

***Sciurus carolinensis* foraging preferences in locations with high and low availabilities of anthropogenic food items**

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The eastern gray squirrel, *Sciurus carolinensis*, can be found foraging throughout the University of Maryland campus. We aimed to determine if *S. carolinensis* prefers natural foods or anthropogenic foods and if locations with a high or low availability of anthropogenic foods (i.e. heavily developed or less developed locations) affect their preference. We examined foraging preferences by alternately presenting *S. carolinensis* with dry roasted peanuts (natural food option) or mozzarella sticks (anthropogenic food option) at two feeding stations; a location with high human traffic on the University of Maryland at College Park campus and a location with low human traffic at Berwyn Neighborhood Park in College Park, Maryland. We found no significant difference between the number of visits by individuals to stations when natural or anthropogenic foods were presented, as well as no significant difference in the number of visits at locations with high or low availabilities of anthropogenic foods. The fact that we did not find a preference by *S. carolinensis* for different food types, or for food types at different locations, could have detrimental consequences for the health of individuals. If individuals do not select against less nutritious, anthropogenic foods, they may not be able to meet their dietary requirements. Although our results were inconclusive due to a small sample size, Bowers and Breland (1996) conducted a similar study and found that *S. carolinensis* foraged more frequently in environments with higher human populations. Such a finding arouses similar concerns regarding the impact of these foraging preferences on *S. carolinensis* health.

Key words: anthropogenic foods, eastern gray squirrel, foraging, natural foods, rural, *Sciurus carolinensis*, urban

The behavior of the eastern gray squirrel, *Sciurus carolinensis*, on college campuses has been a subject of curiosity for some time. These mammals are unique in that they have a reasonably high tolerance for human interaction. College campuses tend to be densely populated environments with a high availability of anthropogenic food items. Trash cans, for example, are often filled with fast foods and other unnatural items, which *S. carolinensis* takes advantage of while foraging (personal observation). Recent news has highlighted the detrimental effects of such foods to the health of humans, but there has been considerably less research conducted on the effects of these foods on local wildlife. As Bowers and Breland (1996) conclude in their experiment, an understanding of the ecological relationship between humans and *S. carolinensis* in urban environments is preliminary to determining anthropogenic impacts. It is necessary to investigate the food preferences of *S. carolinensis* in order to determine how humans are affecting the species and possible management strategies to minimize these impacts.

We examined *S. carolinensis* foraging preference when presented with either natural or anthropogenic food items at two locations, one with a high and one with a low availability of anthropogenic food. Because *S. carolinensis* is known to forage on human food items, we hypothesize that the level of anthropogenic food available at a location will affect the foraging preference of *S. carolinensis* for anthropogenic and natural food items. If there is a correlation between location and food type, such that individuals at different locations prefer different food types, then we expect to observe a greater preference for anthropogenic food items versus natural food items at the location with a high anthropogenic food availability as opposed to the location with a low anthropogenic food availability. If there is no correlation between location and food type, then we expect to find a greater selection for anthropogenic food items compared to natural food items at both locations, and expect the degree of preference for anthropogenic food items over natural food items to be the same at both locations.

MATERIALS AND METHODS

Field observations – We chose Planters regular dry roasted peanuts as our natural food item (serving size 28g, fat 15g, sodium 160mg, sugar 1g) and Sargento® mozzarella sticks as our anthropogenic food item (serving size 30g, fat 7g, sodium 188g, sugar 1g). We set up our feeding stations at locations with a similar ratio of forest cover to open space (based on a visual assessment) in Berwyn Neighborhood Playground Park and a field south of Memorial Chapel at

the University of Maryland. In each location we set up a feeding station 1m from the largest diameter at breast height (DBH) tree within a cluster of trees as an individual's flight initiation distance increases with the distance from the nearest refuge tree (Dill and Houtman 1989). We designated a circular boundary with a 1m radius around each feeding station using pin flags and placed 60g of a food item (enough so that we would not need to restock the food station mid-observation) in a pile in the center of the circle (Fig. 1). On alternate days, we placed either peanuts or mozzarella in the feeding station at each location. We began observations at 17:30 hours due to the crepuscular nature of *S. carolinensis* and the observation that the species' peak afternoon foraging time is 2-5 hours before sunset (Skibieli et al. 2002). We observed for a 1 hour time block, which constituted a trial, and recorded the number of times *S. carolinensis* visited the feeding station during that trial. An individual was required to remain at the station for a minimum of 3 seconds to constitute a 'visit' and if the individual left the station for a minimum of 30 seconds and then returned, it constituted an additional 'visit'.

Statistical analysis – We ran a Two-Way Analysis of Variance in Microsoft Office Excel 2007 in order to test for an interaction effect of level of anthropogenic food availability and food item type on the number of visits to a feeding station in a 1 hour trial. We also tested for main effects of level of anthropogenic food availability on the number of visits and food item type on the number of visits.

RESULTS

We found no interaction effect between the level of anthropogenic food availability and food item type on the number of visits by *S. carolinensis* to a feeding station ($df = 1$, $F = 0.472$, $p > 0.05$), indicating inconclusive results concerning whether individuals prefer different food types at different locations. Furthermore, we found no main effect of level of anthropogenic food availability on the number of visits ($df = 1$, $F = 0.019$, $p > 0.05$), indicating inconclusive results regarding the frequency of foraging at locations with different levels of anthropogenic food availability. We also found no main effect of food item type on the number of visits ($df = 1$, $F = 1.528$, $p > 0.05$), indicating inconclusive results regarding the frequency of foraging when either anthropogenic or natural food items are available.

DISCUSSION

Our results were inconclusive with regards to *S. carolinensis* foraging preferences for anthropogenic or natural food types, foraging frequency at locations with different levels of anthropogenic food availability, and interactions between location and food type on foraging preferences (Fig. 2). Our inconclusive findings were likely a result of our small sample size which can be attributed to several factors. To begin with, researchers have noted higher concentrations of *S. carolinensis* in urban areas as opposed to natural, forested areas (Bowers and Breeland 1996). Our selection of more forested areas within our study locations could have influenced the low concentrations of *S. carolinensis* observed during the experiment. In addition, precipitous weather conditions precluded us from conducting observations on many of the days in the study time period in order to minimize confounding variables. Furthermore, the time of year during which we conducted our study may not have been ideal for high frequencies of observations. The species' second mating period begins in May and could have resulted in individuals prioritizing their reproductive success over foraging.

Though our results were inconclusive, similar studies have found that *S. carolinensis* forages more frequently in areas with high human populations (Bowers and Breeland 1996). This finding could have implications on the health of individuals due to a lack of nutrition in anthropogenic foods as opposed to natural foods and the presence of preservatives and toxins in anthropogenic foods that individuals would not otherwise be exposed to. In addition to affecting *S. carolinensis* health, foraging preferences for anthropogenic over natural food items could disrupt seed dispersal by the species and negatively impact the ecosystem on a larger scale. Further research is needed on the foraging preferences of *S. carolinensis* with regards to anthropogenic versus natural foods at different locations and laboratory experiments are needed on the effects of commonly available anthropogenic food items on the health of individuals. With the addition of such research, management policies could be implemented to incorporate wildlife-proof refuse containers into urban landscapes and develop educational programs on the effects of littering on wildlife. Such policies could better provide for the health of *S. carolinensis* and the continuation of natural ecosystem processes such as seed dispersal.

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FIG. 1 – Layout of a feeding station. The station is situated one meter from the largest DBH tree (far right) in a cluster of trees. The orange pinflags designate a circular boundary for the station with a 1m radius. A pile of peanuts can be seen in the center of the feeding station.

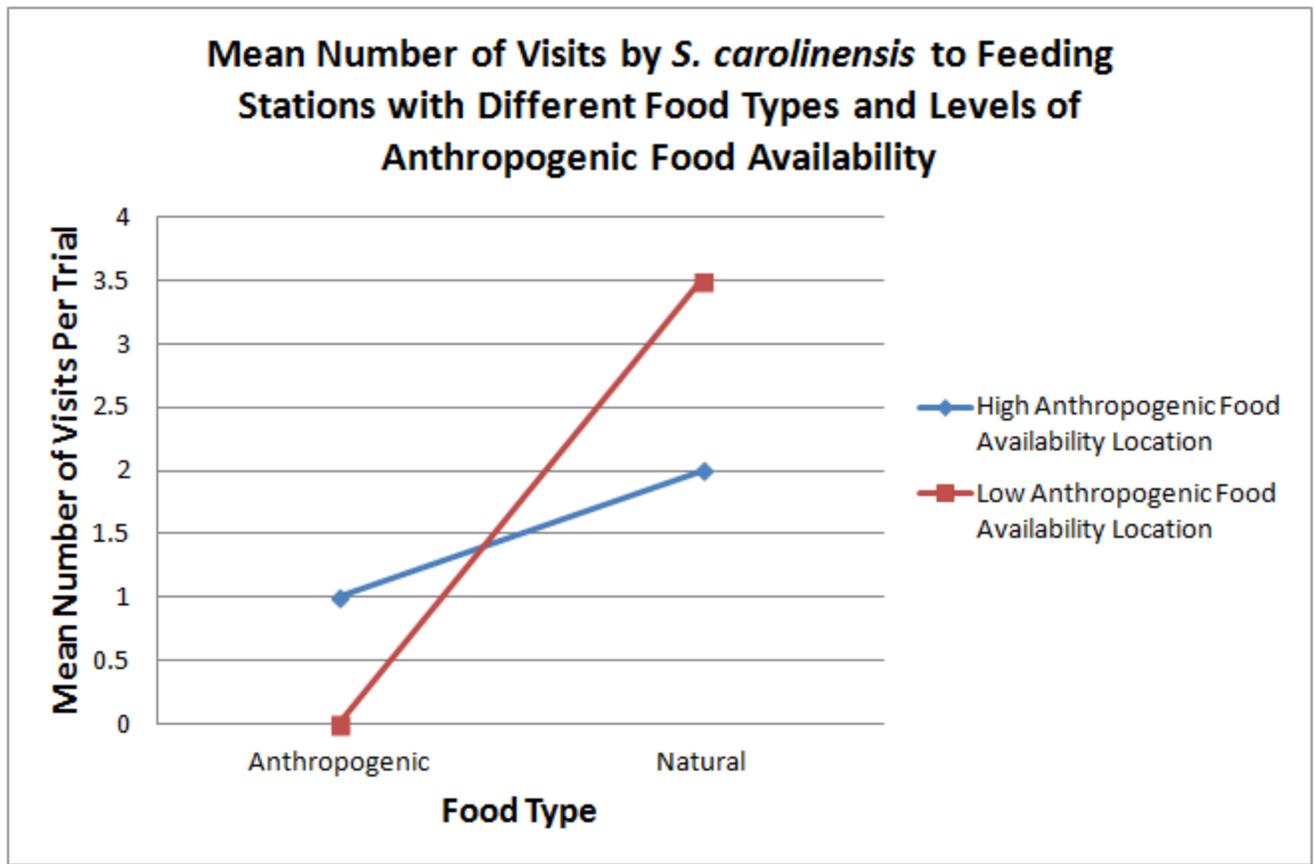


FIG. 2 – Mean number of visits to a feeding station by *S. carolinensis* when presented with anthropogenic or natural food items at locations with high or low levels of anthropogenic food availability. The red line denotes observations for both anthropogenic and natural food items at the location with a low anthropogenic food availability while the blue line denotes observations for each food type at the location with a high anthropogenic food availability. The intersecting lines do not denote an interaction effect as all results had a p -value > 0.05 .