Title

Conservation Implications of a Marbled Salamander, Ambystoma opacum, Metapopulation Model

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Abstract

Amphibians are in decline globally and a significantly greater percentage of ambystomatid salamander species are in decline relative to other species; habitat loss contributes significantly to this decline. The goals of this thesis is to better understand extinction risk in a marbled salamander (ambystoma opacum) population and how forestry effects extinction risk. To achieve this goal we first estimated an important life history parameter (Chapter 1) then used a metapopulation model to estimate population viability and determine what aspects of their life history put them most at risk (Chapter 2) and finally predicted extinction risk in response to hypothetical forestry scenarios (Chapter 3).

In Chapter 1 we estimated one of the requisite parameters for the model, juvenile survival, based on 8 years of field data. We estimated juvenile survival probabilities (to first breeding) at 17% for males and 11% for females. To our knowledge, these are the first estimates for marbled salamanders that include both returning and dispersing individuals.

In Chapter 2 we used a metapopulation model to estimate extinction risk and sensitivity of extinction risk to changes in vital rates and other model parameters. We found that although there is considerable uncertainty in our estimate it is likely that extinction risk is low at our study site. Sensitivity analysis revealed that small changes in adult survival lead to relatively large changes in persistence and the presence of an apparent threshold in reproductive failure probabilities beyond which extinction risk rapidly increased.

In Chapter 3 we used the extinction risk and sensitivity estimates to model the effects of forestry on the metapopulation. We parameterized several different levels of impact of forestry on salamander survival; for each parameterization we calculated the extinction risk for 20 different forestry scenarios involving buffer size (30 to 300 meters) and complete or partial restrictions on cutting (5 different levels). We found for all but the most optimistic parameterizations large buffers (around 200 meters) with high restrictions on cutting within the buffer were necessary to maintain a low extinction risk. Overall we show that although the population at our intensively studied field site is unlikely to go extinct under present conditions small decreases in adult survival, small increases in catastrophe rate, and intensive forestry can all make extinction likely.

First Advisor

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