Carry-over effects of pond canopy cover on locomotor performance of the American toad

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Introduction

Conditions experienced early in ontogeny may carry-over and affect size, locomotor performance, and physiology in later life stages.

Pond canopy is an important abiotic factor impacting amphibian larvae.

Metamorphs emerging from open and closed canopy ponds face different dispersal challenges.

We predict metamorphs from open and closed canopy ponds may have different locomotor abilities and different muscle compositions.

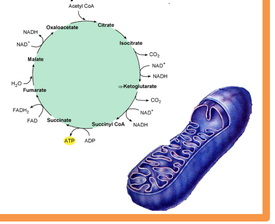
Experimental design

American toad tadpoles were raised in open and closed canopy 1000 L mesocosms, each replicated 5 times and collected upon emergence.

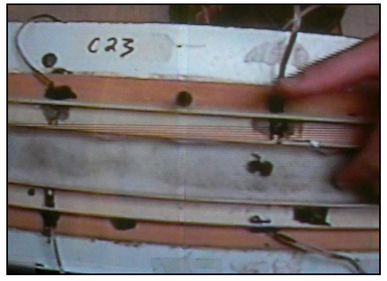
We measured mass and Snout Vent Length (SVL), and estimated maximum speed and endurance in 80 animals.

We estimated maximal citrate synthase activity, a measure of oxidative capacity, of the hindlimb muscle in 40 animals.

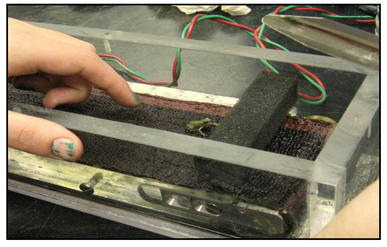
Krebs cycle



Experimental mesocosms at the Ecological Research Center in Ohio.



Three consecutive speed trials were recorded on a 1.0 m long track.



Endurance trials were conducted on a custom-made treadmill and set at a constant speed (.02m/s).

Results

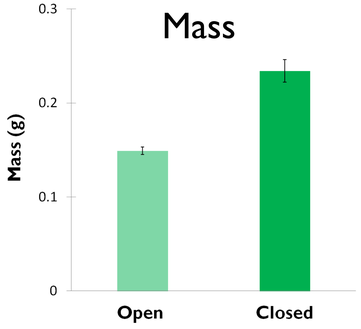


Fig. 1: At metamorphosis, closed canopy toads were significantly larger than open canopy toads (p=.001).

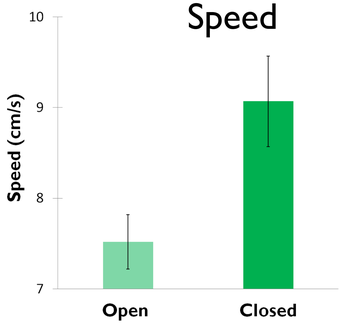


Fig. 2: Closed canopy toads had significantly higher maximum speed than open canopy toads (p=.001).

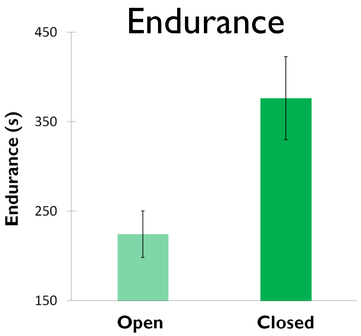


Fig. 3: Closed canopy toads had significantly higher endurance capacity than open canopy toads (p=.01).

Size independent effects

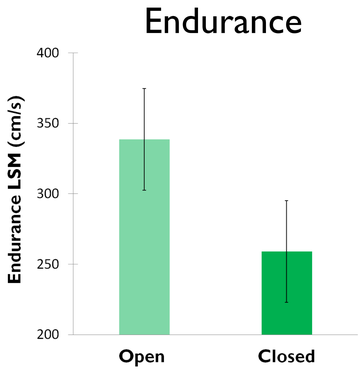


Fig. 4: Open canopy toads had significantly higher mass specific endurance than closed canopy toads (p=.03).

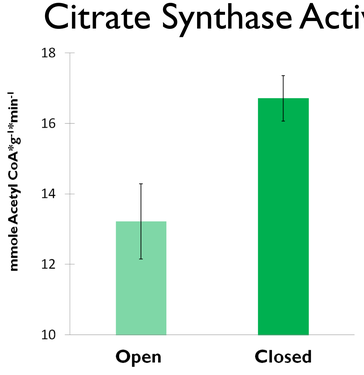
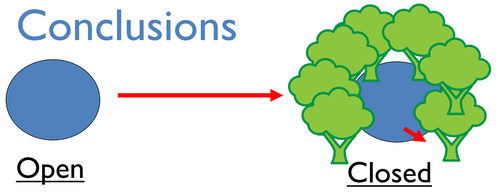


Fig. 5: Closed canopy toads had significantly higher citrate synthase activity (p=.04).

Conclusions



Open

Smaller

Higher size independent endurance

Closed

57% larger

Better overall locomotor capacity

Mass and citrate synthase activity do not account for higher endurance of open canopy toads.

Future directions: What are the compensatory mechanisms allowing higher mass specific endurance in open canopy toads?

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