Eastern Chipmunk (*Tamias striatus*) responses in home range to artificial food supplementation

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We were interested in what influences home ranges of eastern chipmunks (*Tamias striatus*). We hypothesized that chipmunks would extend and shift their home range in response to an additional abundant food source. We mapped the home ranges of 4 individually marked chipmunks for five days in July of 2016. Once the home range was known, we placed an abundant source of black oil sunflower seeds outside of the known home range. Three of the chipmunks with burrows <65 m away responded and shifted their home range. The size of home ranges for those three animals increased. We also found increase in overlap of home ranges after manipulation, as well as increased aggression. The fourth chipmunk, whose burrow was 143m away did not respond.

The eastern chipmunk (*Tamias striatus*) is a small rodent commonly found throughout the northeastern United States and into southern Canada. They prefer open deciduous forest and human constructions like parks and golf courses (Wilson and Ruff 1999). Eastern chipmunks establish a home range of roughly 40m, which consists of a tightly defended area around a burrow and a larger less defended area beyond 40m in which the animal tolerates others (Wilson and Ruff 1999; Baker 1983). Many studies have shown that the size of home ranges vary due to several factors including food abundance (Mares et al. 1976), time of year (Forsyth and Smith 1973), age, sex, calendar year (Mares et al. 1980), and distribution of masting trees (Lacher and Mares 1996).

Chipmunks store food, generally reproductive parts of plants like nuts and seeds, in their burrows (Wilson and Ruff 1999). During winter, chipmunks enter a state of inactivity, though they do not hibernate (Baker, 1983). They arouse frequently and feed on cached food. If insufficient food is cached, it is likely that the animal will not survive through the winter.

In this study, we examine chipmunk food storage and home range. Mares et al. (1976) showed that abundant food sources when placed within an animal's core defended territory lead to a significant reduction of home range. We instead asked whether food introduced outside an animal's territory would affect its home range.

We hypothesized that introduction of an abundant food source to an area outside of a chipmunk's home range would change and shift the animals home range. We predicted the new food source would result in a shift or expansion of the animal's home range towards the food source.

Materials and Methods

Our study was done on the campus of the University of Michigan Biological Station (45° 33' 34" N, 84° 40' 31" W). The campus is a mixture of open area and deciduous forest dominated by red oak (*Quercus rubra*) with gravel roads running through it, cabins, and

classrooms. The area is heavily used by pedestrians, leading to chipmunks being habituated to human activity and presence.

We trapped 4 focal animals and marked them via hair clipping to enable us to clearly recognize them individually. Once the animal was marked, we released it where it had been trapped. We placed food outside of the trap before release, so that we could follow the animal after feeding to locate and mark the animal's burrow.

From July 20-25 we mapped the locations of the animals. Observation was done primarily in the morning and afternoon, though student researchers who spotted a marked individual outside the observation time recorded it. Location, date, and time were recorded.

After initial observations were completed, we introduced an abundant food source outside the home ranges of the individuals in the study. Two cups of black oil sunflower seeds were spread in an approximately 10m line and replenished so that seeds were constantly available. From July 26-31 we observed the animals using the same technique as used before sunflower seeds were introduced in determining home ranges and burrow.

We used ArcGIS convex hull mapping to calculate the area of each chipmunk's home range, both before and after manipulation.

Results

Three animals with a burrow < 65m away from the food site responded to the food manipulation (Figure 1). Their home ranges enlarged and shifted to include the food site. The fourth animal, whose burrow was 143m away, did not respond to the food manipulation.

The three animals that responded each increased their home range by >800m^2, when the largest range prior to feeding was 637m^2. Where prior to manipulation no overlap in home ranges existed, afterwards there was much overlap (Figure 1). Additionally, we noted an increase in aggression between chipmunks post introduction of sunflower seeds.

Discussion

Mares et al. (1976) showed that chipmunk home ranges were sensitive to food manipulation when they added food to the highly defended area around each burrow. As we have predicted, we show that the home range sensitivity to food extends to outside the home range of animals for those animals with a burrow <65m from the added food source.

The animals close (burrow <65m away) to the food source altered their home ranges to include the food source. The fourth animal showed no obvious reaction to the food source which could be because the distance to the food source is not worth the risk for that individual or that the food supplementation was at a distance beyond the animal's capacity to detect it. Responding individuals increased their home range sizes and shifted locations of their home ranges to include the food source. We also observed a distinct increase in home range overlap in response to the food source.

The chipmunks did not shift burrows to decrease the distance to the food source. Such a shift of burrow could be a large energy expenditure to create a new burrow. Another cost of moving burrow is the loss of already-stored food in the current burrows.

We observed notably increased aggression and fighting amongst chipmunks around the food source. As many as eight animals were observed simultaneously around the food source, though most were unmarked animals. The costs of fighting were apparently not large enough deterrents to prevent the increase in home range we saw in our animals. Injury, energy expense, and increased predation risk are all associated with our food source as it was located in an open and exposed area.

Our small sample size prevented us from being able to use statistical analyses for many of our observations. We intend for our results to be guidelines and inspiration for future studies. Our qualitative assessment of home range overlap and maximum distance for a singular food source to impact animals would be interesting foci for later experiments.

Figures

Figure 1. Home ranges pre and post food manipulation

Home ranges pre food manipulation (unshaded) and post manipulation (shaded) for 4 eastern chipmunks. Burrows of each individual are marked with a circle, and the food source is marked with a star.

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