

One gecko, Two geckos, not few geckos - but many geckos!

Spatial partitioning among geckos at Lambir Hills National Park

Ruchira Somaweera¹, Wayne Hsu² & Mona Octavia³

¹ Department of Zoology, University of Peradeniya, Sri Lanka.

² Department of Ecology, Evolution, and Environmental Biology, Columbia University, USA.

³ Department of Zoology, University of Malaysia Sarawak, Malaysia.

ABSTRACT

Four species of sympatric geckos occur in the Lambir Hills National Park headquarters premises. We investigated whether this distribution was facilitated by spatial partitioning among the species. Of the 212 individuals observed in five buildings, there was no significant difference in the distance geckos forage around artificial lights ($p = 0.0541$). Three of the four species have similar surface preferences. *Gekko smithii* tends to occur farthest from light sources, and *G. monarchus* appears restricted to wall surfaces; thus, our results suggest spatial partitioning occurs in multiple ways.

INTRODUCTION

A mega-hotspot for reptiles, the island of Borneo harbors 289 species of reptiles, of which 29 species are geckos (Gekkonidae) (Das 2006). Over 15 gecko species have been recorded from Lambir Hills National Park (LHNP). Many species have overlapping ranges around the LHNP headquarter premises, attracted to and possibly supported by the abundance of insects around artificial lights at night. Thus, the diverse gecko community provides an opportunity to study inter-specific and intra-specific coexistence and spatial partitioning.

The social behavior and spatial partitioning of animals are not only of intrinsic interest, but may also be relevant to our understanding of population dynamics and habitat selection (Stephens & Sutherland 1999). Studies on the social behavior of reptiles have lagged behind those of birds and mammals, reinforcing the traditional view that reptilian social systems are simpler than those of endothermic vertebrates. Recent studies have forced a reassessment of this perception, because it is increasingly clear that some reptiles exhibit complex social behavior and niche partitioning (Kearney *et al.* 2001).

Perhaps the most widely reported form of “sociality” in reptiles involves the tendency for individuals of multiple species to form aggregations, especially within feeding and retreat sites. Such behavior may be driven by the attraction of individuals to habitats that are more productive, such as around artificial lights. However, competition for limited resources necessitates some form of intra-specific partitioning.

We investigated whether there is spatial partitioning among geckos in the LHNP headquarter premises by testing two hypotheses, *viz.*:

H_A1: Sympatric gecko species feed at different distances from lights near human structures.

H_A2: Different gecko species are found on different surfaces around artificial lights.

MATERIALS AND METHODS

Field sampling

We sampled gekkonid aggregations on the exteriors of five buildings within the LHNP headquarters premises on 28, 29 and 31 July 2007. The sampling sessions began at 2130 with two observers (RS and WH) looking for geckos using flashlights, headlamps, and binoculars and the other investigator (MO) recording the data. We recorded the date and weather at the beginning of each sampling session and the following data for each individual:

1. Species – identified using external morphological features following Das (2006). We captured and keyed out unidentified species using Das (2007).

2. Life stage – juvenile or adult, determined based on the snout-vent length (SVL). Those whose approximate SVL were less than half of that given by Das (2006) were considered juveniles whereas the others were considered adults.
3. Building – public toilet, park shop/notice board, canteen, park office, cooking house.
4. Time – encounter time for each gecko.
5. Surface – the surface on which a gecko was first observed (ceiling, wall, pillar).
6. Height – the vertical distance (meters) from the ground to where a gecko was first observed.
7. Distance – shortest distance (meters) to nearest light source.
8. Source of light – nearest florescent or incandescent light, on or off.
9. Behavior – the prominent behavior observed (*e.g.* resting, foraging, feeding, fighting).

Statistical analysis

We entered data using OpenOffice Calc and performed analyses using program R 2.3.1. We used Analysis of Variance (ANOVA) to compare the distance to nearest light source for different gecko species, and also the number of individuals perched on each type of surface.

RESULTS

We found four species of geckos: *Gehyra mutilata* (Four-clawed house gecko) [14 individuals], *Gekko monarchus* (Warty house gecko) [14 individuals], *Gekko smithii* (Smith's giant gecko) [25 individuals], and *Hemidactylus frenatus* (Asian house gecko) [159 individuals] (Figure 1). There was no significant difference among species in the distance from light (Figure 2, $p = 0.0541$). Geckos mainly preferred to station themselves on the wall, but preferences differed slightly among species (Figure 3). Additionally, we observed a Striped Bornean tree skink (*Apterygodon vittatum*) hiding in the same crevice at the cooking house during all sample days but did not include it in further analyses.

DISCUSSION

Contrary to expectations, gecko species at LHNP do not appear to significantly partition territories around artificial lights by the distance that they feed around a light. However, *Gek. smithii* tends to occur farther from light sources than the other three species. Except *Gek. monarchus*, which we observed on walls only, the other species had similar surface preferences. Hence, our results suggest *Gek. smithii* and *Gek. monarchus* display spatial partitioning in distance from light and substrate choice, respectively. We detected no differences in spatial occurrence of *Geh. mutilata* and *H. frenatus*, but the greater abundance of *H. frenatus* indicates the two species might differ in other respects not considered in our study.

Larger individuals of *Gekko* spp. are known to prey on smaller geckos (Somaweera, pers. obs.). All *Gekko* individuals we considered adults were not fully-grown; thus, the absence of large predatory individuals could have allowed the coexistence of the different gecko species despite indistinct spatial separation. The introduction of artificial lights to LHNP could have resulted in unnaturally high concentrations of geckos to which distinct niche partitioning has not yet evolved. Insects might also not be a limiting food resource, therefore no partitioning may be necessary. Furthermore, different light sources are turned on for different lengths of time, so the spatial distribution of geckos may not correlate strongly to the location of lights.

Though not observed within the five buildings, we recorded three individuals of *Cyrtodactylus pubisulcus* (Grooved bent-toed gecko) and one *C. malayanus* (Malayan bent-toed gecko) near the public toilet and park shop, at the park boundary. Additionally, Das (pers. comm.) has observed *Cosymbotus platyurus* (Frisly house gecko), *Ptychozoon kuhli* (Kulh's gliding gecko), and *P. horsfieldii* (Horsfield's gliding gecko) on these structures. Spatial partitioning may contribute to, but is not the only factor allowing for the striking diversity of geckos at LHNP.

ACKNOWLEDGMENTS

Our sincere gratitude goes to the organizers of the Biodiversity of Borneo Harvard Field Course 2007, especially Dr. Cam Webb for the opportunity to participate; Dr. Indraneil Das for his guidance; Min Sheng Khoo for assistance with data analysis; and the staff of LHNP.

REFERENCES

DAS, I. 2006. A photographic guide to snakes and other reptiles of Borneo. New Holland Publishers.

DAS, I. 2007. Online guide to the Lizards of Borneo<??????> 12 June 2007.

KEARNEY, M., SHINE, R., COMBER, S. & PEARSON, D. 2001. Why do geckos group? *Herpetologica*. 57(4):411-422.

STEPHENS, P.A. & SUTHERLAND, W.J. 1999. Consequences of the Allee effect for ecology, behavior and conservation. *Trends in Ecology and Evolution*. 14:401-404.

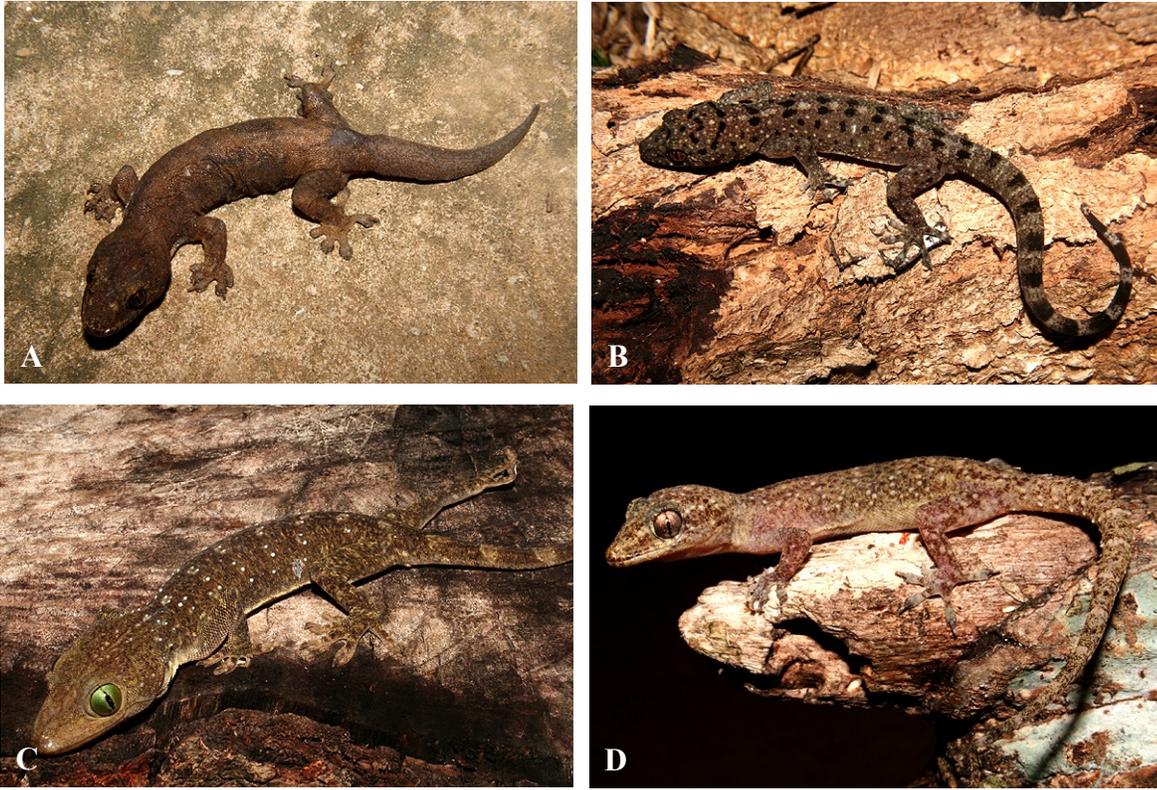


FIGURE 1: Four gecko species found during the survey. A- *Gehyra mutilata*, B- *Gekko monarchus*, C- *Gekko smithii*, D- *Hemidactylus frenatus*.

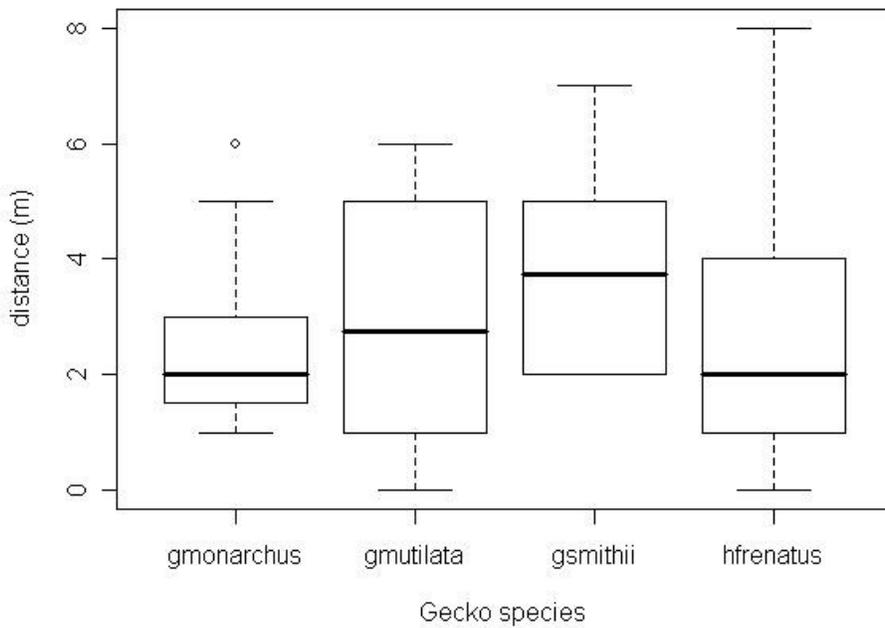


FIGURE 2. Foraging distance from light (m) of four gecko species at LHNP. Differences were not

significantly different; $p = 0.0541$.



FIGURE 3. Proportional occurrence of geckos on three different substrates. Width represents relative sample size.
