Microhabitat selection by cave salamander (*Eurycea lucifuga*) as it relates to relative humidity and temperature

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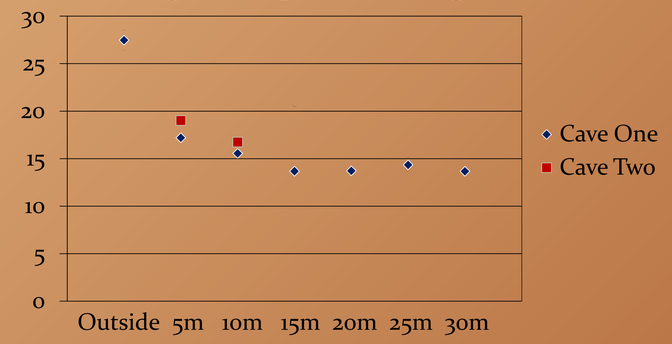
Introduction

There are few places in Missouri where Salamanders are more abundant than in wet caves. Of the four types commonly found there (grotto (*Typhlotrition spelaeus*), cave (*Eurycea lucifuga)*, southern red-back (*Plethodon serratus*), and western slimy(*Plethodon albagula*)) only grottoes and Cave Salamanders can permanently live in the cave. Of those two, only Cave Salamanders inhabit the twilight region of the cave in strong numbers. On a routine outing, our group noticed that the Cave Salamanders seemed to be more abundant at a certain distance into the cave. This led us to suspect that the salamanders select for a certain microhabitat depending upon humidity, temperature, or amount of light. We could use temperature and humidity in the cave systems to allow us to observe climate change and determine the effect it is having on Cave Salamander populations. If the climate were to follow the current warming trend, we believe the Cave Salamanders would begin to move back into caves to escape the high heat. This could eliminate some of the shallower caves as habitat. Climate change would not affect the amount of light coming into the cave so we decided to omit that measurement from out study. From our initial outing, we hypothesized that Cave Salamanders preferred the 15 m zone of the cave, and its corresponding temperature and humidity.

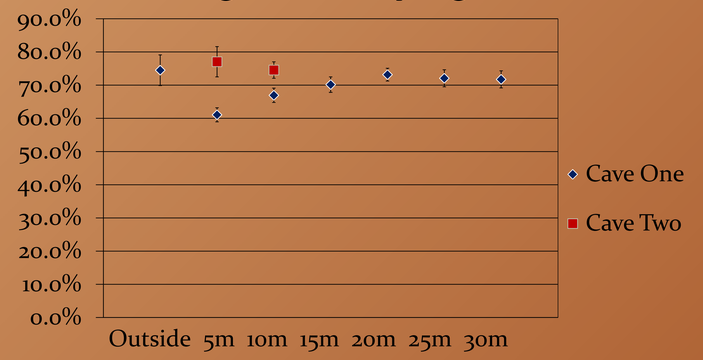
Methods

Two wet caves on Missouri Department of Conservation land, in the Current River Conservation Area, were selected because both were known to house Cave Salamanders. Each cave was divided into five meter zones as far back as we could safely crawl before our body heat would affect the temperature. On a given data collection day, we arrived at the caves at approximately 1:30 p.m. and collected the outside temperature and humidity by suspending the hygro-thermometer probe about a meter off the ground in between the two caves and allowing it to sit undisturbed for five minutes. Then the larger of the two caves would be searched zone by zone using flashlights to illuminate the specimens. After the zone had been counted, we planted the probe roughly in the center of the zone and retreat back from it for five to six minutes and then humidity and temperature were recorded. Any species other than Cave Salamanders we found in the cave were ignored. We moved to the next cave to repeat the process, again going back as far as possible. We analyzed the average temperature and humidity in each 5 m zone and determined if there was any correlation between these factors and the abundance of Cave Salamanders.

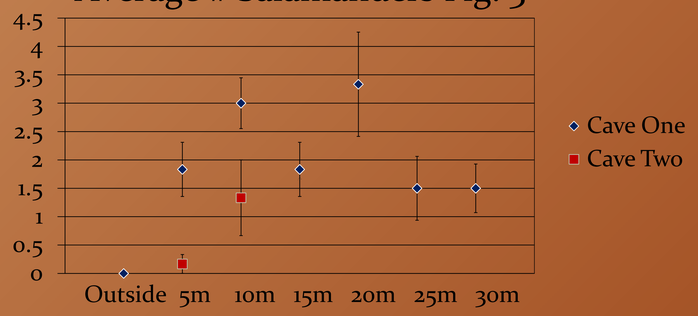
Average Temperature Fig. 1



Average Humidity Fig. 2



Average # Salamanders Fig. 3



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Results

The average temperature outside the two caves was 27.5°C. In Cave 1, the average temperature fell consistently to about 14 degrees Celsius starting around 15 m, where it came to a plateau (Fig. 1). Relative humidity in Cave 1 on average was lowest at 5 m, but then rose and stabilized as we moved back into the cave (Fig.2). While the outside humidity was higher on average, the highest recorded average humidity was taken in the 20 m zone at 73%. The greatest average number of salamanders observed was in the 20 m zone with 3.3 salamanders per run (Fig. 3). This location also had the greatest number of salamanders observed on a given day with 7. The 10 m zone was a close second with an average of 3 salamanders caught per run.

Cave 2 seemed to follow the initial pattern set forth by Cave 1 (Fig. 1 and 2), but due to the restricting nature of the cave, data collection was not feasible any further than 10 m. Salamanders were more abundant in the 10 m zone with an average of 1.33 observed per run (Fig. 3). Only one salamander was ever observed in the 5 m region of Cave 2.

Discussion

While we hypothesized that we would find the most Cave Salamanders in the 15 m zone, our results showed that in fact the 20 m zone had the highest abundance of any single zone. However the 10-20 m zones all showed strong numbers of Cave Salamanders. These zones corresponded to the areas in which the temperature and humidity stabilized. This was also the area in which sunlight became less abundant due to the contours of the cave and the distance from the opening. The habitat in Cave 1 was also more conducive to Cave Salamanders. It was much moister due to a small stream that zigzagged through the cave, and also had multiple large flat rocks on the ground in which the salamanders could hide. Cave 1 was more favorable to finding salamanders since the walls were strewn with small openings that were sufficient to house a salamander, but still shallow enough to easily see inside. Cave 2 had more crevices, but they were much deeper, thus more difficult to see into. While it appears humidity and temperature played a role in Cave Salamander habitat selection, an exact relationship could not be determined by our means. It is highly likely that we did not find all of the salamanders in the cave each time due to the secretive nature of the animal and the abundance of hiding spots. Climate change would have the most impact on the Cave Salamanders at the 20 m zone. As temperature increases and humidity decreases salamanders would have to seek refuge deeper in the cave, possibly eliminating shallower caves. Our study could best be seen as a preliminary project for a more in-depth study. If it were possible, tagging of species with the intent to recapture would help to further examine microhabitat selection for each individual. We would have been able to follow specific individuals and their movement for day to day in relation to temperature and humidity. Also the amount of light at each zone should be measured to give a more holistic look at the microhabitat.