

Population Status and Management of Lesser Prairie-chicken in Colorado

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ABSTRACT -- Populations of lesser prairie-chicken (*Tympanuchus pallidicinctus*), apparently abundant in southeastern Colorado prior to EuroAmerican settlement, reached a low during the "Dust Bowl" years in the 1930's. Restoration of native sand sagebrush (*Artemisia filifolia*) grasslands and management of grazing on the Comanche National Grasslands by the United States Forest Service have resulted in modest population increases of lesser prairie-chicken since the 1960's. Past translocation efforts to expand distribution in Colorado and increase population size were not successful because too few birds were released and habitats may not have been suitable. Continued restoration and management of degraded habitats, as well as successful transplants into suitable habitats, could result in substantial increases in both distribution and population size. Precipitation appears to be a major factor affecting population changes as reflected in annual counts of active leks and males. Present populations in Colorado are estimated at less than 1,500 breeding individuals.

Key words: Colorado, habitat, lesser prairie-chicken, status, *Tympanuchus pallidicinctus*.

The lesser prairie-chicken (*Tympanuchus pallidicinctus*) is presently listed as state threatened in Colorado and has been petitioned for listing under the Federal Endangered Species Act. Much of what is known concerning the historical and present breeding distribution and population size of lesser prairie-chicken in Colorado has been summarized by Hoffman (1963), Bailey and Niedrach (1965), Andrews and Righter (1992), Giesen (1994a), and Winn (1998). Records of lesser prairie-chicken in Colorado prior to 1900 are lacking, although sand sagebrush (*Artemisia filifolia*) rangeland associated with sandy soils likely provided suitable habitats along both the Cimarron and Arkansas rivers prior to settlement by EuroAmericans. Museum specimens and published reports suggest it occupied most suitable sand sagebrush and mixed grass habitats in six southeastern counties in the early 1900's. Documented distribution markedly declined and became fragmented prior to 1940 as a result of excessive livestock grazing, cultivation of native rangelands, and drought. Isolated populations presently

exist in four counties, with the largest populations in Baca and Prowers counties contiguous with populations in Oklahoma and Kansas.

Management of lesser prairie-chicken in Colorado is the responsibility of the Colorado Division of Wildlife and historically involved surveys and counts of birds present on active display grounds or leks. These efforts were initiated in the late 1950's, although systematic efforts to survey all known populations did not occur until 1980. Other management efforts included identification of potentially suitable habitats for reintroduction (Hoffman 1967), transplant efforts (Giesen 1998), evaluation of lek survey efficacy (Schroeder et al. 1992), and telemetry studies to understand movements and habitat use of this species in native sand sagebrush rangelands managed for livestock grazing (Giesen 1991, 1994b).

Habitat management for lesser prairie-chicken is primarily the responsibility of private landowners and the United States Forest Service. The Comanche National Grasslands (Pike-San Isabel National Forest) is comprised of former cropland and rangeland, which was abandoned by settlers following the "Dust Bowl" of the 1930's. Management of this area included extensive reseeding projects and other rangeland restoration practices to establish permanent grassland vegetation, and manage it as range for cattle. The objective of my paper is to review the present distribution and population status of lesser prairie-chicken in Colorado, and examine the potential effects of precipitation on population trends.

METHODS

Surveys of lesser prairie-chicken breeding grounds have traditionally been conducted by local Colorado Division of Wildlife personnel in southeastern Colorado. Annual survey efforts have varied substantially, depending upon interest and priorities. Most efforts included visits to and counts of grouse on known display grounds, with unequal effort expended annually in searching for additional leks. Because an average of 14% of leks active in one year were either inactive or moved in subsequent years (unpubl. data), there is potential bias in population estimates based solely on surveys of historical leks. More intensive efforts occurred from 1980 to 1990 when efforts were made to obtain a minimum of three counts of each known lek in April-May, and search adjacent suitable habitats for additional leks. Changes in personnel and budget restrictions reduced survey efforts after 1990. In 1998, a one-week intensive survey involving more than 16 biologists was conducted during early April (peak of hen attendance) in an attempt to survey all active and inactive (historical) lek sites and search all suitable habitats within the known or suspected range of lesser prairie-chicken in Baca and Prowers counties. When possible, birds were classified as male or female, although previous studies (Giesen 1994a, unpubl. data) indicated that few (less than 5%) birds observed during counts were actually females. Thus, the maximum count of males on a lek was either the maximum number of males positively classified, or the total number counted when birds were not classified to gender. Sex ratios reported in the literature vary widely but are not actually known (Giesen 1998), and few hens are counted on leks

relative to the number of males. Therefore, I assumed the adult sex ratio was 1:1 when estimating total population sizes. Lek density and breeding male density were reported to be highly correlated (Cannon and Knopf 1981), thus being better indices of population size and trend than average number of males per lek (lek size).

Colorado Division of Wildlife records and reports were reviewed to document early management practices, and agency personnel were contacted to provide additional information or details on transplant efforts. Success or failure of transplants was determined by existence of active lesser prairie-chicken leks on or near transplant sites 5 to 20 years later (Toepfer et al. 1990), as most transplant projects were not monitored after birds were released.

Precipitation records were obtained from the National Climatological Data Center (<http://www.ncdc.noaa.gov/>). Because summer precipitation is highly variable over small distances in southeastern Colorado, annual precipitation from Springfield (approximately 30 km northwest from the largest lesser prairie-chicken population in Baca County) was used as a gross measure of total precipitation. To test for correlation between precipitation patterns and apparent size of lesser prairie-chicken populations, the annual precipitation in Year_(t) was compared to lesser prairie-chicken population indices (number of leks and number of males) in Year_(t+2) by using simple linear regression. Precipitation in Year_(t) should result in greater vegetative growth the same year and greater height-density of residual nesting cover in Year_(t+1) which increases nest success (Davis et al. 1979, Haukos and Smith 1989, Riley et al. 1992, Giesen 1994b), which should be reflected in higher populations in Year_(t+2). Production of young has been hypothesized as the most important parameter affecting population trends in prairie grouse (Bergerud 1988, Peterson and Silvy 1996).

RESULTS

Distribution

Documented distribution of lesser prairie-chicken in Colorado has remained relatively stable since survey efforts were initiated in the late 1950's. Populations exist in all three counties where initially reported (Baca, Prowers, and Kiowa). When additional leks were discovered they were typically adjacent to known occupied habitats. However, in 1998 another population was located in Cheyenne County. These birds were on private lands where surveys had not been conducted in previous years, and not all available habitat in this area had been searched. Presently, lesser prairie-chicken occur in at least four of the six counties in Colorado where they historically occurred (Fig. 1). Some isolated areas in Baca County, which had small populations in the 1980's, apparently did not have breeding lesser prairie-chicken in 1998.

Using transplants of wild-trapped birds, multiple efforts to increase the range or population size of lesser prairie-chicken in Colorado have been attempted since 1960 (Table 1). None has been successful in either establishing new populations outside its

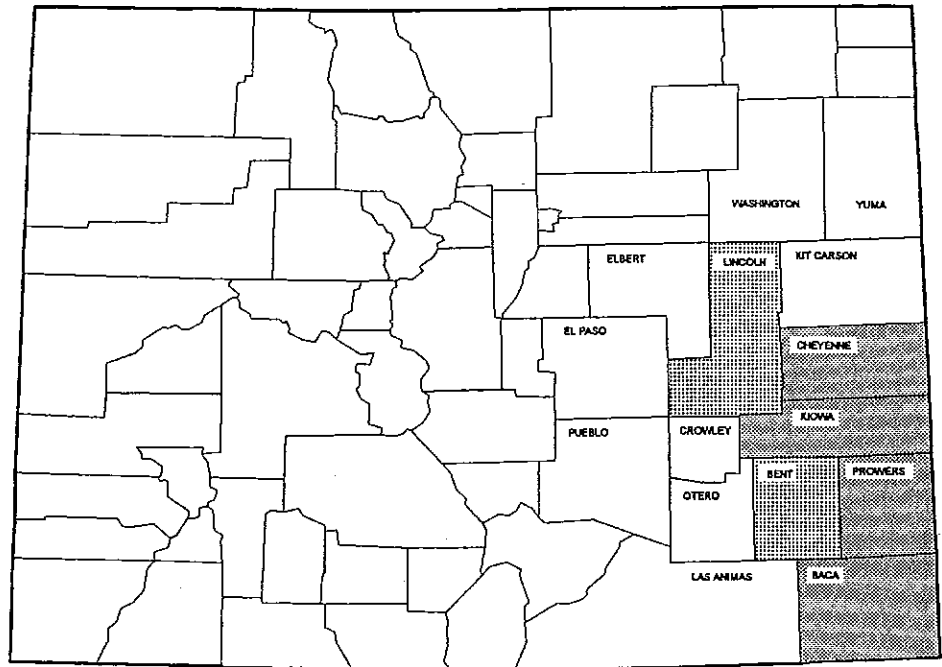


Figure 1. Documented historical (light stipple) and present (dark stipple) county distribution of lesser prairie-chicken in Colorado.

historical range, nor in increasing numbers in areas having existing viable populations, as determined from lek surveys.

Population Status

Number of active leks (Fig. 2) and total males counted (Fig. 3) have increased substantially since survey efforts were initiated in 1959. Counts of both number of active leks and males peaked in the late 1980's, when more than 400 males were counted on more than 40 active leks. Because not all suitable habitats were searched on privately owned lands, and few hens were counted, the actual breeding population during the peak was likely between 1,000 and 2,000 individuals.

Survey efforts after 1990 were less intensive, and fewer active leks and displaying males were counted. The exception was in 1998 when an intensive effort by more than 16 biologists counted 302 males on 33 active leks during the peak week of hen attendance in April. These numbers exceeded (2X) the number of active leks, and number of males (3X) counted during the previous year, when survey effort was more typical of that in 1991 to 1997.

Table 1. Lesser prairie-chicken transplants within Colorado, 1961 to 1994.

Date	Source	Release site	Birds (n)
1961	Colorado	Campo, southwest	8
Mar 1968	Kansas	Hugo, south	21
Apr 1968	Kansas	Hugo, south	6
Jan 1972	Kansas	CNG ^a , pasture 13E	43
Jan 1972	Kansas	CNG, pasture 1AE	6
Feb 1972	Kansas	CNG, pasture 13E	5
Jan 1975	Kansas	CNG, pasture 1AE	8
Jan 1975	Kansas	CNG, pasture 13B	10
Feb 1975	Kansas	CNG, pasture 6M	10
Feb 1975	Kansas	CNG, pasture 1B	10
Feb 1975	Kansas	CNG, pasture 1AE	3
Feb 1975	Kansas	CNG, pasture 13E	8
Apr 1988	Colorado	Pueblo County	24
Apr 1989	Colorado	Pueblo County	6
Apr 1993	Kansas	Pueblo County	28
Apr 1994	Kansas	Pueblo County	49

^a Comanche National Grassland.

Effects of Annual Precipitation

Precipitation at Springfield exceeded the long-term mean of 39.2 cm in 17 of 24 years since 1975, including 13 of 15 years since 1984 (Fig. 4). There was a weak relationship between total precipitation in Year_(t) and number of males counted on leks

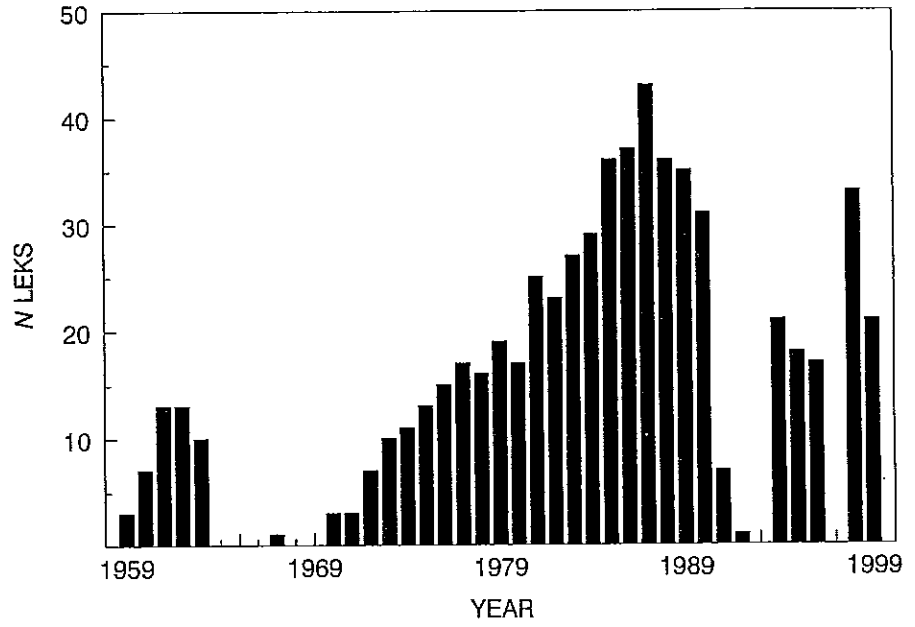


Figure 2. Number of active leks of lesser prairie-chicken counted in Colorado, 1959 to 1999.

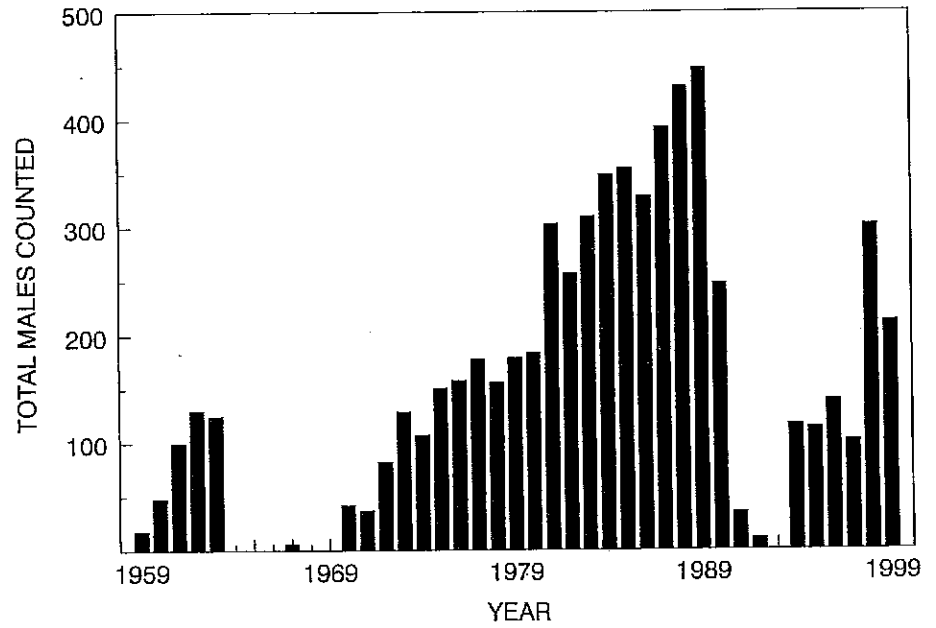


Figure 3. Number of male lesser prairie-chicken counted on leks in Colorado, 1959 to 1999.

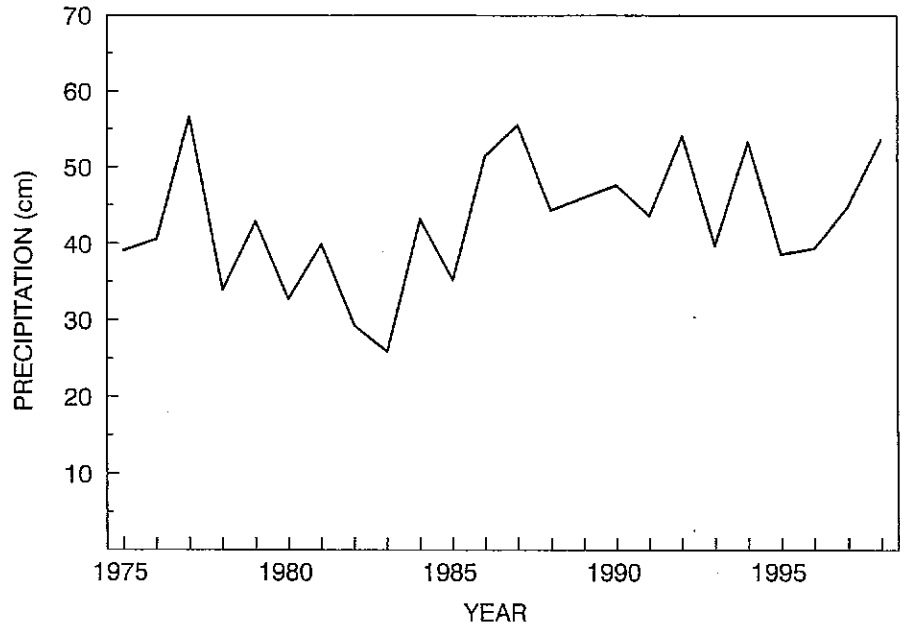


Figure 4. Annual precipitation at Springfield, Baca County, Colorado, 1975 to 1998.

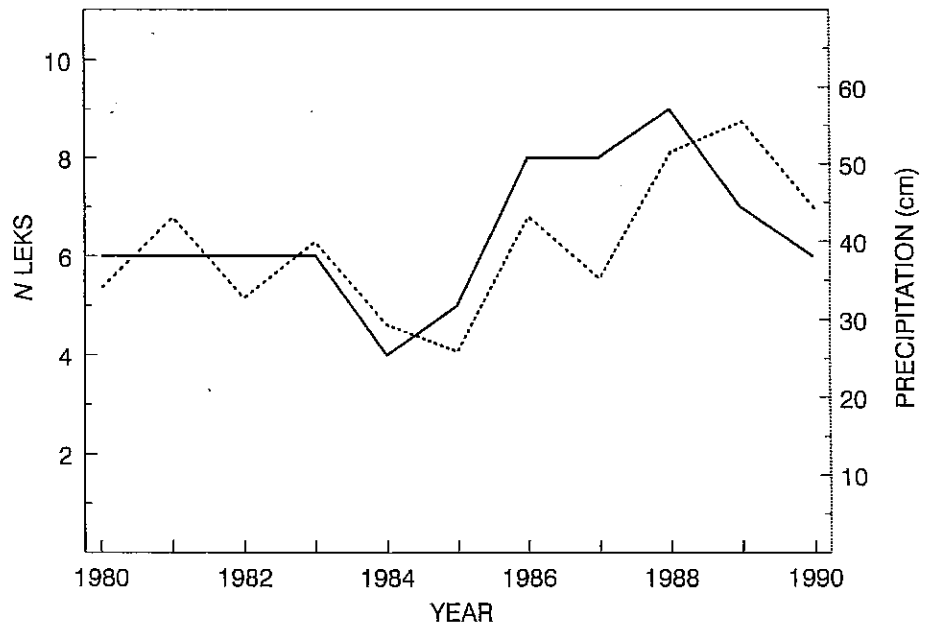


Figure 5. Relationship between precipitation (dotted line) and number of occupied leks ($Year_{(t+2)}$) on a 41-km² study area on the Comanche National Grasslands, Baca County, Colorado, 1980 to 1990.

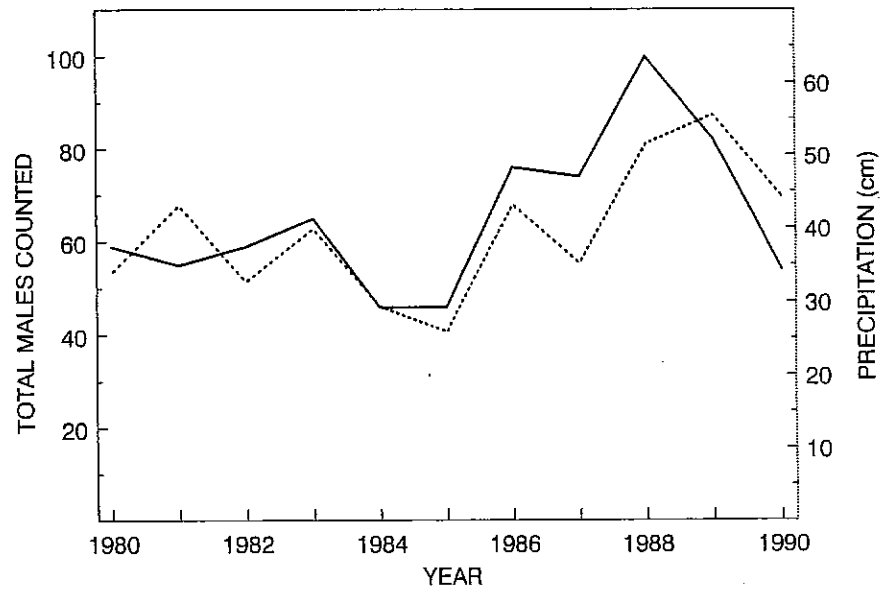


Figure 6. Relationship between precipitation (dotted line) and total males counted ($\text{Year}_{(t+2)}$) on a 41-km² study area on the Comanche National Grasslands, Baca County, Colorado, 1980 to 1990.

in $\text{Year}_{(t+2)}$ ($r = 0.33$, $P = 0.0568$) when examining all data since 1975. Because survey effort across the occupied range in Colorado was not uniform among years, I examined a subset of lek survey data from 16 sections (41 km²) on the Comanche National Grasslands during an 11-year period (1980 to 1990) when survey efforts on this site were comparable. The number of active leks and total number of males counted on this area ranged from four to nine and 46 to 100, respectively. With this subset of data, the relationships between precipitation and number of leks (Fig. 5, $r = 0.59$, $P = 0.03$) and between precipitation and total number of males counted (Fig. 6, $r = 0.91$, $P = 0.0001$) were much stronger.

DISCUSSION

Lesser prairie-chicken occur in at least four of six counties historically occupied, although populations in two counties (Kiowa and Cheyenne) have less than 100 individuals and appear isolated from populations in Colorado and adjacent states. Possibly other populations may be detected with additional search effort of suitable habitats. However, no other breeding populations were identified during completion of the Colorado Breeding Bird Atlas project (1987 to 1994) when this region was

extensively searched (Kingery 1998).

Transplant efforts within (Baca and Lincoln counties) and outside (Pueblo County) the known distribution have failed to either expand the species distribution or increase population size in Colorado. Evaluation of other wildlife transplant efforts (Wolf et al. 1996) suggested translocations were most likely to be successful when animals were released into the core of their historical range, habitat conditions were good to excellent, and large numbers of native and non-endangered species were released. Toepfer et al. (1990) reported the greatest predictor of success for prairie grouse transplants was the amount of high quality habitat in the release area. Likely, for most transplants in Colorado, too few birds were released to become established. Although there was some evaluation of habitat at release sites (Hoffman 1967), the seasonal requirements of lesser prairie-chicken relating to vegetative structure and species composition for successful nesting and brood rearing were not well known or evaluated. The apparent intent of some transplants was to increase the genetic diversity of existing populations by releasing small numbers of males. However, transplanted males probably would not become dominant on occupied leks and breed during the one to two years they might survive, thus having little impact on genetic diversity. Another concern with transplanting animals into occupied habitat is the threat of outbreeding depression (Leberg 1993), which may decrease productivity. Thus, at best, some transplants may have had a neutral effect on the existing population and, at worst, may have lowered productivity for a few years.

The apparent increase in populations as reflected in lek surveys may reflect long-term recovery of habitat from historical grazing levels and droughts, and better grazing management practices, especially on the Comanche National Grasslands. The effect of the Conservation Reserve Program (CRP) on lesser prairie-chicken populations in Colorado is unknown, although populations have not increased since CRP was initiated in 1985, despite the fact that one-third of the former cropland in Baca County is enrolled in this program. There have been no documented leks in CRP fields in Colorado, although anecdotal evidence suggested some use of these fields as roosting cover.

The positive relationship between precipitation and numbers of active leks and males counted suggests that much of the population increase since the mid 1970's may be explained by precipitation, which has been above the long-term average for most of this period. If precipitation is a primary factor affecting lesser prairie-chicken productivity and, subsequently, population trends, then a return to more normal precipitation patterns or periodic droughts may be expected to have negative impacts on population size. The effects of precipitation appear to be indirect, affecting vegetative growth and residual cover for nesting in subsequent years. Therefore, management of rangelands for livestock forage should be closely monitored to insure sufficient herbaceous cover remains after each growing season to provide adequate nesting cover for lesser prairie-chicken in subsequent years. This may entail changing grazing systems or more intensively managing stocking rates during the grazing season to correspond to

levels of precipitation and resultant vegetative growth.

Because numbers of males and active leks in Year_(t+2) were highly correlated with precipitation in an intensively surveyed area, but the relationship was weak over the entire range of lesser prairie-chicken in Colorado, likely there were many more active leks than detected or counted on annual surveys. Lek data from the intensive effort in 1998 suggests that "normal" survey efforts, i.e., surveying only known leks, may not be adequate to document population trends. Annual surveys for new and/or "satellite" leks are necessary to increase the reliability of lek surveys as indices to population trends (Haukos and Smith 1999).

Because of the importance in documenting population size and trend, additional research is needed to ascertain population size or develop a reliable population index. The relationship between lek density and actual population density is unknown because the percent of males attending leks and sex ratios are unknown (Giesen 1998). Aerial surveys may be useful in surveying areas for the presence of prairie-chicken leks, although they may not be precise enough for documenting annual trends (Schroeder et al. 1992). Line transect methodology (Buckland et al. 1993) may have potential for estimating population density. However, when this method was evaluated in New Mexico (Olawsky and Smith 1991), the calculated densities were much higher than expected from lek surveys, which suggests further testing of this technique is warranted.

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LITERATURE CITED

- Andrews, R., and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Mus. Nat. Hist., Denver, CO.
- Bailey, A. M., and R. J. Niedrach. 1965. Birds of Colorado, Vol. 1. Denver Mus. Nat. Hist., Denver, CO.
- Bergerud, A. T. 1988. Population ecology of North American grouse. Pp. 578-685 in Adaptive strategies and population ecology of northern grouse. (A. T. Bergerud and M. W. Gratson, eds.). Univ. Minnesota Press, Minneapolis, MN.
- Buckland, S. T., D. R. Anderson, K. P. Burnham, and J. L. Laake. 1993. Distance sampling: estimating abundances of biological populations. Chapman & Hall, London, U.K.

- Cannon, R. W., and F. L. Knopf. 1981. Lek numbers as a trend index to prairie grouse populations. *J. Wildl. Manage.* 45:776-778.
- Davis, C. A., T. Z. Riley, R. A. Smith, H. R. Suminski, and M. J. Wisdom. 1979. Habitat evaluation of lesser prairie chickens in eastern Chaves County, New Mexico. *New Mexico Agric. Exp. Sta., Las Cruces, NM.*
- Giesen, K. M. 1991. Population inventory and habitat use by lesser prairie-chickens in southeast Colorado. *Colorado Div. Wildl., Fed. Aid Proj. W-152-R. Apr.* Pp. 7-35.
- Giesen, K. M. 1994a. Breeding range and population status of lesser prairie-chickens in Colorado. *Prairie Nat.* 26:175-182.
- Giesen, K. M. 1994b. Movements and nesting habitat of lesser prairie-chicken hens in Colorado. *Southwest. Nat.* 39:96-98.
- Giesen, K. M. 1998. Lesser prairie-chicken (*Tympanuchus pallidicinctus*). in *The Birds of North America*, No. 364 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Haukos, D. A., and L. M. Smith. 1989. Lesser prairie-chicken nest site selection and vegetation characteristics in tebuthiuron-treated and untreated sand shinnery oak in Texas. *Great Basin Nat.* 49:624-626.
- Hoffman, D. M. 1963. The lesser prairie chicken in Colorado. *J. Wildl. Manage.* 27:726-732.
- Hoffman, D. M. 1967. Lesser prairie chicken adaptability. *Colorado Game, Fish and Parks, Fed. Aid Proj. W-37-R. Apr.* Pp. 143-156.
- Kingery, H. E. (ed.). 1998. Colorado breeding bird atlas. Colorado Bird Atlas Partnership and Colorado Div. Wildl., Denver, CO.
- Leberg, P. L. 1993. Strategies for population reintroduction: effects of genetic variability on population growth and size. *Cons. Biol.* 7:194-199.
- Olawsky, C. D., and L. M. Smith. 1991. Lesser prairie-chicken densities on tebuthiuron-treated and untreated sand shinnery oak rangelands. *J. Range Manage.* 44:364-368.
- Peterson, M. J., and N. J. Silvy. 1996. Reproductive stages limiting productivity of the endangered Attwater's prairie chicken. *Cons. Biol.* 10:1264-1276.
- Riley, T. Z., C. A. Davis, M. Ortiz, and M. J. Wisdom. 1992. Vegetative characteristics of successful and unsuccessful nests of lesser prairie-chickens. *J. Wildl. Manage.* 56:383-387.
- Schroeder, M. A., K. M. Giesen, and C. E. Braun. 1992. Use of helicopters for estimating numbers of greater and lesser prairie-chicken leks in eastern Colorado. *Wildl. Soc. Bull.* 20:106-113.
- Toepfer, J. E., R. L. Eng, and R. K. Anderson. 1990. Transplanting prairie grouse: what have we learned? *Trans. North Am. Wildl. and Nat. Resour. Conf.* 55:569-579.

- Winn, R. 1998. Lesser prairie-chicken. Pp. 156-147 in Colorado breeding bird atlas. (H. E. Kingery, ed.). Colorado Bird Atlas Partnership and Colorado Div. Wildl., Denver, CO.
- Wolf, C. M., B. Griffith, C. Reed, and S. A. Temple. 1996. Avian and mammalian translocations: update and reanalysis of 1987 survey data. *Cons. Biol.* 10: 1142-1154.

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