Evolutionary genomics of endangered Hawaiian tree snails (Achatinellinae: Achatinellidae) for conservation of adaptive capacity

BACKGROUND

In the last five years, **nearly all populations of Hawaiian tree snails in the subfamily Achatinellinae (Achatinellidae) have declined** to undetectable levels. Nearly 100 species have existed historically, but habitat loss, overcollection, and predation by invasive species have decimated populations. As such, this system offers the **opportunity to integrate efforts to conserve evolutionary potential into conservation planning for a rapidly declining subfamily**.

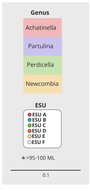
METHODS

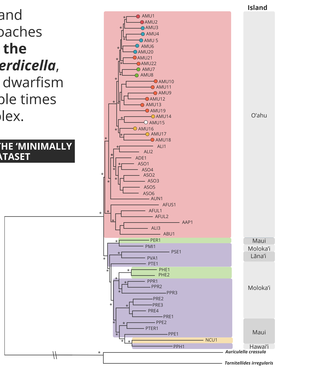
In this study we used **genome-wide**, **restriction-site associated DNA sequencing** (RADseq), along with **mitochondrial genome reconstruction**, to resolve evolutionary relationships to inform conservation efforts.

RESULTS

1. Both the mitochondrial and genome-wide SNP approaches supported **polyphyly in the genera *Partulina* and *Perdicella***, and results suggest that dwarfism may have evolved multiple times across the species complex.

MAXIMUM LIKELIHOOD TREE OF THE 'MINIMALLY FILTERED' GENOME-WIDE SNPS DATASET

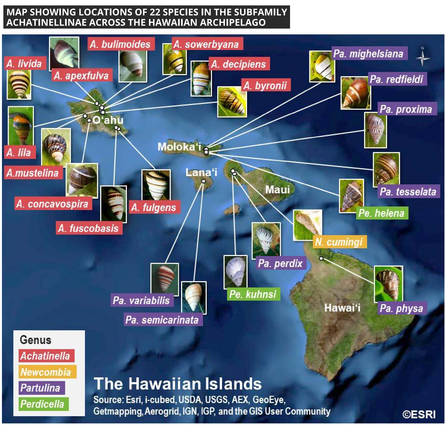




2. **Populations of *Achatinella mustelina* are likely in the process of undergoing speciation**, with cryptic divergence among populations at levels comparable to, or deeper than, accepted species within the family, based on both mitochondrial and genome-wide SNP phylogenetic and coalescent analyses.

3. **Conservation of evolutionary potential is critical across this subfamily**. Given the divergence within species among populations that are geographically proximate (sometimes within one kilometer), our results indicate that with each population that becomes extirpated by invasive predators, a significant amount of within-species diversity is lost.

MAP SHOWING LOCATIONS OF 22 SPECIES IN THE SUBFAMILY ACHATINELLINAE ACROSS THE HAWAIIAN ARCHIPELAGO



4. Due to the genetic structuring over dramatic environmental gradients across multiple mountain ranges and islands, this **study system appears ideal for examining the ability to predict adaptation to future conditions**.

IMPLICATIONS FOR CONSERVATION

Given the extirpation rate of populations due to invasive predators, few (if any) are likely to remain outside of exclosures within the next decade. **Since conservation of biodiversity must include conservation of genetic diversity, construction of exclosures in climate-suitable areas is urgently needed, along with captive propagation efforts.**

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