Sexual Dimorphism and Observations of Sexual Differences in Behavior in *Molossus molossus*

By: D.J. Gerrity

Texas A&M University

Dr. Thomas Lacher

Dr. James Woolley

Abstract:

Members of the species *Molossus molossus* were captured at the Archbold Tropical Research and Education Facility in Spring Field, Dominica ($15^0$34644'N, $61^0$36892'W) in an attempt to see if there was any evidence of sexual dimorphism in the forearm length and weight of the species. A total of 26 bats were captured near the Archbold Facility. From the sampled group it was found that there is sexual dimorphism in the weight of *M. molossus* there was not enough conclusive evidence of sexual dimorphism in forearm length in *M. molossus.*

Introduction:

The Island of Dominica contains some of the world's few remaining rain forests that have been untouched by humans. This 750 km^2 island is home to six families and twelve species of bats that represent most of the islands few mammals (Media 2011). Very little research has been done on most of these bat species. This is odd since bats make up the majority of mammalian species found in the Caribbean. The purpose of this study was to investigate possible sexual dimorphism in the species *M. molossus* or the velvety free-tailed bat, in an attempt to provide better insight into the identification of *M. molossus* specimens.

Methods:

A polyester bat mist net made by Avinet Inc. was set up between two bamboo poles approximately 9 feet tall across the stream that runs through Springfield, Dominica. The mist net had 4 shelves, was 2.6x6 meters with a 38mm mesh. The bamboo poles were secured to

the stream's banks by being tied down with two stakes on each side that were then surrounded by heavy rocks. Bats were caught from June 1- June 3 2012 from the hours of 15:00-21:30.

Upon capture the bats were identified by species. Bats that were not *M. molossus* were set aside for the echolocation study that coincided with this project. Each individual of *M. molossus* was placed in a tube sock with a cloths pin shutting the top. Once netting had been complete the bats were taken to Mount Joy, where a mock tunnel had been set up for bat flight. The tunnel was made using a 40x20ft tarp and two (length) ropes inside the frame work of a burned down dormitory at the Archbold Tropical Research and Education Center. At the mock cave the caught bats were weighed in the sock using a Pesola balance. Then the bats were removed from the sock which was then weighed and then subtracted to get the bat's weight. The bats were then sexed and had their right forearm measured using a ruler. Some observations were also made about the behavior of the bats during their flight sessions in the cave mainly focusing on aggressiveness and willingness to fly.

Results & Discussion:

Over the three nights of netting 26 *M. molossus* were caught. In this sample eight of the bats were male and the other 18 bats were females. Their individual weights and measurements are presented in Table 1. From this the group statistics were run using the SPSS software; male bats were coded as the number 1 and female bats the number 2. I generated mean weights and forearm lengths for each sex with standard deviations. The males had a mean weight of 39.00g and a mean forearm length of 12.63mm with standard deviations of 0.756g and 1.768mm respectively. Females had a mean weight of 38.11g and a mean forearm

length of 13.42mm with standard deviations of 0.758g and 1.458mm respectively. Next a t-test for equality of means was run. From this the forearm length was found to have an assumed equal variance t-statistic of 1.198 with 24 degrees of freedom and a significance P value of 0.242. For weight the assumed equal variance t-statistic was 2.761 with a df value of 24 and a P value of 0.011. From those data a principal component analysis was run and the results from that analysis are represented in Tables 2 & 3 and Figure 1. The culmination of these analyses shows that there is a significant level of sexual dimorphism in the weight of *M. molossus* as demonstrated by the value of P being less than 0.05 at 0.011, which shows that the chance of there not being sexual dimorphism between the male weight and female weight is only 1.1%. Yet since the P value of the forearm length is .243 there is no indication of any sexual dimorphism in this feature in *M. molossus* Weight is an important factor in the principal component analysis, yet there is not enough evidence in just the weight and the forearm length to cause clear separation of males and females in Figure 1. Based on these two characteristics, evidence of sexual dimorphism in *M. molossus* is not very strong.

The behaviors of the different sexes in the bat tunnel were observed as well. All of the females were docile while being handled and when released refused to fly out of the handler's gloves and had to instead be placed on a tree. While the males were fairly more aggressive compared to their female counter parts occasionally biting their handler's gloves and out of the eight males three of them flew out of their handler's hand in the bat tunnel and the other five had to be placed on trees like the females.

Table 1. Individual measurements of *M. molossus* collected

Table 1. Individual measurements of caught *M. molossus*					
Date	Age	Sex		Weight(g)	Fore arm length(mm)
1-Jun	Adult	Male	1	14	40
1-Jun	Adult	Male	1	15	39
1-Jun	Adult	Female	2	13	38
1-Jun	Adult	Female	2	14	39
1-Jun	Adult	Female	2	14	38
1-Jun	Adult	Male	1	12	38
1-Jun	Adult	Female	2	11	38
1-Jun	Adult	Male	1	11	39
1-Jun	Adult	Female	2	12	39
1-Jun	Adult	Female	2	14	38
1-Jun	Adult	Female	2	13	37
2-Jun	Adult	Female	2	13	38
2-Jun	Adult	Male	1	12	39
2-Jun	Adult	Female	2	14	38
2-Jun	Adult	Female	2	14	38
2-Jun	Adult	Female	2	13.5	39
2-Jun	Adult	Male	1	11	38
2-Jun	Adult	Female	2	12	37
2-Jun	Adult	Female	2	14	39
3-Jun	Adult	Female	2	16	39
3-Jun	Adult	Male	1	11	39
3-Jun	Adult	Female	2	12	37
3-Jun	Adult	Female	2	15	39
3-Jun	Adult	Female	2	11	38
3-Jun	Adult	Female	2	16	37

Table 2

Total Variance Explained

	Component	Initial Eigenvalues[a]			Extraction Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Raw	1	2.500	78.498	78.498	2.500	78.498	78.498
	2	.685	21.502	100.000			
Rescaled	1	2.500	78.498	78.498	1.072	53.602	53.602
	2	.685	21.502	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.

Table 3

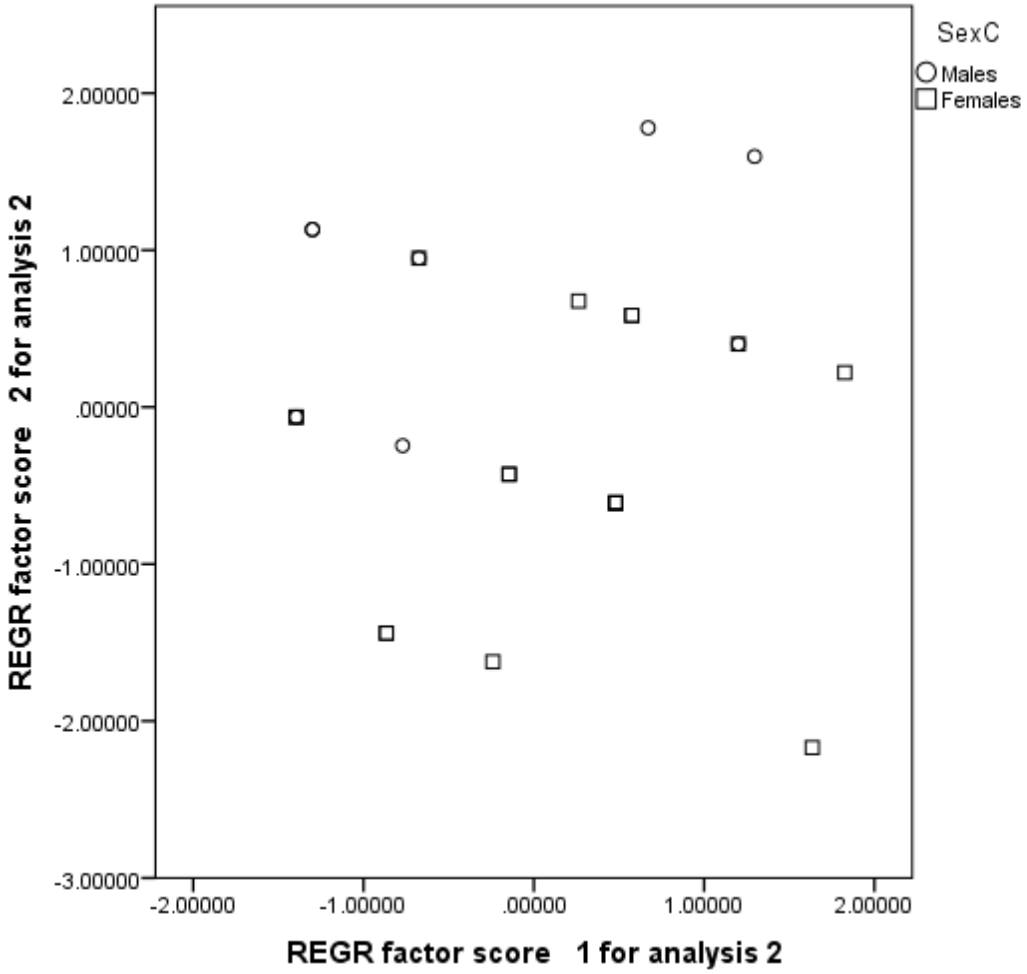
Component Matrix[a]

	Raw		Rescaled	
	Component		Component	
	1	2	1	2
Forearm	1.563	-.125	.997	-.080
Weight	.239	.818	.280	.960

Extraction Method: Principal Component Analysis.

a. 2 components extracted.

Figure 1 Graph of component analysis



Conclusion:

Even though there is clear sexual dimorphism in the weights of the male and female *M. molossus* there is not conclusive evidence of sexual dimorphism in *M. molossus* based on weight and forearm length combined. Yet there may very well be other morphological variables that could be measured to give stronger evidence of sexual dimorphism in *M. molossus*. A future study could easily measure ear length, hind foot length, tail length, and skull sizes to see if there is any evidence of sexual dimorphism in those characteristics as well.

In respect to the observed behavioral differences of the two sexes the only notable trait was the slightly more aggressive behavior of males compared to females, the similar disposition of males not to fly out of the handler's glove and having to be placed in trees just like the females was not evidence of strong differences in behavior. An interesting study would be to observe the behavior of males and females while not being handled in the late hours of the evening when *M. molossus* begin to be active and can be clearly observed in the light of the sunset like the study performed by Kössl et al.(1999)

References:

Medina, Heather. 2011. Characteristics of Echolocation Calls of Bats in Dominica. Dominica Study Abroad Project Report. Texas A&M University

Gregorin, Renato, Arthur Setsuo Tahara and Debora Ferrari Buzzato. "Molossus aztecus and Other Small Acta ChiropterologicaMolossus (Chiroptera: Molossidae) in Brazil." *Acta Chiropterologica* 13.2 Acta Chiropterologica (2011): 311-317.

Kossl, M, et al. "Two-Toned Echolocation Calls from Molossus molossus in Cuba." *Journal of Mammalogy* (Aug 1999): 929-932.

Acknowledgements:

Thanks to Travis Pruitt, Andrea James, Sarah Sarkhosh, Juliet Vallejo, Catherine Saenz, and Kathy Demarest for helping me to collect the bats and for help in getting all of their measurements.

Thanks to Dr. Lacher for handling the bats in the bat cave and recording their behaviors as he handled them. Also thank you for helping me with your expert knowledge of SPSS and The Lady in White.