HOME RANGE OF CREVICE SPINY LIZARDS (SCELOPORUS POINSETTII) AT MASON MOUNTAIN WILDLIFE MANAGEMENT AREA, MASON COUNTY, TEXAS

THESIS

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By

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DEDICATION

To my loving children,

Kady, Logan, and Molly

We took the road least traveled, the journey was long, difficult, exciting and memorable, but we finally made it.

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TABLE OF CONTENTS

LIST OF TABLES

PAGE

LIST OF FIGURES

PAGE

ABSTRACT

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Daily movements, home range size, and habitat use patterns were quantified for crevice spiny lizards (Sceloporus poinsettii) at Mason Mountain Wildlife Management Area, Mason County, Texas. Habitat parameters also were assessed to determine influence on habitat use during the non-breeding season. Fluorescent powder tracking technique was used to determine the daily movement patterns and home range. Ten male and ten female lizards were captured three times each to determine an average daily movement and home range size. Average daily movements for immature males were 73.4 m and mature males were 52.0 m. Average daily movements for immature females were 54.2 m and mature females were 63.1 m. Average home range size was determined to be 590.0 m^2 for females and 660.0 m^2 for males. Home ranges overlapped extensively, but crevice spiny lizards were not found to aggressively defend them. Community groups consisted of multiple immature and dominant mature lizards. Behavioral observations were conducted throughout the research period. Data suggested that vertical granite rock surfaces were primary use areas, while the horizontal plane was used to move between vertical surfaces. It is recommended that studies of home range size and

daily movements be repeated in future years during breeding season to ascertain trends in movement patterns and multiple usage of home range areas.

CHAPTER 1

INTRODUCTION

The area occupied by an organism during its daily activity frequently is termed the home range. One definition of home range is "that area traversed by the individual in its normal activities of food gathering, mating and caring for young" (Burt 1943). Quantification of home range parameters, such as size, location, content, and movement patterns can yield insight into habitat selection, population dynamics, and population parameters (Warrick et al., 1998). Information about the home range therefore is critical to the understanding of the autecology of any species.

Organisms do not necessarily confine their activities to a two-dimensional plane. The structural nature of a vertical rocky habitat or arboreal nest could be an important component of their home range. Within the three-dimensional space areas not usually considered could account for a large area of the organism's home range. Determining accurate home range size of a complex three-dimensional space may be difficult.

Most studies of members of the genus Sceloporus deal with taxonomy, reproduction, and population dynamics (Ortega-Rubio et al., 1999). Species such as the western fence lizard (S. occidentalis), rosebelly lizard (S. variabilis), and blue spiny lizard (S. serifer cyanogenys) have been studied for overt aggression, aggregation during non-breeding season, and territorial behavior (Greenberg 1977, Sheldahl and Martins 2000). There is however, little information available

on habitat use or home range of the crevice spiny lizard (Sceloporus poinsettii). Crevice spiny lizards are wary, active, diurnal lizards with a maximum length of ca. 215 mm for males and ca. 200 mm for females. Crevice spiny lizards commonly are seen on boulders, in canyons, and on rocky outcrops in arid and semi-arid environments. They rarely are found more than a meter or two from a crevice into which they will retreat when threatened. In North America, this lizard's distribution extends from the Balcones Escarpment through the Edwards Plateau westward through the Trans-Pecos region into southern New Mexico and southward through the states of Chihuahua, Coahuila, and Durango in Mexico (Vermersch 1992).

Various techniques have been used to estimate home ranges of sceloporine lizards, such as the minimum convex polygon method (Rose 1982), bivariate normal distribution method, and nonparametric harmonic mean of location methods (Anderson 1982). None of these studies address the use of a vertical space, nor do they measure distances moved within the home range during daily activities.

Three points often are considered sufficient for determining home ranges by statistical methods and many studies have fewer than 10 points per lizard (Rose 1982). He found that approximately eighteen sightings described 80% of the home range, and were considered the minimum number to represent the home range of the striped plateau lizards (Sceloporus virgatus).

Fellers and Drost (1989) used fluorescent pigments to provide more detailed

information than visual sightings of an animal's movements. Island night lizards (Xantusia riversiana) marked with fluorescent pigments showed a large continual trail of powder. Powder continued to be deposited and examined for at least five days, but areas of new activity became increasingly difficult to detect. They used string to delineate daily movements of island night lizards.

In order to get a more accurate estimate of the home range of the crevice spiny lizards it is useful to incorporate horizontal and vertical planes. Few authors address a vertical component of home range. A noted exception is Meserve (1977) who studied habitat use by the white-footed mouse, Peromyscus leucopus.

Behavior is another component in understanding the use of home range by crevice spiny lizards (Waldschmidt 1980). Maintenance behaviors such as postures, movements and orientations were indexed under controlled laboratory conditions on blue spiny lizards, Sceloporus serifer cyanogenys (Greenberg 1977). These behaviors can be used as a model for crevice spiny lizards in an unrestricted natural habitat.

My objectives for this study were:

1. **Calculate and map horizontal and vertical home range of the crevice spiny lizard,**
2. **Calculate and map horizontal and vertical daily movement patterns of the crevice spiny lizard, and**
3. **Make behavioral observations of the crevice spiny lizard in its natural habitat.**

CHAPTER 2

MATERIALS AND METHODS

Study Site

Crevice spiny lizards were studied on the granite outcrops of Mason Mountain Wildlife Management Area, (hereafter, MMWMA), 7 kilometers north of the city of Mason, in Mason County, Texas (Figure 1). The primary habitat for the crevice spiny lizard at MMWMA is the Granite Hills Range Site. The Granite Hills overlies parent material of pink Katemcy batholith (Schwertner 1998).

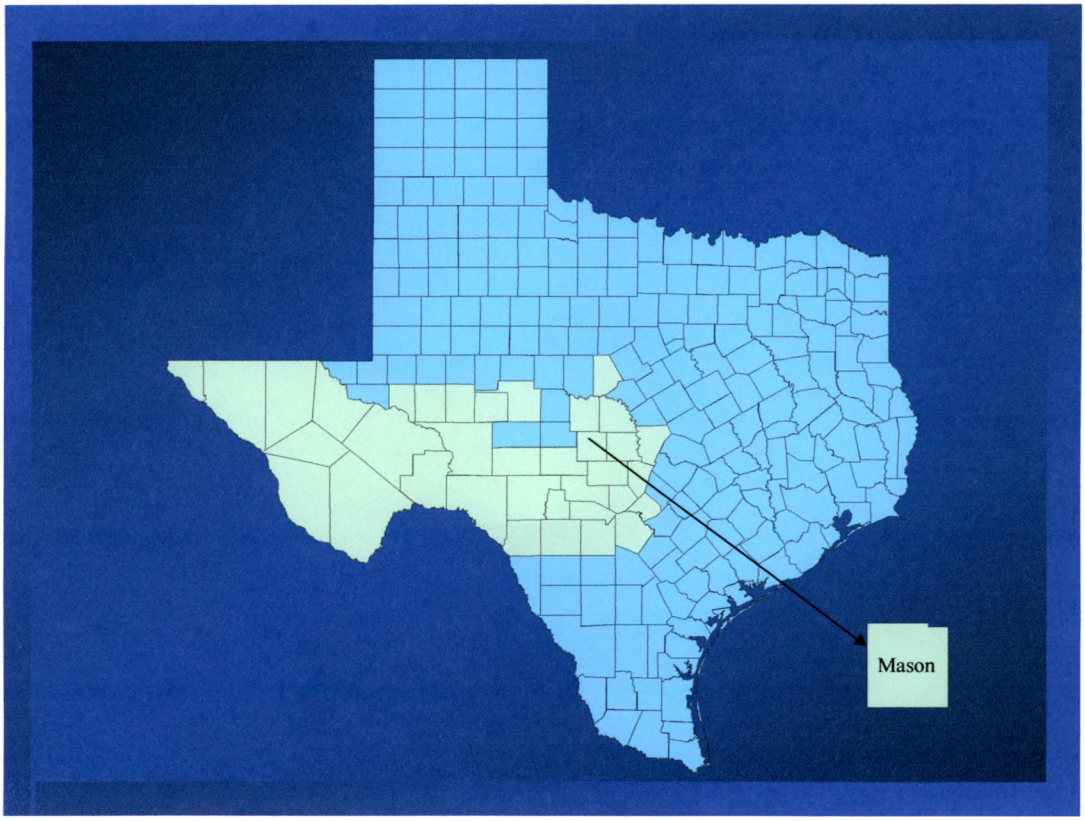
Study Period

The study period began 25 May 2000 and terminated 19 July 2000. The average monthly temperatures, maximum and minimum daily temperatures for May, June and July, along with total precipitation for each month (Table 1) were obtained from climatological data provided by the National Oceanic and Atmospheric Administration (Koil, 2000).

Table 1. Average, minimum, maximum temperatures, and total precipitation for the months of May, June, and July Mason, Texas 2000.

Month	Mean Temperature °C	(min. – max.)	Total Precipitation cm
May	23.9	(17.7 – 30.6)	9.50
June	25.4	(20.1 – 30.7)	9.83
July	28.8	(21.0 – 36.7)	0.00

Figure 1. Distribution of the crevice spiny lizard in Texas with the study site located in Mason County, Texas.



Capture Methods and Measurements

A twelve-foot telescopic crappie pole with a noose made of Spider Line monofilament wire was used to capture crevice spiny lizards. Snout-vent length (SVL) and total length (TL) were recorded to the nearest one mm for each lizard. Weights were determined to the nearest gram using a Pesola Micro-line Spring scale. Probing technique was used to determine sex. Males were considered immature if SVL was shorter than 95 mm. Females were considered immature if SVL was shorter than 85 mm (Ballinger 1973). A Schultheiss thermometer was used to determine cloacal temperatures. Overall conditions of the lizards were noted with any abnormalities recorded.

Fluorescent Pigment Tracking

Ten male and ten female crevice spiny lizards were marked with Radiant color fluorescent pigments #R-103-G and tracked using a Raytector-V Portable UV light, based on methods developed by Fellers and Drost (1989). The males and females captured and tracked three times were used in the analysis of home range and daily movements. Daily capture occurred from 7:00 a.m. to 10:00 a.m., leaving a maximum period of daytime activity after release. Lizards, with the head covered to protect eyes, nose, and mouth, were placed into a small plastic container filled with fluorescent pigment. The container was gently shaken to cover the body with pigment (Figure 2). Lizards then were released near the point of capture because Rose (1982) noted that any disturbances of a population's social structure, such as removing a lizard, is likely to produce changes in the home ranges and territories of adjacent lizards. In subsequent captures, different color pigments of pink, green, or chartuse were used to distinguish between tracking events and lizards.

Figure 2. Dusting fluorescent pigment on a crevice spiny lizard at MMWMA.

Coordinates (UTM) of capture sites were determined with a Garmin GPS-12 unit.

The ultraviolet light tracking started after 10:00 p.m. to follow trails of pigment residue left by lizards. Pieces of masking tape were placed at approximately 15-cm intervals along the pigment route until the lizard was found (Figure 3). The use of masking tape prevented the obliteration of the marked trail overnight. Distances were measured to the nearest 1.0 m to determine the lengths of daily movement. Outer most points of the marked trail were measured on all surfaces to estimate the home range. The minimum convex polygon method was used to calculate area on the horizontal surfaces. The vertical surfaces of the boulders were estimated using best-fit polygons (Figure 4). The vertical and horizontal measurements were added to obtain a total home range for each lizard captured three times.

Figure 3. Marked trail left by a crevice spiny lizard powdered with fluorescent pigment.

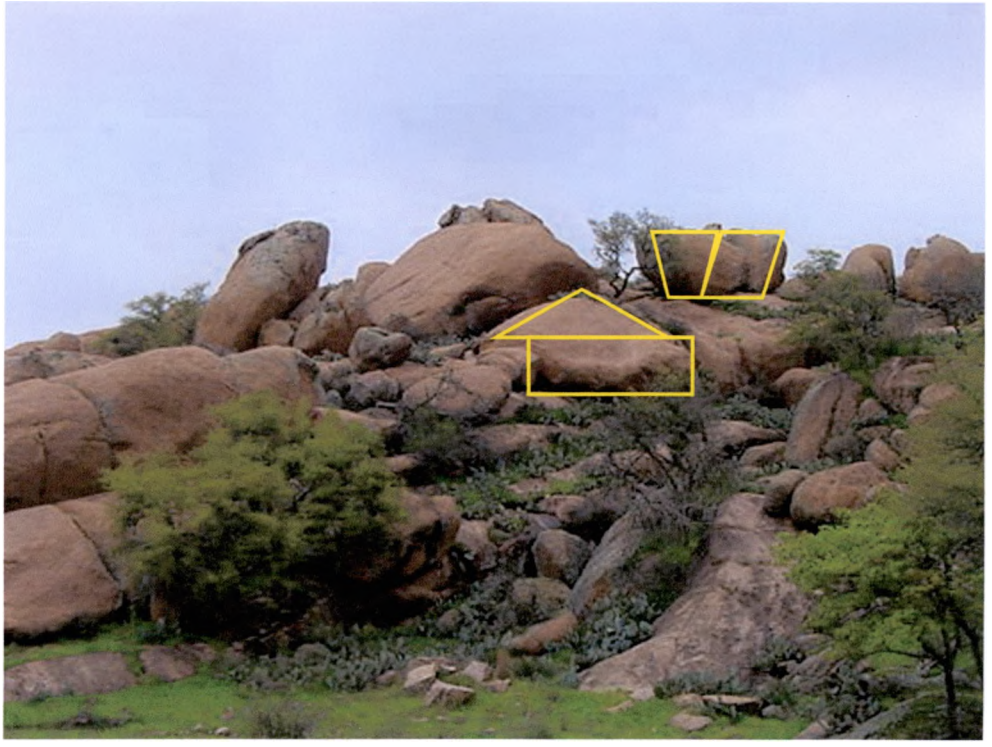


Figure 4. Vertical surface area estimated using polygons of best fit.

To measure habitat parameters, two perpendicular line intercepts were taken between the farthest points of travel in each home range to estimate percent ground cover. Temperature and relative humidity were measured using a thermo-hygrometer, at the point of capture. The site was photographed using a 35-mm camera and a Sony digital camera. A surveying pole was placed in each photo to give a reference point for height and width of each boulder in an outcrop.

Lizards captured a fourth time, were marked with a passive integrated transponder (PIT). The PIT was injected subcutaneously on the dorsum with a 5-gauge hypodermic needle. A PIT reader was used to read the individual code (Germano and Williams 1993). Information obtained in my study will be used to start a permanent record of the crevice spiny lizard on MMWMA for future studies involving population size, movement patterns and immigration and emigration within the study area.

Behavioral Observations

Behavioral observations were made throughout June and July to record actions related to habitat use by crevice spiny lizards. Observations were made for one-hour followed by a one-hour period of rest, permitting six hours of observation per day. For each observation period, temperature and relative humidity were recorded. Directional positioning of lizards on vertical and horizontal surfaces, orientation toward the sun and shade, and the number of lizards present in the area also were recorded. Behaviors observed included basking, adjustments in position, resting, foraging, walking, agonistic pushup movements, and fleeing. Total time for each behavior throughout the study was used to calculate percent of time spent in each behavior. Straight-line distances were measured from the

initial location of a lizard to its location at the end of an observation period. Basic postures and movements were noted during observation periods based on the blue spiny lizard ethogram (Sceloporus serifer cyanogenys) by Greenberg (1977). The categories selected were:

1. **Body-down: ventrum resting on substrate,**
2. **Walking: body slightly elevated, tail down, forward movement often interrupted by pauses,**
3. **Jumping: jumping between elevated positions or up or down between elevated sites and the ground,**
4. **Head-up: head tipped up from horizontal,**
5. **Anterior body-up: elbows maximally straightened,**
6. **Positive orientation: animal faces stimulus (sun), and**
7. **Negative orientation: animal faces away from stimulus (sun).**

Statistical Tests

The data were analyzed using a t-test (Voelker et al. 1993). Parameters tested included:

1. **The horizontal vs. vertical area of the crevice spiny lizard home range,**
2. **The total home range size, horizontal and vertical, between male and female lizards,**
3. **The total home range size between mature and immature lizards by sex,**
4. **Total distances traveled per day by male and female lizards, and**
5. **Distances traveled per day by mature and immature lizards by sex.**

A Chi-square test (Voelker et al. 1993) was used to evaluate time spent on vertical vs. horizontal surfaces by the crevice spiny lizards.

CHAPTER 3

RESULTS

A total of 102 lizards was captured (36 mature males, 28 immature males, 8 mature females, 24 immature females, and 6 juveniles). There were 160 recaptures (Figure 5). Only two fatalities of marked lizards were noted.

There were 14 site locations for the multiple recaptures of the 10 male and 10 female lizards for determining home ranges and daily movements. One of the 14 sites had an immature female and mature male, sharing the same area. A second site had three immature females and two mature males. Average home range size for crevice spiny lizards (vertical and horizontal components combined) was 628.8 m^2 (min. 195.5 m^2 – max. 1033.7 m^2). The average horizontal component was 368.0 m^2 (min. 99.85 m^2 - max. 671.05 m^2). The average vertical component was 268.0 m^2 (min. 95.66 m^2 – max. 487.64 m^2) (Table 2). No significant difference was detected between the vertical and horizontal surface areas (t-calculated 1.72 < t-critical 2.44). No significant difference was detected in mean home range size between males and females (t-calculated .52 < t-critical 1.83).

Table 2. Average home range sizes (m^2) for male and female crevice spiny lizards at MMWMA.

	Averages all Lizards (n=20)	Average all Males (n=10)	Average all Females (n=10)
Horizontal + Vertical	**628.8 ± 272.6**	**657.6 ± 270.5**	**600.1 ± 286.0**
Horizontal only	**368.0 ± 197.1**	**385.7 ± 192.5**	**344.0 ± 217.2**
Vertical only	**268.0 ± 118.5**	**275.5 ± 120.7**	**260.5 ± 122.3**

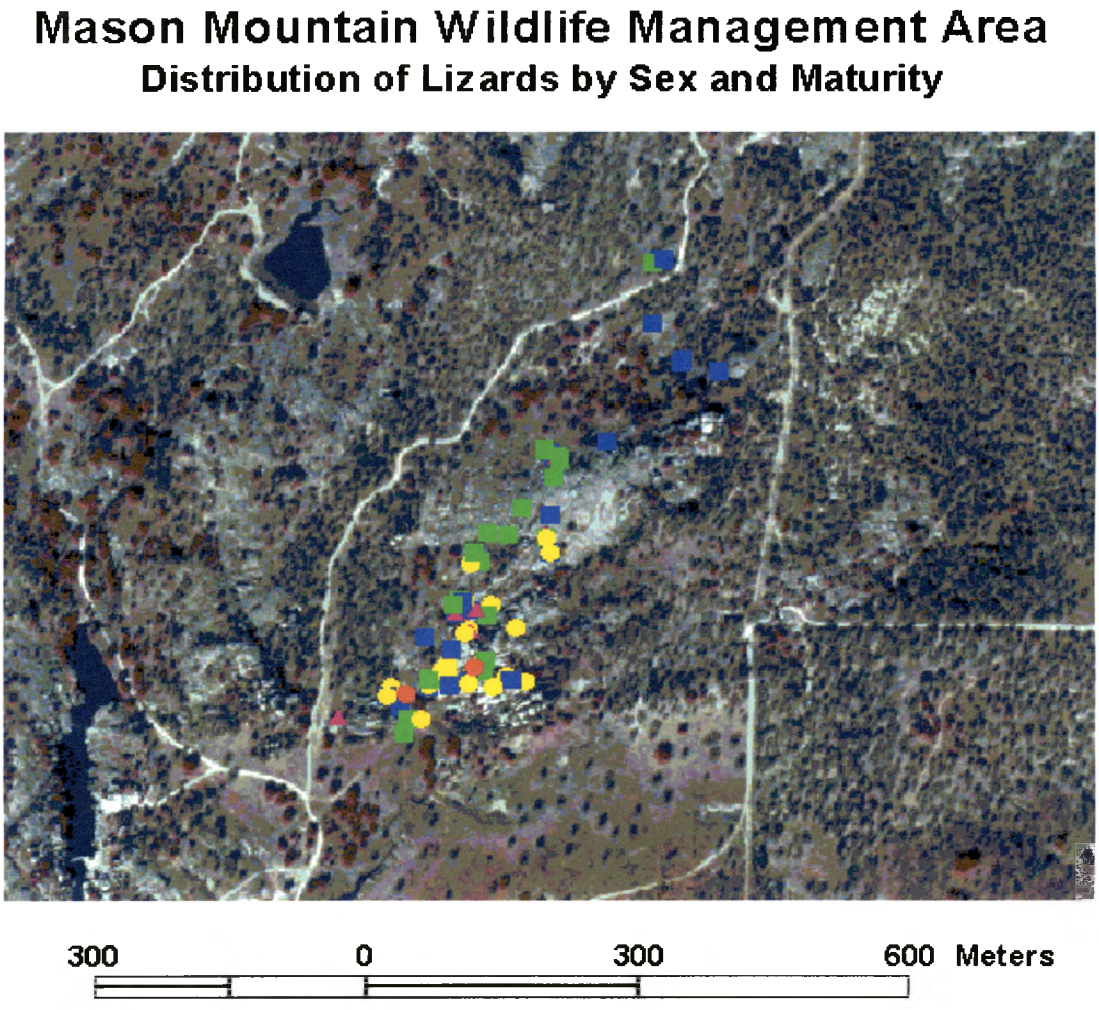


Figure 5. Distribution of lizards by sex and maturity at MMWMA

Daily movements of ten males average 58.5 m/day (min. 40.4 m/day – max. 83.1 m/day). Daily movements of ten females average 57.7 m/day (min. 41.5 m/day – max. 89.3 m/day). There was no statistical difference between males and females in daily movements. A statistically significant difference was detecdted between mature and immature males (t-calculated 5.28 > t-critcal 2.92) (Table 3).

Table 3. Average daily movements of crevice spiny lizards by sex and age at MMWMA

Males (n=10)		Females (n=10)	
Mature (7)	**52.1 ± 10.28**	**Mature (3)**	**68.8 ± 18.4**
Immature (3)	**73.4 ± 8.72**	**Immature (7)**	**53.0 ± 11.6**

Habitat analysis showed within each home range that 86% of the habitat consisted of exposed granite rock. The remaining area consisted of: sticky granite daisy (Heterotheca stenophylla), Virginia creeper (Parthenocissus quinquefolia), Texas persimmon (Diospyros texana), coreopsis (Coreopsis basalis), prickly pear cactus (Opuntia lindheimeri), live oak (Quercus fusiformis), moss , and leaf liter (Table 4).

Table 4. Percentages of vegetation types and substrate at 14 capture sites at MMWMA.

Vegetation/Substrate	Percentages (%)
granite rock	86.0
coreopsis	3.0
prickly pear cactus	2.0
sticky granite daisy	2.0
Virginia creeper	1.0
live oak	0.2
Texas persimmon	0.9
moss	0.9
leaf liter	4.0

Thirty-two hours of behavioral observations were conducted on six lizards. Lizards were in view for 24 of the 32 hours. Lizards spent 67% of their time in full shade, 30% of the time in full sun, 3% time with the body partially in sun and shade. These lizards spent 276 minutes (19%) on a horizontal surface and 1164 (81%) on a vertical surface at MMWMA. Chi-square analysis indicated that crevice spiny lizards spent significantly more time on a vertical surface (X^2 calc. 547.6 > X^2 critcal 3.8) (Table 5). Data suggested that vertical space was used for most daily activities with the horizontal space used when moving between vertical surfaces. Data showed no significant difference between males and females on vertical surfaces.

Table 5. Orientation of lizards during behavioral observations to vertical and horizontal faces of the granite rocks and body location to sun and shade

Orientation	Percentages (%)
Vertical plane	**81.0**
Horizontal plane	**19.0**
Body in full sun	**30.0**
Body in full shade	**67.0**
Body in both sun and shade	**3.0**

Common ancestors of all sceloporine lizards were most likely territorial and would aggressively defend their home range (Ballinger 1973). Throughout the summer, however, crevice spiny lizards occurred in groups, of mixed sex and age. Multiple captures at a single site typically consisted of one mature male and occasionally one mature female, with several immature males and females, and newborns for the season (based on SVL).

CHAPTER 4

DISCUSSION

This project was primarily a descriptive study to get baseline information about Sceloporus poinsettii with regards to their home range and daily movements. Use of home range area indicates that a majority of the time is spent on the vertical surface with the horizontal surface used for travel.

With a substrate of granite rock comprising 86% of the habitat and nearly devoid of vegetation, the use of crevices and rock faces on a vertical plane might aid in spotting and evading predators. An immature female was observed being eaten by a rattlesnake on the horizontal surface. Use of the vertical plane on boulders also could permit a better view of the habitat which might increase foraging success. At MMWMA six other varieties of lizards specie have been identified utilizing the same habitat as Sceloporus poinsettii. Four of these species utilize a strictly horizontal plane preferring rocky washes, and sandy areas in brushy habitat. These species are, Texas earless lizard (Cophosaurus texanus), six-lined racerunner (Cnemidophorus gularis), Eastern collared lizard (Crotaphytus collaris collaris), and ground skink (Scincella lateralis). Two species, Texas spiny lizard (Sceloporus olivaceus), and Eastern tree lizard (Urosaurus ornatus ornatus) utilize both the horizontal and vertical plane. However, they utilize vertical vegetation rather than exposed rock. Sceloporus poinsettii is the only lizard utilizing bare rock on a vertical plane. Perhaps this is a result of resource partitioning at MMWMA providing Sceloporus poinsettii a unique niche.

Lizard density is extremely variable between species, and habitats. Densities of lizard populations are known to fluctuate from 10 to 100 adults/ha (Ortega-Rubio et al., 1999). A study of Sceloporus occidentalis by Sheldahl and Martin (2000)

examining home range size was conducted at two sites. At site #1 the average home range size for males was 299.9 m^2. At the same site, the home range size for females averaged 159.2 m^2. At site #2 the average home range size for males was 289.8 m^2 and the average home range size for females was 331.3 m^2. In my study, home range of males and females averaged much greater (see Table 2).

If only the traditional horizontal component is considered, a large portion of used area (vertical) is ignored. By adding vertical space you increase the estimation of the home range area by ca. 70%.

Future research should include evaluations of home range size and movement patterns during the breeding season. Additional information on microhabitat use would add substantially to our understanding of the crevice spiny lizard.

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VITA

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