

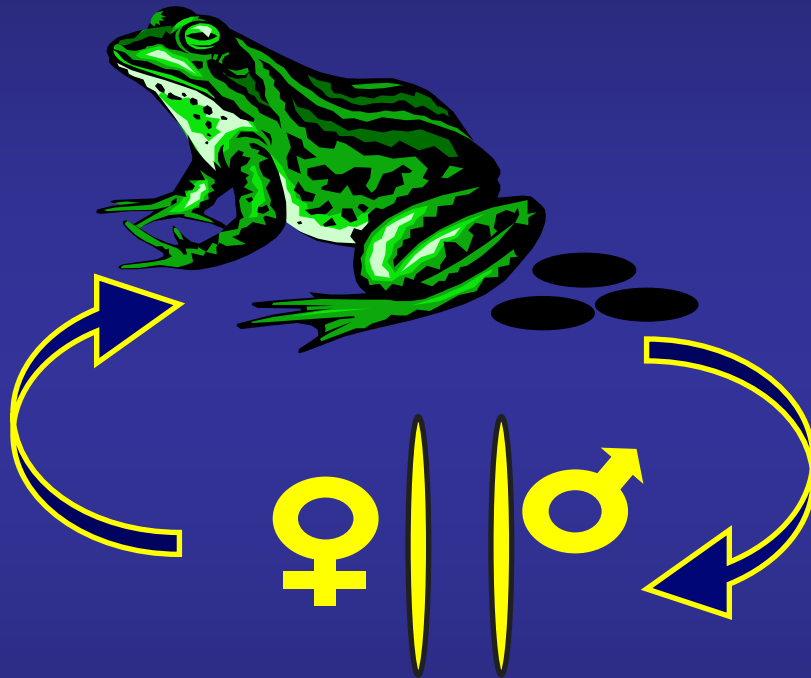
**Molecular phylogeny of North American Rhabdias spp.:
Ecological and physiological factors in lungworm host specificity.**



Gabriel J. Langford and John Janovy Jr.
University of Nebraska-Lincoln

Model system: *Rhabdias* (a.k.a. lungworms)

Rhabdias life cycle

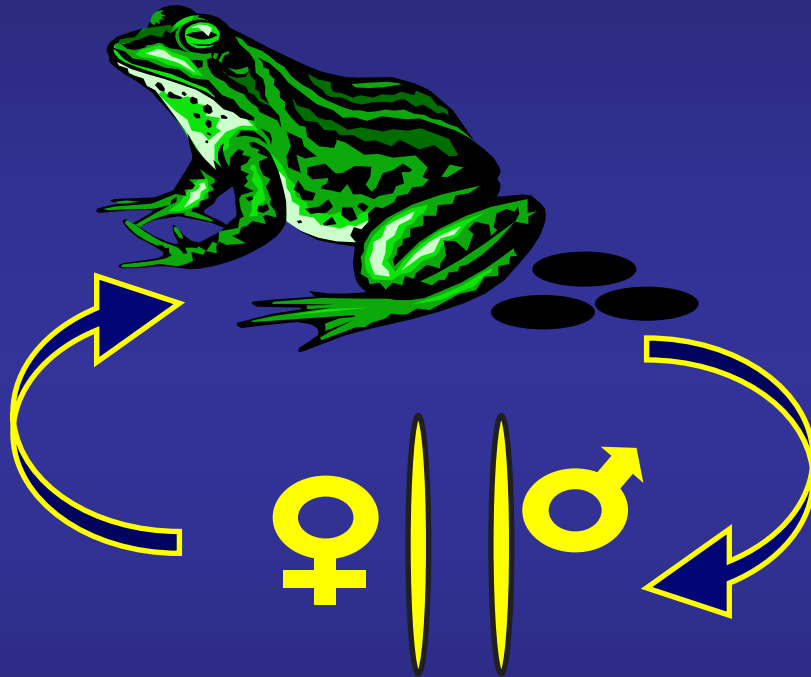


Frog vs. Snake worms

- Free-living stage

Langford and Janovy. 2009. Comparative life cycles and life histories of 6 *Rhabdias* spp. (Nematoda: Rhabdiasidae): lungworms of snakes and frogs. *Journal of Parasitology*.

Rhabdias life cycle

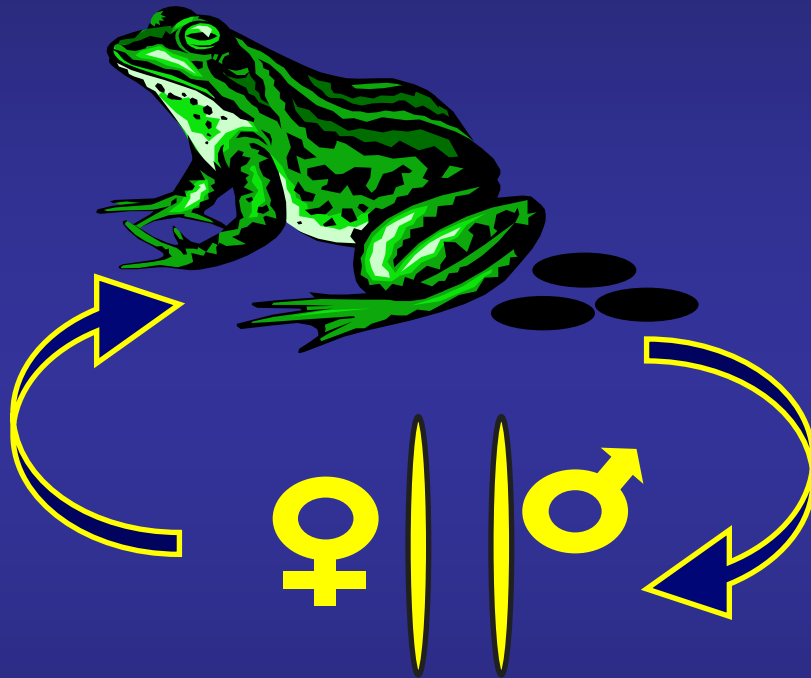


Frog vs. Snake worms

- Free-living stage
- Infection route

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Rhabdias life cycle



Frog vs. Snake worms

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- Infection route
- Lifespan

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- Develop a molecular phylogeny

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Working hypothesis: Based on previous studies (Baker, 1979; Tkach et al. 2003) we predict most lungworm species will display high levels of specificity.

Host specificity

- It is unlikely to encounter a free-living organism that is not parasitized by at least one parasite (Roberts and Janovy, 2005).

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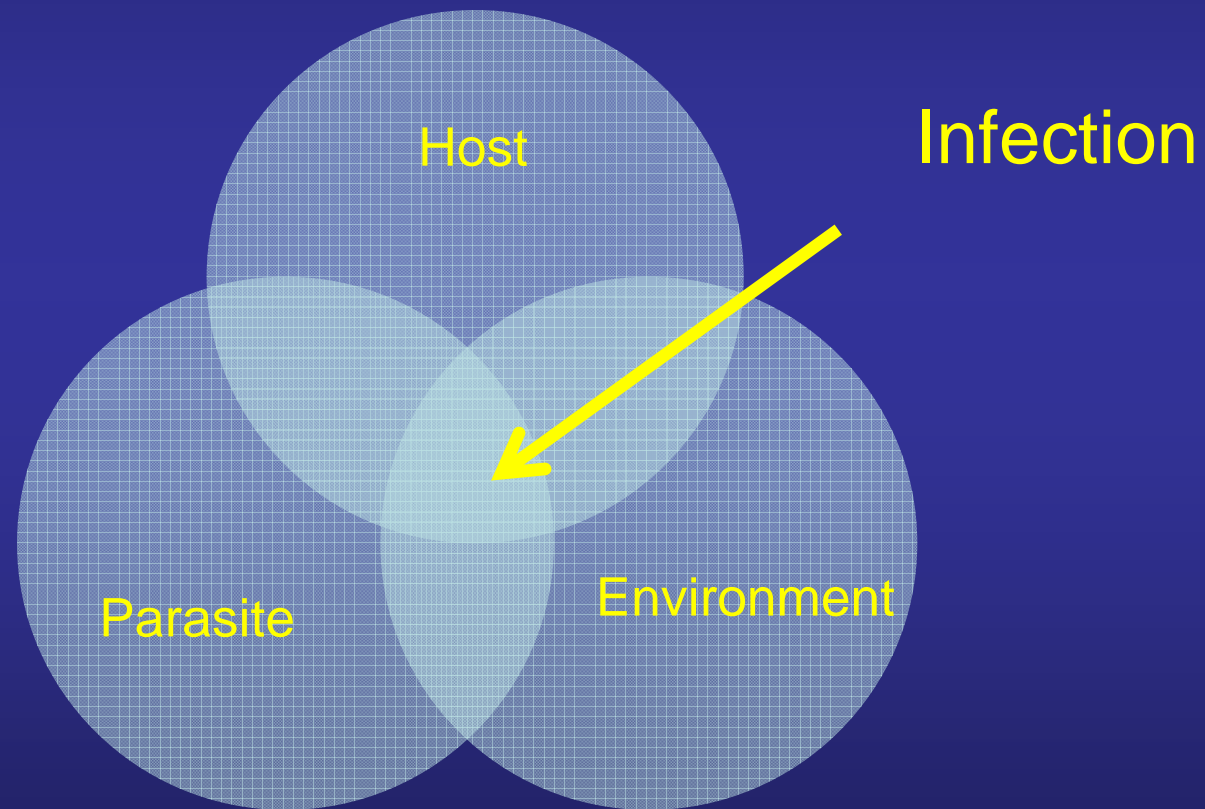
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- **Triad of infection**

Triad of infection

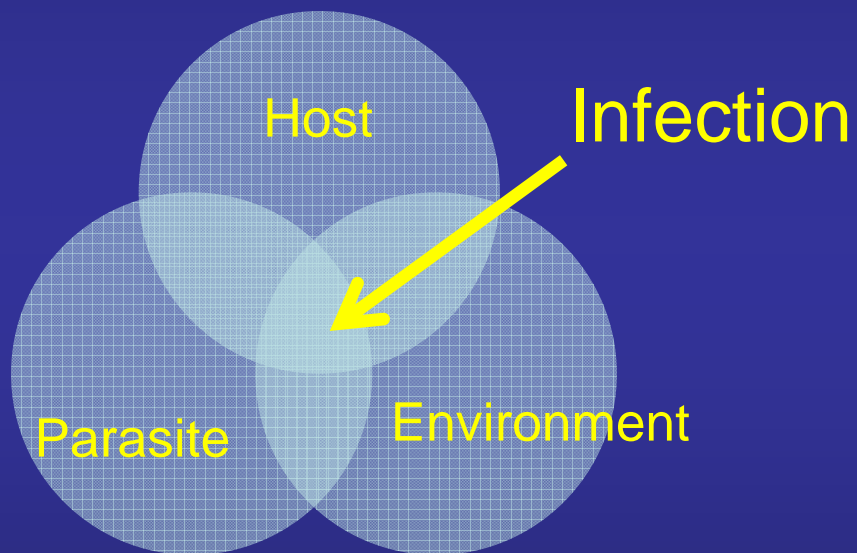


Host specificity

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- Triad of infection
- **Best determined by experimental infections**

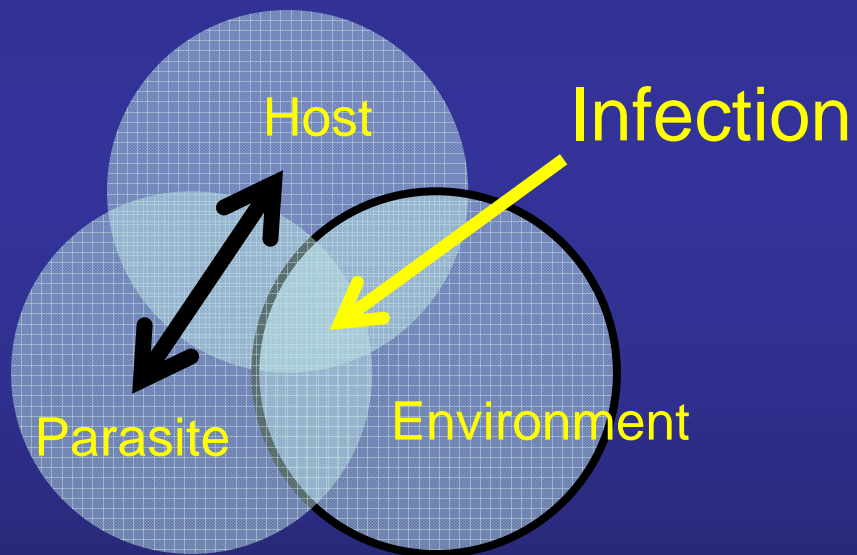
Benefit of experimental infections

- Sampling in nature is limited by space and time.

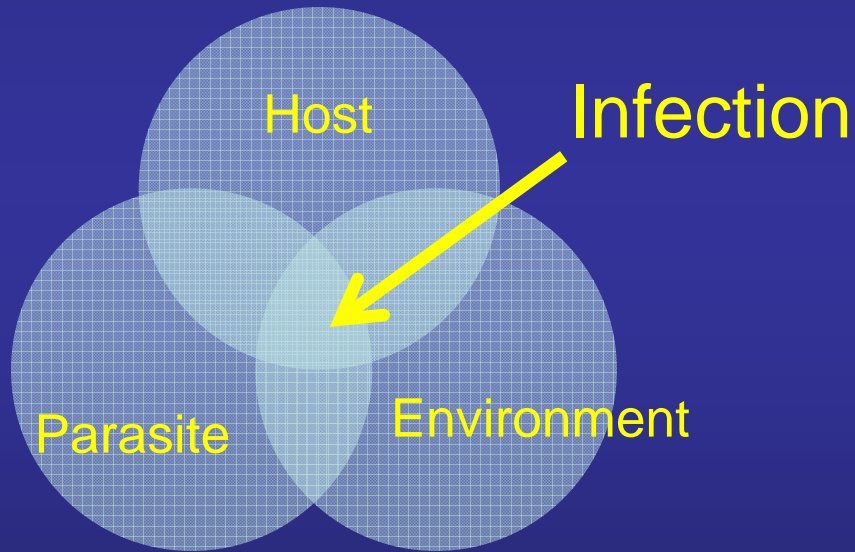


Benefit of experimental infections

- Sampling in nature is limited by space and time.
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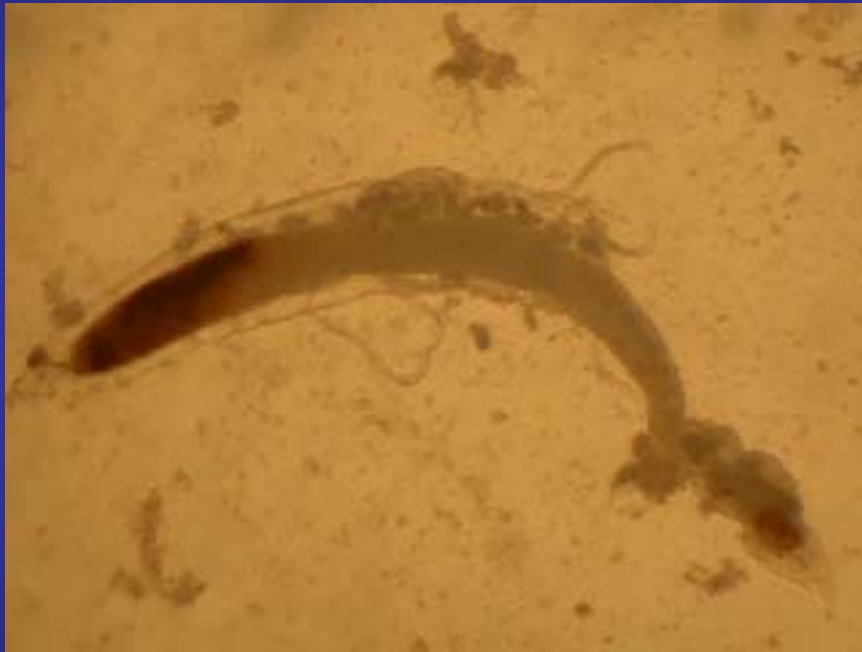


Benefit of experimental infections

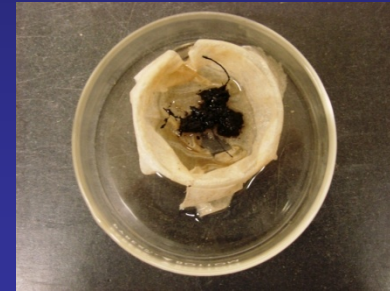


- Sampling in nature is limited by space and time.
- Experimental infections permit control of the triad
- **Broken down into 2 determinants**
 - Physiological (i.e. compatibility)
 - Ecological (i.e. encounters and environment)

Methods



Collecting juveniles

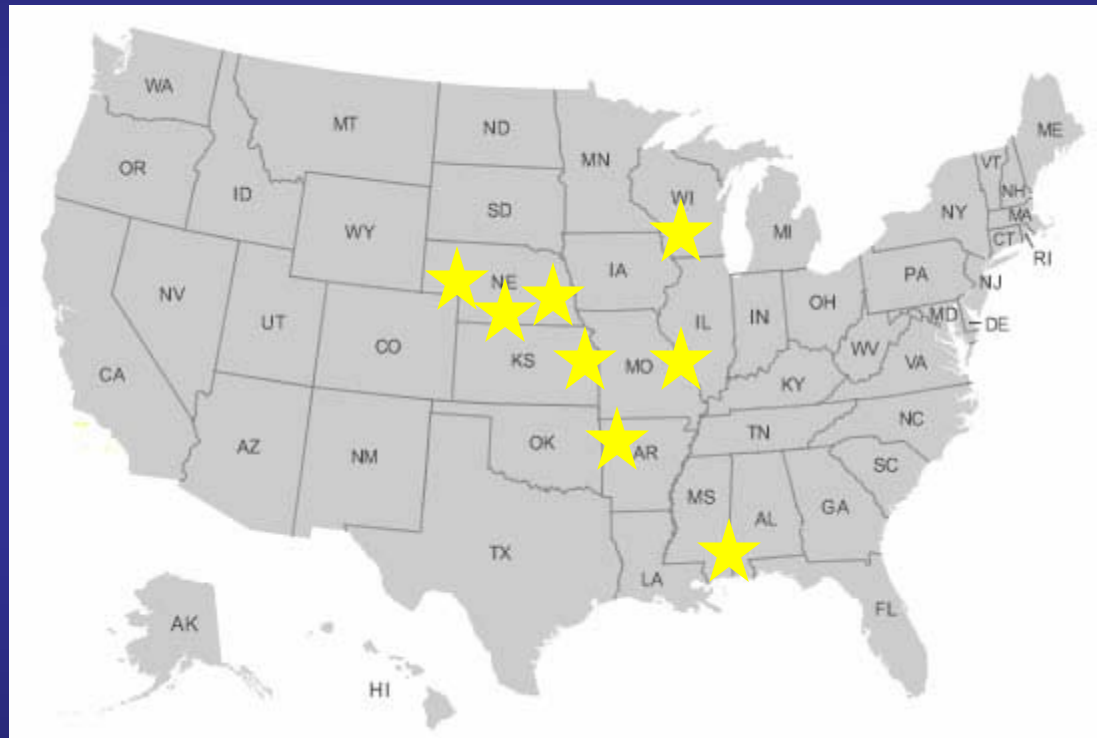


Developing juveniles

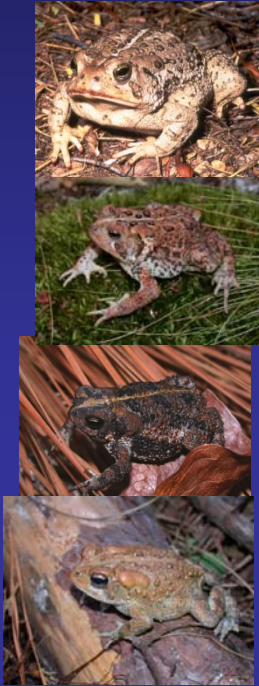


Experimental infection

Locations



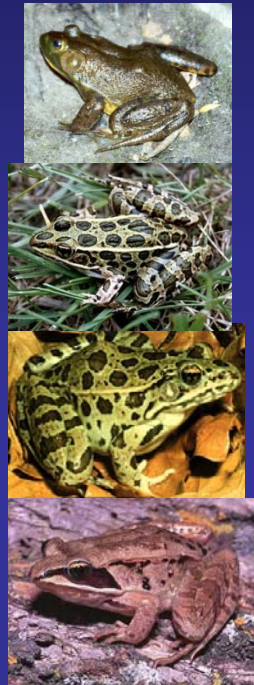
Physiological host specificity



Bufonidae



Hylidae



Ranidae



Microhylidae



Non-anurans

- Controls:
- Time 0
 - Time t
 - Positive

R. bakeri

Physiological host specificity



Bufonidae

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Non-anurans

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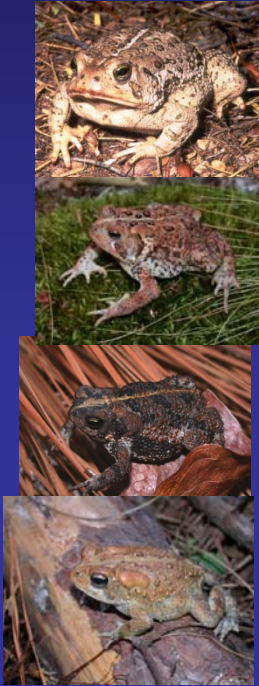
R. bakeri

Ecological host specificity



Are toads likely evolutionary avenues in nature?

Physiological host specificity



Bufonidae



Hylidae



Ranidae



Scaphiophidae



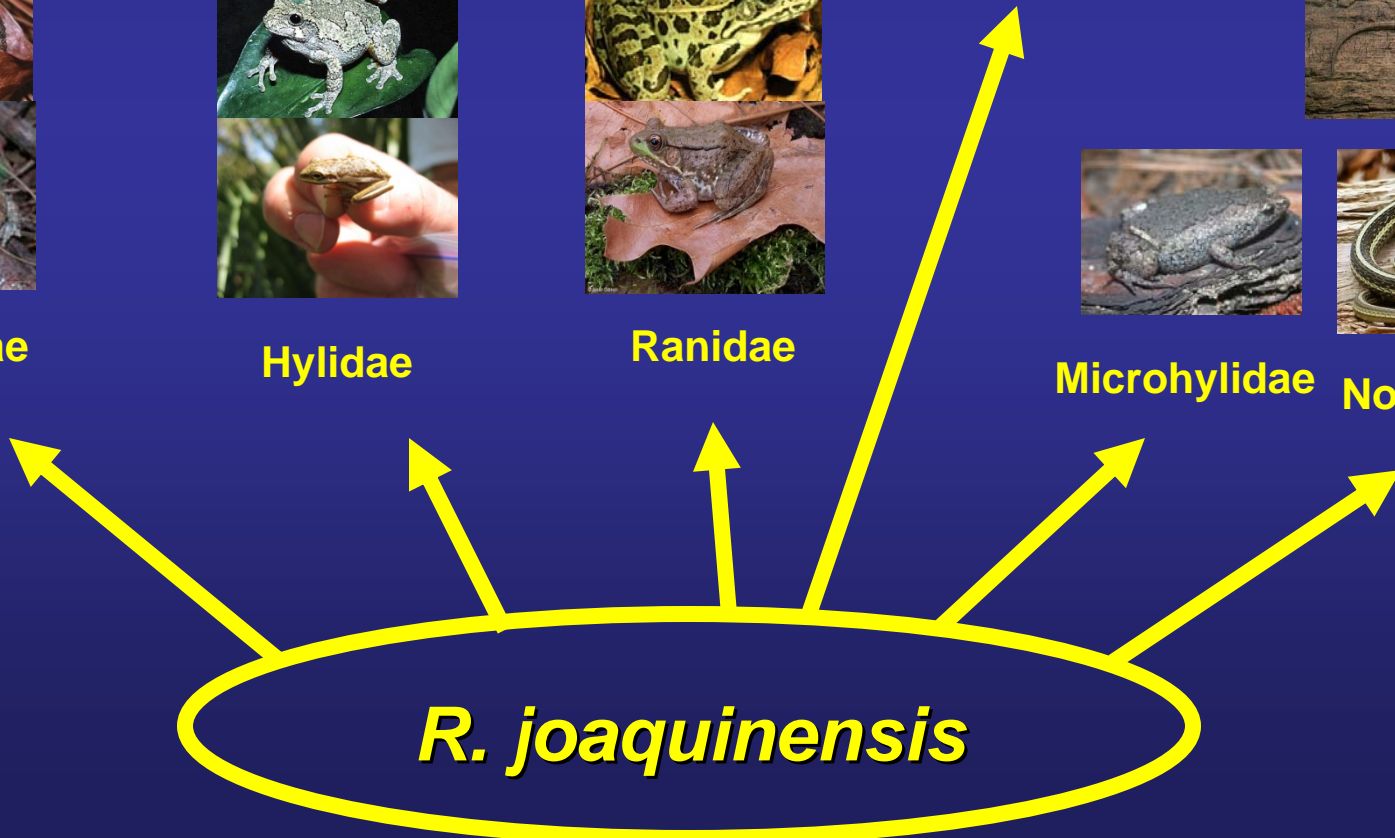
Microhylidae



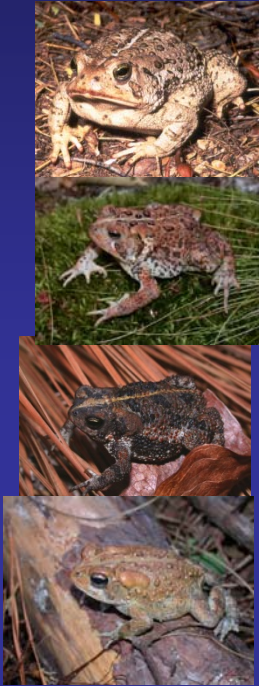
Non-anurans

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R. joaquinensis



Physiological host specificity



Bufonidae



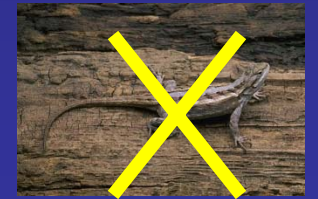
Hylidae



Ranidae



Scaphiophididae



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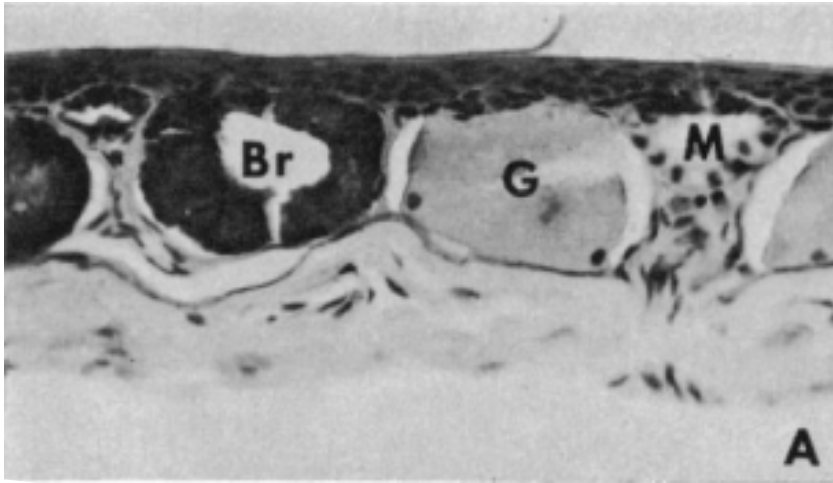
R. joaquinensis



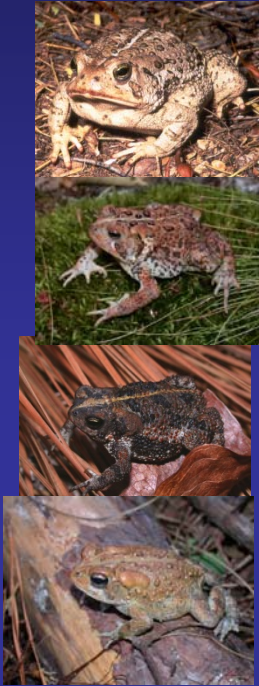
**Are *Spea* viable avenues for
R. joaquinensis?**



Why no infections?



Physiological host specificity



Bufonidae



Hylidae



Ranidae



Microhylidae



Non-anurans

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***R. ranae* MS**

Physiological host specificity



Bufonidae



Hylidae



Ranidae



Microhylidae



Non-anurans

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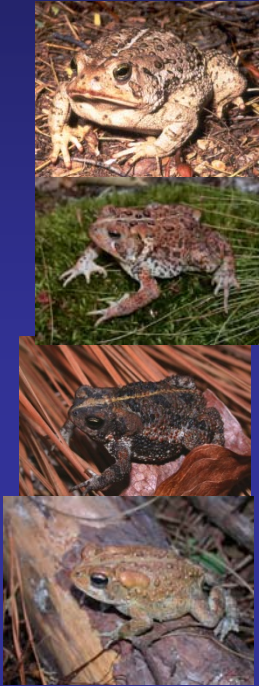
***R. ranae* MS**

Ecological host specificity



Are toads likely evolutionary avenues in nature?

Physiological host specificity



Bufonidae



Hylidae



Ranidae



Microhylidae



Non-anurans

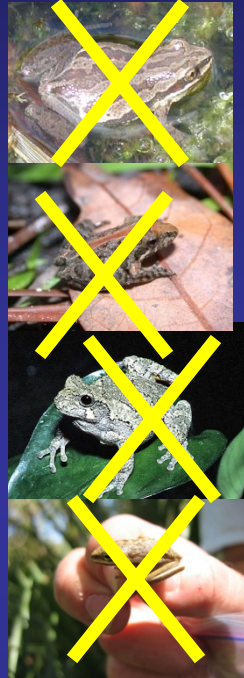
- Controls:
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***R. ranae* MS**

Physiological host specificity



Bufonidae



Hylidae



Ranidae



Microhylidae

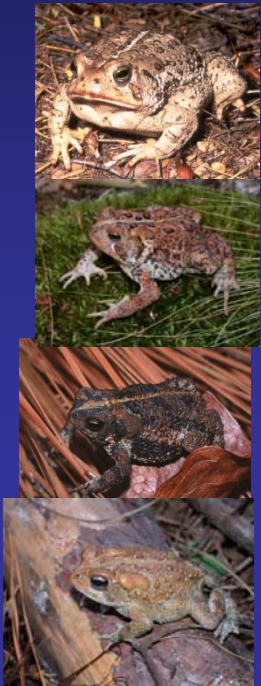


Non-anurans

- Controls:
- Time 0
 - Time t
 - Positive

R. ranae WI

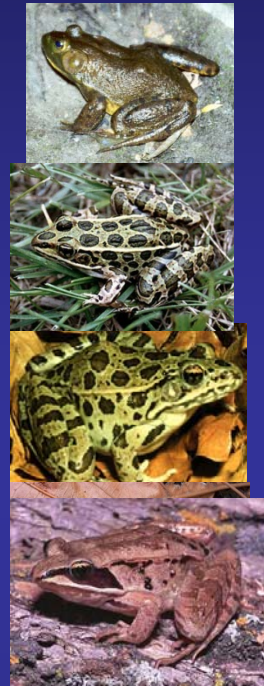
Physiological host specificity



Bufonidae



Hylidae



Ranidae



Scaphiopodidae



Microhylidae



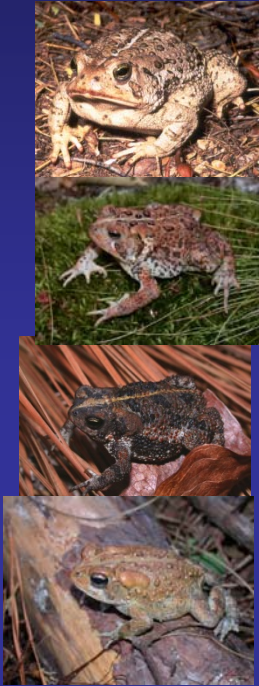
Non-anurans

- Controls:
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R. americanus

Physiological host specificity



Bufonidae



Hylidae



Ranidae



Scaphiopodidae



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R. americanus

Ecological host specificity



**Are wood frogs likely
evolutionary avenues in
nature?**

Why a phylogeny?

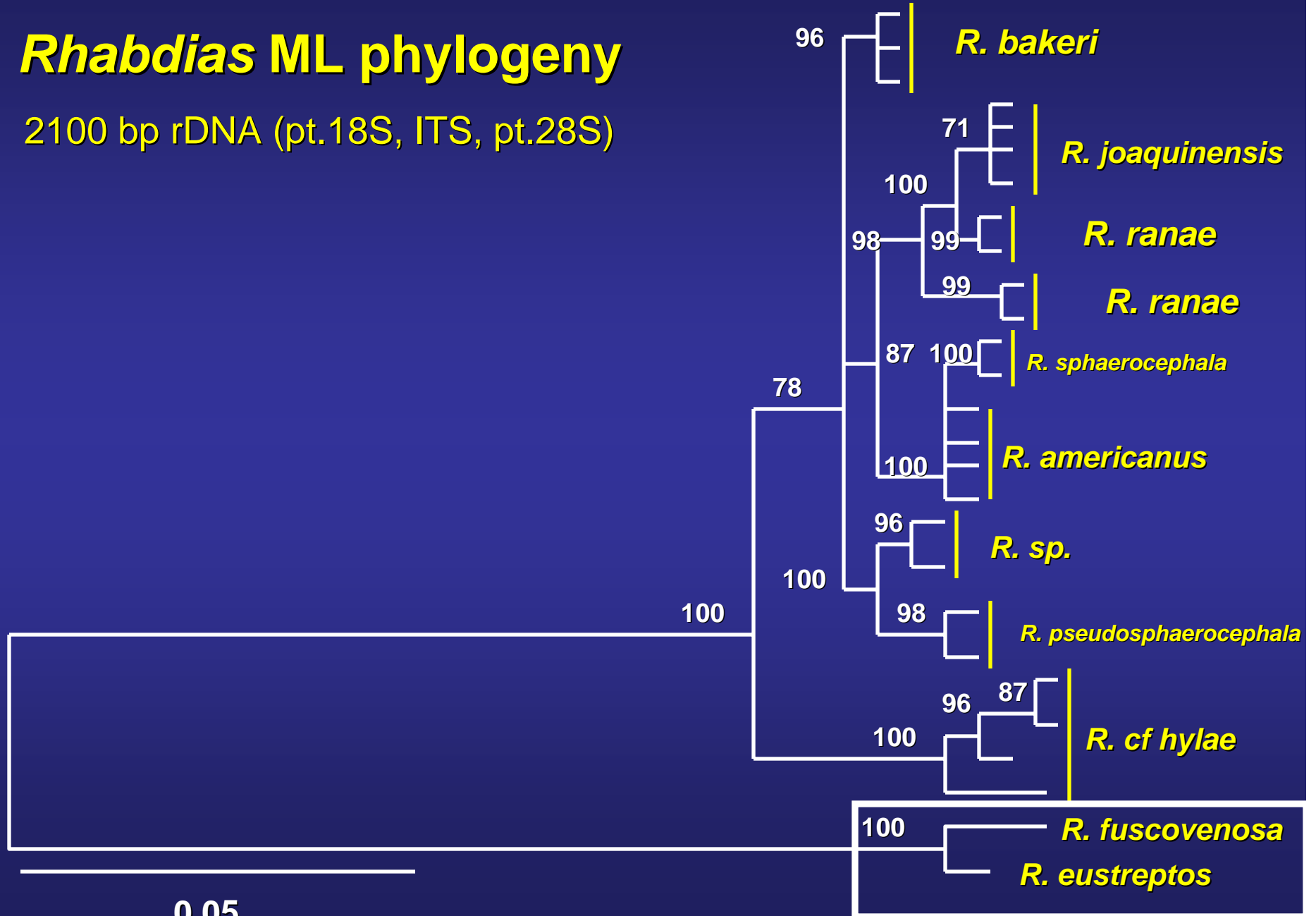
- Avoid pitfalls of species complexes

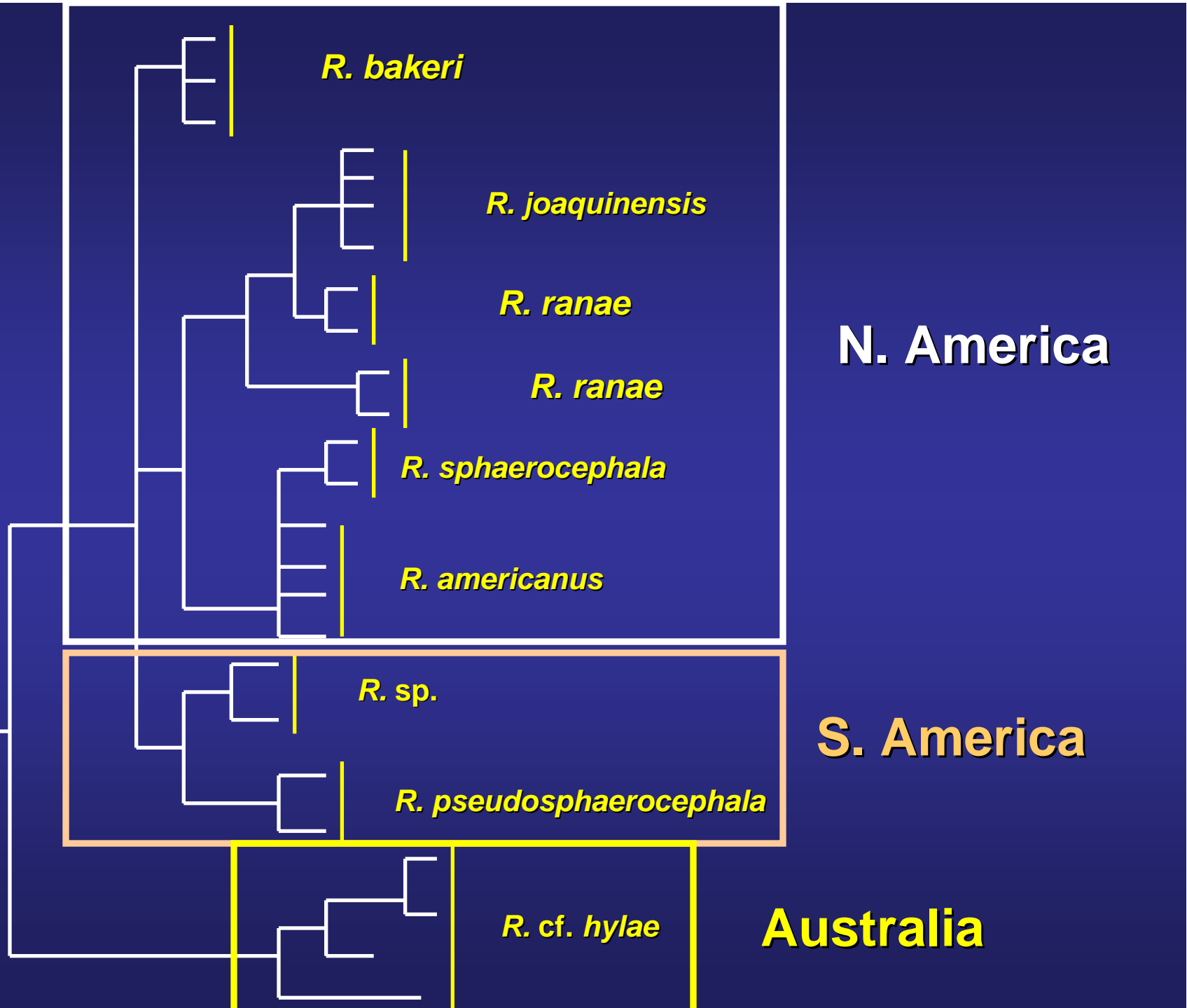
Why a phylogeny?

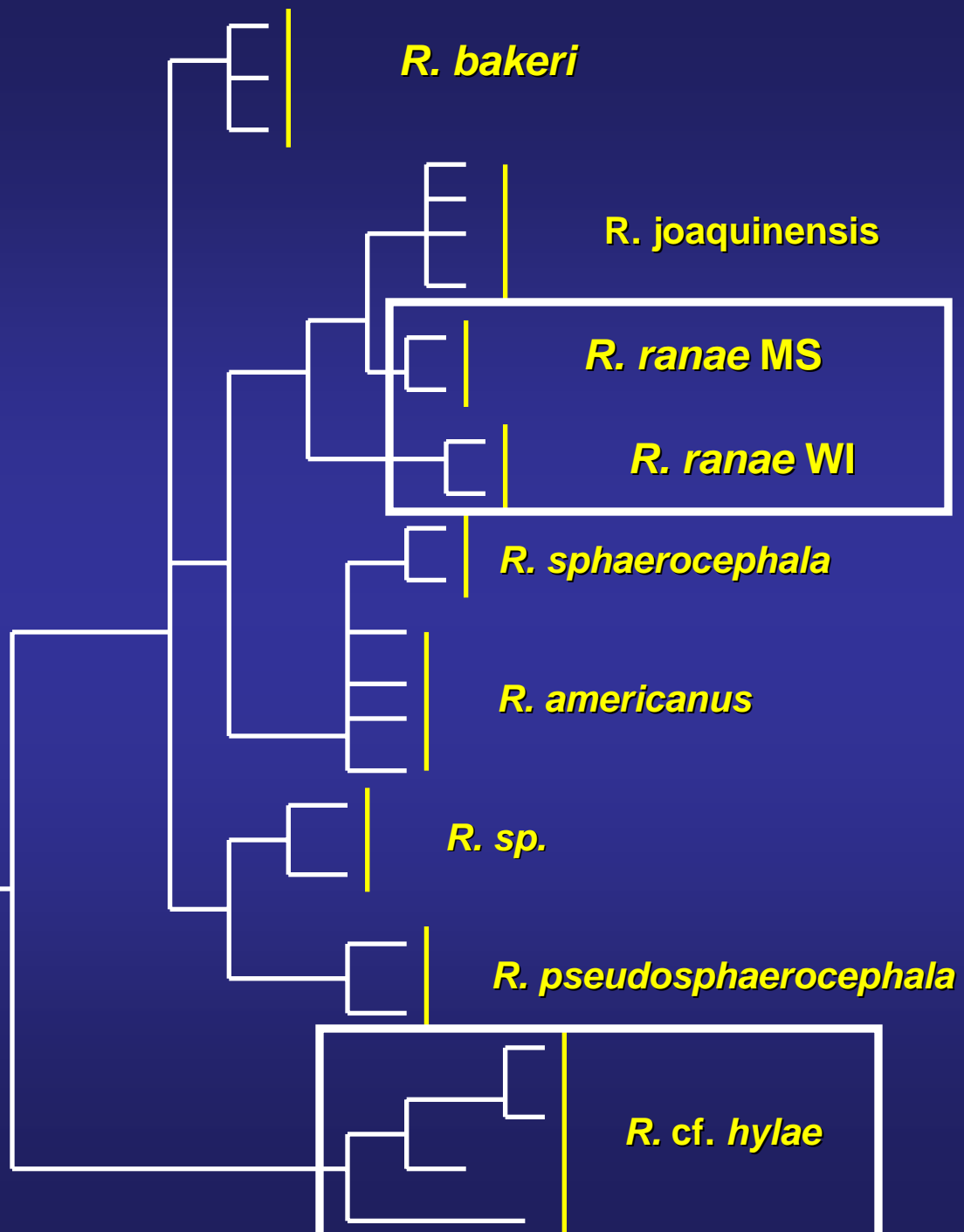
- Avoid pitfalls of species complexes
- Provides an evolutionary platform for studying host specificity

Rhabdias ML phylogeny

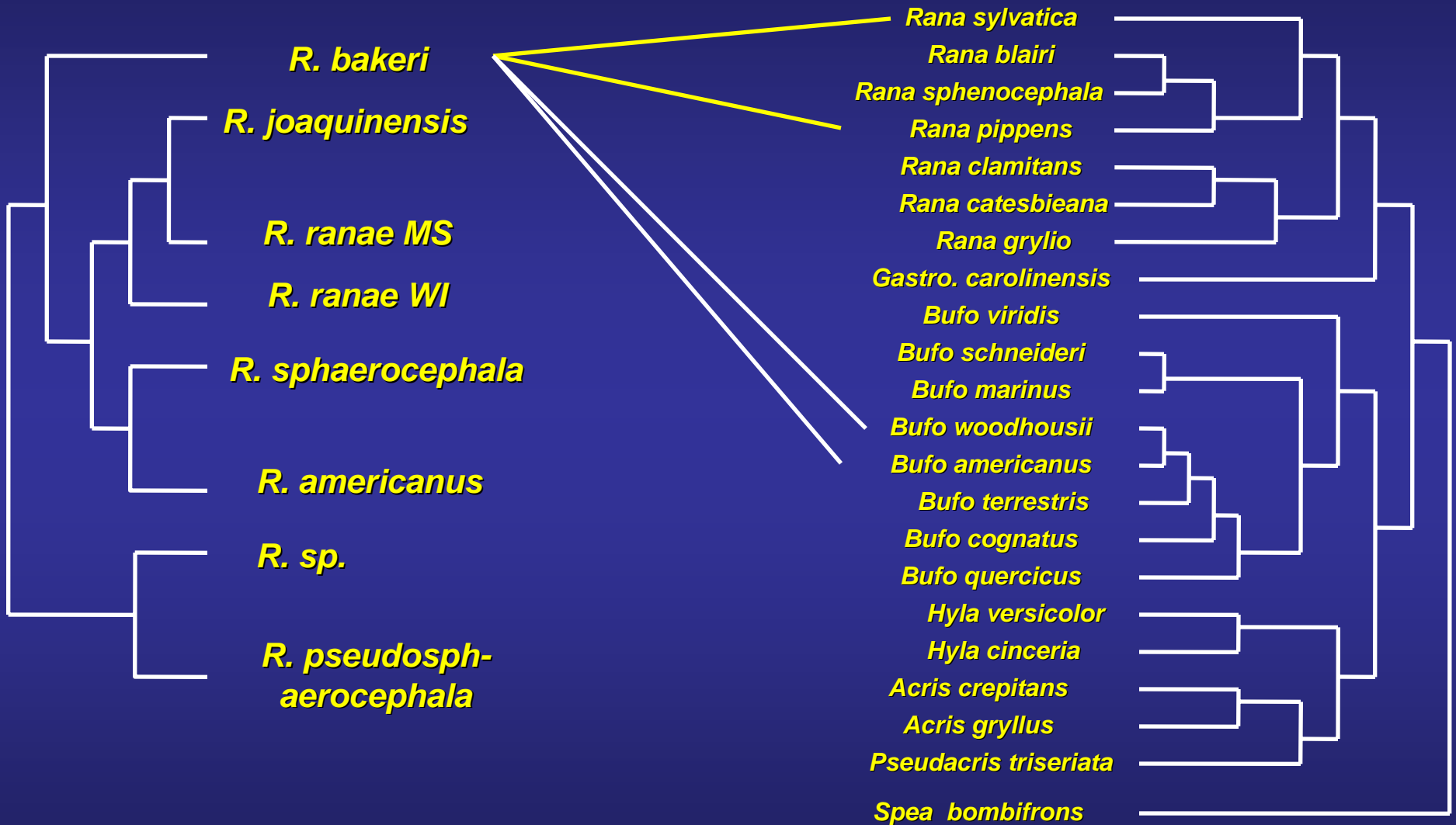
2100 bp rDNA (pt.18S, ITS, pt.28S)







— Natural infection
— Experimental infection



— Natural infection
— Experimental infection



— Natural infection
— Experimental infection



— Natural infection
— Experimental infection



— Natural infection
— Experimental infection



— Natural infection
 — Experimental infection



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— Natural infection
— Experimental infection



Take home messages

- Snake and anuran lungworms form separate clades.

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- Snake and anuran lungworms form separate clades.
- Ecological interactions play a larger role in anuran lungworm specificity than previously thought.
- Assuming host specificity in *Rhabdias* spp. is not a good practice.
- **Combining experimental infections and field studies with a phylogeny has proved useful in exploring the host specificity of lungworms.**

Acknowledgements

- **Scott Snyder**
- **Matthew Bolek**
- **Everyone in the Janovy and Gardner labs**
- **Univ. of Nebraska-Cedar Point Biological Station**
- **Univ. of South Alabama**
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- **Supported by the National Oceanic and Atmospheric Administration and UNL Special Funds**





Questions

