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Do Small Mammals Prey Switch During the Winter? An Evaluation of Invertebrate Prey Availability in the Subfolium Level of the Forest Floor.

Natalie Auman and Courtland Hess and Dr. Aaron Haines

Abstract

Many small mammals such as shrews and rodents prey on terrestrial invertebrates, but some also eat vertebrates such as other small mammals, frogs, snakes etc. Based on the varied diets of rodents and shrews there is the potential that this species may exhibit prey switching under the alternative prey hypothesis. The alternative prey hypothesis, or APH, is defined when a predator that has a strong preference for one prey source witches to an alternative prey source when the main prey source is scarce (Kjellander and Nordstrom 2003). For example, Red foxes (Vulpes vulpes) switch between the field vole (Microtus agrestis) and the bank vole (Clethrionomys glareolus) to Roe deer fawns (Capreolus capreolus) due to fluctuating population densities between the predator and prey species (Kjellander and Nordstrom 2003).

Our objective will be to determine if small mammals become more attracted to the scent of vertebrate prey as invertebrate prey numbers decline during colder temperatures. Our hypothesis is that as seasonal temperatures decline, invertebrate prey density will decline and small mammals will become more attracted to a potential vertebrate prey scent. Our null hypothesis is that the invertebrate prey density will not change within the subfolium layer during cold periods and thus small animals will not need to prey switch. This study provides a greater ecological understanding of potential prey switching strategies of small mammals such as the Northern short- tailed shrew.

Introduction

There are some small mammals such as the Northern short- tailed shrew (Blarina brevicauda) that do not hibernate and are active throughout the winter (Merritt 1986, Newman and Rudd 1978). This makes them a good candidate for prey switching because vegetable matter and invertebrates that are a part of their normal diet are not as abundant in the winter as in the spring and summer (Hamilton 1941, Boonstra et al. 1982, Ritzi et al. 2005).

Forest floor macroinvertebrate abundance is comprised of Insecta, Arachnida, Myriapoda, Isopoda, Gastropoda, and Oligochaeta, all of which can be eaten by small mammals (Castien and Gosalbez, 1995). For small mammals living in a temperate climate, annual temperature change is a factor that affects them as it changes the numbers and types of prey accessible to them due to downward vertical migration of invertebrates (Dowdy, 1944). Subfolium, the area in and under the leaf litter, is another factor since it maintains non-extreme temperatures in the soil and also reduces daily temperature fluctuations (MacKinney, 1929).

Procedures

This is the first part of a multi- year study. The two traplines are located in the Millersville University Biological Preserve. Each study site contained a trap line consisting of paired Sherman small mammal traps (treatment and control) (n≈32 traps at each site. Control traps had clean wood shavings while experimental traps had wood shavings soiled with mice urine, which is the scent source of potential vertebrate prey. Traps were set and checked once a week from August 2017 until May 2018. Trapping success was recorded as the number of shrew captures recorded on each trap line for both control and treatment traps divided by the total number of traps. To sample for invertebrate prey abundance, four 24cm2 areas of subfolium and topsoil were sampled at each trap line. The samples were collected into cloth bags and then transferred into Berlese funnel apparatuses. At each of the invertebrate sampling sites, ambient, subfolium, and soil temperatures were recorded. Invertebrate prey abundance was determined upon analysis of the contents from the Berlese funnel apparatuses. We used a general linearized model to determine if trapping success was influenced by invertebrate prey abundance, ambient temperature, subfolium temperature and topsoil temperature. We also ran interactions between invertebrate abundance and the different temperature readings.

Results and Discussion

Macroinvertebrate numbers collected from the subfolium and topsoil declined during the winter, but did not diminish completely. Trapping data has shown that small mammals are not attracted to the scent of a potential vertebrate prey. This could mean that there are enough insects that remain in the subfolium so that small mammals are able to subsist on them and only consume vertebrate prey opportunistically.

This is a multi- year study. In Fall of 2018 until Spring of 2019 invertebrate analysis and trapping will continue on the Millersville University Biological Preserve sites except that the paired traps will switch along the trap lines with one study site consisting of control and treatment traps that have non-urine soaked woodchips and woodchips soaked in mice urine respectively. The next study site will have control and treatment traps consisting of no food and food (sunflower seeds and dried dog food) respectively. This will help to show if small animals are attracted to any food source over the course of the winter or if there are enough invertebrates in the subfolium layer for small mammals to subsist on. In year three invertebrate analysis and trapping as described above will be done off campus at two Lancaster Conservancy properties to test our results in a different environment

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