Radio Telemetry Study of Lesser Prairie Chicken Habitat Use in the Caprock Wildlife Habitat Management Area

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Introduction

Over the last 100 years, populations of Lesser Prairie Chickens (LPCH, *Tympanuchus pallidicinctus*) have been declining sharply over the bird's entire range in Kansas, Oklahoma, Texas, Colorado, and New Mexico (Lesser Prairie Chicken Interstate Working Group 1998). In 1995, the US Fish and Wildlife Service (Service) received a petition to list the LPCH as threatened (Biodiversity Legal Foundation 1995). In June, 1998, the Service ruled the LPCH listing as "warranted but precluded," meaning that, although the species should be listed, the Service will first act on behalf of other species of higher priority. The LPCH will be reconsidered in 1999. The recent ruling underscores the necessity of acting to conserve this species and its habitat.

Long-term lek survey data collected by the Bureau of Land Management (BLM) Roswell Field Office indicate that LPCH populations in New Mexico, although larger than in some states, are no exception to the range-wide trend. The New Mexico Department of Game and Fish (NMDGF) is expected to rule in mid-1998 on a petition to list the species as endangered under the New Mexico Wildlife Conservation Act.

The purpose of this study was to investigate nesting success and nesting habitat use by LPCH at the Caprock Wildlife Habitat Management Area of the BLM. In addition, we collected blood to begin a study of blood parasites and genetic variation and fecal samples for analysis of gut parasites.

Methods

<u>Access Database</u>

We added all 1998 survey data collected by BLM surveyors to the NMNHP Access database. In addition, we added incidental survey data we collected while trapping on multiple days at three lek sites. We then queried the database for survey trends over the 27-year survey period.

<u>Trapping and Telemetry</u>

During the peak lek attendance period, 31 March, 1998, to 6 May, 1998, we trapped LPCH at three BLM lek sites, 2N, 24N, and 45N. Lek 2N was trapped on 11 days between 8-18 April; lek 24N was trapped on 22 days between 31 March and 5 May; and lek 45N was trapped on 34 days between 31 March and 6 May. The total number of lek trapping days was 67.

Birds were trapped in circular welded wire walk-in traps, placed in a line across each lek and connected with chicken wire leads (Toepfer et al. 1987). The following data were recorded for each bird: age, sex, weight, right tarsus, left tarsus, right wing chord, left wing chord, culmen, and comb color (by Munsell color standard, males only). Each bird trapped was uniquely banded with plastic color bands and numbered aluminum Game and Fish bands. Each female was fitted with a radio transmitter. Approximately 50 microliters of blood was taken from the brachial vein and stored in cell lysing buffer for later DNA analysis. A blood smear was made for blood parasite analysis, and a fecal sample was taken for gut parasite analysis. The fecals were taken from the ground after the birds were released or from the box in which the bird was held before processing. All birds were safely released after approximately 30 minutes handling time.

Males subsequently sighted at leks were identified by their color bands, and re-sighted females were identified by either bands or transmitter frequency. We tested three types of transmitters, loop necklaces from AVM (15g) and loop necklaces (11g) and whip antennas (7g) from Telemetry Solutions (TS). We attempted to locate each female at least twice each week after banding. When a hen's nest was located, we re-checked the nest once or twice during incubation to look for signs of predation. With assistance from BLM personnel, we collected vegetation data at each nest site, after all nests were empty (the week of June 15), using the BLM vegetation monitoring protocol, combined with methods used by Davis et al. 1979.

Vegetation Sampling

We employed two methods of vegetation sampling at nests, both used by Davis et al. in their 1979 study. In the line-point transects (also known as step-point method), an X-shaped transect was centered at each nest, with arms extending north, south, east, and west from the nest. Each arm consisted of 100 steps, with a point taken at the toe of the right boot every other step, such that each arm contributed 50 points and each transect 200. At each point, bare ground, litter, or plant species touched by the boot tip was recorded. If no plant was hit by the boot, the species of the nearest plant ahead of the toe was recorded. We then computed the percent composition of ground cover types around each nest by dividing the number of points of each ground cover type by the total number of hits/plants recorded. We also computed species composition from the nearest plant data.

A second method was used to characterize the area within 10 feet of the nest site. The same method was employed by Davis et al. (1979) to assess daily activity sites. These transects had eight arms extending 10 feet to the N, S, E, W, NE, SE, NW, and SW. Data points were taken at one-foot intervals, such that each arm provided 10 points, for 80 total points per nest. As on the large transects, litter, bare ground, and plant species were recorded. Height of the plant nearest the center of the transect and height of the plant nearest each third data point were recorded. Percent composition of ground cover types and vegetation composition within 10 feet of the nest were then computed from these data.

Results

Database of Survey Results

The number of active leks was 25 in 1998, up from 19 in 1997. The total number of LPCH counted in 1998 was 196, the largest total since 1993, in which the total was 247 (Figure 1). These increases can be accounted for in small part by increased survey effort in 1998. However, the number of sites visited increased by only 11% in 1998, while the number of active leks increased by 32% and the number of birds increased by 131%.

Trapping and Banding

We captured 12 hens and 9 cocks, 21 birds total (Table 1). Five of the males were second-year birds, and four were adults. Seven of the hens were second-year birds, and five were adults. None of the 1998 birds had been captured in 1997.

We analyzed 21fecal samples for the presence of coccidial parasites. One sample contained sporulated oocysts of an unidentified species of *Eimeria*. Another sample contained two nematode oocysts. Preliminary scans of 20 blood smears indicate the presence of both *Plasmodium* and *Haemoproteus* parasiteseach parasite in at least two individual birds.

Transmitter Function

All hens were fitted with transmitters. Three received TS whip antennas, four received TS necklace transmitters, and five received AVM necklace transmitters purchased in 1997. One of the TS necklace transmitters was re-used, after it was found off the first hen.

The majority of transmitters functioned well, but four of 12 transmitters fell off or were removed by hens. We lost track of two hens, both wearing the AVM transmitters from 1997. These hens could have been lost due to transmitter failure, because the AVM transmitters were over one year old. These two transmitters were functioning when applied to hens, but their batteries could have drained over time. It is also possible that the transmitters were damaged or buried by predators or the hens traveled too far for us to detect them. The mortality sensors functioned properly on other transmitters. Two other AVM necklaces were found off the birds, suggesting that the birds removed them or they fell off. The fifth AVM transmitter remained on a bird that nested.

One of the TS necklace transmitters was used twice, after it was found on the ground with dried blood or tissue on it, making it a suspected mortality. For the second use we attached a bib, and the second hen that wore the transmitter was found dead wearing it. The other two TS necklaces were found off the birds. The three TS whip necklaces remained on the birds and appeared to function well, although we noted that signal strength on one varied, apparently with the hen's foraging movements.

Fate of Hens

The hens wearing transmitters were located from 3 to 13 times. Of the 8 hens that kept radios, three were found dead and we suspected that a fourth was predated, based on the dried tissue found on the transmitter. All three carcasses we found were completely consumed, except for a few feathers, and we suspected coyote predation (Table 2). Coyote tracks were found near one of the three. We lost track of two hens (see above), and two were known to be living when last located in early June. Thus, the mortality rate of the 8 hens that kept radios between April and early June, 1998, was at least 50% and

I.D.			Date	Lek #	Capture/	Sex	Age	Weight	Tarsus		Wing		Culmen	Pinnae	Blood		Fecal	Munsell
Band #	Color	Freq.			Release			(g)	L. (mm)	R. (mm)	L. (mm)	R. (mm)	(mm)	(mm)	Smear	Sample (ml)		
7	R/RR	--	4/2/98	24N	0553:0618	M	ASY	805	52.3	53.1, 52.6	207, 206	206	14.2	--	Y	40	Y	--
8	W/WW	--	4/3/98	24N	0505:0535	M	SY	796	55.4, 54.2	52.1	208, 209	208	14.7	--	N	15	Y	--
9	G/YG	--	4/4/98	24N	0741:0808	M	ASY	700	51.9, 51.9	51.8	207, 206	204	12.9	--	Y	60	Y	--
10	W/RW	--	4/5/98	24N	0700:0740	M	SY	802	55.0	55.3, 55.0	211, 210	211	13.2	--	Y	30	Y	--
11	B/RB	165.480	4/7/98	45N	0635:0734	F	SY	710	52.9	52.6, 52.8	198	202, 202	14.9	--	Y	50	Y	--
13*	Y/WY	165.400	4/9/98	45N	0630:0725	F	ASY	733	50.9	52.4, 51.5	195, 194	207	13.4	--	Y	0	Y	--
14	Y/RY	165.500	4/13/98	45N	0630:?	F	ASY	687	49.8	49.5	208	210	15.9	--	Y	15	Y	--
15	Y/PP	165.460	4/13/98	2N	0627:?	F	ASY	735	53.8	53.5	201	204	16.2	--	Y	40	Y	--
16	B/YY	165.440	4/14/98	2N	0600:0705	F	SY	785	52.3	52.7, 52.8	206	209, 206	16.6	--	Y	30	Y	--
17	W/PW	165.420	4/14/98	45N	0618:?	F	ASY	773	52.4	52.4, 52.4	214, 213	209	17.0	--	Y	50	Y	--
18	G/YY	165.160	4/15/98	2N	0620:?	F	SY	640	50.7, 50.8	50.7	200, 201	198	13.2	--	Y	25	Y	--
19	P/GG	165.130	4/15/98	2N	0620:?	F	SY	705	51.5	51.9, 52.0	201	205, 205	14.3	--	Y	30	Y	--
20	B/GR	--	4/16/98	45N	0602:0658	M	SY	760	54.1, 54.7	54.5	210	210, 210	13.2	65	Y	40	Y	10yr 8/14
21	W/YR	165.170	4/17/98	45N	0617:0715	F	SY	694	52.4, 52.2	52.0	195	194, 196	12	--	Y	20	Y	--
22	G/WG	--	4/17/98	2N	0555:0811	M	ASY	752	53.4	53.3, 53.5	214	214, 215	17.2	62	Y	20	Y	10yr 8/14
23	P/WP	165.190	4/19/98	45N	0646:0735	F	SY	734	53.4	53.3, 52.8	204, 202	198	12.8	--	Y	50	Y	--
24	B/GB	--	4/19/98	45N	0725:0814	M	ASY	748	52.0, 52.4	52.3	215, 215	211	13.8	67, 63	Y	50	Y	10yr 8/14
25	W/WR	--	4/20/98	24N	0729:?	M	SY	747	52.9	52.0, 52.7	210	211, 211	14.3	65, 70	Y	50	Y	10yr7.5/14
26	Y/PY	--	4/22/98	45N	0545:?	M	SY	716	50.3	51.9, 51.9	204, 205	204	11.9	69, 70	Y	50	Y	10yr7/14
27	B/WB	165.210	4/22/98	45N	0640:?	F	SY	675	48.5	49.1, 48.6	196	196, 196	14.7	--	Y	25	Y	--
28	G/RG	165.400*	5/2/98	45N	0610:0702	F	ASY	707	50.6	52.1, 51.8	203	210, 210	15.2	--	Y	20	Y	--

Table 1. Measurements of LPCH captured at the Caprock, 1998. * Band number 12 was damaged and not used. Transmitter .400 was recovered and re-used.

possibly as high as 75%. Including all 12 hens captured, the mortality rate was at least 33% and possibly as high as 83%

Fate of Nests

All four of the nests we located were entirely or partially predated (Table 2). Two nests, having nine and ten eggs each, were completely predated during incubation. No shell fragments were found in or near these nests, suggesting predation by snakes (Davis et al. 1979). One other nest that had six eggs when located on May 19 had one egg on June 2 and was empty when checked on June 17, thus could not have produced more than one chick. We suspect snake predation of the entire clutch. The hen did not flush from a fourth nest when it was found on May 13; therefore, we do not know how many eggs were laid. On June 2, only two eggs and no shell fragments were present, suggesting that the other eggs were predated by a snake. The nest was empty on June 17 and thus could not have produced more than two chicks.

Hen ID	# Times Located	Date Nest Found	# Eggs	Transmitter Found	Nest Depredated	Hen Depredated
.500	10	5/5/98	9, 0	-----	6/3/98	6/3/98
.480	4	-----	-----	4/28/98	-----	-----
.460	7	5/13/98	?, 2	6/2/98	6/2/98	-----
.440	5	-----	-----	-----	-----	4/30/98
.425	13	-----	-----	-----	-----	-----
.400#1	3	-----	-----	4/28/98	-----	4/28/98 ?
.400#2	3	-----	-----	-----	-----	5/20/98
.210	3	-----	-----	-----	-----	disappeare d
.190	9	5/12/98	10,0	5/26/98	6/3/98	-----
.170	8	-----	-----	5/12/98	-----	-----
.160	5	-----	-----	-----	-----	disappeare d
.130	11	5/19/98	6,1	-----	6/2/98	-----

Table 2. Results of telemetry study. UTMs of nests: .460: E611104, N3707916; .130: E607833, N3705987; .190: E611461, 3702182; .190: E612562, N3703874.

One hen apparently did not nest. She was located in the same area 13 times between 14 April and 2 June, never on a nest. We suspect that her nest was predated very early in incubation or that she did not nest at all. Including this hen as a reproductive failure, either due to predation or failure to nest, with the depredated hens, the rate of reproductive failure for this study was at least 50%, and could have been as high as 100%.

Species	Acronym	% hits, nest	% hits, pasture	% nearest plant, nest	% nearest plant, pasture
Amsonia spp.	AMSO	0.000	0.000	0.000	0.000
Dalea nana	DANA	0.000	0.001	0.000	0.004
Evolvulus sericeus	EVSE	0.000	0.000	0.000	0.007
Guara villosa	GUVI	0.000	0.001	0.000	0.001
Legume-unidentified	LEGU	0.000	0.001	0.006	0.012
Total Forbs		0.000	0.004	0.006	0.025
Andropogon hallii	ANHA	0.016	0.012	0.050	0.071
Aristida purpurea	ARPU	0.019	0.036	0.123	0.123
Bouteloua hirsuta	BOHI	0.003	0.018	0.022	0.042
Cyperus spp.	CYPE	0.000	0.001	0.000	0.002
Digitaria cognata	DICO	0.000	0.009	0.025	0.044
Eragrostis secundiflora	ERSE	0.000	0.000	0.009	0.009
Paspalum setaceum	PASE	0.000	0.004	0.006	0.028
Schizachyrium scoparium	SCSC	0.022	0.027	0.044	0.083
Sporobolus cryptandrous	SPCR	0.019	0.014	0.072	0.042
Sporobolus flexuosus	SPFL	0.000	0.001	0.006	0.004
Sporobolus giganteus	SPGI	0.006	0.004	0.013	0.010
Total Grasses		0.085	0.126	0.371	0.458
Artemesia filifolia	ARFI	0.000	0.000	0.003	0.000
Mimosa quadrivalvis	MIQU	0.000	0.000	0.000	0.001
Opuntia phaeacantha	OPPH	0.003	0.002	0.006	0.004
Prosopis glandulosa	PRGL	0.003	0.002	0.031	0.009
Quercus havardii	QUHA	0.038	0.070	0.547	0.482
Yucca glauca	YUGL	0.006	0.007	0.035	0.020
Total Shrubs		0.050	0.083	0.623	0.515
Bare ground		0.230	0.233		
Litter		0.635	0.555		

Table 3. Vegetation composition (nearest plant) and percent of each cover type (% hits) on long (pasture) and short (nest) transects at nests, 1998. Data are summed and averaged over all four 1998 nests.

Vegetation Measurements

Hens chose to nest in untreated pastures. For all four nests combined, the most common cover type on the long transects (pasture) was litter, comprising 55.5% of hits (Table 3), followed by bare ground (23.3%) and shinnery oak (*Quercus havardii*, 7%). All other cover types comprised less than 5% of hits. The most common plant species on the long transects was *Q. havardii* (48.2%), followed by *A. purpurea* (12.3%) and *Schizachyrium scoparium* (8.3%, Table 3). The composition of forbs (2.5%), grasses (45.8%), and

Shrubs (49.6%) on our long transects most closely resembled that of Davis et al.'s shinnery oak-tallgrass subtype III, the least productive of the three subtypes for nesting (Davis et al. 1979).

The most common cover type on the short transects near nests was litter (63.5%), followed by bare ground (23%, Table 3)). No other cover type reached 5% of hits. As on the longer transects, the most abundant species was *Q. havardii* (54.7%), followed by *A. purpurea* (12.3%) and *S. cryptandrous* (7.2%). No other plant species approached the occurrence of shinnery oak near nest sites. Species composition of forbs (0.6%), grasses (37.1%), and shrubs (62.3%) within ten feet of nests most closely resembled species composition near nests in that of Davis et al.'s shinnery oak-tallgrass subtype III. Figure 2 shows the four most common plants near the nests (short transects) and in the pasture (long transects), broken down by nest to show variation among the four nest sites.

Mean and standard errors of all vegetation heights on the short transects at each of the four nests are shown in Table 4. The means were similar for all four nests, ranging from 9" to 10.67", and standard errors ranged from 0.69 to 1.63, indicating that variation existed but it was not extreme. No vegetation measurement near any nest exceeded 36", and most measurements were less than 15"; the overall mean height at all short transects at all nests was 9.9".

		Nest		
	1	2	3	4
Mean	10.250	9.833	10.667	9.000
SE	0.843	0.879	1.634	0.694

Table 4. Summary statistics for vegetation heights on short transects at each nest, 1998.

The average vegetation heights were not appreciably greater near nests than a few feet away. Means for the three height measurements (standard errors in parentheses) were as follows: inside, 9.88 (0.83); middle, 11.03 (1.11); outside, 8.91 (0.78). The heights of the plant sheltering the nests were: 35" (nest 1), 34" (nest 2), and 12" (nest 3, nest 4 not measured).

Discussion

<u>Population Trends</u>

The Roswell area population of LPCH increased appreciably between 1997 and 1998. We consider these results in light of the surveys conducted in other parts of the state. In 1998, we also surveyed 29 traditional lek sites in the BLM Carlsbad Resource Area. We entered data from these leks, collected since 1985, into the NMNHP Access database.

Numbers of active leks and total numbers of booming males at the Carlsbad leks have declined dramatically since the early 1990s. Increases similar to those observed at Roswell were not seen at Carlsbad, and 1998 was the worst year ever for prairie chickens in the Carlsbad Resource Area**.** Only one of 29 historical lek sites was active in 1998, and there were six males at that lek. The Carlsbad population is clearly in serious trouble.

In contrast, surveys at the NMDGF Prairie Chicken Areas (PCAs) near Portales indicate a dramatic increase in both lek numbers and bird numbers between 1997 and 1998 (Johnson et al. 1998). NMNHP surveyors detected more than three times as many leks in 1998 as in 1997. Most of these (20/32) were not on the PCAs, but our ability to detect them from listening points on PCAs indicates that the population in the area has increased appreciably since 1997. A five-fold increase occurred in the number of individual birds detected in and around PCAs. Thus, growth of the Roswell population was greater than that at Carlsbad but less than that at the PCAs.

The most obvious hypothesis to explain population increases in 1998 is that favorable weather led to greater recruitment. The drought of the mid-1990s appeared to break in 1997. All three survey areas received greater precipitation in 1997 than in the two previous years. However, precipitation increases cannot explain population growth differences between the three sites. The Palmer Drought Index and local rainfall data (www.ncdc.noaa.gov/cgi-bin/ginterface) indicate that the Carlsbad climate was wetter than average in 1997 and did not differ appreciably in 1996-7 from that in Roswell or Portales, where the PCAs are located. Likewise, there were no obvious differences in precipitation or Palmer Drought Indices between Portales and Roswell in 1996-97. Some other factors must be causing differential ability of these populations to respond to improved weather conditions.

Oil and gas activity is higher in the Carlsbad area than on the Caprock or at the PCAs, and grazing is also practiced. Habitat is fragmented by access roads to oil and gas wells, and drilling-related activities disturb native plant communities. Noise from inadequately-muffled pump jacks can be heard up to two miles away. This creates significant noise pollution for a minimum of a square mile (John Sherman, pers. comm.). Our surveyors noted moderate to high oil and gas-related noise levels at 11 of 29 lek sites visited. The most plausible hypothesis to explain the decline of the LPCH population in the Carlsbad area is that oil and gas activity, possibly exacerbated by grazing, have caused degradation of prairie chicken habitat. Populations are now so small that recovery, even when weather patterns are favorable, is unlikely. There are no data available to test alternative hypotheses such as predation, disease, or loss of genetic variability. However, it is clear that adoption of oil and gas policies similar to those that have been implemented at Carlsbad would negatively impact the LPCH population at Roswell.

Data from 1998 surveys suggest that the Caprock LPCH population has increased approximately 131% over 1997. The number of active leks increased from 19 in 1997 to 25 in 1998. Although this increase is encouraging, the Roswell population is still only one-sixth as large as it was during years in the mid-1980s in which comparable survey effort was exerted. The 1998 increase at Roswell was also not as dramatic as the increase on the PCAs. As in Carlsbad and Portales, the drought of the early 1990s broke in 1997, one apparent reason for the 1998 LPCH increases at Roswell. Oil and gas impacts are fewer on the Caprock, but grazing is widespread there. Populations at both the PCAs and the Caprock probably suffered the effects of the drought in the early 1990s, but LPCH habitat has been more heavily grazed at the Caprock than at the PCAs, most of which are not grazed. It is possible that more suitable nesting habitat was present at the PCAs, and the birds were able to efficiently utilize the nesting habitat when the rains brought food and further increases in cover.

In summary, differences in land use patterns at the three areas may have impacted the abilities of LPCH populations to begin a comeback after a severe drought. At the PCAs, where petroleum exploitation and grazing are light or non-existent, LPCH populations began to rebound after drought. At Roswell, females nested in shinnery pastures, but nests were not typically constructed in large clumps of bluestem grass, as found by Davis et al. (1979). The LPCH population there was able to respond somewhat in response to increased precipitation, but not to the extent observed at the PCAs. At Carlsbad, it appears that populations were so small and/or impacts so great, that the LPCH population has not been able to rebound, and in fact extinction of that population may be imminent. These data suggest that nesting habitat preserves near lek sites, such as the PCAs, are effective conservation tools.

Telemetry Study

One problem with this study was that transmitters came off the birds' necks, apparently because the necklace opening was too large. Only the whip antennas stayed on well, because these transmitters had to be worn much tighter for the antennas to stay in place down the middle of the bird's back. Even AVM necklaces with bibs attached to reduce the size of the necklace were lost. All seemed to transmit relatively well; however, one female wearing a whip antenna gave fluctuating signals, apparently due to the hen moving while foraging. We conclude that whip antennas transmit well and stay on the birds best, but if improperly attached they could interfere with flight.

Because so many transmitters were dropped, we do not have exact data regarding survival and reproductive success. Even the ranges in this study, however, are alarmingly low. A mortality rate of even 33% would be high for adult birds, and it is difficult to imagine a population being sustained with reproductive failure rates between 50% and 100%.

Predation and Habitat Quality

It is clear that predation is greatly impacting the Caprock Lesser Prairie Chicken population. This is consistent with other telemetry studies of Lesser and Greater Prairie Chickens (*Tympanuchus cupido*, Roger Applegate, Don Wolfe, pers. comm.). There are several plausible hypotheses to explain the extraordinary predation rates detected in these studies. First, habitat quality may be too poor to provide sufficient cover for hens to avoid predators and hide their nests.

The mean height of vegetation on the short transects within 10 feet of nests was 9.9", comparable to the vegetation height in Davis et al.'s shinnery oak-tallgrass subtype II, the subtype with intermediate LPCH nesting success (Davis et al. 1979). The species composition in the general area of nests and within ten feet of nests most closely resembled Davis et al.s' shinnery oak-tallgrass type III, the lowest quality of the three shinnery oak habitat subtypes. The pastures and nesting areas near the four nests in this study contained more shrubs and fewer grasses than found in the optimal nesting habitat (type I) as defined by Davis et al. (1979). The main cause of nest failure in the Davis study was predation (63% of failures), and predation was higher in subtypes II and III than in subtype I. In this study, hens may have been choosing areas for nesting based on shinnery cover in the pasture as a whole, but grass abundance may have been too low to provide adequate nest protection. The climax community in the Caprock area contains a mix of shinnery and grass, such that healthy grass growth prevents dominance of shinnery. When grazing is allowed to reduce grass cover, shinnery oak tends to dominate.

Second, predator populations may be higher now than in the past, due to extermination of wolves and reduction of predator control by ranchers. Further study of predator populations would address this hypothesis. A negative correlation between LPCH population and predator control rates by ranchers could also address this hypothesis. However, predation and nesting habitat should not be considered independent effects, as predation rate varies with subhabitat type (Davis et al. 1979).

Demography

Third, the post-drought age structure in the Caprock population may be biased toward young hens. Seven of the 12 hens we captured (58%) were second-year birds (i.e., in their first breeding season). It is possible that inexperienced hens choose poorly-protected nest sites. However, the resemblance of the nest pastures in this study to the poorer sub-habitats of Davis et al. (1979) suggests that scarcity of high-quality nesting habitat better explains predation rates than poor nest site choice by naïve hens. Three of four depredated hens were after-second-year birds, and two of four depredated nests were those of after-second-year birds.

Investigator Impact

Finally, and of most concern, investigators may be cueing predators to the location of nests. Predators could be following investigator signs to nest sites. This hypothesis seems unlikely for coyotes, because two nests were only partially predated and no shell fragments were found, suggesting snake predation. It is possible that snakes follow researcher scent to nests and harvest eggs over several days. The investigator hypothesis also does not explain predation on hens that were not on nests when killed. That predation rates were higher on nests (100%) than on non-nesting hens (33%-83%), may suggest investigator impact on nest predation; however, nests may be easier to find and predate than non-nesting hens. In addition, we created many more false trails through the dunes than trails that actually culminated at nests.

Research Recommendations

The above data must be interpreted with caution. A sample size of four nests is not large enough to allow conclusions, and thus the above discussion is necessarily speculative. We recommend continuing this study for at least two more seasons, after which sample sizes should be large enough to allow more confidence in conclusions. Until more nest site data are available, it would be relatively easy to compare randomly-selected vegetation plots in treated versus untreated pastures. Comparison of vegetation characteristics at the Mathers RNA with those at more heavily-grazed pastures would also be instructive.

Davis observed hens dispersing up to eight miles from the point of capture. Scheduling one flight over the Caprock during the nesting season could reduce data losses from widely-dispersed, radio-collared hens. If the two "lost" hens were long-distance dispersers, this information could be important to understanding habitat use and reproductive success of the Caprock LPCH. It is important to take precautions to avoid leading predators to nests; e.g., visit nests infrequently, avoid touching nests or surrounding vegetation, and do not approach nests when ravens or other potential predators are in the area.

As part of the trapping, we drew blood for eventual analysis of genetic variation and blood parasitemia. We also collected fecal samples for analysis of gut parasites. Any of these factors has the potential to greatly impact a small, declining population such as the one at Carlsbad. Any future trapping studies should include further DNA and parasite analysis.

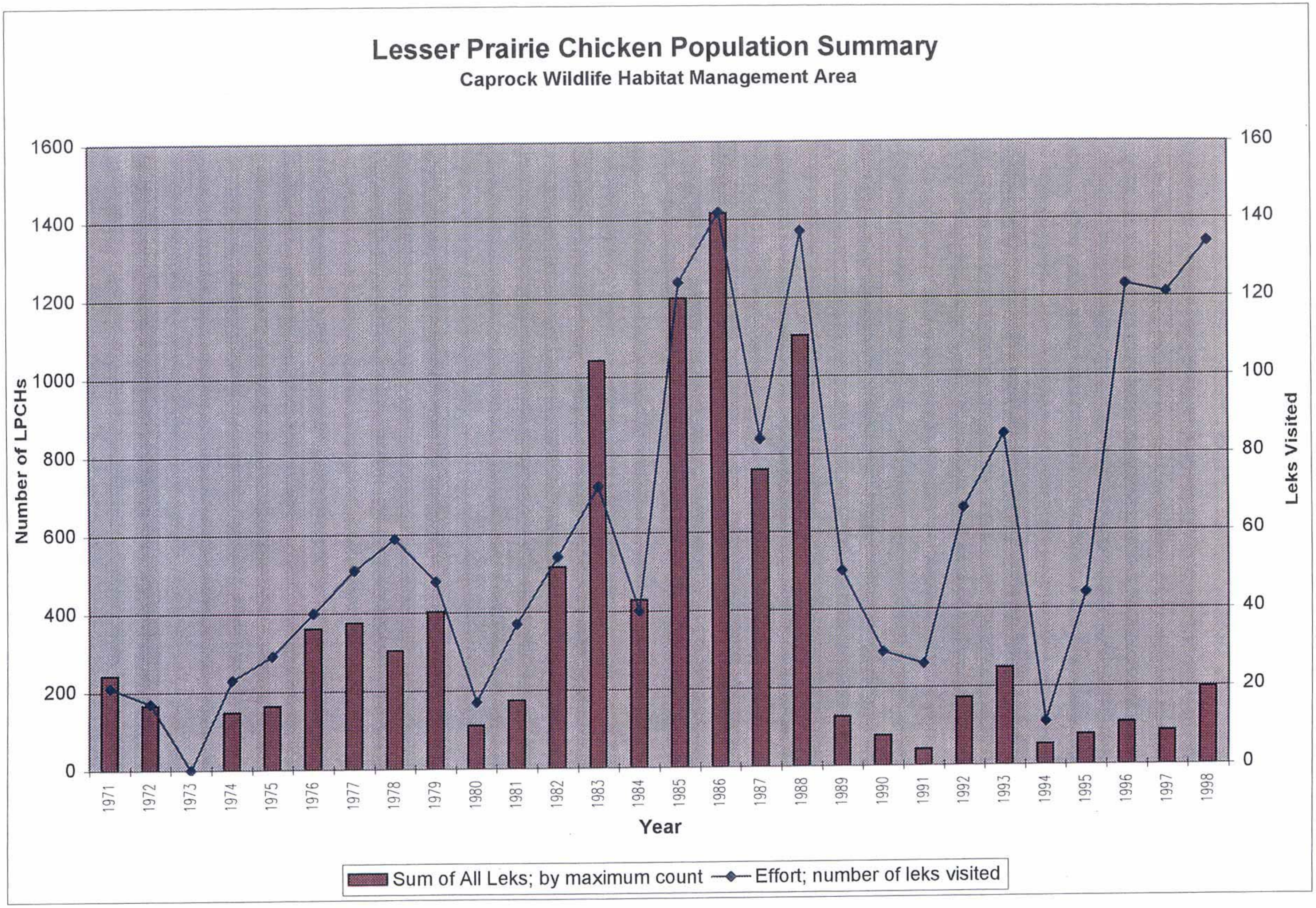
Surveys should be continued at all three New Mexico populations, and the NMNHP Access database updated yearly. The different responses to improved weather at Carlsbad, Portales, and Roswell, should be investigated further. No comparisons have been made between the nesting habitat and reproductive success at the three sites. These three populations offer an opportunity to investigate causes of decline by making comparisons among populations with similar habitats and weather but differing land use patterns.

We cannot yet make specific management recommendations based on this study. Until more data are available, for example regarding nesting in treated versus untreated pastures, managers should consult earlier studies, the most complete of which is Davis et al. (1979), in making management decisions.

Figure Legends

Figure 1. Sums of maximum numbers of LPCH counted at all BLM leks, 1971-1998. Blue line connects points showing the number of lek sites visited.

Figure 2. Percent composition of four most common plant species, a. within ten feet of nests, b. on longer transects in pasture. QUHA=*Quercus havardii*, ARPU=*Aristida purpurea*, SCSC=*Schizachyrium scoparium*, SPCR= *Sporobolus cryptandrous*, ANHA= *Andropogon halli*.


Lesser Prairie Chicken Population Summary
Caprock Wildlife Habitat Management Area
Number of LPCHs
Leks Visited
Year
Sum of All Leks; by maximum count
Effort; number of leks visited
0
200
400
600
800
1000
1200
1400
1600
20
40
60
80
100
120
140
160
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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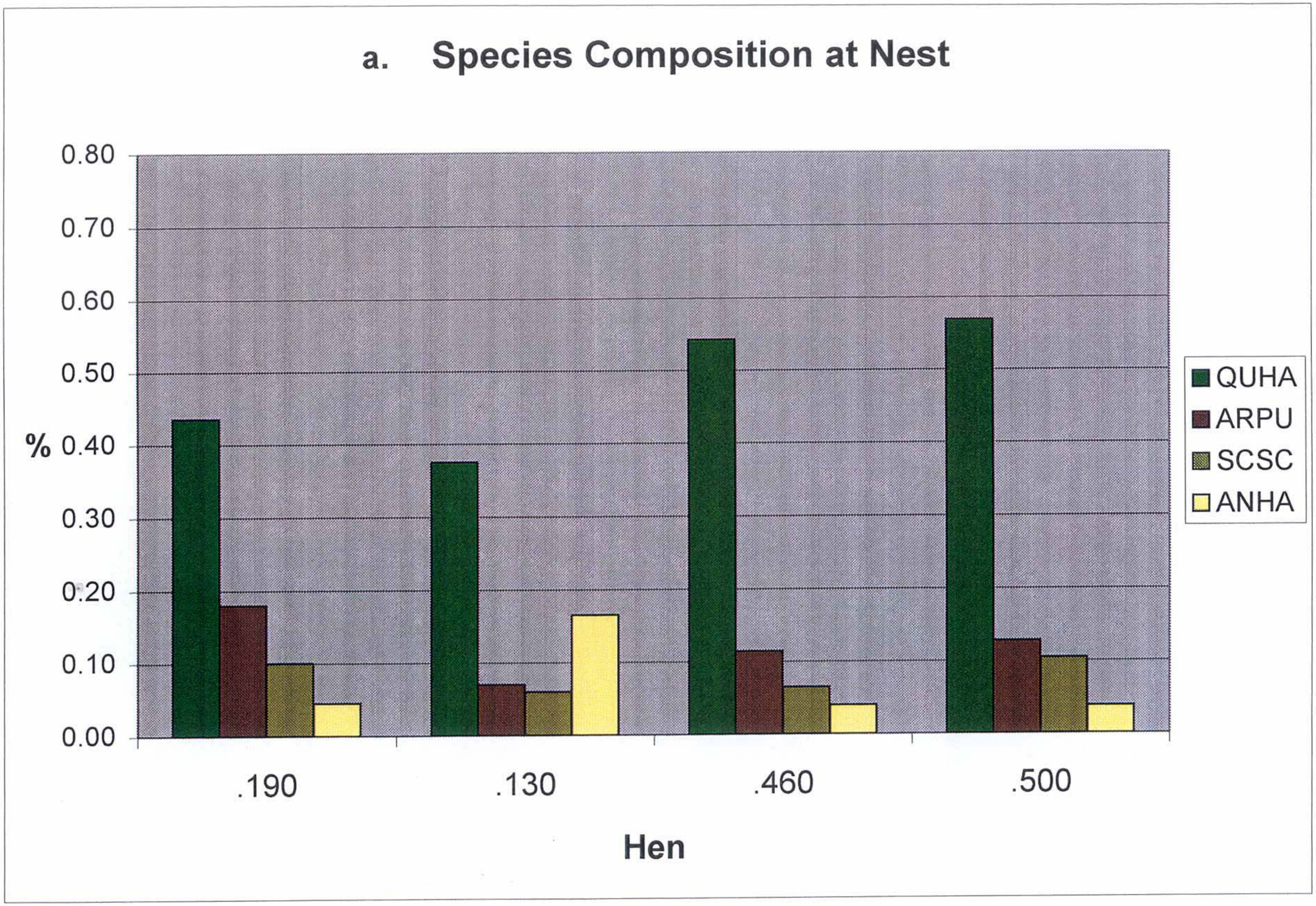
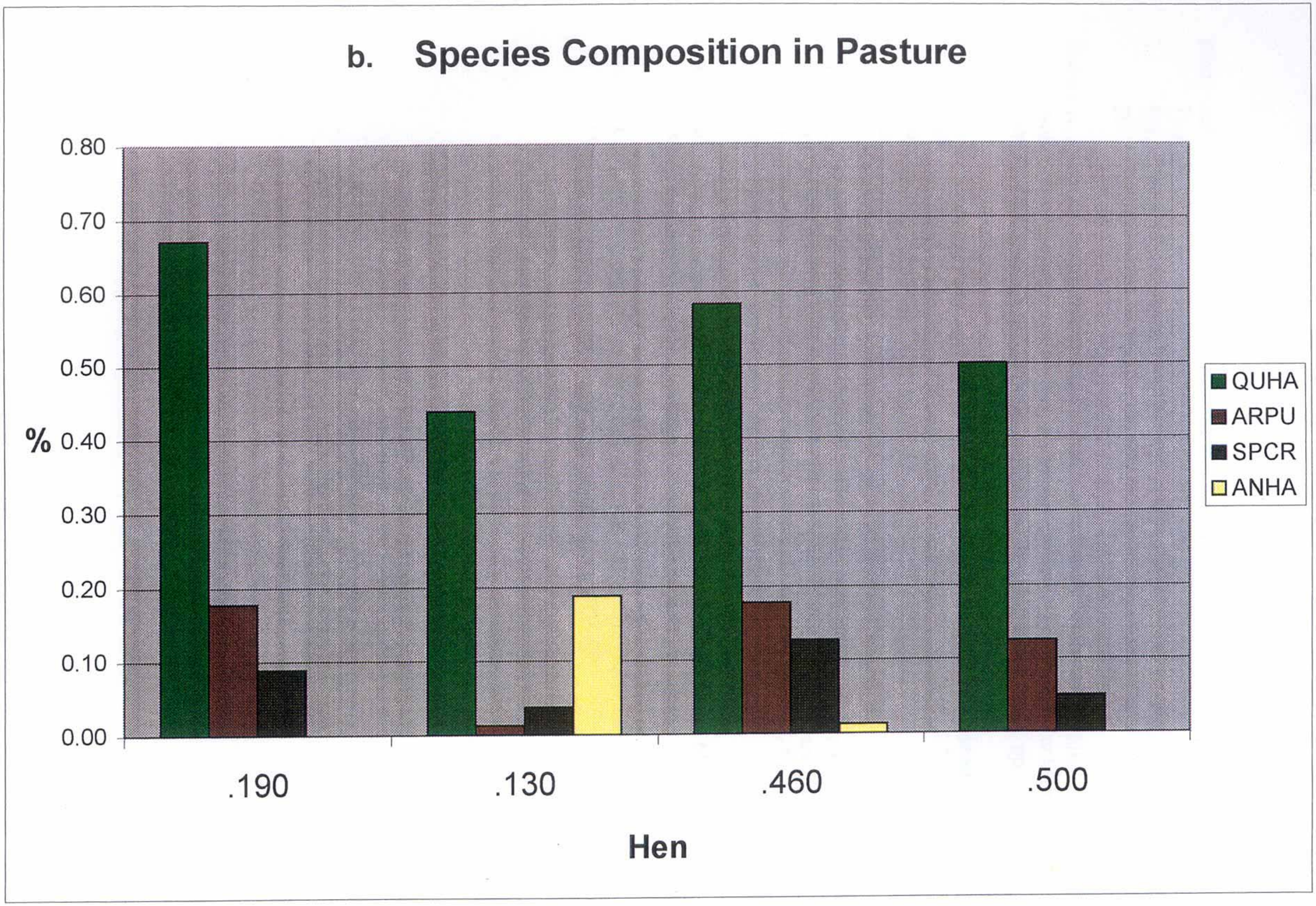
1991
1992
1993
1994
1995
1996
1997
1998



a. Species Composition at Nest
0.80
0.70
0.60
0.50
% 0.40
0.30
0.20
0.10
0.00
.190
.130
.460
.500
Hen
QUHA
ARPU
SCSC
ANHA


b. Species Composition in Pasture
0.80
0.70
0.60
0.50
% 0.40
0.30
0.20
0.10
0.00
.190
.130
.460
.500
Hen
QUHA
ARPU
SPCR
ANHA

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