Darwin in the Galapagos

Each island had its own species of mockingbird.
- Why different species on such similar islands?
- Why are these different species so similar?
- Why are they similar to mockingbirds of S. America?
- Why is this pattern repeated in tortoises, insects, lizards, plants, and other birds?
- Why are the Galapagos inhabited solely by good travelers?

Evolution explains all this, but it also makes predictions that Darwin couldn’t test.

Phylogeny on islands should reflect the history of island formation

- Oldest islands were inhabited first.
- Deepest nodes in phylogeny should separate species on older islands.

Island chains of the Pacific

- Islands are arranged in straight lines running generally SE to NW.
- In each chain, islands increase in age from SE to NW.
- NW of existing islands, each chain continues below the sea.

Tectonic Plates and Continental Drift

How island chains form
Major Hawaiian Islands

The Hawaiian Island Chain

Hawaiian flightless cricket of genus Laupala

- Cannot fly; rarely move from island to island
- Many species on each island

Illustration ©1994, Daniel Otte

Laupala phylogeny

- Colors keyed to map.
- Oldest node separates green (oldest island) from rest.
- Each branch limited to an island.
- Too confusing to see much more.
- Let’s make a simpler tree without so many twigs.

Area cladogram

- Each branch represents all the closely-related species on an island.
- Label branches with the “number” of the island.
- Islands are numbered from oldest to youngest.

Island Age

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Age (Myr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kauai</td>
<td>5.1</td>
</tr>
<tr>
<td>2</td>
<td>Oahu</td>
<td>3.7</td>
</tr>
<tr>
<td>3</td>
<td>Molokai</td>
<td>1.8</td>
</tr>
<tr>
<td>4</td>
<td>Maui</td>
<td>1.3</td>
</tr>
<tr>
<td>5</td>
<td>Hawaii</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Note “stair-stepped” pattern. Why should this occur?
Why we expect a stair-stepped area cladogram

At each stage
- New island colonized from next-newest.
- Branch to next-newest island splits in two.

Summary
- Area cladogram consistent with geological history of islands.
- This is the expected pattern, if these species evolved.
- Same pattern occurs in other taxa, on this and other island chains.
- Darwin’s theory is supported by data he never imagined.

Area cladogram for *Laupala* crickets

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