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Home Range Of The Florida Scrub Lizard (Sceloporus woodi)

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HOME RANGE OF THE FLORIDA SCRUB LIZARD
(Sceloporus woodi)

Submitted in Partial Fulfillment of the Requirements for
Graduation with Honors to the Department of Biology and
Chemistry at
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ABSTRACT

I studied the effects of gender and habitat patch size on the home range of the Florida Scrub Lizard (*Sceloporus woodi*) for a period of three months during the summer of 1997. Scrub Lizards were trapped using 5-gallon bucket traps, noosing, and visual recapture. Location data collected for the lizards on eight 1-ha trapping grids was used to estimate the lizards' home range size. Significant differences between home ranges of males and females were found. Males had larger home ranges than females. There was no significant difference in home range size between lizards in small versus large patches. In addition, there was no significant interaction between sex of the lizard and patch size in their effect on home range size. Although patch size did not significantly influence home range size, there was a trend toward such an effect, especially for females. Males may have larger home ranges in order to have access to a greater number of females. Both sexes may have slightly smaller home ranges in large patches because lizard density is higher in large patches leading to increased competition. My results suggest that
gender and possibly patch size can have significant effects on life history parameters such as home range.
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INTRODUCTION AND LITERATURE REVIEW

Study Background

How home-range size varies among species has long been a subject of ecological interest (Schoener et al. 1982). Many factors affect home range sizes in lizards such as sex, body size, time of year, trophic level, foraging behavior, population density, energetic requirements, social behavior, and mate availability (Van Sluys 1997).

One focus of this project was to determine the effects of the lizards' sex on the home range of the Florida scrub lizard. According to Van Sluys (1997), home range selection in lizards may differ between sexes. This difference may result from differing reproductive strategies. A male's fitness may be more affected by mate supply whereas a female's fitness may be more influenced by food supply (Schoener et al. 1982).

A second focus of this project was to determine the effects of habitat patch size on the lizards' home ranges. This is important because effects associated with patch size also may be deterministic and directly influence individual fitness and, consequently, the survival of local populations (Branch et al. 1996).
A third aspect of this study was to determine if there were any significant interactions between the sex of a lizard and habitat patch size. Because the home range is one characteristic of the life history of the lizard, information from this research may be used as an aid to help assess current models that examine the persistence of regional populations of the lizard.

This study was conducted on Avon Park Air Force Range (APAFR), in Florida (Fig. 1), and was a continuation of the research carried out to determine the association between habitat patch size and demographic parameters of the Florida scrub lizard (Branch et al. 1996). In addition to scrub lizard home range analysis, incidental data was collected regarding the herpetological fauna that exists on Avon Park Air Force Range (APAFR). This data was combined with existing data to provide a continual assessment of species diversity on APAFR.
Scrub Habitat

The location of scrub in Florida has been correlated with such ancient marine features as dunes, beaches, bars, and submerged hilltops (Jackson 1973a). In fact, many of the inland scrub patches have probably persisted on fossil dune systems since the early Pleistocene (Myers 1990). However, recent times have seen the loss of scrub habitat. More than 70 percent of the southern Lake Wales Ridge (located in central Florida) xeric uplands has been lost to citrus cultivation and residential development in the past forty years, and much of the central ridge has suffered the same fate (Myers 1990). Approximately 80 percent of Florida’s original scrub has been destroyed (Stap 1994).

The sand-pine scrub that the Florida scrub lizard prefers is a two-layered fire subclimax in which sand pine (Pinus clausa), often closely spaced, is the sole overstory species. The understory is a chaparral of several scrub species (Jackson 1973a), including oaks (Quercus geminata, Q. myrtifolia, Q. inopina, Q. chapmanii) and Florida rosemary (Ceratinola ericoides). Other vegetation commonly seen includes rusty lyonia (Lyonia ferruginea) and saw palmetto (Serenoa repens; Myers 1990). Soils supporting scrub vegetation are excessively well drained, siliceous
sands practically devoid of slit, clay, and organic matter and thus low in nutrients. In fact, the appearance and stature of scrub vegetation seems to be due primarily to the low nutrient supply rather than dry conditions (Myers 1990).

A variety of animals make the scrub habitat their home. These animals include the Florida mouse (Podomys floridanus), the Florida Scrub Jay (Aphelocoma c. coerulescens), the Florida scrub lizard, the sand skink (Neoseps reynoldsi), and the blue-tailed mole skink (Eumeces egregius lividus). The scrub jay, sand skink, and blue-tailed mole skink are federally listed as threatened. In addition to animals, scrub supports several thousand species of arthropods (Myers 1990). Numerous plants are also found in scrub. Nowhere else in the United States, including Hawaii and Puerto Rico, do so many endangered plants occur so near to each other (Stap 1994).
Sceloporus woodi

The Florida scrub lizard was the focal animal of this research project. One reason that this lizard was used in this study is that it is in need of further study and may greatly benefit from careful management of scrub habitat on APAFR (Branch et al. 1996). Secondly, this lizard is abundant on APAFR. Florida scrub lizards were found in 29 scrub patches on APAFR (Branch et al. 1996). Also, the distribution of scrub lizard populations is known to be influenced by landscape features including patch area (Branch et al. 1996).

The scrub lizard is characteristically found in sand-pine scrub but can be found in adjacent beach dune scrub, longleaf pine-turkey oak woodlands, or citrus groves where areas of open, sandy ground exist (Conant and Collins 1991). In fact, the Florida scrub lizard is endemic to the scrub habitats of Central and South Florida (Fig. 2; Branch et al. 1996). The lizard prefers open sandy areas bordering Sand pine scrub and sandhill associations. Like many of its congeners, the lizard could be described as a forest edge species (DeMarco 1992).
The scrub lizard is normally restricted to the sand-pine scrub associated with the Florida Peninsula (Jackson 1973b). It has been found only in scrubs of four regions: the Ocala National Forest, the Lake Wales Ridge, the southwest Gulf Coast in Collier and Lee Counties, and the Atlantic Coast from the vicinity of Titusville south to Miami (Jackson 1973a). This limited distribution may be in part due to the limited dispersal of the lizard. The lizard has a habitat requirement of ground largely free of herbaceous vegetation, and the Florida scrub lizard has never been found in hammocks of low flatwoods (Jackson 1973a). The most likely reason for the lack of the scrub lizards on other suitable scrub areas is poor dispersal, stemming from habitat restriction (Jackson 1973a).

The scrub lizard generally is brown or gray-brown on its dorsal side and whitish on its ventral side with a dark brown lateral stripe separating the two halves of the lizard. The female lizard has dark brown wavy lines across the back. The male lizard has blue patches on the side of the belly and also on the base of the throat. The blue patches at the base of the throat are often bordered by black (Conant and Collins 1991). The lizards are sexually dimorphic in size. Males and females have a mean snout-
vent length (SVL), which is measured from the anterior end of the lizard to the anal opening, of 47.6 mm and 50.5 mm respectively (Jackson 1974). Courtship and mating of the lizards occurs from late March through June (Moler 1992). Large females begin vitellogenesis in late February and deposit eggs by mid-April. Egg deposition continues through August. Hatchlings appear from late June to early November and grow to adult size in ten to eleven months (Jackson 1974).
METHODS

Eight trapping grids were used in this study. The trapping grids were located in eight separate scrub patches on APAFR. Each trapping grid was 1 ha in size and consisted of 100 20-liter plastic buckets which served as pitfall traps. These buckets were placed in 10-m intervals. The grids were placed on patches that ranged in size from 8.5 to 278 ha and in locations within patches that ranged from 42 to 62 percent bare sandy substrate (Branch et al. 1996). The grids were located in patches 16, 27, 30, 79, 80, 82, 83, and 84 (Fig. 2, Fig. 3).

Grids were located in scrub patches that were considered optimal for scrub lizards. To determine if the large versus small patch grid locations were biased in habitat quality factors, patch isolation, vegetation characteristics, rainfall, temperature, and the incidence of arthropods were measured and compared in an earlier study. (Branch et al. 1996).

The patches were divided into two size categories; the four largest patches versus the four smallest patches. Every week of the month, patches were sampled two at a
time, one small patch with one large patch. Over the span of one month, all eight patches were sampled. During the summer of 1997, patches were sampled for a total of two months. Each patch was surveyed twice in this time period.

At the beginning and end of each trapping time, air temperature, rainfall, and wind speed were measured. The rainfall was measured using a rain gauge located at each trapping grid. Rows of the grid were walked and checked for lizards.

Lizards were also captured using dental floss nooses attached to the end of fishing poles. Scrub lizards and racerunners (C. sexlineatus) were sexed, measured for snout to vent length and mass, and given a permanent toe clip number and a temporary paint marking. The permanent toe clips were applied using scissors and cutting off a variety of toes to provide each lizard with a specific number. The toes were cut so that there was still some of the digit remaining. The numbers were cut according to the system depicted in Fig. 5. For example, lizard number five would have the five toe cut off. Lizard seventeen would have the seven and the ten toe cut off. The location of the lizard on the grid was also recorded.

Lizards were also painted with fingernail polish to
provide an individual paint marking. The markings were applied in various combinations of color and position to the head, front, middle, posterior, and tail (Fig. 6). For example, lizard number one would be painted with a white head and a white front (WHWF). The use of a paint mark on the lizard allowed for visual recapture of the lizard.

In order to prevent trap mortality from dehydration, a piece of foam material was placed in each bucket and wetted down each day. To prevent direct sunlight from entering the bucket, the lids of the bucket were propped up over the bucket using three clothes pins. Ant traps were placed in traps that were determined to have high ant mortality. If possible, I examined the remains of the lizards that succumbed to the ants to determine if they had been captured previously. If this was not possible, I assumed that the lizard had not been captured before.

After the trapping grids had been opened for five days, the buckets were closed and then covered with a small amount of soil. This was done to hinder other animals from uncovering the traps, which would lead to possible incidental trap mortality.

Data from the summer 1997 survey was augmented with capture data provided by Hokit (personal
communication). The augmented data was collected from January 16, 1995 to August 4, 1997. Only lizards that were captured four or more times were used in the home range analysis. I used individual capture data for lizards captured four or more times to construct data files in Microsoft Notepad. I used the minimum convex polygon method in CALHOME (v1.0; Kie et al. 1994) to calculate home range size. The minimum convex polygon is extremely sensitive to sample size: the smaller the sample, the smaller the area (Schoener et al. 1982). One problem with the minimum convex polygon method is that there is error in the estimate of home range for lizards with less than 10 - 15 observations (Schoener et al. 1982). However, the purpose of this study was to provide a relative comparison between the genders and between large versus small patches and not to precisely estimate home range size. The program was set to calculate the 90% home range size. This provided both a graphical display of the home range and a numerical output in square meters. The area of home range was than imported into SPSS v7.5 (Noruisis 1996) for statistical analysis.

Data was organized into four treatment categories: males versus females in small versus large patches. All lizards that had a calculated home range of zero were
omitted from the data. I then used Analysis of Variance (Zar 1984) to test for differences in home range size between treatments.
RESULTS

Analysis indicated that there was a significant difference between the home ranges of male and female lizards (Table 1; Fig. 7). There was no significant difference in home range between small versus large patches and there was no interaction between sex and patch size (Table 1).

Males had a larger home range size than did females. Male home range sizes average 416.3 m² while females' averaged 223.4 m².
DISCUSSION

It is apparent from the statistical analysis that there is a significant difference between the home range of male and female lizards. It was found that the home range of the male is significantly greater than that of the female. This is consistent with findings of other lizard home range studies (Schoener et al. 1982 and Van Sluys 1997). The male lizards have a general tendency to have a greater home range than female lizards (Van Sluys 1997). The scrub lizard is sexually dimorphic (Moler 1992), which could account for the observed difference in home range sizes between sexes (Van Sluys 1997). In some cases, male territories depend on the presence and dispersion of females; but for females, the selection of home ranges is independent of males (Van Sluys 1997). Accordingly, several lizard studies suggest that home ranges of male lizards are larger than home ranges of females because male home range size is influenced predominately by reproductive opportunities and female home range is influenced by food resources (Branch et al. 1996).

The hypothesis that there is a significant difference
in lizard home range in large versus small patches was marginally rejected, assuming a significant $P$-value of 0.05. The analysis clearly shows that there is no significant effect of the interaction of patch size and sex on the home range of the lizard. Although not statistically significant, graphical examination suggests a trend toward home range differences, especially for females. The difference in home ranges for females from patches of different sizes is nearly significant but less so for males (Fig. 7). Because of high variability in home range estimates, further sampling may reveal significant associations between female home range size and patch size.

Such an association would fit with findings that other life history characteristics are significantly influenced by patch size (Branch et al. 1996). Patch size was found to influence scrub lizard density, survivorship, recruitment, and growth rate. Density, survivorship, recruitment, and male growth rate, were positively associated with patch size. Female growth rate was negatively associated with patch size, suggesting that females were competing more for food resources in the high density patches.

Many studies have suggested that small populations may
go extinct more readily than large population due to stochastic factors (Shaffer 1981; Caughley 1994). Smaller populations have a higher probability of going extinct due to demographic, environmental, and gene for stochasticity. However, small populations may also be affected by deterministic factors (Thomas 1995; Branch et al. 1996). Habitat change and edge affects may be greater in small versus large patches. For example, predators from neighboring habitats may penetrate small patches more readily than large patches because small patches have a higher perimeter to surface area ratio.

My study suggests that gender, and possibly patch size, may influence home range size. These results, together with those of Branch et al. (1996), suggest that deterministic factors may be as important as stochastic processes in influencing population persistence. If so, such deterministic effects should become an integral part of any regional population model.
Table 1. Analysis of variance (ANOVA) of home range.

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<th>P</th>
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Figure 1. Map of APAFR and Arbuckle State Forest depicting presence of *S. woodi* (from Branch et al. 1996).
Figure 2. Distribution of the Florida scrub lizard (after DeMarco 1992).
Figure 3. Map of the scrub patches and occupancy by *S. woodi* in the north cluster on APAFR (from Branch et al. 1996).
Figure 4. Map of the scrub patches and occupancy by *S. woodi* in the south cluster on APAFR (from Branch et al. 1996).
Figure 5. Numbering system for permanent toe clips.
Figure 6. Paint mark locations on *S. Woodi* for visual recapture.
Figure 7. Mean home range size (+SE) of *S. woodi* in small and large patches.
LITERATURE CITED


