Emergence Behaviors of Dominican Bats: *Molossus molossus, Monophyllus plethedon, Natalus stramineus* and *Tadarida brasiliensis*

Texas A&M University
Study Abroad in Dominica

Submitted to:
Dr. Tom Lacher
&
Dr. Jim Woolley

By:
Nicole Wade
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Abstract

This research project was conducted to observe the emergence behaviors of several different species of bats. I discovered five major things over the course of the study. First bats do tend to emerge according to the sunset, and the time of emergence is dependent on the altitude of the roost. At higher altitudes the bats emergence before official sunset and at lower altitudes they emerge after the sunset. This phenomenon may be due to the fact that higher altitudes loose the light earlier in the evening. In addition, bat emergence will be delayed if the sky is overcast. This event is possibly due to the fact that changes in the amount of sunlight are harder to determine when there is heavy cloud cover. The third thing I discovered was the fact that all of the species observed make some sort of a speaking noise (a sound like squeaking or clicking audible to humans) before they start to move around -- possibly to prepare the rest of the colony for emergence. The fourth behavior observed is that several bat species fly around inside the roost before they actually depart to forage, this may be due to the fact that while sleeping the bats go into torpor and must exercise in order to efficiently forage. The last major discovery was that I noticed a trend between rainfall and the end of *Molossus molossus* inhabitance of the breeding roost. Overall several different trends and discrepancies exist between bats of different species.

Introduction

In my project I intended to provide information on the emergence behaviors of several different species of bats. I began my observations on May 23, 2000 and ended them on June 5, 2000, a period of 14 days. I chose three different location sites: Fort Shirley in Cabrits National Park, Tou Santi -- on the Middleham falls trail in Morne Trois Pitons National Park, and Springfield Station Stream-house. Cabrits National Park is a dry forest habitat, "a band of woodland specially adapted to withstand periods of drought... because the western leeward coast receives the least rainfall (Evans and James, Vol. 1)." We located the bat species *Tadarida brasiliensis* in the dry forest habitat at Fort Shirley. *Tadarida brasiliensis* belongs to the family Molossidae, a group of small, insect eating bats. *Tadarida brasiliensis* are dark brown, small bats, with a wrinkled upper lip. They tend to roost in buildings, and are extremely common bats; they can be found all across the Americas and the Caribbean (Evans and James, vol. 2). I chose Tou Santi as my next site for observations. Tou Santi is located in primary rainforest habitat; it was "named partly because of the sulphurous fumes that escape from volcanic vents in the earth partly from the stench of bat guano. At the base of the hole, two caverns, one on each side, plunge into pungent, airless darkness. In these collapsed lava tubes live large numbers of bats (Evans and James, Vol. 7)." Random sampling showed that two species, *Monophyllus plethedon* and *Natalus stramineus*, live in Tou Santi, although several sources of literature site Tou Santi as being home to *Brachyphylla jamaicensis* a random sample of 16 bats performed one evening did not collect this species. *Monophyllus plethedon* belongs to the family Phyllostomatidae and is a "Lesser Antillean endemic, grey-brown, long-snouted nectar-feeding bat (Evans and James, vol. 2)." *Natalus stramineus* belongs to the family Natalidae and is a "gingery insect-eating bat (Evans and James, vol. 2)." The last site I chose to observe was the Springfield Station stream-house. Springfield Station is located in secondary rainforest; a secondary rainforest forms when a primary forest has been cleared (either naturally, hurricanes, or by humans) and the plant life is left to regrow (Myers, 1980). The stream-house at Springfield station houses *Molossus molossus* during the breeding season. *Molossus molossus* also belong to the family Molossidae and are blackish to reddish-brown insect eating bats that roost in buildings with corrugated roofs, deserted dwellings, and in large open caves (Evans and James, Vol. 2). The stream-house has a corrugated roof, which is one of the preferred types of roosts for *Molossus molossus*. I hoped the diversity of roost locations and types would help me to identify major behaviors important to all bat species and species-specific behaviors that occur during emergence for nighttime foraging.

Methods and Materials

Materials:

- Watch
- Weather information from the Caribbean Meteorological Organisation
- All-weather field notebook
- Writing Utensil

Methods:

The methods I used for this project were extremely crude. I went to each of the bat roost locations at least 30 min to 1 hour before expected emergence. I placed myself in front of an opening in the roost most plausible for bat emergence. Then I waited; when the first bat left an opening in the roost I recorded the time that it left as beginning emergence time. Two of the roosts had emergence patterns too complicated to record the length of time required for all bats to emerge. Then as the bats were emerging I documented any behavior I found to be important in my field notebook. Once I had enough information I compiled it into a set of patterns prominent at each roost.

Results

Tadarida brasiliensis:
Altitude = sea level

May 26, 2000

General Weather Description around Emergence	Sunny
Official Sunset Time	18:33
Emergence	18:37

May 30, 2000

General Weather Description around Emergence	Overcast, rainy, and windy
Official Sunset Time	18:34
Emergence	18:40

General Behavior:

The *Tadarida brasiliensis* started vocalizing (the high pitched squeaking or chirping noises audible to humans) for several hours before they made any attempts to leave the roost for foraging. When the left the roost, they first dropped down from the ceiling where they were roosting, then they flew around inside of the building before exiting to forage. Full emergence time was not documented.

Monophyllus plethedon and *Natalus stramineus:*
Altitude = 670 m

June 02, 2000

General Weather Description around Emergence	Overcast, rainy, and windy
Official Sunset Time	18:35
Emergence	18:17

June 05, 2000

General Weather Description around Emergence	Sunny and windy
Official Sunset Time	18:36
Emergence	18:14

General Behavior:

The bats at Tou Santi were vocalizing throughout most of the day. Tou Santi is formed so that a large, deep cavern opens into an oblong shaped hole in the ground. The bottom of the hole is relatively flat; when the bats emerge, the first thing they do is a "runway-type" flight back and forth across the bottom of the hole. Then they start circling the hole and flying upward in a tornado type fashion. In the beginning of the emergence a few come out by themselves, then a large group of bats burst out of the cavern circling the hole. Anywhere from 50 – 200 bats per minute emerge from the hole. I observed numerous lulls in which about 50 bats per minute came out for about two minutes, then another burst would emerge with around 200 bats per minute for about two minutes. There was almost a sinusoidal pattern to the lulls and bursts of the bat emergence. Complete emergence time was not determined, but it lasted over one hour.

Molossus molossus:
Altitude = 350 m

May 23, 2000

General Weather Description around Emergence	Sunny with misting showers
Official Sunset Time	18:32
Emergence	18:32

May 24, 2000

General Weather Description around Emergence	Sunny with misting showers and breezy
Official Sunset Time	18:32
Emergence	18:33

May 25, 2000

General Weather Description around Emergence	Mostly cloudy and light rain
Official Sunset Time	18:32
Emergence	18:36

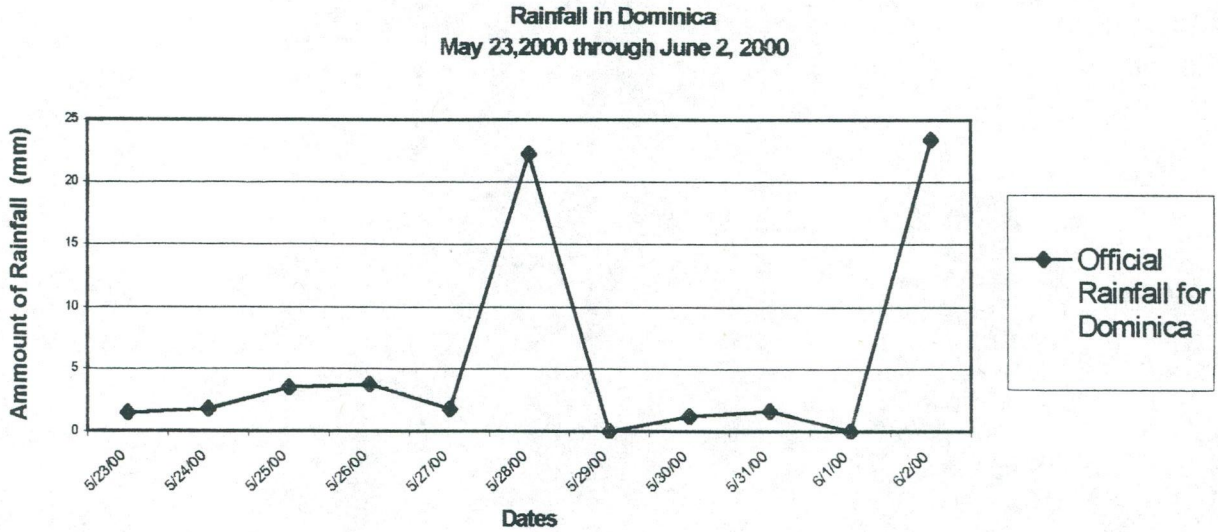
May 27, 2000

General Weather Description around Emergence	Overcast and rainy
Official Sunset Time	18:33
Emergence	18:50

May 29, 2000: No Emergence
May 31, 2000: No Emergence
June 01, 2000: No Emergence
General Behavior:

The colony that roosted above the stream-house had a maximum population of six bats during my observational period. The bats started speaking anywhere from 15 – 30 min before they actually emerged. When the bats emerged, they would first crawl along to the opening between two boards in the roof. Then they would just sort of drop down and start flapping their wings. They would fly straight on the sidewalk on the Southeast side of the upper story of the building and exit the building cover at the patio between the Southeast side and the front of the building, then on out to forage.

Graph 1



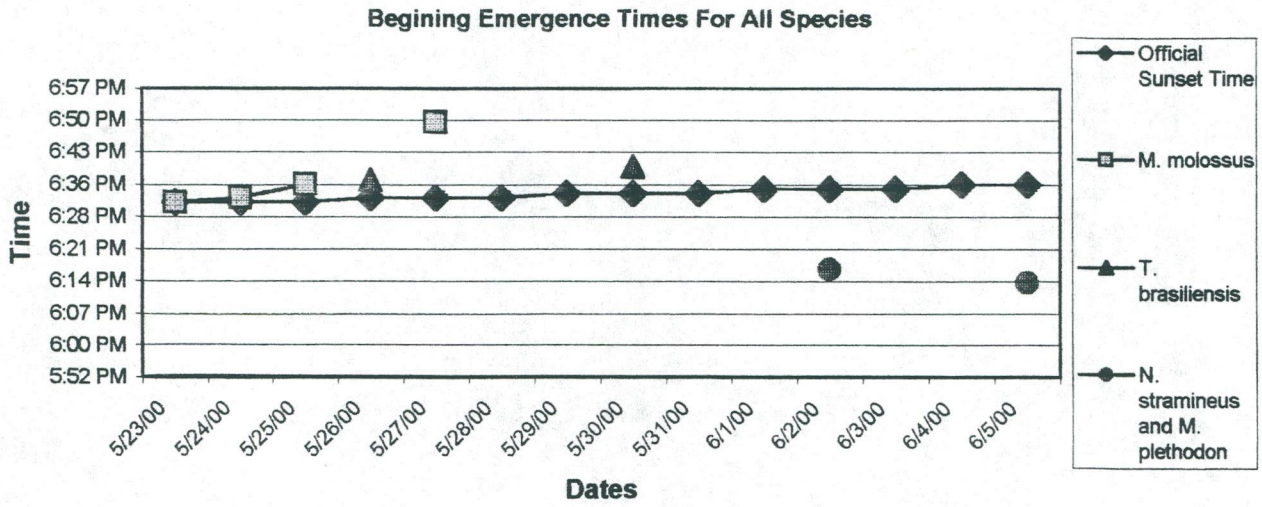
On May 28, 2000 there was an extremely large amount of rainfall (22.2 mm) and the bats were not seen or

heard in the building again. I watched for the bats on three nights to make sure the bats had left and no sign of the bats remained at the roosting site.

Discussion

I found some extremely interesting information from my observations about bat emergence behaviors. My original hypothesis was that almost all bat species would emerge at sunset. This appears to be true with some minor modifications. I now believe that emergence is also related to elevation. By referring to graph 2 below, you can see that *Tadarida brasiliensis* which roost close to sea level, emerge after sunset. I believe this is due to the fact that there may be residual sun light lasting longer closer to sea level. The bats that roost at Tou Santi live at a higher elevation and emerge before sunset. This could be due to the large colony size, but I believe if they were leaving earlier for the purpose of allowing the rest of the colony to have more foraging time, the early emergence would be more profound than it is. By only emerging 15-20 min before sunset the colony is not allowing enough extra time according to the size of the roost to warrant that explanation. I believe at the higher altitude the bats loose sunlight earlier in the evening and therefore emerge at an earlier time. The *Molossus molossus* roost at an intermediate altitude between the other two roosts, but their emergence time behavior was more sporadic than the other three species.

Graph 2



A trend I noticed is that on days when the weather is overcast the emergence time for the bats tends to be later. This may be due to the fact that the sky was relatively the same brightness all day long. The transition of day to night is harder to differentiate when the sky is overcast, so the bats may wait until it is darker than normal when they leave to be certain that evening has actually arrived.

Vocalizations were universal among all bat species. All the bats started making noise before they actually emerged. The larger colonies tended to start chattering earlier in the evening than the smaller colonies. I don't know if the timing of the behavior is due completely to colony size or if it is a species-specific behavior. The *Molossus molossus* (colony size of 6) started to vacalize between 15 and 30 minutes before they emerged, and the *Tadarida brasiliensis* (colony size 60-100) would start hours before emergence. The bats in Tou Santi would chatter most of the day, but it is not certain if both *Monophyllus plethodon* and *Natalus stramineus* were vocalizing through out the day or if only one of the species would speak at certain times.

Another behavior that I found interesting is that of "warming-up." *Tadarida brasiliensis, Monophyllus plethodon,* and *Natalus stramineus* flew around the interior area of the roost dwelling before actually emerging into the environment to forage. *Molossus molossus* immediately flew off to forage without warming-up. It is possible that they fly around away from the roost to warm-up before they actually start foraging for food. I believe it would prove valuable to determine if *Molossus molossus* as a species do not exhibit a type of warming-up behavior, or if the constraints of the roost just do not allow the behavior to occur immediately at the roosting site.

I also found that the timing of the seasonal departure from the roost site at the stream-house could be valuable information for learning more about this species. I started the study at the end of the dry season when some rain started falling almost every day. If you refer back to graph 1 you can see the low amount of average daily rainfall. I believe

the *Molossus molossus* breed during the peak of the dry season and find roosting sites which will support large amounts of smaller, weaker, baby bats. I also believe that the bats studied in this project are the bats delayed in leaving the breeding roost after breeding season ends. I have come to believe that rain is a trigger signal for the bats to leave the breeding roost for a different type of shelter in the wet season. This is supported by the fact that on May 28, 2000 there was a large amount of rainfall (22.2 mm) not yet consistently occurring. After this rainfall occurred, bats were no longer observed roosting in the roof of the stream-house.

The main problem with my research project was that I had too many variables to determine the causes of a specific behavior. I could not conclude whether the behavior was species specific or determined by other factors such as the type of roost or altitude of roost. Because of these problems there are many things that future groups can do to build upon and improve the research I have conducted. One thing they could do is observe the behaviors of only one bat species at many different types of roosts at one altitude, or similar roosts at different altitudes. Another project could be to observe different bat species that live in similar roosts at different altitudes, or different roosts at one altitude. I also believe my research is a good stepping stone for researching the life of *Molossus molossus* in more depth. While I do believe that would be too in-depth of a project for this course, I believing that tagging the animals at the stream house during breeding season and trying to track their locations during wet-season would provide valuable information. I think it would also be important to track the population size of the *Molossus molossus* as it changes during the breeding season to get a better idea of the life strategies of this animal.

In conclusion I discovered information about the similarities and differences of bat behaviors as they emerge from the roost for nighttime foraging. The main accomplishment of the project was being able to narrow down the window of time in which a colony of bats will begin to emerge according to the official time of sunset. Over-all I believe I was successful in determining key behaviors of Dominican bats at the time of emergence.

Acknowledgements

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