” during these dry years as per the guidelines. Some individuals have moved for greater distances to spend the fall and/or winter in breeding areas not their own. The few that have survived for >1 year have shown the fidelity to seasonal ranges described in the guidelines. One female spent fall and winter at the north end of the Big Flat breeding area, >15 km from her nest site near Mt. Biedeman, and returned to nest within 200 m of her previous year’s nest.

Seasonal movements are discussed in more detail under Habitat Requirements below.

Survival

Comparison with survival rates cited in the guidelines is problematic as it is not always clear how they were derived. One way to consider survival rates would be in terms of annual survival from one breeding season into the next. Eliminating from consideration signals lost (e.g. collar shed or battery expired) between breeding seasons, in 25 instances sage grouse were located at some time within a breeding season and only 10 of these, or 40%, were located at some time during the next breeding season. The other 15 were all known mortalities. During what seasons do these mortalities occur? Below we give “over-period” survival, i.e. percentages of telemetered grouse that enter a seasonal period already radio-marked and emerge from it still alive. Again we have eliminated from consideration all whose fate became unknown before the end of the season. Note that sample sizes are small and these should be construed as preliminary observations only, not definitive findings.

Most sage grouse were captured and radio marked during a spring lekking period, March-May; of these, 21 of 24 survived through the remainder of that period; but only 11 entered a March-May period already marked and 7 of these survived into June, or 64%. Of 27 telemetered grouse entering a summer period of June-August, 19 survived that period, or 70%. Of 18 entering the September-November period, 15 survived, or 83%. For the winter period of December through February, of 12 telemetered grouse entering the period, all survived into spring, implying 100% overwinter survival.

Note that these data do not support the idea that winter kill is a significant population limiting factor in the Bodie Hills. This hypothesis was proposed, but not tested, by Robert Gibson (unpublished paper) and will receive further scrutiny. Seeking correlations between winter weather data and subsequent lek census data may be informative but would be complicated by the fact that census access to several Bodie Hills leks is limited when snow is deep. A better test would be longterm telemetry study, accumulating a statistically significant sample size and encompassing a typical range of Bodie Hills winter conditions rather than only the relatively dry winters observed thus far. Aircraft support is crucial for tracking when ground access is limited throughout winter and early spring.

Reproduction

Of 12 hens radio-collared, 2 died before the nesting season and 3 survived with functioning radios through 2 nesting seasons, so that pooling the 3 years’ data gives 13 instances of a telemetered hen entering a nesting season. Of these 13 opportunities, 6 were confirmed to result in nests initiated and 5 were not (i.e. the hens were found in different locations throughout the nesting season), giving a 46% nest initiation rate (Table 1). It is possible that some nests were not detected if they were abandoned or lost to predation before or very soon after incubation began. Also, 2 of the hens we counted as not nesting died in early May and could conceivably have still established late nests if they had survived. The 3 individual hens who were tracked through 2 nesting seasons were consistent in nesting (N=1) or not nesting (N=2) from one year to the next. Only one nest failed, due to the hen’s death by predation during incubation (possibly while off the nest, which was untouched), giving a nest success rate of 86% (Table 1).

Table 1. Nest initiation and success for telemetered sage grouse in the Bodie Hills, 2000-2002.

	2000	2001	2002	Overall
Confirmed nests initiated / hens = %	2/3 = 67%	2/4 = 50%	2/6 = 33%	6/13 = 46%
Successful nests / all nests = %	1/2 = 50%	2/2 = 100%	2/2 = 100%	5/6 = 83%

The guidelines give nest initiation rates ranging from 65% to 99%, and reported an improvement in one population from 78% to 99% that was possibly attributable to improved range condition and better pre-laying nutritional status. It may be noteworthy that the overall nest initiation rate within this small sample has been low during the 3 drought years of the study. The sample size for each year is too small to reliably indicate a downward trend.

The 86% nest success rate for confirmed nesters in our study compares favorably with estimates reported in the guidelines, which vary from 12 to 86%. Wing estimates of nest success may provide a larger sample. Clutch size was within the known range at 6 or 7 in each of the 6 nests. We have detected no re-nesting. All successful hens were observed with broods some weeks after hatching but we have not attempted to determine brood survival rates.

Habitat Requirements

Breeding habitats

Leks in the Bodie Hills are on dry meadow or low sage sites. All known nests have been ≤ 3 km from the nearest lek and the females have been captured either near that lek or near the nest site.

The guidelines report that most sage grouse nests are under a sagebrush and that nests under a sagebrush are more successful than those under other species. We have had only one confirmed unsuccessful nest and in that case the hen was found dead at a distance from the nest, which was undisturbed, so nest cover characteristics may not have influenced her success. Of the 5 successful nests, 3 have been under a mountain big sagebrush, 1 under a bitterbrush, and 1 under a bitterbrush-dominated portion of a sagebrush and bitterbrush growing so intertwined as to constitute a single shrub form (Table 2).

We conducted vegetation assessments at nest sites along 100 m transects centered on the nest, using a protocol developed by Idaho BLM based on the guidelines. According to the guidelines mean heights of nest shrubs range from 29 to 80 cm and nests tend to be placed under the tallest sagebrush in a stand. Our nest shrubs fit these parameters, ranging from a 67 cm sagebrush to the 90 cm intertwined sagebrush/bitterbrush, with an average height of 80cm; and 4 out of 5 were taller than the average shrub height along their transect. Shrub heights along the nest transects averaged 60 cm overall (Table 2).

The guidelines cite several studies showing that shrub canopy cover in the stand surrounding a nest is greater for nest vs. random sites, or for successful vs. unsuccessful nests. We found that shrub canopy cover at Bodie Hills nest sites is greater than the highest figures given in the guidelines, with bitterbrush clearly providing a major cover component. Bitterbrush cover exceeded sagebrush cover at 3 of the 5 successful nest sites and nearly equaled it at the other two, with combined canopy cover from these structurally-similar shrubs ranging from 34.3% to 58.4% (Table 2). Overall, sagebrush cover averaged only 16% but bitterbrush added another 24%, combining with another 4% from other shrubs to give 44% shrub canopy cover, with bitterbrush providing 55% of that cover. While we have not yet performed the same assessments on random sites, nor determined whether hens select sagebrush/bitterbrush over other available sites, we have observed that mixed sagebrush/bitterbrush stands in the Bodie Hills tend to

be more dense than sagebrush alone and their use by nesting hens apparently is not detrimental to their success.

The guidelines stress the importance of grass height and cover at nest sites. Our nest sites had a healthy component of perennial grasses, often closely clustered around the nest shrub. Great Basin wild rye contributed especially to tall, dense cover. The guidelines cite a study showing greater nest success in stands where grass was >18 cm tall; ours ranged from 18.3 to 56.6 cm.

Table 2. Vegetation characteristics at successful nests of sage grouse in the Bodie Hills, 2000-2002. All measurements are in centimeters.

Successful nests	Hen 040 2000	Hen 160 2001	Hen 070 2001	Hen 070 2002	Hen 190 2002	all nests
Nest shrub						
nest shrub species	putr	artva	putr/artva	artva	artva	
nest shrub height	80	90	110	84	67	86
nest shrub greatest width x mean width	190 x ?	150x110	235x210	145x 107	117x 46	
Cover class perennial grass	1 (0-5%)	1 (0-5%)	2 (6-15%)	1 (0-5%)	1 (0-5%)	1
grass annual	1 (0-5%)	1 (0-5%)	1 (0-5%)	1 (0-5%)	1 (0-5%)	1
forb perennial	1 (0-5%)	1 (0-5%)	1 (0-5%)	1 (0-5%)	1 (0-5%)	1
forb annual	1 (0-5%)	1 (0-5%)	1 (0-5%)	1 (0-5%)	1 (0-5%)	1
Veg heights on 100m transect						
sagebrush	112	58.9	66.8	52.3	58.9	70
bitterbrush	69	49.1	99.6	60.7	56.6	67
shrubs all	84.6	55.5	81.6	58.9	57.9	68
grass perennial	24.9	33.0	56.6	18.3	25.7	32
forb perennial	14.2	0	45.0	16.5	-----	15
Canopy cover on 100m transect						
sagebrush	21.9%	13.5%	18.0%	12.6%	15.4%	16%
bitterbrush	36.1%	13.3%	16.8%	25.7%	26.8%	24%
shrub all	58.4%	34.3%	36.0%	47.8%	42.2%	44%
Veg composition and mean heights within 7 ½ foot radius of nest						
# plants, height sagebrush (artva)				7, 50.8	5, 54.9	6, 53
# plants, height bitterbrush				5, 90.0	6, 55.1	6, 73
# plants, height all shrubs				15, 64.8	11, 54.9	13, 60
# plants, height perennial grass				18, 18.5	7, 32.0	13, 25

We documented several early brood-rearing areas (all fairly near nest sites) but have not yet performed vegetation assessments at any. They were observably relatively open compared to nest sites, as per the guidelines. Note that while the guidelines' discussion under "Habitat requirements" addresses nest and early brood-rearing habitats separately, the recommendations for breeding habitat in the "Recommended guidelines" section combine these and give average figures (Braun pers. comm.). We believe they should be evaluated separately wherever specific observations allow. The "Recommended guidelines" figures for

grass and forb cover are much greater than what our nest sites have but are likely more applicable to early brood rearing sites. We need to conduct assessments in early brood-rearing areas as soon as possible after identifying them to evaluate grass and forb cover accurately.

Summer-late brood rearing habitats

Telemetered hens with broods have moved to higher elevations during late June and early July, lagging slightly behind males and non-nesting females. The higher elevations in the Bodie Hills generally remain cooler and moister and support forbs to a later date than lower elevation sites. One telemetered non-nesting female has spent the summer at lower-elevation, spring-fed Little Mormon Meadow, and one male died in summer in Bridgeport Valley, consistent with casual summer observations of grouse at lower-elevation wet meadow sites. The high-elevation summer observations also cluster around springs, streams and reservoirs. This results in many grouse concentrating in a few areas around the adjacent peaks of Bodie Mountain and Potato Peak - a very small percentage of all sagebrush habitat in the Bodie Hills. Continuing the study during wetter years will tell us if this is the norm. Further vegetation assessments may also reveal the extent to which sagebrush community characteristics, e.g. at high-elevation sites altered by chemical treatments conducted 3 decades ago, may be factors in summer habitat choice.

Fall and winter habitats

In 2000 and 2001 nearly all telemetered sage grouse left the high country by mid-September and returned to the 7000-8000 foot level. They tended to concentrate in two areas, the expanses of sagebrush in Big Flat and north and east of Mount Biedeman. We have not performed fall habitat assessments but observe that these areas have extensive, almost monotypic stands of sagebrush with what appears to be good canopy cover. Our few winter telemetry observations suggest that they continued to use these and nearby areas, occasionally visiting high elevations when weather conditions allowed, and spreading out into other lek areas by early March.

It is essential to continue the study through several winters of heavy snowfall to find out where sage grouse go when snow forces them to leave these fall/winter/spring areas. Suitable habitats may be few and/or distant, as pinyon and juniper cover much of the land below 7000 feet elevation in the Bodie Hills. Again, aircraft tracking support during the winter months is crucial to gaining this information.

Effects of habitat alteration

Past chemical range management treatments, as mentioned above, may or may not influence sage grouse choice of high elevation summer sites. There have been no extensive fires, mining activities or major developments in the Bodie Hills in recent years. Our telemetry study has not revealed effects of roads and fences (although lek censuses revealed displacement from a lek area by a fence constructed earlier). We do not have the type or quantity of data that would allow us to link livestock grazing with sage grouse distribution or success. The drought weather prevailing during the first three years of the study likely affected seasonal movements as discussed above, and may have reduced the nest initiation rate.

Predation

With six nests observed, we have not had a single instance of nest predation. In most cases of mortality of our telemetered adult sage grouse we cannot determine whether deaths have been due to predation, because in most cases all we find are the transmitter and a few feathers, with no certainty as to whether a predator or scavenger was involved. In one case we found, under the whitewash-streaked sagebrush

where an adult male had been defeathered, a golden eagle secondary feather with a bite taken out of it – possible evidence of a struggle between predator and prey. This is the only instance in which we found identifiable evidence of a specific predator. In two cases we found intact carcasses of females that evidently escaped or were dropped by a predator that had inflicted fatal injuries but did not retrieve the bird. One of these two was likely lost by an avian predator, landing headfirst and feet-up in a shrub, with feather damage suggesting a strike to the back. The other was the nesting hen who was killed during incubation, found about 1 km from the nest (the nest was still intact), missing a few feathers from one wing and showing subcutaneous bleeding on the same side. We also found an intact carcass of a female that had died without any evidence of injury.

Earlier in the study we believed we had a high mortality rate among telemetered birds and speculated that shiny, reflective antennae might be increasing visibility to predators, but re-examination of the data shows more moderate mortality rates and no difference between those wearing reflective or dull black-coated antennae. As it is impossible to monitor an unmarked “control group” in the same manner as radio-marked birds, we can have no certainty of whether mortality rates among telemetered birds are affected by the burden of carrying a transmitter or are representative of the population overall.

Recommended guidelines

The “General habitat management” guideline #2 referencing pinyon/juniper control likely warrants our consideration. In a heavy snow winter we may want to note whether pinyon and juniper may be limiting potential winter habitat or constraining potential migration routes. Expanses of Wyoming sagebrush exist in lower-elevation areas, with pinyon/juniper zones lying between these and the known sage grouse habitats in the Bodie Hills.

Under “Breeding habitat management,” we should consider whether our range utilization monitoring protocol suffices to assess herbaceous cover in brood rearing habitat, to ensure we are meeting or in near accord with breeding habitat protection guideline #6 with reference to livestock management practices during drought periods.

With reference to habitat protection guideline #7 we should seek to determine whether our known breeding habitats should have a high priority for wildfire suppression, or whether some of these and other seasonal habitats may be candidates for prescribed burning.

Conclusion

The study so far has succeeded in identifying some migration patterns and some apparently important seasonal habitat areas for sage grouse in the Bodie Hills during drought conditions, most notably high elevation areas near water during the summer months. Nesting habitat is generally consistent with the guidelines, although with shrub canopy cover unusually high and bitterbrush prominent compared to most other regions, and nest success has been high. Conditions in other seasonal habitats should be assessed, and all habitats warrant monitoring to ensure sage grouse needs continue to be met. As the study continues we may accumulate sufficient demographic data for statistical analysis. We have not placed a time limit on the duration of this effort. It is most important that we continue for as many years as necessary to identify important seasonal habitats for sage grouse throughout weather patterns representative of the normal range of extremes in the Bodie Hills. The intent is to continue the project until this fundamental question is clarified, to the extent possible.

Literature Cited

Connelly, J.W., M.A. Schroeder, A. R. Sands, and C.E. Braun. 2000. Guidelines to manage sage grouse populations and their habitats. *Wildlife Society Bulletin* 2000, 28 (4): 967-985