

**A Comparison of morphological differences between
Gymnophthalmus spp. in Dominica, West Indies**

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Abstract:

Gymnophthalmus pleei and *Gymnophthalmus underwoodi*, commonly known as the rough-scaled worm lizard and smooth-scaled worm lizard respectively, inhabit dry leaf litter habitats on the island of Dominica, West Indies. This paper reports the morphometric data (SVL, head width from center of ear, weight, tibia length, ulna length, and tail length) and examines the differences between the two species. The *G. underwoodi* were found to be smaller in size overall with hind limb length and weight being the two factors measured that are statistically significant in difference. However, due to low numbers of collected *G. underwoodi*, the comparison is greatly skewed.

Introduction:

The Caribbean island of Dominica is part of the West Indies and is commonly called the Nature Island due to its wide floral and faunal diversity. The high yearly rainfall and tropical latitude supports the many extant species of vertebrates including *Gymnophthalmus pleei* and *Gymnophthalmus underwoodi*.

Gymnophthalmus lizards are relatively small, metallic-colored, and diurnal in activity, making them blend in with their typically dry forest floor habitat (Corke 1986). *G. pleei* and *G. underwoodi* are very similar in appearance and often mistaken to be juvenile skinks, but are distinguishable due to the latter's smooth or unkeeled body scales (Malhotra and Thorpe, 1999). *G. pleei*, shown in Figure 1, are endemic to the Lesser Antillean islands of Martinique, Dominica, and Guadeloupe (Daniells et al. 2008) *G. underwoodi*, shown in Figure 2, are located

on the South American mainland as well as many of the Lesser Antillean islands (Daniells et al. 2008).



Figure 1: *Gymnophthalmus pleei* caught at Cabrits National Park with arrow indicating the keeled scales



Figure 2: *Gymnophthalmus underwoodi* caught at the Bee House at ATREC with the arrow indicating the smooth scales

The two main locations of collecting, Cabrits National Park and the Archbold Tropical Research and Education Center (ATREC) at Springfield, are located on the Northwest and Southwest sides of the island respectively. *G. pleei* have been commonly observed at Cabrits, but discovering a small population of *G. underwoodi* within the grounds of ATREC was a new area of habitat (Alexander 2007). The purpose of this project is to determine differences in morphometric measurements of the species modeled off of the project conducted in 2008 by Turk et. al.

Materials and Methods:

In order to capture the lizards, a transect was walked a number of times depending on the population density of the area. The length of the transect also was subject to varying lengths due to the particular terrestrial habitat area. The area intended was walked first and stakes were placed at the start and stop, and then measured with a 50 meter measuring tape. GPS coordinates were also taken at the starting of a transect with the Garmin GPS map 78. While walking each transect, most of the capturing was done by hand as it is the most efficient method due to their size. In a few cases, a bucket with the bottom cut out was used to close in around the area where one was spotted and could be picked up within the bucket. Once caught, looking for keeled or smooth scales using a 14x magnifying hand lens identified them.

Morphological measurements using a SPI Polymid Dial Caliper and Avinet S10 Precision Spring Scale were taken and recorded for each individual. A Ziploc

bag was clipped onto the scale and each individual was placed in to get a total weight and the Ziploc bag weight was subtracted. The snout to vent length was measured from the tip of the snout to the anal scale and the tail length began at the anal scale and continued to the tip of the tail. The width of the head was measured from the center of the ear. The weight, ulna length, and tibia length were also taken at the time of capture. Environmental measurements such as, litter depth, relative soil moisture, and relative shade percentage were observed to further record the habitat in which they were found.

Results:

A total of 24 lizards were caught on three separate occasions in two general locations, the Bee House at Springfield and at Cabrits National Park.

Gymnophthalmus pleei was found only at Cabrits and *Gymnophthalmus underwoodi* was found only at the Bee House at Springfield.

In the three Bee House transect locations the soil cover was significantly more dense than that at Cabrits. There were many thick roots and twigs as well as holes and dugouts in the soil in which the *G. underwoodi* were able to hide and seek refuge from being captured. In my observations of their running, they commonly went into the roots of the lemongrass plant and hid within the center of the roots. This was observed on three separate occasions all within the 10:00am and 12:00pm.

The leaf litter at Cabrits National Park was less dense, about four inches in depth overall. It also mostly consisted of various species of tree leaves, but not many roots or branches as were seen at the Springfield transects.

Group Statistics					
	Species	N	Mean	Std. Deviation	Std. Error Mean
SVL (cm)	1.00	21	3.1938	1.08664	.23713
	2.00	3	2.4600	.55435	.32005
Head Width (cm)	1.00	21	.5157	.12335	.02692
	2.00	3	.4067	.07572	.04372
Hind limb (cm)	1.00	21	.3436	.10155	.02216
	2.00	3	.2600	.02646	.01528
Forelimb (cm)	1.00	21	.2690	.07648	.01669
	2.00	3	.2533	.07506	.04333
Tail Length (cm)	1.00	21	4.3029	2.06737	.45114
	2.00	3	3.3567	1.24022	.71604
Weight (g)	1.00	21	1.1429	1.13911	.24857
	2.00	3	.4200	.13856	.08000

Figure 3: Statistics for all *Gymnophthalmus* caught.

The mean and standard deviation for each variable measured is shown in Figure 3. They are divided up by species: *G. pleei* is represented by the number 1.00 and *G. underwoodi* is represented by the number 2.00. The sample size for *G. underwoodi* is much less than that of the *G. pleei*.

Organized in Figure 4 are the results of an independent sample test in where each variable was assessed. The first two numbered columns are Levene's Test for Equality of Variance and by looking at the significance column, if the value is less than 0.05, equal variances cannot be assumed. This was the case for the SVL, head width, and hind limb length. The second t-test is a 2-tailed test and Tamhane's Test is used to determine if those means differ for cases with

unequal variances. Just as the Levene's Test, if the value is below 0.05, that variable is of statistic significance.

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
SVL (cm)	Equal variances assumed	9.158	.006	1.133	22	.269	.73381	.64775	-.60953	2.07715
	Equal variances not assumed			1.842	4.658	.129	.73381	.39832	-.31315	1.78076
Head Width (cm)	Equal variances assumed	3.185	.088	1.475	22	.154	.10905	.07395	-.04431	.26240
	Equal variances not assumed			2.124	3.750	.105	.10905	.05134	-.03732	.25541
Hind limb (cm)	Equal variances assumed	4.748	.040	1.394	22	.177	.08357	.05996	-.04079	.20793
	Equal variances not assumed			3.105	13.360	.008	.08357	.02692	.02558	.14156
Forelimb (cm)	Equal variances assumed	.025	.875	.333	22	.742	.01571	.04712	-.08202	.11344
	Equal variances not assumed			.338	2.632	.760	.01571	.04644	-.14449	.17592
Tail Length (cm)	Equal variances assumed	1.650	.212	.764	22	.453	.94619	1.23833	-1.62194	3.51432
	Equal variances not assumed			1.118	3.842	.329	.94619	.84631	-1.44203	3.33441
Weight (g)	Equal variances assumed	7.729	.011	1.078	22	.293	.72286	.67085	-.66840	2.11412
	Equal variances not assumed			2.768	21.998	.011	.72286	.26113	.18130	1.26441

Figure 4: Independent Samples Test for each variable measured.

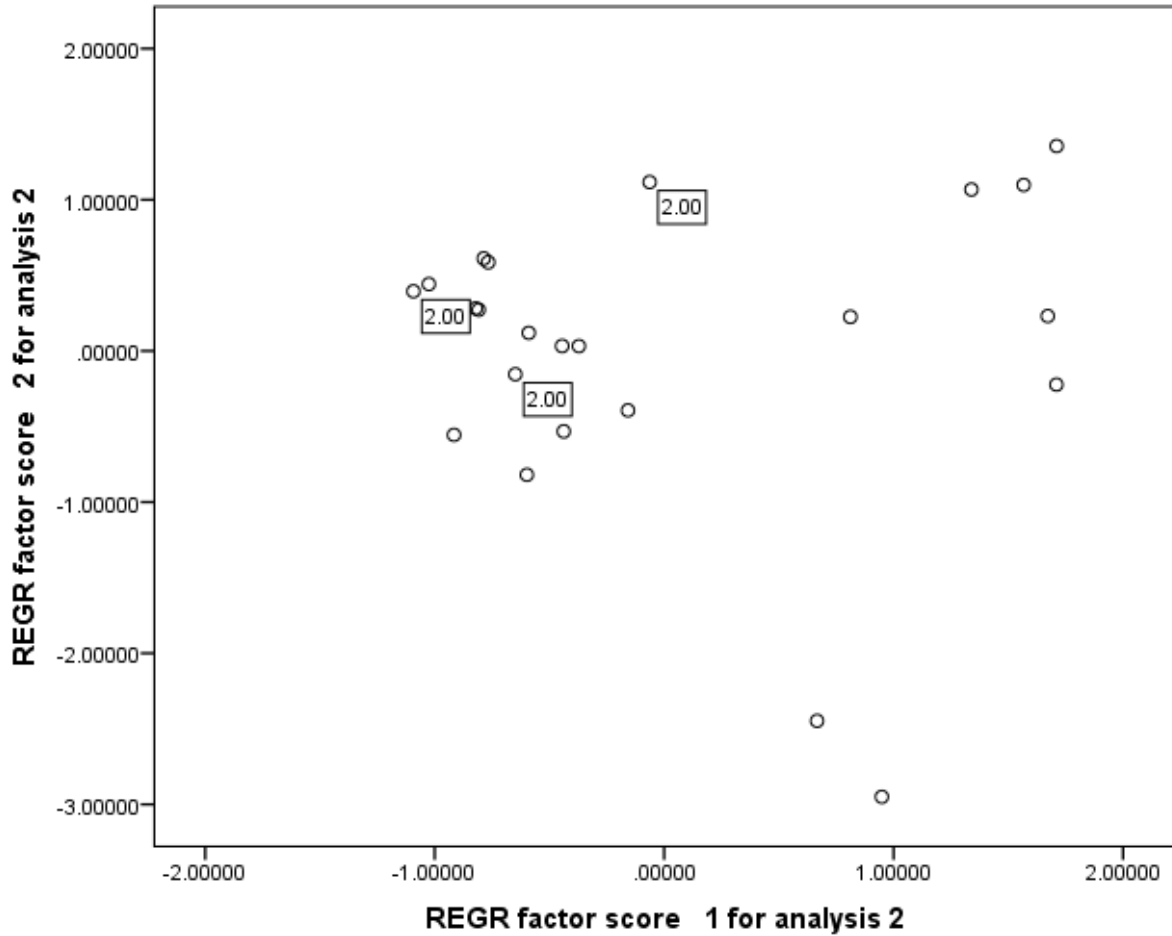


Figure 5: Principal components plot with points of *G. underwoodi* labeled on the plot.

The distribution of species in 2-dimensional morphological space is shown in Figure 5. The *G. underwoodi* is gathered closer to the upper left-hand corner while the *G. pleei* distribution is more widespread across the plot.

Discussion:

The major factor in being able to spot and capture either species was the weather patterns of the day. Looking at the Bee House within the Springfield Estate, the day-to-day temperature and humidity levels varied and affected the number of sightings. It was concluded that they are active during a mid-morning

to mid-afternoon time frame when there was no rain within approximately 4 hours before the time of walking the transect. An association was observed with relative soil moisture and number of individuals spotted.

In Figure 4, the statistically significant variables were hind limb length and weight. This is to say that with a size comparison between the two species of *Gymnophthalmus*, they are diverse in terms of size and shape, specifically their tibia length and their weight. The *G. underwoodi* are smaller in hind limb length and lighter in weight than *G. pleei*. In figure 5, the *G. underwoodi* are to the left on the x-axis meaning they have a lower weight and positive on the y-axis indicating a shorter hind limb length.

One of the major issues that arose was that of Batalie Beach. This was intended to be a major site in which *Gymnophthalmus underwoodi* could be collected within the dry litter, but that area changed ownership and was cleared of all leaf litter and made private property with no visitor entrance. This hindered my hope of finding *G. underwoodi* there and increasing my sample size for that species as well as searching for a difference in morphometric data for the species at different latitudes on the island.

If this project were to be repeated, new locations on the island would need to be found for *Gymnophthalmus underwoodi* in addition to the Springfield Bee House location had sparse populations. Also, a larger sample size for the *G. underwoodi* would improve the reliability of the comparison.

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