Population density, diets, and growth rates of *Eleutherodactylus coqui* in Hawaii

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Population Estimates

2,954 adults in 8 study plots over 3 years

Beard et al. (In Review) J. of Herpetology
Sex, SVL, Habitat, Color pattern, Individually mark 5-9 nights, 60% recap

Woolbright (2005) Herp. Review
Lava Tree had a 3-yr mean 3X higher than the highest long-term mean from Puerto Rico.

Beard et al. (Accepted) J. of Herpetology
Total density estimates
Preadult:adult x adult estimate = preadult estimate

<table>
<thead>
<tr>
<th>Site</th>
<th>Preadult:Adult</th>
<th>Total Density (Frogs / ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2004</td>
<td>2005</td>
</tr>
<tr>
<td>AK</td>
<td>10.86</td>
<td>2.64</td>
</tr>
<tr>
<td>HS</td>
<td>2.00</td>
<td>2.27</td>
</tr>
<tr>
<td>KP</td>
<td>--</td>
<td>2.97</td>
</tr>
<tr>
<td>LT</td>
<td>1.43</td>
<td>2.27</td>
</tr>
<tr>
<td>MP</td>
<td>5.62</td>
<td>0.57</td>
</tr>
<tr>
<td>OL</td>
<td>0.24</td>
<td>1.17</td>
</tr>
<tr>
<td>PK</td>
<td>1.84</td>
<td>1.27</td>
</tr>
<tr>
<td>PP</td>
<td>2.76</td>
<td>--</td>
</tr>
</tbody>
</table>

Note: 2X indicates that the values have been multiplied by 2.
What limits coqui densities?

Before Hurricane Hugo 1989

After Hurricane Hugo 1990

Positive relationship between total density and habitat structure across study sites

$R^2 = 0.85$
$F = 28.42, P < 0.01$

Beard et al. (Accepted) J. of Herpetology
Weak positive relationship between invertebrate abundance and total density across study sites

$R^2 = 0.45$
$F = 4.04, P = 0.10$
Frog Stomach Content Analyses

11 study sites, Summer 2004

Beard 2007 Copeia
696 frogs, 5310 invertebrates were identifiable. 7.6 ± 7.6 (SD) prey items per stomach.
Growth rates

Males: $0.008 \pm 0.0007$ vs. $0.02 \pm 0.0003$
Females: $0.01 \pm 0.001$ vs. $0.08 \pm 0.005$

Controlled for SVL

Woolbright (1985) *Copeia*
• Is fitness higher in Hawaii or Puerto Rico?
• Common environment
• 4 Puerto Rico populations and 2 Hawaii populations
• Fitness measures:
  – Number of eggs per clutch?
  – Egg size?
  – Offspring size?
  – Growth/survivorship of offspring?
\[ F_{1,27} = 1.38, P = 0.25 \]

\[ F_{1,27} = 12.68, P = 0.0014 \]

\[ F_{1,27} = 6.89, P = 0.014 \]

\[ F_{1,27} = 6.90, P = 0.015 \]
Velo-Antón et al. (2007) Molecular Phylogenetics and Evolution
• Thirteen microsatellite loci were isolated from the coqui frog

• The purpose for initiating this study was to determine the number of introductions in Hawaii and the primary source or mode of introductions.
Bayesian population assignment test

Peters et al. (2008) Molecular Ecology Notes
Conclusions

- Coqui densities *vary* across sites, but can be 3X higher than Puerto Rico
- Habitat structure is highly correlated with coqui densities
- Coquis are mostly consuming non-native leaf litter invertebrates, esp. ants, amphipods
- Two introductions
- Extreme bottleneck
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