

Ecology of the Mountain Lion on Big Bend Ranch State Park in Trans-Pecos Texas

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Abstract: Reproduction, mortality rates, dispersal, and survival of young lions are among the most basic factors affecting lion populations. The Texas Parks and Wildlife Department (TPWD) initiated a research study to investigate home ranges, population dynamics, genetic variability, and diets. We captured 19 mountain lions (*Felis concolor*) on Big Bend Ranch State Park (BBRSP) 22 January 1993 through 9 March 1995, using trained hounds or leg-hold snares. All captured lions were examined, aged and sexed, and a series of body measurements were recorded. Two lions—1 adult female and 1 subadult male—died during capture. A subadult male orphaned as a kitten and sent to a wildlife rehabilitator was returned to the study area, but was later killed off the study area. Fifteen lions—5 adult females, 1 subadult female, 7 adult males and 2 subadult males—were fitted with radio transmitters. Three of the collared lions—1 adult female and 2 adult males—were killed north of the study area. Collared lions were monitored from the ground and fixed-wing aircraft. We recorded 506 locations and delineated home ranges for 10 collared lions. Home ranges of males varied from 316–597 km², while those for females ranged from 167 to 505 km². Fecal analysis indicated collared peccary (*Tayassu tajacu*), mule deer (*Odocoileus hemionus*), and lagomorphs (*Lepus spp.*) were the most important prey species in descending order of frequency of occurrence. Data will continue to be collected for another 2 years.

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Since 1983, the Texas Parks and Wildlife Department (TPWD) has collected state-wide mountain lion sighting and mortality data. These data seem to indicate an increasing population trend in the west, central, and southern portions of Texas with isolated occurrences extending into the northern and eastern areas of Texas (Russ 1992). However, this information alone does not

produce accurate estimates of lion population densities in the state and must be supported by research on lion ecology in the respective regions. This study is the first attempt by TPWD to supplement current mountain lion status information with field research.

Research on mountain lions in Texas has been limited primarily to the Chihuahuan Desert Region and includes studies by McBride (1976), Harvey and Stanley Associates (1986), Pence et al. (1986), Leopold and Krausman (1986), Waid (1990), Packard (1991), and Ruth (1991). These studies provide a foundation of mountain lion research in the state, but most Texas lion studies have been conducted on Big Bend National Park. Harvey and Stanley Associates (1986) conducted their research in the Guadalupe Mountains, and McBride (1976) did some of his work in South Texas and Mexico. The mid-elevation desert grasslands of BBRSP are a contrast to the low desert scrub and isolated Chisos Mountains of Big Bend National Park. In addition, the widely distributed and abundant perennial water of the study area further defines the site as unique in the Trans-Pecos Region of Texas. The large size of the area also makes it an ideal study site to complement and contrast previous and future lion work in Texas.

The only other long-term comprehensive study of lion ecology in the Chihuahuan Desert currently is being conducted in New Mexico by the Hornocker Wildlife Research Institute (Logan et al. 1993).

Reproduction, mortality rates, dispersal, and survival of young lions are among the most basic factors affecting lion populations. Dispersal of juvenile lions acts as a population regulating mechanism, resulting in colonization of unoccupied habitat and contributing to gene flow of surrounding populations (Greenwood 1980). Knowledge of dispersal characteristics will contribute substantially in making future lion management decisions in Texas. The objectives of the BBRSP mountain lion study were to determine home ranges, examine population dynamics, evaluate genetic variability, and identify diets.

Methods

Study Area

BBRSP, owned by the TPWD, contains approximately 107,242 ha (265,000 acres) and is located within the Chihuahuan Desert in southwestern Brewster and southeastern Presidio counties. BBRSP is dominated by desert grasslands with over 90 springs and associated riparian habitats within its boundary. Most of these spring systems provide a perennial water source for wildlife. The terrain is rugged, ranging from broad mesa tops to steep canyons draining into the Rio Grande.

Elevation on BBRSP averages 1,067 m (3,500 feet), and average rainfall is approximately 28 cm (10.92 inches) per year with most falling from July through October.

Mountain lions within the study site were captured using trained lion

hounds or leg-hold snares, immobilized with Ketamine and Rompun, and fitted with radio collars (Telonics, Inc., Mesa, Ariz.). Captured lions were immobilized with a 1.0:0.1 mg mixture of ketamine hydrochloride [Ketaset (ketamine hydrochloride 100 mg/ml), Fort Dodge Laboratories, Inc. for Aveco Co., Inc., Fort Dodge, Iowa] and xylazine hydrochloride [Rompun (xylazine hydrochloride 20 mg/ml), Miles Inc., Shawnee Mission, Kansas]. Kittens were captured by hand and fitted with expandable collars to allow adequate growth without injury. Approximately 1 year after initial capture, kittens were recaptured and fitted with an adult collar. All transmitters were equipped with a mortality sensor that activated once the transmitter remained motionless for more than 5.5 hours.

Age (from dental characteristics as described by Ashman et al. 1983), sex, and body measurements were recorded on each captured lion. Blood samples were collected for DNA and disease analysis according to established protocols (Mike Tewes 1993, Texas A&M University, Kingsville, pers. commun.).

All collared lions were monitored weekly by ground and aerial telemetry to collect data on movements, home range characteristics, habitat use, location of den sites, and survival and dispersal of kittens after they become independent. Telemetry locations were recorded as Universal Transverse Mercator grid coordinates (UTM's) to the nearest 0.01 km on USGS 7.5 minute topographic maps. Home areas (Seidensticker et al. 1973) were determined for each collared resident lion by connecting the distant location points to form a convex polygon. A resident adult lion (Waid 1990) was defined as a self-sufficient animal whose locations and activities demonstrated its preference to a predictable area. Convex polygons were developed by using ARC/INFO software.

All fecal samples encountered were collected and labeled for diet analysis using micro and macroscopic characteristics of hair, feathers, and skeletal remains. Lion kills were verified and recorded on base maps.

Mule deer, hare, rabbit (*Sylvilagus spp.*), and furbearer census data from fall spotlight surveys were used to estimate prey population trends during the study period. Four spotlight survey transects, representing 96 km (60 miles) and 2,979 ha (7,448 acres) of visibility, were established on the study area.

Results

We captured 19 mountain lions on BBRSP from 22 January 1993 through 9 March 1995 (Table 1). Fifteen of this total—five adult females, 1 subadult female, 7 adult males, and 2 subadult males—were fitted with radio transmitters. Two capture-related mortalities—1 adult female and 1 subadult male—occurred, and therefore these animals were not included in the study.

Six mortalities—2 of the adult females, 2 of the adult males, and 2 of the subadult males—occurred during the study.

A male kitten, approximately 2 months old, was captured at the same snare site 4 days after one of the female mortalities occurred. Because the female had

Table 1. Capture dates and status of male (M) and female (F) mountain lions captured on Big Bend Ranch State Park (BBRSP), Texas between January 1993 and March 1995.

| Lion ID | Capture date | Est. age at capture | kg | Weight (lb) | Condition class | Capture location | Capture method | Status in study |
|---------|--------------|---------------------|------|-------------|-----------------|------------------|----------------|---------------------|
| F1 | 22 Jan 93 | 3 years | 32.7 | (72.0) | Fair | Panther Mountain | Snare | Resident |
| Female | 4 Feb 93 | 2-4 weeks | 4.5 | (10.0) | Poor | Arroyo Segundo | Hounds | Unknown |
| Male | 4 Feb 93 | 2-4 weeks | 3.9 | (8.5) | Poor | Arroyo Segundo | Hounds | Unknown |
| F2 | 16 Feb 93 | 14 months | 24.9 | (55.0) | Good | Alamo Spring | Hounds | Resident |
| Female | 20 Feb 93 | 4 years | 29.0 | (64.0) | Good | Fresno Canyon | Snare | Capture mortality |
| M3 | 24 Feb 93 | 2 months | 6.8 | (15.0) | Good | Fresno Canyon | Snare | Killed ^a |
| M1 | 25 Feb 93 | 5 years | 63.5 | (140.0) | Good | Arroyo Segundo | Snare | Resident |
| Male | 25 Mar 93 | 15 months | 24.9 | (55.0) | Good | Arroyo Segundo | Hounds | Capture mortality |
| F3 | 25 Mar 93 | 4 years | 34.5 | (76.0) | Fair | Arroyo Segundo | Snare | Killed ^b |
| M2 | 28 Dec 93 | 3 years | 54.4 | (120.0) | Good | Panther Mountain | Hounds | Killed ^c |
| F4 | 14 Jan 94 | 4 years | 29.5 | (65.0) | Good | Las Burros | Snare | Resident |
| M4 | 27 Jan 94 | 4 years | 56.7 | (125.0) | Good | Botella Spring | Snare | Killed ^d |
| F5 | 3 Feb 94 | 6 years | 28.1 | (62.0) | Poor | Left Hand Draw | Snare | Resident |
| F6 | 3 Mar 94 | 4 years | 34.0 | (75.0) | Good | Left Hand Shutin | Snare | Resident |
| M5 | 6 Apr 94 | 5 years | 56.2 | (124.0) | Good | Left Hand Shutin | Snare | Resident |
| M6 | 7 Feb 95 | 4 years | 52.2 | (115.0) | Good | Fresno Canyon | Snare | Resident |
| M7 | 11 Feb 95 | 4 years | 62.6 | (138.0) | Good | Las Cuevas | Snare | Resident |
| M9 | 23 Feb 95 | 4 months | 12.7 | (28.0) | Good | Alasan | Hounds | Resident |
| M8 | 9 Mar 95 | 5 years | 61.2 | (135.0) | Good | Madera Canyon | Snare | Resident |

^aOrphan kitten taken to Central Texas Wildlife Institute, Inc., Hamilton, Texas. Relocated 8 Jan 1994 on BBRSP and killed 27 Jan 1994 south of the study area.

^bKilled by a private trapper north of the study area on 11/16/94.

^cKilled by a private trapper north of the study area on 2/19/95.

^dKilled by a private trapper north of the study area on 2/25/95.

been lactating, it was assumed that the kitten belonged to her. Dogs were used to search for other litter mates, but none were found. The orphaned kitten was taken to Central Texas Wildlife Institute, Inc., Hamilton, Texas, for rehabilitation. Nearly 1 year later, on 8 January 1994, M3 was fitted with a radio transmitter and released on BBRSP. M3 was killed south of the study area along the Rio Grande on 27 January 1994. In addition, 3 collared adult lions, 1 female and 2 males, were caught and killed north of the study area by a private trapper.

On 4 February 1993, 2 kittens, 1 male and 1 female, were captured together at a den site. The kittens, estimated to be 2 to 4 weeks of age, were in extremely poor condition, especially the female. The kittens were not collared because of their condition. The adult female moved the kittens that night and the status of the kittens is unknown.

A young male (M9), approximately 4 months old and offspring of F4, was captured 23 February 1995. This lion was fitted with an expandable collar equipped with a radio transmitter and released.

Four collared lions were recaptured using trained lion hounds. Three adult female lions (F1, F5, F6) were recaptured and new radio transmitters were attached. The subadult female (F2) initially captured 16 February 1993 at approximately 14 months old was recaptured and her collar adjusted.

All animals were recaptured beginning 28 December 1993 to collect blood samples for DNA and disease analysis. Samples are in storage, but have not been submitted for analysis.

We conducted ground and aerial radio tracking of collared lions 10 March 1993 through 14 March 1995. An attempt was made to obtain 1 aerial telemetry location per collared lion every 14 days. Ground telemetry locations were used to supplement locations as needed. We recorded 506 locations for 9 adult lions (4 males, 5 females) and 2 subadult lions (1 male, 1 female). Ground and aerial telemetry locations indicated F2 dispersed from her dam (F3) in September 1993 at approximately 20 months of age. Tracking periods, number of locations, and home areas for individual lions were recorded (Table 2). Mean home area estimates for the 6 females and 4 males was 318.8 km² (123.2 mi²) and 490.5 km² (189.5 mi²) respectively.

Sixty-five scats were collected from January through April 1993, December through April 1994, and January through March 1995 as they were encountered during field activities. Analysis of the scats collected in 1993 and 1994 indicated 3 prey components: deer, collared peccary, and lagomorphs. Only 1 prey item was present in each scat. Peccary were the most important prey with a frequency of occurrence of 46.7%. Deer and lagomorphs were the second and third most important prey with frequencies of 42.2% and 11.1%, respectively.

Incidental observations of lion kills were investigated and verified. Observers attributed 4 collared peccary kills and 2 mule deer kills to lion predation.

Spotlight surveys conducted during November 1992, September 1993 and October 1994 indicated mule deer densities varied from 3.36 to 5.60 deer/400 ha (1,000 acres) on BBRSP. The spotlight surveys also included furbearers, rab-

Table 2. Home ranges (HR) as determined from aerial and ground radio telemetry locations for 11 collared mountain lions on Big Bend Ranch State Park (BBRSP), Texas, between March 1993 and March 1995.

| Lion ID | Tracking period | N locations | Home range | |
|---------|---------------------|-------------|-----------------|--------------------|
| | | | km ² | (mi ²) |
| F1 | 10 Mar 93–14 Mar 95 | 79 | 231.5 | (89.4) |
| F2 | 10 Mar 93–3 Jun 94 | 61 | 505.3 | (195.2) |
| F3 | 25 Mar 93–8 Nov 94 | 72 | 386.1 | (149.2) |
| F4 | 19 Jan 94–14 Mar 95 | 40 | 329.8 | (127.4) |
| F5 | 2 Feb 94–14 Mar 95 | 38 | 292.7 | (113.1) |
| F6 | 1 Mar 94–14 Mar 95 | 30 | 167.4 | (64.7) |
| M1 | 10 Mar 93–14 Mar 95 | 81 | 699.5 | (270.2) |
| M2 | 1 Feb 94–2 Feb 95 | 36 | 316.6 | (122.3) |
| M3 | 8 Jan 94–26 Jan 94 | 3 | | a |
| M4 | 1 Feb 94–10 Dec 94 | 26 | 348.7 | (134.7) |
| M5 | 6 Apr 94–14 Mar 95 | 28 | 597.1 | (230.7) |
| M6 | 7 Feb 95–14 Mar 95 | 4 | | a |
| M7 | 11 Feb 95–14 Mar 95 | 4 | | a |
| M8 | 9 Mar 95–14 Mar 95 | 2 | | a |
| M9 | 1 Mar 95–14 Mar 95 | 2 | | a |
| | | Total | 506 | |

^aInsufficient number of locations for determining home range.

bits, and hares (Table 3). There is no reliable technique for surveying collared peccary; therefore, their population density is unknown.

Discussion and Summary

We have just completed the third year of a 5-year study on BBRSP. Even though the information presented here is preliminary, comparisons from previous Texas mountain lion studies can be made. Home range estimates of male and female mountain lions on BBRSP indicate larger ranges than those estimated on Big Bend National Park and Guadalupe Mountains National Park. Mountain lion home ranges, as determined by previous Texas mountain lion researchers, ranged from 59 km² to 159.3 km² for females (Harvey and Stanley Associates 1986) (Waid 1990). Female lions on BBRSP ranged from 167.4 km² to 505.3 km².

Two years remain on the BBRSP mountain lion study and future activities will be conducted to accomplish the objectives. These include capturing and collaring new resident lions, capturing and collaring juvenile lions born to collared resident females, continuation of telemetry activities of all collared lions, submission of samples for analysis, and the continued inclusion of Wildlife Division personnel to familiarize them with the basics of mountain lion ecology.

Table 3. Mule deer, furbearer, rabbit, and hare census data determined from spotlight surveys on Big Bend Ranch State Park (BBRSP), Texas, November 1992, September 1993, and October 1994.

| Year | Animals/400 ha (1,000 acres) | | | | | | | Animals/1.6 km (mile) | | |
|------|------------------------------|---------|----------|--------|--------|-------|-------------------|-----------------------|------------|--|
| | Mule deer | Kit fox | Gray fox | Coyote | Bobcat | Skunk | Unknown furbearer | Jack rabbit | Cottontail | |
| 1992 | 5.60 | 0.40 | 0.27 | 0.27 | 0 | 0 | 0.40 | 0.10 | 0 | |
| 1993 | 5.12 | 0 | 0.23 | 0.15 | 0.15 | 0.23 | 0 | 0.10 | 0.03 | |
| 1994 | 3.36 | 0 | 0 | 0 | 0.13 | 0 | 0 | 0.08 | 0.03 | |

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