Mediterranean House Geckos exploit novel resources in a recipient lizard assemblage

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Introduction

A species' ecological niche represents the environmental conditions needed for an individual to replace itself and is comprised of multiple resource axes (Pianka 2000 *Evol. Ecol.*).

One mechanism of establishment of non-native species is via exploitation of novel resources in recipient ecosystems through their unique functional traits (Schalk *et al.* 2018 *Biol. Invas.*).

Mediterranean House Geckos (*Hemidactylus turcicus*) are an exotic species introduced in urban areas across Texas, yet little is known about their resource use relative to native lizards.

We hypothesized that *H. turcicus* would exhibit low overlap in resource use in their habitat, dietary, and isotopic niches compared to native lizard species (Green Anole [*Anolis carolinensis*], Little Brown Skink [*Scincella lateralis*], Five-lined Skink [*Plestiodon fasciatus*]).

Methods

We conducted diurnal and nocturnal lizard surveys from May 2019 to July 2019 on the campus of Stephen F. Austin State University.

Each time a lizard was found, we quantified microhabitat by measuring ambient temperature (ºC), perch temperature (ºF), relative humidity, perch height, and perch type.

Fig.1: Collecting habitat data during nocturnal lizard survey (Left), Mediterranean house gecko (*H. turcicus*, Middle), and lizard stomach contents ([Lepidoptera, Top Right] [Orthoptera, Bottom Right]).

We examined the functional position of each species by measuring 12 morphological traits associated with diet and habitat use.

The stomach of each lizard was dissected, and invertebrate prey were identified to Order. Muscle tissue was analyzed for two stable isotopes ($\delta^{15}N$ – estimates trophic position and $\delta^{13}C$ – energy source supporting the consumer).

Functional Traits

H. turcicus were significantly different in their functional traits compared to the native lizard assemblage (PERMANOVA; F = 16.93; P [perm] = 0.0001; Fig. 2).

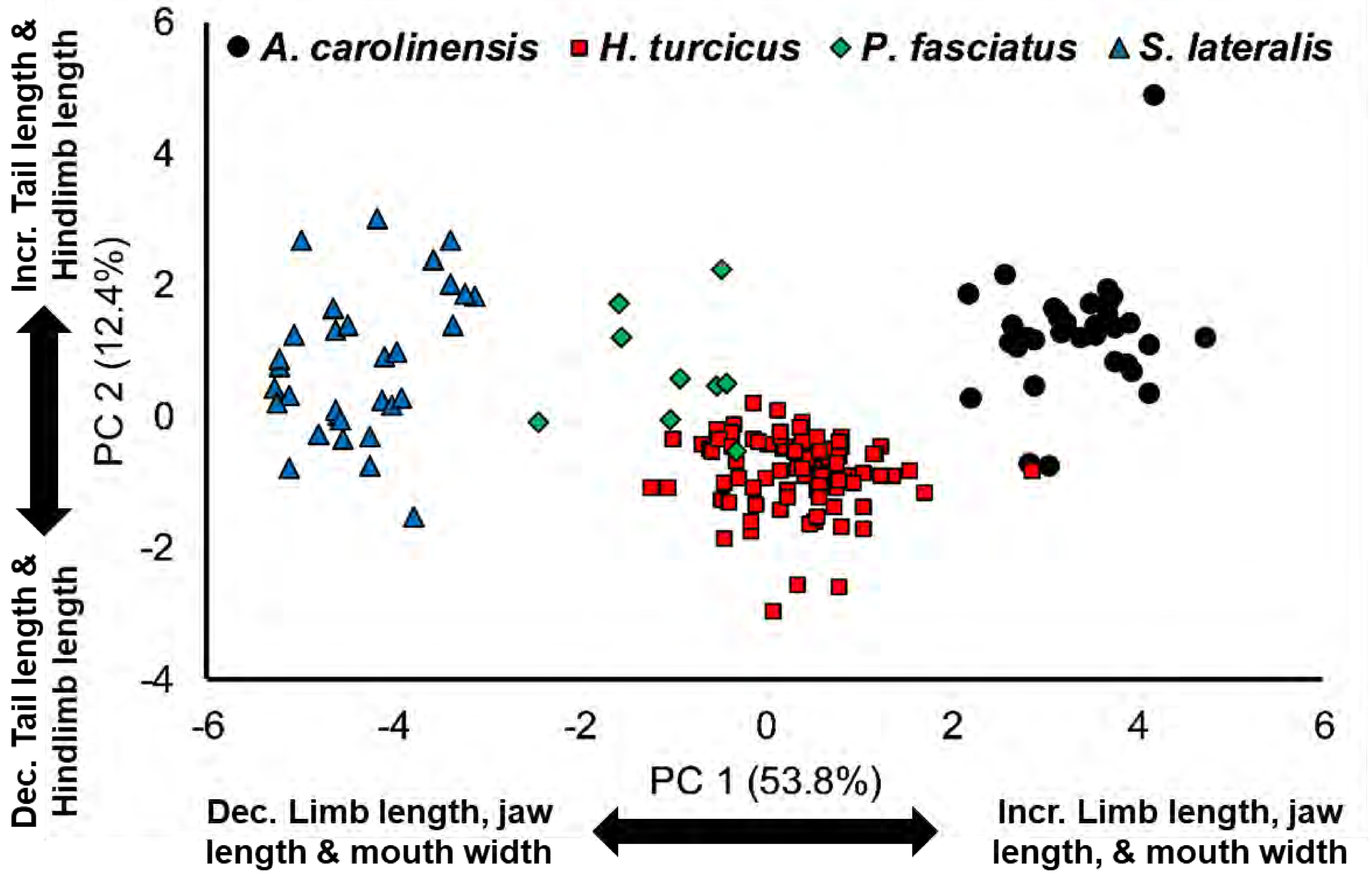


Fig. 2: Principal components analysis (PCA) of the functional position of native species and *H. turcicus* based on size-adjusted functional morphological traits. Each point represents a single individual of each species captured during the lizard surveys.

Habitat Niche Partitioning

Compared to native lizards, *H. turcicus* exploited novel microhabitats that consisted of high perches typically on unpainted concrete that were lower in temperature and relative humidity (PERMANOVA; F = 34.66; P [perm] = 0.0001; Fig. 3).

Native species used warmer perches (*A. carolinensis*) or perches that were lower in height or more terrestrial (*S. lateralis* and *P fasciatus*; Fig. 3).

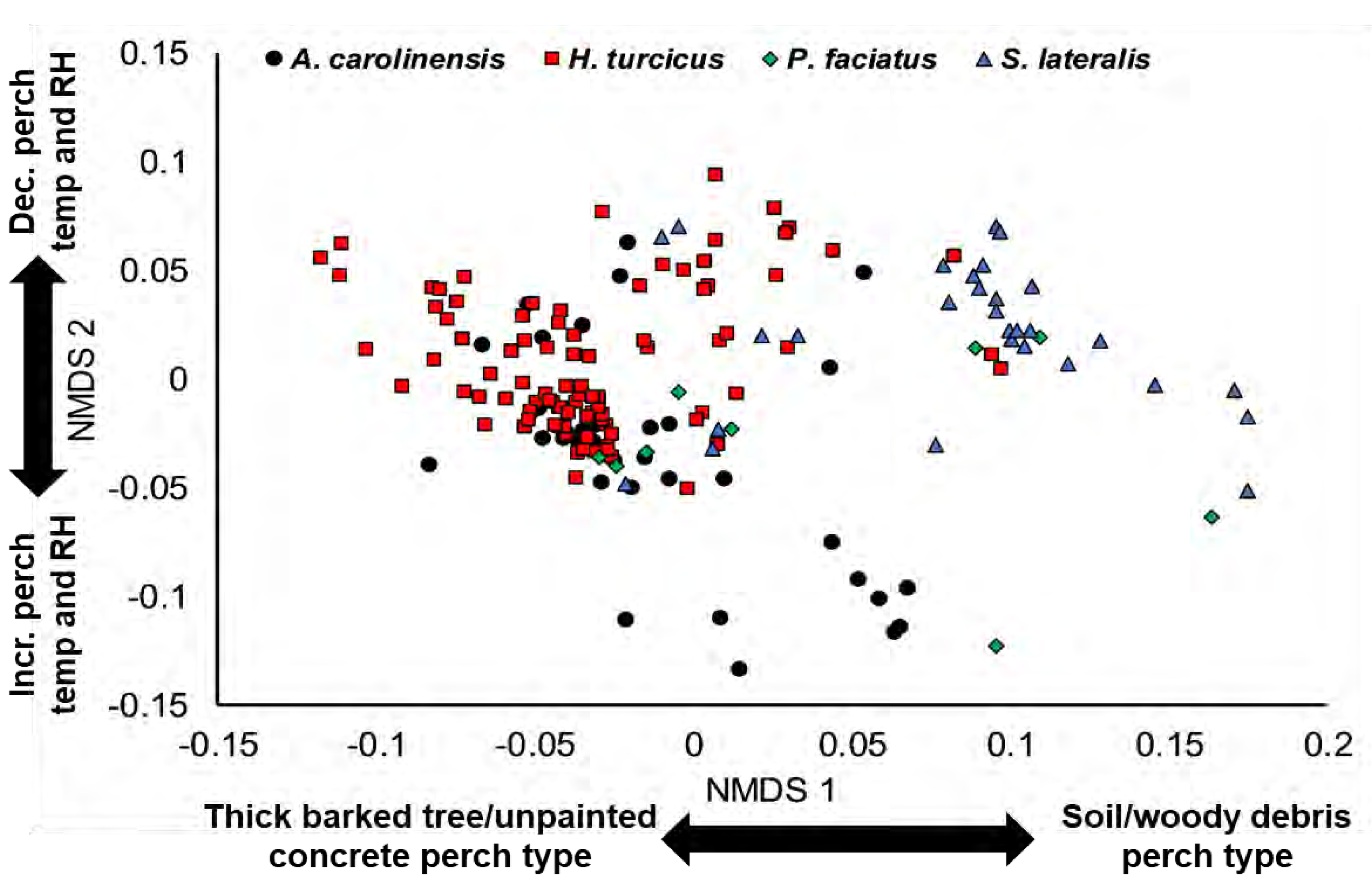
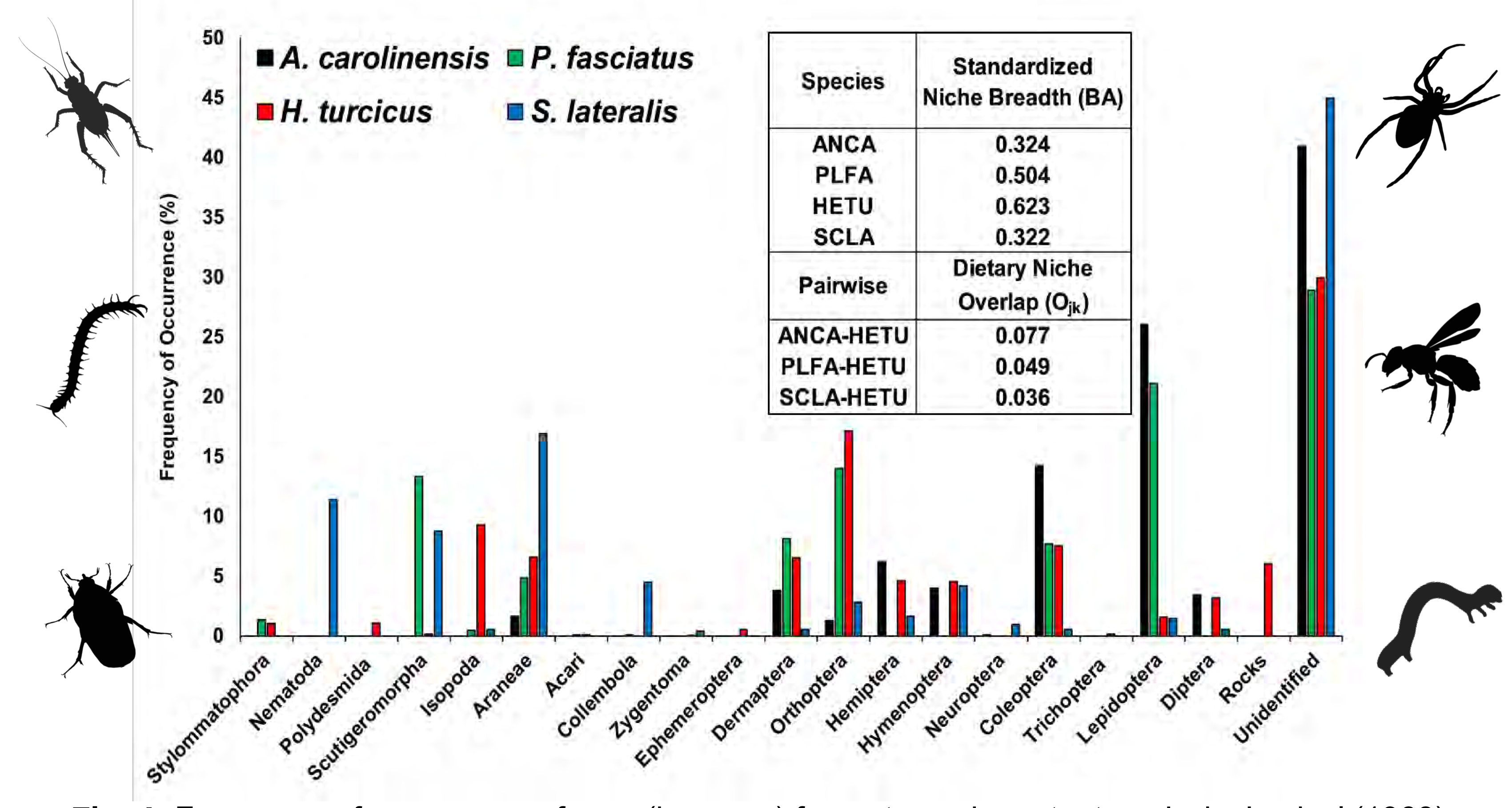


Fig. 3: Non-metric multidimensional scaling (NMDS) ordination of lizard microhabitat use.

Dietary Niche Partitioning

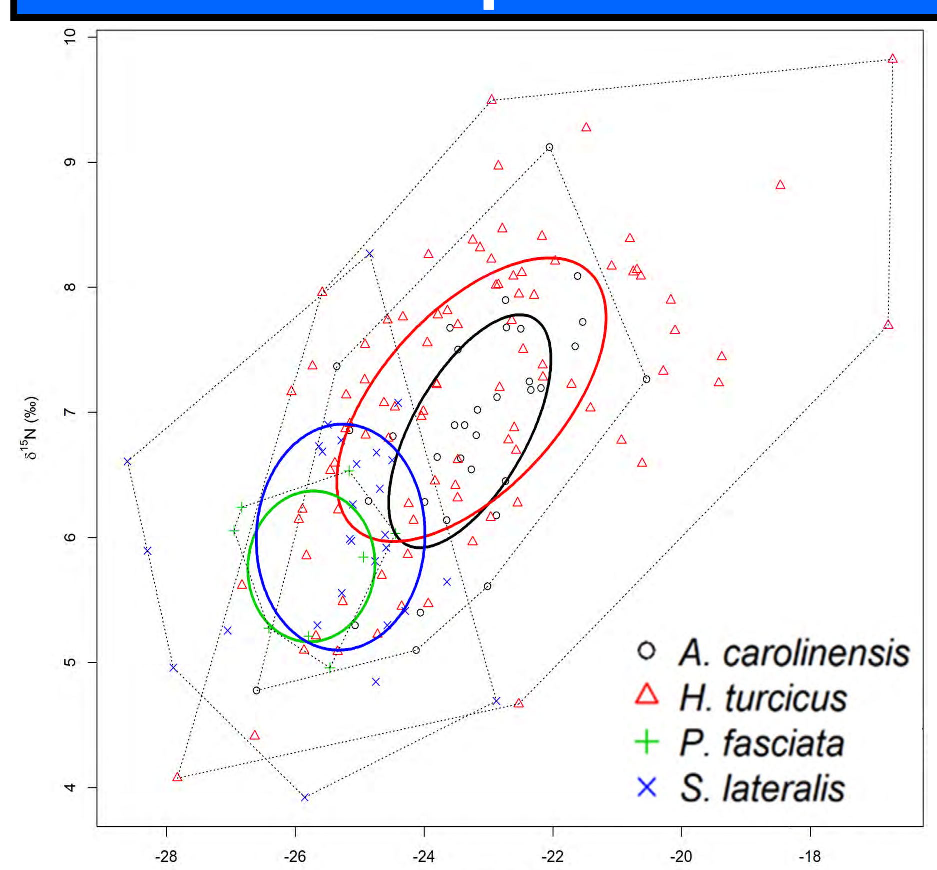
H. turcicus appeared to be a generalist predator and consumed a variety of prey such as orthopterans, isopods, and spiders (Fig. 4). Also, it had the broadest dietary niche breadth and exhibited low dietary niche overlap with native species (Fig. 4).



Species	Standardized Niche Breadth (BA)
ANCA	0.324
PLFA	0.504
HETU	0.623
SCLA	0.322
Pairwise	**Dietary Niche Overlap (O_{jk})**
ANCA-HETU	0.077
PLFA-HETU	0.049
SCLA-HETU	0.036

Fig. 4: Frequency of occurrence of prey (by mass) from stomach content analysis. Levins' (1968) standardized niche breadth (BA) ranges from 0-1 with 0 indicating a specialist and 1 indicative of a generalist. Pianka's (1973) dietary niche overlap (O_{jk}) of the sum of squared proportional volume of prey categories between species.

Isotopic Niche Partitioning



The four lizard species overlapped considerably in isotopic niche space (Fig. 5).

H. turcicus occupied greater isotopic niche space than native lizards and had the widest niche breadth in resource utilization ($\delta^{13}C$ range) and trophic level ($\delta^{15}N$ range).

Fig. 5: Bi-plot representing the sampled lizard assemblage in isotopic niche space. Standard ellipses area (corrected for sample size), shows areas of isotopic overlap between species. Carbon range ($\delta^{13}C$) is on the x-axis, and nitrogen range ($\delta^{15}N$) is on the y-axis.

Discussion

The functional uniqueness of *H. turcicus* enables it to exploit novel resources along multiple niche axes, facilitating their establishment and spread in novel ecosystems.

While their establishment likely does not affect native lizards, their impacts on native invertebrate (i.e., prey) populations is unknown.

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