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Habitat preferences of four species of lizards found at the Las Vegas Springs Preserve

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Habitat Preferences of Four Species of Lizards Found at the Las Vegas Springs Preserve

by

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INTRODUCTION

Developing an understanding of the habitat usage of reptiles is important when trying to develop a management or restoration plan that is compatible with what is known of the reptile species that are being investigated. There are many lizard species found in the Mojave Desert, but there are only four known to inhabit the Las Vegas Springs Preserve (LVSP) in Las Vegas, Nevada. In the LVSP, sites are going to be restored with native Mojave Desert vegetation. Since there are many habitat types in the Mojave Desert, we must determine which types would be best suited for the four species of lizards at the LVSP. Therefore this study will determine habitat usage by the four species of lizards at the LVSP.

One issue that arises in determining the true habitat found at the LVSP is whether the lizards are using the habitat around the array or are they moving from a nearby habitat. Research is limited on home range and foraging dealing with the four lizard species, and the area of study is small and isolated, so determining where exactly the lizards are coming from is not possible for this study.

Owing to the isolation of the population of lizard species, they may in some way become specialized to certain habitat types. If the area is restored to a habitat type that is not used by the four species of lizards, then this could cause populations to move or be less viable and hence disrupt the current ecological balance.

The four species of lizards that are found at the LVSP are: *Cnemidophorus tigris* (*C. tigris*), *Uta stansburiana* (*U. stansburiana*), *Sceloporus magister* (*S. magister*), and *Xantusia vigilis* (*X. vigilis*). These are all common species that are found in the Mojave Desert region of the United States (Behler and King, 2002). Although these species are found in the same region, they have different habitat preferences, and activity patterns (Table 1 and Table 2).

Table 1. Activity patterns and habitat preference for four species of lizards found at the Las Vegas Springs Preserve.

Species	Substrate	Perennial Plants	Daily Activity	Home Range
C. tigris	Sandy	Widely Dispersed	Cooler parts of the day	M=0.07 ha F=0.04 ha
U. stansburiana	Sandy	Abundant, with moderate ground cover	Midday hours	M=0.02-0.08 ha F=0.01-0.05 ha
S. magister	Rocky	Trees	All day	Unknown.
X. vigilis	Duff and leaf litter	Yucca and Joshua trees	Diurnal	Unknown

Table 2. Food preference, cover source, and seasonal activity of the four species of lizards found at the Las Vegas Springs Preserve.

Natural history variable	Category	*U. stansburiana*	*C. tigris*	*S. magister*	*X. vigilis*
Food	Grasshoppers		X	X	
	Spiders	X	X		
	Beetles		X	X	X
	Ants		X	X	X
	Termites		X		X
	Scorpions	X			
	Mites	X			
	Ticks	X			
	Flies			X	X
Cover	Dense vegetation		X	X	X
	Shrubs	X	X		
	Trees		X[a]	X	X
	Rocks	X		X	
	Sparse vegetation		X	X	
	Sandy substrates	X	X	X	X
Active seasons	January - February	X[b]			
	March-April	X			
	May – June	X	X	X	X
	July – August	X	X	X	X
	September – October	X			
	November - December	X[b]			

a: Hotter parts of the day b: Southern extent of the range

Cnemidophorus tigris

C. tigris (Squamata: Teiidae) is commonly known as the western whiptail lizard and is known for its long tail. There are 55 species found in the genus *Cnemidophorus*. They are only found in North, Central, and South America (Collins and Conant 1998). *C. tigris* is approximately 7.0 to 10.2 centimeters (cm) from snout-to-vent in length (SVL). It is common throughout California, except the northwest coast, in most parts of Utah, southwest Idaho, and southeast Oregon, all of Nevada, Arizona, New Mexico, Southwest Colorado, and west Texas (Brown 1974).

This species spends little time in the open and its activity patterns changes throughout the day as temperatures increase. It is known to cross open areas in order to hunt prey and find shade (Morey, 2002). *C. tigris* will spend its time in sparsely covered shaded areas in the cooler parts of the day, and then move to a more complex habitat like tree communities in the hotter part of the day so it can remain active (Asplund, 1974). Its feeding habits are diurnal and it hunts at the base of vegetation, eating a wide variety of ground dwelling invertebrates, like grasshoppers, spiders, beetles, ants, and termites. Adults are active until early fall, and the juveniles are active into winter depending on local temperature (Morey, 2002). It is reported that *C. tigris* will change its feeding preferences throughout the seasons to match invertebrate availability (Vitt and Ohmart, 1977).

Uta stansburana

U. stansburana (Squamata: Phrynosomatidae) is commonly referred to as the side-blotched lizard (Palermo, 2002). *U. stansburiana* is a ground dwelling lizard that rarely climbs (Palermo, 2002). If rocks or logs are present *U. stansburiana* will sit on top of them to better its view, but if they are not present then it will sit on the mound at the base of large perennial plants (Parker and Pianka, 1975). *U. stansburiana* is also found in sandy substrates with sparse plants, but is not as common there (Tinkle et al., 1962). *U. stansburiana* can grow between 10.2 to 16.9 cm SVL. *U. stansburiana* is found from southeast Washington, through eastern Oregon, southwest Idaho, western Wyoming, almost all of Nevada and Utah, central and southern California, western Colorado, New Mexico, west Texas, and the western half of Mexico (Behler and King, 2002)(Brown, 1974). *U. stansburiana* feeds on a wide selection of invertebrates including scorpions, spiders, mites, and ticks. It is an opportunistic feeder, sit-and-wait predator (Palermo, 2002). It is active throughout the year, but if winter conditions get too harsh it will become inactive (Stebbins, 1954). Male *U. stansburiana* is most active in the spring when it is their mating season, but their activity declines throughout the rest of the year (Tinkle, 1967).

<u>Sceloporus magister</u>

S. magister (Squamata: Phrynosomatidae) is commonly referred to as the spiny lizard (Marlow, 2002). *S. magister* becomes active in April and remains active until October (Marlow, 2002). The average length of *S. magister* is between 8.9 to 14.0 cm SVL. It ranges from central and southern California, central Nevada, central Utah, south west Colorado, New Mexico, west Texas, and into northern and western Mexico (Brown, 1974). *S. magister* is most commonly found in rocky areas where it finds perches on necessary cover, but if there are no rock outcrops then they will perch in trees, such as yucca, cottonwoods, willows, and mesquites. Adults are largely arboreal, but the juveniles are most commonly found on the ground (Stebbins, 1954; Tinkle, 1976). *S.*

magister is diurnal and it feeds primarily on ants, beetles, flies and grasshoppers (Marlow, 2002). In southern California *S. magister* has been known to prey on *Xantusia vigilis* (Perkins et. Al., 1997). There is no information available on its home range, but it is found in densities of 6-50 animals per hectare. It is also believed to be territorial, but this information is anecdotel (Marlow, 2002). Tinkle (1976) found that even with *S. magister* being arboreal, *C. tigris,* and *U. stansburiana* were common in the study area, owing to the surrounding vegetation.

Xantusia vigilis

X. vigilis (Squamata; Xantusiidae) is commonly referred to as the Desert night lizard (Marlow a, 2002). *X. vigilis* ranges in size from 9.5 to 12.9 cm from SVL, and its most distinguishing feature is that it has no eyelids. It ranges from Southwest Utah, southern Nevada, northwest Arizona, southern California, and into northern Mexico. It is diurnal, and it feeds on termites, ants, beetles, and flies (Behler and King, 2002). *X. vigilis* was once thought to be a rare species, but it has been determined that little was known about its activity patterns. The habitat that *X. vigilis* is most commonly associated with is the downed branches of the yucca tree. It is also sometimes referred to as a yucca night lizard. *X. vigilis* is also found in other types of duff material like downed cottonwood trees, and pinyon-juniper treess. They are usually found in tree habitats that have pines, Joshua trees, yuccas, and oaks, and that provide some canopy cover. *X. vigilis* prefers partially decaying logs to newly fallen logs, with peeling bark and deep grooves (Morafka and Banta, 1973). *X. vigilis* is active from early April until early fall, depending on elevation. The daily activity patterns are hard to determine because of their secretive behavior, but in lab experiments it was determined to be mostly diurnal

(Marlow, 2002). The home range of *X. vigilis* is hard to determine because of its secretive behavior, but it is believed that it will spend its entire life under one log, or will remain in its cover site and the areas adjacent to it (Miller, 1951).

MATERIALS AND METHODS

In 2002, 7 pit fall reptile arrays were put into the LVSP in 4 different habitat types: trees, *Atriplex*, open scrub, and knapweed. The dominant vegetation that was found in the immediate area determined these categories. In 2003, 7 more arrays were established. These fell in the same habitat type, but a new habitat type was included, named “Disturbed,” because the vegetation in the area was completely removed and is now barren ground.

Literature searches would lead us to believe that *C. tigris* and *U. stansburiana* would be found in the knapweed, open scrub, and atriplex habitat types. Research also shows that *S. magister* and *X. vigilis* would most likely be found in the tree habitat type. The proposed hypotheses are: 1) Are *C. tigris* and *U. stansburiana* most abundant in the habitat types known as knapweed, open scrub, and *Atriplex*? 2) Are *S. magister* and *X. vigilis* most abundant in the tree habitat type? 3) Is there a difference in the Macrohabitats between captures and no captures of each species? 4) Is there a difference in the microhabitats between captures and no captures? 5) Are the habitat names truly representative of the actual habitat type?

Study Site

The LVSP is located in the central part of Las Vegas, in Clark County, Nevada. It is in Section 29 and 30, in Township 20S, and Range 61E. LVSP is bordered by US Highway 95 to the north, Valley View Boulevard to the west and Alta Drive to the south

(Seymour, 2001). LVSP has been inhabited for thousands of years, it was not until the early 1900's that the springs were being used beyond capacity (Seymour, 2000). The Railroad companies moved and this opened the area for exploration from the east. This promoted the introduction of new plants for their aesthetic value. This introduction of knapweed, which flourishes in disturbed areas, started to dominate the site (Seymour, 2000).

There are many types of vegetation found in the Mojave Desert, but just a few of them are found at the LVSP. The more common ones that are found at the LVSP are the *Atriplex canescens, Acacia greggii, Prosopis glandulosa*. These species were selected for representation because of there great abundance on the site. These species of vegetation are in close proximity to all known habitat types.

The North Well Field (NWF) of the LVSP (Fig. 1), is dominated by the invasive plant known as Russian knapweed (*Centaurea repens L.*); knapweed is a perennial plant that grows in thick colonies, it is widely established in the western United States and grows in cultivated fields, orchards, pastures, and roadsides, basically anywhere the area gets disturbed (Whitson et.al. 1999).

<u>Trapping Arrays</u>

In this study there were fourteen reptile arrays placed in different areas of the NWF (Fig. 1). Each reptile array was constructed with the following items: seven five-gallon buckets, a dozen two foot wooden stakes, a roll of 48 inch solar screen, seven five-gallon bucket lids, a roll of 48 inch hardware cloth for the snake traps, PVC tees, and staples.

Reptile Array Locations

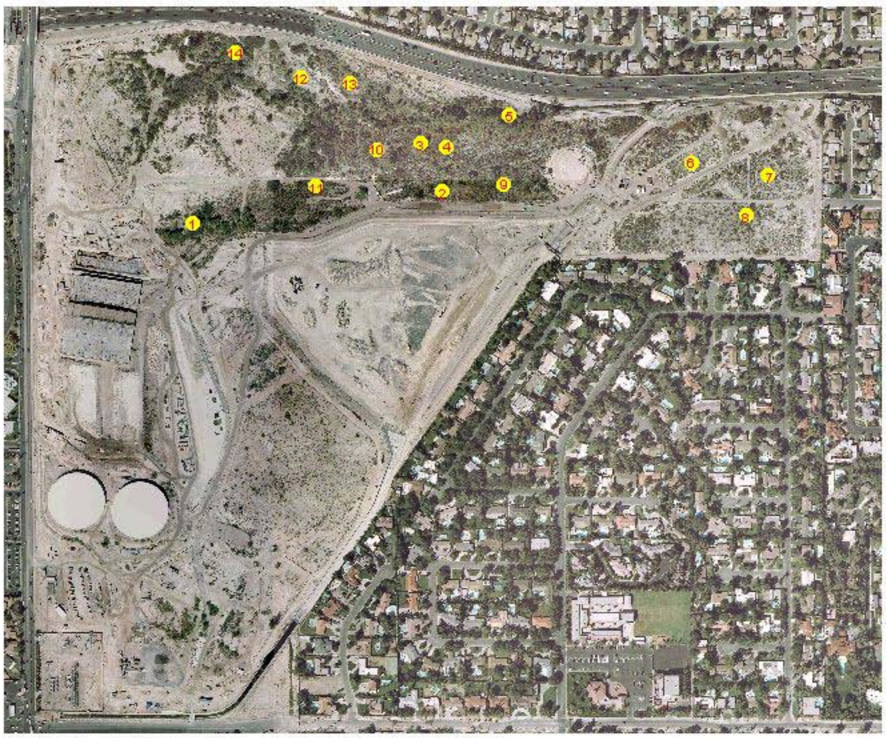


Figure 1. LVSP location, and reptile array location.

Each array had a center bucket with three 10-meter arms that were set at a 120° apart from each other. Then at 10-meters from the center bucket there was an end bucket put in; arms were connected by solar screen. The two-foot wooden stakes held up the solar screen. Then at five-meters or half way down the arm, there was another bucket with a snake trap (Fig. 2). Snake traps were made with 48-inch hardware cloth, and cut and rolled into a cylinder. Two funnels were placed on each end (also made from hardware cloth). The PVC tee was placed in the middle of the cylinder and attached to the five-gallon bucket lid by wire (Fig. 3).

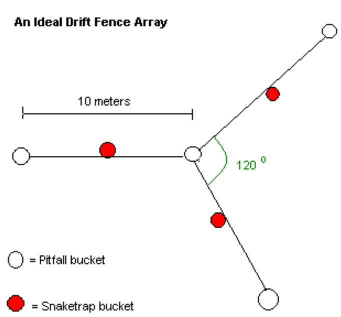


Figure 2. This is a picture of a reptile pit fall array.

Figure 3. This is a photo of a snake trap in the pit fall array.

Sampling Protocol

In April through the month of October in 2003, for a period of one week, reptile arrays were opened for data collection. On the Monday of each sampling week, at approximately 8:00 a.m., the arrays would be opened. The start time changed with the weather conditions, such that the start times were earlier on the hotter days and later on the colder days.

Table 3. Average Temperature and precipitation for the seven trapping periods in this study.

Month	Temperature Average (C)	Precipitation Monthly (cm)
April	16.8	0.97
May	18.9	0.03
June	31.3	0.00
July	34.7	2.74
August	31.7	2.11
September	27.7	1.32
October	23.6	0.00

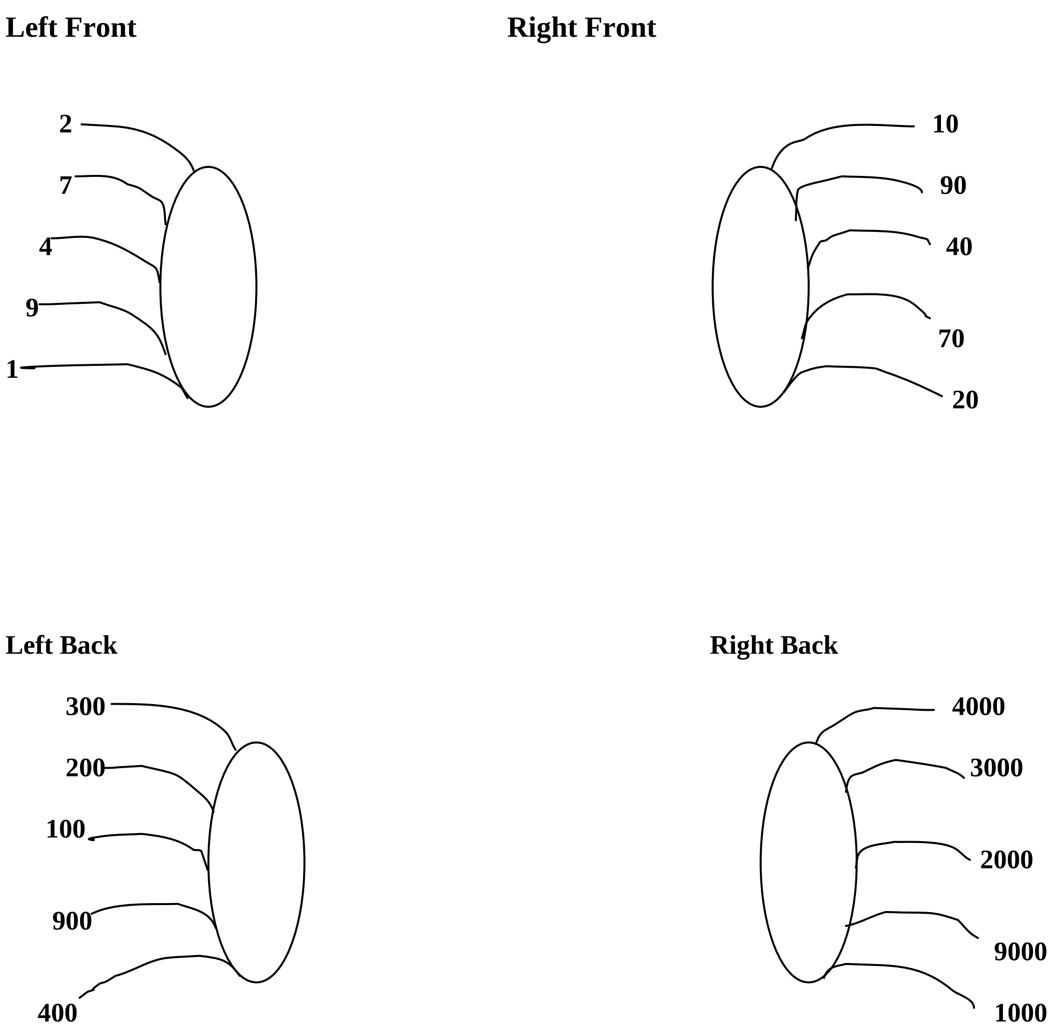
At approximately the same time as the arrays were opened, they were checked to see if any reptiles were caught. All non-target species caught in the bucket were removed and released. The target species that were caught were processed. They were placed in a one gallon ziploc storage bag, measured from tip of snout to the vent in centimeters, and weighed using a 30 or 100-gram pesola scale. Then the lizards were toe clipped for a permanent marking, and each toe had a designated number (Fig. 4). Data on weather conditions and precipitation were obtained from the National Weather Service for each trapping day (Table 3).

Habitat Classification and Analysis

To determine the macrohabitat of the surrounding arrays, we used ArcView GIS. Using an aerial photograph of the LVSP (1 meter resolution), we zoomed into each array until the pixels were visible. In order to go past the end of the array by 10 meters, we used basic trigonometric equations for a 30, 60, 90 triangle to determine the number of squares to encompass a 20 meter area extending from each array arm. Once the area was

Figure 4.

Reptile Toe Clipping Chart:



Reptiles: Front and Back toes

determined, pixels were counted and characterized as ground cover, partial coverage, bare ground and overstory; these were converted to percentages for analysis. To determine what was ground cover and bare ground, the partial coverage was divided in half and each half was added approximately to ground cover and bare ground. Then an independent t-test or Mann-Whitney test was run to compare the percents for capture/no capture arrays (SPSS version 12.0, 2004). This was done to determine if there is a significant difference in the macrohabitat type.

For the microhabitat analysis, three photos were taken from the center bucket down each array arm. By using features on the photo and field interpretations, a scale was determined. Using the array arm as the center, I went a distance of two meters away from the arm on either side. Microhabitat was separated into six categories; Leaf Litter, Duff Material, Shrubs, Mesquite and Acacia, Knapweed, and Bare Ground. The percents were then determined by ocular estimate assuming that the pictures were representing the entire array, and entered into SPSS independent T-test or Mann-Whitney test using the variables percent and capture/no capture (SPSS version 12.0, 2004). This was used to see if there was a difference in the microhabitats.

Simpson’s Index for Diversity was also calculated for each species. This was used to quantify the biodiversity. Simpson’s Index looks at the number of a different species caught and the amount of each species. Diversity is calculated by taking into account both richness and evenness (Figure 5).

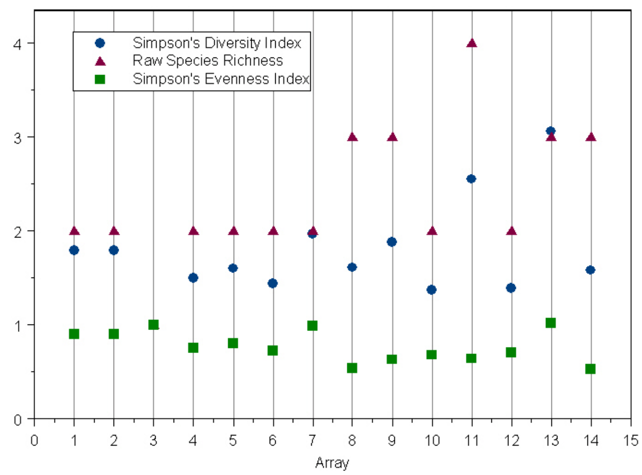


Figure 5. A graph showing Simpson's Index of Diversity, Evenness, and Richness.

Evenness is the abundance of different species caught in the arrays compared to each other. Richness is the number of species present in each array. The evenness for the arrays are all similar because there are only four species of lizards found at the LVSP. The richness for the arrays was all similar except for 5 arrays. Array 8, 9, 13, and14 were all the same which is surprising, because array 13 is disturbed and has no available cover. Array 11 was very interesting because of the high richness; this array had a capture of all four species. The habitat is not the type associated with *X. vigilis* and *S. magister*. *S. magister* juveniles are commonly found on the ground, but the surrounding area is still not common habitat for adult *S. magister.*

RESULTS

Macrohabitat

In the following tables either a t-test for normally distributed data or a Mann-Whitney test for data that was not normal distributed was used to compare means to test if there were any significant differences. The α-level used for the analyses was 0.05, and the hypotheses were H_o: $\overline{X}_1 = \overline{X}_2$ and H_a: $\overline{X}_1 \neq \overline{X}_2$. For the Mann-Whitney test the hypotheses were H_o: $Median_1 = Median_2$ and H_a: $Median_1 \neq Median_2$.

For the species *U. stansburiana* no significant difference were found for ground cover or bare ground; overstory was not present on any of the capture locations, resulting in a significant result (Table 4).

Table 4. T-test and Mann-Whitney test result for *U. stansburiana* for macrohabitat. ns=not significant, s=significant.

Species	Variable	Test statistic	*P*-value	Conclusion
Uta stansburiana	Ground cover	2.036^{t}	0.064	ns
	Bare Ground	0.005^{m}	0.897	ns
	Overstory	$---^{m,a}$	0.005	s

a: Test statistic not calculable
t: Student's t-test
m: Mann-Whitney U-test

For *X. vigilis* no significant difference was found in ground cover, bare ground, or overstory (Table 5).

Table 5. T-test and Mann-Whitney results for *X. vigilis* for macrohabitat. ns=not significant.

Species	Variable	Test Statistic	P-value	Conclusion
Xantusia vigilis	Ground Cover	-1.006^{t}	0.334	ns
	Bare Ground	0.005^{m}	0.798	ns
	Overstory	0.005^{m}	0.551	ns

t: Student's t-test
m: Mann-Whitney U-test

For *S. magister* there was no significant difference in the ground cover, bare ground, or overstory (Table 6).

Table 6. T-test and Mann-Whitney results for *S. magister* for macrohabitat. ns=not significant.

Species	Variable	Test Statistic	P-value	Conclusion
Sceloporus magister	Ground Cover	-1.363^{t}	0.198	ns
	Bare Ground	0.005^{m}	0.671	ns
	Overstory	0.005^{m}	0.284	ns

a: Test statistic not calculable
t: Student's t-test
m: Mann-Whitney U-test

C. tigiris was caught in every array, suggesting that there was no significant difference between the variables Ground Cover, Bare Ground, and Overstory.

Microhabitat

For the microhabitat the same tests apply. The t-test was used for the normally distributed data, and the Mann-Whitney test was used for the data that was not normally distributed. The α-level used for the analyses was 0.05, and the hypotheses were H_o: $\overline{X}_1 = \overline{X}_2$ and H_a: $\overline{X}_1 \neq \overline{X}_2$. For the Mann-Whitney test the hypotheses were H_o: $Median_1 = Median_2$ and H_a: $Median_1 \neq Median_2$.

For the species *U. stansburiana*, five of the variables had data that was not normally distributed so the Mann-Whitney test was run. For the variables Leaf Litter, Duff, and Shrubs the p-values were lower than 0.05, so we reject the H_o. The variables Mesquite/Acacia, Knapweed, and Bare ground were not significant, so we fail to reject the H_o. Mann-Whitney test was used for the variables Mesquite/Acacia and Knapweed and for the variable Bare ground the T-test was used (Table 7).

Table 7. T-test and Mann-Whitney test for *U. stansburiana* for microhabitat. ns=not significant, s=significant.

Species	Variable	Test Statistic	P-value	Conclusion
Uta stansburiana	Leaf Litter	0.005^m	0.05	s
	Duff	0.005^m	0.001	s
	Shrubs	0.005^m	0.018	s
	Mesquite/Acacia	0.005^m	0.119	ns
	Knapweed	0.005^m	0.529	ns
	Bare Ground	1.248^t	0.236	ns

t: Student's t-test
m: Mann-Whitney U-test

The species *S. magister* had for the variables Leaf Litter, Shrubs, Mesquite/Acacia, and Bare Ground, had no significance, so we fail to reject the H_o hypothesis. For the variables Leaf Litter, Shrubs, and Mesquite/Acacia, a Mann-Whitney test was run for not normally distributed data. The Duff variable came up significant so we rejected the H_o. For the variable Knapweed, the test statistic was not calculable (Table 8).

Table 8. T-test and Mann-Whitney results for *S. magister* for microhabitat. ns=not significant, and s=significant.

Species	Variable	Test Statistic	P-value	Conclusion
Sceloporus magister	Leaf Litter	0.005^m	0.255	ns
	Duff	3.248^t	0.007	s
	Shrubs	0.005^m	0.768	ns
	Mesquite/Acacia	0.005^m	0.119	ns
	Knapweed*			s
	Bare Ground	-1.228^t	0.243	ns

*: Knapweed : W= asymptotic 0 The test is significant at 0.000
t: Student's t-test
m: Mann-Whitney U-test

The species *X. vigilis* had no significant difference in all the categories for the microhabitat variable. For Leaf Litter, Shrubs, and Mesquite/Acacia variables, the data was not normally distributed so Mann-Whitney test were run, so we failed to reject the H_o for the variables (Table 9).

Table 9. T-Test and Mann-Whitney results for X. vigilis for microhabitat. ns=not significant.

Species	Variable	Test Statistic	P-value	Conclusion
Xantusia vigilis	Leaf Litter	0.005^{m}	0.411	ns
	Duff	1.411^{t}	0.184	ns
	Shrubs	0.005^{m}	1.000	ns
	Mesquite/Acacia	0.005^{m}	0.461	ns
	Knapweed	-1.036^{t}	0.321	ns
	Bare Ground	-0.116^{t}	0.909	ns

t: Student's t-test
m: Mann-Whitney U-test

C. tigiris was caught in every array so there was no significant difference in the different variables Leaf Litter, Duff, Shrubs, Mesquite/Acacia, Knapweed, and Bare Ground.

DISCUSSION

At the macrohabitat level for the lizard species *U. stansburiana*, it was found that the species showed no preference in habitat for ground cover. This was the expected result, because of the known natural history of *U. stansburiana*. It was surprising that there was no significant difference found for the bare ground variable. This likely occurred because of the close proximity of the surrounding habitat types. For overstory, there was a difference. This was the expected result, because the natural history of *U. stansburiana* tells us it does not prefer tree habitats.

At the microhabitat level, a more in-depth look at the habitats for *U. stansburiana* was examined. Having no significance in the Knapweed and Bare ground variables tells us that the surrounding habitats play a role in the range of *U. stansburiana* at the LVSP. With Mesquite/ Acacia habitat type showing no significance, we can only conclude that this species does not prefer this habitat type. The data show that Leaf Litter, and Duff were significant, which tells us that this species does not prefer this habitat. For the Shrub variable the significance shows that *U. stansburiana* is in its preferred habitat. The microhabitat level for *U. stansburiana* shows more specialization in habitat preference.

The macrohabitat level For *S. magister* shows that there is no preference between the habitat types. Having no difference in the Overstory Variable tells us there is an underling factor determining the habitat preference. The distribution of trees on the LVSP suggests that *S. magister* will move about the site, and not stay in one habitat.

S. magister at the microhabitat level should show differences in the preferred habitat type. Duff and Knapweed were the only variables showing a significant difference. Since the Knapweed habitat is devoid of trees, the habitat is not preferred. The Duff variable is a preferred habitat because of the surrounding trees. The other variables for microhabitat showed no difference, which may indicate that *S. magister* perceives no difference in the habitat.

The macrohabitat for the species *X. vigilis* showed that there was no difference in the habitat variables. The number of *X. vigilis* caught during the trapping season was low. This can cause the data to be skewed, hence showing no difference in habitats. The data suggests us that there is another factor affecting *X. vigilis* at the macrohabitat level.

The species *X. vigilis* showed no difference in habitat variables at the microhabitat level. For *X. vigilis* at the LVSP there is no habitat preference. Again with the low numbers caught and the known secretive behavior of the species we can only conclude that this species will inhabit any portion of the LVSP. More data need to be collected and a further review needs to be conducted to see why this is occurring.

In the case of *C. tigris* it has a capture at every array on the site, so there was no significant difference in the macrohabitat variables. *C. tigris* will be able to survive in any part of the LVSP at a macrohabitat scale. At the microhabitat level for *C. tigris* there was also no difference in the habitat types. *C. tigris* has no habitat preference and it can inhabit any part of the LVSP.

For the species *X. vigilis* and *C. tigris*, were restoration is concerned, any habitat will be equally suitable. Using the natural history of these species will be the best way to determine how to revegetate a restoration site if these are the species you want to thrive on the LVSP. For the species *U. stansburiana*, the best habitat for the species would be of the shrub variety. There was a significant difference in the shrub variable, and research shows this type to be commonly associated with shrubs. For *S. magister* the best type of habitat would be of trees, so duff can be supplied, because of the preference for the duff habitat variable.

CONCLUSION

In determining the habitat preference for the four species of lizards at the LVSP, a much more in-depth study needs to occur. The study design for this paper was sufficient for restoration purposes, but the close proximity of the different habitat types to each other makes it difficult to determine if the lizards are using this habitat or are passing through. Of the five habitat types that were named in the beginning of the study two should have been named differently. Two of the tree habitat types were named incorrectly, and the trees are not the dominant vegetation in the array. Array 5 should be classified as an open scrub community, and for array 1, it is mostly bare ground with Mesquite/Acacia surrounding the area. Mesquite/Acacia would be a better name for the habitat.

There are many weaknesses to this study design: (1) The sample sizes were too small; (2) Even though most of the habitats are similar and close together, there are still little influences that can cause one species to stay away from one area and thrive in another. (3) The habitat types were selected at the start of the study, potentially biasing the study design. (4) There were unequal sample sizes for the habitat types, in four of the habitat types, there are three arrays, but in the fifth type there are only two arrays; this weakens the power of the statistical tests. (5) The ocular estimates can also bias the results.

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