

Parasite loss and introduced species: the parasites of *Eleutherodactylus* *coqui* in its native and introduced ranges with comments on potential biological control

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Why are there so many coqui frogs in Hawaii?

- ◆ Similar environment to Puerto Rico
- ◆ Numerous retreat sites
- ◆ Lack of predators
- ◆ Lack of parasites???



Photo by Chris Jacobson



Other research questions

- ◆ What is the role of parasites in the coqui frog invasion?
- ◆ To what extent do parasites control host populations?
- ◆ Does a safe and effective biological control exist?

Enemy Release Hypothesis

- ◆ Plant or animal invader is “released” from its co-evolved parasites during invasion, allowing populations to reach greater densities
- ◆ Only a few individuals colonize new location
- ◆ Complex life cycles requiring >1 host
- ◆ Transmission of some parasites is host population dependent
- ◆ Some parasites are very host specific

Project Hypotheses

- ◆ Frogs in Puerto Rico will have greater parasite
 - ◆ Species richness
 - ◆ Prevalence
 - ◆ Intensitythan frogs in Hawaii
- ◆ Frogs in Hawaii will be larger than frogs in Puerto Rico

Methods

- ◆ Collected 80 frogs from 4 different sites in Puerto Rico and 80 frogs from 4 different sites on Big Island
- ◆ Site selection based on estimated population density, precipitation, elevation, and presence of other frogs



Dissection Methods

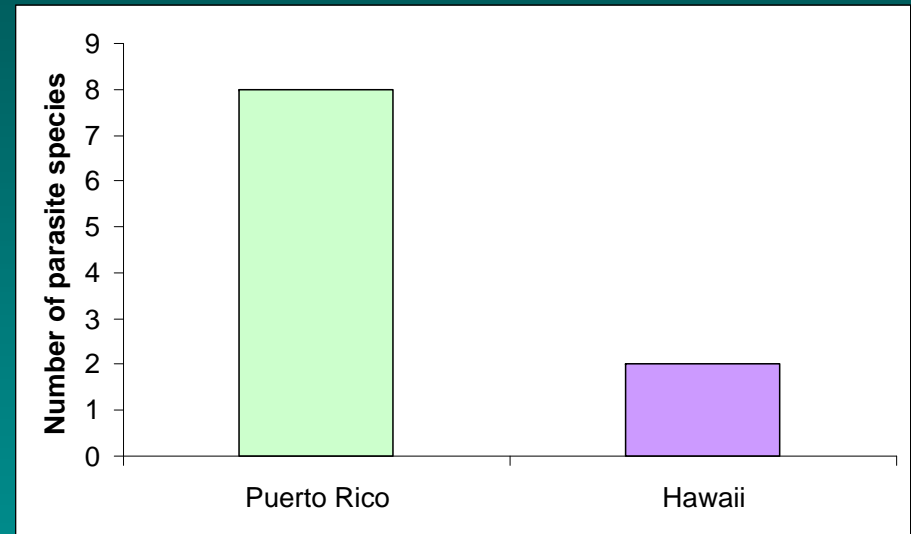
- ◆ Examined skin, eyes, mouth, and internal organs
- ◆ Collected blood samples
- ◆ Examined fecal samples for eggs, larvae, and protozoans



Photos by Jamie Bettaso

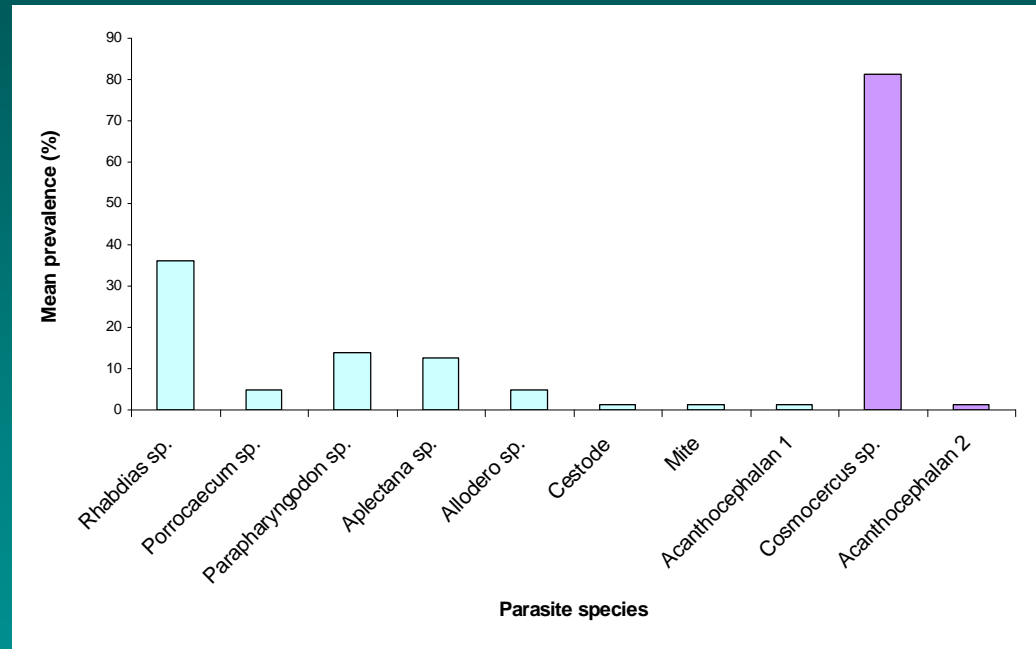
Results: species richness

- ◆ Parasite species richness: Puerto Rico > Hawaii
 - Puerto Rico
 - ◆ Four nematodes
 - ◆ One acanthocephalan
 - ◆ One cestode
 - ◆ One oligochaete
 - ◆ One arachnid
 - Hawaii
 - ◆ One nematode
 - ◆ One acanthocephalan



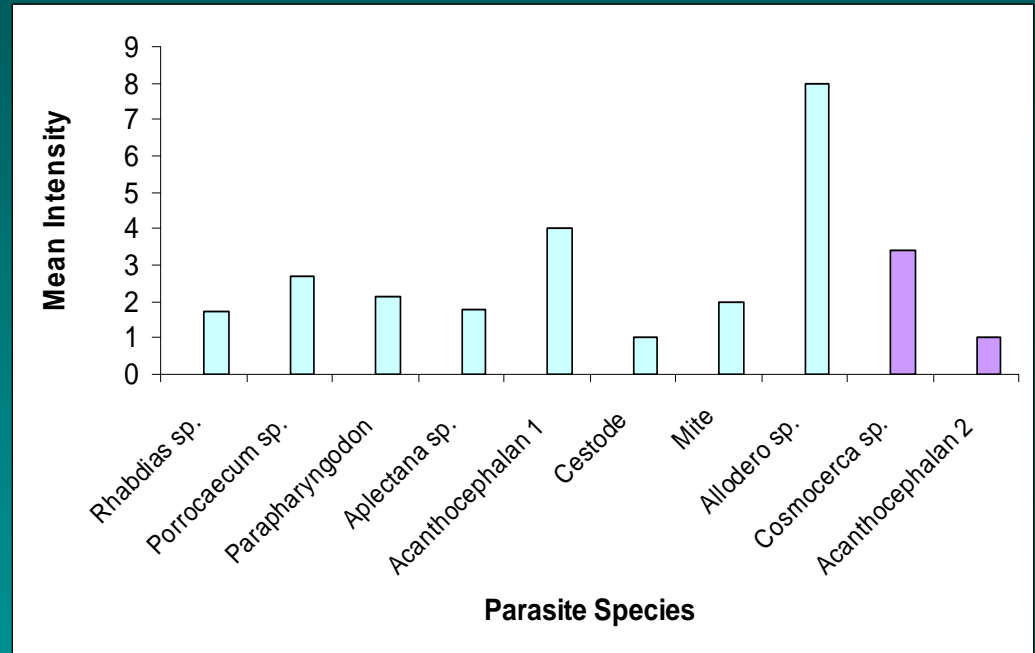
Prevalence

- ◆ No difference in the % of frogs infected with ≥ 1 parasite of any species ($p=0.9590$)
- ◆ GI tract: HI > PR ($p=0.0001$)
- ◆ Body cavity: PR > HI ($p=0.0154$)
- ◆ Lungs: PR > HI ($p=0.0001$)



Intensity

- ◆ Mean parasite count intensity:
Hawaii > Puerto Rico
($p = 0.001$)
- ◆ Mean species count intensity:
Puerto Rico > Hawaii
($p < 0.001$)



Body mass and length

Puerto Rico > Hawaii for both mass and length

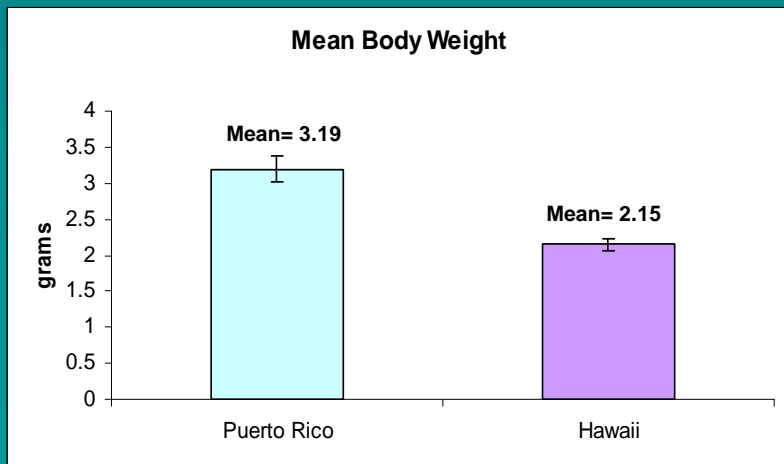
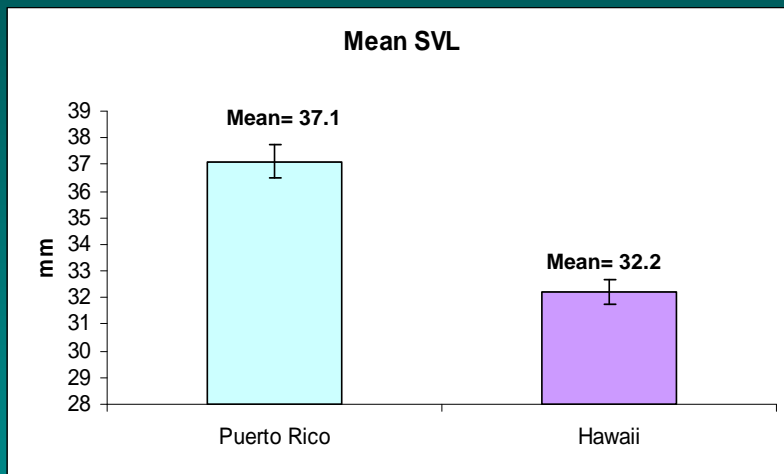


Photo by Chris Jacobson

Body Size

- ◆ Higher frog densities in Hawaii → more competition for food?
- ◆ Young population in Hawaii has not reached maximum size potential?

Other findings

- ◆ None of the same parasites found in Puerto Rico and Hawaii
- ◆ Majority of the nematodes found were in larval stage → frog is an intermediate host
- ◆ This study reports the most parasite species recorded from *E. coqui* in Puerto Rico

Conclusions

Many factors including retreat sites, environmental conditions, and lack of predators likely contribute to the success of coqui frogs in Hawaii

Coqui frogs are probably more successful than they would have been had they brought their parasites with them



What about biological controls?

- ◆ Nematode *Rhabdias* has potential



- ◆ Studies on two different species of bufonids found decreased growth, food intake, survival, and locomotory performance of infected young toads^{1,2}

¹Goater 1991

²Goater et al. 1993

What needs to be done?

- ◆ Test for efficacy
- ◆ Non-target studies



Important considerations

- ◆ *Rhabdias* is fairly common in anurans worldwide
- ◆ Effects likely would not be noticeable for a long time
- ◆ If effective, likely most useful on juvenile frogs; may help minimize range expansion
- ◆ No parasite or disease is a “magic bullet”

Acknowledgements



Carter Atkinson, Jamie Bettaso, Fernando Bird-Pico, Charles Bursey, Marta deMaintenon, Mike Dionne, Mike Dohm, Rogelio Doratt, Kevin Lafferty, Valerie McKenzie, Steve Nadler

Support generously provided by the County of Hawaii, National Science Foundation, USDA, and Sigma Xi