Jason J. Kolbe
Washington University, St. Louis, Missouri

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Genetic Variation Increases During Biological Invasion by a Cuban Lizard

Overview

- **Non-native species** introductions are a widespread and growing problem; nonetheless, understanding why particular species become invasive has eluded biologists (see Box 1).
- Enormous incentive exists to understand biological invasions due to their high economic ($135 billion annually in the U.S.) and biological costs.
- To address the origin and colonization of invasive species, I used DNA sequence data to reconstruct the invasion history of the worldwide invasive lizard, *Anolis sagrei*.

Genetic Paradoxes in Invasion Biology:

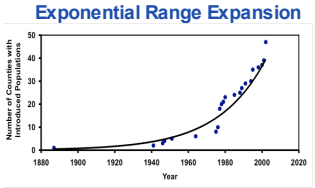
1. If population bottlenecks are harmful, then why are invasive species that have gone through a founding bottleneck so successful?
2. If local adaptation is common and important, then why are introduced species so successful at out-competing and replacing native species?

(Allendorf & Lundquist, *Conservation Biology*, 2003)

Box 1

Anolis sagrei Biological Invasion

* Also introduced to Hawaii, Taiwan & Grenada

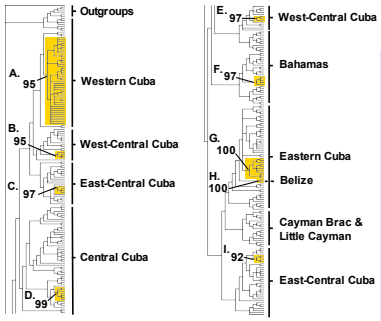


- Highly Invasive in Its Introduced Range
- Well-studied Ecology & Evolution
- Well-documented Biological Invasion

A Model System for Invasive Species Genetics!

Research Findings

Scientific Result #1



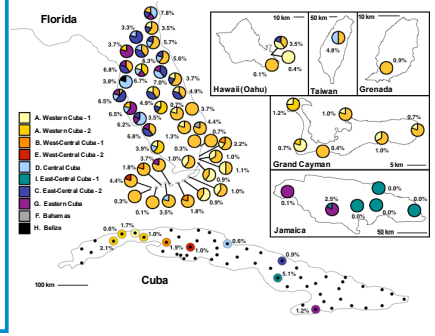
- **Multiple introductions** from Cuba, Belize, and the Bahamas account for the invasion of Florida.

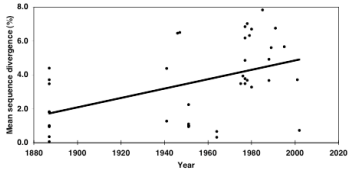
APPROACH: I compared DNA sequences from introduced and native populations of *A. sagrei* to determine the number and source of introductions. DNA sequences from individuals sampled in introduced populations were nested within well-supported geographic groups in the native range.

Scientific Result #2

APPROACH: I compared the frequency and distribution of genetic variation in introduced populations to determine the source of recent introductions. Identical DNA sequences and the same combinations of distantly related sequences are shared between recent introductions and Florida, but not Cuba.

- **Secondary introductions** from Florida account for recent invasions around the world.





APPROACH: I compared the amount of genetic variation in introduced Florida populations to the year each population was established. More recently established populations have higher levels of genetic variation than older populations due to the mixture of genetic variation from multiple source populations.

Scientific Result #3

- **Genetic variation** increases during the biological invasion of Florida.

Impact

- **Blending genetic variation** from different geographic source populations increases the amount of genetic variation within introduced populations.
- **Adaptation** in these genetically variable introduced populations may be enhanced.
- **Well-established introductions** can become sources for future introductions that maintain elevated levels of genetic variation.
- **Biological control** efforts need to account for genetically diverse biological invasions resulting from multiple introductions.

Publication: Kolbe et al. 2004. Genetic variation increases during biological invasion by a Cuban lizard. *Nature* 431:177-181.

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Contact Information:
kolbe@biology.wustl.edu

Washington University in St. Louis Arts & Sciences — Evolution, Ecology & Population Biology

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