

**Foraging and Aggressive Behaviors of
Dominican Hummingbirds and Territorial
Aggression of the Purple-throated Carib in
Relation to Feeder Distribution**

Bethany Wilkins

Texas A&M University

Dr. Jim Woolley

Dr. Thomas E. Lacher

Dominica Study Abroad 2009

Abstract

This project was set up into 2 phases. In the first phase, the relation between time of day and foraging time, time of day and aggression time and proportion of acts of aggression within the time of day was observed for the three different species of the Dominican hummingbirds at Springfield Station. Hummingbird feeders were set out to draw out foraging and aggression from the hummingbirds. Any observation was then recorded. The second phase was set up to examine territorial aggressive behaviors of the Purple-throated Carib (*Eulampis jugularis*) in relation to feeder distances. The Purple-throated Carib's aggressive interactions between their same species as well as other bird species were recorded and their territorial boundary was explored. In Phase 1, it was discovered that there was no significant relationship between time of day and time of aggression, time of day and time of foraging and time of day with number of aggressive acts. Phase 2 showed that the Purple-throated Carib's territorial aggressive behaviors decrease with increased distance.

Introduction

Three species of hummingbirds can be found at Springfield Station, Dominica. These species are the Purple-throated Carib (*Eulampis jugularis*), Green-throated Carib (*Eulampis holosericeus*), and the Antillean Crested Hummingbird (*Orthorhyncus cristatus*). The Purple-throated Carib (*Eulampis jugularis*) is the largest of the three and will be the main focus of this project. This hummingbird is endemic to Dominica and is mostly dark colored with a large downward curving bill. The wings of the Purple-throated Carib shine an emerald color and a brilliant purple to red color will appear on its chest when the sun shines down on the hummingbird. Due to the Purple-throated Carib's

larger size, this hummingbird tends to be very aggressive and the most dominant hummingbird in territorial terms. This project will begin with Phase 1 which will consist of an overview of hummingbird foraging and aggressive behaviors in relation to time. Phase 2 will be focused on the Purple-throated Carib's territorial aggressive behaviors and will explore the boundaries of those territories.

Materials and Methods



I began my research by mixing 10 cups of water with 2.5 cups of sugar making a 4:1 ratio of water to sugar. I then filled 7 hummingbird feeders with this sucrose mixture as evenly as possible. I chose four sites to place my hummingbird feeders, allowing for slightly different environments that I could observe. At site 1, next to the terrace, I placed 2 feeders in the Mimosa tree about 10 feet apart. Site 2 was located at the front of the

station and consisted of one feeder in the front tree. Site 3 was located at the side of the station near the Stream house and had two feeders placed far apart from each other. One was located by the bridge on the side path, while the other was placed in the Bread Fruit Tree. Site 4, located in the tree in the back garden, had 2 feeders placed about 10 feet apart. I used string to attach my feeders to the tree making a pulley system. I performed Phase 1 of my project on May 27 and May 29, 2009. Phase 1 consisted of observing aggressive hummingbird behavior at each site for about 12 minutes. When observing, I used binoculars to aid in identifying the hummingbirds, a stop watch to time foraging and aggression and a notepad in which to record. I continued the cycle of observation throughout the day about every couple of hours. This phase was important because it allowed the hummingbirds to locate the feeders and begin to build possible territories around them. It also allowed me to discover which site was the most active as well as record aggressive behavior and foraging times of hummingbirds. On Sunday, May 31, I built two tripods out of bamboo poles and string. I placed one of the tripods 3 meters from the original two feeders at site 1. The second tripod was placed 3 meters from the original two feeders at site 4. These two sites were chosen because they proved to be the most active as well as show the most territorial behavior. On June 1, June 2, June 3 and June 5 I observed territorial aggressive behaviors and moved the tripod feeders according to the aggressive behaviors I recorded. Every time I moved the feeder, I recorded distance from the original feeders (in meters) as well as distance from the edge of the tree's canopy. If the dominant hummingbird protected the new feeder, then I moved the feeder away from the tree another 3 meters. Once the dominant hummingbird ignored the new feeder and any birds that foraged on it, I moved the feeder back towards the tree one

meter. The plan was to discover the boundary of the hummingbird's territory. When recording data for both phases, I used numbers to show Site Location (1, 2, 3, 4), Location on Tree (Feeder = 1, Tree = 2) and Time of Day (8-10 = 1, 11- 1 = 2, 2-3 = 3, 5-6 = 4).

Results

PHASE 1:

Time Spent Foraging by time of day:

Table 1

Descriptives

Time Foraging (sec)

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum Lower Bound	Maximum Upper Bound
					Lower Bound	Upper Bound		
1	6	10.4883	8.21733	3.35471	1.8648	19.1119	1.19	23.27
2	7	12.3800	8.84670	3.34374	4.1982	20.5618	1.47	25.60
3	15	9.7107	7.79108	2.01165	5.3961	14.0252	2.54	33.28
4	13	12.5054	12.00522	3.32965	5.2507	19.7601	.66	42.63
Total	41	11.1663	9.29340	1.45138	8.2330	14.0997	.66	42.63

Table 2

Significance of Time Spent Foraging by Time of Day

Time Foraging (sec)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	68.163	3	22.721	.248	.862
Within Groups	3386.524	37	91.528		
Total	3454.688	40			

Time spent in aggression by time of day:

Table 3

Descriptives

Time Aggression (sec)

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound
1	20	2.2485	1.64614	.36809	1.4781	3.0189	.19	6.82
2	18	1.7306	1.26476	.29811	1.1016	2.3595	.24	5.22
3	24	2.2263	1.14070	.23284	1.7446	2.7079	.88	4.56
4	36	2.4472	2.44085	.40681	1.6214	3.2731	.34	9.94
Total	98	2.2209	1.82569	.18442	1.8549	2.5869	.19	9.94

Table 4 Significance of Time aggression by Time of Day

Time Aggression (sec)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.188	3	2.063	.611	.609
Within Groups	317.128	94	3.374		
Total	323.316	97			

Number of aggressive acts:

Table 5

TimeDay * Action Crosstabulation

		Count		Total
		1.00	2.00	1.00
TimeDay	1	20	6	26
	2	18	7	25
	3	24	13	37
	4	35	14	49
Total		97	40	137

Table 6

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.129(a)	3	.770
Likelihood Ratio	1.129	3	.770
Linear-by-Linear Association	.281	1	.596
N of Valid Cases	137		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.30.

My results for Phase 1 indicate that there is no significant relationship between time of day and time of foraging, time of day and time of aggression, and number of aggressive acts in relation to time of day. The data varies greatly within each site, and the variability in means between sites is not significant. For example, foraging varies from 2.62 seconds to 42.63 seconds in Site 4 but the variation between sites is far less. A p value of 0.862 means that 86% of the time I would observe differences among the means like what I observed. If the significance was less than 0.05, then that would give a significant variation.

PHASE 2:

Location: Site 1/ Third Feeder- Bird number 1 and 2

Table 7

Hummingbird 2

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.595	1	.595	.275	.606(a)
	Residual	45.512	21	2.167		
	Total	46.107	22			

a. Predictors: (Constant), Distance from Feeders (m)

b. Dependent Variable: Time in Aggression (sec)

Table 7 shows that there is no linear regression of hummingbird 2's aggression in relation to distance. There is no strong linear relationship.

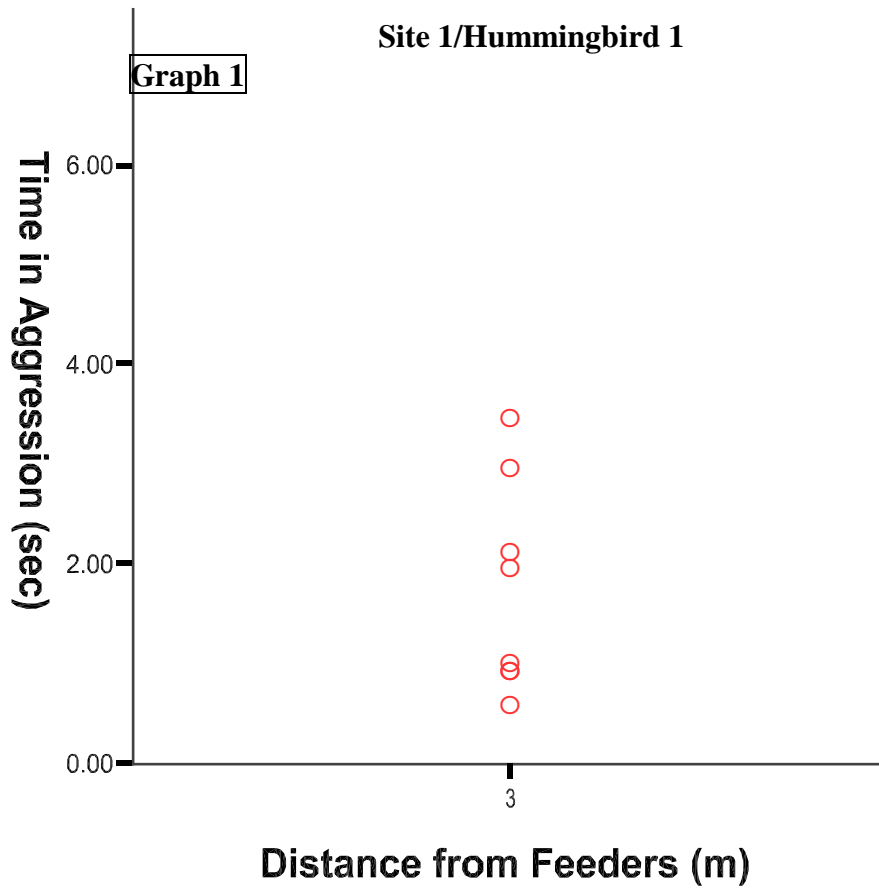


Figure 1: Time Spent in aggression acts by the territorial hummingbird in encounters, if won

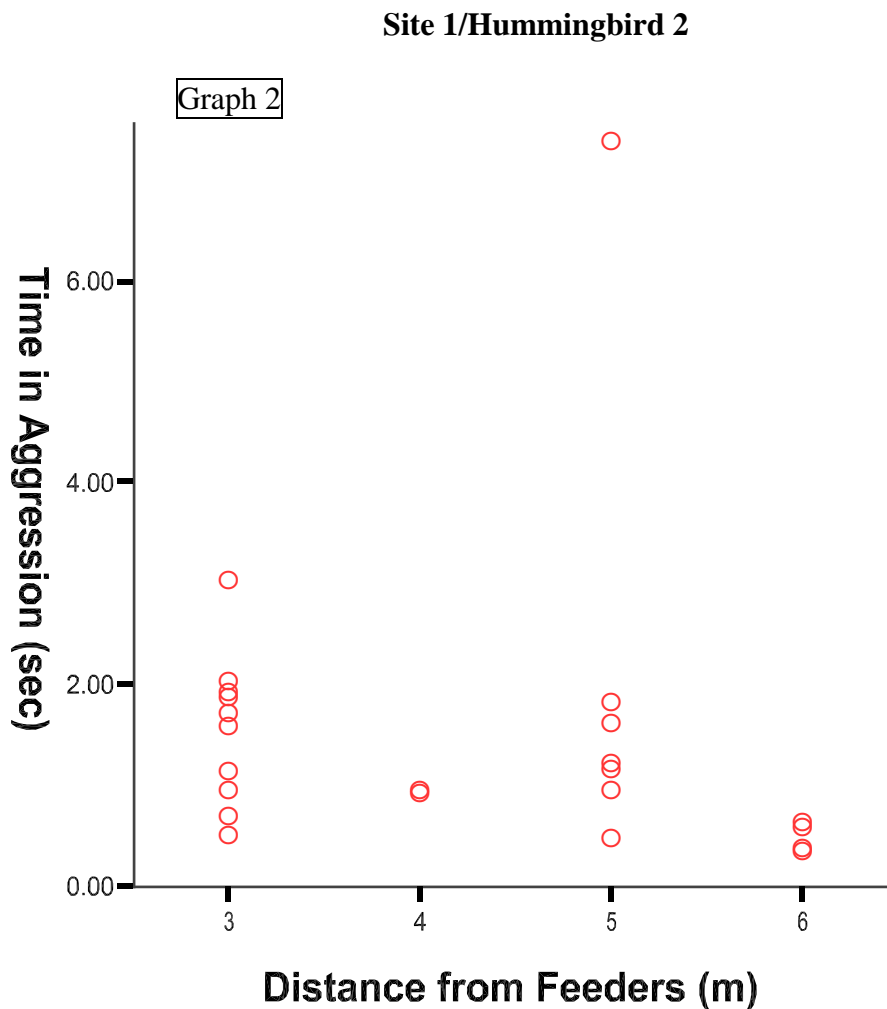


Figure 2: Time spent in aggressive acts by the invading hummingbird in encounters, if won

Graphs 1 and 2 show that, although Table 7 showed no significant linear regression, there is still a clear pattern between the distance of the feeder and the time spent in aggression. The original Purple-throated Carib (Hummingbird 1) that guarded Site 1's territory continued to show territorial aggression once the third feeder was added

at a distance of 3 meters. Once the feeder was moved to 6 meters from the feeders, however, Hummingbird 1 did not extend his territorial aggression to this distance. A new Purple-throated Carib (Hummingbird 2) took this third feeder as his territory. At a distance of 6 meters, Hummingbird 2's aggressive acts were not as numerous or long. As the feeder was moved to 5 meters, 4 meters, and then back to 3 meters from the original feeders, Hummingbird 2's aggression times lengthened due to increased competition. Although Table 7 shows no significance, Hummingbird 2's aggressive behavior shows a distinct pattern of increase in aggression as distance in the feeders decreases.

Location: Site 4/Third Feeder- Bird 1 and 2

Table 8

Hummingbird 1 Significance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.261	1	.261	.085	.773(a)
	Residual	58.039	19	3.055		
	Total	58.300	20			

a. Predictors: (Constant), Distance from Feeders (m)

b. Dependent Variable: Time in Aggression (sec)

Table 8 shows that there is no significant variability of hummingbird 1's aggression in relation to distance. Again, there is no evident strong linear relationship.

Graph 3

Site 4/Hummingbird 1

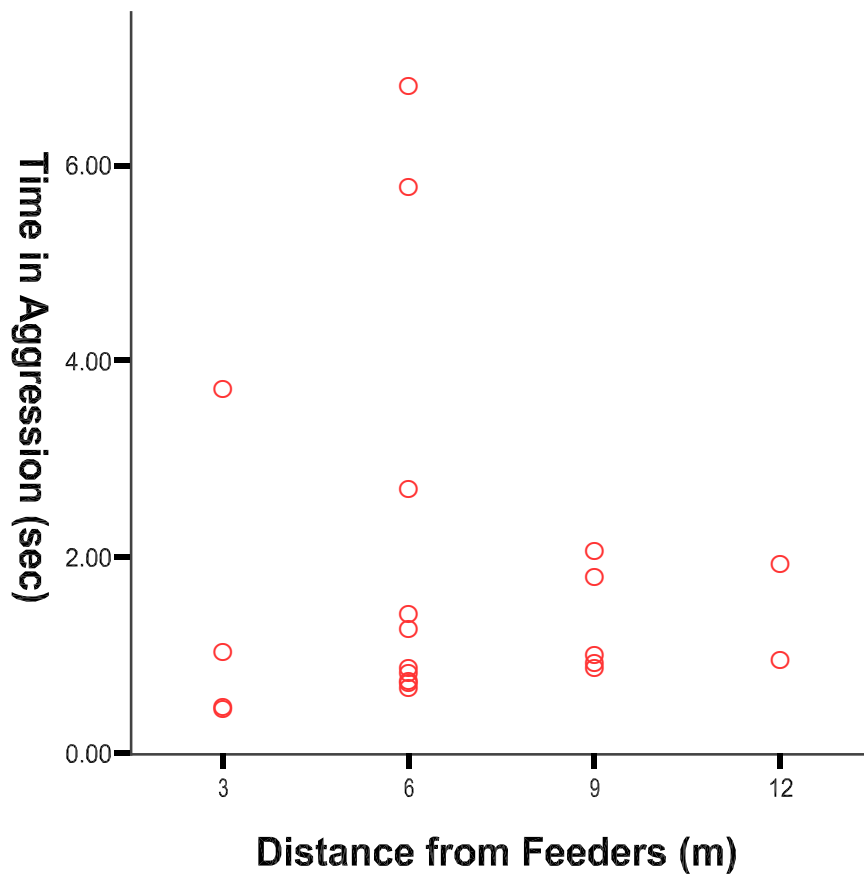


Figure 3: Time spent in aggressive acts by the territorial hummingbird in encounters if won

Graph 4

Site 4/Humminbird 2

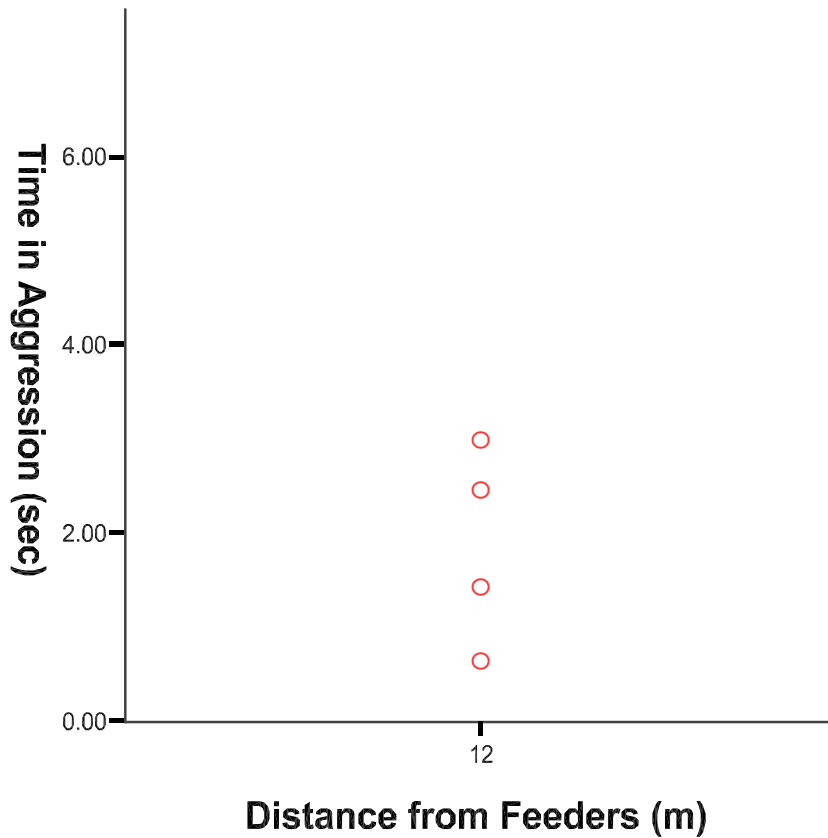


Figure 4: Time spent in aggressive acts by the invading hummingbird in encounters if won

Graphs 3 and 4 suggest that, although there is no significant linear relationship, there is still a distance pattern in hummingbird aggression relating to feeder distance. Hummingbird 1 shows territorial aggression all through the distances of 3, 6 and 9 meters. Once the feeder was placed 12 meters from the original feeders, it was not in Hummingbird 1's interest to guard Feeder 3 anymore. As the distance increased from the

original feeders, there is a linear trend of a regression in Hummingbird 1's aggressive behavior. The satellite hummingbird only won encounters at a distance of 12 m.

Discussion

Phase 1:

In this phase there was no significant relationship between time of day and time of foraging, time of day and time of aggression, and number of aggressive acts in relation to time of day. These results are most likely due to the extreme variability that occurs from hummingbirds within sites. When observing the hummingbirds, I noticed that sometimes they would forage or show aggression for longer times than others. With aggression, they might simply chirp at a potential competitor as a sign of warning. In other cases, a hummingbird might actually chase the potential intruder out of the territory and out of eyesight. This extreme variability within the sites makes it very hard to show statistical significance of the time of day in relation to foraging or aggression. I am only taking random samples out of the 24 hour period they might actually be practicing these behaviors. While actually observing the hummingbirds at the feeders, it seemed that they showed more aggression closer to the end of the day. Again, when an analysis was run on this, no significant relationship was shown between time of day and number of aggressive acts. From these results, I can conclude that hummingbirds are active in aggressive and foraging behaviors throughout the day. From the raw data, one could observe that there seems to be more of these behaviors later in the day, despite the lack of significance in the data.

Phase 2:

The territorial aggression practiced by the Purple-throated Caribs in Phase 2 showed no significant linear relation to distance of feeders when statistically analyzed. However, the 4 graphs produced from this same analysis do show a distinct pattern in aggression. From these graphs one can conclude that as feeder distances increase, the Purple-throated Carib's territorial aggression declines. This may be due to the wider range of territory the new feeder produces. In Site 1 (graphs 1 and 2), the original territorial Purple-throated Carib (Hummingbird 1) does not find it necessary to guard the new feeder and does not accept the feeder into its territory. Hummingbird 2 takes the new feeder in as its own territory and begins to protect it. At the farther distances, Hummingbird 2 does not have a large amount of competition and does not need to engage in aggressive acts as often or as long. Once the feeder moves closer to Hummingbird 1's territory, Hummingbird 2 must fight for his new territory and shows longer aggressive acts. Site 1 was a very large Mimosa tree. Throughout my observations, I noticed a lot of activity in this tree throughout the day. I also noticed a female Purple-throated Carib with a nest that she defended against any type of bird that would land in the tree. All of this activity that took place in the Mimosa tree could be other factors that went in to Hummingbird 1's lack of interest in Feeder 3 after the 3 meter distance. In Site 4 (graphs 3 and 4), the territorial Purple-throated Carib (Hummingbird 1) continued to show aggression up until the 12 meter distance. These aggressive acts shortened in time as the distance between feeders increased. Once the 12 meter distance was obtained, Hummingbird 1 began to give up and go back to his original feeders. A new hummingbird (Hummingbird 2) started to make feeder 3 his new territory. Hummingbird 1's persistent aggression at Site 4 could be due to the lack of activity that I observed at

this site. There was not a nesting female in this tree and activity mostly took place in the evening. These factors most likely led to Hummingbird 1's continued aggression because there were fewer intruders to watch. Therefore, the intruders that did come were easily chased away.

If more time was available, Hummingbirds 1 and 2 at both sites might have formed stronger territories and shown more aggression toward each other. It would be interesting in continuing studies to see what kind of interaction might take place when merging two territories together.

Acknowledgements

I would like to thank Dr. Lacher and Dr. Woolley for their aid in this project and their continual supply of knowledge every step of the way to better my studies.



Works Cited

James, Arlington. Dominica's Birds. Dominica: Forestry, Wildlife and Parks Division of Dominica, 2005. Pg 83-85