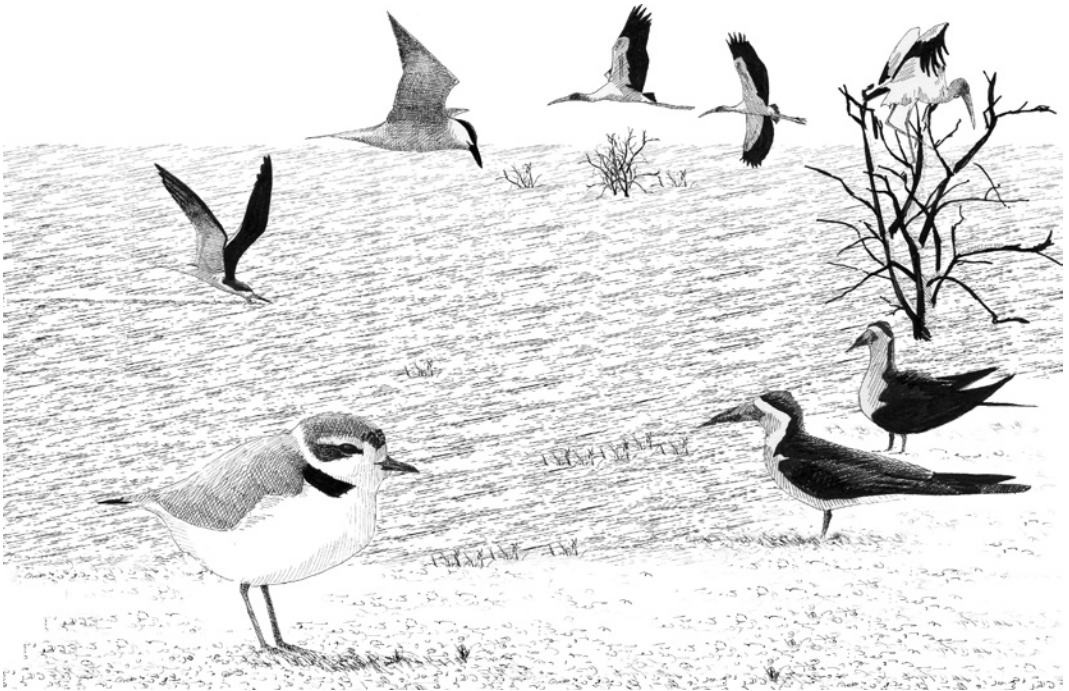


II

SPECIES ACCOUNTS



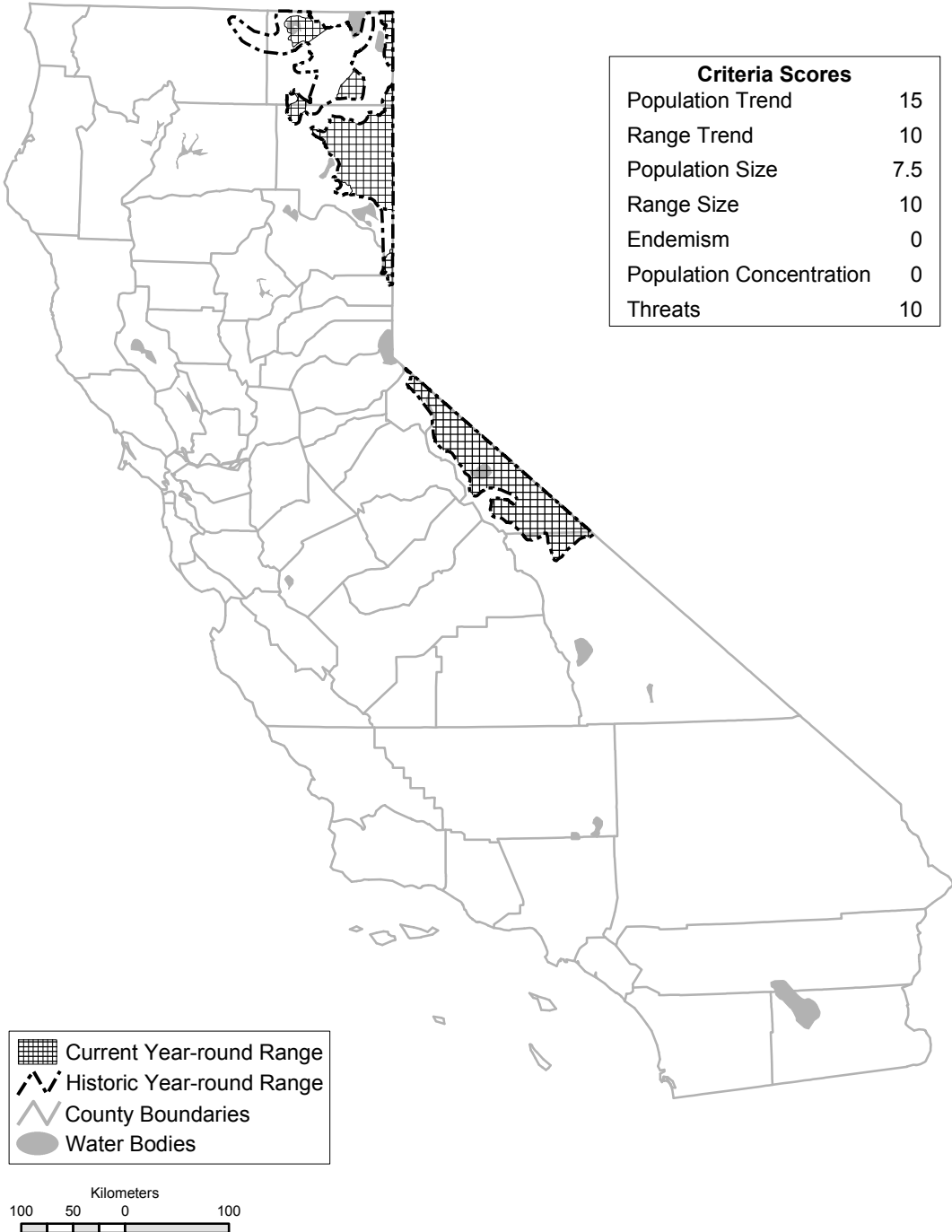
Andy Birch

PDF of Greater Sage-Grouse account from:

Shuford, W. D., and Gardali, T., editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

GREATER SAGE-GROUSE (*Centrocercus urophasianus*)

FRANK A. HALL, SCOTT C. GARDNER, AND D. SAM BLANKENSHIP



Current and historic (ca. 1944) year-round range of the Greater Sage-Grouse in California. Numbers have been greatly reduced and range has retracted slightly, particularly in parts of Modoc County; extirpated from eastern Siskiyou County and (prior to 1944) extreme northeastern Shasta County.

SPECIAL CONCERN PRIORITY

Currently considered a Bird Species of Special Concern (year round), priority 2. Included on both prior special concern lists (Remsen 1978, 3rd priority; CDFG 1992).

BREEDING BIRD SURVEY STATISTICS FOR CALIFORNIA

Data inadequate for trend assessment (Sauer et al. 2005).

GENERAL RANGE AND ABUNDANCE

The Greater Sage-Grouse currently occupies portions of two Canadian provinces and 11 western states and reaches its southwestern limit in eastern California (Connelly et al. 2004). The largest populations are in southeastern Oregon, northern Nevada, southern Idaho, and central Wyoming. The current range is estimated to be about 670,000 km², with about 50,000 males counted on about 2600 leks in 2003 and an estimated breeding population of about 175,000 individuals (Connelly et al. 2004). The name change from Sage Grouse to Greater Sage-Grouse was necessitated by the acceptance of a population occupying portions of Colorado and Utah as a distinct species, the Gunnison Sage-Grouse (*C. minimus*; AOU 2000). The taxonomic status of a genetically distinct population of Greater Sage-Grouse recently described from Mono County, California, and Lyon County, Nevada (Benedict et al. 2003, Oyler-McCance et al. 2005), is uncertain.

SEASONAL STATUS IN CALIFORNIA

Occurs year round; breeding extends from March through May. Some birds are resident; others exhibit migratory movements between seasonal ranges (Connelly et al. 2000; see below).

HISTORIC RANGE AND ABUNDANCE IN CALIFORNIA

Grinnell and Miller (1944) described the sage-grouse range as the northeastern Great Basin portion of California, from eastern Siskiyou and (formerly) northeastern Shasta counties, east to Modoc County and south and east of the Sierra Nevada as far as the Owens Valley in the vicinity of Big Pine, Inyo County. Altitudes of occurrence ranged from 3500 (1062 m) to 12,000 ft. (3640 m). They considered the species "formerly abundant" but now "greatly reduced in numbers and localized in occurrence." Areas occupied before,

but not after, 1945 include those portions of eastern Siskiyou County west of the Lower Klamath Basin (including Butte Valley), near Fall River Mills in eastern Shasta County, and Sierra Valley in eastern Sierra and Plumas counties (Grinnell and Miller 1944). The historic range of sage-grouse in California, estimated on the basis of the range of sagebrush and recorded occurrences since about 1850, was about 26,011 km² (Hall 1995).

RECENT RANGE AND ABUNDANCE IN CALIFORNIA

The current range of the sage-grouse in California is about 11,064 km² (Hall 1995). This reduction in overall area includes contraction on the edge of the range and fragmentation within it (see map). This change came mostly in Siskiyou and Modoc counties and, to a lesser extent, Lassen County in northeastern California. The species is currently most abundant in the Surprise Valley in northeastern Modoc County, eastern Lassen County north of Honey Lake and east of Eagle Lake, and in the Bodie Hills and Long Valley areas of Mono County (Hall 1995, Schroeder et al. 2004). Areas occupied in 1945 but not since 1995 include eastern Siskiyou County west to the Lower Klamath Basin–Mt. Dome area, the Goose Lake Basin in northeastern Modoc County, the upper Pit River portion of Modoc County between Adin and Alturas, the Rocky Prairie area near Alturas in Modoc County, and the Honey Lake Valley area south to near Hallelujah Junction in southern Lassen County (Hall 1995). No significant contraction from the historic range has been documented in Mono County. However, significant reductions in abundance have occurred in the Fales area, with the extirpation of the main lek about 1982. Sage-grouse are presumed to be extirpated from the Coyote Flat area of northern Inyo County.

The most significant range contraction has occurred in Modoc County in the Devils Garden area and Likely Tables southeast of Alturas (now only one active lek in each area). Each of these groups is discreet, containing <50 individuals, and neither is connected to any other sage-grouse population. Smaller peripheral populations in Mono County are found in the White Mountains, extending into northern Inyo County; the area south and east of Mono Lake, including the Parker Bench and Adobe Valley; the Fales area, north of Bridgeport Valley along Highway 395; and Jackass Flat, along Desert Creek and the Nevada border. Only anecdotal reports remain for Big Valley

between Bieber and Adin near the Modoc-Lassen County line, Willow Creek Valley area in Lassen County, and northeastern Alpine County.

Annually in March through early May, biologists count males at all known active leks to determine their peak attendance, which is used to estimate population size (peak males counted + [2.5 x males counted]; Hall 1995, Connelly et al. 2004). In 2004, California's Greater Sage-Grouse population included at least 59 active leks and at least 5410 breeding birds (mean 2000–2004 = 4499 birds). The subtotals for Modoc and Lassen counties were 37 leks and 3187 breeding birds (mean 2000–2004 = 2762 birds). Respective data for subareas of that region were 2, 78, and 77 for the Devil's Garden and Likely Tables area, Modoc County; 6, 697, and 504 for Surprise Valley, Modoc County; and 29, 2412, and 2181 for the east of Eagle Lake and north of Honey Lake Valley area, Lassen County. The subtotals for Mono County were 22 leks and 2223 breeding birds (mean 2000–2004 = 1737 birds). Respective data for subareas of that county were 9, 781, and 553 for the Bodie Hills; 3, 161, and 133 for the Fales area and Jackass Flat; and 10, 1281, and 1051 for the Long Valley, Parker Bench, and Adobe Valley area.

ECOLOGICAL REQUIREMENTS

Greater Sage-Grouse are dependent on sagebrush (*Artemisia* spp.) for food and cover year round (Connelly et al. 2000, 2004). Although they use other plant species for food and cover, their range is closely aligned with the range and integrity of sagebrush ecosystems (Schroeder et al. 2004). Predominant types of sagebrush in California include Wyoming Sagebrush (*A. tridentata* ssp. *wyomingensis*), Mountain Sagebrush (*A. t.* ssp. *vaseyana*), Big Sagebrush (*A. t.* ssp. *tridentata*), and Low Sagebrush (*A. arbuscula*). Sage-grouse exhibit "clumped polygyny," in which multiple males display on an arena (lek) for females (Bergerud 1988). Sage-grouse have distinct habitat requirements for nesting, early brood rearing, and wintering, which increases their vulnerability to habitat loss and degradation (Schroeder et al. 1999; Connelly et al. 2000, 2004).

Male sage-grouse form breeding display leks opportunistically at sites within or adjacent to potential nesting habitat. Leks typically occur in open areas surrounded by sagebrush where visibility among males is unobstructed (Connelly et al. 2000).

Sage-grouse were found to nest primarily under Big Sagebrush and had higher nest suc-

cess there (53%) than under other plants (22%; Connelly et al. 2000). In Lassen County, 67% of sage-grouse nests ($n = 45$) were found in Big Sagebrush, 4% in Low Sagebrush, and 29% in mixed shrub cover types, including Rabbitbrush (*Chrysothamnus* spp.), Horsebrush (*Tetradymia* spp.), and Bitterbrush (*Purshia tridentata*; Popham 2000, Popham and Gutierrez 2003). Overall, nest success was 40%, but it was higher for birds nesting under other shrubs (42%) than Big Sagebrush (31%).

Characteristics of successful sagebrush nest sites include 15%–25% canopy and mean height of 29–80 cm (Connelly et al. 2000). Sage-grouse select nest sites under shrubs having greater canopy, ground, and lateral cover than randomly available sites (Connelly et al. 2000). In Lassen County, sagebrush was taller at successful than at unsuccessful nests (Popham and Gutierrez 2003). In Mono County in 2003, sage-grouse selected nest sites ($n = 32$) in mixed shrub stands, similar to shrub species composition at nests in Lassen County. Shrub canopy of nest sites ranged from 45% to 63% versus 30% to 51% at random sites, with sagebrush cover ranging from about 22% to 27% (USGS unpubl. data, M. Casazza pers. comm.).

Herbaceous cover and residual grass from the previous growing season contribute to visual screening, which is an essential requirement for successful nesting. However, Popham and Gutierrez (2003) did not find significant differences in residual grass height between successful and unsuccessful nests. Rock cover was greater at successful (28%) than unsuccessful nest sites (14%). Additionally, mean nest-to-lek distance was almost twice as great for successful as for unsuccessful nests (Popham and Gutierrez 2003).

Early brood rearing areas occur in sagebrush habitats close to nest sites. These habitats may be relatively open stands of sagebrush (<15% canopy cover), with $\geq 15\%$ cover of grasses and forbs (Connelly et al. 2004). Insects, especially ants (Hymenoptera), beetles (Coleoptera), and arthropods, are an important component of early brood rearing habitat (Leach and Hensley 1954, Drut et al. 1994). As sagebrush habitats desiccate, sage-grouse move to more mesic sites in summer and early fall. These may include meadows, riparian sites, and croplands, especially alfalfa (Leach and Browning 1958). These sites are typically forb- and insect-rich.

During winter, sage-grouse rely on sagebrush almost exclusively for food and cover (Connelly et al. 2004). Leach and Hensley (1954) found

sagebrush was the single largest item in the diet as early as September in both Mono and Lassen counties.

Sage-grouse are considered to be either resident (within ≤ 10 km of leks year long) or migratory, moving >10 km from breeding leks to summer or winter habitats (Connelly et al. 2000). In California, sage-grouse exhibit both resident and migratory behavior. Seventy-nine radio-marked sage-grouse captured near nine leks monitored from 1998 to 2000 in eastern Lassen County included some resident and some migratory individuals associated with each lek (Popham 2000). Most nesting took place within 5–8 km of each lek, consistent with other populations (Connelly et al. 2004). However, some females moved their broods as far as 70 km by September. A large portion of the Lassen County and Surprise Valley (Modoc County) breeding populations migrate to western Washoe County, Nevada, either for winter (Lassen) or for brood rearing (Surprise Valley; NDOW 2004). Similarly, in Mono County, some sage-grouse are resident, whereas others migrate to both brood-rearing and winter habitats (M. Casazza pers. comm.). In general, the Long Valley population is resident, the Bodie population migratory (R. Gibson pers. comm.).

THREATS

Because sage-grouse are sagebrush obligates, they are threatened by activities that reduce the extent and integrity of this habitat. Also, the threat of West Nile virus is emerging and potentially significant. It caused up to 20%–40% annual mortality in sage-grouse in parts of Wyoming and Alberta in 2003 (Naugle et al. 2004, Walker et al. 2004), and three radio-marked birds found dead in Mono County tested positive for this virus in 2004.

Western Juniper (*Juniperus occidentalis*) expansion is a major threat to sage-grouse occupation in northeastern California and to a lesser extent in Mono and Inyo counties. Similarly, Singleleaf Pinyon (*Pinus monophylla*) is an increasing but modest threat to sage-grouse habitat in the Bodie Hills of Mono County. Juniper displaces sagebrush and other shrubs proportionally to the canopy density of juniper (Miller et al. 2005; R. Miller pers. comm.). Juniper also provides additional perches for aerial predators and cover for terrestrial ones. Radio-marked sage-grouse in Lassen County (1998–2001) avoided juniper-dominated uplands but flew between sagebrush and forb-dominated sites that were isolated between juniper-dominated areas (NDOW 2004).

Both prescribed fires and wildfires have the capacity to degrade sage-grouse habitat significantly. Sagebrush is typically slow to reestablish following fire, has poor seed dispersal, and has little ability to naturally reestablish in sites dominated by annual grassland (Monsen et al. 2004). Connelly et al. (2000) indicated that prescribed burning of Wyoming Sagebrush during a drought period resulted in a large decline ($>80\%$) of a sage-grouse breeding population in southeastern Idaho. Similarly, Nelle et al. (2000) reported that burning Mountain Sagebrush stands had long-term negative impacts on sage-grouse nesting and brood-rearing habitats. Even 14 years after burning, canopy cover in Mountain Sagebrush did not provide appropriate nesting habitat.

Fire may negatively affect sage-grouse brood-rearing habitat rather than improve it in Wyoming Sagebrush habitats, and its effects on sage-grouse in Mountain Sagebrush habitats needed further investigation (Connelly et al. 2000). Byrne (2002) subsequently found generally negative effects for sage-grouse use after prescribed fires at sites at Hart Mountain in Oregon. Cheatgrass (*Bromus tectorum*) commonly occupies sites following disturbance, especially burning (Connelly et al. 2004). Repeated (<20 -year interval) or late-summer burning favors Cheatgrass invasion and may be a major cause of the expansion of this species to the detriment of sagebrush.

Development and fragmentation by roads, overhead lines, fences, reservoirs, ranches, farms, landfills, and housing have resulted in loss and degradation of sage-grouse habitat (Braun 1998). Structures such as overhead lines, towers, and fences pose a hazard to sage-grouse as perch and nesting sites for raptors and ravens (F. Hall unpubl. data) or as sites for collisions (S. Blankenship pers. obs.). Long-term (± 50 years) use of leks in Lassen County has been significantly reduced by proximity to overhead lines and towers (NDOW 2004, F. Hall unpubl. data). While radio-marked sage-grouse were not subject to significant mortality from collisions during a three-year study, adult mortality (primarily to golden eagles) and nest losses (primarily to ravens) were significantly higher near (≤ 5 km) overhead lines and towers than at further distances (NDOW 2004, F. Hall unpubl. data). The proportion of losses of radio-marked sage-grouse to avian, versus mammalian, predators decreased linearly as distance from overhead lines and towers increased.

Grazing by domestic livestock and wild horses can degrade the herbaceous layer, reducing concealment of grouse, their nests, and chicks, which

increases their vulnerability to predation. Also, land management activities to reduce sagebrush and increase forage for livestock have degraded habitat (Connelly et al. 2004). However, maintenance of late-season brood-rearing meadows is often accompanied by moderate livestock grazing, which may be beneficial. Grazing depresses grass components that otherwise could displace more desirable forbs eaten by sage-grouse. Fencing meadows to exclude livestock often reduces sage-grouse use by reducing forbs and creating too much grass cover for them to enter (D. Klebenow pers. comm.).

Hunting of sage-grouse in California by unlimited numbers of hunters has led to numerous closures, the most recent statewide being in 1983–1986. In 1987, the season was reopened under a permit system with reduced hunt areas and additional closures for peripheral and small populations (Hall 1995). The annual numbers of permits are linked to annual lek counts, resulting in an annual harvest of 3%–6% and 2%–4% of the breeding populations in Lassen and Mono counties, respectively, which is well below the recommended maximum of 10% of the fall population (Connelly et al. 2000). The current season lasts two days, with bag limits of two birds in Lassen County and one in Mono County.

There is considerable evidence that current hunting is not a threat to sage-grouse populations in California (Hall 1995, Connelly et al. 2004, NDOW 2004). For example, in California's largest population (Lassen), male attendance at index leks increased 78% between 1996 and 1999 while 1395 sage-grouse were estimated to have been taken by hunting during the same years from the same population. Similarly, annual female mortality rates from 1998 to 2000 radiotelemetry ($n = 102$) showed hunting mortality was 5%, while nonhunting mortality was 32% in the Lassen population (NDOW 2004). As added protection to peripheral populations, approximately 30% of the currently occupied range containing about 25% of California's total sage-grouse population has been closed to hunting since 1982. This includes northern Lassen County and all of Modoc County, the northern portions of Mono County, as well as the White Mountains in northern Inyo County. Since 1987, hunted populations in California generally have shown stability or slight increases (Connelly et al. 2004), and peripheral, nonhunted populations have continued to decline.

Other recreational activities, including public viewing and photography near leks, are of increasing concern to sage-grouse in California, though

no documentation exists that this use is any more than a minor threat.

MANAGEMENT AND RESEARCH RECOMMENDATIONS

- Continue to participate in local sage-grouse conservation planning with local working groups and develop local conservation plans. This process provides a mechanism for education, monitoring, habitat restoration, and research that supports sage-grouse management for specific populations.
- Continue to develop geographic information system data layers illustrating seasonal migration patterns, seasonal ranges, and habitat suitability models based on radiotelemetry and other data. This has been largely completed for Lassen County and is in the developmental stages for Mono County.
- Use standard radiotelemetry techniques to evaluate habitat selection by hens during nesting and brood-rearing activities, and to determine nest success and brood survival. This research has been completed for Lassen County but is needed for Modoc, Mono, and Inyo counties.
- Expand radiotelemetry determinations of migration and residency patterns in peripheral ranges in Modoc, northern Lassen, and southern Mono and Inyo counties.
- Complete analysis of relationships between lek use and proximity to overhead lines and towers in Lassen County.

MONITORING NEEDS

Annual lek counts, wing analyses, and radiotelemetry provide most of the monitoring data collected for sage-grouse. Currently, biologists and trained volunteers attempt to count all known active leks in California for peak male attendance in March through early May each year. Lek surveys (Connelly et al. 2000) and searches for reoccupied historic leks are often combined with systematic surveys by ground or aircraft for "new" leks that may have been previously undetected. Analysis of hunter-harvested wings provides age and sex ratios and an estimate of the proportion of successfully nesting females. Data from radiotelemetry projects has agreed closely with nesting performance determined from wing analysis in those years when radio-marked females were present within populations (Lassen County, 1998–2001; Mono County, 2003–2005).

ACKNOWLEDGMENTS

This account benefited from reviews by C. Braun, G. Milano, W. D. Shuford, S. Stiver, and R. Woodward. We thank M. Nordstrom for additional technical assistance.

LITERATURE CITED

- American Ornithologists' Union (AOU). 2000. Forty-second supplement to the American Ornithologists' Union Check-list of North American Birds. *Auk* 117:847–858.
- Benedict, N. G., Oyler-McCance, S. J., Taylor, S. E., Braun, C. E., and Quinn, T. W. 2003. Evaluation of the eastern (*Centrocercus urophasianus urophasianus*) and western (*Centrocercus urophasianus phaios*) subspecies of Sage-Grouse using mitochondrial control-region sequence data. *Conserv. Genetics* 4:301–310.
- Bergerud, A. T. 1988. Mating systems in grouse, in Adaptive Strategies and Population Ecology of Northern Grouse (A. T. Bergerud and M. W. Gratson, eds.), pp. 439–472. Univ. Minnesota Press, Minneapolis.
- Braun, C. E. 1998. Sage Grouse declines in western North America: What are the problems? *Proc. W. Assoc. Fish and Wildl. Agencies* 78:139–156.
- Byrne, M. W. 2002. Habitat use by female Greater Sage Grouse in relation to fire at Hart Mountain National Antelope Refuge, Oregon. M.S. thesis, Oregon State Univ., Corvallis.
- California Department of Fish and Game (CDFG). 1992. Bird species of special concern. Unpublished list, July 1992, Calif. Dept. Fish & Game, 1416 Ninth St., Sacramento, CA 95814.
- Connelly, J. W., Knick, S. T., Schroeder, M. A., and Stiver, S. J. 2004. Conservation assessment of Greater Sage-Grouse and sagebrush habitats. Unpublished report, W. Assoc. Fish and Wildl. Agencies, Cheyenne, Wyo.
- Connelly, J. W., Schroeder, M. A., Sands, A. R., and Braun, C. E. 2000. Guidelines to manage Sage Grouse populations and their habitats. *Wildl. Soc. Bull.* 28:967–985.
- Drut, M. S., Pyle, W. H., and Crawford, J. A. 1994. Diets and food selection of Sage Grouse chicks in Oregon. *J. Range Mgmt.* 47:90–93.
- Grinnell, J., and Miller, A. H. 1944. The distribution of the birds of California. *Pac. Coast Avifauna* 27.
- Hall, F. A. 1995. Determining changes in abundance of Sage Grouse *Centrocercus urophasianus* in California. *Wildl. Mgmt. Branch Admin. Rep.*, Calif. Dept. Fish & Game, Sacramento.
- Leach, H. R., and Browning, B. M. 1958. A note on the food of Sage Grouse in the Madeline Plains area of California. *Calif. Fish Game* 44:73–76.
- Leach, H. R., and Hensley, A. L. 1954. The Sage Grouse in California with special reference to food habits. *Calif. Fish Game* 40:385–394.
- Miller, R. F., Bates, J. D., Svejcar, A. J., Pierson, F. B., Jr., and Eddleman, L. E. 2005. Biology, Ecology, and Management of Western Juniper (*Juniperus occidentalis*). Oregon State Univ. Agri. Experiment Station.
- Monsen, S. B., Stevens, R., and Shaw, N. L., compilers. 2004. Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136, 3 vols. U.S. Forest Serv., Rocky Mtn. Res. Station, Fort Collins, CO.
- Naugle, D. E., Aldridge, C. L., Walker, B. L., Cornish, T. E., Moynahan, B. J., Holloran, M. J., Brown, K., Johnson, G. D., Schmidtman, E. T., Mayer, R. T., Kato, C. Y., Matchett, M. R., Christiansen, T. J., Cook, W. E., Creekmore, T., Falise, R. D., Rinkes, E. T., and Boyce, M. S. 2004. West Nile virus: Pending crisis for Greater Sage-Grouse. *Ecol. Letters* 7:704–713.
- Nelle, P. J., Reese, K. P., and Connelly, J. W. 2000. The long-term effect of fire on Sage Grouse nesting and brood-rearing habitats on the Upper Snake River Plain. *J. Range Mgmt.* 53:586–591.
- Nevada Division of Wildlife (NDOW). 2004. Greater Sage-Grouse Conservation Plan for Nevada and eastern California. Available at www.ndow.org/wild/conservation/sg/plan/index.shtml.
- Oyler-McCance, S. J., Taylor, S. E., and Quinn, T. W. 2005. A multilocus population genetic survey of the Greater Sage-Grouse across their range. *Molecular Ecol.* 14:1293–1310.
- Popham, G. P. 2000. Sage Grouse nesting habitat in northeastern California. M.S. thesis, Humboldt State Univ., Arcata, CA.
- Popham, G. P., and Gutierrez, R. J. 2003. Greater Sage-Grouse (*Centrocercus urophasianus*) nesting success and habitat use in northeastern California. *Wildl. Biol.* 9:327–334.
- Remsen, J. V., Jr. 1978. Bird species of special concern in California: An annotated list of declining or vulnerable bird species. *Nongame Wildl. Invest.*, Wildl. Mgmt. Branch Admin. Rep. 78-1, Calif. Dept. Fish & Game, 1416 Ninth St., Sacramento, CA 95814.
- Sauer, J. R., Hines, J. E., and Fallon, J. 2005. The North American Breeding Bird Survey, results and analysis 1966–2004, version 2005.2. USGS Patuxent Wildl. Res. Ctr., Laurel, MD. Available at www.mbr-pwrc.usgs.gov/bbs/bbs.html.
- Schroeder, M. A., Aldridge, C. L., Apa, A. D., Bohne, J. R., Braun, C. E., Bunnell, S. D., Connelly, J. W., Diebert, P. A., Gardner, S. C., Hilliard, M. A., Kobriger, G. D., and McCarthy, C. W. 2004. Distribution of Sage Grouse in North America. *Condor* 106:363–376.
- Schroeder, M. A., Young, J. R., and Braun, C. E. 1999. Sage Grouse (*Centrocercus urophasianus*), in *The Birds of North America* (A. Poole and F. Gill, eds.), no. 425. Birds N. Am., Philadelphia.
- Walker, B. L., Naugle, D. E., Doherty, K. E., and Cornish, T. E. 2004. From the Field: Outbreak of West Nile virus in Greater Sage-Grouse and guidelines for monitoring, handling, and submitting dead birds. *Wildl. Soc. Bull.* 32:1000–1006.