Abstract:

Microclimate Influences Variation in the Upper Thermal Tolerance of a Complex Lifecycle Amphibian

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Microclimatic conditions experienced by individuals within a population can vary dramatically, particularly in the thermal regime. Notably, the temperature experienced by developing embryos can result in individual differences in physiological traits due to acclimation. Complex lifecycle amphibians, such as pond-breeding Spotted Salamanders (*Ambystoma maculatum*), provide an opportunity to evaluate whether the temperature experienced by developing embryos affects the upper thermal limit of those individuals in later life stages. We investigated the effect of aquatic microclimate on critical thermal maxima (CT_{max}) during multiple stages in the lifecycle of *A. maculatum*. Utilizing a replicated split-clutch experimental design, we raised *A. maculatum* in partially shaded and sunny treatments, which were located ~100 m apart. We measured the water temperature of each treatment and found that salamanders in the sun developed at a mean temperature of 13.9°C, while those in the partial shade developed at a mean temperature of 12.5°C. We also measured CT_{max} of larval and metamorphic salamanders from both treatments and found that individuals from the sun treatment had a significantly higher CT_{max} (larval $\bar{x}$ = 37.4°C and metamorphic $\bar{x}$ = 37.8°C) than individuals from the partial-shade treatment (larval $\bar{x}$ = 36.2°C and metamorphic $\bar{x}$ = 36.9°C). Our results suggest *A. maculatum* may display intrapopulation variation in thermal tolerance due to acclimation to distinct microclimatic conditions. However, our results are insufficient to determine if the variation between treatments is due to seasonal or developmental acclimation. More generally, our findings strongly suggest that the natural microclimate variation commonly encountered by pond breeding salamanders can impact the physiological traits of individuals, potentially contributing to differences in fitness.