

Diversity of Bat Species across Dominica

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Abstract:

Twelve species of bats can be found on the island of Dominica, however there are still some species that have not been thoroughly catalogued. Our report is based on further findings regarding *Artibeus jamaicensis*, *Sturnira lilium*, *Ardops nichollsi*, *Myotis dominicensis*, *Monophyllus plethodon* and *Brachyphylla cavernarum*. We collected mass, forearm length, hind foot length, ear length, sex, and reproductive condition for every individual bat and then compared this information among species to observe morphological differences. We also added new data to past studies on wing loading and aspect ratios for the species we caught. We found a statistical significance among species in body size measure and wing morphology. Among the bats examined, the measurements can be used in order to positively identify species.

Introduction:

Dominica, also known as the Nature Island, is home to a great diversity of plants and animals. There are many various habitats ranging from dry forest to montane and elfin rainforest. Within each habitat, one may find species only endemic to that area. Animal activity at night in Dominica is quite different than what can be witnessed during the day. As nighttime falls, the call of the tink frog can be heard all over the island, and the mating click beetles will illuminate even the darkest of forests, but by far the most exciting nocturnal animals are the thousands of bats that come alive when the sun begins to set.

There are twelve species of bats on the island of Dominica. Past research has cataloged bat morphology in the area with regards to mass, forearm length, hind foot length, ear length, sex, and reproductive condition. This study will extend the past research to species that have been difficult to catch in the past. We set up nets in different habitats in order to collect the different species. The three habitats for this study included primary, secondary, and lower

montane rainforests. These habitats in particular were chosen because they have rarely been visited in the past. The species cataloged were: *Artibeus jamaicensis*, *Sturnira lilium*, *Ardops nichollsi*, *Myotis dominicensis*, *Monophyllus plethodon* and *Brachyphylla cavernarum*.

Materials/Methods:

We set traps on five different nights at three locations of varying habitats: two nights were spent at the Check Hall River in secondary rainforest, two nights were spent at a trail near Emerald Pool in primary wet rainforest, and one night was spent at the Stinking Hole in the primary lower montane rainforest on the trail leading to Middleham Falls. We set up two 9-meter nets at both the Check Hall River and at Emerald Pool. At each location, nets were set up along major waterways and fly zones. Near the Stinking Hole, one 9 meter net was set up across the pathway and partially into the woods.

The bats were removed as quickly and carefully as possible to eliminate unnecessary stress on the bat. We wore work gloves while handling the bats and placed each of them in socks secured with a clothes pin until we were ready to take their measurements. We used a Pesola scale to weigh each of the bats inside the sock, and then subtracted the sock's weight to obtain the actual weight of each bat. A ruler was used to measure forearm length, hind foot length, and ear length of every bat. We also took note of gender and reproductive condition when applicable. Finally, we took wing-loading pictures of *Ardops nichollsi*, *Myotis dominicensis*, and *Brachyphylla cavernarum* because these species have not been captured in nearly a decade.

Once back at Springfield Research Center, the pictures taken in the field were corrected for exposure, contrast, and image flatness using Adobe Photoshop Lightroom. Then, we used ImageJ to calculate the wing length and area of the documented species.

Results:

Table 1: Morphology of Collected Bats Shows the data collected for: sex, redproductive condition (if applicable), mass, forearm length, hind foot length and ear length.

Bat #	Date	Species	Sex	Weight	Forearm L.	Hindfoot L.	Ear lenth	Repro. Cond.
1	6/1/2015	<i>Sturnira lilium</i>	M	23g	45mm	10mm	13mm	young
2	6/1/2015	<i>Artibeus jamaicensis</i>	F	67g	61mm	9mm	15mm	post lactating
3	6/1/2015	<i>Artibeus jamaicensis</i>	M	37g	60mm	10mm	15mm	young
4	6/1/2015	<i>Artibeus jamaicensis</i>	M	44g	63mm	10mm	9mm	mid-age
5	6/1/2015	<i>Artibeus jamaicensis</i>	M	35g	58mm	9mm	15mm	young
6	6/1/2015	<i>Artibeus jamaicensis</i>	F	45g	59mm	10mm	13mm	post lactating
7	6/1/2015	<i>Artibeus jamaicensis</i>	M	49g	62mm	11mm	13mm	n/a
8	6/3/2015	<i>Artibeus jamaicensis</i>	F	58g	65mm	13mm	15mm	lactating
9	6/4/2015	<i>Ardops nichollsi</i> ¹	M	19g	43mm	11mm	11mm	n/a
10	6/6/2015	<i>Artibeus jamaicensis</i>	F	49g	62mm	8mm	15mm	non-lactating
11	6/6/2015	<i>Myotis dominicensis</i> ¹	F	4g	34mm	4mm	8mm	non-lactating
12	6/9/2015	<i>Monophyllus plethodon</i>	F	13g	40mm	9mm	11mm	non-lactating
13	6/9/2015	<i>Monophyllus plethodon</i>	F	15g	42mm	9mm	11mm	n/a
14	6/9/2015	<i>Monophyllus plethodon</i>	F	15g	40mm	11mm	12mm	n/a
15	6/9/2015	<i>Brachyphylla cavernarum</i> ¹	F	43g	63mm	13mm	19mm	n/a
16	6/9/2015	<i>Brachyphylla cavernarum</i> ²	F	46g	64mm	14mm	16mm	n/a

17	6/9/2015	<i>Monophyllus plethodon</i>	F	15g	41mm	11mm	9mm	n/a
18	6/9/2015	<i>Monophyllus plethodon</i>	M	14g	40mm	10mm	10mm	n/a
19	6/9/2015	<i>Monophyllus plethodon</i>	F	13g	40mm	10mm	10mm	n/a
20	6/9/2015	<i>Monophyllus plethodon</i>	F	13g	41mm	10mm	12mm	n/a
21	6/9/2015	<i>Monophyllus plethodon</i>	F	14g	39mm	10mm	11mm	n/a
22	6/9/2015	<i>Natalus stramineus</i>	F	11g	40mm	6mm	11mm	n/a
23	6/9/2015	<i>Monophyllus plethodon</i>	F	15g	39mm	9mm	10mm	n/a
24	6/9/2015	<i>Monophyllus plethodon</i>	F	14g	44mm	9mm	11mm	non-lactating
25	6/9/2015	<i>Brachyphylla cavernarum</i>	F	23g	64mm	15mm	17mm	Lactating
26	6/9/2015	<i>Brachyphylla cavernarum</i>	F	44g	65mm	17mm	17mm	post-lactating
27	6/9/2015	<i>Brachyphylla cavernarum</i>	F	46g	67mm	15mm	17mm	Lactating
28	6/9/2015	<i>Brachyphylla cavernarum</i>	F	48g	60mm	14mm	18mm	Lactating
29	6/9/2015	<i>Brachyphylla cavernarum</i>	F	44g	67mm	17mm	19mm	non-lactating
30	6/9/2015	<i>Brachyphylla cavernarum</i> ³	F	46g	64mm	15mm	18mm	Lactating
31	6/9/2015	<i>Brachyphylla cavernarum</i> ⁴	F	47g	65mm	12mm	19mm	Lactating
32	6/9/2015	<i>Brachyphylla cavernarum</i> ⁵	F	49g	67mm	18mm	18mm	post-lactating
33	6/9/2015	<i>Brachyphylla cavernarum</i> ⁶	M	49g	66mm	15mm	20mm	n/a

Figure 1: Discriminant Analysis Shows that bat species can be easily separated based on morphological characteristics. 2=*Artibeus jamaicensis*, 3=*Brachyphylla cavernarum*, 4=*Monophyllus plethodon*.

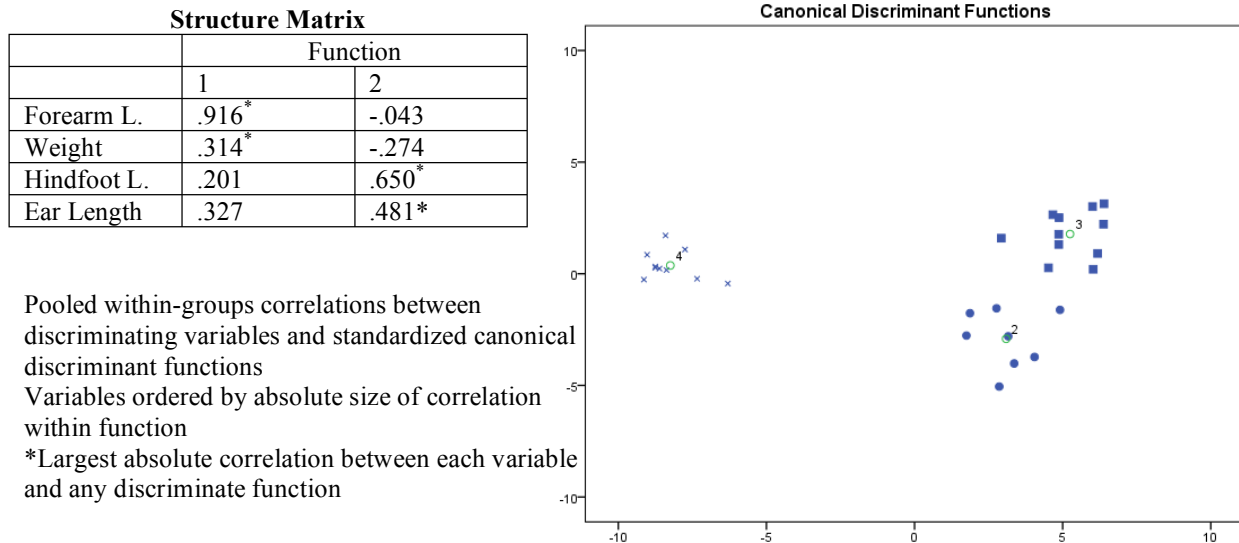


Table 2: Wing Loading and Aspect Ratio: Shows the calculations in wing length, using area, aspect ratio on relative wing loading per individual.

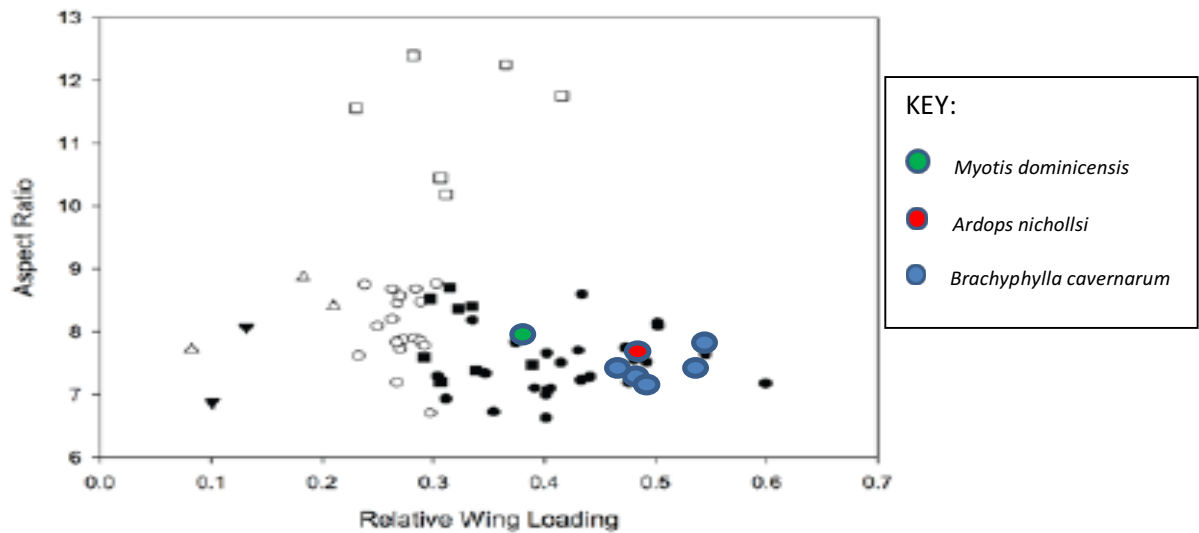
Aspect Ratio = Total Length squared divided by total wing area

Relative Wing Loading = weight raised to 0.67 divided by total wing area

*not included in graph due to poor positioning of wing in photograph

Individual	Wing Length (cm)	Wing Area (cm2)	Total Length (cm)	Total Wing Area (cm2)	Weight (g)	Relative Wing Loading	Aspect Ratio
<i>Myotis dominicensis</i>	10.9	30.4	21.8	60.8	4	0.42	7.82
<i>Ardops nichollsi</i>	16.5	74.1	33	148.2	19	0.49	7.35
<i>Brachyphylla cavernarum 1</i>	19.6	111.3	39.2	222.6	43	0.56	6.90
<i>Brachyphylla cavernarum 2</i>	22.1	138.4	44.2	276.8	46	0.47	7.06
<i>Brachyphylla cavernarum 3</i>	20.9	128.9	41.8	257.8	46	0.50	6.78
<i>Brachyphylla cavernarum 4</i>	20.8	116.5	41.6	233	47	0.57	7.43
<i>Brachyphylla cavernarum 5</i>	20.9	129.8	41.8	259.6	49	0.52	6.73
<i>Brachyphylla cavernarum 6*</i>	17.5	85.3	35	170.6	49	0.80	7.18

Figure 2: Wing Comparisons between Species: Plots relative wing loading against aspect ratio, super imposed on Figure from Hixon et al, 2012.



Discussion:

Table 1 is a complete list of the 33 individuals we collected over five nights. We included sex, hind foot, forearm and ear lengths, as well as reproductive condition, if applicable. Table 2 is the wing loading data used to make Figure 2. Wing loading is the amount of weight an individual has to carry per square centimeter of wing.

Based on the data collected, morphological measurements such as mass, forearm length, hind foot length, and ear length were significant enough to be able to accurately identify each bat species (Figure 1). On the first axis, forearm length has the greatest influence on differentiating *Monophyllus plethodon* from *Artibeus jamaicensis* and *Brachyphylla cavernarum*. On the second axis, we are able to see that hind foot length and ear length are the most significant canonical variances when distinguishing *A. jamaicensis* from *B. cavernarum*. Those with the positive figures have a longer hind foot and ear length than those with the negative figures.

In general, *B. cavernarum* and *A. nichollsi* have a higher wing loading than the other catalogued bat species, but an average to low aspect ratio (Figure 2). *M. dominicensis* also has an average aspect ratio, however, they have a much lower wing loading, when compared to the other two species we captured. In order to calculate more accurate wing loading figures, more data would need to be taken for the *A. nichollsi* and *M. dominicensis*, as only one of each species was collected.

References:

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