

**Survey for Active Lesser Prairie-Chicken Leks:
Spring 2009**

**A Contribution of
Federal Aid in Wildlife Restoration**

Project W-138-R-7

New Mexico Department of Game and Fish

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July 2009



2008 Lesser Prairie-Chicken Surveys

Federal Aid in Wildlife Restoration Project W-138-R-6

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In 2009, Lesser Prairie-Chickens (LPC) were surveyed audibly and visually along public roads and on State Game Commission-owned Prairie Chicken Areas (PCAs). This was the twelfth year of roadside route survey efforts. Ninety-one leks were detected on 13 of 29 (45%) roadside routes surveyed. Trend analysis of the total number of leks detected have shown a statistically significant increase from 1998–2009 along these routes. Twenty-nine Prairie Chicken Areas (PCAs) were also surveyed. Over the last 12 years, both the number of leks detected and number of LPC observed have steadily increased in these areas. One hundred twenty-five leks were detected on or near PCAs, and 609 LPC were observed on 76 of those leks. Average lek size was 7.57 birds/lek with an estimated minimum spring breeding population of approximately 4,968 birds. This is a 47% decrease from 2008, which may be attributed to the dry spring and summer of 2008 and a large hailstorm in May of 2008.

METHODS AND STUDY AREA DESCRIPTION

STUDY AREA

Roadside Surveys

Survey routes were located within the known occupied and potential range of LPC. The original boundary of the survey area included 150 townships, which are comprised of habitats consisting of sandy and deep sand range sites supporting shinnery oak and bluestem grasses. In 2003, roadside routes were established in the northeastern part of the LPC historical range, east and south of Clayton, NM and east and south of Amistad, NM (which were previously surveyed by NMDGF in 1999) and areas near reported sightings of LPC. In 2004, additional routes were established within Ligon's (1927) suitable LPC range. The boundary of this expanded survey area included 389 townships in portions of 10 counties (Union, Harding, Quay, Guadalupe, DeBaca, Chaves, Roosevelt, Curry, Lea, and Eddy). Of the 389 complete townships, 41 were randomly selected for the roadside survey efforts (Figure 1), and the 29 survey routes were located within these townships (Figure 2).

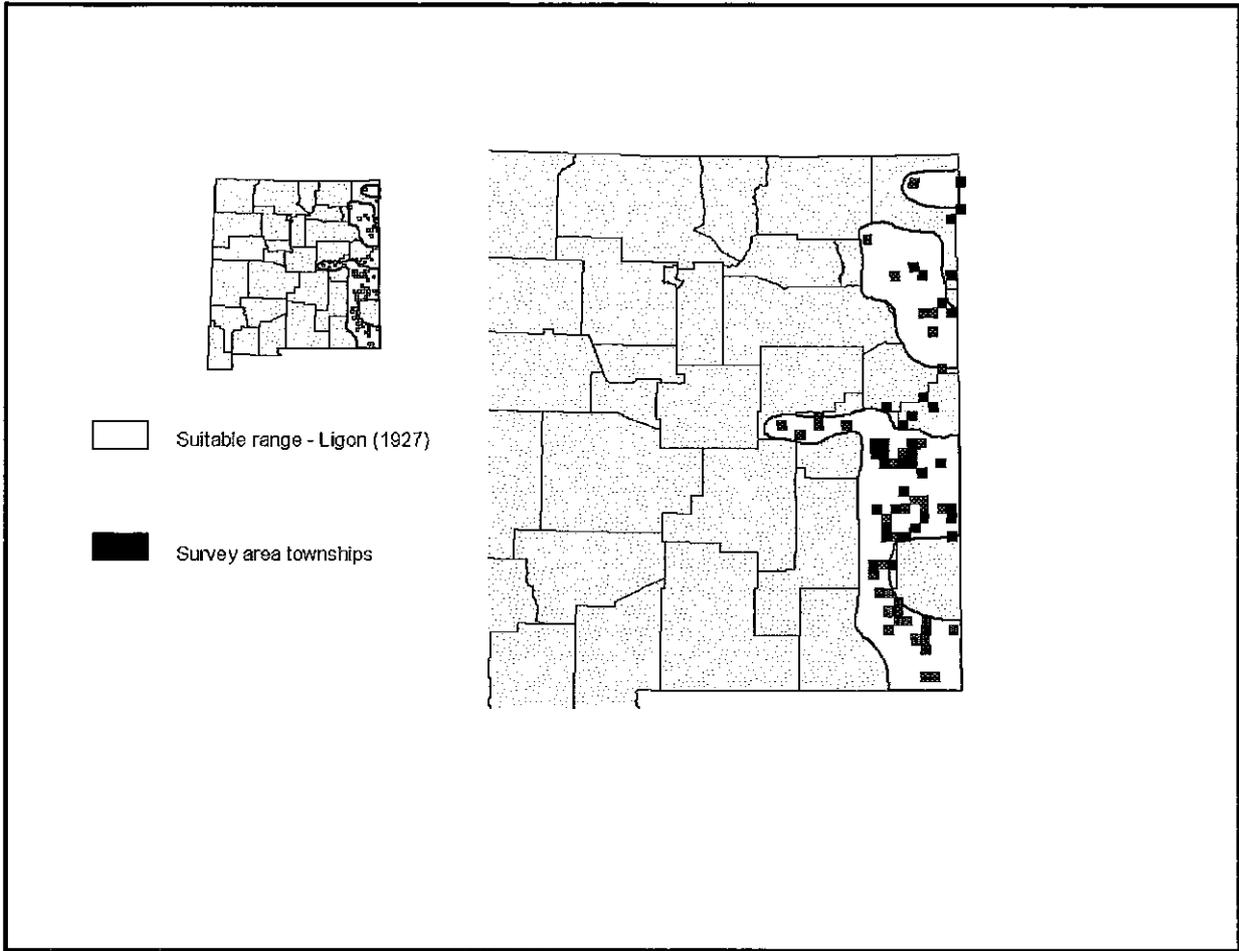


Figure 1. Survey area townships for roadside surveys.

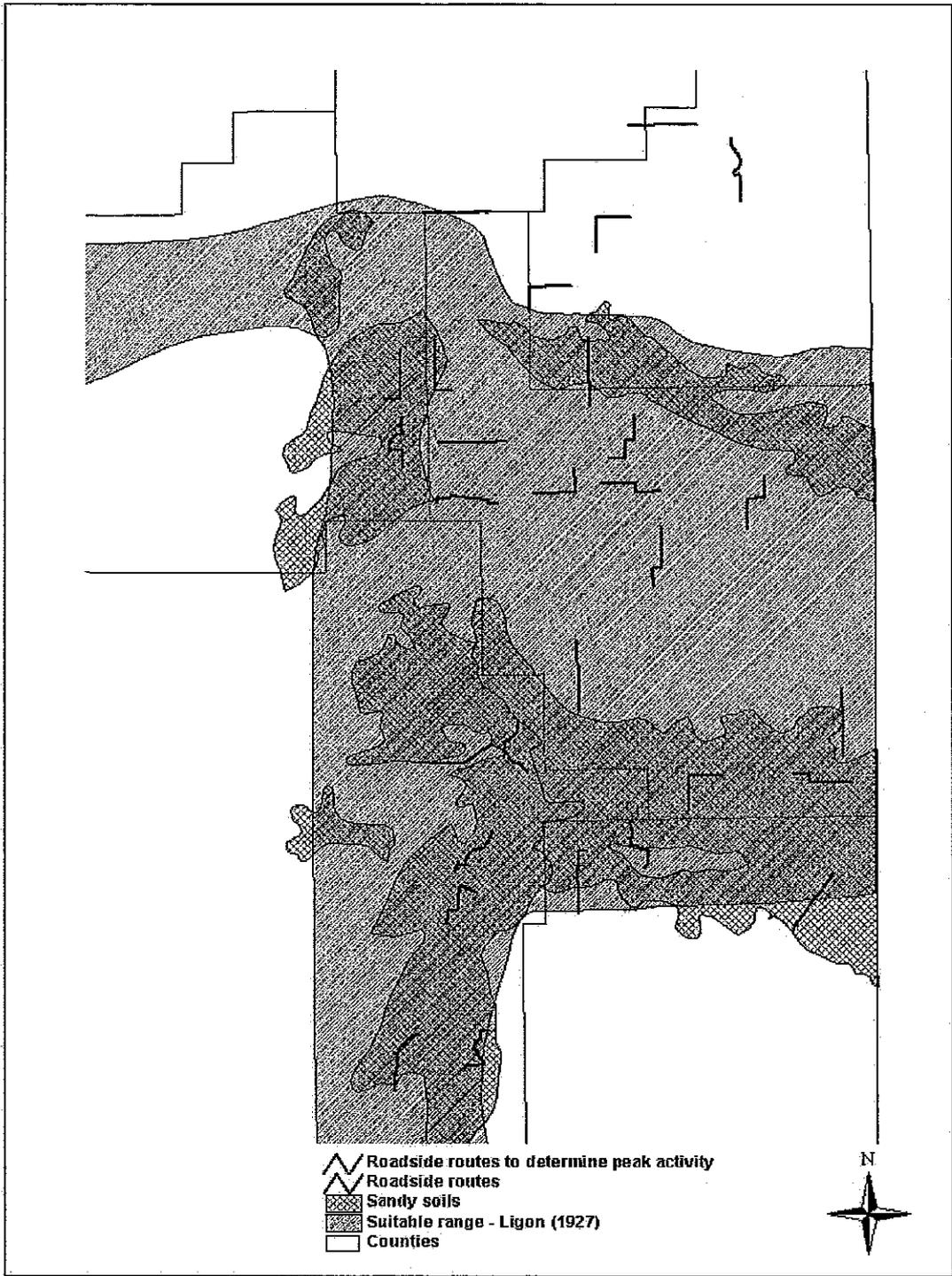


Figure 2. Twenty-nine roadside survey routes.

Prairie Chicken Areas (PCAs)

The New Mexico State Game Commission owns and manages 29 PCAs ranging in size from 10.50 to 3171.15 ha (29 to 7,800 ac). They lie from 32 km (20 mi) south of Taiban (T2S, R28E) in the northwest to 4.8 km (3 mi) southeast of Tatum (T13S, R36E) in the southeast and from the Texas border (T7, 8, 9S, R38E) to 48 km (30 mi) northwest of Tatum (T10S, R31E) in the west (Figure 3).

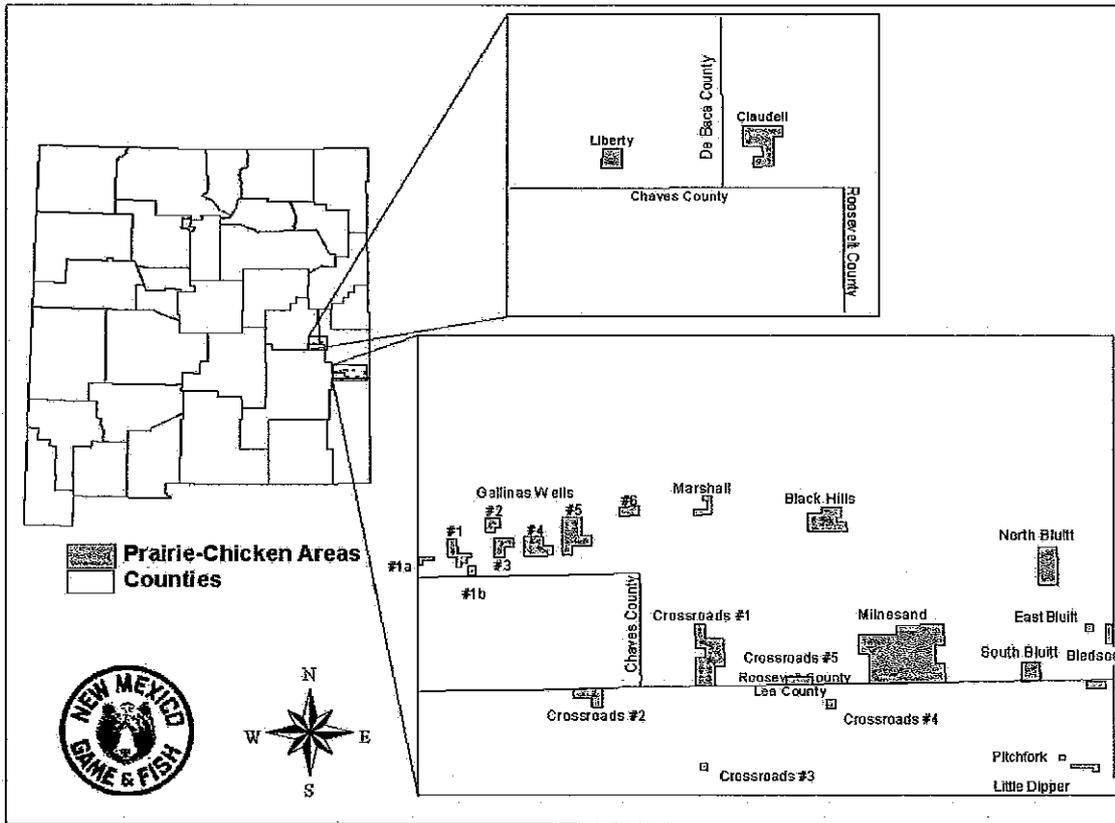


Figure 3. State owned Prairie Chicken Areas (PCAs). Tatum and Wayside PCAs are not shown.

Additionally, surveys were completed on the Sandhills Prairie Conservation Area (Figure 4).



Figure 4. Sandhills Prairie Conservation Area shown in red. PCA's are shown in yellow.

Private Lands

Private land surveys were conducted by Grasslans Charitable Foundation and The Nature Conservancy in Roosevelt County, on the Milnesand Prairie Preserve. State Game Commission Regulation 19 NMAC 33.4 requires locations of LPC found on private lands to be kept strictly confidential.

METHODS

Roadside Surveys

Route selection: Roadside routes were first established in 1998. The original survey area boundary for roadside surveys was based on available information about the known occupied and potential range of the LPC. The survey boundary was drawn along township boundaries and included only whole townships occurring within New Mexico. Incomplete townships adjacent to the Texas border were not included. Those townships within the survey area, which supported $\leq 25\%$ of the habitat types consisting of sandy and deep sand range sites supporting shinnery oak and bluestem grasses, were also excluded. In addition, townships, which included portions of the Melrose Bombing Range, were excluded due to restricted access. Thus, the survey area contained

182 townships. Of the 182 complete townships, 60 were randomly selected and a total of 30 priority routes were selected for the 1998 roadside survey efforts.

In 1999, the survey boundary was modified to include 150 townships. The portion of the original survey area south and west of Lovington, NM was removed because only 1 lek was detected in that section of the survey area. However, attempts will continue to locate any reported leks in habitat outside of the designated survey area. New townships with sandy soils immediately north of Clovis, NM were added. Most of this area is currently in agricultural production, however, leks have been found elsewhere in areas of intense cultivation and leks were observed in this area in the past. Twenty-nine routes were selected for the 1999 survey. This included 19 routes from the 1998 survey, and routes in 10 new randomly selected townships.

In 2004, the survey boundary was expanded to include 389 townships occurring within Ligon's (1927) suitable LPC range in New Mexico. Eighty routes were selected for the 2004 survey. This included 29 routes from the 1999 survey, 10 routes established in 2003 in the northeastern part of the LPC range, and routes in 41 new randomly selected townships.

Routes were 12.8 km (8 mi) long with 9 listening points located at 1.6 km (1 mi) intervals. Routes were selected by locating county or state roads in the most northeastern corner of the randomly selected township. Routes could extend in any direction as long as at least 8 km (5 mi) of the route were within the township and did not extend beyond the overall survey area or into excluded areas. Efforts were made to choose routes as straight as possible. When 2 selected townships were adjacent to one another, then routes were located such that the distance between them was at least 3.2 km (2 mi). In addition, if the township contained a municipality, routes were selected so that no portion of the route was located closer than 3.2 km (2 mi) to an urban area. All routes were located on public roads. Maps for each route and data sheets with instructions were provided to observers. Each route was surveyed once so that the number of routes, and in turn as much LPC range as possible, could be surveyed.

Survey procedure: Each survey began approximately one-half hour before and concluded 1-2 hours after local sunrise. Wind speed and temperature were recorded at the beginning and end of each survey. Surveys were not conducted if wind speed continuously exceeded a 3 (12mph) on the Beaufort Scale or if rain or snow was falling.

At each stop, the observer shut off the vehicle's engine, moved at least 10 m from the vehicle, listened, and observed for 5 minutes. The observer then traveled 1.6 km (1 mi; allowing 5 minutes) to the next stop and repeated the procedure. Observations at the first and last stop were assumed to include any leks detected both 1.6 km (1 mi) behind and forward of the respective stops.

Number of leks, method of detection (audibly or visually), and the direction where the lek was detected were recorded. When a lek was detected audibly, the surveyor would record the compass bearing and an arrow was drawn on the map indicating direction from listening point to the lek. The observer would attempt to make a visual confirmation from the listening point. If the lek was detected visually, the observer recorded the total number of LPC present at the lek and marked the

location on the map. A single lek was assumed when the compass direction from 2 consecutive listening points indicated a lek in the same general vicinity within a 1.6 km (1 mi) radius of each listening point. This audio triangulation or visual confirmation was used to determine whether vocalizations detected at 2 consecutive stops were from the same or different leks. Thus, there was little probability that a lek would be recorded more than once.

To provide an index of each observer's opportunity to hear vocalizations out to a 1.6 km (1 mi) distance, the observer rated noise disturbance at each stop (e.g., traffic, pump-jacks, cattle, and dogs) on the survey form as none, low, moderate, or high. The observer also classified habitat at each stop by dominant shrub type (e.g., shinnery oak, sand sagebrush, mesquite), agriculture (cropland), grass rangeland [tall (knee high), medium (shin high), or short (ankle high)], or undetermined.

At the conclusion of the survey, each observer backtracked and attempted to locate lek sites, count the number of LPC observed, and map location of leks detected audibly but not visible during the actual survey, if time and access allowed. When the lek was visually observed, the observer recorded the UTM coordinates and noted the lek location(s) on the topographic route map provided.

Prairie Chicken Management Areas (PCAs)

Our goal was to determine presence of LPC leks over the entire area of each PCA, i.e., a "saturation" survey. The assumption was that LPC vocalizations could be heard up to 1.6 km (1 mi). Listening points were located along established roads. The first listening point was located at the entrance point of a PCA and each additional listening point would be 0.8 to 1.6 km (0.5 to 1 mi) apart depending upon terrain and noise disturbance. Number of leks, method of detection (audibly or visually), and the direction where the lek was detected were recorded. When a lek was detected audibly, the surveyor would record the compass bearing and an arrow was drawn on the map indicating direction from listening point to the lek. A single lek was assumed when the compass direction from 2 consecutive listening points indicated a lek in the same general vicinity within a 1.6 km (1 mi) radius of each listening point. The observer counted all leks heard during 5 minute listening periods, but counted only the number of birds per lek on those leks that could be seen from public access or were on public land.

Private Lands

The Nature Conservancy of Eastern New Mexico conducts surveys on their Milnesand Prairie Preserve near Milnesand, NM. They visit known and historic lek sights and conduct multiple counts on each active lek during March, April, and May and determine an average number of birds per lek for each lek surveyed. Grasslans Charitable Foundation also conducted lek surveys on private ranches in Roosevelt county.

Bureau of Land Management (BLM) LPC Surveys

Both the BLM Roswell Field Office (RFO) and Carlsbad Field Office (CFO) conduct annual surveys for LPC within their respective jurisdictions. Approximately 99,225 ha (245,000 ac) of LPC habitat, containing 191 known lek sites, occur within the Caprock Wildlife Habitat Area (WHA). The RFO visits known historic lek sites within the Caprock WHA from 20 March – 1 May each year to determine activity and birds present; however, annual survey efforts have varied since surveys were initiated in 1971. All active leks are documented and counts are made of birds present. In 2003, the CFO conducted roadside route surveys, which included visits to historic lek sites and previously unsurveyed areas of northern Lea County. In 2009, CFO conducted LPC surveys from March 6 – May 15. In 2009, a total of 68 listening routes, including a total 737 listening points, were surveyed for audible LPC activity. Routes were selected based on the presence of shinnery oak and/or its proximity to historical lek sites. Listening points were spaced at 0.8 km (0.5 mi) intervals, which resulted in 134,354 ha (331, 997 ac) surveyed. Surveys began approximately 30 minutes before local sunrise and concluded at approximately 8:30 a.m. In addition to listening route surveys, CFO conducted surveys of historic leks sites. Surveys were conducted after 8:30 a.m. and lek sites were examined for evidence of recent LPC activity (e.g., tracks feathers, scat) at least twice during the breeding season with at least one week between surveys of the same site.

Analysis

Regression analysis was conducted for numbers of leks detected and average numbers of birds per lek for roadside routes and PCAs as well as for the minimum population estimate. Changes in population trends were considered significant at $P \leq 0.05$.

RESULTS

Roadside Surveys

Northeastern New Mexico: Northeastern New Mexico contains the smallest amount of suitable habitat (Ligon 1927, Frary 1957, Snyder 1967) and is defined as the area above 35 degrees north (Bailey and Williams 2000). The Department has received few verifiable reports of LPC in the northeastern part of the LPC historical range since 1993, although a verified sighting was reported of a male LPC in Logan in December 2007 (Beauprez 2008). From 2003–2009, no leks have been detected on the 10 roadside routes in northeast New Mexico, providing evidence that LPC probably no longer occupy their historical range within Union, Harding, and portions of northern Quay counties.

East-central New Mexico: In 2009, 28 roadside routes were surveyed from March 23–April 17 (Appendix B). This is during the peak lekking period for LPC (Crawford and Bolen 1975, Haukos and Smith 1999, Davis 2003). Of these, 15 routes have been surveyed since 1998. Numbers of leks detected have fluctuated on these 15 routes, ranging from a low of 22 in 1998 to a high of 90 in 2008 (Figure 6). Twenty-two routes have been surveyed from 1999 to 2009. Total number of leks detected (range = 34–84 leks) has been stable over the last 10 years with a notable increase in

2006-2008 (Figures 7). When the 29 routes are considered collectively, there is a statistically significant increase in the total number of LPC leks detected over the last 12 years ($r^2 = 0.7501$, $P = 0.0003$) (Figure 8). Although there has been an increase in the total number of leks detected over this time period, there has been no significant trend in the average numbers of birds per lek (Figure 9).

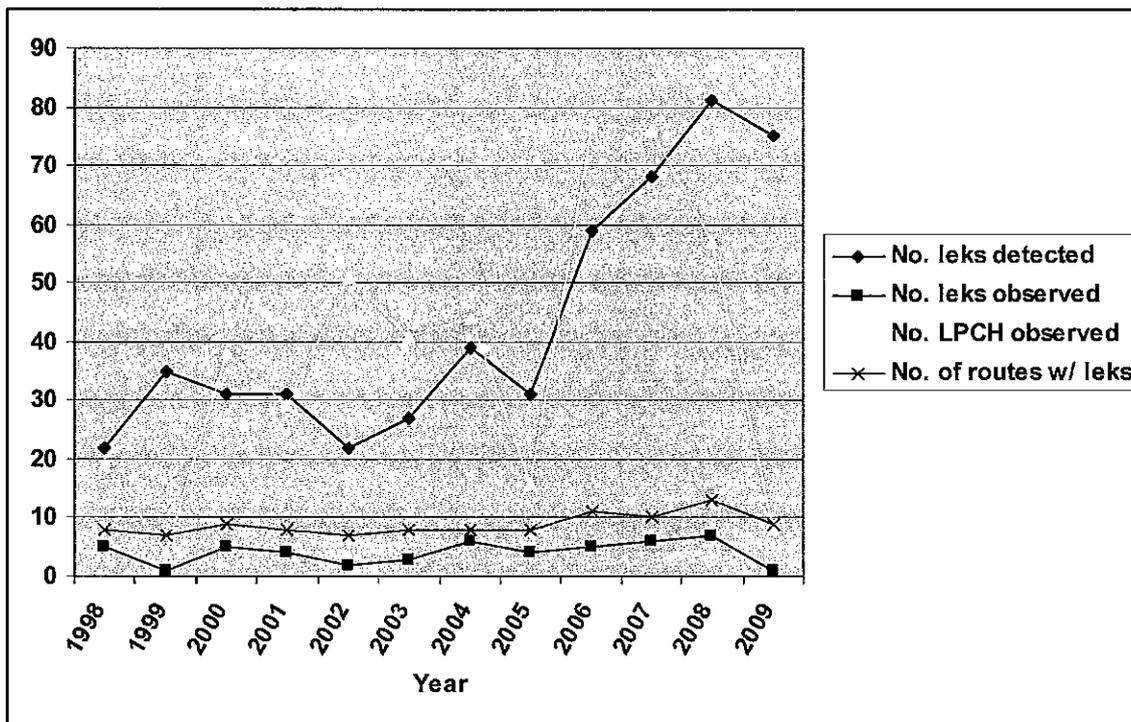


Figure 6. Lesser Prairie-Chicken lek activity on 15 roadside routes surveyed in east-central New Mexico, 1998-2009.

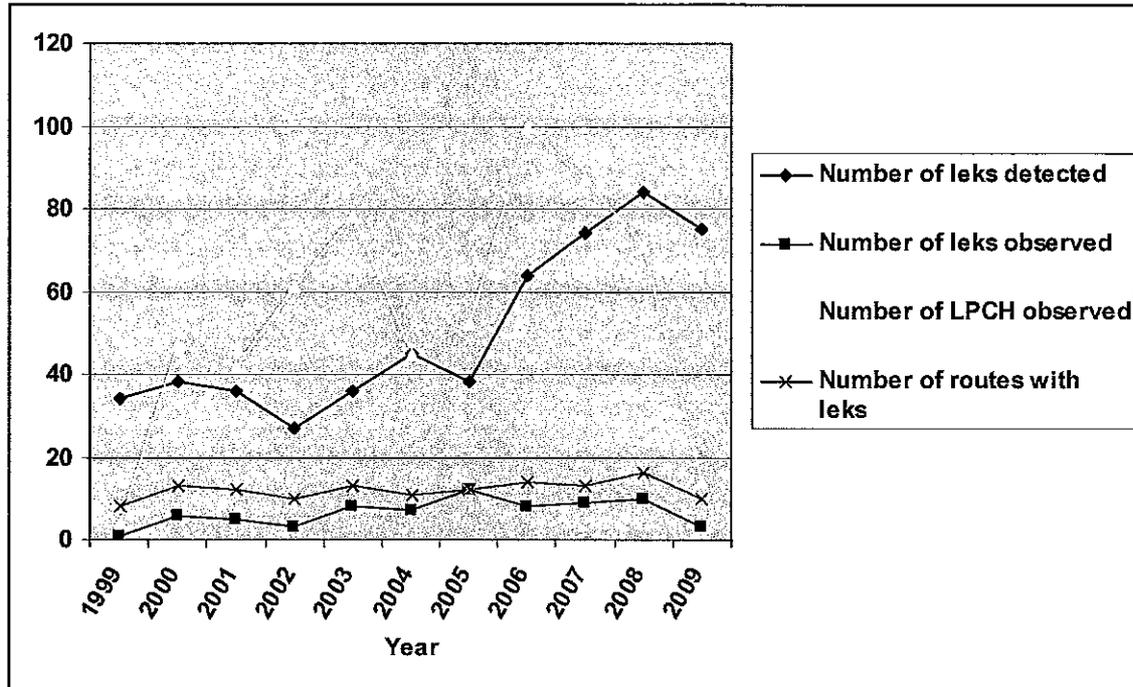


Figure 7. Lesser Prairie-Chicken lek activity on 22 of 29 roadside routes surveyed in east-central New Mexico, 1999-2009.

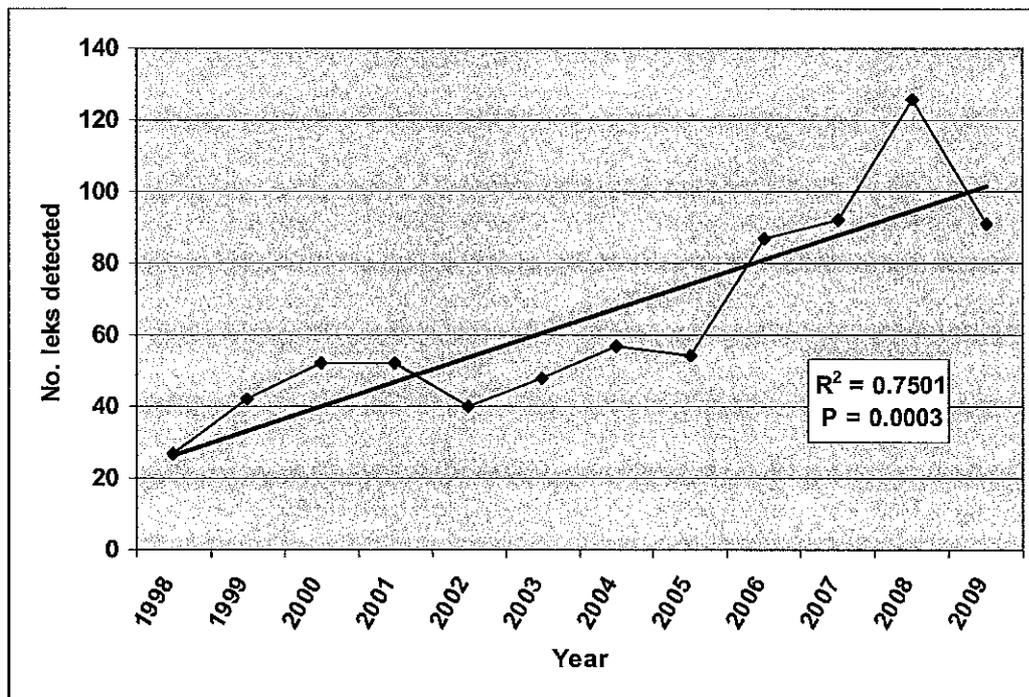


Figure 8. Changes in numbers of leks detected for 29 roadside routes between 1998 and 2009.

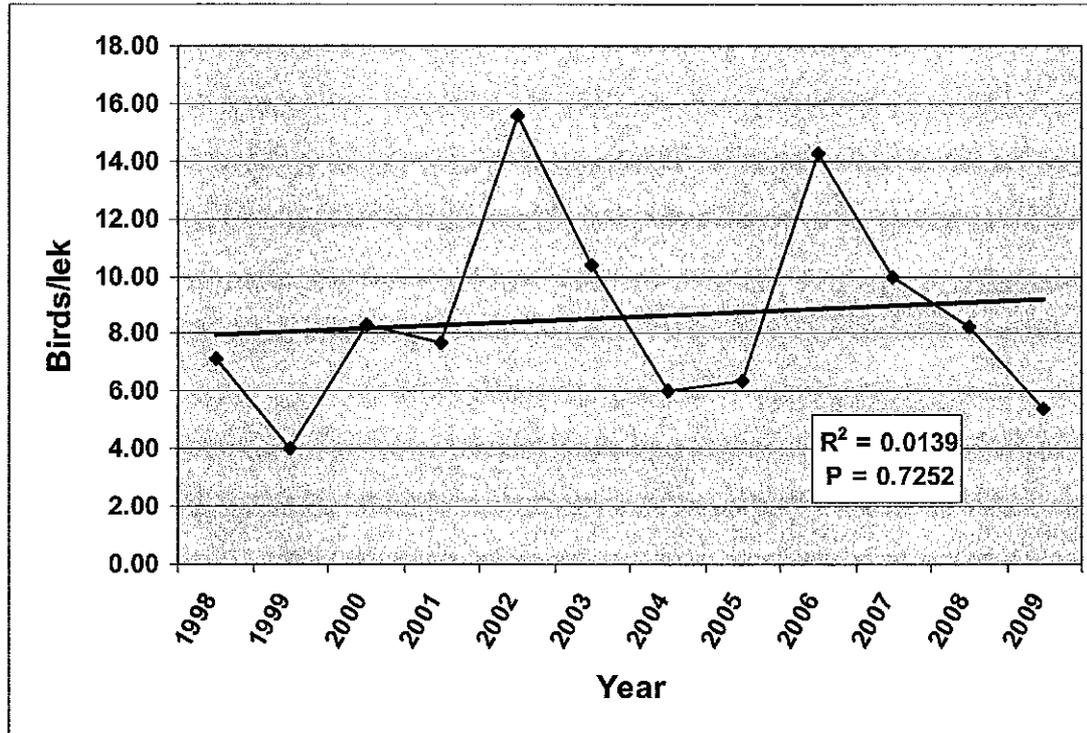


Figure 9. Changes in average number of birds per lek for 29 roadside surveys between 1998 and 2009.

The core of remaining LPC populations in New Mexico lies in south Roosevelt, north Lea, and northeast Chaves counties and contains the largest contiguous amount of available habitat. Roadside routes 17-27 occur within this area (Table 1).

Table 1. Number of Lesser Prairie-Chicken leks detected on roadside routes where prairie-chicken populations were identified as sparse and scattered (Roadside Routes 1-16; Bailey and Williams 2000), in the core of currently occupied prairie-chicken range (Roadside Routes 17-27; Bailey and Williams 2000), and in southeast Chaves County, south of U.S. Highway 380 (Roadside Routes 28-29).

	Year											
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007 ^c	2008	2009
Routes 1-16	1 ^a	2	9	8	5	10	7	8	15	12	19	8
Routes 17-27	23 ^b	37 ^b	43	43	31	38	50 ^d	45	71	80	102	79
Routes 28-29	3	3 ^c	0	1	1	0	0	1	1	0	5	4

^aRoutes 1-8, 11-12, and 14 were not surveyed in 1998.

^bRoute 18 was not surveyed in 1998 and Route 19 was not surveyed in 1998 and 1999.

^cRoute 29 was not surveyed in 1999.

^dRoute 24 was not surveyed in 2004.

Routes 11 and 28 were not surveyed in 2007.

When considering these eleven routes collectively there has been a significant increase in the numbers of leks detected during this time ($r^2 = 0.7707$, $P = 0.0002$) (Figure 10).

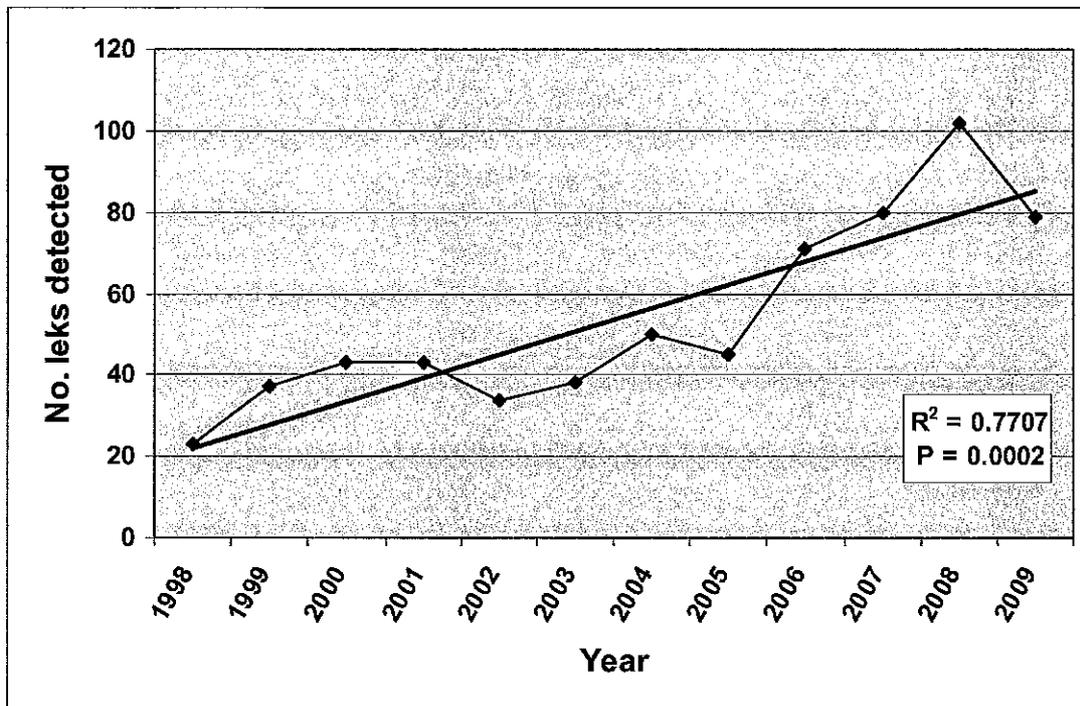


Figure 10. Changes in numbers of leks detected for the LPC core population (roadside routes 17-27) between 1998 and 2009.

Roadside routes 1-16 occur within the sparse and scattered LPC populations in Curry, northern Roosevelt, and east DeBaca counties (see Bailey and Williams 2000). Changes in the number of leks detected on roadside routes 1-16 between 1998 and 2007 show a significant increase ($r^2 = 0.5311$, $P = 0.0072$) (Figure 11).

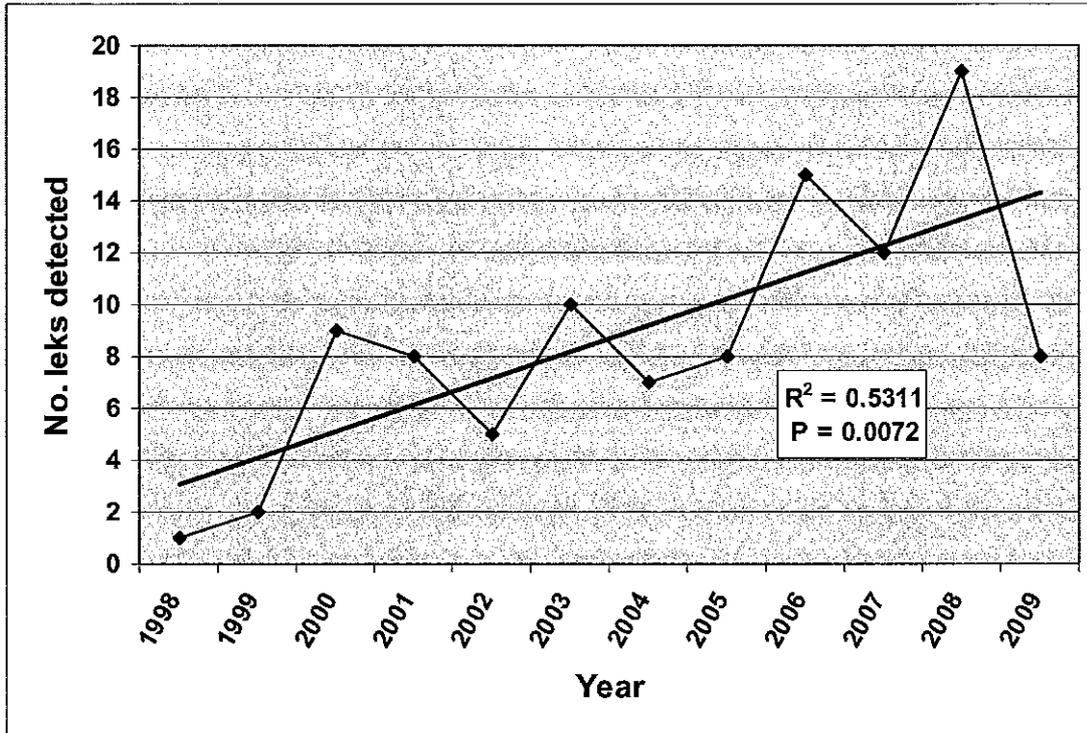


Figure 11. Changes in the numbers of LPC leks detected in the sparse and scattered populations (roadside routes 1-16) between 1998 and 2009.

Southeastern New Mexico: The southeast area (below 33 degrees north) represents the southern periphery of LPC range and may only be occupied during favorable climatic periods (Snyder 1967). Four leks were detected on the 2 roadside routes (28-29) in southeast Chaves County where LPC are sparse and scattered (Table 2). Best et al. (2003) concluded anthropogenic factors have rendered LPC habitat south of Highway 380 inhospitable for long-term survival of LPC in southeastern New Mexico. Survey data suggests quality of habitat may be limiting the recovery of these populations. While it is desirable to maintain and/or re-establish LPC in their historical range within southeast New Mexico, populations in east Eddy and southern Lea counties are not considered necessary for continued viability of the species in New Mexico (Bailey 1999).

Prairie Chicken Management Areas (PCAs)

Surveys were conducted on 29 PCAs from March 23–April 17, 2009 (Appendix B). In 2009, 125 leks were detected either audibly or visually on or near PCAs. During 2009, 639 LPC were counted on a total of 80 leks; a 24% decrease from the previous year (Appendix B). Since 1996, the number of leks detected, number of leks observed, and number of LPC observed have increased; but, survey effort and number of PCAs surveyed have also increased over that time period (Figure 12). However, over the last 13 years, the total number of leks detected and number of leks observed (on which counts were made) have also steadily increased when examining 15 PCAs that have been surveyed each year during that time period, although there has been a downward trend since 2006 (Figure 13). Population trends (indicated by average birds per lek) increased in the late 90’s and

peaked in 2000, but seem to have leveled off in recent years ($r^2 = 0.2967$, $P = 0.0443$) although the overall trend is increasing (Figure 14).

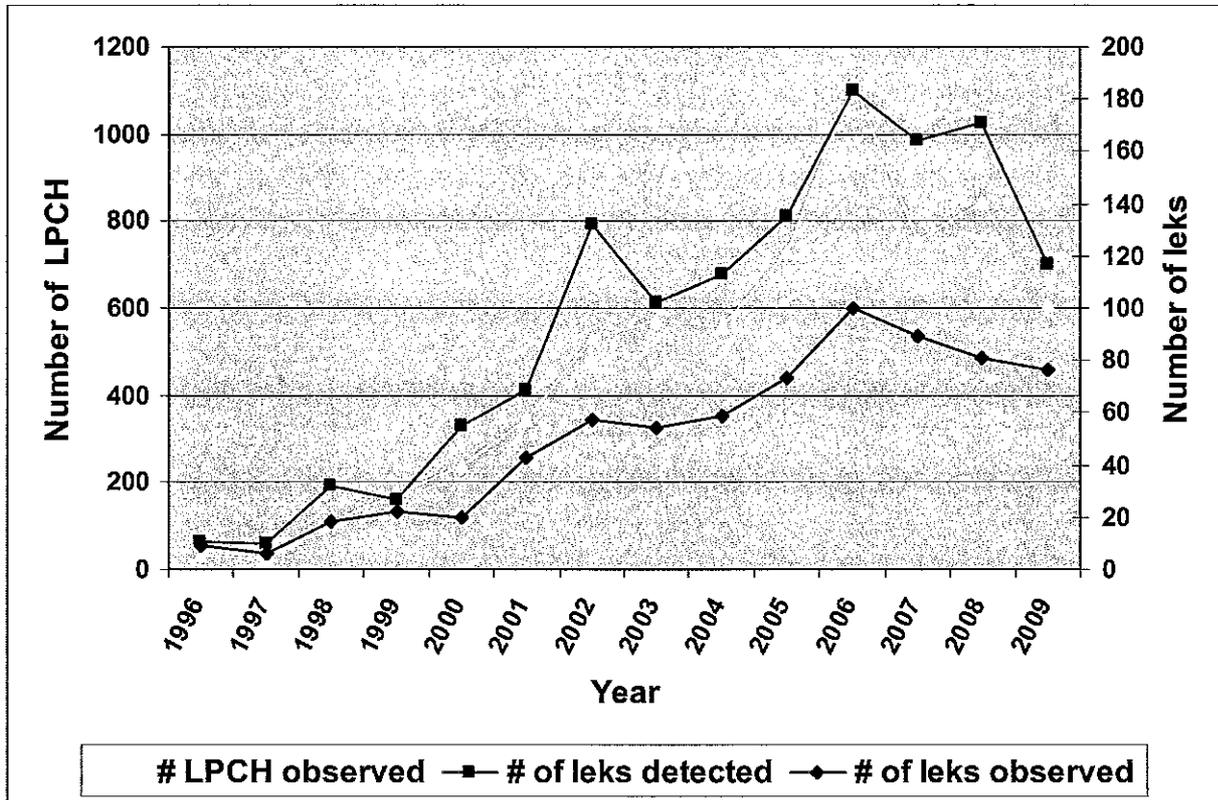


Figure 12. Prairie Chicken Areas surveyed, number of leks observed, and number of LPC observed on or near PCAs in eastern New Mexico, 1996–2009.

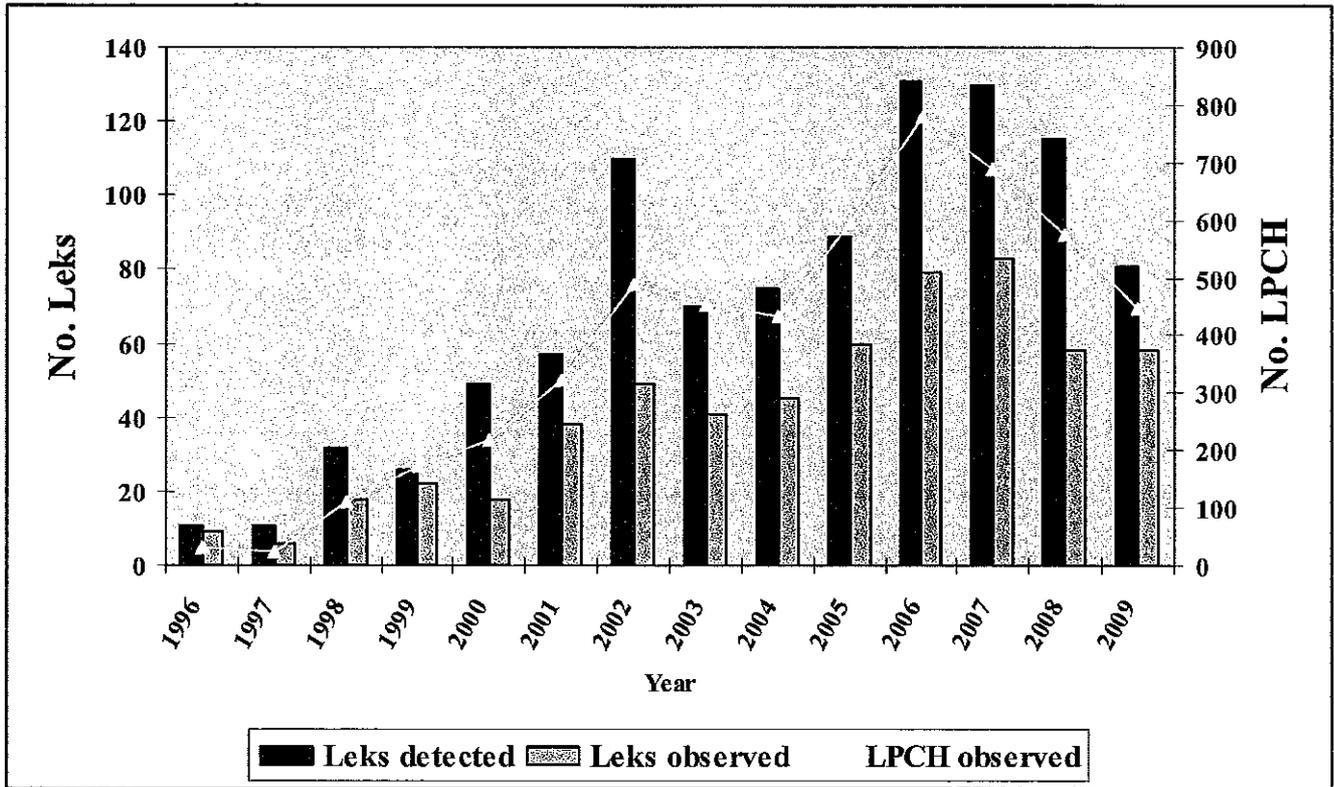


Figure 13. Lesser Prairie-Chickens counted on or near 15 PCAs in eastern New Mexico, 1996–2008.

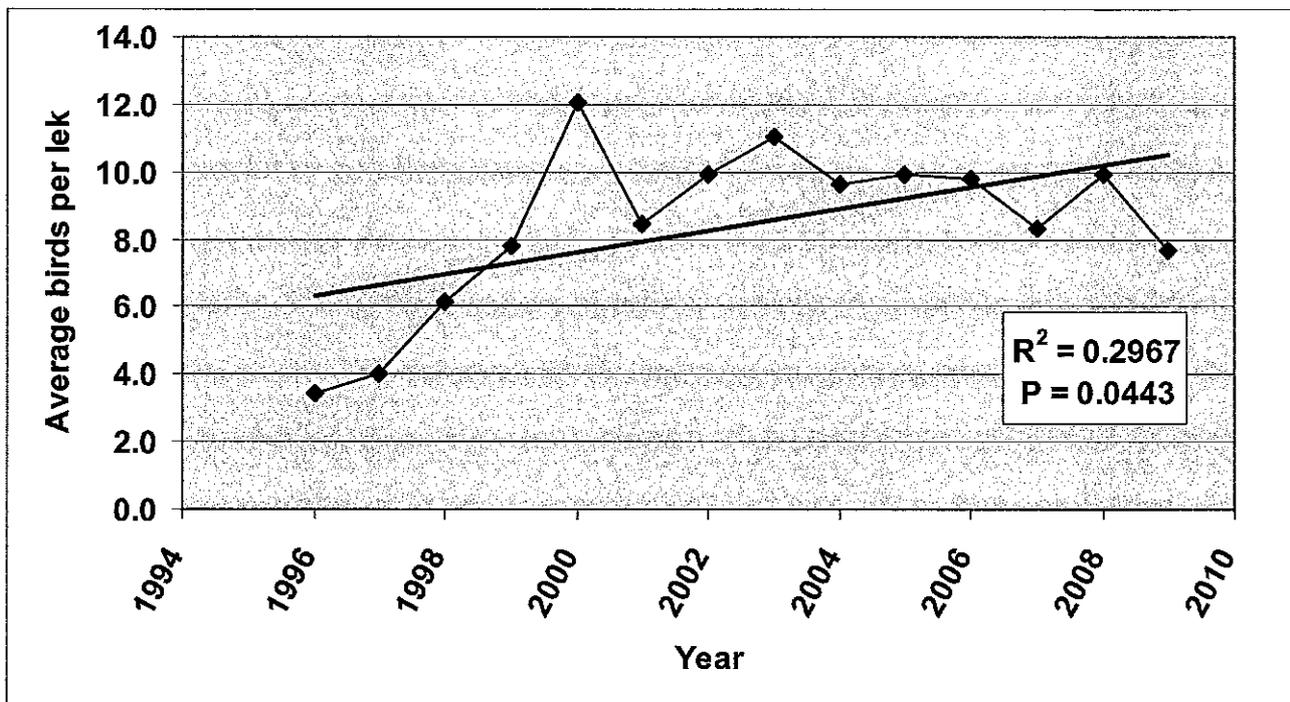


Figure 14. Changes in lek size (birds per lek) for LPC observed on or near 15 PCAs surveyed annually in eastern New Mexico, 1996–2008.

Private Lands

Approximately 28,000 acres were surveyed in spring 2009 by The Nature Conservancy on their Milnesand Prairie Preserved in southern Roosevelt County. They recorded a total of 54 active leks with 441 birds. Private lands were also surveyed in southern Roosevelt and northern Lea county by the Grasslans Charitable Foundation and they documented 20 leks with 138 birds (Table 4).

Bureau of Land Management (BLM) LPC Surveys

Thirty-eight active leks were observed, with a total of 247 prairie chickens, or 6.5/active lek (Table 4). This is the lowest total since 2003, and a 53% decrease from 2008. Of concern is the area south of Highway 380 which has only one lek, with 11 birds. This is down from 3 leks with 14 birds in 2006. This same area had 51 active leks recorded in the 1980's.

Statewide Population Estimate

LPC occupy at least 6 of the 12 counties within the historic distribution of LPC in New Mexico, and 328 leks were detected during 2009 (Table 4). This includes 38 active leks identified on public lands administered by the BLM, 216 active leks detected during spring lek counts conducted by the Department, and 74 active leks detected on private lands. For the purposes of this report, a lek is defined as a traditional display site with 2 or more males that was active in the

past year. The mean lek size for active leks was calculated for each year since 2001, and a conservative *ad hoc* minimum spring breeding population estimate was derived for each year (i.e., mean number of birds per lek multiplied by the number of leks detected) (Davis 2006). Analysis indicates the minimum population of LPC in New Mexico for 2009 is approximately 2,484 males or a minimum spring breeding population of about 4,968 birds. This is a decrease of approximately 47% from the previous year and the lowest level since 2004 (Figure 15). This drastic drop is likely attributed to the dry spring and summer of 2008 and a large hailstorm in May of 2008 during the peak of the nesting season. Although there is no objective definition of what constitutes a “viable” population, numerous studies indicate that a population of 5,000-50,000 is desirable for long-term persistence (Frankham et al. 2002).

Statewide population estimates were based on lek counts, which are commonly used as an index of population trend; however, their validity to estimate population size has often been questioned (Beck and Braun 1980, Applegate 2000, Anderson 2001). Lek count-derived population estimates have no measure of precision and may underestimate the population. The statewide estimate of the breeding LPC population in New Mexico assumes that all known leks are surveyed within the area of interest; almost all birds counted on leks are males, and a 1:1 sex ratio. Although population estimates based on lek counts contain significant uncertainty (and should be interpreted with caution), the amount of effort and economic resources required to generate population estimates using other methods (e.g., mark-resight techniques) limits the feasibility of these techniques (Walsh 2002). Despite the limitations of current Department survey efforts, information on lek distribution and activity are based on the best available data and represent the most complete database available for LPC in New Mexico.

Table 4. Survey results and population estimates for New Mexico, 2001-2008.

	Year								
Parameter	2001	2002	2003	2004	2005	2006	2007	2008	2009
NMDGF									
# leks detected	121	172	150	170	189	270	256	297	216
# leks counted	49	64	65	69	88	111	99	92	85
# birds counted	389	652	684	621	825	1274	857	935	666
Mean birds/lek	7.94	10.19	10.52	9.00	9.38	11.48	8.66	10.16	7.84
BLM									
# leks detected	27	34	37	48	64	94	79	46	38
# leks counted	27	34	37	48	64	94	68	46	38
# birds counted	213	365	438	415	559	1099	692	523	247
Mean birds/lek	7.89	10.74	11.84	8.65	8.73	11.69	10.18	11.37	6.50
Private Lands									
# leks counted	35	46	59	57	56		71	85	74
# birds counted	429	566	718	547	506		646	1002	579
Mean birds/lek	12.26	12.30	12.17	9.60	9.04		9.10	11.79	7.82
Totals									
# leks detected	183	252	246	275	309	364	406	428	328
# leks counted	111	144	161	174	208	205	238	223	197
# birds counted	1031	1583	1840	1583	1890	2373	2195	2460	1492
Mean birds/lek	9.29	10.99	11.43	9.10	9.09	11.58	9.22	11.03	7.57
Population Estimate	3400	5541	5623	5004	5615	8427	7489	9443	4968

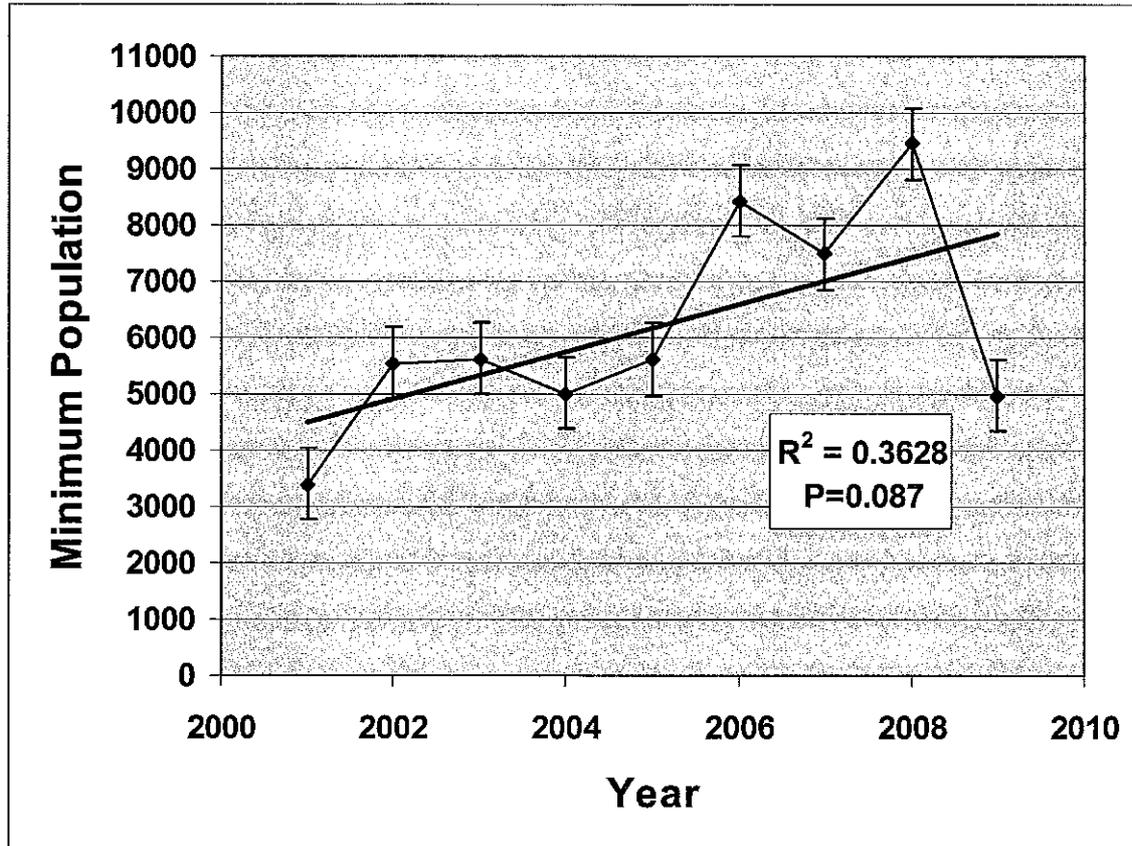


Figure 15. Minimum spring breeding population of LPC in New Mexico. Error bars indicate + or - 5%.

DISCUSSION

The 47% drop in estimated population was the largest single decrease since surveys began in 1996. This decrease can be partially attributed to the dry spring and summer of 2008 and a large hailstorm in May of 2008 during the peak of the nesting season. Also disturbing is the downward trend the past 3 years in numbers of leks detected on PCAs to 2004 levels. The spring and summer of 2009 have been relatively wet however, and this may help the population to rebound in 2010.

While LPC populations appear to be increasing during 1998-2009 in the core area of remaining populations in south Roosevelt, north Lea, and east Chaves counties, and have demonstrated an upward trend within the Caprock WHA north of U.S. Highway 380, BLM surveys and NMDGF roadside surveys in southeast Chaves county indicate LPC have experienced a significant decline south of Highway 380 over the last 11 years. Best et al. (2003) concluded anthropogenic factors have rendered LPC habitat south of Highway 380 inhospitable for long-term survival of LPC in extreme southeastern New Mexico. Similarly, NMDGF survey data suggest quality of habitat may be limiting the recovery of these populations and supports the need for additional management and conservation efforts to reverse this downward trend.

Department surveys from 2009 provide additional evidence that LPC no longer occupy their historical range within east-central New Mexico in west and central DeBaca and Guadalupe counties west of Ft. Sumner, and in Union, Harding, and Quay counties in northeastern New Mexico. Regression analysis shows there has been a significant increase in the number of leks detected on roadside routes in north Roosevelt, Curry, and east DeBaca counties over the past 12 years. However, the small increase in leks detected when compared to the core population continues to indicate that land use in this area may be impacting LPC populations. Consequently, management efforts must continue to protect small, isolated populations of LPC in north Roosevelt, east DeBaca, and Curry counties, and in southeast Chaves County, south of Highway 380.

Current efforts by NMDGF to conduct roadside surveys are useful to detect long-term population trends or presence of LPC in local areas (Autenrieth et al. 1982) and to track population distribution (Applegate 2000). While there has been considerable annual variation in the total number of leks detected and number of LPC observed along the 29 roadside routes, fluctuations between years might be associated with lek attendance rates rather than variation in population size. Although regression analysis is useful to assess population trends, statistical power analysis will be necessary to determine the appropriate sample size of roadside routes required to detect changes in LPC population sizes and to increase the efficiency of current LPC survey efforts.

Lek surveys are the primary method of estimating minimum spring LPC breeding populations (Hagen et al. 2004). Roadside routes are limited in their applicability for assessing LPC populations because they occur on the northeastern-most public roads within randomly selected townships. Therefore, data on LPC represents the number of LPC found along northeastern-most public roads, not the entire historic or occupied range of LPC in New Mexico. In line transect sampling (e.g., roadside route surveys) some leks will go undetected. Also, there is a marked tendency for detectability to decrease with increasing distance from the roadside route. Further, the reliability of the roadside survey route is subject to observer bias unless individual skill levels among the observers are similar within and among years. If observers fail to detect satellite leks and/or changes in lek locations, particularly if physical or topographic features influence detection by the observer, roadside route surveys may underestimate the number of LPC (Applegate 2000). While failure to detect changes in lek locations may affect the precision of roadside route surveys, training of observers by NMDGF prior to data collection and standardization of lek count protocols has improved the reliability and efficiency of roadside route surveys. Except for mark-resight techniques, a reliable index for estimating population size is not available. Although mark-resight techniques have the greatest utility for estimating population size, the amount of effort and economic resources required to generate population estimates using this techniques limits its feasibility. Thus, despite the limitations of roadside route surveys, current efforts to assess LPC population trends and distribution should continue.

Prairie Chicken Area surveys determines the presence of LPC leks over the entire area of each PCA and may provide a reliable index to lek size (assuming 100% detectability). Lek density is not being determined by current NMDGF surveys. To convert from an index to an estimate of actual density of leks, the observer must know the proportion of the total population that is observable in the sample and the range occupied by LPC must be known for the sample area(s) in question (Caughley and Sinclair 1994). Detection distances need to be determined in the range of

habitats and topography LPC occur. Potentially evaluating the detectability of leks as a function of distance can be assessed from PCA surveys in which listening points are close enough to determine distances beyond which leks remain undetected. This would be foundational to measuring LPC densities and would provide validity to the assumption that booming male LPC can be heard an average of 1.6 km (1 mi). Provided lek counts from PCAs are based on data collected with consistent survey effort and methods it may be possible to derive a population estimate for each PCA once a long-term data set is established; however these results cannot be extrapolated across the range of LPC. Regardless, the Department will continue to attempt complete counts of leks in PCAs. This should include surveying known lek sites at least 3 times during the peak of breeding (approximately 21 March – 21 April) at 7-10 day intervals. High counts of males per lek may then be used as an additional index of LPC population trend.

Establishing annual surveys on private lands by NMDGF will continue to be pursued. Survey efforts on private lands provide additional information on LPC distribution and provide comparative information regarding lek sizes and habitat.

Current survey methods and protocol in New Mexico vary depending on what state or federal agency is administering population monitoring efforts. While counts of both leks and number of birds provide a reliable index to determine status and monitor trends of LPC populations, there is a clear need to standardize data collection and reporting methods across the range to derive a range wide population estimate. Population monitoring guidelines proposed by Hagen et al. (2004) suggest the improvements to lek survey methods will require time and research to develop. Specifically, the guidelines identified the need to determine the relationship of lek surveys to: 1) number of nesting females; 2) variation in the total population size; and 3) actual densities of leks and breeding birds (Hagen et al. 2004). In the interim, NMDGF will continue efforts to work cooperatively with other agencies, private landowners, and other interested organizations to address management needs and work towards standardizing estimates of spring breeding populations across the range. An interagency approach will prevent repetition of effort, increase efficiency, and promote dissemination of information and public support.

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Appendix A. Lesser Prairie-Chicken leks detected along 29 roadside routes in east-central New Mexico, 1998–2008.

Route number	Number of leks detected										
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	--	0	1	0	0	2	2	2	2	1	3
2	--	0	1	0	0	0	0	0	0	0	0
3	--	0	0	0	0	0	0	0	0	0	0
4	--	1	2	1	1	3	2	1	1	1	1
5	--	0	0	0	0	0	0	0	0	0	0
6	--	1	0	1	0	0	0	0	0	0	0
7	0	0	1	2	0	0	0	0	0	0	2
8	--	0	0	0	1	1	0	0	0	0	1
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	1	0	0	0	0	1	8	0	2
11	--	0	0	0	0	0	0	0	0	--	2
12	--	0	3	2	3	2	2	3	2	4	3
13	1	0	0	1	0	1	0	0	0	1	0
14	--	0	0	1	0	1	0	1	1	0	0
15	0	0	0	0	0	0	0	0	0	0	1
16	0	0	0	0	0	0	1	0	1	5	4
17	6	1	0	1	1	1	1	1	2	5	6
18	0	0	3	0	1	0	0	0	1	1	7
19	3	1	1	5	6	5	7	9	10	13	14
20	4	10	6	6	3	2	11	8	7	9	7
21	2	7	13	9	4	7	7	3	11	13	16
22	--	--	13	7	5	6	9	8	9	9	15
23	1	3	0	3	6	4	3	3	5	0	9
24	3	2	1	5	0	2	--	4	8	9	11
25	0	7	0	0	0	2	2	2	3	4	2
26	1	0	1	2	1	2	4	1	6	5	1
27	3	6	5	5	4	7	6	6	9	12	14
28	2	3	0	0	0	0	0	0	1	--	5
29	1	--	0	1	1	0	0	1	0	0	0
No. routes surveyed	18	27	29	29	29	29	28	29	29	27	29
No. routes w/ leks	11	11	14	16	13	16	13	16	18	15	21
No. leks detected	27	42	52	52	40	48	57	54	87	92	126
No. leks/route	1.5	1.6	1.8	1.8	1.4	1.7	2.0	1.9	3.0	3.4	4.3

Appendix B. Lesser Prairie-Chicken leks detected on or near PCAs in eastern New Mexico, April 1996–2009.

PCA	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Antelope Flats	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Black Hills (East and West)	4	1	3	5	9	8	11	2	6	7	12	7	4	4
Bledsoe ^d	--	--	--	--	--	2	3	3	4	5	9	6	*	--
North Bluit	0	1	1	2	2	2	7	1	7	6	9	7	10	7
South Bluit	0	0	1	1	0	2	2	5	1	4	9	9	9	10
East Bluit ^d	--	--	--	--	--	1	1	1	2	2	1	3	--	--
Claudell	0	0	1	0	4	2	2	2	5	4	3	5	2	2
Crossroads 1	4	2	6	4	4	8	8	9	7	7	13	13	13	8
Crossroads 2	0	1	4	2	2	3	2	2	4	7	9	7	9	8
Crossroads 3	--	--	--	--	4	4	8	10	9	10	17	3	9	2
Crossroads 4	--	--	--	--	--	0	0	2	3	3	4	7	7	5
Crossroads 5	--	--	--	--	--	1	3	5	6	6	6	--	--	4
Farmer's	--	--	--	--	--	1	3	--	3	6	3	3	4	5
Gallina Wells 1	0	0	2	1	5	5	4	7	8	7	9	10	7	3
Gallina Wells 1A	--	--	--	--	1	2	1	3	2	3	2	4	1	1
Gallina Wells 1B	--	--	--	--	1	0	2	3	2	--	1	3	0	1
Gallina Wells 2	0	1	2	1	1	1	2	2	2	3	3	3	0	3
Gallina Wells 3	0	0	0	0	1	0	2	1	0	2	5	3	2	2
Gallina Wells 4	0	0	0	0	3	2	3	1	3	5	12	12	8	4
Gallina Wells 5	0	0	2	1	3	2	4	4	4	6	7	7	7	4
Gallina Wells 6	0	0	1	1	1	6	8	6	6	5	9	8	7	5
Liberty	0	1	0	1	1	1	2	2	1	2	4	2	3	2
Marshall	0	1	2	2	4	5	8	9	3	3	4	3	5	2
Milnesand	3	2	7	6	9	10	45 ^c	17	18	21	23	33	29	17
Tatum	--	--	--	--	--	0	--	--	--	--	--	0	--	--
Wayside	--	--	--	--	--	0	0	0	0	0	0	3	0	0
Pitchfork	--	--	--	--	--	--	--	1	3	2	2	--	1	2
Little Dipper	--	--	--	--	--	0	1	4	4	9	7	6	8	3
Sandhills Prairie Conservation Area	--	--	--	--	--	--	--	--	--	--	--	--	26	21
PCAs surveyed	15	16	16	16	19	27	26	26	27	26	27	26	28	29
Leks detected	11	10	32	27	55	69	132^a	102	113	135	183	164	171	125
Leks observed	9	6	18	22	20	43	57	54	59	73	100	89	81	80
LPC observed	31	24	111	172	238	343	533	571	561	726	1,117	757	844	639
Mean birds/lek	3.40	4.00	6.20	7.80	11.90	8.00	9.35	10.57	9.51	9.95	11.17	8.51	10.42	7.99