Size Variation in *Anolis oculatus* Between Dominican Habitats

Gaston Casillas
Kristina Carter
Lara Kreuter
Candice Ferguson
Alejandra Mendez

Texas A&M University
Dr. Lacher
Dr. Woolley

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Abstract:

Anolis oculatus, or commonly known as the Dominican anole, is abundant on the island of Dominica. The following report observed the size variation of anoles in habitats with differing moisture levels using a caliper, data sheet, and an Avinet precision spring scale. By using principle component statistics to compare the variables (Jaw length, Head width, head length, front leg length, and back leg length) we observed no trends in size of any morphological measures except for weight in relation to the levels of moisture content.

Introduction:

Although the island of Dominica has several types of habitats from coastal to montane, because the shape and layout of the land many different parts of the island receive large differences in annual rainfall. The rainforests obviously accumulating the most rain to Cabrits National Park, a dry forest accumulating the least. This study was to determine whether or not there are significant morphological differences among anole populations in habitats that receive different levels of annual precipitation.

Three different locations were used to determine size variation in anoles (*Anolis oculatus).* Each location was unique in vegetation and moisture content on the Dominica Island. The locations used were Emerald Pool, Batalie Beach, and Cabrits National Park.

Emerald Pool (EP) was the site chosen for the primary rainforest location. This location was chosen for an undisturbed habitat and is known for its high rainfall. In general primary rainforests occur at elevations between 1,000to 2,500 feet, they average between 175 to 300 inches of precipitation per year, and tend to have more mature trees.

Batalie beach (BB) is a coastal habit at sea level. It has large amount of coastline and an abundance of detritus in the forested area. This location is more open to sunlight and better fitted for the *Anolis* to bask. The average rainfall is 50 to 60 inches per year (Tarbox, 2005).

Cabrits National Park (CNP) was chosen for dry forest habitat location. Dry forest habitats usually average a precipitation rate of 60 to 70 inches per year and occur at elevations from 0 to 1,000 feet (Valentine, 2002). A common sight at CNP is the ruins of the British settlements from the 18th century which are now reclaimed by the forest; the old Commandant Quarters and the Douglas Bay battery, two separate yet similar locations only differing in 100 feet elevation were chosen for lizard collection.

In areas with high moisture content it is expected that there will be higher concentrations of insects, therefore more potential for feeding for the anoles. Another prediction is that with high amounts of moisture there will be a high density of vegetation, or camouflage for the anoles. As a result it could be estimated that there will be a larger individual size of anoles contained within the wet forest areas. In addition to the moisture, more arboreal habitats would favor longer limbs to be able to climb trees more efficiently.

Methods and Materials

The group used a caliper, a 100-gram scale, a plastic bag, data sheets, a clipboard, and a pigma pen for the measurements and data collection. All anoles were caught by hand in the various habitats. During the process of data collection a minimum of three people were required for collecting and recording data.

The group would spread out within the study areas searching the most likely spots for anoles. For example, in Cabrits National Park the ruin walls were searched, in Batalie beach the forest areas were explored, and in Emerald Pool the rocks and vegetation adjacent to the water were examined. After an anole was caught one person would hold the anole, one person would measure (weight, front leg length, back leg length, tail length, head length, head width, and jaw length), and the other person would record the data. This process was repeated every time an anole was caught and at every location.

The data that were obtained was analyzed using a principle components analysis program on all variables except weight and tail length. The Tail length was excluded due to the amount of anoles missing their tails. The weight was extremely skewed towards the Batalie beach anoles and did not have an influence on morphological size. All the variables were also compared among sites using a one-way analysis of variance.

Results

Date:	Time:	Location:	Weather	Weight (g)	Front Leg (mm)	Back Leg (mm)	Tail Length (mm)	Head Length (mm)	Head Width (mm)	Jaw Length (mm)
5/24/13	9:10 AM	Batalie Beach	Sunny	4.5	17.7	24.4	44	15.9	8.24	5.1
5/24/13	9:13 AM	Batalie Beach	Sunny	2.5	14.4	19.4	83.5	14.1	7.5	4.3
5/24/13	9:38 AM	Batalie Beach	Sunny	3.5	16	22.1	89.3	15	8	5.4
5/24/13	9:38 AM	Batalie Beach	Sunny	10.5	20.9	30.9	102.1	19	12.7	9.8
5/24/13	9:50 AM	Batalie Beach	Sunny	9.5	21.8	28.6	88.4	22	14.2	9.7
5/28/13	1:50 PM	Batalie Beach	Rainy	7.2	15.4	23.7	69.5	15.3	6.4	6.9
5/28/13	2:01 PM	Batalie Beach	Rainy	15.5	24.8	24.6	99.8	25.1	15.9	11.8
5/28/13	2:03 PM	Batalie Beach	Rainy	11	18.9	22.3	85.6	23.8	13.6	7.7
5/28/13	2:07 PM	Batalie Beach	Rainy	15	24	34.5	129.7	22.3	16	11.3
5/28/13	2:10 PM	Batalie Beach	Rainy	6.5	19.5	28.1	108.35	17.6	11.5	7.2
5/28/13	2:17 PM	Batalie Beach	Rainy	6.5	18.7	24.3	113.8	16.6	9.6	7.1
5/28/13	2:22 PM	Batalie Beach	Cloudy	14.5	20.4	29	134.4	24.8	13.8	11
5/28/13	2:30 PM	Batalie Beach	Cloudy	11.5	21.5	32.8	128	22.6	13.6	?
5/24/13	12:01 PM	Cabrits	Rainy	5	17.1	22.8	105.1	18.8	10	4.9
5/24/13	12:35 PM	Cabrits	Sunny	6.5	20.1	30.3	128.2	21.3	11.9	8.9
5/24/13	12:50 PM	Cabrits	Hummid/Cloudy	3	15.7	22.2	22.2	16.6	10	6.6
5/24/13	12:54 PM	Cabrits	Hummid/Cloudy	2.5	17.1	24.2	78.9	14.4	7.5	5.9
5/24/13	1:11 PM	Cabrits	Hummid/Cloudy	4	18.9	26.7	102.8	16.7	9.6	6.2
5/24/13	1:13 PM	Cabrits	Hummid/Cloudy	3.5	17	25.1	76.1	16.9	8.6	5.4
5/24/13	1:36 PM	Cabrits	Hummid/Cloudy	2.5	13.5	24.5	90.6	18.9	7.7	5.9
5/24/13	1:36 PM	Cabrits	Hummid/Cloudy	8.5	23.2	32.4	131.6	26.15	13.6	8

5/24/13	1:40 PM	Cabrits	Hummid/Cloudy	4.5	17.7	27.3	87.9	18.3	8.4	5.8
5/24/13	1:51 PM	Cabrits	Hummid/Cloudy	6.5	18.6	33.6	135	21.2	12.9	9.4
5/24/13	2:20 PM	Cabrits	Hummid/Cloudy	7	18.5	29.9	127.2	16.1	9.7	7.8
5/23/13	3:20 PM	Emerald Pool	Humid	6.5	19.9	29.9	89.87	11.4	9.9	6.65
5/23/13	3:31 PM	Emerald Pool	Cloudy	13	24.9	37	126.2	23.3	12.1	13.2
5/23/13	3:41 PM	Emerald Pool	Cloudy	4.5	16.3	29.5	65.5	16.5	9.4	7.5
5/23/13	4:03 PM	Emerald Pool	Cloudy	1.5	13.4	20.4	68.2	11.8	6.4	4.8
5/23/13	4:15 PM	Emerald Pool	Cloudy	4.5	16.1	29.7	76	18.3	8.7	6.9
5/23/13	4:25 PM	Emerald Pool	Cloudy	4.7	21.9	25.1	67.8	21.3	10.4	8.5
5/23/13	4:30 PM	Emerald Pool	Cloudy	4.7	20.4	30	94.8	21.5	10.9	8.4
5/25/13	2:25 PM	Emerald Pool	Cloudy	4	17.5	28.5	92.5	15.6	8.9	6.1
5/25/13	2:36 PM	Emerald Pool	Cloudy	5.5	16.3	25.3	92.5	18.1	9.3	6.2
5/25/13	2:49 PM	Emerald Pool	Rainy	4.5	17.3	25.4	99.2	15.1	8.7	5.9
5/25/13	3:13 PM	Emerald Pool	Cloudy	9	25.5	31.1	110.4	24	12.6	9.3
5/25/13	3:33 PM	Emerald Pool	Cloudy	5	19.9	30.2	105.8	16.6	11.3	6

Total Variance Explained

	Component	Initial Eigenvalues[a]			Extraction Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Raw	1	39.346	73.082	73.082	39.346	73.082	73.082
	2	9.339	17.347	90.429	9.339	17.347	90.429
	3	2.796	5.194	95.623	2.796	5.194	95.623
	4	1.363	2.532	98.155			
	5	.993	1.845	100.000			
Rescaled	1	39.346	73.082	73.082	3.745	74.898	74.898
	2	9.339	17.347	90.429	.619	12.376	87.274
	3	2.796	5.194	95.623	.243	4.851	92.125
	4	1.363	2.532	98.155			
	5	.993	1.845	100.000			

Extraction Method: Principal Component Analysis.

a. When analyzing a covariance matrix, the initial eigenvalues are the same across the raw and rescaled solution.

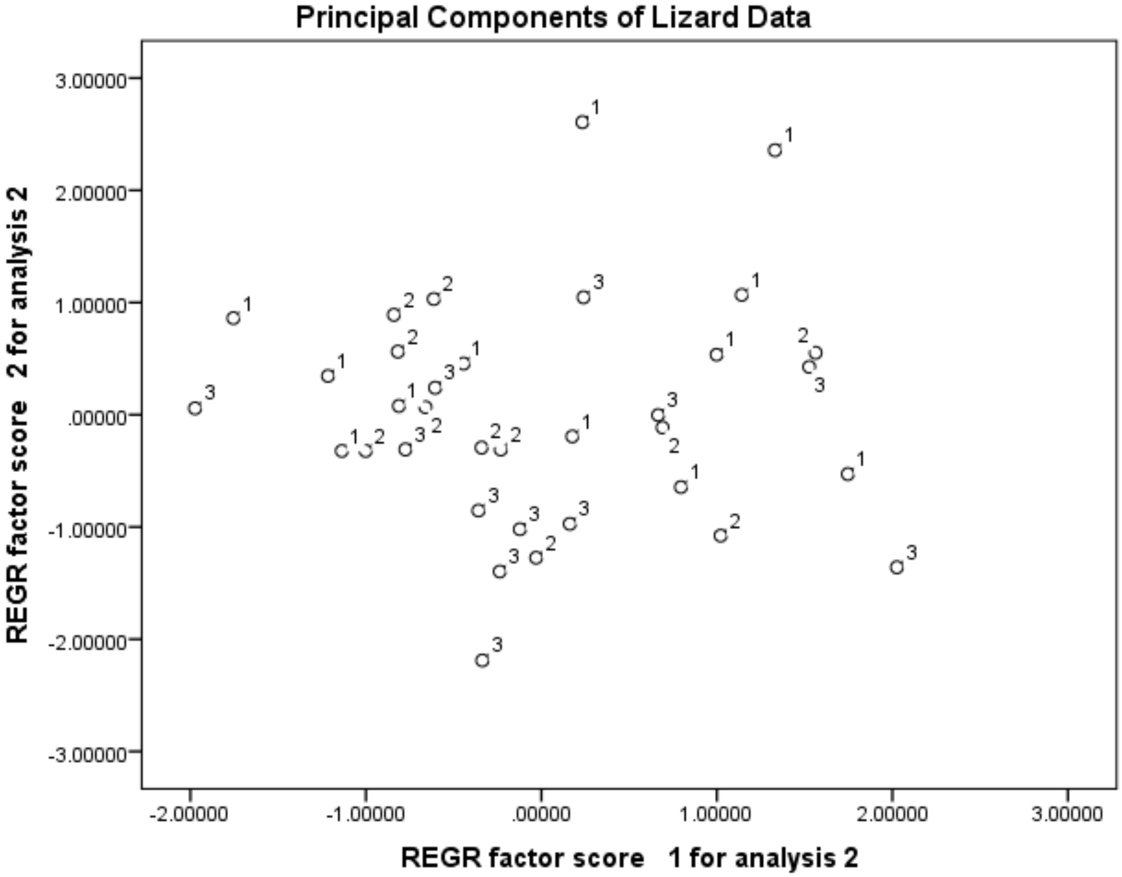
Component Score Coefficient Matrix[a]

	Component		
	1	2	3
Front Leg (mm)	.241	.078	1.449
Back Leg (mm)	.364	-1.061	-.722
Head Length (mm)	.309	.727	-1.267
Head Width (mm)	.151	.194	.318
Jaw Length (mm)	.104	.013	.075

Extraction Method: Principal Component Analysis.

Component Scores.

a. Coefficients are standardized.



Principle component output comparing the lizards from all three locations, 1 being Batalie beach, 2 being Cabrits, and 3 being Emerald Pool.

Tests of Between-Subjects Effects

Dependent Variable: Weight (g)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	129.510[a]	2	64.755	5.691	.008
Intercept	1470.730	1	1470.730	129.265	.000
LocationN	129.510	2	64.755	5.691	.008
Error	375.462	33	11.378		
Total	2039.000	36			
Corrected Total	504.972	35			

a. R Squared = .256 (Adjusted R Squared = .211)

Weight (g)

	LocationN	N	Subset	
			1	2
Tukey HSD[a,b,c]	2	11	4.64	
	3	12	5.58	
	1	13		9.00
	Sig.		.773	1.000

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 11.378.

a. Uses Harmonic Mean Sample Size = 11.944.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.

Discussion

The three most important factors for determining the size based on habitat are: weight, length of back leg, and tail length. Our hypothesis was that the wetter the environment, the larger the anoles would be. This is due to the fact that more wet environments would be conducive to higher insect populations, thus more food for the anoles to eat. The more the anoles can eat the larger they should be. Along with the high rainfall levels, an arboreal habitat should favor adaptations for climbing trees more efficiently, such as longer limbs.

The results were not as conclusive as we had hoped. The anoles from BB have the heaviest with an average of 9.09 g. (reference weight table in results) The anoles from EP have the longest back leg length with an average of 28.51 mm and the anoles from CNP have the longest tail length with an average of 102.69 mm, none of these were statically significant.

It was admittedly easier to catch smaller anoles than larger ones, which was the case at BB and EP. There were some very large anoles but we couldn't catch them, which skewed the data. It has also been one of the wettest years on record, with April and May being new monthly records for rain on the island. This increased moisture across the island may have reduced the difference in bug density amongst the different ecosystems reducing the impact of habitat difference on anole size.

In comparing tail size, it is common for lizards to store fat (an energy reserve) in their tails. It makes sense then that EP has the shortest tail length, because of the three sites it has the least accessibility to anoles for predators. With the anoles not necessarily needing the extra energy to escape predation their tails wouldn't have to store as much fat, thus the average tail length would be markedly smaller. There was, as stated previously, several anoles missing tails that is why this variable was excluded from the component analysis.

Principle component statistics allows for the comparison of multiple variables in a multidimensional space to examine patterns between variables. When running principal components on our lizard data we excluded weight and tail length from the variables. The graph shows an even distribution of all the lizards from the three sites. (1 being Batalie beach, 2 being Cabrits, 3 being Emerald Pool) This distributions means that morphologically there is no real difference in the lizards on the west side of the island. Although the lizards from Batalie beach are significantly heavier there is no apparent size differences. The reason the lizards at Batalie were heavier is probably because they have a much larger and readily available food source from people.

Future projects could look into the association of the anole density in areas closer and father from a water source. During the research it seemed that more numbers of anoles were spotted near the river at EP and the estuary at BB, with fewer anoles being spotted at CNP.

Work cited

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