SPRING AND SUMMER MOVEMENTS AND HABITAT USE BY LESSER PRAIRIE CHICKEN FEMALES IN YOAKUM COUNTY, TEXAS

by

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CHAPTER I

INTRODUCTION

Status of the Lesser Prairie Chicken

Pinnated grouse, as a group, are the tetraonids most affected by human activities in North America (Johnsgard 1973). This certainly has been the case with the lesser prairie chicken (Tympanuchus pallidicinctus). Lesser prairie chickens were more abundant at the turn of the 20th century, due to the increase in homestead farms and the associated dryland sorghum crops, which were used as winter food (Jackson and DeArment 1963). Following this temporary increase, extensive market shooting caused a drastic decline in prairie chicken numbers (Greenway 1958). Extensive alteration of native habitat to agricultural uses during the World War I era also led to a declining population (Copelin 1959).

Further encroachment of cultivation on lesser prairie chicken habitat and the drought of the 1930's depressed populations of lesser prairie chickens in Texas (Hoffman 1963). Bent (1932) also noted that overgrazing had a deleterious impact on lesser prairie chicken populations.

The lesser prairie chicken population has further declined recently due to overgrazing, aerial spraying of herbicides for shrub control, and clean farming practices

(Jackson and DeArment 1963). The lesser prairie chicken population fell to less than 50% of the early 1940's level during the drought of the 1950's (Hamerstrom 1961). Today, lesser prairie chicken populations have reached a level which supports limited sport hunting in Texas.

Review of Research on the Lesser Prairie Chicken

Much research has been done on prairie grouse, but little of it has emphasized the lesser prairie chicken as a unique species. Copelin (1959) stressed the need for research on the lesser prairie chicken's ecology if this bird is to continue as a game species.

Several aspects of lesser prairie chicken ecology have been studied, while much of this bird's natural history has only been touched upon. The specific distinction between the lesser and greater prairie chicken (*T. cupido*) was described by Jones (1964). He based the distinction on differences in fall arena activities, courtship behavior, vocalization, color of the gular air sac, diet and habitat use.

The lesser prairie chicken, both historically and presently, has been vulnerable because of its dependence on medium to tall grasses and low shrubs (Hamerstrom 1961). This dependence makes the species sensitive to overgrazing and to brush control. Recently, increased lesser prairie chicken populations in New Mexico were attributed to habitat improvement, effective predator control, and landholder cooperation (Lee 1950).

Crawford (1974) studied land use effects on lesser prairie chickens and formulated a habitat classification scheme. The best habitat (Class I) consisted of large units of rangeland interspersed with grain sorghum fields.

Large continuous units of rangeland (Class II) had lower lek densities than Class I habitat. Areas of less than 63 percent rangeland were incapable of supporting stable lesser prairie chicken populations. Copelin (1963) designated range units of more than 80 percent grassland as Class I, and 10-80 percent grassland as Class II if the remainder was cultivated land.

Martin et al. (1951), reviewing food habits, found that acorns contributed 52 percent of the diet, and grasshoppers contributed the major portion of the animal intake. Beetles, bugs, and caterpillars contributed a lower amount. Crawford (1974) found that plants contributed 90 percent of the lesser prairie chicken diets by weight and 81 percent by volume during fall. The remainder was composed of insects. Grain sorghum was the most common food item. Extensive use of grain sorghum fields was observed from September through May.

Stock ponds were used by lesser prairie chickens as a watering source during the March and April drought period (Crawford and Bolen 1973). This use ceased in early May. In Oklahoma, lesser prairie chickens drank daily at ponds from October through March (Copelin 1963).

Lesser prairie chickens are aged by the color and condition of primaries IX and X (Ammann 1944). Juveniles have conspicuous light spotting on the anterior portion of the vanes all the way to the tip, and the vanes are

relatively narrower and more frayed and worn than those of adults. Sex determination is based on differences in the color patterns of rectrices and under tail coverts. Males also have supraoccular combs (Copelin 1963).

Campbell (1950) described harassment of lesser prairie chickens on a lek by a pair of marsh hawks (Circus cyaneus). The effects of raptors, as a group, was reported as negligible for Wisconsin greater prairie chickens (Berger et al. 1963). Hammerstrom et al. (1965) concluded that with the exception of man, mammals cause little disturbance to prairie chickens on Wisconsin leks. The scope of predation not associated with lek activities is undocumented.

Several trapping techniques have been used. Kobriger (1965) used a baited, walk-in trap at feeding stations from February through March. Comparing mist nets to cannon nets as a means of capture for greater prairie chickens on booming grounds, Silvy and Robel (1968) found mist nets advantageous in that fewer recaptures resulted, there was some selectivity for females, less disturbance resulted and acquisition and operational costs were substantially lower. Its only disadvantage was that, generally, only one bird could be captured at a time. Recordings of "booming" males also were used by Silvy and Robel (1967) to aid in capturing greater prairie chickens on the booming grounds. They found that recordings extended the afternoon trapping period,

influenced bird movements on the booming grounds, decreased the time birds remained off the booming ground after being disturbed, and increased seasonal booming ground use. Decoys of female prairie chickens, posed in a copulatory posture, have been used as an aid in capturing prairie chickens with bow nets and noose carpets (Anderson and Hamerstrom 1967).

Few lesser prairie chicken nests have been found. Jones (1963) found no nests in searching 98 ha. An old, deserted nest was found in a clump of purple three-awn (*Aristida purpurea*). Copelin (1963) located only 7 nests in 2 years of searching, using a flushing bar mounted on the front of a vehicle. Nests were found only among shrubs less than 38 cm high. Bent (1932) noted 3 nests: 2 under bunches of sagebrush (*Artemisia* spp.), and a third under a tumbleweed which had lodged between two tufts of grass.

Purpose

The primary objective of this study was to examine female lesser prairie chicken habitat use throughout the spring and summer. Use relative to variations in the available habitat was examined. Subsequently developed management recommendations could be used by ranchers in Texas to benefit lesser prairie chickens.

CHAPTER II

METHODS

Description of the Study Area

Northeastern Yoakum County was selected as the study site due to its relatively high population of lesser prairie chickens. Yoakum County is in the southern Texas High Plains (Llano Estacado). It has a flat to undulating topography and soils consist of Brownfield fine sands with a thick sandy surface layer, and Brownfield-Tivoli fine sands (U.S.D.A. 1964). Wind erosion is common and locally severe, resulting in large areas of active dunes. The area has a warm-temperate, continental climate typical of the Southern High Plains. The U.S. Department of Agriculture classifies this area as semiarid. Annual precipitation averages 39.6 cm.

Dominant vegetation includes the low shrub, sand shinnery oak (*Quercus havardii*), and sand sagebrush (*Artemisia filifolia*). Honey mesquite (*Prosopsis glandulosa*) is conspicuously absent over much of the study area, whereas it dominates much of adjacent areas with finer-textured soils. Dominant grasses include purple three-awn, sand dropseed (*Sporobolus cryptandrus*), and thin paspalum (*Paspalum setaceum*). Annual forbs are diverse and abundant during years with wet springs.

This study was conducted on approximately 4,600 ha of rangeland, with about 130 ha of cultivated fields located at the north and south ends. Grazing pressure was high, as indicated by the presence of many invader and increaser plant species. Most of the study area was in one pasture which was grazed continuously during the growing season. Water was available from stock tanks and runoff, which collected for short periods following heavy spring and summer rains. Windmills were also present.

ARENA LOCATION AND CENSUS TECHNIQUES

Field work began in February, 1976. Arenas to be used as capture sites were located by driving the available roads both early in the morning and late in the afternoon, stopping at 0.8-km intervals, and listening for gobbling males. Nine potential arenas were located, with six subsequently being used as capture sites.

To obtain an index of population level, males were counted on each of the 9 arenas during the springs of 1976 and 1977. The maximum number of males counted at each arena was used as the population index. A Student's t-test (Snedecor and Cochran 1967) was used to evaluate yearly population differences from the arena counts.

Trapping and Marking Techniques

Beginning on 4 April 1976 and on 19 March 1977, lesser prairie chickens were trapped throughout the spring display periods, during early morning and evening. Capture methods included the use of a 183 x 183 dm dropnet, a 183 x 91 dm rocket-net, 210d/ 2 ply, 10-cm mist nets, and a 1.5 m diameter, walk-in trap. Sex, age, weight, pinnae length, tarsus length, and tail length of captured birds were recorded.

After sexing and aging, each bird captured was fitted with an aluminum butt-end leg band and numbered, colored plastic leg bandettes. A specific color bandette was placed on the right leg, along with the aluminum band, to denote capture site. Specific color combinations of plastic bandettes were placed on the left leg for individual recognition of birds.

Birds in 1976 and 1977 were also tagged with transmitters to follow their movements. Solar-powered transmitters were used because they have a longer life expectancy and a longer transmission range than battery-powered units. Availability of direct sunlight to charge the transmitters was of little concern due to the low brush cover of the study area. An AVM model LA 12 receiver was used in conjunction with a Hy-Gain, 3 element, hand-held yagi antennae for location. Locations were taken daily, when possible, by triangulation.

Vegetation Analysis

Agricultural Stabilization and Conservation Service aerial photographs were used to subdivide the study area into 11 sampling units based on topography and degree of site disturbance. Each unit was sampled during May, June and July of 1977 using 30, $1m^2$ circular quadrats. Measurements taken included: sand shinnery oak canopy and height, sand sagebrush canopy and height, percentage of bare ground, percentage litter, percentage standing dead cover, percentage grass cover and species frequencies were later calculated. Vegetation structure was measured using a set of 3 density boards as described by Jones (1968). The 3 boards were positioned in a triangular fashion and viewed from 4 positions: 1) at a 45-degree angle from horizontal at eye level, 3) at a height of 30 cm, from distances of 1 m, 3) 3 m, and 4) 5 m. Visible squares were counted at each position and summed to give an index of relative structural density.

Because the vegetation on the study area is a continuum, rather than discrete communities, a similarity index was applied to the cover and frequency data to place sampling units into habitat types. Each value was transformed to a percentage of the maximum value obtained, so that the different types of units could be made comparable. The properties were then adjusted to a relative basis.

The formula C= 2w/a+b x 100 (Loucks 1962) was used where:

C= the index of similarity:

a= the sum of all quantitative mesurements taken on area A

b= the sum of all quantitative measurements taken on area B and

w= the sum of all the minimum quantitative measurements shared by both areas.

A matrix of C values was then constructed and areas were grouped using a comparison of C values between sampling units. Habitat types were described from these comparisons.

Movement Analysis

The number of daily locations of lesser prairie chickens was recorded for each habitat type, by month. As the habitat types encompassed different sized areas, the lesser prairie chicken locations were transformed to locations per 100 ha of hatitat type and tabulated. Analysis of variance (Snedecor and Cochran 1967) was used to determine whether a preference was shown for a particular habitat type. Duncan's Multiple Range Test was then used to identify which habitat type or types were preferred.

Average minimum daily movements were calculated for each transmitter-equipped individual by connecting consecutive location points, determining the distance between them, summing the distances for a one month period and dividing by the number of days in that month. Differences in average minimum daily movements between 1976 and 1977 were evaluated with a Student's t-test.

Areas of use were calculated by connecting peripheral location points for an individual for each month, and determining the area encompassed within, using a compensating polar plainmeter. Significance in yearly differences in these values was evaluated with Student's t-tests.

Six variables were compared between nest sites and the corresponding values obtained for those variables for the entire sampling unit in which that nest was located, using Student's t-tests. The variables used included: sand shinnery oak canopy and height, sand sagebrush canopy and height, grass cover, and structural density.

CHAPTER III

RESULTS AND DISCUSSION

Arena Location

Courtship activity, in both 1976 and 1977, began during the second week in February. During February, 1976, the study area was systematically searched for active display grounds. Eight arenas were located, with another, newly formed arena being located in 1977.

Of the nine arenas studied, eight were on sites created by man's activities (Table I). All windmill sites on the study area, characterized by bare ground and/or low herbs, with an absence of shrub species, were used as display grounds. Other commonly accepted sites were abandoned oil pads, which were generally devoid of vegetation. A patchwork of herbicide treatment plots were also used as an arena presumably because the shrub cover had been greatly reduced. Also, one display ground was located on an elevated spot in an agricultural field. It is not known whether this was a traditional site prior to ground breaking, which took place in recent years, or whether the arena was formed subsequently. Consistent use of areas disturbed by man may be because of the extremely loose sandy soil surface, characteristic of the majority of the study area, and its associated heavy brush cover. The

Table I. Lesser prairie chicken arena sites, their substrate and maximum number of territorial males present in 1976 and 1977.

Arena No.	Substrate	No. of Males	
		1976	1977
1	oil pad	20	15
2	pasture	13	0
3	oil pad	12	14
4	herbicide plots	12	11
5	windmill site	6	6
6	grain field	14	8
7	windmill site	8	6
8	windmill site	6	1
9	oil pad	0	4
Totals		91	65

resulting bare or shrubless areas afforded by the disturbed sites made available to the lesser prairie chicken an open and preferred area for arena activities (Jones 1963). Arenas apparently can be created by brush removal on a relatively small scale, as evidenced by the herbicide treatment plots being accepted by lesser prairie chickens as an arena site.

Trapping Results and Population Characteristics

Each display ground was visited at least three times each spring to census territorial males. With the exception of arena #3, which had 17 percent more, all arenas had the same number or fewer displaying males in 1977. Average maximum counts decreased from 11.3 males in 1976 to 8.1 males in 1977. The total number of males decreased 29 percent ($p<0.1$).

Lesser prairie chickens were trapped during the spring and fall of 1976, and during the spring of 1977. Thirty lesser prairie chickens were captured during 1976 and 16 were captured in 1977 (Appendix A). Twenty-one females and 5 males were equipped with radio transmitters. As 5 transmitters malfunctioned in 1976, only 14 females were subsequently used for movement analysis.

Habitat Type Formulation

Similarity indices were compared between sampling areas in order to group them into habitat types (Table II). This method was effective in forest communities (Loucks 1962) and in conifer swamps (Clausen 1962). The principle differences between habitat types were topographic and plant species abundances for the 20 most commonly encountered species.

Habitat type I consisted of the four sampling areas with the most level topography. Active dunes were uncommon, with those present being smaller than in the other habitat types. Sand shinnery oak coverage was the lowest of the three groupings. Sand sagebrush coverage was intermediate. The shrub species attain low to intermediate heights as compared with the other habitat types. Combined frequency values for the 20 most common grasses and forbs were the highest for this habitat type, with the total grass cover and standing dead vegetation values being intermediate. The structural density was also intermediate in this habitat type.

Habitat type II encompassed those sampling areas located on sites with large, actively blowing dunes. These areas had the highest sand shinnery oak coverage and height, lowest grass cover, and the lowest structural density. Combined species frequencies were also the lowest, however,

Table II. Matrix of C values (a similarity index) for 11 sampling areas. The upper-right portion shows indices of similarity. The lower-left portion shows indices of dissimilarity (1.00-C).

	1	2	3	4	5	6	7	8	9	10	11
1	1.00	0.70	0.75	0.86	0.62	0.73	0.74	0.73	0.83	0.65	0.81
2	0.30	1.00	0.80	0.74	0.79	0.75	0.78	0.78	0.71	0.80	0.75
3	0.25	0.20	1.00	0.77	0.79	0.76	0.79	0.80	0.76	0.80	0.82
4	0.14	0.26	0.23	1.00	0.68	0.80	0.82	0.77	0.84	0.70	0.84
5	0.38	0.21	0.21	0.32	1.00	0.69	0.71	0.73	0.63	0.84	0.74
6	0.27	0.25	0.24	0.20	0.31	1.00	0.90	0.76	0.78	0.67	0.80
7	0.26	0.22	0.21	0.18	0.29	0.10	1.00	0.81	0.76	0.73	0.80
8	0.27	0.22	0.20	0.23	0.27	0.24	0.19	1.00	0.72	0.77	0.74
9	0.17	0.29	0.24	0.16	0.37	0.22	0.24	0.28	1.00	0.68	0.81
10	0.35	0.20	0.20	0.30	0.16	0.31	0.27	0.23	0.32	1.00	0.78
11	0.19	0.25	0.18	0.16	0.26	0.20	0.20	0.26	0.19	0.22	1.00

all 20 of the most common grasses and forbs were represented. The amount of bare ground was the highest of the three habitat types, due mainly to the large blowouts associated with the active dunes and to the low grass cover.

Habitat type III represents those sampling areas which were intermediate to the others in terms of dune activity. Dunes were present, but they were generally smaller and more stable than those in habitat type II. Habitat type III contained the most sand sagebrush cover and the highest sand sagebrush heights. Grass cover was the highest of the three types, while down litter coverage was lowest. Standing dead cover values were highest in this habitat type, due mainly to residual grasses. Structural density was also greatest in this habitat type. Combined species frequencies were intermediate to habitat types I and II.

Habitat Use

From the location data, it was evident that lesser prairie chicken females had distinct habitat preferences. Habitat type II, the sampling areas with the greatest dune activity, was used significantly more ($p<0.01$) than either the flat or moderate areas of habitat types I and III (Table III). Habitat type II encompased those areas with the highest sand shinnery oak coverage and height, which

afforded the birds a greater amount of shade and greater relief from high temperatures at the soil surface. This protection apparantly supercedes the value of high grass and forb frequencies.

Although shrub canopy and height were lowest in habitat type I, it was preferred over habitat type III. Grass and forb frequencies were the highest in this habitat type and it may be used as feeding areas by lesser prairie chickens during the summer months. A more diverse habitat of this type afforded a greater diversity of both grass and forb species, and associated insects, both key food items of lesser prairie chickens during the spring and summer months (Martin et al. 1951, Crawford 1974).

TABLE III. Monthly habitat use by lesser prairie chickens during 1976 and 1977.

Habitat	No. of locations per 100 ha. of habitat					
Type	May	June	July	Aug.	Sept.	Mean
I	1.9	3.6	3.2	3.3	1.3	2.6
II	2.6	8.3	8.9	5.7	1.2	5.4
III	0.9	2.8	0.4	0.0	0.0	0.8

Lesser Prairie Chicken Movements

Minimum daily movements were calculated for 9 lesser prairie chicken females in 1976 and for 5 in 1977 (Tables IV and V). Movements were greatest during the spring and early summer periods. Movements decreased in the fall. This was probably related to increased activity during the breeding season. Movements were less in late summer and early fall when food supplies were at a peak. Average minimum daily movement was significantly ($p<0.05$) less in 1977 compared to those for 1976.

The terminology "area of use" as opposed to home range was used here because the values were derived from only a portion of the year and do not account for autumn or winter ranges. Hens used the largest areas from June to August (Tables VI and VII). Spring and late summer were periods of smaller area requirements. The high abundance of annual forbs during the spring and high numbers of insects in the fall resulted in less area needed during these periods.

Of the hens, only number 23040 successfully hatched a brood. The average minimum daily movement and area of use values corresponding to this hen and brood were intermediate to those hens without broods, indicating that the area requirements were similar. The decrease in the

Table IV. Monthly average minimum daily movements (km) of 9 lesser prairie chicken females in 1976.

Individual	May	June	July	Aug.	Sept.	Oct.
23011	0.1	0.1	---	---	---	---
23013	0.3	---	---	---	---	---
23017	0.4	---	---	---	---	---
23020	0.2	0.5	---	---	---	---
23021	1.0	0.8	---	---	---	---
23022	---	0.5	0.3	0.2	0.2	0.4
23024	---	0.6	0.5	0.4	0.2	0.3
23025	---	0.4	0.4	0.4	0.1	0.2
23026	---	---	0.4	0.2	---	---
Mean	0.4	0.5	0.4	0.3	0.2	0.3

size of area used by female lesser prairie chickens in 1977 as opposed to 1976 was significant ($p<0.1$).

Table V. Monthly average minimum daily movements (km) of 5 lesser prairie chicken females in 1977.

	No. of locations per 100 ha. of habitat					
Individual	April	May	June	July	Aug.	Sept.
23037	0.2	0.3	0.3	0.1	---	---
23038	---	0.4	0.2	0.3	0.2	0.1
23040	0.1	0.1	0.3	0.3	0.3	0.1
23044	1.5	0.5	0.3	0.2	0.2	0.1
23051	---	---	0.3	0.2	0.2	0.1
Mean	0.6	0.3	0.3	0.2	0.2	0.1

Table VI. Monthly areas of use (ha) by 9 lesser prairie chicken females in 1976.

Individual	May	June	July	Aug.	Sept.	Oct.
23011	32	--	--	--	--	--
23013	18	--	--	--	--	--
23016	15	--	--	--	--	--
23020	16	82	--	--	--	--
23021	12	122	--	--	--	--
23022	--	38	38	58	17	--
23024	--	74	112	101	23	6
23025	--	43	61	57	30	16
23026	--	--	66	5	--	--
Mean	19	72	69	55	23	11

Table VII. Monthly areas of use (ha) by 5 lesser prairie chicken females in 1977.

Individual	April	May	June	July	Aug.	Sept.
23037	14	21	57	2	--	--
23038	--	31	73	71	44	--
23040	19	6	53	35	41	6
23044	49	95	22	38	84	--
23051	--	--	87	33	20	tr[a.]
Mean	27	38	58	36	47	3

a. tr= a value less than 0.5

NEST SITES

Of the 8 nests located, 7 were located using radio telemetry. The remaining site was located incidentally after the clutch had hatched.

Distance travelled by hens from the point of capture to the nest site ranged from 0.9 to 2.3 km (Table VIII), with a mean distance of 1.2 km. It was assumed that these females were captured on the arena where mating took place, even though copulation was not observed, and the hens had already begun egg-laying or incubation.

Table VIII. Distance from capture site to nest site (km) and nest fate for 8 lesser prairie chicken females.

Individual	Distance from Capture Site to Nest	Habitat Type	Nest Fate	Days Into Incubation
23016	1.0	I	Successful	--
-----	0.9	II	Successful	--
23020	1.2	II	Mammalian predation	18
23025	1.0	I	Deserted	21
23037	1.0	I	Avian predation	13
23038	2.3	I	Mammalian predation	24
23040	1.2	I	Successful	--
23051	1.0	I	Deserted	17

Six of the 8 nests were in habitat type I. The remaining 2 were in habitat type II. Possible factors selected for by these hens in locating a nest site include a flat topography, a lower, less dense sand shinnery oak canopy, and a high grass and forb frequency. It also appears as if concealment of the nesting hen was a primary consideration as structural density was the highest in habitat types I and II.

Sand sagebrush was the most common overhead cover for the nest sites studied, occurring at 5 of the 8 sites. Two nests were concealed in clumps of purple three-awn and the remaining was located in a dense patch of sand shinnery oak.

In comparing 6 variables measured at the nest sites, with average values obtained for the sampling area in which that nest occurred, the following was determined. Sand shinnery oak canopy and height were not significantly different at nest sites as compared to the area means. There was a significant ($p<0.01$) increase in sand sagebrush canopy at nest sites, while no difference in sand sagebrush height was demonstrated. Grass cover at nest sites was not significantly different from the sampling area means. Structural density was greater at nest sites by a significant ($p<0.01$) amount, as compared to their respective sampling area means.

The most critical nest site considerations appeared to be overhead cover and structural density for lesser prairie chickens. As sand sagebrush afforded the greatest concealment during the nest initiation period in this area, it was obvious choice for a nest site.

Movements by the incubating hen occurred during the early morning and late afternoon periods. Movements were considerable, with one individual visiting a windmill site well over 2 km from her nest.

Average nest bowl diameter and depth for 8 lesser prairie chicken nests were 19.0 and 7.2 cm, respectively. The range of values for nest diameter was 17.0 to 22.0 cm and for nest bowl depth were 6.0 to 9.0 cm. Of the 8 nests studied, 3 successfully hatched a brood, 2 were deserted, 2 were destroyed by mammalian predators, and 1 was destroyed by an avian predator.

Mortality

Of the 26 transmitter-equipped lesser prairie chickens, 7 fatalities were accounted for. Of the 46 birds marked, the fate of 14 were accounted for (Table IX).

Four individuals were harvested by hunters during the 1977 hunting season. Two had been marked during the spring of 1976. One had been transmitter-equipped, but had lost its transmitter prior to being shot. Five individuals were killed or scavenged by mammalian predators. The only large mammalian predators observed on the study area were coyotes (*Canis latrans*) and badgers (*Taxidea taxus*).

It was apparent that the lesser prairie chicken is quite susceptible to shock when being handled in capture and marking operations. In the cases of 23008, 23009 and 23014, the predations were possibly related to the birds' condition after being released. All 3 showed definite

Table IX. Fate of 14 lesser prairie chickens marked during 1976 and 1977 in Yoakum County, Texas.

Individual	Date of Capture	Date of Death	Fate
23005	4/24/76	10/15/77	Hunter kill
23006	4/23/76	5/18/76	Drowned in stock tank
23008	4/25/76	5/ 7/76	Mammalian predation
23009	5/ 1/76	5/ 9/76	Mammalian predation
23014	5/13/76	5/29/76	Mammalian predation
23015	5/13/76	10/15/77	Hunter Kill
23022	6/11/76	12/23/76	Unknown
23025	6/16/76	12/26/76	Unknown
23026	7/ 9/ 76	8/ 5/77	Unknown
23031	10/ 3/76	10/ 5/76	Shock
23033	3/19/77	10/15/77	Hunter kill
23037	4/ 2/77	7/ 5/77	Mammalian predation
23044	4/26/77	7/ 9/77	Mammalian predation
23045	5/ 4/77	10/15/77	Hunter kill

signs of shock when released. Hen number 23031 showed shock symptoms and later was found dead, with its transmitter harness entangled on a sand shinnery oak branch. A male, number 23006, was found dead from drowning in a circular steel stock tank. It apparently had lost its balance from the tanks rim while attempting to drink, fallen into the water, and was unable to escape. Three other individuals remains were recovered, but it was impossible to determine cause of death.

Several additional birds were in shock when released. Typical behavior included an inability or refusal to take flight. These individuals would attempt escape by running. When approached on subsequent days, they did not fly. One male showed extreme shock symptoms by dying in the captors hands while being banded. Most individuals showed no ill effects from handling, with several females returning to continue incubation of a completed clutch.

On 2 occasions, individual males were observed to be injured while attending an arena. One was the dominant male on arena #5. A patch of blood was visible on the right wing. No adverse effects were evident as he was able to maintain his dominance and was able to fly well. On another occasion, a male having a fractured right humerus and missing several retrices, was observed on arena #1. This individual was captured by hand and died soon after being confined.

Use Of Water

Lesser prairie chickens used water more extensively than previously reported (Crawford and Bolen 1973, Copelin 1963). They used available water sources from late April through the end of June and again in late August. Females in the early stages of incubation regularly visited stock tanks, while males used water sources associated with arenas throughout the lekking period.

CHAPTER IV

MANAGEMENT RECOMMENDATIONS

This study suggests possible management practices for the lesser prairie chicken in West Texas, and possibly other lesser prairie chicken ranges, which should be compatible with ranching interests:

1. Where a low density of lesser prairie chicken arenas is present, the construction of sites may be accomplished by using a brush control herbicide on small areas (approximately 0.5 ha) to eliminate sand shinnery oak and encourage vegetation of low height.
2. Water should be provided throughout the management area at intervals of approximately 2 km.
3. Although winter ranges were not considered, based on spring and summer areas of use, minimum daily movements and the distance from nest site to the nearest arena, a management area should be 2,000 ha or larger.
4. Nesting cover, in the form of sand sagebrush or residual bunchgrass should be provided. This could be maintained by exclosing a portion of a management area from intensive grazing.
5. An attempt should be made to ascertain population characteristics without capturing lesser prairie

chickens. This bird is indeed susceptible to shock induced by capture and they may be better studied in other ways.

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APPENDIX

Capture Data for 46 Lesser Prairie Chickens Captured

During 1976 and 1977 in Yoakum County, Texas

Date	Sex	Age	Wt. (g.)	Pinnae Length (mm)	Tarsus Length (mm)	Tail Length (mm)	Capture Site	Transmitter Frequency	Band No.
4/21/76	M	A	620	63	89	102	1	---	23001
4/23/76	M	A	680	69	98	93	1	150.845	23002
4/23/76	M	A	650	60	105	106	7	---	23004
4/23/76	M	J	740	68	101	99	1	---	23006
4/24/76	M	J	820	70	103	98	7	---	23005
4/24/76	M	J	680	76	102	102	8	150.890	23007
4/25/76	F	J	680	31	95	96	8	150.965	23008
5/ 1/76	F	A	900	37	99	95	8	150.905	23009
5/ 1/76	F	A	650	33	91	93	8	150.875	23010
5/ 1/76	F	A	760	36	92	102	8	150.980	23011
5/ 2/76	M	A	790	64	104	103	8	---	23012
5/13/76	F	A	---	31	99	---	8	150.965	23013

Appendix A. Continued

Date	Sex	Age	Wt. (g.)	Pinnae Length (mm)	Tarsus Length (mm)	Tail Length (mm)	Capture Site	Transmitter Frequency	Band No.
5/13/76	M	J	820	64	98	99	8	150.905	23014
5/13/76	M	J	830	69	100	100	8	---	23015
5/14/76	F	A	820	45	103	99	8	150.860	23016
5/15/76	F	J	620	32	99	101	8	150.935	23017
4/21/76	M	J	760	68	98	102	7	---	23018
5/15/76	F	J	540	32	95	96	8	150.920	23019
5/16/76	F	J	880	34	98	91	8	150.950	23020
5/29/76	F	A	620	30	100	---	8	150.905	23021
6/11/76	F	J	---	39	99	95	8	151.017	23022
6/15/76	M	J	510	--	101	102	8	---	23023
6/16/76	F	J	740	--	99	100	8	151.079	23024
6/16/76	F	J	680	30	100	99	8	151.102	23025
7/ 9/76	F	A	560	28	---	96	8	151.051	23026

Appendix A. Continued

Date	Sex	Age	Wt. (g.)	Pinnae Length (mm)	Tarsus Length (mm)	Tail Length (mm)	Capture Site	Transmitter Frequency	Band No.
9/11/76	M	A	740	--	99	---	1	---	23027
9/17/76	M	J	---	--	101	---	3	---	23029
9/17/76	M	J	700	--	97	---	3	---	23028
10/ 2/76	M	A	760	42	104	103	3	---	23030
10/ 3/76	F	A	700	--	102	---	3	151.030	23031
3/12/77	M	A	840	--	---	103	3	---	23032
3/19/77	M	A	---	73	90	---	1	---	23033
4/ 2/77	F	A	780	30	96	---	3	151.140	23037
4/ 7/77	F	A	810	--	---	94	5	151.063	23038
4/ 7/77	F	A	800	36	98	93	5	151.079	23039
4/ 7/77	F	J	800	30	90	92	1	151.091	23040
4/20/77	M	J	840	72	97	94	1	---	23041
4/21/77	M	A	---	71	84	103	1	---	23099

Appendix A. Continued

Date	Sex	Age	Wt. (g.)	Pinnae Length (mm)	Tarsus Length (mm)	Tail Length (mm)	Capture Site	Transmitter Frequency	Band No.
4/21/77	M	A	820	70	92	101	1	---	23042
4/21/77	M	A	720	74	97	104	1	---	23043
4/24/77	M	J	780	72	96	105	5	---	23035
4/24/77	M	A	830	69	101	103	5	---	23036
4/26/77	F	J	800	--	95	94	5	151.051	23044
5/ 4/77	M	A	---	70	97	107	1	151.102	23045
5/ 7/77	M	A	800	67	96	98	1	150.963	23046
6/ 3/77	F	J	620	34	95	---	5	151.122	23051