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Joshua Barzilai  
*Case Western Reserve University*

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# Adaptations and Preferences of Wild Hummingbirds Introduced into a Captive Setting

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## -Joshua Barzilai -

Josh Barzilai is a third year junior at CWRU, majoring in Biology, Chemistry, and German, with the future hope of going to medical school. Outside of class, Josh is an active member of the Alpha Epsilon Pi fraternity, and the co-founder and president of the Case Biology Society. Currently Josh is trying to found a local Tri Beta chapter, the honor biology society, on campus.

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### ABSTRACT

This case study focuses on the effects of avian introductions into a captive exhibit. Two hummingbirds, *Colibri coruscans* (sparkling violet eared) and *Anthracothorax prevostii* (green breasted mango), were both observed over an 8 week period as they were reintroduced into a recently remodeled Free Flight Exhibit, located at Perching Bird house of the Brookfield Zoo in Chicago, Illinois. Prior to introduction, the birds were held in isolation holding. In both the zoo and isolation, the subjects were observed on their location, social proximity, and behavior. The questions of whether the subjects would have a preference in location and whether a change in behavior while in captivity were studied. The end result was that both birds showed preferences of location in the exhibit, as well as an increased perching behavior, greater than what is observed in their natural habitats.

### INTRODUCTION

The Free Flight exhibit at the Brookfield Zoo is large aviary enclosure that houses several varieties of birds. This enclosure has a wide array of trees and plants that are separated in the middle by a large winding stream that gives the birds, within the exhibit, a wide selection of perches and other necessities. However, recently the exhibit was closed and remodeled. The roof panels were removed and replaced with clear transparent windows to allow sunlight into the exhibit; the walls were repainted to give the impression that the exhibit was on the top of a mountain; and the flora (trees and floor plants) in the exhibit



**Figure 1.** The Free Flight exhibit at the Brookfield Zoo

were changed. The end result was a new environment that mirrored an entirely new habitat.

The two hummingbirds that were observed for a period of 8 weeks were the male *Colibri coruscans* and female *Anthracothorax prevostii* hummingbirds. Both hummingbirds are members of the family Trochilidae and are native to either Central or South America.

*C. coruscans* is characterized by its all green body with stripes of violet around both eyes and is native to North West South America, mainly NW Venezuela and Columbia through Ecuador and Peru to Bolivia and NW Argentina (Campbell 1974). Its particular habitat or niche includes forest edges, open woodland, flowering gardens, and plantations. These habitats are ideal for *C. coruscans*, as its primary food sources are

nectar from flowers and small insects, both of which are abundant in such a tropical region (Perrins 2003). It is known to migrate for food, although this is mainly done during dry seasons.

*A. prevostii* also has an all green body, most noticeable in its breast. Another characteristic of *A. prevostii* is its decurved bill (Alderfer 2005). *A. prevostii* is most commonly found in central and the northern South America. It usually inhabits open grassy or shrubby areas with scattered taller trees, especially near water, savannas pastures, parks, gardens, shaded coffee plantations, and other sparsely lowland forests at an elevation between 900-1200 Meters. *A. prevostii* mainly feeds on the nectar of brightly-hued plants and small insects (Perrins 2003). It is not known to migrate



long distances; however, its movements are known to correlate based on the local flora.

The purpose of this case study is to observe the behavior of two of the exhibit's residents, *Colibri coruscans* (Sparkling violet eared) and *Anthracothorax prevostii* (Green Breasted Mango) hummingbirds, both while they are in holding, and after they are reintroduced into Free Flight. These observations will focus on monitoring their location within the exhibit, their social proximity to other birds, and their behavior at specific intervals. The purpose of collecting this data is to help answer the questions, "Do these hummingbirds have particular preferences in terms of habitat within a captive environment?" and "Does captivity drive the actions/behaviors of these birds? Do they differ from what is witnessed in the wild, and if so why?" The end goal is to use the preferences and adaptations of these birds to gain more information about them in a captive setting and understand how to better design exhibits in the future.

## MATERIALS AND METHODS

The subjects of this study were the *Colibri coruscans* (Sparkling violet eared) and *Anthracothorax prevostii* (Green Breasted Mango) hummingbirds. Both birds were on display at the Brookfield Zoo. The specific age of both hummingbirds was unknown since they were originally from the wild. At the start of the observations, both birds were housed in an off exhibit holding area; this lasted for about 2 weeks and they were later moved into the Free Flight Aviary in the Perching Bird House.

Data for both subjects was collected via the in-

stantaneous sample collection method. Each subject was individually observed for 15 minutes in the morning (approximately 10am) and again individually observed for 15 minutes in the afternoon (approximately 2pm) for approximately 8 weeks. Times of observation varied slightly as the upkeep of the exhibit delayed the start of the observations. To avoid observing the animals after being disturbed, an additional 5 minutes were allotted, and the new observation start time was noted. The subjects were observed for the following criteria every minute: location, social proximity, and behavior during the 15 minute observation period.

The location of the subjects was recorded by mapping the exhibit into approximately equal sized quadrants. These quadrants was later be used to help record the location of each subject at each 1 minute instantaneous sampling interval.

The exhibit was divided into 18 quadrants measuring 2 quadrants deep, 3 quadrants in length, and 3 quadrants high. Each quadrant was approximately 125 cubic feet (5x5x5). However, the size of the quadrants varied slightly to fit in with the exhibit. The numbering of the quadrants started at the top, front, left quadrant and then proceeded down the column. The numbering then continued from the top of the column on the immediate right. After quadrant 9, located on the bottom, front, right quadrant, the number proceeded to quadrant 10, in the top, back, left corner, directly behind quadrant one. The numbering process continued as in the front section (quadrants 1-9).

Next, the social proximity of the two subjects was categorized according to the subject's nearness to other birds and recorded. The purpose this observation was to record the social interactions of the subject in

relation to both the other birds in the enclosure as well as the other hummingbird subject. The proximity of the subject to other birds was based on a 2 foot radius around the subject and further defined based on the following:

1. Subject is alone and not interacting/acknowledging other birds
2. Subject is alone, but is engaged in watching other birds
3. Subject is with a small group of bird (less than 3)
4. Subject is with a medium group of birds (3-7)
5. Subject is with a large group of birds (7+)

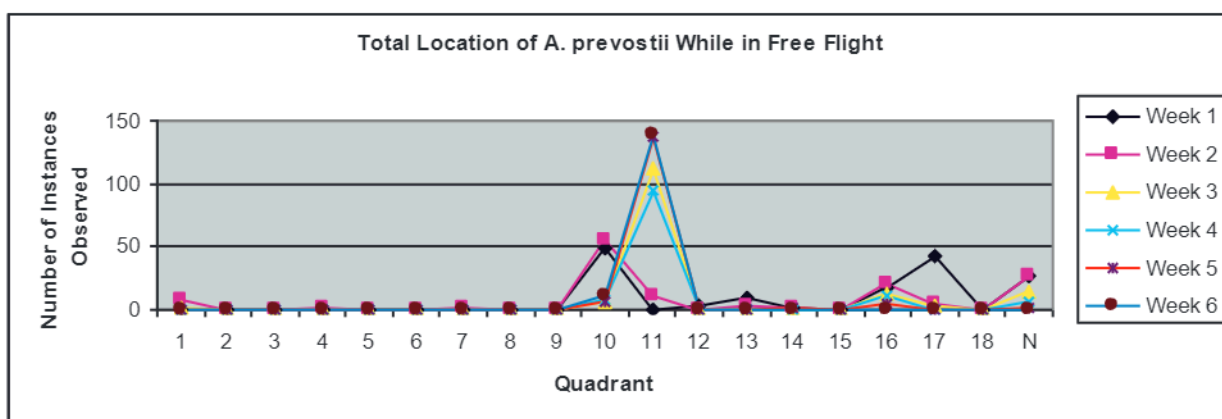
In addition to classifying the subject's general proximity to one another and the other birds in the exhibit, a count of aggression, which received or expressed the aggression, was recorded. This tally of aggression was gender neutral, as it was impossible to identify the gender of every bird without close examination of the bird's band. As a result, the bird's particular species

was used as classification instead.

The behavior of the subjects was also recorded. These behaviors were based on an ethogram (see addendum 1) of both known and observed behaviors. The ethogram was designed based on the priorities of behaviors, to eliminate the possibility of having 2 behaviors for one particular sample.

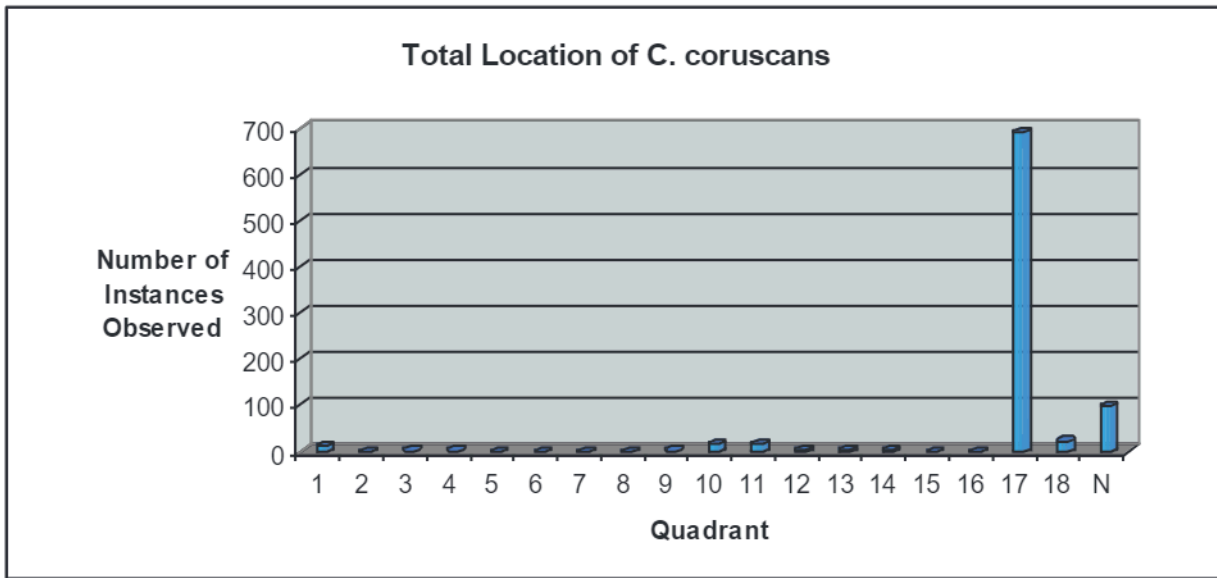
## RESULTS

The total data for the location for *A. prevostii* shows little difference between morning and afternoon observations while in Free Flight. The location in isolation was not recorded since the size of the holding cage was smaller than one quadrant. However, there is a difference in the subject's location over the six week span of time in the Free Flight exhibit. Figure 2 shows a shift in the preference of location towards the beginning of week 3 from quadrant 10 to quadrant 11. The overall location for *C. coruscans* showed a consistent prefer-



**Figure 2. Total Location of *A. prevostii* While in Free Flight**

Figure 2 is the data of both morning and afternoon observations on location for *A. prevostii* while in Free Flight. Figure 2 shows a clear transition in preference in location for quadrant 10 in weeks 1 and 2, to a preference of quadrant 11 in weeks 3, 4, 5, and 6.



**Figure 3. Total Location of *C. coruscans***

Figure 3 shows the location of *C. coruscans* while observed in Free Flight. Figure 3 shows the preference of *C. coruscans* of quadrant 17.

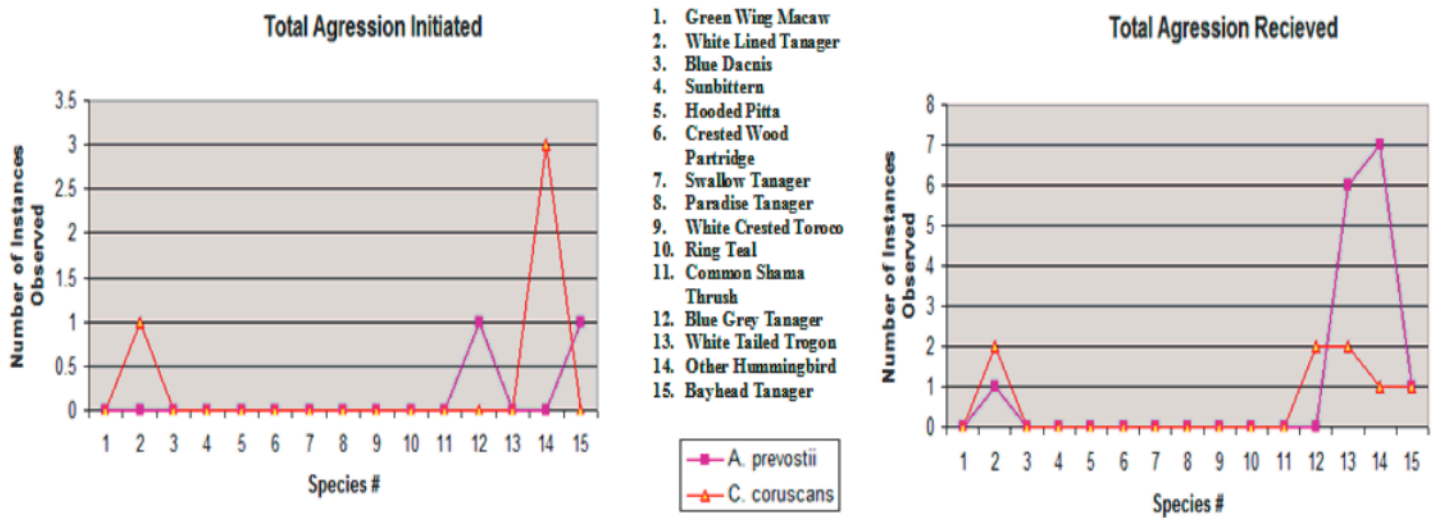
ence for quadrant 17 during both the morning and afternoon observations, as is seen in Figure 3.

The social proximity of both subjects was consistent. It comprised entirely of point 2 on the social proximity chart: “bird is alone, but is engaged in watching other birds.” Though usually isolated from other birds, both subjects received and initiated aggression with the other birds as seen in Figure 4 (next page). Figure 4 shows the number of instances of aggression received and initiated. *C. coruscans* was observed initiating more acts of aggression, especially against *A. prevostii*. *C. coruscans* also received less aggression than *A. prevostii*.

The behavior of *A. prevostii* showed no difference between the morning and afternoon observations. There was a difference, however, between the behaviors

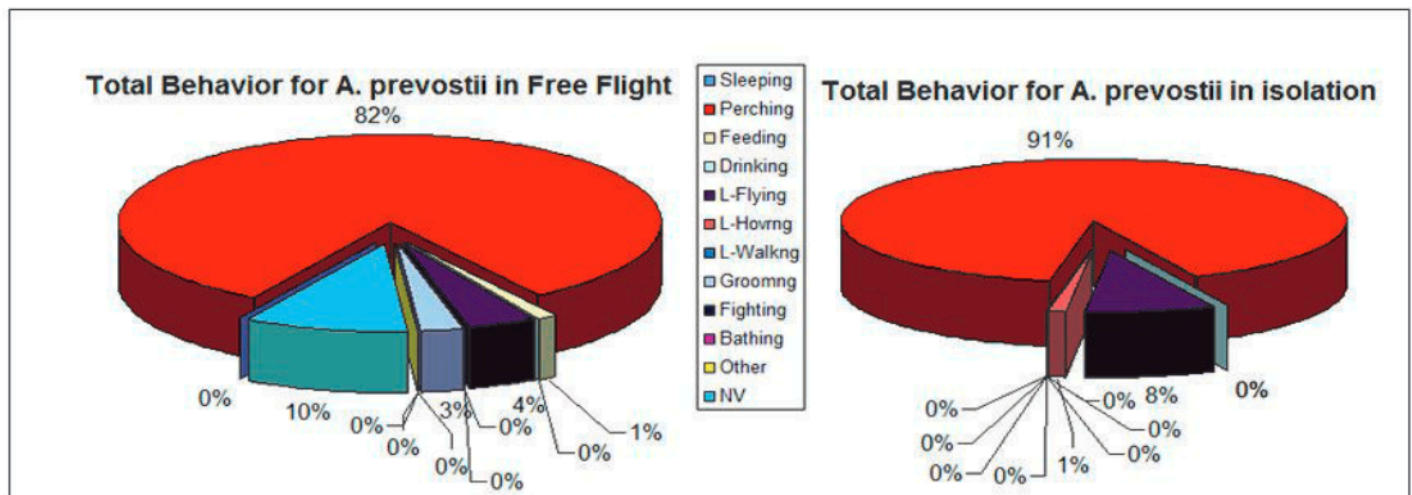
noted while the subject was in isolation holding and, afterwards, in the Free Flight Aviary. As can be seen in Figure 5 (next page), there is a significant drop in the amount of perching behavior when in Free Flight as well as a slight decrease in the flying behavior compared to its behavior observed in isolation.

The behavior of *C. coruscans* was consistent. However, as can be see in Figure 6 (next page), certain behaviors were more prevalent depending on the time or location. Figure 6 shows that both fighting and bathing behaviors were only witnessed in Free Flight and in the morning. It also shows that behaviors such as feeding, grooming, fighting, and bathing were not seen, either in the morning or afternoon, while *C. coruscans* was in isolation.



**Figure 4. Total Aggression Initiated and Received by *A. prevostii* and *C. coruscans***

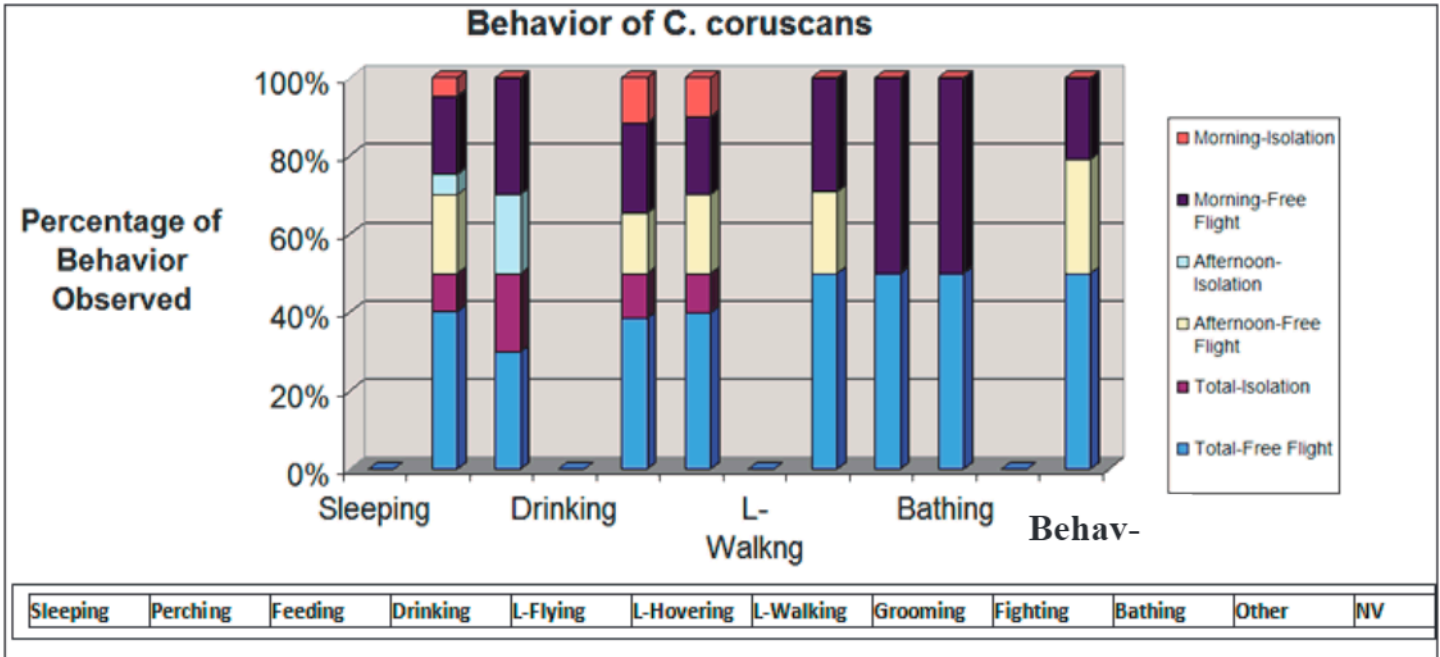
Figure 4 shows the number of observed instances of received and initiated aggression. It can be seen in the left portion of that *C.* initiated more instances of aggression, especially towards *A. prevostii*. The right portion shows that *A. prevostii* received more instances of aggression from other birds than *C. coruscans*.



**Figure 5. The Total Behavior of *A. prevostii* in both Free Flight and Isolation**

Figure 5 shows the difference in total behavior fro *A. prevostii* between the two environments: Free Flight, isolation. There is approximately a 10% decrease in the number of perching observations, as well as a 50% decrease in the number of flying observations.





**Figure 6. Behavior of *C. coruscans***

Figure is a stacked graph that shows the percentage of a behavior at a particular time. Figure 6 shows that certain behaviors are prevalent regardless of location or time, such as perching and flying. Other behaviors such as bathing, fighting, feeding, and grooming are only seen at certain times and only in Free Flight.

## DISCUSSION

The location for both subjects was very specific. As illustrated in Figures 1 and 2, both subjects were prone to certain locations. Both subjects preferred to be in the back row, farthest away from public viewing and the keeper maintenance areas. This appears to demonstrate that both subjects prefer to be as far away from humans as possible.

*A. prevostii* initially preferred to be at the highest point of the exhibit (quadrant 11), and then moved to a lower position (quadrant 10). *A. prevostii*'s initial prevalent location could demonstrate an initial stress to the environment, the public (Demarset, Durrant, & Gibbons 1995), or other birds in the exhibit. Such a re-

sponse could explain the high vantage point. Gradual acclimation to the environment could be a possible explanation for its change in preferential location. The behavior of *A. prevostii* in the exhibit is comparable to its known behavior in the wild. High and open locations are known favorites of this species as they allow the bird to be vigilant and watch for potential predators.

*C. coruscans* demonstrated a clear preference for quadrant 17. This quadrant is in the right, middle of the back row and is mostly covered by plants and trees. The location where *C. coruscans* was most often observed was on a small branch within a tree. This sheltered location as well as the heightened aggression noted in Figure 4 could be indicative of its territorial nature. Such a behavior is similar to its known natural behavior.



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Hummingbirds are known to be territorial, especially in regards to feeding locations (Carpenter, Hixon, Paton 1983).

The social proximities observed for both birds were that they were isolated from the other birds; however, they were still very observant of the birds around them. This also follows what is known about hummingbird behavior. Hummingbirds, in general, are known to be solitary when not breeding.

The behavior of both birds in isolation was relatively identical to the behavior they exhibited in the Free Flight Aviary. This similarity is most likely due to the fact that the temporary holding cages were not conducive to extensive movement of the hummingbirds. Such extensive movement may have been prevented due to cage obstructions.

In Free Flight, both birds were most often observed in a perched position. While both birds did fly for short periods of time, these rarely overlapped with observation times, reflected in Figure 6. This behavior is prevalent in hummingbirds since their rapid metabolism requires them to rest often. However perching for such long periods of time is probably uncommon. As a result, long periods of flight are probably uncommon. Hummingbirds are especially flighty and much more prone to flight as it is their only means of escape, especially as

their feet are ill-equipped to walk even short distances. This reoccurring behavior is most likely caused by captivity and prolonged exposure/close proximity to so many other birds. As both birds were confined to the same space as other birds, it appears that their behaviors tended to become more observant than evasive.

This experiment placed focus on the after affects of placing both subjects into a large aviary setting, Free Flight, in order to see the effects. This experiment was limited since it did not take into account several factors that could be the basis for future studies. These factors include the effects of people (public and keepers), the amount and distribution of light, concentration of nectar, as well as many others. These factors would provide even more information about these species.

In conclusion, the data shows a clear preference within the Free Flight exhibit. Both subjects demonstrated clear preferences in both location and behavior. The location varied for each hummingbird; however this agreed with the territorial nature of the type of bird. Perching was the predominant behavior for both birds. This behavior was probably a result of both natural instincts and adjusting to a captive environment. While both subjects were originally from the wild, both demonstrated some acclimation to their new environment, whether it was in location (for *A. prevostii*) or behavior (for both subjects).

### ADDENDUM I: ETHOGRAM OF OBSERVED BEHAVIORS

1. Feeding	Subject is hovering with beak in nectar tube.
2. Drinking	Subject is perched or hovering with beak in water.
3. Locomotion-flying	Subject in flight (non-stationary)
4. Locomotion-hovering	Subject remains stationary while in flight.
5. Locomotion-walking	Subject moves along perch without flight
6. Fighting	Subject is engaged in violent aggressive behavior
7. Grooming	Subject manipulates feathers while perched.
8. Bathing	Subject places water on feathers or enters water.
9. Sleeping	Subject is perched and unaware/non-reactive to local environment
10. Perching	Subject was perched/otherwise inactive
11. Other	Subject performs a behavior not listed in this ethogram.
12. Not Visible	Subject cannot be seen at specific time

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