The impact of incubation temperature on the hatchling and larval form of Tennessee Streamside Salamanders (*Ambystoma barbouri*)

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Introduction

The streamside salamander (*Ambystoma barbouri*) is a state endangered species in Tennessee that is threatened by elevated water temperatures at nesting sites. To see how incubation temperatures influence morphology, we incubated eggs across a range of temperatures and measured body size, head length, head width, snout length, gill length, and hind limb length of hatchlings and larvae.

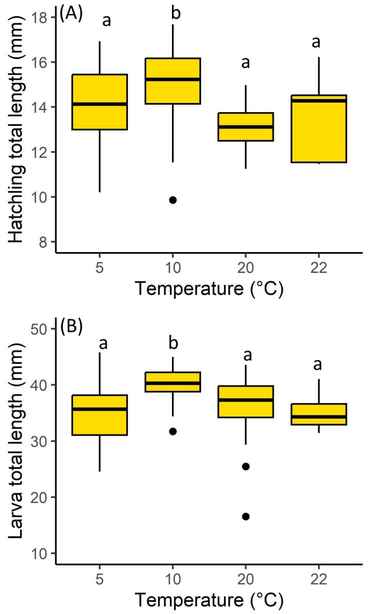

Fig. 1. Effect of incubation temperature on body size. Letters denote statistical differences among treatment.

Methods

We studied the morphology of the Streamside salamanders after incubating randomized sets of eggs from three genetic clades in differing temperatures from 5 ℃ to 22 ℃ by photographing hatchling and larval stages. We took measurements at hatching and 60 days post-hatching using ImageJ. We used linear mixed effects models using the lmerTest package to analyze metrics of body size according to treatment, age, and their interaction. For head, gill, and limb morphology, total body length was a covariate. We made pairwise comparisons using the emmeans package.

Fig. 4. A streamside salamander

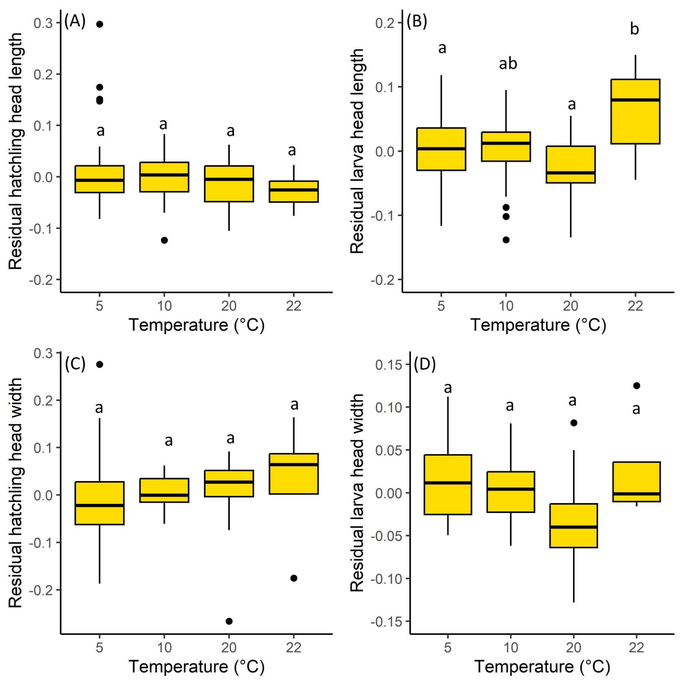

Fig. 2. Effect of incubation temperature on head length and width. Larval head length is larger at 22 ℃ proportionate to body size.

Results

We found that individuals incubated at 10 ℃ had an overall larger body size at hatching. This is the optimal thermal zone seen in the wild. This trend continued from hatchling to larval stages. Although smaller in total size, individuals incubated at 22 ℃ expressed a longer limb length and head length relative to body size.

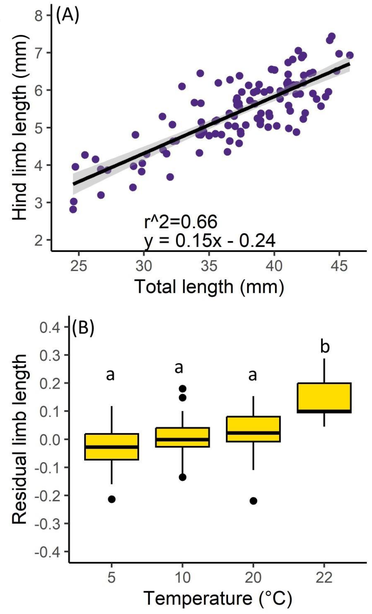

Fig. 3. Effect of incubation temperature on limb length. Each purple dot on (A) represents an individual. As total length increases so does limb length.

Conclusion

Individuals exhibiting longer limbs and heads relative to their body size at 22 ℃ may be better suited to low-oxygen environments, such as warmer waters. This effect may result in increased surface area of their bodies enhancing their ability to absorb oxygen in warm, low-oxygen environment.

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