A Comparison of Activity Time and Thermal Preferences between *Ameiva fuscata* Age Groups

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Dominica Tropical Field Biology 2015

Abstract:

A differential study was conducted between juvenile and adult *Ameiva fuscata* investigating the times of day during which juveniles and adults were active, as well as the preferred heat indices and substrate temperatures of each group. Two study sites were surveyed, the Archbold Tropical Research and Education Centre (ATREC) at Springfield and Cabrits National Park, and the time and age group of each sighting were recorded in addition to paired observations of the heat index and substrate temperature at the location of each sighting and a random point. The results suggested that juveniles became active earlier in the day than adults, but that adults remained active later into the day and on average occupied sites with cooler temperatures compared to juveniles. Future studies should be made to determine the extent of and mechanism behind this disparity in activity time.

Tags: Ameiva, fuscata, Teiidae, Dominica, thermal

Introduction:

The Dominican ground lizard or abòlò, *Ameiva fuscata*, is endemic to the Caribbean island of Dominica in the Lesser Antilles. *Ameiva fuscata* is mostly restricted to dry coastal woodland and scrub, littoral woodland, and agricultural areas below 300 meters above sea level, but has begun to expand its range into higher elevation areas as rainforest is cleared for agriculture (Malhotra et al 2007). *A. fuscata* is an active generalist omnivore with a diet ranging from fruit and small animals to carrion and garbage. Juveniles are easily distinguished from mature adults by their coppery brown coloration with yellow lateral stripes and mottling (see Figure 1), in contrast to the blue-gray coloration, pale blue venter, and dark mottling of mature specimens (see Figure 2).

Teiids such as *Ameiva fuscata* are active foragers and maintain a relatively high body temperature throughout the day, usually around 37°C, indicating an ability to thermoregulate very effectively (Sales et al 2011). A 1996 study with *Ameiva ameiva* in southeastern Colombia by Carmen Biázquez has shown a disparity in time of activity between adults and juveniles, with the juveniles being most active during midday and the adults being most active during late morning and early afternoon. However, Biázquez notes that the *Ameiva* found in the study area were relatively small compared to those found in other areas, suggesting a relatively narrow difference in size ranges between juveniles and adults, and that the disparity in activity time seemed to be more due to changes in humidity than external temperatures (Biázquez 1996). However, as Biázquez did not provide specific morphometric data to indicate what constituted relatively small, I must infer that the *Ameiva* populations found within this study's sample sites contain a greater range of sizes more representative of *Ameiva* in general.

I hypothesize that there will be a disparity in time of activity and external temperature between adult and juvenile specimens: juvenile activity on average will begin earlier in the day and decline as temperatures decreases, whereas adult activity on average will begin later in the day and last longer than that of juveniles. In addition, Teiid lizards are heliothermic, using heat from the sun to increase their body temperature and withdrawing to cooler areas to decrease it (Malhotra et al. 1999). As objects of greater mass both heat and cool more slowly than objects of lesser mass, I suspect that the exothermic *Ameiva*, which depend on external temperatures to control body temperature, will exhibit different thermoregulatory behavior based on mass. The larger adults will require more energy to reach a high internal body temperature than juveniles and will begin activity at higher temperatures, but will cool more slowly, allowing them to remain active as temperatures begin to decline.

Figure 1. Juvenile *Ameiva fuscata*. ©2008 Wolfgang Wuster

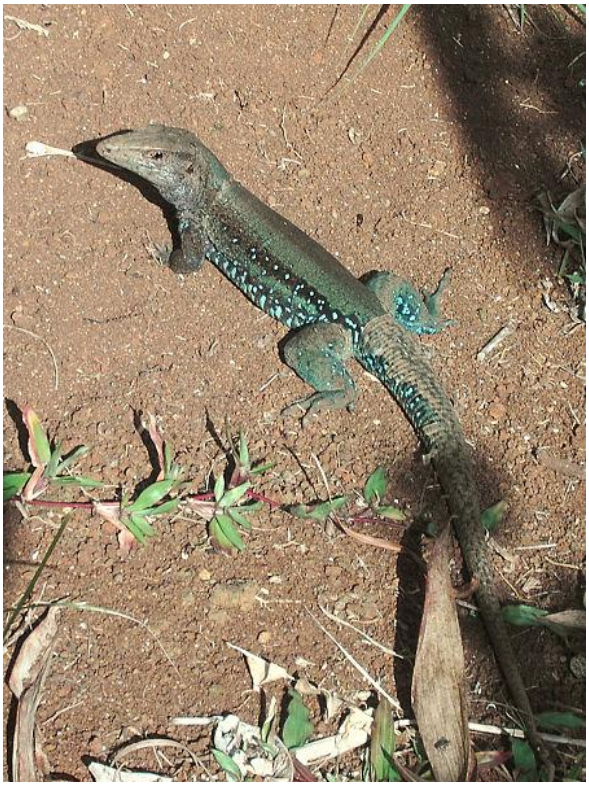

Figure 2. Adult *Ameiva fuscata*. © Hans Hillewaert / CC-BY-SA-4.0

Materials and Methods:

Surveys were conducted on two study sites: The Archbold Tropical Research and Education Center in Springfield and Cabrits National Park. Springfield was a former agricultural area mostly composed of secondary rainforest, and Cabrits National Park consisted mostly of Caribbean dry forest (Encarnacion 2014).Heat indices and substrate temperature were measured by a Kestrel 3000 weather meter and a Fluke CNX t3000 Wireless K-Type Thermometer respectively. Using a random number generator, a random compass bearing between 0 and 360 degrees was generated for each point, as well as a random distance between 1 and 10 meters. These were used to select a random point where the heat index and substrate temperature were measured and recorded to form a control, as described by Fitzgerald et al 1997. Points were segregated between those occupied by juveniles and adults.

Results:

	Time	Original Site (Heat Index)	Random Site (Heat Index)	Original Site (Substrate Temperature)	Random Site (Substrate Temperature)	J/A	Location
	9:59	32.5	34.5	30.5	31.5	J	Cabrits
	10:00	37	35.7	32	32.3	J	Cabrits
	10:01	35.5	36.5	36.8	34.1	J	Cabrits
	10:07	31	31.3	24.5	26.2	J	Springfield
	10:10	41	42	32	39.4	J	Springfield
	10:13	35	35.3	41.2	29.7	J	Springfield
	10:20	37.5	38	32.1	31	J	Cabrits
	10:25	39.2	39.2	33.5	31.2	J	Cabrits
	10:31	37	37	32	28	J	Springfield
	10:52	34.3	32.7	29.3	28.3	J	Cabrits
	10:55	52.5	50.5	36.7	34.4	J	Springfield
	11:03	49.1	40.1	26.7	29.7	J	Springfield
	11:10	36	35.3	24.5	26.3	J	Springfield
	11:12	35.3	50.5	27.3	29	J	Springfield
	11:12	51.6	49.6	35.4	32	J	Springfield
	11:15	42.4	43.8	27.6	33.9	J	Springfield
	11:27	36.9	36.5	31.6	30.2	J	Cabrits
	12:06	34	36.7	31.2	28	J	Springfield
	12:06	38.3	35.8	36	26.5	J	Springfield
	13:33	45.3	47	38	35.3	J	Springfield
	13:46	50.1	51.4	27.8	38.2	J	Springfield
	14:11	36	35.4	28	26.6	J	Springfield
	14:27	41	43.2	30.2	28.3	J	Springfield
	15:45	39.2	38.5	28.1	28.8	J	Springfield
	15:45	40.5	39.2	32.4	29	J	Springfield
Average	11:42	39.528	39.828	31.416	30.716		

Figure 3. Statistics of thermal microhabitat selection by juvenile *Ameiva fuscata.*

Paired T-tests: Original site HI vs. Random site HI t: 0.39 df: 24 p: 0.701

Original substrate vs Random substrate t: 0.75 df:24 p:0.46

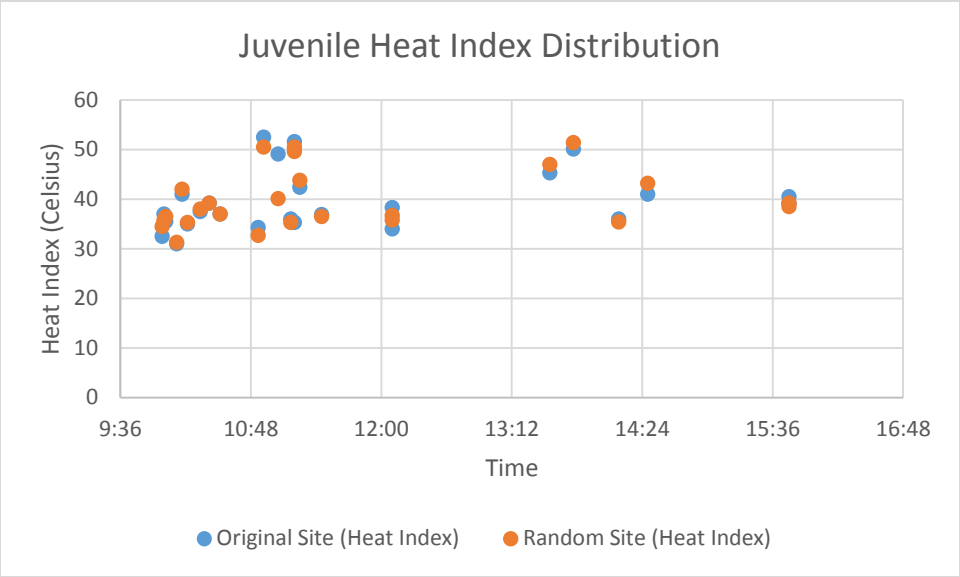

Figure 4. The distribution of juvenile *Ameiva* sightings and the accompanying heat indices across time.

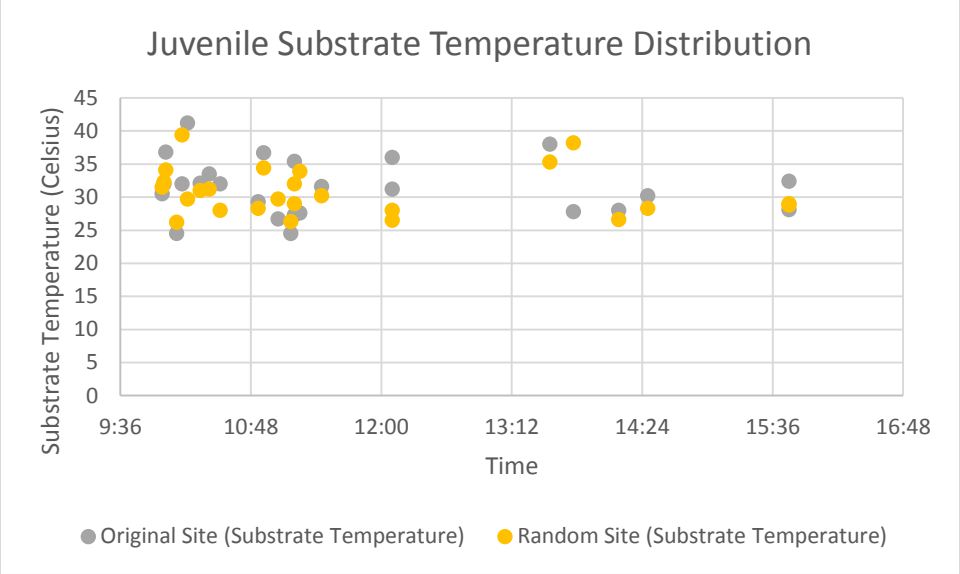

Figure 5. The distribution of juvenile Ameiva sightings and the accompanying substrate temperatures across time.

	Time	Original Site (Heat Index)	Random Site (Heat Index)	Original Site (Substrate Temperature)	Random Site (Substrate Temperature)	J/A	Location
	10:40	29.7	30.4	28.2	24.2	A	Springfield
	10:42	33.1	35.8	28.4	26.2	A	Springfield
	10:43	33.8	35	29.3	30.1	A	Cabrits
	10:47	38	44.4	31	32.7	A	Springfield
	11:05	34	34.5	29.3	28.5	A	Cabrits
	11:39	37.1	34.6	27	26.5	A	Springfield
	11:44	38	43.1	31.6	31.8	A	Cabrits
	11:48	46.8	48.3	31.7	33.4	A	Springfield
	11:49	34.8	33	26.8	25.8	A	Springfield
	11:49	33	35	26.5	27	A	Springfield
	12:00	31.6	24.7	26	24.7	A	Springfield
	12:18	37.2	39	33.6	33.3	A	Cabrits
	12:25	37.2	34	27.9	27	A	Springfield
	12:25	28	31.7	25.2	26.5	A	Springfield
	12:40	28	35	28.2	29.5	A	Springfield
	12:43	28.8	35.5	25.2	27.2	A	Springfield
	12:45	36	44	31.5	31.7	A	Springfield
	12:49	32.3	42.5	29.4	39.3	A	Springfield
	13:40	47	57.9	48.8	42	A	Springfield
	13:48	41.2	26.2	29	32.6	A	Springfield
	14:15	42.1	38	31	30.1	A	Springfield
	14:23	39	36.2	31.9	30.2	A	Springfield
	14:43	35	34.3	27.5	28.1	A	Springfield
	15:14	36	36.3	25.8	27	A	Springfield
	15:40	39.3	38	28.6	27.8	A	Springfield
Average	12:34	35.88	37.096	29.576	29.728		

Figure 6. Statistics of thermal microhabitat selection by adult *Ameiva fuscata.*

Paired T-tests: Original Site HI vs. Random Site HI: t: 1.08 df: 24 p: 0.292

Original substrate vs. random substrate: t: 0.26 df: 24 p: 0.796

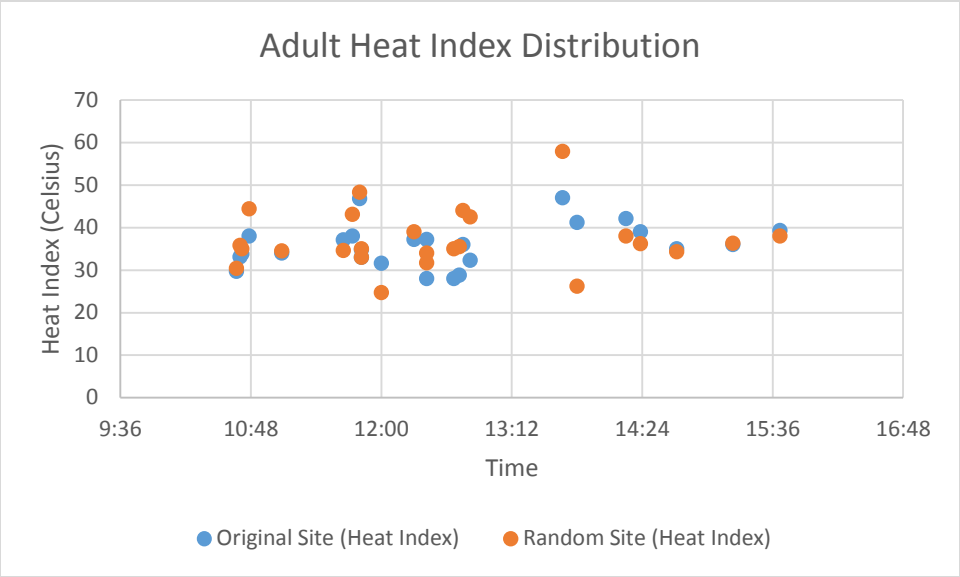

Figure 7. The distribution of adult Ameiva sightings and the accompanying heat indices across time.

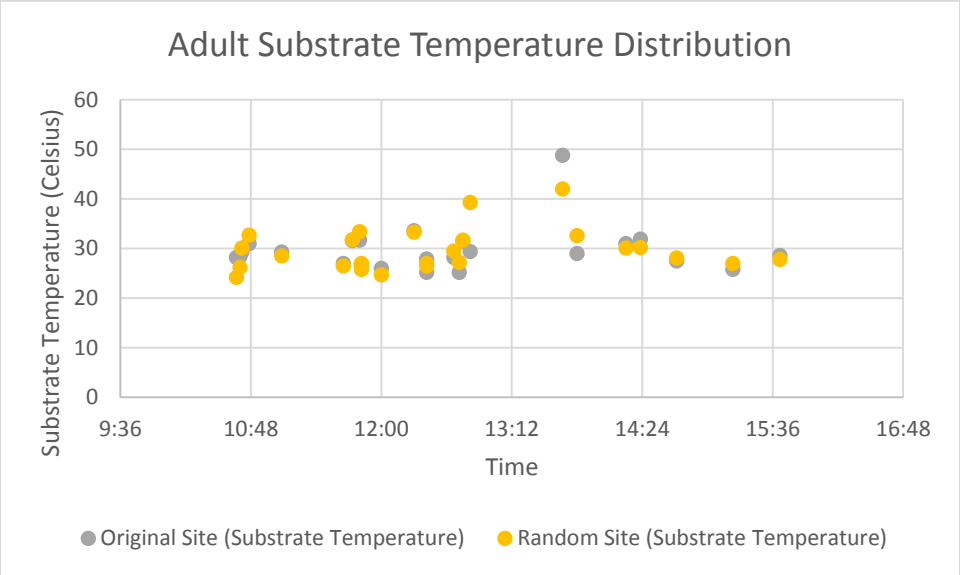

Figure 8. The distribution of adult Ameiva sightings and the accompanying substrate temperatures across time.

T-tests	Adult vs Juv HI	Adult vs Juv Substrate
	t: 2.34 df: 48 p: 0.024	t: 1.47 df: 48 p: 0.149

Discussion:

The results mostly support the hypothesis: adult *Ameiva*, on average, were active later in the day than juveniles. Also, a set of pair T-tests confirmed that while adults and juveniles occupied points with similar substrate temperatures, possibly due to thermal homogeneity throughout the study sites, adults were able to operate at lower heat indices than juveniles. This supports the claim that the larger adults cool more slowly and thus are able to remain active at lower temperatures than juveniles. In addition, juveniles began activity earlier in the day than adults. There was limited evidence that juveniles began to decline in activity earlier in the day than adults, but the sample size was not large enough to observe a definite trend. Contrary to the findings of Biázquez's 1996 study, juvenile activity was most heavily concentrated during mid to late morning, rather than at midday. Similarly, adult activity was heaviest at midday, rather than morning and afternoon as Biázquez found. Further, a set of Paired T-tests indicate that the range of heat indices and substrate temperatures was similar in both occupied and random points, suggesting that external temperature may not have been a deciding factor in microhabitat selection. This may be due to a lack of thermal heterogeneity at the study sites during times of activity, leading to most microhabitats to fall within the *Ameiva's* range of tolerance. Future studies should attempt to conduct surveys in different sites or different times of the year which exhibit greater thermal heterogeneity in order to investigate differences in temperature tolerance between juveniles and adults.

Due to time and transportation constraints, the sample size and diversity of sample sites were limited, and any future studies should try to increase both. While the study does indicate a disparity in time of activity between juvenile and adult *Ameiva*, it does not discount humidity rather than temperature as a determining factor as it was in Biázquez's 1996 study. As such, humidity should be incorporated as a variable in future studies concerning the disparity in activity time between juvenile and adult *Ameiva.*

Acknowledgements:

To Dr. Thomas Lacher for transportation, analytical and moral support, and for his assistance in procuring supplemental morphometric data. This study could not have occurred without your help.

To Dr. Lee Fitzgerald for helping to design and improve this study. Thank you for encouraging me to be more ambitious in my research.

To Dr. Jim Woolley for moral and logistical support, and for helpful advice at every turn.

To Diana Encarnacion for bringing *Ameiva fuscata* to my attention and stimulating my interest in the species.

To Texas A&M PhD student Nicole Angeli, for encouraging my interest in *Ameiva* and allowing me to participate in her morphological project.

To the staff at the Archbold Tropical Research and Education Centre for moral support and helping me to learn the habits of the flighty abòlò.

To Nancy Osler for allowing me to borrow her live animal trap.

To the administration of Cabrits National Park, for allowing me to attempt specimen acquisition.

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