Effects of Mink Urine on Trappability of Small Mammals: *Peromyscus maniculatus, Peromyscus leucopus, Tamias striatus, Myodes gapperi* and *Blarina brevicauda.*

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Abstract

Animals have to deal with the risk of being prey when they forage, which is why they should balance both. Studies show that animals have different reactions to predator scent. This study investigated how the presence of mink urine affects small mammals' behavior. I studied the trappability of five different small mammals *Peromyscus maniculatus*, *Peromyscus leucopus*, *Tamias striatus*, *Myodes gapperi* and *Blarina brevicauda* on five grids across the UNDERC property, using mink urine as a predator cue. Small mammals had the option to visit traps on the ground with and without mink urine. Analysis of the data revealed that there was not a significant preference of small mammals for any of the traps, regardless of treatment (control or predator scent).

Introduction

Food chains, including interactions between predators and prey, are an essential part of any ecosystem; these are transfers of energy through a series of organisms. Organisms often occupy several trophic levels and depend on the species population dynamics in upper and lower levels. (Wooton 1998)

Predation is one of the major influences that determine animal behavior (Lima 1998). Animals have to go out and find food in the presence of predators. For this reason, they need to balance the demands of finding food and avoiding predators (Hamilton and Heithaus 2001).

Studies show that predator scent has different effects: (1) inhibition of activity, (2) non-defensive behaviors such as foraging, feeding and grooming, and (3) shifts to secure locations where scents are not present (Apfelbach et al. 2006). Many predators such as weasels (*Mustela nivalis*) can detect female deer mice (*Peromyscus maniculatus*) that are in reproductively active (Cushing 1984, 1985). Small mammals are nocturnal and secretive creatures that make trapping difficult (Kurta 2005). Deer mice, white-footed mice and shrews are nocturnal creatures that spend the day in areas such as trees or burrows where they have nests made of plants. The eastern chipmunk, on the other hand, leads a more or less solitary existence and is active during daylight hours.

Predators have different strategies for feeding on small mammals. Coyotes primarily eat small mammals, but part of their success as a species is their adaptable diet (Fox 1995). Minks have a similar diet, but they tend to occur more in water because they can swim well and catch many kinds of fish. They are usually nocturnal and when on land their diet consists of mice and muskrats (Burt 1957). The coyote represents an active hunter with a broad hunting range and a diet that is less specific to mice than other potential predators of *Peromyscus* (Young et al. 2006).

Small mammal population and behavior should be more affected by the mink. By trapping small mammals in the presence and absence of predator urine, I will be able to assess how prey alter their behavior in response to two different predators (Bono 2008, unpublished manuscript). I hypothesize that small mammals will visit fewer the traps with the mink urine.

Methods

In order to observe the effects of mink (*Mustela vison*) urine on small mammal (*Peromyscus maniculatus, Peromyscus leucopus, Tamias striatus* and *Blarina brevicauda)* trappability, Sherman traps were located in five random grids at the University of Notre Dame Environmental Research Center (UNDERC). The common characteristic of these places was the dominance of sugar maple (*Acer saccharum*). Each grid consisted of 50 ground traps, placed in pairs in a 5 x 5 configuration, with 15 m spacing.

A cotton ball containing 1mL of mink urine was placed randomly in one of the traps in each station and was replaced every day. All traps were baited with one tablespoon of sunflower seeds and rolled oats. All captured small mammals with the exception of *Blarina brevicauda* were marked with ear tags, weighed, sexed and then released.

A chi-square analysis was used to compare the number of captures per species in traps with and without predator scent. In addition, proportions of captures in traps with predator scent for common species (*Peromyscus maniculatus, Peromyscus leucopus* or *Tamias striatus*) were compared to the null hypothesis of no preference (i.e., $P < 0.5$). We included only individuals that were caught at least twice.

Results

After 17 nights trapping small mammals, I had a total of 207 captures, 136 recaptures including 63 *Blarina brevicauda*, 13 *Tamias striatus*, 5 *Myodes gapperi*, 14 *Peromyscus leucopus* and 41 *Peromyscus maniculatus*. Across all species 105 captures were in control traps (without mink urine) and 101 captures were in predator scent traps.

There was no significant relationship between the species preferences for the traps with or without the mink urine ($X^2 = 4.096$, df = 4, p = 0.393; Figure. 1). Of the five species tested, three were captured with a high enough frequency to test trap preferences: *Peromyscus maniculatus, Peromyscus leucopus,* and *Tamias striatus*. None of the three species showed a preference for either of the two traps on the ground (*Peromyscus maniculatus:* proportion = 0.617, z = 1.620, p = 0.947; *Peromyscus leucopus:* proportion = 0.556, z = 0.579, p = 0.719; *Tamias striatus:* proportion = 0.388, z = -0.951, p = 0.171; Figure. 2).

Discussion

The data do not support my hypothesis. The chi-square test revealed that there was no significant relationship between the species preferences for the traps with or without the predator scent (mink urine). Two species (*Blarina brevicauda* and *Tamias striatus*) were captured more in the control traps (without the mink urine), supporting my hypothesis but in the case of *Peromyscus maniculatus* there were more captures in the predator scent traps and for *Myodes gapperi* and *Peromyscus leucopus* the number of captures was exactly the same between control and predator scent traps.

Although small mammals may have different reactions to predator scent, it is also true that they are prey to so many different predators that they may not show a strong response to any particular cue. The effectiveness of use of predator scents in an experiment like this one can depend of the ecological circumstances that surround the small mammal (Swihart 1991). Small mammals did not alter their giving-up density (remaining seeds) in presence of mink or any other predator scent (Orrock et al. 2004). Mice have been shown to avoid forest edges, where the risk of predation is greater (Morris and Davidson 2000).

Another explanation for these results for *Peromyscus leucopus* can be that they are neophilic, which means that they are attracted to novelty and new things (Sheppe 1966) and may be curious about the predator scent. However, many predators use scent for territorial marks, which means that predator scent may be prevalent in the environment for a long time. Small mammal species may habituate to predator scent, which would reduce response to this type of cue.

This could be experimentally tested by individual responses of each of the 5 species in the laboratory. Animals would be exposed to 2 traps or 2 trays with bait, one with the predator scent and the other with only water. Following the same procedure for a few days we would expect that the species reaction to the predator scent will decrease.

The hypothesis testing for *Peromyscus maniculatus, Peromyscus leucopus,* and *Tamias striatus* revealed that none of these species showed a preference for either of the two traps on the ground. For both *Peromyscus* species the visits to the predator traps was greater than or equal to visits to control traps. For *Tamias striatus* there were more visits to the traps with no predator scent, but this difference was not statistically significant. This could be due to the fact that mink are nocturnal animals whereas chipmunks are diurnal.

An improvement for future study would involve with more time trapping, perhaps in another season. In addition, water may be put on cotton to serve as a better control. For more control it could be a laboratory experiment, knowing the fitness of each individual and testing only one species at a time.

From an evolutionary standpoint, if small mammals can recognize danger from potential predators, they will have a greater probability of survival, and have more offspring to pass on that behavior (Lind and Cresswell 2005). However, it would be necessary to run another similar experiment to this one. The new experiment could test the effects of other predator scent on the small mammals' behavior, and see if the small mammals have the same reaction.

To determine the effects of predator scent on fitness, observations could be made concerning whether a small mammal that visits traps without predator scent has higher survival. A population with good fitness would be the one that has more births than deaths. To relate species fitness and antipredation behaviors we would need to consider the reduction of predation risk, increased reproductive output and other behaviors. (Lind and Cresswell 2005).

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Appendix

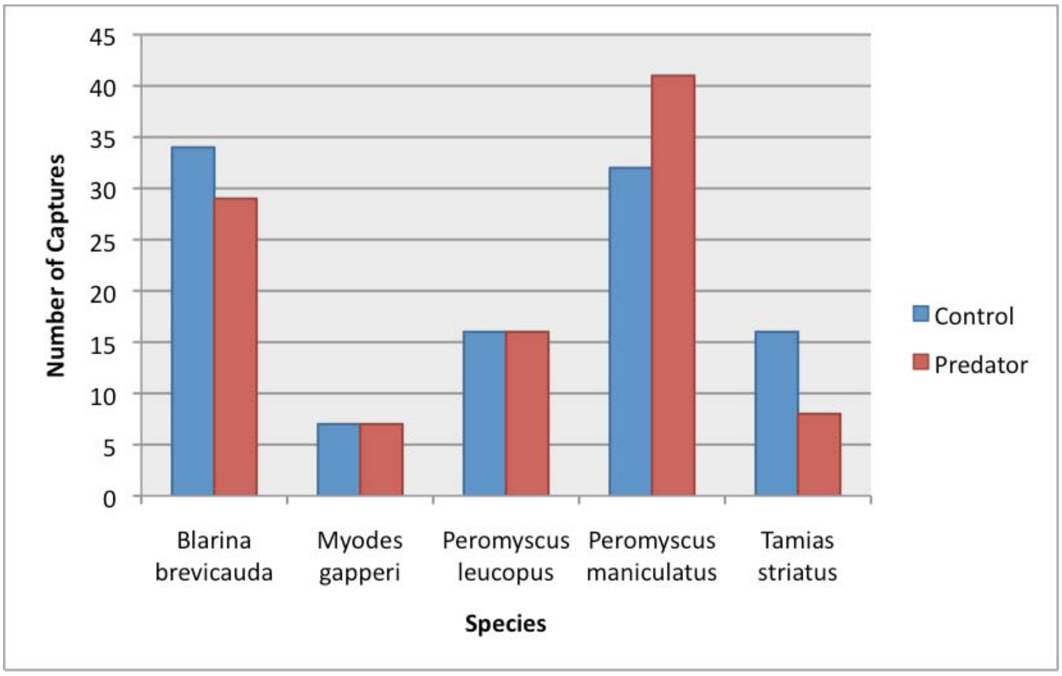

Figure. 1- Comparison of number of captures in control and predator scent traps for 5 species, *Peromyscus maniculatus*, *Peromyscus leucopus*, *Tamias striatus*, *Myodes gapperi* and *Blarina brevicauda*. There was no significant relationship (X^2 = 4.096, df = 4.0, p = 0.393).

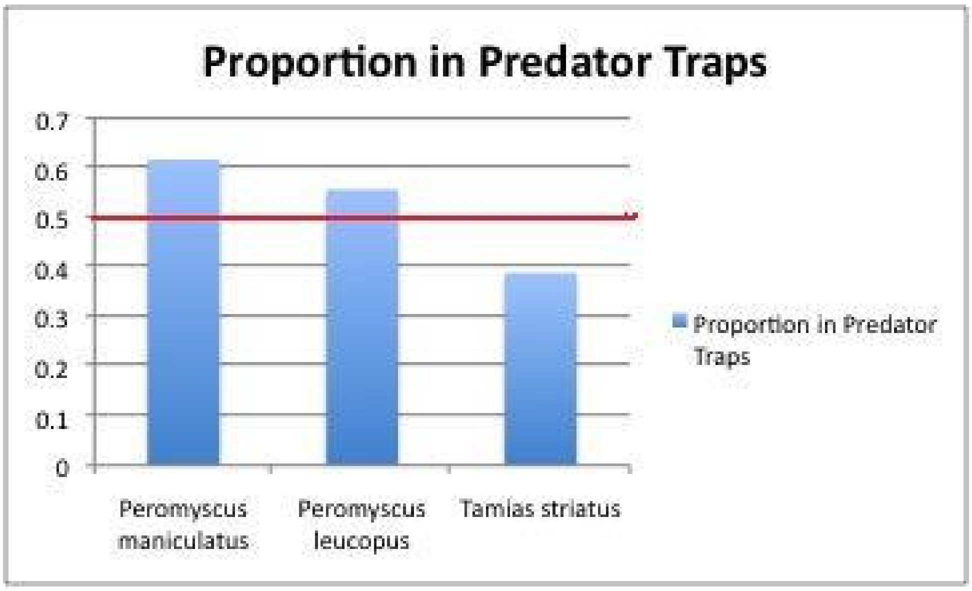

Figure. 2- Proportion in predator traps for 3 species, *Peromyscus maniculatus, Peromyscus leucopus*, *Tamias striatus*. *Peromyscus maniculatus*, *Peromyscus leucopus* show a proportion greater than 0.5. The line that crosses the y-axis at 0.5 illustrates my null hypothesis that small mammals do not have a preference for either treatment.