The Headwaters Salamander Project: Citizen Science in Action

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OVERVIEW

The Headwaters Salamander Project is an ongoing collaborative effort utilizing citizen science, which can be defined as volunteer partnerships with scientists, to answer real-world questions in the Bureau of Land Management’s (BLM) Headwaters Forest Reserve.

The Project began in 2010 as a partnership between the BLM Arcata Field Office and East High School in Fortuna. The goals of the project are to monitor the health of old-growth redwood forest ecosystems, assess the impacts of restoration treatments, promote scientific literacy, and cultivate connection with place.

Salamanders were chosen as the Project’s indicator of forest health because they are sensitive to changes in environmental conditions and are relatively easy to sample.

BACKGROUND

Students and teachers were involved from the beginning by helping design and fabricate the salamander coverboards and assisting BLM scientist mentors with installing them in the field. BLM scientists trained the students in procedures and protocols in order to ensure consistency between the different classrooms.

To date student citizen scientists have monitored 11 different salamander coverboard sites across a range of conditions in Headwaters, including old-growth redwood groves and second-growth forests.

Students from East High School in Fortuna, and St. Bernard’s Academy in Eureka, collect data in the field monthly. During a given academic year, each school takes 8-12 field trips which each include a 3-11 mile hike to access sampling sites.

The WSP Member placed at BLM Arcata regularly collected data from 10 other remote sites during Winter/Spring of 2015-2016.

METHODS AND MATERIALS

Monitoring data was collected from coverboard sites in two different stand types (8 old-growth & 9 second-growth sites). Students monitored 11 of 17 sites used in this study.

Salamanders were sampled over the study period with passive coverboards. Coverboards consisted of two redwood planks (18” × 7.75”) stacked with a 0.6” spacer between them and held together with removable PVC semi-sections. Coverboards were placed (6 per site) in a circle within a 3m radius of a center point. All salamanders were identified, weighed (to within 0.1g), measured (total and snout-vent length to within 0.1 cm), and released. Observers made notes on injuries such as missing limbs or tails.

Statistical analysis was conducted on one dependent variable - body condition of the two study species, California slender salamander (*Batrachoseps attenuatus*) and ensatina (*Ensatina eschscholtzii*). Salamanders with missing body parts were eliminated to reduce bias.

To determine body condition of the two species among the two stand types we compared residuals from least squared regressions of mass to total length as an index of body condition. Positive residuals represent better body condition than negative values.

PRELIMINARY FINDINGS

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<thead>
<tr>
<th>Species</th>
<th>Old-growth</th>
<th>Second-growth</th>
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<tbody>
<tr>
<td>California slender salamander</td>
<td>22</td>
<td>16</td>
</tr>
<tr>
<td><em>Batrachoseps attenuatus</em></td>
<td></td>
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<tr>
<td>Ensatina</td>
<td>70</td>
<td>76</td>
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<tr>
<td><em>Ensatina eschscholtzii</em></td>
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Fig. 1 – Salamander abundance by forest stand type. The numbers indicate individuals captured by forest stand type.

Fig. 2 – Salamander body condition index by forest stand type for (A) *Batrachoseps attenuatus* (old-growth, n=14; second-growth, n=13); and (B) *Ensatina eschscholtzii* (old-growth, n=34; second-growth, n=57). Body index was calculated by regressing salamander body mass to length and using the residuals of the regression as the index. Individuals with positive residuals are in better condition than individuals with negative residuals.

CONCLUSIONS AND NEXT STEPS

The Project has proven to be a legitimate approach to scientific monitoring as well as an exciting way to teach others about science and the natural world. We were able to collect useful data from the students for basic statistical analyses. In the future, we will offer additional training to ensure students collect consistent, high-quality data.

Students have built deeper connections with their community, cultivated a sense of belonging, recognized their own self-importance for the Project, and developed an understanding that research is not just for scientists with degrees.

Long-term citizen monitoring will continue to be used by the BLM Arcata Field Office and its WSP Members to assess the effectiveness of our restoration treatments and to provide the basis for adaptive management of the Headwaters Forest Reserve.

We would like to thank all the teachers and students of East High in Fortuna and St. Bernard’s Academy in Eureka for all their hard work and dedication. You are the future of scientific inquiry!