

Chaotic Patterns in Tropical Lizard Thermoregulation: Does It Exist, and Can It Explain Coexistence?

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The Effects of Temperatures on Animals

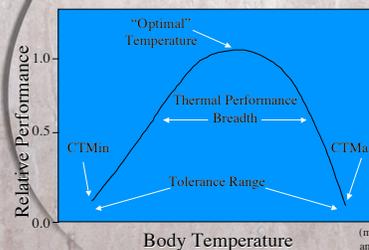
Basic functions in the body (biochemical reactions) are highly temperature sensitive.

Tissue metabolism, and ultimately life is dependent on maintenance of an internal temperatures that facilitates enzyme activities to run metabolism.

Lizards as Ectotherms

- What are ectotherms?
 - ❖ body temp heat loss is high
 - ❖ high thermal conductances = poorly insulated
 - ❖ low metabolic rates
 - ❖ heat production is low, so heat must be derived from environment
 - ❖ majority of animals

Hypothetical Performance Curve of an Ectotherm



Performance and Fitness

- Maximum performance is often thought of as relating to optimal fitness of an individual.
- This may be the case, even if only occurring in rare events if it leads to the survival of the individual.
- Recent studies show that ectotherms use sub--maximal performance in predator escape situations, and that coordinated escape may be more important to survival than power.
- It begs the question of how temperature affects coordinated activities, like foraging or predator escape.

How Can Lizards Regulate Their Body Temperatures?

- Behavioral basking in sun and shuttling between sun and shade.
- Changing postural positions and direction to the sun.
- Physiological control of circulation to the skin.
- Physiological control of skin color.

Two Tropical Lizard Species Live Sympatrically: Potentially Using the Same Resources

Ameiva quadrilineata

= Chisbala

Basiliscus basiliscus

= Jesus Christ Lizard



The Study Site - COSTA RICA NKU CURTS / Punta Rio Claro Reserve



Behavioral Shuttling for Thermoregulation

Video Clip here

Temperature Regulation in Lizards: What is the Appropriate Measure?

- Mean body temperature (T_b) typically used as a single descriptor of thermal status.
- Temporal series (time series) of T_b 's potentially more important in understanding thermoregulation patterns.
- Time series often noisy & complex with high frequency oscillatory patterns.

How to Handle Complex Oscillatory Patterns - Chaos Theory?

- Reptiles often show complex oscillatory patterns of T_b 's within a single daily activity period.
- Ditto & Pecora (1993) suggest that most natural systems are non-linear and that changes in behavior are not just a response to conditions.
- Chaos theory offers models to explain non-linear systems, and have been applied to complex cyclical phenomenon like reptile thermoregulation.

Tropical Lizard Thermoregulation - Questions?

- What are the temporal thermoregulatory patterns in these two tropical lizard species (*A. quadrilineata* & *B. basiliscus*)?
- Do these lizard species exhibit chaotic patterns in thermoregulation?
- If these thermoregulatory patterns are chaotic in nature, would these patterns alter lizard activity in a manner that facilitates co-existence between these two species?

Methods

Data Collection of Lizard Tb's in a Sun/Shade Thermogradient

Methods

Data Collection of Lizard Tb's from Wild Caught Individuals

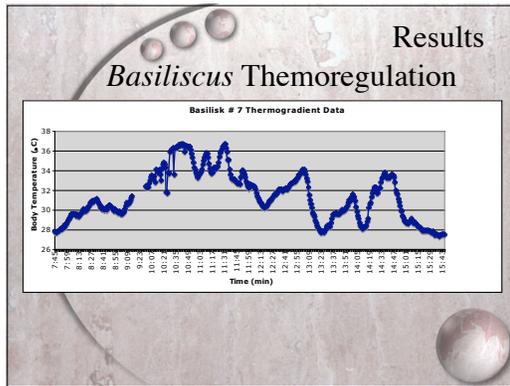
Methods

Data Collection of Environmental Temperatures from Varied Habitats

Results

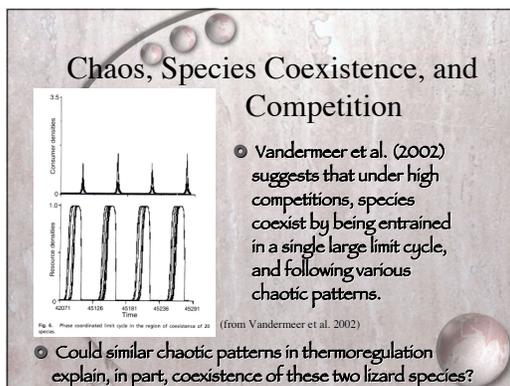
Ameiva Thermoregulation

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How To Test for Chaotic Patterns?

- STELLA?
- Other Suggestions?



With Many Thanks!

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