



Virginia Commonwealth University  
**VCU Scholars Compass**

---

Biology Presentations

Dept. of Biology

---

2011

# The Cost of Hatching Early: Vulnerability and Exposure to Predators [poster]

M. S. Palmer  
*Ohio Wesleyan University*

B. Willink  
*Universidad de Costa Rica*

T. Landberg  
*Boston University*

James R. Vonesh  
*Virginia Commonwealth University, [jrvonesh@vcu.edu](mailto: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](#)

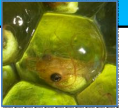
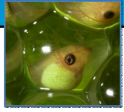
---

Downloaded from

[http://scholarscompass.vcu.edu/biol\\_present/2](http://scholarscompass.vcu.edu/biol_present/2)

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).

# The Cost of Hatching Early: Vulnerability and Exposure to Predators



M. S. Palmer<sup>1</sup>, B. Willink<sup>2</sup>, T. Landberg<sup>3</sup>, J. R. Vonesh<sup>4</sup>, K. M. Warkentin<sup>3</sup>

<sup>1</sup>Ohio Wesleyan University; <sup>2</sup>Universidad de Costa Rica, San José; <sup>3</sup>Boston University, MA; <sup>4</sup>Virginia Commonwealth University, Richmond (email: [mspalmer@owu.edu](mailto:mspalmer@owu.edu))

## Introduction

Red-eyed treefrog embryos hatch up to 30% prematurely in response to egg-stage threats, thus entering the water smaller and less developed and being exposed to aquatic predators for longer, compared to embryos that hatch spontaneously. Both developmental stage and the period of exposure to predators during early life may alter survival, but previous studies have focused only on development.

**Objective:** Assess how being less developed and smaller at hatching combines with increased duration of exposure to aquatic predators to create the total consequences of early hatching.

## Methods

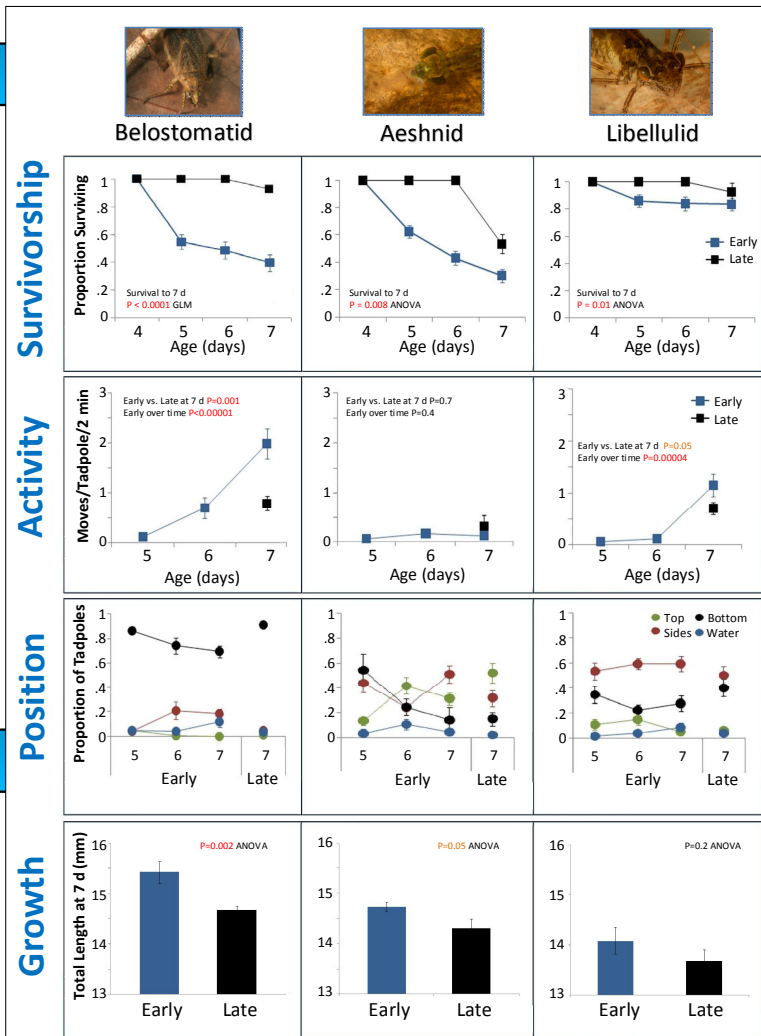
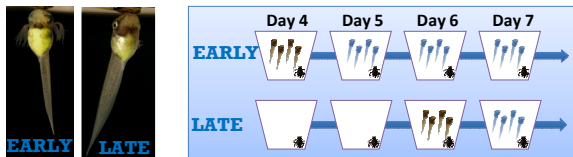
Three experiments with three insect predators that differ in foraging style

Two treatments:

- 1) Hatching induced at 4 days, "Early"
  - onset of hatching competence
- 2) Hatching induced at 6 days, "Late"
  - peak of spontaneous hatching

Hatchlings exposed to predators in 40-L mesocosms until 7 days post-oviposition (N = 20 tadpoles/tank; 10 tanks/treatment/experiment)

Measured survival, behavior, and growth



## Results

- **Survival:** Hatching early increased predation by all 3 insects
  - Early hatched: daily mortality was less after the first day with belostomatids and libellulids, not so with aeshnids
  - Early vs. Late: From 6-7 d, aeshnids and libellulids ate proportionately more of late hatchlings than of remaining early hatchlings

## Results

- **Activity:** Increased developmentally, strongly suppressed by aeshnids
- **Position:** More tadpoles were on the bottom with belostomatids than with odonates, development reduced use of the bottom
- **Growth:** Early hatched tadpoles were bigger than lates at 7 d; odonates weakened this pattern

## Discussion

- Early hatched tadpoles suffered higher mortality than lates from all predators
  - immediately after hatching with belostomatids and libellulids, cumulatively over time with aeshnids
- Proportionately lower mortality from 6-7 d of surviving early hatched vs. newly late-hatched tadpoles suggests selection, induction by predators, or benefit of faster growth in the water than egg
- Hatched tadpoles typically grow faster than equal-aged embryos. Odonate cues appear to suppress this more than do belostomatid cues.

Any potential benefits of predator-induced phenotypes on tadpole survival were insufficient to compensate for the exposure duration cost of early hatching