Desmognathus (Dusky Salamander) as a Stream Health Indicator in Letcher County, Kentucky

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Introduction

Headwater streams control nitrogen uptake and nutrient transport, and are important in maintaining the health of the entire watershed. They are also very vulnerable to the effects of land disturbances.

Mountaintop coal mining practices in the southeastern Appalachian region have had significant effects on surrounding headwater streams. Research has shown that the aquatic life (macroinvertebrates) in mined areas is negatively affected by mountaintop mining activities.

A *Desmognathus* salamander

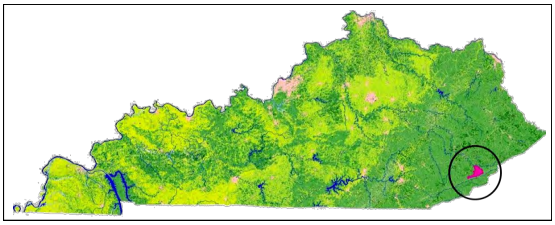
Desmognathus (dusky) salamanders are good indicators of stream health and were used as bioindicators in this study. The study took place in three different streams, each downstream of areas with different mining and reclamation histories. After determining the levels of disturbance from mountaintop coal mining activity, (1) the health of these streams were compared to one another using multiple parameters, and (2) salamander results were compared to previous macroinvertebrate studies using rapid habitat assessment as the mode of comparison.

Methods

At each stream, there was a down-, mid-, and upstream site. Each site was 100m and both stream banks were searched by two observers. Both observed and captured salamanders were recorded. Captures were identified to genus level, measured, weighed, then released. At the downstream point of each site, a probe was used to determine pH, DO(%), conductivity (µS/cm), and temperature (^{o}C). A rapid habitat assessment was performed at each site (Barbour et. al., 1999). Traveling sediment was collected by *in situ* sediment traps that were near the outflow of each stream. This sediment was transported to the lab then processed and analyzed for its δ15N values.

Streams of Interest

Big Everidge originates in the Lilley Cornett Woods, an old growth forest, and is the control site for this study. The upper portion of the Island Branch watershed was mined recently, with reclamation ending in late 2009. The Pole Branch watershed was mined in the 1970s, prior to the Surface Mining Control and Reclamation Act of 1977.



Watershed Disturbance (%)

	Island	Big Everidge	Pole
Mining Disturbance	11.36%	0%	0%
Other Disturbance	3.37%	0.72%	0.73%
Total Disturbance	14.73%	0.72%	0.73%
δ15N	1.876 (+/- 0.098)	1.204 (+/- 0.188)	1.259 (N/A)

δ15N values are higher in Island Branch. Mining is the main disturbance in this watershed, so it is assumed that most of the elevation in δ15N is from mining.

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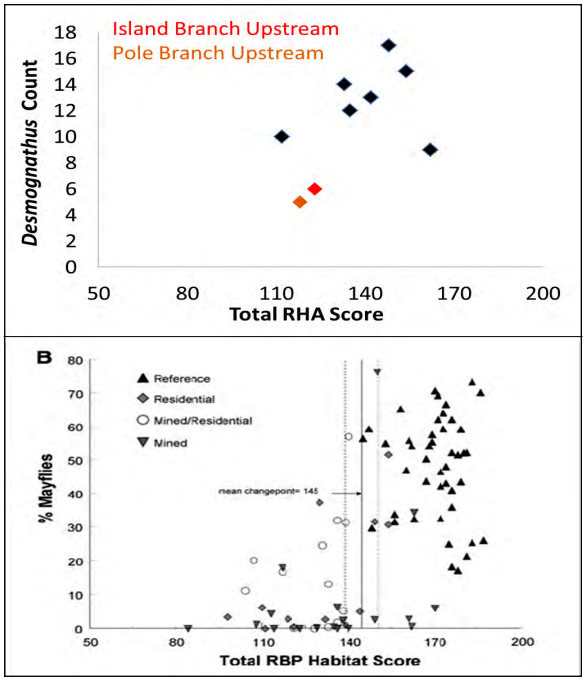

Figure 1. *Mayfly data taken from Gregory Pond's 2010 publication.*

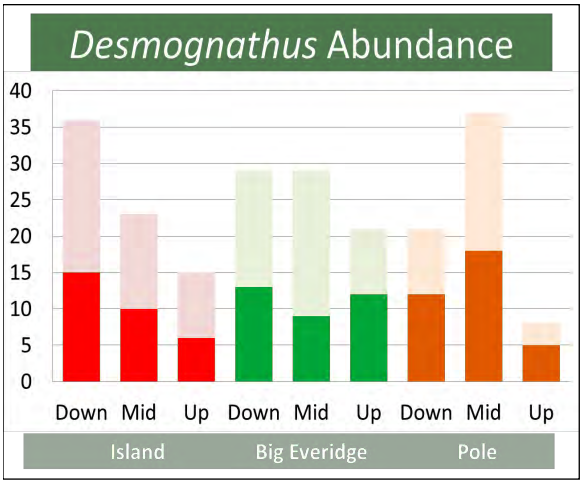

Figure 2. *The full height of the bars in this graph represent all salamanders observed. The darker colors represent the amount of* Desmognathus *salamanders caught and measured.*

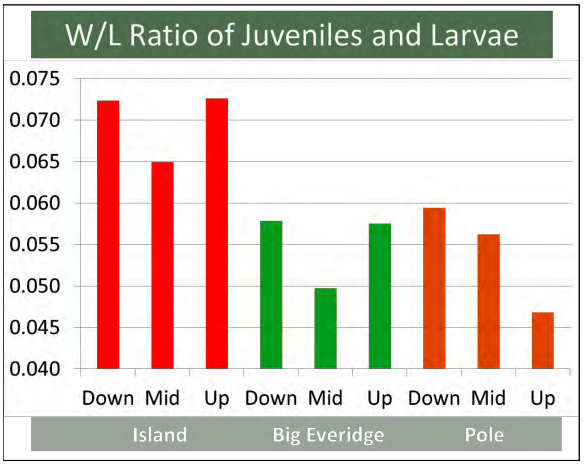

Figure 3. *Weight-Length ratio is a measure of health in salamanders, with higher numbers indicating better health.*

Results

The salamander data was positively correlated with rapid habitat assessment scores; lower habitat assessment scores were associated with lower salamander counts. These data were compared to patterns of mayfly (*Ephemeropterataxa*) loss in Appalachian Kentucky headwater streams (Pond 2010). Similar trends were observed in both salamander and mayfly data (Figure 1).

From downstream to upstream, Island Branch showed a steady decline in number of salamanders observed or caught because of recent mining activity (Figure 2). Pole Branch's upstream reach showed very few salamanders. These were the least healthy salamanders, which is most likely because of the abandoned sediment pond at the top of the watershed. Island Branch salamanders were found to be the healthiest (Figure 3), which was a surprising result given that this watershed was the most recently mined.

Conclusions

The health of these three streams varied. Big Everidge was found to be healthy. Pole shows signs of disturbances, mainly at the upstream site. Island exhibited signs of disturbance throughout the stream. Although both the salamander and macroinvertebrate results were positively correlated with rapid habitat assessment scores, in order to fully understand what is happening to both organisms, further research would require them to be part of the same study.

References

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