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(*Tympanuchus pallidicinctus*)

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## Effects of Lek Age on Age Structure and Attendance of Lesser Prairie-Chickens (*Tympanuchus pallidicinctus*)

ABSTRACT.—We used data from lesser prairie-chickens captured on leks to test the hypothesis that age structure of attending birds is reflected in lek age (*i.e.*, years of continuous attendance). As leks become older the age structure of attending birds becomes dominated by adults. Average lek size (number of attending males) was not affected by lek age. Establishment of satellite leks (leks  $\leq 2$  y of consecutive use) during spring was approximately 1 mo later than other leks and corresponded to a decrease in the number of males attending other leks. Interpretation of data collected from birds attending lesser prairie-chicken leks should include consideration of the lek age.

### INTRODUCTION

Typically, the number of active leks varies among and within years for a defined population of prairie grouse (*Tympanuchus* spp., *Centrocercus urophasianus*) (Gibson and Bradbury, 1986; Horak, 1986; Schroeder and Braun, 1992). This variation is usually attributed to a fluctuating number of "satellite," "temporary" or "unstable" leks (henceforth referred to as satellite), which are perceived to be used less frequently by fewer males and females than "permanent," "ancestral" or "stable" leks (Hamerstrom and Hamerstrom, 1973; Cannon and Knopf, 1981; Schroeder and Braun, 1992). Existence of satellite leks has been attributed to changes in population size [*e.g.*, an increasing population has more satellite leks than a decreasing population (Gibson and Bradbury, 1986)], physical destruction of or a portion of an existing lek (Cannon and Knopf, 1979) or changes in intensity of lek display and breeding effort during the lekking period (Gibson and Bradbury, 1986). Formation of satellite leks has been reported for lesser prairie-chicken (*Tympanuchus pallidicinctus*) (Cannon and Knopf, 1979, 1981; Haukos, 1988), greater prairie-chicken (*T. cupido*) (Hamerstrom and Hamerstrom, 1973; Schroeder and Braun, 1992), sharp-tailed grouse (*T. phasianellus*) (Baydack, 1988) and sage grouse (*Centrocercus urophasianus*) (Gibson and Bradbury, 1987).

Although several hypotheses have been presented to explain lek formation [*see* Hoglund and Alatalo (1995) for a review], none predicts age structure or attendance patterns of prairie grouse using either permanent or satellite leks. Schroeder and Braun (1992) hypothesized that male greater prairie-chickens attending satellite leks were yearlings. We used data from lesser prairie-chickens captured on leks to test the hypothesis that age structure of attending birds is reflected in lek age (*i.e.*, years of continuous attendance). Additionally, we examined the influence of lek age on lek size (number of males) and hen visitation with the use of lek counts of males and lek captures of females (an index to hen visitation).

### METHODS

The study was conducted in Cochran and Yoakum counties, Texas, during the springs of 1987 and 1988 (15 Feb.–1 May). The study area consisted of 4145 ha of rangeland, all of which was grazed by cattle. The area was characterized by Brownfield-Trivoli fine sand associations, which produced a gently undulating and duned landscape. Native short- and midgrasses once dominated the area, but have been partially replaced by sand shinnery oak (*Quercus havardii*). We identified 10 lek sites by daily surveys. They included rangeland sites, livestock handling or watering areas, abandoned oil pads and roadsides.

We initiated lek counts when males began attending leks in early February; lek captures began in late February when male lek attendance became consistent. We used walk-in drift traps and rocket nets to capture lesser prairie-chickens on leks (Haukos *et al.*, 1990). Each captured prairie-chicken was aged (yearling or adult) based on characteristics described by Coplin (1963) and Campbell (1972). Spotting on the outer primaries was the principal determinate of age (spotting at or near the tips of the outer primaries and corresponding feather wear indicated a yearling). Captured birds were fitted with a colored and numbered plastic leg band for future identification.

Lek age, based on the number of consecutive years of use before and including 1988, was determined through our surveys and communication with past researchers using the study area. We grouped leks

TABLE 1.—Lek size (number of males) and age structure (yearling:adult) in relation to lek age (years of consecutive male attendance) for lesser prairie-chickens

	Lek age			Total
	≤2 y	3–6 y	>6 y	
Number of surveyed leks	2	4	4	10
Number of lek counts	46	129	88	263
Average lek size (SE)	19.3 (4.5) <sup>a</sup>	19.7 (4.7) <sup>a</sup>	16.5 (2.4) <sup>a</sup>	18.4 (2.1)
Males				
Number captured	47	86	43	176
Yearling:Adult ratio	3.7:1	1.6:1	0.8:1	1.6:1
Females				
Number captured	11	26	18	55
Yearling:Adult ratio	4.5:1	4.2:1	2.0:1	3.2:1
Sexes combined				
Yearling:Adult ratio	3.8:1 <sup>a</sup>	1.9:1 <sup>a</sup>	1.0:1 <sup>b</sup>	1.9:1
Male:Female Capture ratio	4.3:1 <sup>a</sup>	3.3:1 <sup>a</sup>	2.4:1 <sup>a</sup>	3.2:1

<sup>a,b</sup> Average lek size means, combined yearling:adult ratio and male:female capture ratio with the same lowercase superscript do not differ ( $P > 0.05$ )

into three categories: 1–2 y (satellite leks,  $n = 2$ ), 3–6 y (potentially satellite or permanent leks,  $n = 4$ ), and  $> 6$  y (permanent leks,  $n = 4$ ). Eight leks were studied each year. Schroeder and Braun (1992) defined leks used  $\leq 2$  y by greater prairie-chickens as unstable or temporary (*i.e.*, satellite). Walk-in traps were established on each lek and two rocket nets were rotated among leks in response to observations of hen visitations, resulting in similar trapping effort among leks.

A multiway log linear model ( $G$ -test) was used to compare age ratios (yearling:adult) among lek categories and between sexes. Contingency table analysis was used to compare the male:female capture ratio among lek categories. A Kruskal-Wallis test was used to compare lek size (number of displaying males) among lek categories.

## RESULTS

A total of 176 individual male greater prairie-chickens was captured on the 10 leks (Table 1). Based on average lek counts during the study, we captured 95.6% of males attending leks. On five of the 10 studied leks, all territory holding males were captured. Additionally, 55 females were captured on eight leks (Table 1). There was no three-way interaction in the log linear model ( $\chi^2 = 0.64$ ,  $P = 0.72$ ). Sex of attending birds was independent of lek age ( $\chi^2 = 3.98$ ,  $P = 0.41$ ) and bird age ( $\chi^2 = 5.88$ ,  $P = 0.12$ ). Bird age was not independent of lek age ( $\chi^2 = 12.76$ ,  $P = 0.01$ ). Therefore, sexes were combined to test the effect of lek age on age ratios of attending lesser prairie-chickens. The yearling:adult ratio of birds from leks  $> 6$  y in age varied from the age ratios of birds on 3–6 y leks ( $\chi^2 = 3.80$ ,  $P = 0.05$ ) and 1–2 y leks ( $\chi^2 = 10.56$ ,  $P = 0.001$ ) (Table 1). The age ratio of birds on leks 1–2 y old differed ( $\chi^2 = 3.22$ ,  $P = 0.07$ ) from those on leks 3–6 y old. Male to female capture ratio was not affected by lek age ( $\chi^2 = 1.86$ ,  $P = 0.39$ ) (Table 1).

Average lek size was not affected by lek age ( $H = 0.74$ ,  $P = 0.69$ ) (Table 1). During spring, males were detected displaying on leks 3–6 and  $> 6$ -y-old 1 mo before birds were found on leks  $\leq 2$ -y-in longevity (Table 2). Use of leks  $\leq 2$ -y-old corresponded to a decrease in displaying males associated with the other lek categories (Table 2). Approximately 70% of female captures occurred as two peaks during the last week of Mar. and second week in April. Females started attending leks  $> 6$  y old sooner than the other leks (Table 3, Fig. 1).

Only data from the initial capture of any recaptured birds were included in the analyses. Six males

TABLE 2.—Average weekly lek counts of male lesser prairie-chickens in relationship to lek age

Week	Lek age		
	≤2 y	3–6 y	>6 y
Feb. 1–7	0.0	9.0	16.0
Feb. 8–14	0.0	25.0	20.3
Feb. 15–21	0.0	23.6	20.0
Feb. 22–28	0.0	29.4	21.5
Mar. 1–7	22.5	17.5	14.3
Mar. 8–14	22.0	21.8	15.3
Mar. 15–21	20.4	22.1	15.7
Mar. 22–31	18.0	19.2	14.7
Apr. 1–7	18.6	18.4	14.2
Apr. 8–14	19.7	15.8	11.2
Apr. 15–21	18.0	12.3	10.8

captured in 1987 were recaptured in 1988, each was recaptured on the same lek as the initial capture. Of 35 males captured more than once within the same year, only two (one yearling and one adult) were recaptured on a lek different than the initial capture. There was no difference ( $\chi^2 = 2.23$ ,  $P = 0.14$ ) in the recapture rate between adult males (26.9%) and yearlings (15.6%), indicating no age capture bias. Only one female was recaptured during a year; 3 d apart on two different leks. No females were recaptured from the previous year.

#### DISCUSSION

Interpretation of lesser prairie-chicken age ratios, and perhaps other population attributes, depends on the age of the lek from which the birds were captured or, potentially, collected. As lesser prairie-chicken leks increase in age, attending birds are more likely to be adults, thus giving importance to the task of identification and conservation of established lek sites.

Formation of satellite leks in this population could be attributed to two, potentially interacting, factors. Our data support the hypothesis that satellite leks form during increasing populations (Gibson and Bradbury, 1986). Olawsky and Smith (1991) estimated lesser prairie-chicken population densities of 0.23 and 0.43 birds/ha for summer and winter, respectively, during 1986 for a study area that included our leks. These estimates are considerably higher than previously reported for lesser prairie-chickens (Sands, 1968; Crawford, 1980; Taylor and Guthery, 1980a). Additionally, our study period corresponded with a peak in average lek size (*i.e.*, number of males attending leks) of 16.1 males/lek in 1988, as measured by Texas Parks and Wildlife Department to monitor changes in lesser prairie-chicken populations, which have steadily declined since our study to 5.7 males/lek in 1997 (K. Mote, Texas Parks and Wildlife Department, pers. comm.).

TABLE 3.—Weekly percentage (% by lek age) of captured female lesser prairie-chickens as an index to hen spring visitation to leks and relationship to lek age.

Week <sup>a</sup>	Lek age			Total
	≤2 y	3–6 y	>6 y	
Mar. 15–21	0.0	0.0	22.2	7.3
Mar. 22–31	18.2	26.9	11.1	20.0
Apr. 1–7	9.1	3.8	0.0	3.6
Apr. 8–14	63.6	50.0	44.4	50.9
Apr. 15–21	9.1	19.2	22.2	18.2

<sup>a</sup> No females were captured after 19 April in either year

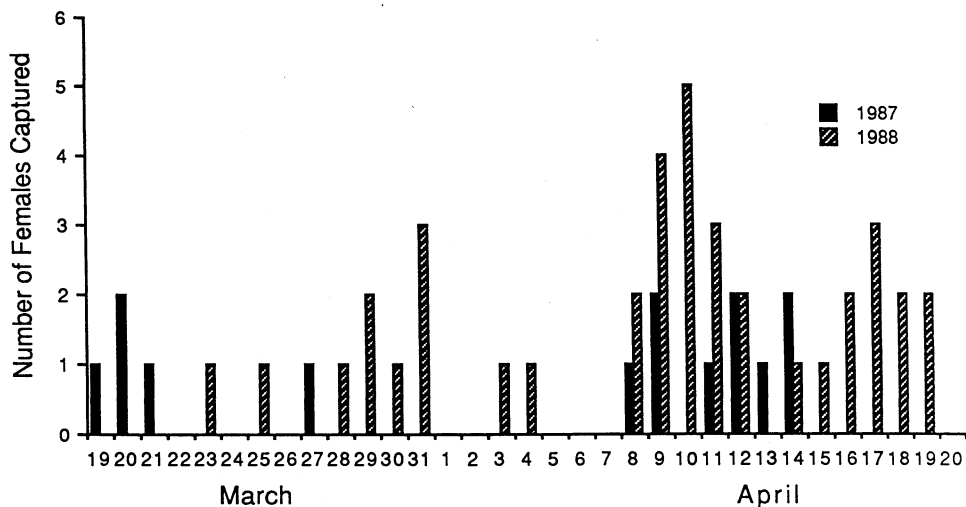


FIG. 1.—Distribution of lek captures of female lesser prairie-chickens during 1987 and 1988

However, satellite leks did not form until a month after males initiated display on other older leks during spring on the study area, with formation of satellite leks corresponding to a decrease in number of displaying males at other leks. Thus, satellite leks could be assemblages of males unable to establish territories on older leks (Gibson and Bradbury, 1986) and relocate to form leks just before the start of hen visitation. Hypotheses on formation of leks in relation to differences in competitive ability (Sutherland and Parker, 1985; Parker and Sutherland, 1986) are supported by these findings.

Satellite leks may also be a response to movements of female lesser prairie-chickens being most extensive during prenesting (*i.e.*, lek visitation; Davis *et al.*, 1979). Jenni and Hartzler (1978) and Gibson and Bradbury (1986) reported that increasing yearling attendance at sage-grouse leks corresponded to female peak attendance. Formation of satellite leks during peak female activity supports the hot-spot hypothesis of lek development, where males congregate at locations with a high probability of female occurrence (Bradbury *et al.*, 1987; Schroeder and White, 1993; Hogland and Alatalo, 1995). The number of displaying male lesser prairie-chickens on all leks remained relatively constant during the breeding season, with a decrease in lek size in the older leks following peak visitation by females.

Our data confirm observations by Crawford and Bolen (1975) that display intensity by male lesser prairie-chickens in west Texas is greatest from the third week in March through the second week in April, which corresponded to more than 70% of hen visitations to leks. Although not statistically significant, the male to female capture ratio was nearly twice that on satellite leks compared to leks >6 yr-old. This indicates that female lesser prairie-chickens are more likely to visit older leks, but still occur on satellite leks.

Campbell (1972) hypothesized that juveniles were more mobile than adults (supported by Taylor and Guthery [1980b]) and that males have a life-long attachment to a specific lek. Our capture data support a long-term attachment by male lesser prairie-chickens to a specific lek, as indicated by the recapture of only one yearling and one adult on leks different than initial capture, once a territory was established. Davis *et al.* (1979) hypothesized that there was interlek movements by females, but we only recaptured 1 of 55 females on a different lek than the one on which it was initially captured.

The lesser prairie-chicken is being considered for listing as threatened under the Endangered Species Act (U.S. Fish and Wildlife Service, 1997). Therefore, accurate data are necessary to assess and monitor populations, interpret management results and allow for informed decisions during the listing process. The use of number of leks or total number of displaying males (on satellite and permanent leks) in an area is a better indication of a population's status than the index of number of males/permanent

lek (*i.e.*, the typical survey method). For example, when surveying male attendance on permanent leks there could be several years of population declines before it would be reflected in the numbers or ages of males attending the surveyed lek. We support Cannon and Knopf's (1981) recommendations that lek numbers provide a reliable index to numbers of displaying males and failure to survey satellite leks reduces the effectiveness of the index. The recommended period to conduct lek counts and capture lesser prairie-chickens to assess population status is when females start to visit the leks—late Mar.–early April in this study area, 3–4 wk later in the northern portions of the species' range. Our study shows that knowledge of lek age is crucial to interpretation of data from birds using leks, which will likely become the dominant form of data for population assessment because harvest data, historically the primary source of population information, will not be sufficient or available to monitor populations if current declines continue.

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