**Microhabitat use, daily activity pattern and diet of *Liolaemus etheridgei* Laurent, 1998 (Reptilia: Liolaemidae) in the Andean *Polylepis* forests of Arequipa, Peru**

Irbin B. Llanqui1,2, Bryn Edwards3, Evaristo López Tejeda2

1 Escuela de Ciencias Biológicas, Universidad Nacional Mayor de San Marcos, Av. Venezuela s/n, Cercado, Lima, Peru.

2 Escuela de Biología, Universidad Nacional de San Agustín de Arequipa, Av. Alcides Carrión s/n, Cercado, Arequipa, Peru.

3 Lancaster Environment Centre, Lancaster University, Lancaster, LA1 4YQ, United Kingdom.

\* Corresponding author: E-mail: illanquia@unmsm.edu.pe

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**Abstract**

This study compared the microhabitat use, daily activity pattern and diet of *Liolaemus etheridgei* Laurent 1998 in two *Polylepis* woodlands: El Simbral (fragmented) and Tuctumpaya (unfragmented), in Arequipa, Southern Peru. In both populations, we did not detect positive selection for any microhabitat; however, the population at El Simbral showed a negative selection for *Polylepys* trees while the Tuctumpaya population showed negative selection for *Polylepis* trees and non-thorny bushes. In El Simbral, active individuals were detected between 9:00 and 15:59h, whereas in Tuctumpaya, we detected active individuals from 8:00 to 17:59h. In both populations, observations of active individuals dropped between 11:00 and 11:59h. We recorded 17 and 23 prey categories in the El Simbral and Tuctumpaya populations respectively. The most important animal prey category in each population was found to be Lygaeidae: Hemiptera, and was the only animal prey category that was selected for in El Simbral and Tuctumpaya. In addition, due to the proportions of plant material found, the El Simbral was found to be omnivorous, whereas the Tuctumpaya population was herbivorous. Trophic niche breadth was broader in Tuctumpaya (= 0.202) than the El Simbral (= 0.147) population, despite there being no significant differences in diet (Permanova: *F* = 1.036, *P* = 0.409, permutations = 9999), which is coherent with the high value of trophic niche overlap ( = 0.963). Our compiled data reveal that *L. etheridgei* shows no selection for any of the resources we define in *Polylepis* woodlands, on the contrary, it selects negatively against *Polylepis* trees and non-thorny bushes. The daily activity patterns indicate a bimodal pattern with peaks at 9:00-10:59 and 13:00-13:59 h. The diet of *L. etheridgei* consists mainly of plants (%W: 66.373), and the most important animal prey category is Lygaeidae: Hemiptera (%IRI = 55.3), which is selected positively.

**Keywords:** montanus group, resource selection, bimodal activity pattern, herbivory, omnivore

**Introduction**

The *Liolaemus* genus consists of a large group of lizard species distributed from the central Andes of Peru to Tierra del Fuego in Southern Chile and Argentina, within an elevational range of 0 to 5000 m.a.s.l. (Lobo, Espinoza, and Quinteros, 2010; Abdala et al., 2019). Currently, there are thirty *Liolaemus* species recorded in Peru (Uetz and Hošek, 2020), and it is thought that this number will continue increasing (Gutiérrez et al., 2018). However, there is still a lack of ecological studies for the majority of these species, which limits our knowledge on their population status’ and how they should be managed. Some insights into the ecology of *Liolaemus* species in Peru come from short natural history notes in taxonomical studies (but see Llanqui, 2020; Olivera Jara and Aguilar, 2020). For example, Chaparro et al., (2020) report an observation of *L. qalaywa* eating the amphibian *Pleurodema* *marmoratum* as well as some larval insects; Huamani-Valderrama et al., (2020) report the consumption of coleopteran larvae and lepidopteran adults for *L. anqapuka.* Gutiérrez et al., (2018) reports the consumption of Carabidae: Coleoptera, Aranea and larvae for *L. evearistoi.* Thus*,* thorough ecological information is limited, especially when compared with studies on Argentinian or Chilean species. This is of particular concern for multiple *Liolaemus* species in Peru such as *L. anqapuka,* *L. annectens* sensu lato, *L. insolitus*, *L. polystictus, L. qalaywa* and in general the *L. montanus* species group, which are threatened permanently by agriculture, mining activities, urban expansion, habitat fragmentation and climate change (Aguilar et al., 2017; Aguilar-Puntriano et al., 2019; Chaparro et al., 2020; Huamani-Valderrama et al., 2020; Olivera Jara and Aguilar, 2020). Thus, a better understanding of the ecology of these lizards is necessary in order to propose efficient conservation actions.

*Liolaemus etheridgei* is distributed in the Arequipa and Moquegua Regions, southern Peru (Laurent, 1998; Llanqui, 2020), occupying different habitats such as Scrublands, Matorral, and *Polylepis* woodlands. Of particular interest are the *Polylepis* woodlands which comprise small tree relicts across the distribution of *L. etheridgei*, yet its role in the maintenance of these lizard populations and other species remains unclear (see Lloyd and Marsden, 2008). Of the nineteen *Polylepis* species recognized in Peru (Mendoza and Cano, 2011), thirteen (68%) have been included in a threatened category nationally (Decreto Supremo 043-2006-AG. Available from https://www.serfor.gob.pe/portal/wp-content/uploads/2016/03/D.S.-N-043-2006-AG-Aprueban-Categorizacin-de-Especies-Amenazadas-de-Flora-Silvestre.pdf [Accessed 24 April 2021]), urging further investigation into their decline. This study focused on two *Polylepis rugulosa* Bitter, 1911 (local name “Queñua”) relicts with different levels of fragmentation: El Simbral and Tuctumpaya, the former a forest fragmented by Moquegua-Arequipa Road and with smaller trees, and the latter an unfragmented and with taller trees. We aim to determine the difference in three aspects of the ecology of *L. etheridgei*: microhabitat use, daily activity pattern and diet; in those *Polylepis* woodlands, which potentially could be related to the habitat deteriorations. We focus on those aspects as they have been recognized segregation in *Liolaemus* species (Jaksić, Núnñez, and Ojeda, 1980). We expect both populations to select *Polylepis* trees positively for microhabitat use as they have been commonly thought to be an essential resource for the local fauna. Moreover, we expect the range of hour activity for the daily activity pattern to be larger in El Simbral because of the low tree cover would allow more sunlight hours. And finally, that diet is more diverse in Tuctumpaya population as preys are potentially more diverse in that unfragmented forest.

**Material and Methods**

*Study area.*

Fieldwork was conducted within the *Polylepis* forests (*Polylepis rugulosa* Bitter 1911), in the buffer zone of the Salinas y Aguada Blanca National Reserve (SABNR), Arequipa, Peru (Figure 1). The habitat was comprised of shrub-like vegetation including *Adesmia sponossisima, Bacharis* spp., *Chuqiraga rotundifolia, Mutisia acuminata, Parasthrephia lepidophylla, Senecio graveolens, S. nutans,* while the herbaceous species included *Belloa piptolepis*, *Calamagrostis breviaristata*, *Festuca orthophylla*, *Gnaphalium purpureum*, *Sysirinchium chilense*, *Werneria aretioides* (Mendoza, Cano, and Vento, 2010). We studied the lizard populations of two distinct areas, locally called “El Simbral” and “Tuctumpaya”. El Simbral is located in the Chiguata District in Arequipa. It is comprised of *Polylepis* forest fragmented by a road passing through to the Moquegua and Puno Regions of Southern Peru (Figure 2). Tuctumpaya is located in the Pocsi District of Arequipa. In contrast, the *Polylepis* forest here is continuous, with a higher average tree height compared to El Simbral (Figure 2). Both the El Simbral and Tuctumpaya forests are located within the Pichu Pichu volcano's lowland area, which has undergone various anthropogenic pressures. Thus, these two areas provide an ideal comparison for studying the associated effects on the populations inhabiting them.

*Methods*

All data was collected between July to November 2013, within the dry season in the SABNR. We followed the Type I design for resource selection studies, so that we could collect data on the use and availability of resources at the population level (Manly et al., 2002). Thus, in El Simbral and Tuctumpaya it was installed 30 quadrants of 20×20 m, within a total area of ~475 Ha and between an elevation range of 3600 to 4200 m. These quadrants were randomly selected using QGIS. In each quadrant, we determined the abundance of the nine microhabitats: *Polylepis* trees (Pt), Scrubland (S), Thorny bushes (Tb), Not thorny bushes (Ntb), Rocks (R) (Major diameter > 1m), Small rocks (Sr) (Major diameter ≤ 1m), Uncovered land (Ul), Dry organic matter (Dom), and *Nordenstamia longistyla* (Nl). The latter is an Asteraceae shrub abundant in our study area. Apart from Ul, we estimated the coverage of each microhabitat in the quadrats using the Crown-Diameter method(Mueller-Dombois and Ellenberg, 1974) but instead using the ellipse equation. Ul coverage was then calculated by subtracting the total area of the quadrat with the combined area of the microhabitats. In each sector, the microhabitat coverages for each quadrat were averaged. The final means were considered to be estimates of the relative abundances of each resource within the forests, and therefore a measure of their availability (Manly et al., 2002)⁠.

Each quadrat was only surveyed once. Quadrats were randomly selected and then assessed during the daytime between 8:00-17:00h. *L. etheridgei* individuals were searched for using the Visual Encounter Survey (McDiarmid et al., 2012). In all quadrats, two observers would carry out the surveys for 305 minutes. For each survey, the number of lizard occurrences on the habitat resources: Pt, S, Tb, Ntb, R, S, Sr, Ul, Dom and Nl were recorded. Likewise, we recorded the time of encounter and the activity of the individual. In order to assess diet, several individuals were collected by hand, euthanised with Halatal, fixed in formalin 10% and preserved in 70% ethanol. In addition, to study prey availability, we randomly installed six lines of pitfall traps (20 traps separated 10 m each) within each forest. The pitfall traps consisted of 1L plastic containers, which were filled with 0.5L of water plus washing up liquid. Pitfall trap lines were left for 48h; then, the specimens were collected and preserved in 70% ethanol. Specimens collected from both surveys were deposited in the scientific collection of the Herpetology and Entomology Departments of the Museo de Historia Natural de la Universidad San Agustín de Arequipa (MUSA) in Peru.

*Laboratory*

*L. etheridgei* specimens were dissected, and their stomach contents extracted. Most of the stomach items were identified to Family level using specialized bibliography (Borror, de Long, and Triplehorn, 1981) and by comparison to reference material collected in the pitfall traps. However, some were identified until higher taxonomical level (see Table 1). Amongst the contents, grinding plants were also present. Thus, all taxonomical items plus the vegetal material were considered as prey categories for this study. Weight measurements were taken for each prey category using a digital scale (Anyload ES-203HA precision 200g x 0.001 g).

*Data analyses*

We assessed the microhabitat use with selection ratios: , where and are the proportions of use and availability of resource , respectively. Likewise, we determined the 95% confidence intervals for each value using a conservative Bonferroni adjustment (Manly et al., 2002). If the confidence intervals of were >1, the use of a resource was greater than its availability, so it was interpreted as a positive selection; whereas if they were <1, there was a negative selection for the respective microhabitat, so the resource is avoided. When the confidence intervals of included 1, there was no selection process, either positive or negative; thus, the individual was indifferent to the microhabitat. In addition, we used the log-likelihood of Pearson statistic to statistically test for the existence of a selective process in El Simbral and Tucutmpaya as well as for each particular habitat’s resource, the latter included a Bonferroni adjustment (Manly et al., 2002). Lastly, to test the selection process for resources, we estimated the Manly’s standardised selection index, which gives the probability that a resource is used when others are offered in the same availability (Manly et al., 2002). All the above analyses were done using the adehabitatHS R package (Calenge, 2006).

The daily activity pattern was represented with frequency bar charts and kernel density charts considering two contrasting behaviours: Active and Inactive. We also tested for differences in the abundances of individuals from El Simbral and Tuctumpaya using the Wilcocoxn Signed-Ranks Test (Aho, 2014). This test was also used to compare the abundances of active and inactive individuals in El Simbral and Tuctumpaya throughout the day.

For the prey categories, we obtained the number of individuals (N), frequency of stomachs containing the prey (F) and the weight (W). However, for the plant category, we only estimated the F and W; furthermore, this item was not included for further analysis. We determined each measurement's percentage (%N, %F, %W). With these measurements, we obtained the Relative Importance Index (IRI) (Pinkas, 1971) but using the weight instead of the prey volume (Martin, Twigg, and Robinson, 1996). Thus, the index is: IRI = (%N + %W)\*%F. The IRI is used mainly in fishery studies but recommended in other taxa such as reptiles (Hart, Calver, and Dickman, 2002). We the hierarchised %IRI values according to the categories proposed by Montori (1991), which has been used in diet studies in other *Liolaemus* species (see Semhan and Halloy, 2016). Thus, prey categories were ordered under the following diet hierarchy: Fundamental (F: %IRI >75%), Secondary (S: 75% > %IRI > 50%), Accessory (A: 50% > %IRI > 25%) and Accidental (a: 25% > %IRI). Although, the above hierarchy was originally proposed for values of the “Lambda segunda” dominance index (Montori, 1991), it has regularly been used with other indexes in diet studies of *Liolaemus* species (see Semhan and Halloy, 2016; Cabrera and Scrocchi Manfrini, 2020; Olivera Jara and Aguilar, 2020). Trophic niche amplitude was estimated using the standardized Levin’s index: , where is the proportion of prey category *i*, and is the total number of prey categories (Krebs, 1999). We obtained the proportions under the “averaged” method as it reduced the bias into individuals that eat a large number of items (Zaccarelli, Bolnick, and Mancinelli, 2013). We excluded plant material in all the above analyses as it was not convenient to estimate %N. However, we re-estimated the %W to consider the plant content, then determined the diet type according to the %W of plant material using the scale of Espinoza et al., (2004): Insectivorous (0-10%), Omnivorous (11-50%), herbivorous (51-100%). Using the pitfall traps data, we determined the effective number of species (Jost, 2006) for El Simbral and Tuctumpaya, as well as the relative abundance of each prey category, the latter were considered as a measure of prey availability in the forests. Then, we estimated the selection ratios considering each prey category as a food resource and the %N as a measure of use. Likewise, we determined the standardized Manly’s selection ratio considering a type I design (Manly et al., 2002). To test for statistical differences in the diet of the two populations, we applied a Permutational Multivariate Analysis of Variance (Permanova) using a Bray-Curtis dissimilarity distance (Anderson, 2001), and using square root data transformation. As Permanova assumes similar multivariate distribution (Anderson, 2001), we previously tested the multivariate homogeneity of group dispersions using the “betadisper” function from “vegan” R package (Oksanen et al., 2013). Dispersion results were represented by a Principal Coordinates Analysis (PCoA) using two axis (Borcard, Gillet, and Legendre, 2011). Finally, we used non-metric multidimensional scaling (Zuur, Ieno, and Smith, 2007) to order and represent the prey categories consumed by *L. etheridgei* in each *Polylepis* forest*.* We complemented the above analysis with a Pianka overlap index: , where is the proportion of prey category *i* of the total of preys eaten by species *j*, is the proportion of prey category *i* of the total of prey eaten by species *k*, and is the total number of prey categories, (Krebs, 1999).

Considering that both populations belong to a single species, we repeated the above analysis using the total data to provide a general description of basic ecology of *L. etheridgei*. All data analyses were done on the R platform (R Core Team, 2020).

**Results**

*Micohabitat use*

We found significant microhabitat selection in both the El Simbral ( = 13.934, P < 0.05) Tuctumpaya (= 48.383, P < 0.01) populations. According to the selection ratios in El Simbral (P values compared with Bonferroni level = 0.007) there was no positive selection (Wi ± CI 95% > 1), however there was negative selection for Pt (Wi = 0.405 ± 0.385, P < 0.007). We did not detect any selection process for Sr (Wi = 2.034 ± 1.275, P = 0.047), Ul (Wi = 1.818 ± 2.527, P = 0.234), Tb (Wi = 1.038 ± 0.996, P = 0.925), S (Wi = 0.855 ± 0.843, P = 0.673), R (Wi = 0.78 ± 1.114, P = 0.629) and Ntb (Wi = 0.288 ± 0.755, P = 0.021) (Figure 3). In Tuctumpaya, we did not detect a positive selection (P values compared with Bonferroni level = 0.007), yet there was negative selection for Pt (Wi = 0.404 ± 0.244, P < 0.007) and Ntb (Wi = 0.089 ± 0.0227, P < 0.007). There was not selection for Ul (Wi = 5.066 ± 5.077, P = 0.05), R (Wi = 2.411 ± 4.175, P = 0.408), Sr (Wi = 1.646 ± 0.975, P = 0.105), Tb (Wi = 0.803 ± 1.321, P = 0.716) or S (Wi = 0.483 ± 0.49, P = 0.01) (Figure 3). Both Nl and Dom were not used by *L. etheridgei*, as such they were excluded from further analysis. Manly’s standardised selection indices for Sr, Tb, Pt, Ntb were higher in El Simbral, excluding Ul and R, for which the Tuctumpaya population showed a higher selection probability in the selection for those resources (Figure 4).

The general analysis for the combined data showed that *L. etheridgei* exhibited microhabitat selection ( = 29.466, P < 0.01). Positive selection was not found for any of the microhabitats, whereas we found negative selection (avoidance) for Pt (Wi = 0.423 ± 0.306, P < 0.007) and Ntb (Wi = 0.147 ± 0.378, P < 0.007) (P values compared with Bonferroni level = 0.007). We did not find evidence for selection in Ul (Wi = 4.088 ± 4.434, P = 0.088), Sr (Wi = 1.783 ± 1.085, P = 0.077), R (Wi = 1.159 ± 1.652, P = 0.814), Tb (Wi = 0.807 ± 0.963, P = 0.624), or S (Wi = 0.613 ± 0.616, P = 0.068) (Figure 3).

*Daily activity pattern*

*Liolaemus etheridgei* was found to be active between 9:00 and 15:59h in El Simbral, and between 8:00 and 17:59h in Tuctumpaya (Figure 5). The probability density functions revealed a tendency for a bimodal activity pattern in El Simbral, with one spike between 9:00 and 10:59h and another between 13:00 and 13:59h. Likewise, in Tuctumpaya, there was one peak between 9:00 and 10:59h and another between 15:00 and 15:59h. In both cases, there was a drop in activity between 11:00 and 11:59 h, with El Simbral showing a higher number of inactive individuals (Figure 5).

We did not find differences in the abundances of active and inactive individuals across the day for either the El Simbral (Wilcoxon signed-rank test, *N =* 10, *V =* 21, *P =* 0.906) or Tuctumpaya populations (Wilcoxon signed rank test, *N =* 10, *V =* 30, *P =* 0.105). Populations from el Simbral and Tuctumpaya did not differ in the abundances of active (Wilcoxon signed-rank test, *N =* 20, *V =* 22, *P =* 0.61) and inactive (Wilcoxon signed-rank test, *N =* 20, *V =* 33, *P =* 0.61) individuals across the day. The combined dataset showed that *L. etheridgei* had a bimodal daily activity pattern with one activity spike between 9:00 and 10:59 h and another between 13:00 and 13:59 h (Figure 5).

*Diet*

Trophic niche breadth was broader in Tuctumpaya (= 0.202) than El Simbral (= 0.147). According to the IRI index, the most important prey was Lygaeidae (Hemiptera) for both sites, with this prey being “Secondary” in El Simbral (%IRI: 62.9%) and “Accesorial” in Tuctumpaya (%IRI: 44.8%). The remaining items were considered as “Accidental” as they had an %IRI lower than 25% (Table 1). The assessment of plant material weight revealed the population of *L. etheridgei* to be omnivorous in El Simbral (%W Plant material: 47.924%, between 11-50%), and herbivorous in the Tuctumpaya (%W Plant material: 68.865%, > 51%). In both cases, none of the other prey categories surpassed the 15% (Figure 6). We detected selection for at least one prey category in both El Simbral ( *=* 407.782, *P* < 0.05) and Tuctumpaya ( *=* 466.561, *P* < 0.05). The effective number of species in pitfall traps was higher in el Simbral (14.52, *q* = 1) than Tuctumpaya (11.38, *q* = 1). The selection ratios show that the El Simbral population selected positively for Lygaeidae (*Wi* = 14.941 ± 5.245, *P* < 0.004), whereas there was negative selection against Anthomyiidae (*Wi* = 0.215 ± 0.283, *P* < 0.004), Formicidae (*Wi* = 0.041 ± 0.076, *P* < 0.004), Cicadelidae (*Wi* = 0.09 ± 0.239, *P* < 0.004) and Drosophilidae (*Wi* = 0.057 ± 0.151, *P* < 0.004), (*P* values compared with Bonferroni level = 0.004). In the Tuctumpaya population we found positive selection for Lygaeidae (*Wi* = 15.224 ± 7.481, *P* < 0.004), whereas there was negative selection against Anthomyiidae (*Wi* = 0.11 ± 0.08, *P* < 0.004), Cicadelidae (*Wi* = 0.157 ± 0.244, *P* < 0.004), (*P* values compared with Bonferroni level = 0.004). There was no selection prose for the unmentioned prey categories in either site. This was decided by the confidence intervals of the selection ratios including the critical value 1 (Figure 7).

As multivariate homogeneity was found in the group dispersions (*F* = 0.411, *P* = 0.529, permutations = 9999) (Figure 8), the Permanova analysis was used. The Permanova analysis showed no significant differences in diet between the El Simbral and Tuctumpaya populations (*F* = 1.036, *P* = 0.409, permutations = 9999), which is consistent with the high overlap value of the Pianka index ( = 0.963) and the ordination obtained by the non-metric multidimensional scaling (Figure 9).

The overall analysis showed that *L. etheridgei* had a niche breadth of 0.128. According to the IRI index Lygaeidae was the most important alimentary item for the species in the *Polylepis* woodlands, being classified as a “Secondary” prey. Due to the weight of plant material, *L. etheridgei* was found to be herbivorous (%W Plant material: 66.373, > 51%). In addition, prey selection was found ( *=*944.486, *P* < 0.05). The selection rations indicated that *L. etheridgei* selects positively Lygaeidae (*Wi* = 14.675 ± 4.456, *P* < 0.002), whereas it selects negatively against Anthomyiidae (*Wi* = 0.166 ± 0.111, *P* < 0.002), Formicidae (*Wi* = 0.028 ± 0.056, *P* < 0.002), Cicadelidae (*Wi* = 0.142 ± 0.199, *P* < 0.002), Drosophilidae (*Wi* = 0.028 ± 0.078, *P* < 0.002) and Tephritidae (*Wi* = 0.231 ± 0.655, *P* < 0.002), (*P* values compared with Bonferroni level = 0.002) (Figure 7). The confidence intervals of the remaining prey categories included the critical value 1; thus, there was not a selective process for those food items.

**Discussion**

*Microhabitat use*

Our results show that *L. etheridgei* does not select positively for any of the microhabitats found in the *Polylepis* forests of El Simbral nor Tutcumpaya; thus, suggesting this is a generalist species. The resources R, Sr and Ul are usually associated with the thermoregulatory behaviour of *Liolaemus* species (see Carothers, Marquet, and Jaksic, 1998) including *L. quilmes*, *L. ramirezae* (Robles and Halloy, 2008) and *L. tenuis* (Victoriano et al., 2008). Carothers et al., (2001) even suggested that rock distribution could define the altitudinal limits of *L. leopardinus*. However, the absence of selective use for such resources may indicate that L. etheridgei does not require them for thermoregulation. As *L. etheridgei* is a thermal generalist (Llanqui, 2020), it was expected that there would be no critical resources used for thermoregulation. Contrary to our expectations, Pt was avoided by both populations (negative selection), which contradicts the statement that *Polylepis* trees are essential to maintaining this species (Gutiérrez et al., 2010). However, it is necessary to note that our results were restricted to the direct use of trees, either as a refuge or foraging site such as recorded in other species like *L. pictus* (Victoriano et al., 2008), or *L. tenuis* (Medel, Marquet, and Jaksić, 1988), in which even has been proposed that trees play a key role in determining elevational limit (Carothers, Jaksić, and Marquet, 2001). Thus, it is possible that Pt is an important resource for *L. etheridgei*, but due to its indirect effects on the whole ecological system. Such indirect effects could include water retention or enabling the existence of other floral and faunal species. The microhabitats Tb and Ntb usually are recognized as refuges, shelters or foraging sites. For instance, *L. multimaculatus* prefers tusoocks of grassfor shelters (Kacoliris, Williams, and Molinari, 2010); *L. quilmes* has been found in rocks close to shrubs (Robles and Halloy, 2008), and *L. lemniscatus* has been found in herbaceous patches (Jaksić, Núnñez, and Ojeda, 1980). According to our results, *L. etheridgei* was indifferent to S, Tb and Ntb in El Simbral, while in Tuctumpaya Ntb was avoided. Thus, for S, Tb and partially by Ntb we are unable to associated the use with a particular behaviour such as mating, basking, foraging, etc. This could be supported by our field observations of cavities used by *L. etheridgei*, which were encountered under different substrates such as R, Tb, Ntb and S. The avoidance of Ntb in Tuctumpaya suggests that, Ntb couldb be an inconvenient microhabitat for *L. etheridgei*, whether for basking, foraging or shelter, however there is no clear explanation for this.

Vegetation structure and cover influence the microhabitat preferences of lizards (Kacoliris, Williams, and Molinari, 2010). Nevertheless, our results indicate that the use of microhabitats in El Simbral and Tuctumpaya are similar and seem not to have been affected by the fragmentation degree of the *Polylepis* woodlands. As there is no microhabitat selected by *L. etheridgei*, and this species may even avoid *Polylepis* trees, then is questionable as to why it inhabits these forests. Considering that *L. etheridgei* also inhabits sites where *Polylepis* trees are absent (Laurent, 1998), we point out two possible explanations: 1) *L. etheridgei* is inhabiting *Polylepis* forests just because they are included inside its natural elevational range distribution; and 2) Factors other than microhabitats are determining the occupancy of *Polylepis* woodlands by *L. etheridgei*. For the former, a population flux would exist from preferred habitats (i.e., scrublands: source) into habitats in the altitudinal limit (i.e., *Polylepis* forests: sink). It could also imply that *L. etheridgei* would tolerate variation in habitat structure, allowing it to distribute in various landscapes with other factors limiting its distribution (e.g., Temperature). Indeed, species like *L. tenuis* can shift their habitat’s resource use according to the circumstances (Medel, Marquet, and Jaksić, 1988). The second hypothesis implies that factors other than microhabitats presence or abundance are determining occupancy in the *Polylepis* woodlands. Therefore, other variables not considered in our study would favour the occupancy of these forests.

*Daily activity pattern*

Our results show that *L. etheridgei* had a shorter daily activity range in El Simbral than in Tuctumpaya. The population in El Simbral began activity later (9:00h) than Tuctumpaya (8:00h), but it ends earlier (16:00 vs 17:59h). This result contradicts our expectation that the Tuctumpaya population would have a shorter daily activity range because of the higher cover of trees than El Simbral, limiting access to solar radiation. *Polylepis* trees occupy rough terrains with areas where the sunlight reach late in the day, while windy conditions can affect the body temperature of lizards (see Bujes and Verrastro, 2008); thus, both could be involved in the variability of the starting hour of activity. We recorded a drop in the activity between 11:00 to 11:59h in both populations, which is more evident in El Simbral. A drop in the activity pattern has also been recorded in *L. occipitalis* (between 12h-13h in summer) (Bujes and Verrastro, 2008), *L. dawinii* (between 13-14h in summer) (Videla and Puig, 1994). Lizards generally look for cool refuges to avoid overheating (Sinervo et al., 2010), including *Liolaemus* species (Bujes and Verrastro, 2008). Thus, the high tree cover in Tuctumpaya could be reducing the probability of overheating and thus lessening the bimodal activity pattern at this site. Our results show that throughout the day, there was no significant difference between the number of active and inactive individuals for both sites. Thus, there were no particular hours where active individuals were more abundant or vice versa, which is probably not valid in the late afternoon. However, we consider that the abundance of active and inactive individuals was likely similar because inactive individuals would tend to look for near-surface shelters during periods of high activity, eventually seeking deeper refuges as time passed. Due to the lack of difference between active and inactive individuals, the variation between the *Polylepis* woodlands, particularly the abundance cover, appear not to significantly affect the activity patterns of *L. ehteirdgei*.

For the combined data, the activity peak of *L etheridgei*: 9:00 to 10:59 h is identical to that recorded for *L. qalaywa* (Chaparro et al., 2020), which is a species found near to the distribution of *L. etheridgei.* It is therefore likely that both species would have a similar degree of solar radiation exposure and accordingly, show a similar behaviour pattern. Likewise, the second activity peak occurs after midday: 13:00 to 13:59 h, is similar to that of *L. evaristoi* (Gutiérrez et al., 2018). The drop in activity is maintained for the combined data and supports a bimodal pattern for *L. etheridgei*, with a drop between 11:00 to 11:59h. Bimodal activity patterns have also been recorded in *L. darwinii* (Videla and Puig, 1994), *L. koslowski* (Belver, Kozykariski, and Avila, 2010), *L. multimaculatus* (Vega, Bellagamba, and Fitzgerald, 2000) and *L. occipitalis* (Bujes and Verrastro, 2006, 2008). In particular, a bimodal activity with a drop around midday has been recorded for *L. arambaresis* (Liz et al., 2019), *L. constanzae* and *L. nigroroseus* (Labra, Soto-Gamboa, and Bozinovic, 2001), all of which associate this as a strategy to avoid overheating. Ecological interactions such as competition and predation can also influence the activity pattern. However, we did not recognise any direct competitors during our fieldwork. Likewise, we cannot say whether any of the potential *L. etheridgei* predators: *Conepatus chinga* (Medina et al., 2009), *Galictis cuja*, *Lycalopex culpeus*, *Mustela frenata*, *Athene cunicularia*, *Circus cinereus*, *Falco femoralis*, *F. peregrinus*, *F. sparverius* and *Geranoetus polyosoma* are abundant in a particular time of day. Thus, there is a lack of information about the influence of predators on the activity pattern of this species. Lizards can move from a unimodal to a bimodal pattern according to the season being unimodal in cold months and bimodal in warms months (Pianka, 1973). This shift in the activity pattern has also been recorded in *Liolaemus* species such as *L. arambarensis* (Liz et al., 2019), *L. bibronii, L. rothi, L. petrophilus y L. cf. chehuachekenk* (Frutos 2009), *L. darwinii* (Videla and Puig, 1994), *L. espinozai* (Cabrera and Scrocchi, 2014), *L. koslowski* (Belver, Kozykariski, and Avila, 2010), *L. multimaculatus* (Vega, Bellagamba, and Fitzgerald, 2000), *L. occipitalis* (Bujes and Verrastro, 2006, 2008), and this could also be true for *L. etheridgei*.

*Diet*

As expected, we found the niche breadth in Tuctumpaya to be higher than El Simbral; however, we detected a higher prey availability in El Simbral. Thus, the prey on offer in Tuctumpaya should in some way be better than in El Simbral. Nevertheless, pitfall traps are not always suitable for capturing certain types of prey (e.g., Lepidoptrea, Hemiptera), so a higher richness of preys in El Simbral may not necessarily imply a higher prey availability specifically for *L. etheridgei*. Formicidae has been recorded as an important component in the diet of several *Liolaemus* species (Halloy, Robles, and Cuezzo, 2006) such as *L. koslowskyi* (Aun and Martori, 1998); *L. wiegmannii* (Martori, Aun, and Orlandini, 2002); *L. elongatus* (Quatrini, Albino, and Barg, 2001); *L. pseudoanomalus* (Kozykariski, Belver, and Avila, 2011); *L. cuyanus* (Moreno Azócar and Acosta, 2011); *L. irregularis*, *L. albiceps*, *L. multicolor* and *L. yanalcu*, (Valdecantos, 2011). However, our results indicate that Lygaeidae: Hemiptera is the most important dietary animal component for both the El Simbral and Tuctumpaya populations. The confidence intervals of the selection ratios indicate that both of the *L. etheridgei* populations select for this item positively. This selection is strong enough to persist in both sites, despite the different habitat conditions of the two woodlands. Following this, we did not detect selection for any other dietary item, which aligns with the prediction *Liolaemus* species opportunistically and unselectively target animal preys (Pincheira-Donoso, 2012). Even though Hemiptera does not seem to be a typical choice in the diet of *Liolaemus* (Halloy, Robles, and Cuezzo, 2006), it has been recorded as an important item in the diet of *L. eleodori* (Astudillo et al., 2015), *L. quilmes*, *L. ramirezae* (Halloy, Robles, and Cuezzo, 2006; Robles and Halloy, 2008) and *L. ruibali* (Villavicencio, Acosta, and Cánovas, 2005). Interestingly, Mella et al., (2010) reported an avoidance of Formicidae and a positive selection for Lygaeidae in *L. puna* (= *L. barbarae*), but they did not find plant material in its diet as it was found in both of the *L. etheridgei* populations. It is worth noting that *L. etheridgei* belongs to the *Eulaemus* subgenus while *L. puna* (=*barbarae*) belongs to *Liolaemus* subgenus (Lobo, Espinoza, and Quinteros, 2010), so this could be a case of ecological convergence.

Considering the dietary proportions by weight percentage, it is clear that plant material is also an important component in the diet of both populations. Our results find that *L. etheridgei* is omnivorous in El Simbral and herbivorous in Tuctumpaya. Intraspecific variation in plant consumption has been also recorded in *L. elongatus* (Quatrini, Albino, and Barg, 2001). The percentage of plant consumption in el Simbral were close to the critical value for herbivory, and those for Tuctumpaya were far from this point. Thus, we see that *L. etheridgei* has the capacity for both consuming direct plant products (leaves, fruits, seeds), as well as Arthropods. Lygaeidae are Hemiptera that extract sap from plants; thus, we outline two scenarios: 1) Plant products are essential for *L. etheridgei*, and it has to consume insects associated with them, and thus this species is mainly herbivorous or 2) *L. etheridgei* mainly consumes mainly arthropods (e.g, Lygaeidae), but consumes vegetation accidentally. A more complex scenario would be that both plant material and Lygaeidae are consumed because they are of similar importance. Several *Liolaemus* have been considered mainly insectivorous: *Liolaemus espinozai* (Cabrera and Scrocchi Manfrini, 2020), *L. multimaculatus* (Kacoliris et al., 2009; Stellatelli et al., 2016), *L. quilmes*, *L. ramirezae* (Halloy, Robles, and Cuezzo, 2006), *L. wiegmanni* (Aun, Martori, and Rocha, 1999); others mainly herbivorous: *L. aymararum* (Vidal, Ortiz, and Labra, 2008), *L. poecilochromus* (Valdecantos, Arias, and Espinoza, 2012), and some having an intermediate consumption of plants: *L. alticolor*, *L. jamesi* and *L. signifier* (Valencia, Veloso, and Sallaberry, 1982; cited in Semhan, Halloy, and Abdala, 2013), *L. eleodori* (Astudillo et al., 2015), *L. pictus* (Vidal and Sabat, 2010), *L. polystictus* (Olivera Jara and Aguilar, 2020), amongst others (see Abdala et al., 2012). Specifically within the *Eulaemus* subgenus, about 54.4% of species are omnivorous, 38.1% are insectivorous and 9.5% are herbivores (Cabrera and Scrocchi Manfrini, 2020). Semhan et al., (2013) point out the existence of a continuum between carnivory-omnivory-herbivory; we consider that *L. etheridgei* is not in any extreme but is slightly more herbivorous. Plants have been suggested as a source of water in habitats with high temperatures and insolation (Rocha, 2000), as are the conditions in El Simbral and Tuctumpaya during dry the season (Montenegro, Zúñiga, and Zeballos, 2010). According to Espinoza et al., (2004), herbivory is also likely to occur in cooler climates, like our study area where temperatures can descend below zero (Montenegro, Zúñiga, and Zeballos, 2010). Regarding the tendency for herbivory, *L. etheridgei* would be a “widely foraging” species (Huey and Pianka, 1981) in order to reach plants. It would likely have a higher displacement capacity than strictly omnivorous species (Bonino et al., 2011). However, because of the relative abundance of plants found in woodlands, lizards would not actually have to travel considerable distances. Likewise, we also noticed a sit-and-wait foraging strategy, likely reflecting in the variety of items with a high mobility (e.g., Diptera), which also aligns with the foraging behaviours observed by Pearson (1954) in *Liolaemus* populations from Arequipa, Peru. Therefore, we suggest that *L. etheridgei* is an intermediate forager with a tendency to sit-and-wait. The intermediate foraging strategy is plausible if we consider both the widely and sit-and-wait strategies to be extremes of a continuum (Schwenk, 2000), although this is still under discussion (Vitt and Caldwell, 2014). Intermediate strategy has already been proposed in *L. wiegmanni* (Aun, Martori, and Rocha, 1999). For several lizard species, the proportion of vegetation consumed can increase with the SVL (Duarte Rocha, 1998), following the classic idea that herbivory in small lizards is unlikely (Pough, 1973); however, this discussion remains active (see Van Damme, 1999; Espinoza, Wiens, and Tracy, 2004). In fact, herbivory has been recorded in several *Liolaemus* species as for example *L. lutzae* (SVL: 60-80 mm, Weight: 6-14 g)(Duarte Rocha, 1998; Rocha, 2000) and *L. poecilochromus* (SVL: ~68 mm)(Valdecantos, Arias, and Espinoza, 2012). Besides, it has been found that the pattern appears among Liolaemidae, where herbivorous *Liolaemus* are significantly larger than those which are omnivorous and insectivorous (O’Grady et al., 2005). Evidence suggests that herbivorous *Liolaemus* also have higher body temperature than those which are strictly omnivorous (Espinoza, Wiens, and Tracy, 2004). Nevertheless, the body temperature of *L. etheridgei* is lower (Mean: 26.03ºC) (Llanqui, 2020), than the mean of *Liolaemus* species (Oviparous species: 34.01 ºC, Viviparous: 31.7 ºC) (Medina et al., 2012). The Permanova analysis showed no dietary differences between the El Simbral and Tuctumpaya populations; accordingly, Pianka’s overlap index indicated a high diet overlap. This led us to propose that the fragmentation of these woodlands does not affect the diet of *L. etheridgei*.

The combined data revealed Lygaeidae: Hemiptera to be the most important dietary component for *L. etheridgei*, and this is the unique item was selected for positively. Based on the percentage of plant material found, *L. etheridgei* can be classified as an herbivorous species. It has been considered that nematodes could be associated with herbivorous *Liolaemus* (Carothers and Jaksic, 2001; O’Grady et al., 2005), but we do not record any of our sample; however, we do not discard they appear as sample increase. Recenlty, *L. etheridgei* has been classified as artropophagus (Olivera Jara and Aguilar, 2020), but our results suggest it is an omnivory biased into herbivory. Besides, herbivory and omnivory imply a capacity to detect preys and plants (Labra et al., 2007), so following this statement, *L. etheridgei* would have this ability. Other items found in the diet included small mollusc shells and stones. It is not clear whether they were a part of the diet or are accidentally consumed, but stones have also been recorded in *L. eleodori* (Astudillo et al., 2015). Aun et al., (1999) recorded sand in the stomachs of *L. wiegmanni* and pointed out the possibility that this could help in digestion. The question of whether stones do help with digestion or are accidentally consumed by *L. etheridgei* would require further investigation.

*On the ecology of L. etheridgei*

Because of microhabitat use, daily activity pattern and diet showed low variation between the *L. etheridgei* populations, we consider our study as a first inquest into of the ecology of *L. etheridgei* in *Polylepis* forests. Understanding of the ecology of *L. etheridgei* requires interpreting the results of the three key ecological aspects simultaneously, which is challenging. The unselective use of microhabitats could have indicated that *L. etheridgei* does not choose specific sites for deactivities such as foraging or thermoregulation. For the former, it would be possible that L. etheridgei does not need to be selective in foraging due to the high abundance of plants in the forests, and thus the Lygaeidae: Hemiptera associated with them. For the latter, considering that *L. etheridgei* is a moderate thermoregulator (Llanqui, 2020) it is plausible that no microhabitat is selected as this species does not actively thermoregulate. Regardless, we think the bimodal daily activity pattern is likely associated with temperature, if so, *Polylepis* cover would not be not a protection for overheating and this behaviour would come from the main *L. etheridgei* population which mainly inhabits free trees lands.

Given the complexity of studying multiple ecological aspects of *L etheridgei*, we outline some variables that could be biasing our results. For example, it is known that refuges, basking, and foraging sites can easily change according to the hour of the day as is reported for *L. nigromaculatus* (Simonetti, 1984). Also, diet can change according to the season in *L lutzae* (Pincheira-Donoso, 2012), or even an entire ecology, as reported in *L. arambarensis* (Liz et al., 2019). Therefore, we believe that variation in the ecology of the *L. etheridgei* inhabiting *Polylepis* forests would likely occur through different seasons as the weather conditions change dramatically from summer to winter. In addition, it also plausible that juvenile individuals show a different patterns in the microhabitat selection, daily activity pattern (Carothers, Marquet, and Jaksic, 1998; Cabrera and Scrocchi, 2014) and diet (see Duarte Rocha, 1998; Rocha, 1999). Likewise, reproductive state and sex has been also recognized to potentially lead to differences in the activity patterns (Duarte Rocha, 1998; Cabrera and Scrocchi, 2014), and diet (Semhan, Halloy, and Abdala, 2013). We would encourage any future studies to consider the above factors in order to improve our understanding on *L. etheridgei* and *Liolaemus* species in general..

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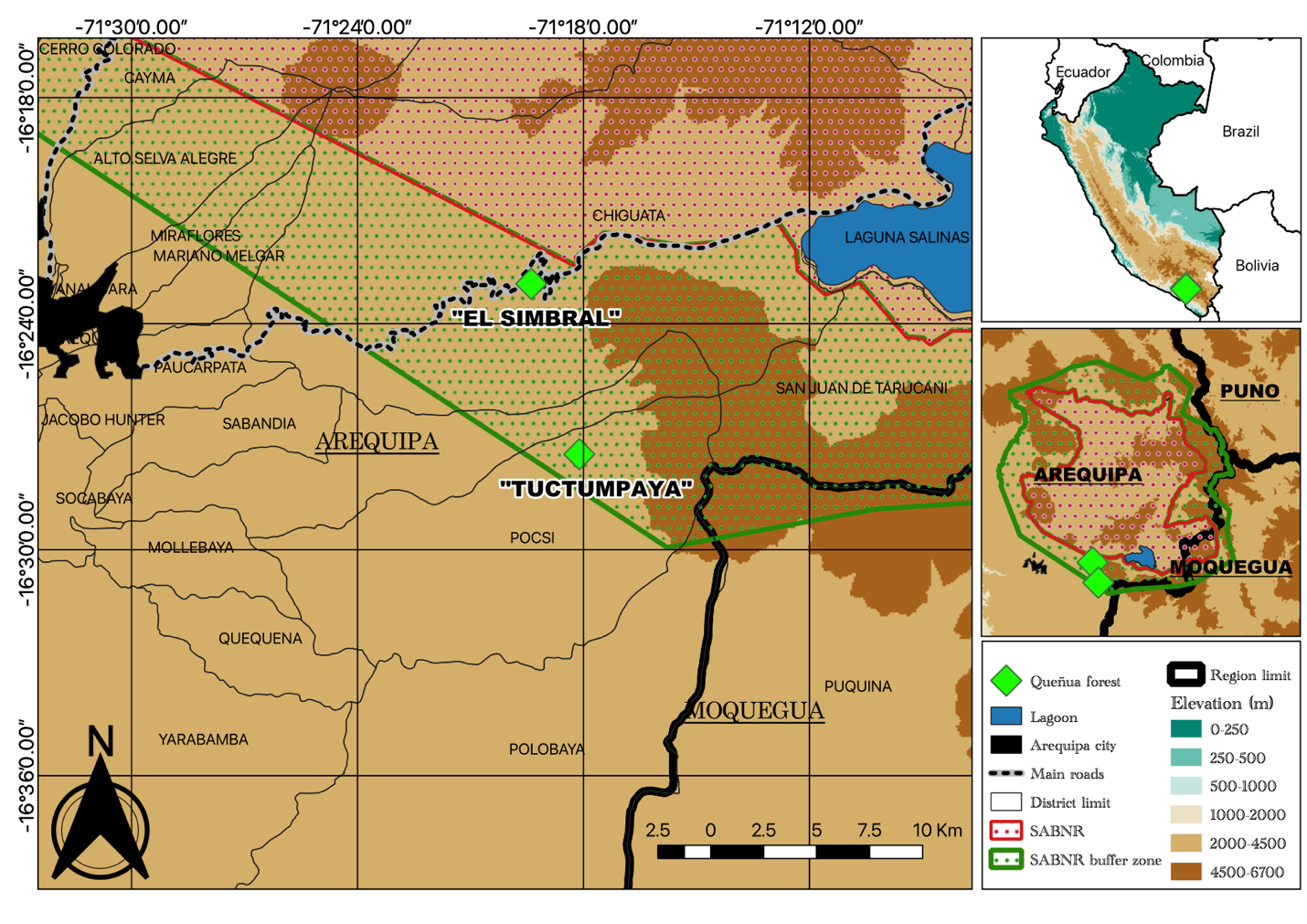
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**Tables**

**Table 1. Diet composition of *Liolaemus* *etheridgei* in El Simbral and Tuctumpaya *Polylepis* forests, Arequipa, Peru. N: Item number, %N: Item number percentage, F: Item frequency, %F: Item frequency percentage, W: Weight, %W: Weight percentage, IRI: Index of relative importance, %IRI: Standardised index of relative importance, Dh: Diet hierarchy.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Prey category** | **El Simbral  (N=14)** | | | | | | | | **Tuctumpaya (N=19)** | | | | | | | | **General (N=33)** | | | | | | | |
| **N** | **%N** | **F** | **%F** | **W** | **%W** | **IRI** | **%IRI** | **N** | **%N** | **F** | **%F** | **W** | **%W** | **IRI** | **%IRI** | **N** | **%N** | **F** | **%F** | **W** | **%W** | **IRI** | **%IRI** |
| Lygaeidae | 76 | 46.9 | 13 | 92.9 | 0.0079 | 8.0 | 5094.6 | 62.9 | 82 | 35.5 | 17 | 89.5 | 0.0085 | 1.9 | 3349.5 | 44.8 | 158 | 40.2 | 30 | 20.7 | 0.016 | 3.0 | 894.8 | 55.3 |
| Acari\* | 38 | 23.5 | 4 | 28.6 | 0.0005 | 0.5 | 684.8 | 8.5 | 21 | 9.1 | 10 | 52.6 | 0.0003 | 0.1 | 481.8 | 6.4 | 59 | 15.0 | 14 | 9.7 | 0.001 | 0.1 | 146.4 | 9.1 |
| Araneae\* | 4 | 2.5 | 4 | 28.6 | 0.0200 | 20.2 | 648.4 | 8.0 | 8 | 3.5 | 6 | 31.6 | 0.0400 | 9.1 | 398.0 | 5.3 | 12 | 3.1 | 10 | 6.9 | 0.060 | 11.2 | 98.2 | 6.1 |
| Sphecidae | 11 | 6.8 | 6 | 42.9 | 0.0013 | 1.3 | 347.1 | 4.3 | 8 | 3.5 | 6 | 31.6 | 0.0009 | 0.2 | 116.2 | 1.6 | 19 | 4.8 | 12 | 8.3 | 0.002 | 0.4 | 43.5 | 2.7 |
| Solifugae\* | 5 | 3.1 | 3 | 21.4 | 0.0100 | 10.1 | 282.8 | 3.5 | 4 | 1.7 | 2 | 10.5 | 0.0080 | 1.8 | 37.5 | 0.5 | 9 | 2.3 | 5 | 3.4 | 0.018 | 3.4 | 19.5 | 1.2 |
| Anthomyiidae | 4 | 2.5 | 3 | 21.4 | 0.0100 | 10.1 | 269.6 | 3.3 | 13 | 5.6 | 7 | 36.8 | 0.0325 | 7.4 | 480.9 | 6.4 | 17 | 4.3 | 10 | 6.9 | 0.043 | 7.9 | 84.5 | 5.2 |
| Coccinelidae | 7 | 4.3 | 3 | 21.4 | 0.0042 | 4.2 | 183.6 | 2.3 | 14 | 6.1 | 7 | 36.8 | 0.0084 | 1.9 | 294.0 | 3.9 | 21 | 5.3 | 10 | 6.9 | 0.013 | 2.3 | 53.0 | 3.3 |
| Asilidae | 2 | 1.2 | 2 | 14.3 | 0.0140 | 14.2 | 219.9 | 2.7 | 2 | 0.9 | 2 | 10.5 | 0.0140 | 3.2 | 42.8 | 0.6 | 4 | 1.0 | 4 | 2.8 | 0.028 | 5.2 | 17.2 | 1.1 |
| Larvae and worms\* | 4 | 2.5 | 3 | 21.4 | 0.0030 | 3.0 | 117.9 | 1.5 | 18 | 7.8 | 7 | 36.8 | 0.0160 | 3.7 | 421.8 | 5.6 | 22 | 5.6 | 10 | 6.9 | 0.019 | 3.5 | 63.0 | 3.9 |
| Formicidae | 2 | 1.2 | 1 | 7.1 | 0.0160 | 16.2 | 124.4 | 1.5 | - | 0.0 | - | - | - | - | - | - | 2 | 0.5 | 1 | 0.7 | 0.016 | 3.0 | 2.4 | 0.1 |
| Curculionidae | 1 | 0.6 | 1 | 7.1 | 0.0070 | 7.1 | 55.0 | 0.7 | - | 0.0 | - | - | - | - | - | - | 1 | 0.3 | 1 | 0.7 | 0.007 | 1.3 | 1.1 | 0.1 |
| Hymenoptera indet.\* | 3 | 1.9 | 1 | 7.1 | 0.0040 | 4.0 | 42.1 | 0.5 | 1 | 0.4 | 1 | 5.3 | 0.0040 | 0.9 | 7.1 | 0.1 | 4 | 1.0 | 2 | 1.4 | 0.008 | 1.5 | 3.5 | 0.2 |
| Apoidea\* | 1 | 0.6 | 1 | 7.1 | 0.0005 | 0.5 | 8.0 | 0.1 | - | 0.0 | - | - | - | - | - | - | 1 | 0.3 | 1 | 0.7 | 0.001 | 0.1 | 0.2 | 0.0 |
| Cicadelidae | 1 | 0.6 | 1 | 7.1 | 0.0003 | 0.3 | 6.6 | 0.1 | 3 | 1.3 | 3 | 15.8 | 0.0009 | 0.2 | 23.8 | 0.3 | 4 | 1.0 | 4 | 2.8 | 0.001 | 0.2 | 3.4 | 0.2 |
| Tephritidae | 1 | 0.6 | 1 | 7.1 | 0.0002 | 0.2 | 5.5 | 0.1 | - | 0.0 | - | - | - | - | - | - | 1 | 0.3 | 1 | 0.7 | 0.000 | 0.0 | 0.2 | 0.0 |
| Drosophilidae | 1 | 0.6 | 1 | 7.1 | 0.0001 | 0.1 | 4.9 | 0.1 | - | 0.0 | - | - | - | - | - | - | 1 | 0.3 | 1 | 0.7 | 0.000 | 0.0 | 0.2 | 0.0 |
| Diptera indet.\* | 1 | 0.6 | 1 | 7.1 | 0.0000 | 0.0 | 4.4 | 0.1 | 13 | 5.6 | 2 | 10.5 | 0.0040 | 0.9 | 68.9 | 0.9 | 14 | 3.6 | 3 | 2.1 | 0.004 | 0.7 | 8.9 | 0.6 |
| Noctuiidae | - | - | - | - | - | - | - |  | 5 | 2.2 | 4 | 21.1 | 0.1040 | 23.8 | 545.9 | 7.3 | 5 | 1.3 | 4 | 2.8 | 0.104 | 19.4 | 57.0 | 3.5 |
| Tabanidae | - | - | - | - | - | - | - |  | 4 | 1.7 | 4 | 21.1 | 0.0960 | 21.9 | 498.3 | 6.7 | 4 | 1.0 | 4 | 2.8 | 0.096 | 17.9 | 52.2 | 3.2 |
| Tachinidae | - | - | - | - | - | - | - |  | 10 | 4.3 | 4 | 21.1 | 0.0800 | 18.3 | 476.0 | 6.4 | 10 | 2.5 | 4 | 2.8 | 0.080 | 14.9 | 48.2 | 3.0 |
| Empididae | - | - | - | - | - | - | - |  | 13 | 5.6 | 5 | 26.3 | 0.0000 | 0.0 | 148.1 | 2.0 | 13 | 3.3 | 5 | 3.4 | 0.000 | 0.0 | 11.4 | 0.7 |
| Halictidae | - | - | - | - | - | - | - |  | 5 | 2.2 | 2 | 10.5 | 0.0200 | 4.6 | 70.9 | 0.9 | 5 | 1.3 | 2 | 1.4 | 0.020 | 3.7 | 6.9 | 0.4 |
| Ichneumonidae | - | - | - | - | - | - | - |  | 2 | 0.9 | 2 | 10.5 | 0.0000 | 0.0 | 9.1 | 0.1 | 2 | 0.5 | 2 | 1.4 | 0.000 | 0.0 | 0.7 | 0.0 |
| Miridae | - | - | - | - | - | - | - |  | 1 | 0.4 | 1 | 5.3 | 0.0001 | 0.0 | 2.4 | 0.0 | 1 | 0.3 | 1 | 0.7 | 0.000 | 0.0 | 0.2 | 0.0 |
| Hemiptera indet.\* | - | - | - | - | - | - | - |  | 1 | 0.4 | 1 | 5.3 | 0.0000 | 0.0 | 2.3 | 0.0 | 1 | 0.3 | 1 | 0.7 | 0.000 | 0.0 | 0.2 | 0.0 |
| Licenidae | - | - | - | - | - | - | - |  | 1 | 0.4 | 1 | 5.3 | 0.0000 | 0.0 | 2.3 | 0.0 | 1 | 0.3 | 1 | 0.7 | 0.000 | 0.0 | 0.2 | 0.0 |
| Mollusca\* | - | - | - | - | - | - | - |  | 1 | 0.4 | 1 | 5.3 | 0.0000 | 0.0 | 2.3 | 0.0 | 1 | 0.3 | 1 | 0.7 | 0.000 | 0.0 | 0.2 | 0.0 |
| Trichoptera\* | - | - | - | - | - | - | - |  | 1 | 0.4 | 1 | 5.3 | 0.0000 | 0.0 | 2.3 | 0.0 | 1 | 0.3 | 1 | 0.7 | 0.000 | 0.0 | 0.2 | 0.0 |

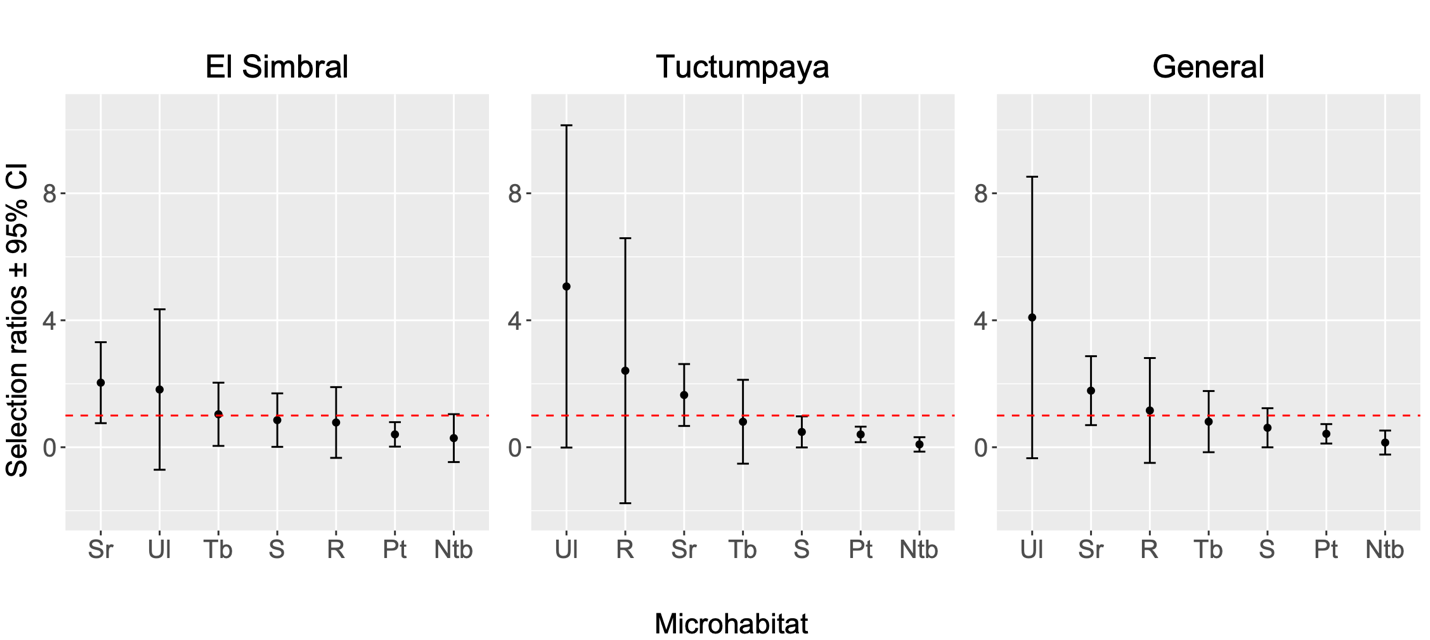
**Figures**

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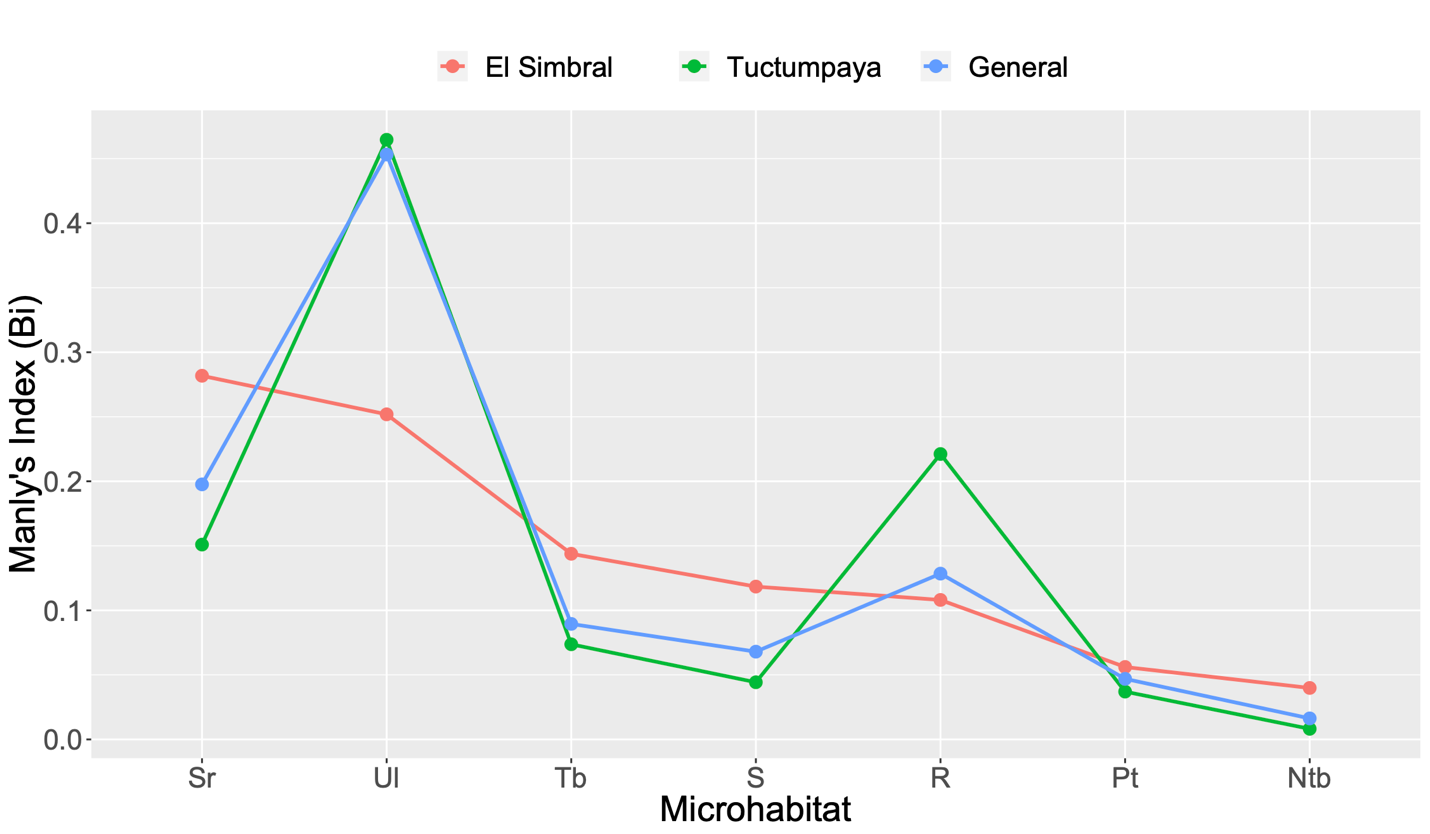
**Figure 1. Location of the *Polylepis* woodlands of “El Simbral” and “Tuctumpaya” in the buffer zone of the Salinas y Aguada Blanca National Reserve, Peru.**

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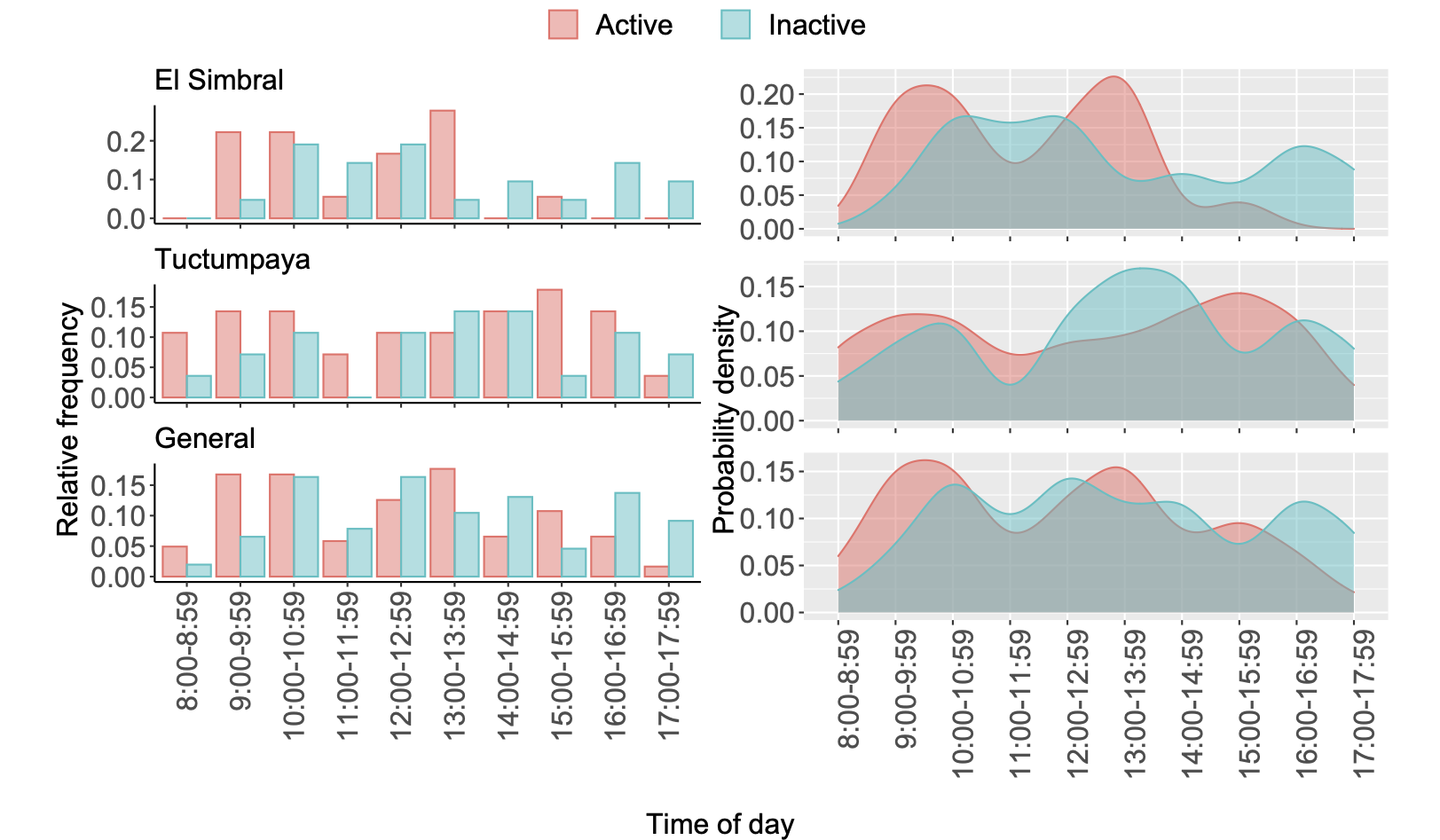
**Figure 2. *Polylepis* forests in “El Simbral” (Left) and “Tuctumpaya” (Right).**

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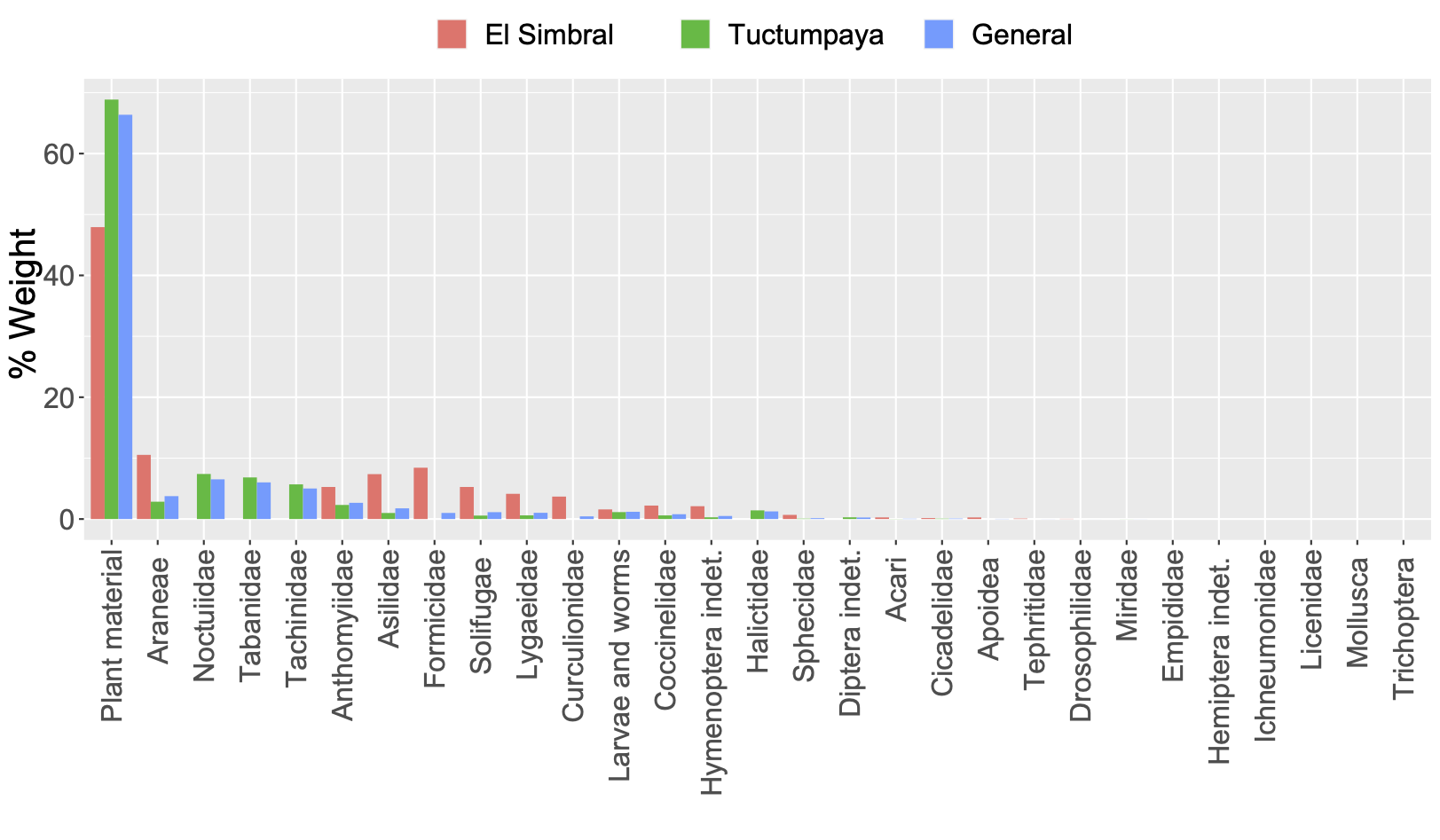
**Figure 3. Resource selection ratios for microhabitats used by populations of *L. etheridgei*. The dashed red line indicates the critic value 1.**

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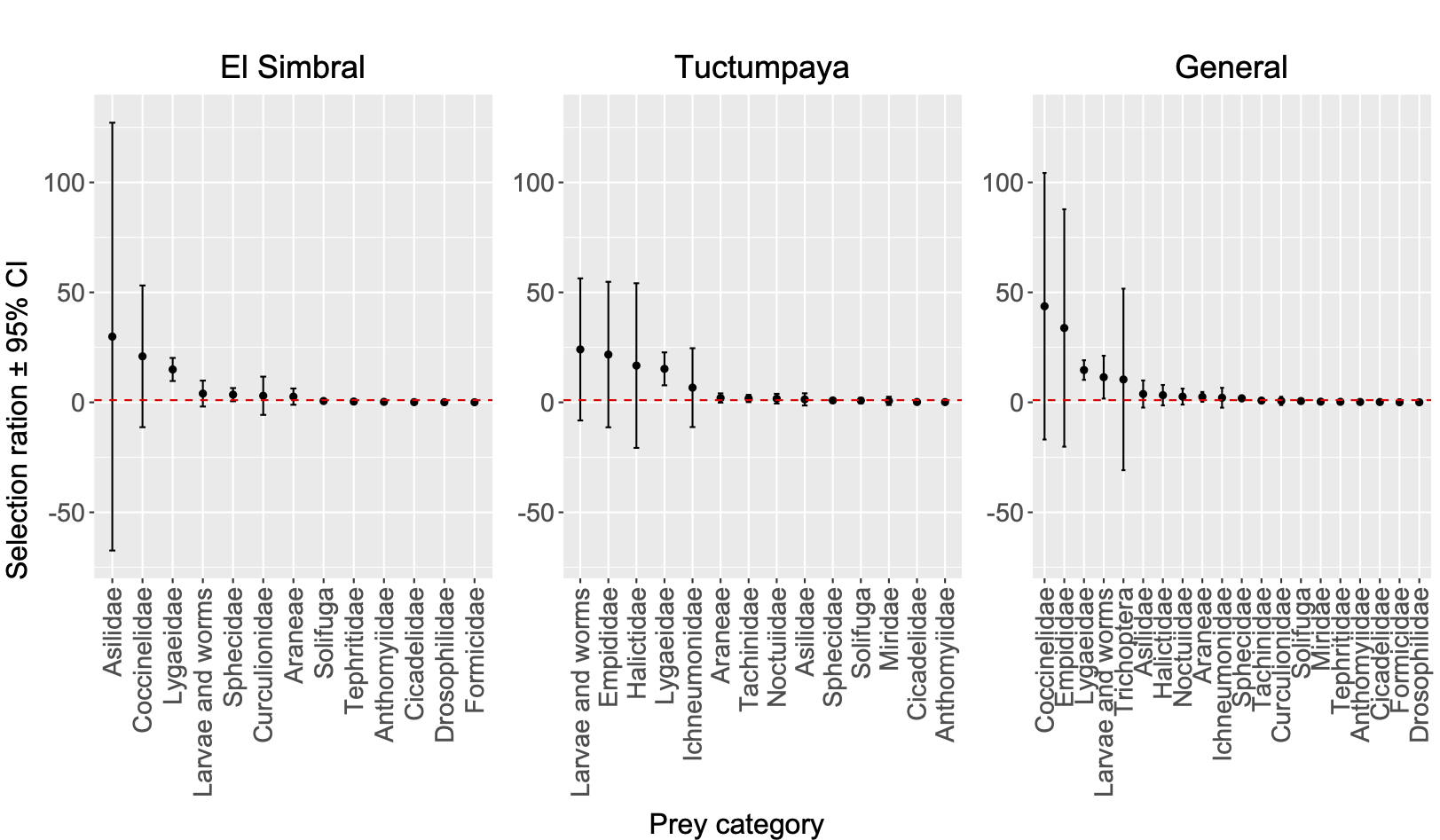
**Figure 4. Manly’s index for microhabitats used by *Liolaemus etheridgei*.**

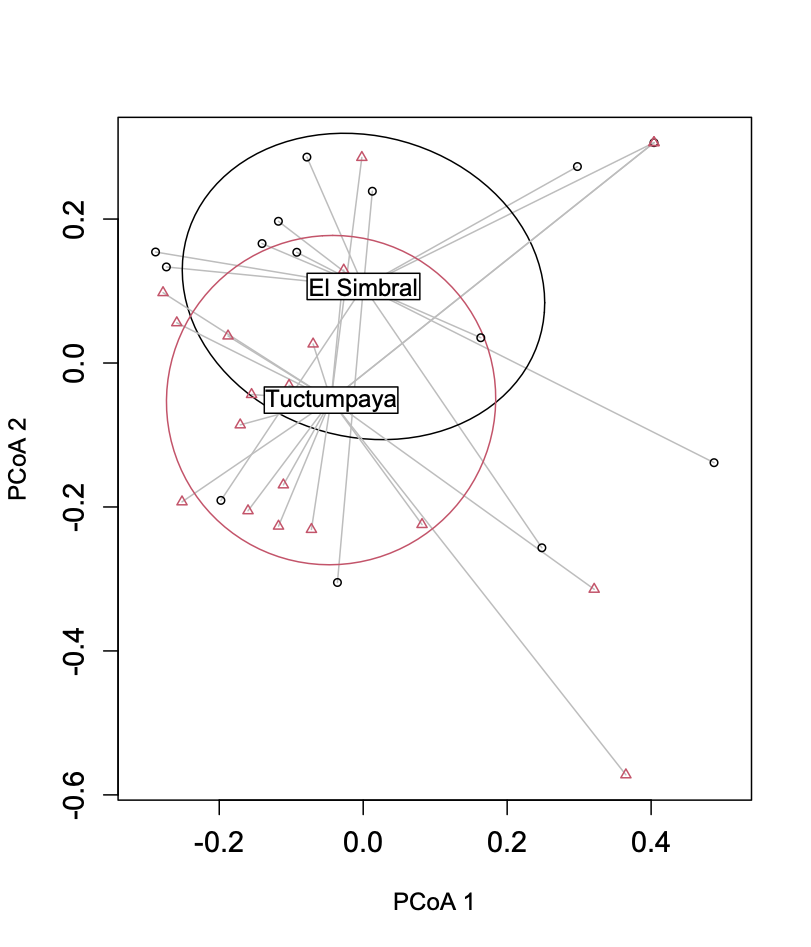
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**Figure 5. Daily activity pattern of *L. etheridgei* in the *Polylepis* forests of El Simbral and Tuctumpaya, Arequipa, Peru. Probability density functions are based on univariate kernel estimator (bandwidth = 1/3).**

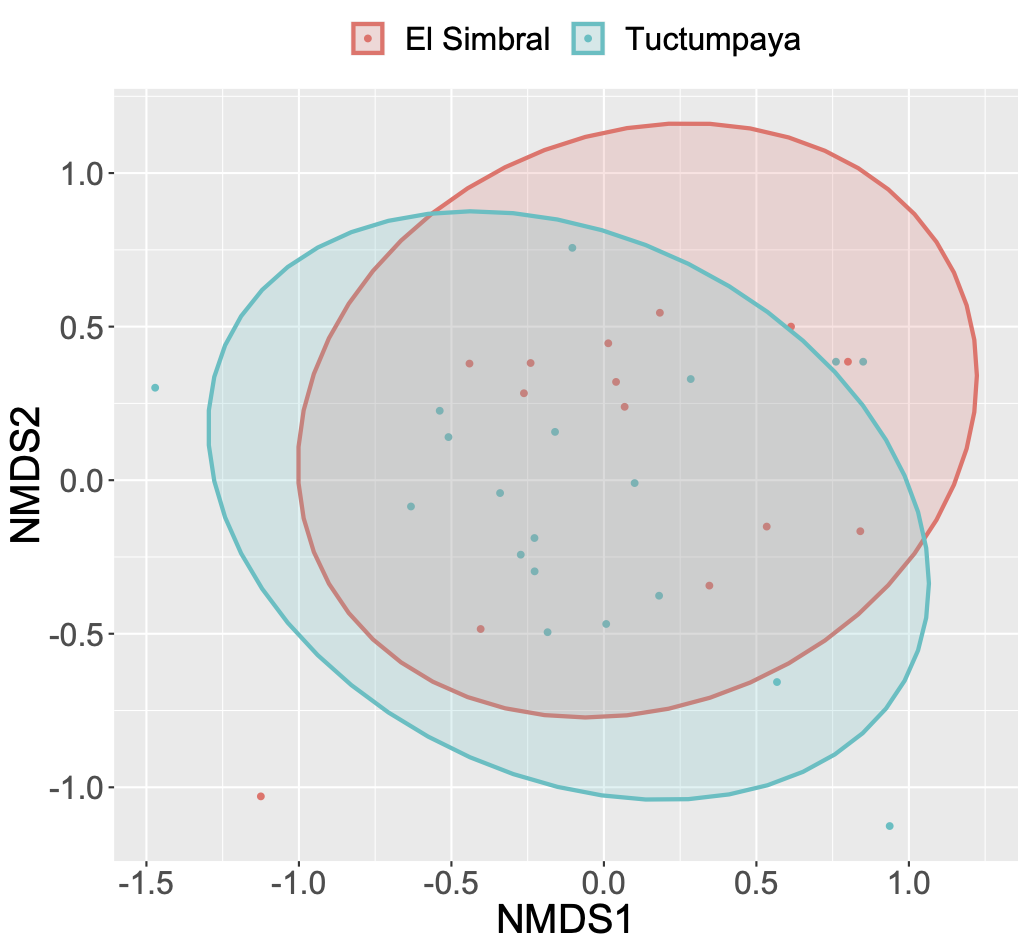
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**Figure 6. Dry weight percentage contribution of prey categories to the diet of *Liolaemus etheridgei*.**

**Figure 7. Resource selection ratios for preys consumed by populations of *L. etheridgei*. The dashed red line indicates the critic value 1.**

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**Figure 8. Multivariate dispersion (permutations = 9999) of prey categories consumed by *Liolaemus etheridgei* from El Simbral and Tuctumpaya. Two axis results from a Principal Coordinate Analysis.**

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**Figure 9. Unconstrained ordination based on non-metric multidimensional scaling (Stress = 0.194)**