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SALAMANDER ABUNDANCE IN RELATION TO SUBSTRATE AND FOOD AVAILABILITY IN FRESHWATER SPRINGS

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ABSTRACT

Desmognathus ochrophaeus, commonly known as the mountain dusky salamander, is a common predator in fresh-water spring ecosystems. These salamanders are more commonly found in some springs than others. By measuring substrate composition, food availability, vegetative cover, and presence of decaying matter, we intended to gain some insight into why mountain dusky salamanders are in higher abundance in some areas than others. We looked at 12 springs with similar water composition but different substrates and vegetation. Our results showed no conclusive correlations between any of these factors and salamander abundance.

Keywords: Desmognathus ochrophaeus, *food availability, spring ecosystems, substrate composition*

INTRODUCTION

Mountain dusky salamanders are the most terrestrial of the salamander species in the northeast United States (Hulse 2001). They can be found under wet rocks, logs and stones in springs and streams (Tsang 2001). These salamanders feed on any available invertebrates including earthworms, spiders, snails and aquatic insects (Tsang 2003). They are not, however, the highest animal in the food chain and therefore must seek shelter from predators such as snakes, birds and shrews.

Salamanders have great ecological significance in spring ecosystems. It is important to monitor their abundances and distributions because they can be the first indicators of local environmental problems. In addition to being sensitive to their surrounding environment, they keep a balance between the animals that prey upon them and the food that they eat (Fergus 2000). In this study, abundance of mountain dusky salamanders was compared to substrate type and prey availability.

FIELD SITE

All measurements were taken from 12 different springs located at the Hundred Springs site in Huntingdon County, Pennsylvania during late March and early April of 2004. This area is a temperate forest habitat. Hemlock and rhododendron are the dominant vegetative species. Other species observed in the area include white-tailed deer, opossums, gray squirrels, and wild turkeys. The springs themselves are home to various plant and animal species, including watercress, mosses, amphipods, snails, and sculpins. All 12 of the springs we studied had similar water chemistry with an average temperature of 9.5ºC and a pH of 7.6.

MATERIALS AND METHODS

For each spring we estimated relative particle substrate size on a scale from 1-5 (including silt, sand, gravel, cobbles and boulders). Percent vegetative cover was also estimated.

Two people searched for 15 minutes in each spring to determine relative salamander abundance. The search involved swipes with small nets throughout the spring and turning over rocks and other vegetative cover along the spring's edge where salamanders were expected to be found. The entire spring including 1m outside the water's edge was surveyed. We performed it this way to account for salamanders that were not in the spring at the time but that still used the spring for food and survival.

We determined relative food availability by taking 10 sweeps with a small net in randomly selected areas of each spring to determine how many amphipods were present. The abundance gathered was then rated on a scale from 0 (none collected) to 10 (nets contained more than 30 individual amphipods). For springs that were too shallow to use a net, we used general visual observations to judge amphipod abundance according to the 0-10 scale.

RESULTS

Salamander abundance was plotted against four environmental factors: relative particle size of substrate, food availability, percent coverage of living vegetation, and percent coverage of decaying matter. Salamander abundance was not significantly correlated with any of these factors (Figures 1-4).

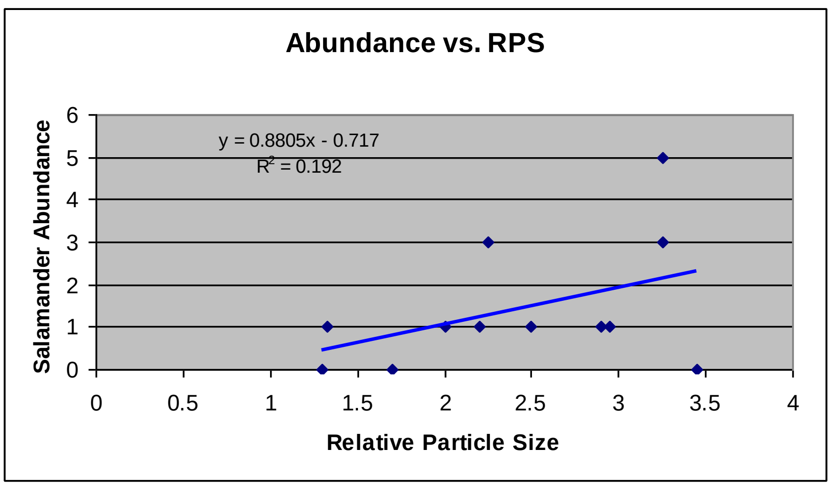

Figure 1. Salamander abundance in relation to relative particle size of substrate.

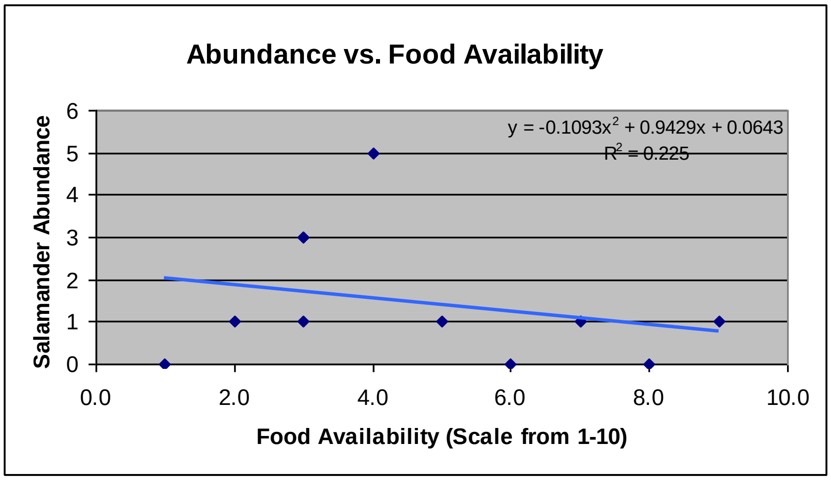

Figure 2. Salamander abundance in relation to food availability.

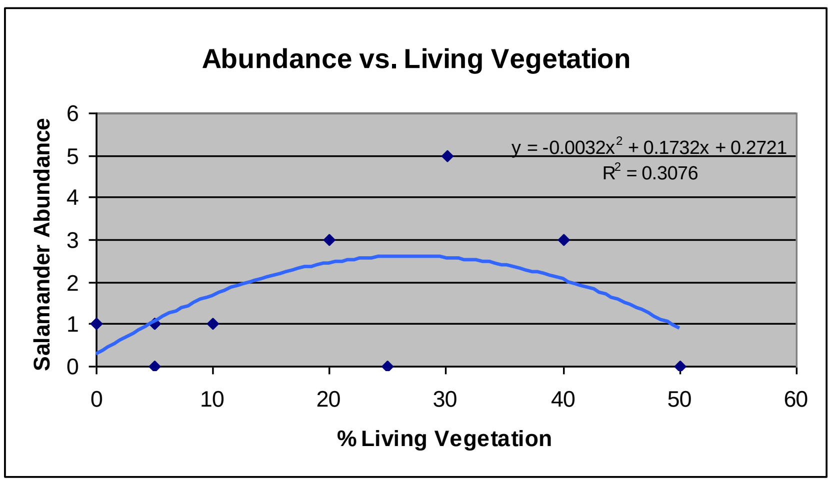

Figure 3. Salamander abundance in relation to living vegetative cover

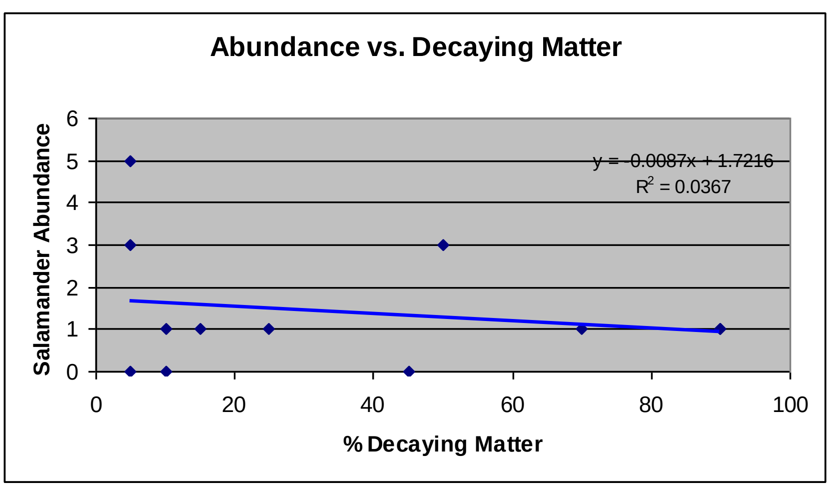

Figure 4. Salamander abundance in relation to decaying matter.

DISCUSSION

To determine which variable has the greatest effect on salamander abundance in local freshwater springs, we used springs that came from the same mountain source to ensure similarity in chemical composition. We made sure we found springs that were composed of different substrates to offer a wide variety of places to find the salamanders. Although our data does not show any conclusive preference for any particular abiotic substrate, it does seem to show a slight preference for about 30% vegetative cover. This is likely due to the fact that it allows cover and places to hide for both the salamanders and their prey. It would be a direct effect if it is cover for the salamanders. On the other hand, it is an indirect effect if it is for prey cover, and we should therefore see a correlation between food availability and salamander abundance as well. However, our results show no conclusive correlation there so we can assume it is not the latter reason.

Some factors have to be considered to explain our inconclusive data. Even though we lifted rocks and dug into the mud to find the salamanders, they may have been easier to find at night because they are nocturnal. Further studies should be conducted at night to determine whether time of day makes a difference. In addition, the mountain dusky salamanders are the most terrestrial salamanders of the genus *Desmognathus* in the northeast (Hulse 2001). To accurately measure the abundance of this species, a terrestrial quantification is needed.

Overall, our data has not proved our hypothesis. Further research could be done by investigating more springs with a new technique to count salamander abundance in each spring. Also, more factors could be investigated to determine if there is some other factor that is more influential on abundance than the four that we investigated. Another factor that we observed that may be correlated was flow rate. We did not measure flow rate, but in random, unrecorded observations of the surrounding creeks, we saw more species and a greater abundance of salamanders than we observed in the springs. There may be some correlation then between flow rate and water source that affect salamanders more than food availability. This topic could be tested further in future studies. There are many possibilities that could have also been a factor in affecting salamander abundance other than the four factors we tested.

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