



2011

# Effects of hatching timing on red-eyed treefrog tadpoles: relative vulnerability varies among predators but not with hatchling age-structure, growth varies with the presence of more vulnerable tadpoles [poster]

B. Willink  
*Universidad de Costa Rica*

T. Landberg  
*Boston University*

James R. Vonesh  
*Virginia Commonwealth University, jrvonesh@vcu.edu*

K. M. Warkentin  
*Boston University*

Follow this and additional works at: [http://scholarscompass.vcu.edu/biol\\_present](http://scholarscompass.vcu.edu/biol_present)

 Part of the [Biology Commons](#)

Downloaded from

[http://scholarscompass.vcu.edu/biol\\_present/9](http://scholarscompass.vcu.edu/biol_present/9)

This Presentation is brought to you for free and open access by the Dept. of Biology at VCU Scholars Compass. It has been accepted for inclusion in Biology Presentations by an authorized administrator of VCU Scholars Compass. For more information, please contact [libcompass@vcu.edu](mailto:libcompass@vcu.edu).



# Effects of hatching timing on red-eyed treefrog tadpoles: relative vulnerability varies among predators but not with hatchling age-structure, growth varies with the presence of more vulnerable tadpoles

B. Willink<sup>1</sup>, T. Landberg<sup>2</sup>, J. R. Vonesh<sup>3</sup>, K. M. Warkentin<sup>2</sup> — <sup>1</sup>Universidad de Costa Rica, San José; <sup>2</sup>Boston University, MA; <sup>3</sup>Virginia Commonwealth University, Richmond (email: bwillink@gmail.com)

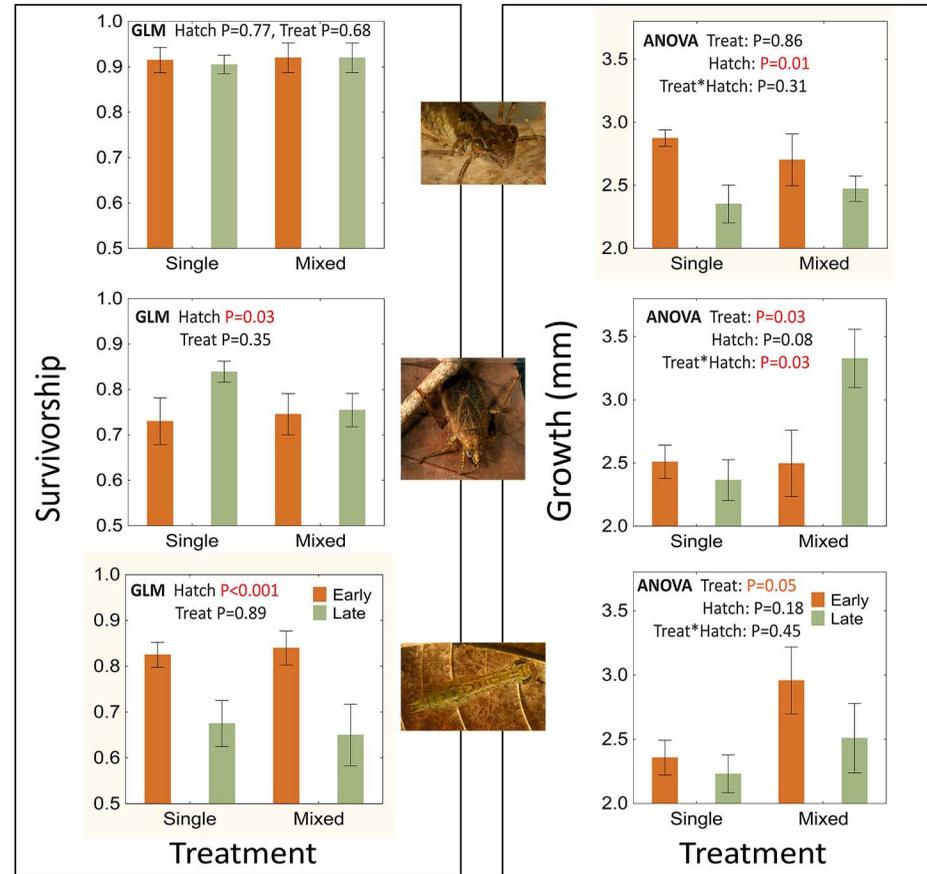
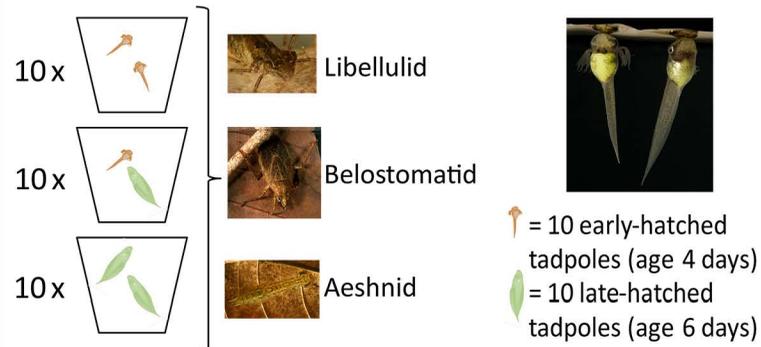
In Gamboa, Panama, undisturbed red-eyed treefrog (*Agalychnis callidryas*) embryos typically hatch at 6 days of age, but they become capable of hatching at 4 days. When egg masses are attacked by predatory snakes or wasps embryos hatch prematurely to escape. In previous studies, embryos induced to hatch 2 days early were more vulnerable to predatory shrimp and fish, revealing a cost of early hatching in the new aquatic environment. However, red-eyed treefrog tadpoles are exposed to many other predators, including several aquatic insects. Also, in previous studies early- and late-hatched tadpoles were exposed to predators separately, ignoring the possibility that interactions between hatching age classes or predator selectivity could affect survival with predators.

## Objectives

- 1) To assess the effect of hatching timing on vulnerability to three common insect predators.
- 2) To examine whether predation on early and late hatchlings is affected by the presence of the other age class.

## Methods

We induced hatching at 4 and 6 days and exposed groups of hatchlings to individual insect predators for 24 h, recording behavior, survival, and growth. We used substitutive designs:

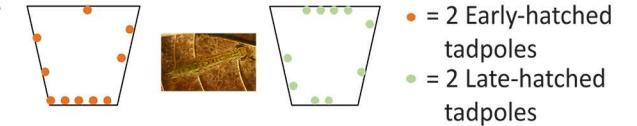


## Results: Survivorship and Growth

Predation by libellulid larvae was not affected by hatching age, early tadpoles were more vulnerable to belostomatids, and late tadpoles suffered more predation from aeshnids. In no case did the presence of the other age class affect mortality. However, in the experiments with belostomatids and aeshnids the age class with lower mortality experienced an increase in growth rate when the other, more vulnerable, age class was present.

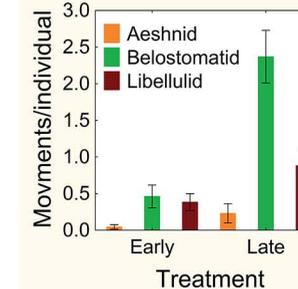
## Results: Spatial distribution

In the presence of belostomatids and libellulids, as in predator-free tanks, tadpoles were found mostly on the bottom and hanging from the sides of the tanks. In the presence of aeshnids, a high proportion of late-hatched tadpoles moved up to the water surface.



## Results: Activity

Late hatchlings were more active than early hatchlings (belostomatid: GLM,  $P<0.001$ , libellulid: GLM,  $P=0.05$ ), except in the aeshnid experiment, where both age classes had very low and similar movement rates (ANOVA,  $P=0.17$ ).



## Conclusions

Combining this and previous studies, early hatchlings are more vulnerable than late hatchlings to most (3/5) predators. The relative inactivity of early hatchlings may reduce their predation risk with aeshnids, which cue strongly on movement. Non-feeding early and barely-feeding late hatchlings with substantial yolk reserves grew faster in the presence of more vulnerable tadpoles. Future work should address how relative vulnerability to predators influences growth and how tadpoles assess their relative risk.

Acknowledgements: We thank Z. Costa, R. Greene, R. Komosinski, C. Noss, M. Palmer, S. Shleier, & J. Touchon for assistance. This work was conducted under permits from the Autoridad Nacional del Ambiente, Panama at the Smithsonian Tropical Research Institute, Gamboa, Panama and funded by the National Science Foundation, Boston University, Virginia Commonwealth University and the Smithsonian Tropical Research Institute.