Factors That Drive Salamander Habitat Use Within The Twilight Zone

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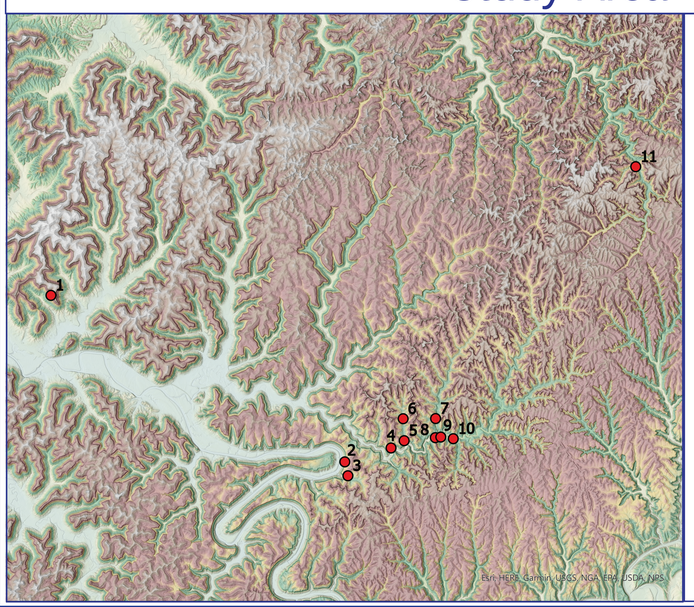
Abstract

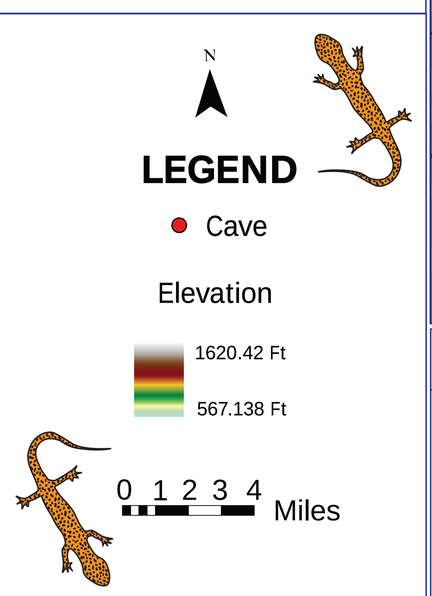
Twilight zones are located in cave systems just beyond the entrance zone. Typically, there is little to no sunlight in the twilight zone and it provides unique conditions for life in the zone. The objective of this study is to explore specific factors that drive salamander habitat use within the twilight zones of caves. These factors include flowing water, dripping water, airflow, surface moisture, pools, presence of predators, and prey availability. The cross-sectional area, slope, aspect, elevation, and width of the cave entrances were evaluated along with these factors for a total of twelve caves in the Red River Gorge Geological Area's Cave Hollow. Field data was collected for five research projects undertaken by the Kentucky Geological Survey's 2024 Paul Edwin Potter interns and synthesized for this analysis. Using linear regression modeling, factors attributed to salamander habitat were individually compared to the number of salamanders found in all twelve caves. The two factors found to drive salamander habitat use in the twilight zone of the twelve caves in this study are the presence of flowing water and pools, with p-values of 0.03543 and 0.01802 and R^2 values of 0.3084 and 0.3881 respectively. When combined, the presence of flowing water and pools compared to salamanders have an R^2 value of 0.5372.

Methods

Methods included statistical analysis on the program RStudio using linear regression modeling and AIC model selection. A bio-inventory was conducted in all twelve caves, as well as a log of the hydrology and rock types of each cave. ArcGIS Survey123 was used to log all data inside the caves for this research project.

Study Area

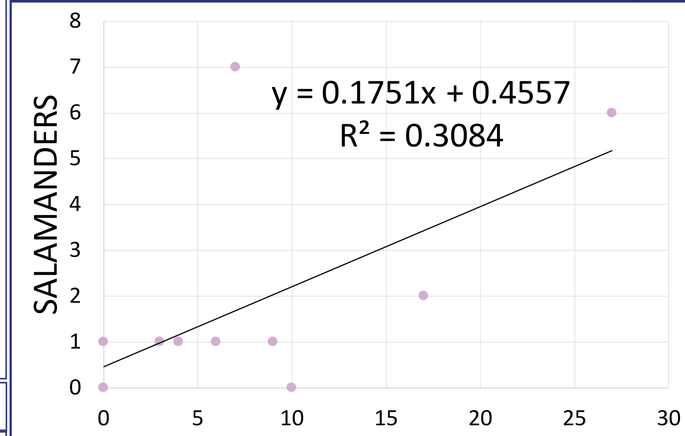




Results

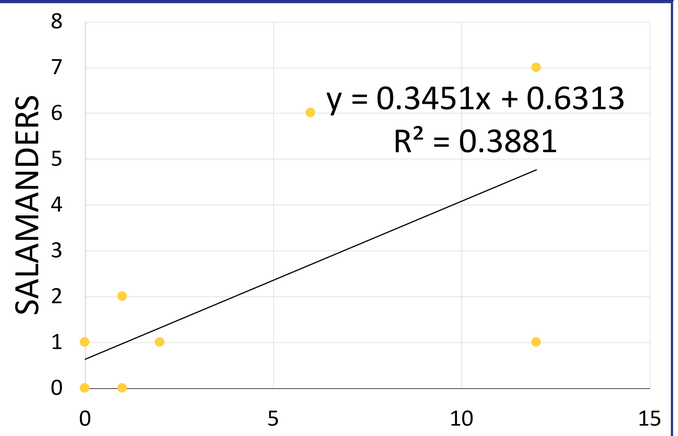
	Flowing Water	Dripping Water	Pools	Bats	df	AICc	delta	Intercept	P-Value	R-Squared Value
Pools			0.3451		3	55.5	0	0.6313	0.01802	0.3881
Flowing Water + Pools	0.1275		0.2729		4	55.6	0.1	-0.03421	0.01265	0.5372
Flowing Water	0.1751				3	56.9	1.47	0.4557	0.03543	0.3084
Dripping Water + Pools		-0.07034	0.5085		4	58.7	3.25	1.143	0.0412	0.3983
NULL					2	58.8	3.37	1.667		
Bats + Flowing Water	0.1292			0.9006	4	59.1	3.63	-0.503	0.04755	0.3789

Linear Regression Models



Flowing water was one of the main factors that showed results for driving salamander habitat use within the twilight zone. The results were a p-value of 0.03543 and an R^2 value of 0.3084. To be a signifcant factor, the p-value has to be less than or equal to 0.05. When combined with pools in the twilight zone, the R^2 value increased closer to 1. Having both flowing water and pools increases the chance of salamanders in the twilight zone.

lm (Salamanders ~ Flowing.Water, data = X1Line)



Pools was one of the main factors that showed results for driving salamander habitat use within the twilight zone. The results were a p-value of 0.01802 and an R^2 value of 0.3881. To be a signifcant factor, the p-value has to be less than or equal to 0.05. When combined with flowing water in the twilight zone, the R^2 value increased closer to 1. Having both pools and flowing water increases the chance of salamanders in the twilight zone.

lm (Salamanders ~ Pools, data = X1Line)

Acknowledgements

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