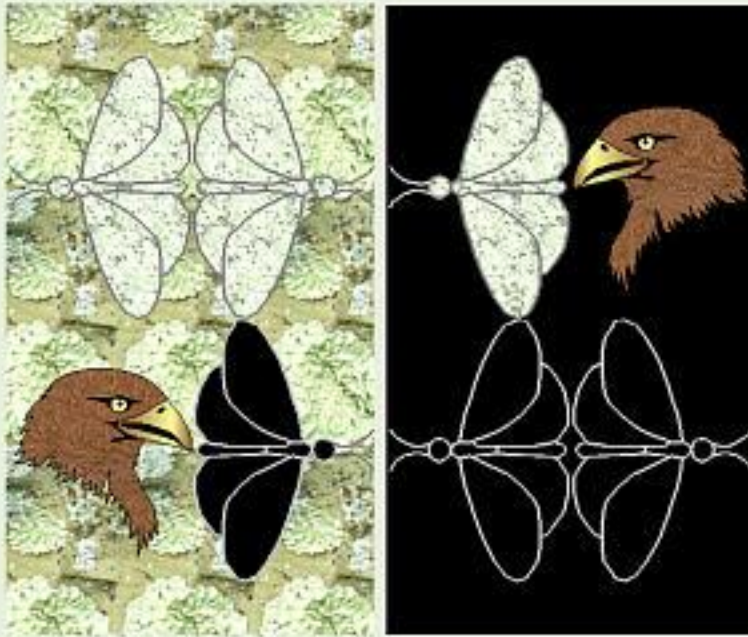


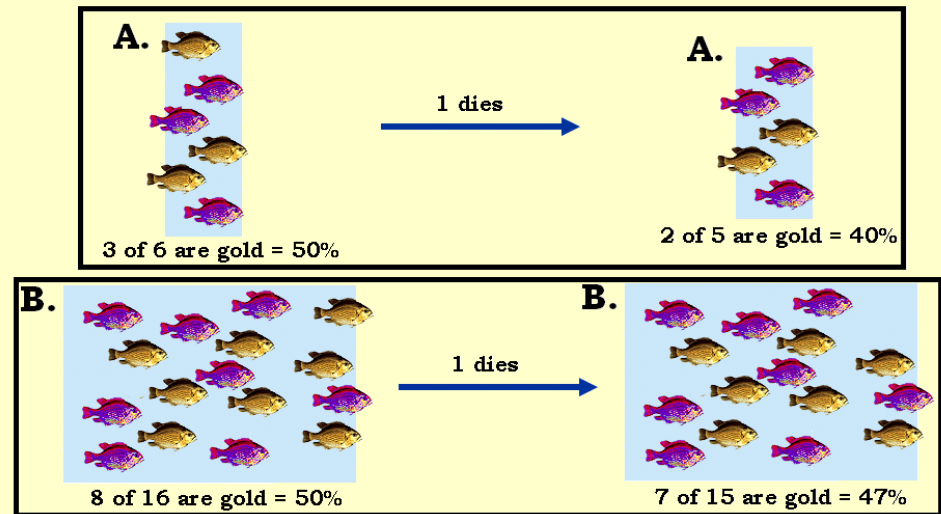
The Process of Speciation

Natural selection and genetic drift lead to formation of new species



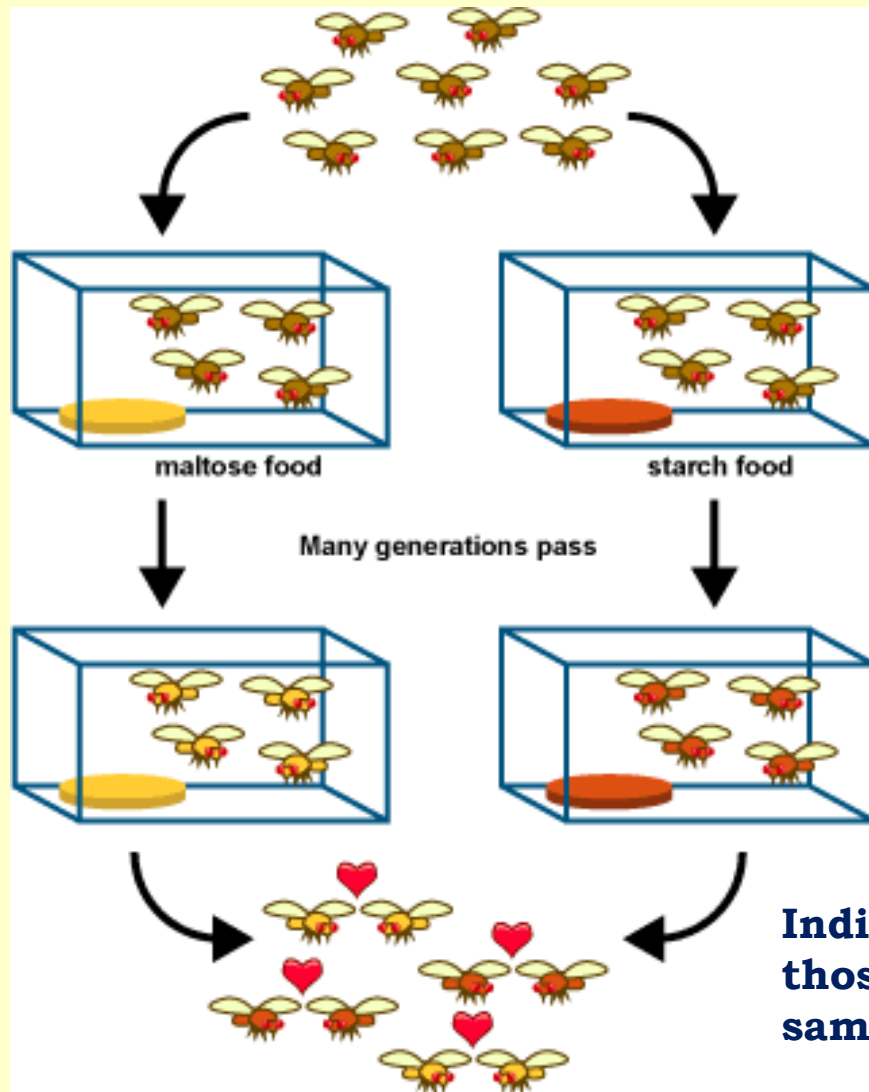
Natural selection

Two Populations



Genetic drift

The Process of Speciation

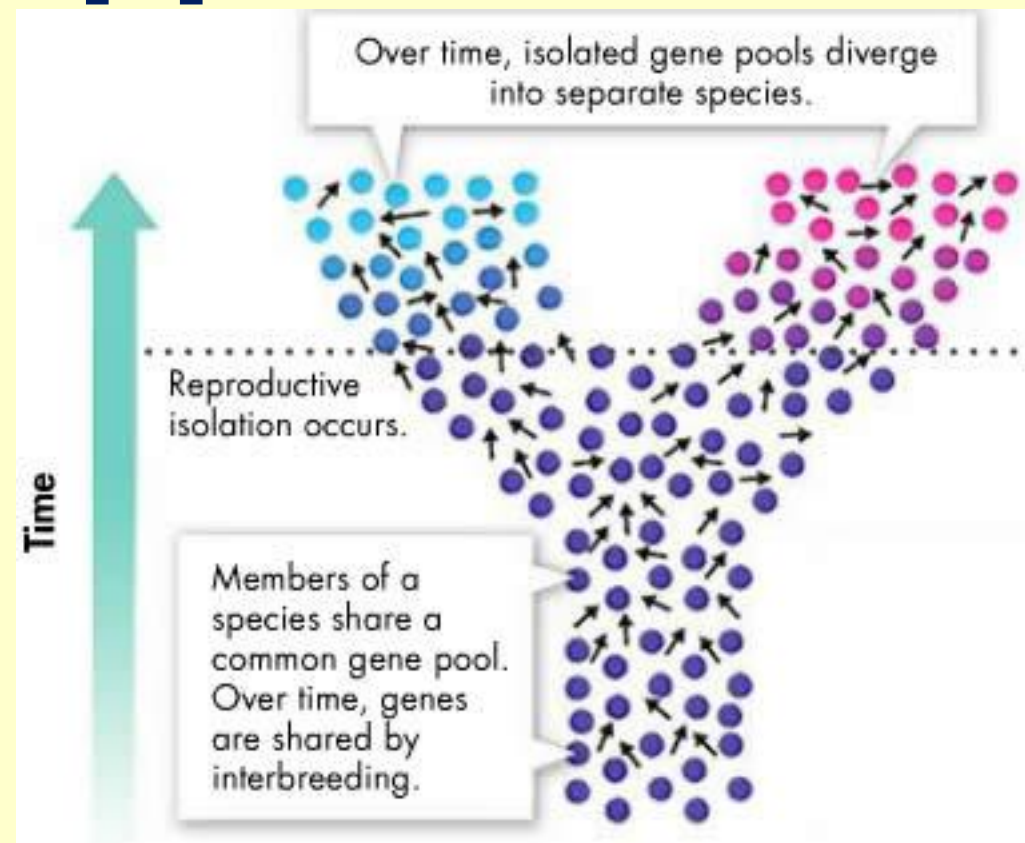


Speciation -
formation of new
species

Individuals no longer recognize
those that look different as the
same species

The Process of Speciation

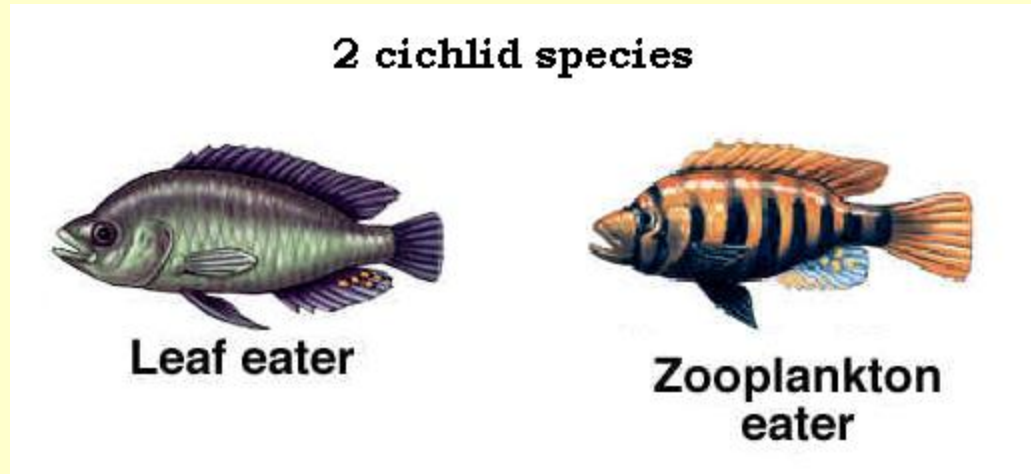
Gene pools must separate for two populations to become two different species



When new species evolve, populations become reproductively isolated from each other

The Process of Speciation

Reproductive Isolation



If changes make some individuals unable to reproduce with the rest of the population, **reproductive isolation** has occurred.

Reproductive isolation
- two populations
cannot interbreed and
produce fertile
offspring

The Process of Speciation

Reproductive isolation may occur if one of these happen.

1. Behavioral Isolation

2. Geographic Isolation

3. Temporal Isolation

The Process of Speciation

Behavioral isolation - 2 populations can interbreed but different reproductive strategies prevent it



Involves differences in courtship behaviors



12 species of fiddler crabs in Panama can be identified by how they wave their pinchers.

The Process of Speciation



© Dan Sudia, Photo Researchers

Behavioral isolation also includes being able to recognize characteristics that are specific to your species.

The Process of Speciation

Geographic isolation - 2 populations are separated by geographic barrier

Geographic barriers do not guarantee that new species will form

If land changes, 2 groups may find themselves back together before speciation occurs



Abert's Squirrel



Kaibab Squirrel



The Process of Speciation

Temporal isolation - 2 populations reproduce at different times



Rana aurora



Rana boylii

If organisms reproduce at different times, they will never reproduce with each other

Rana aurora breeds from **January to early March** – ***Rana boylii*** breeds from **late March to May**. Even if they were different forms of the same species, they would never reproduce.

The Process of Speciation

Speciation in Darwin's Finches



Basic mechanisms for evolution are observed today in nature

Natural selection is seen in Galapagos finches

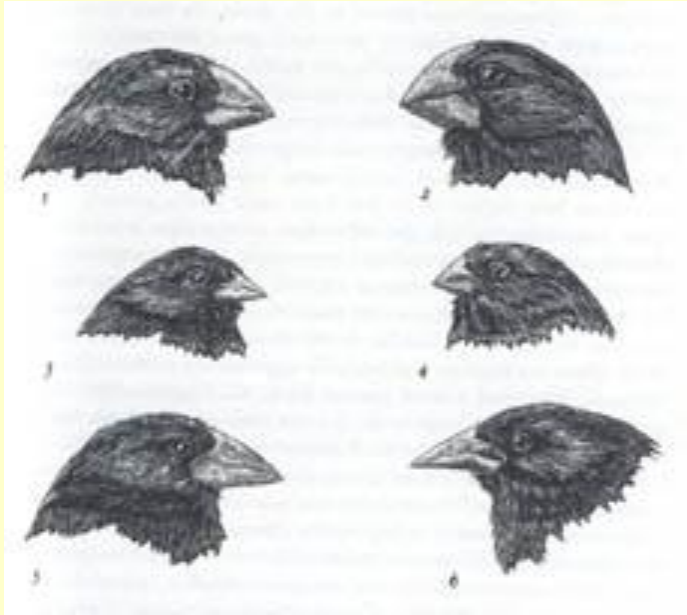
Peter and Rosemary Grant studied medium ground finches for over twenty years

They tested two hypotheses: one involving *variation* and one involving *natural selection*

The Process of Speciation

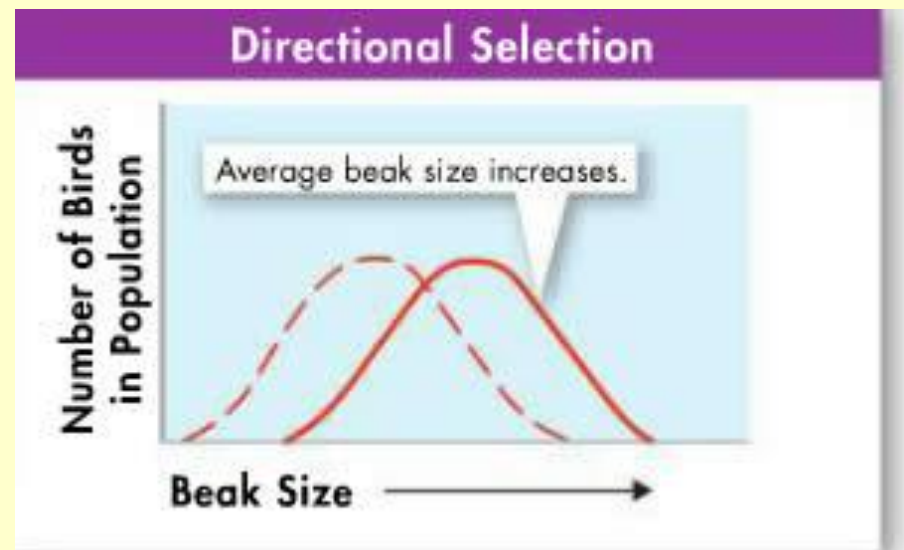
Speciation in Darwin's Finches

Variation



The Grants tested beak lengths in finches

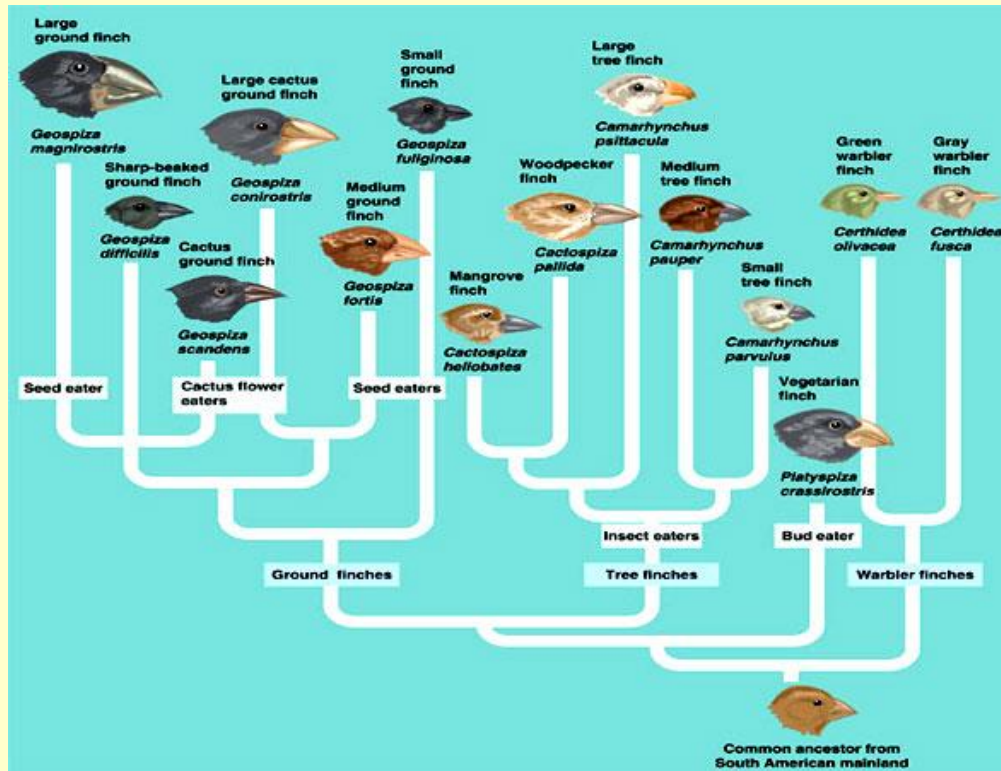
They found bell-shaped curves for beak size (variations in length)



The Process of Speciation

Speciation in Darwin's Finches

Natural Selection



**They tested whether
beak features made
any difference to
survival**

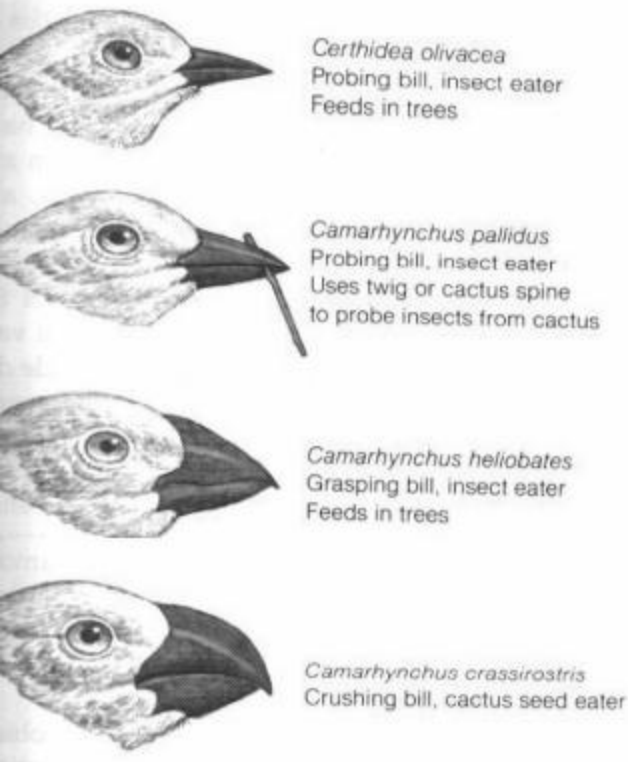
The Process of Speciation

Speciation in Darwin's Finches

Natural Selection

With plenty of rainfall (and therefore food) beak features made little difference on survival

During dry seasons (and little food) birds became feeding specialists



- Beak length and shape were used to feed on food for which beak was designed
- Small beaks couldn't compete with larger beaks during food shortage
- Larger beaks could eat anything; smaller beaks could not

The Process of Speciation

Speciation in Darwin's Finches

Natural Selection

Grant's found that average beak size increased dramatically over time



**original finches
with small beaks**

**20 years later –
finches with
larger beaks**

The Process of Speciation

Speciation in Darwin's Finches

1. Founders Arrive



A few finches flew or were blown off course to islands from mainland

Because they do not normally fly over open water, they probably got lost

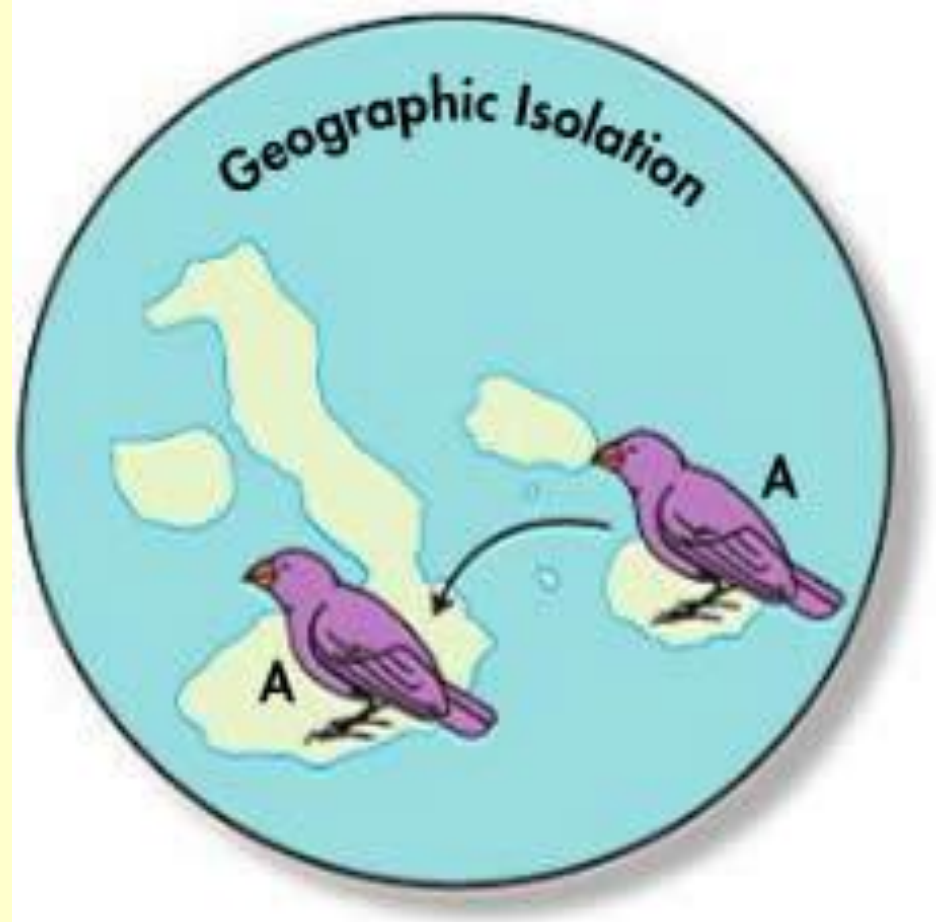
The Process of Speciation

Speciation in Darwin's Finches

2. Geographic Isolation

Birds landing on different islands remained isolated because they do not fly over open water

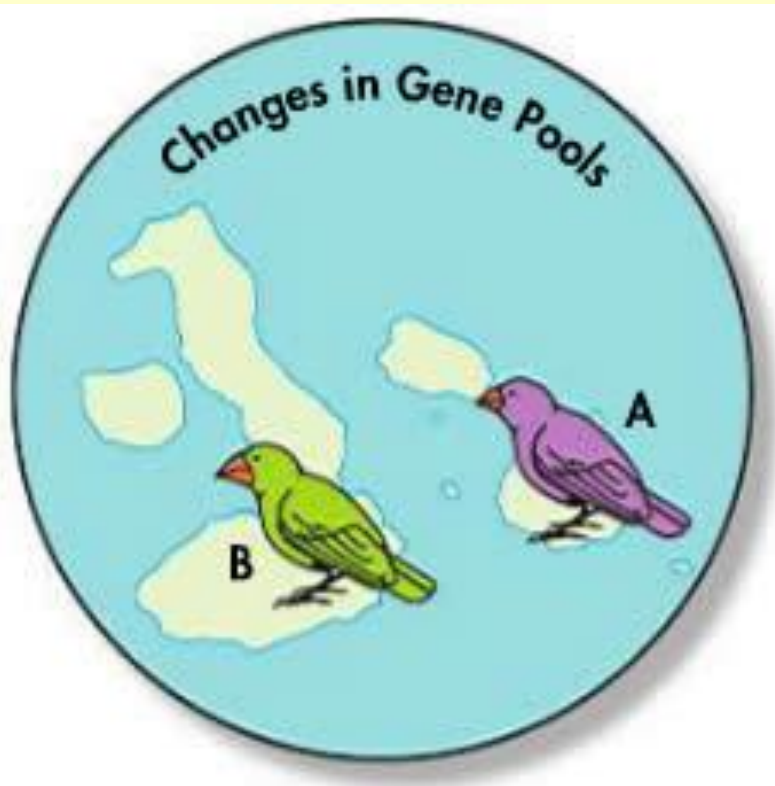
Because of small populations, they would have different gene pools from mainland population



The Process of Speciation

Speciation in Darwin's Finches

3. Changes in the Gene Pool



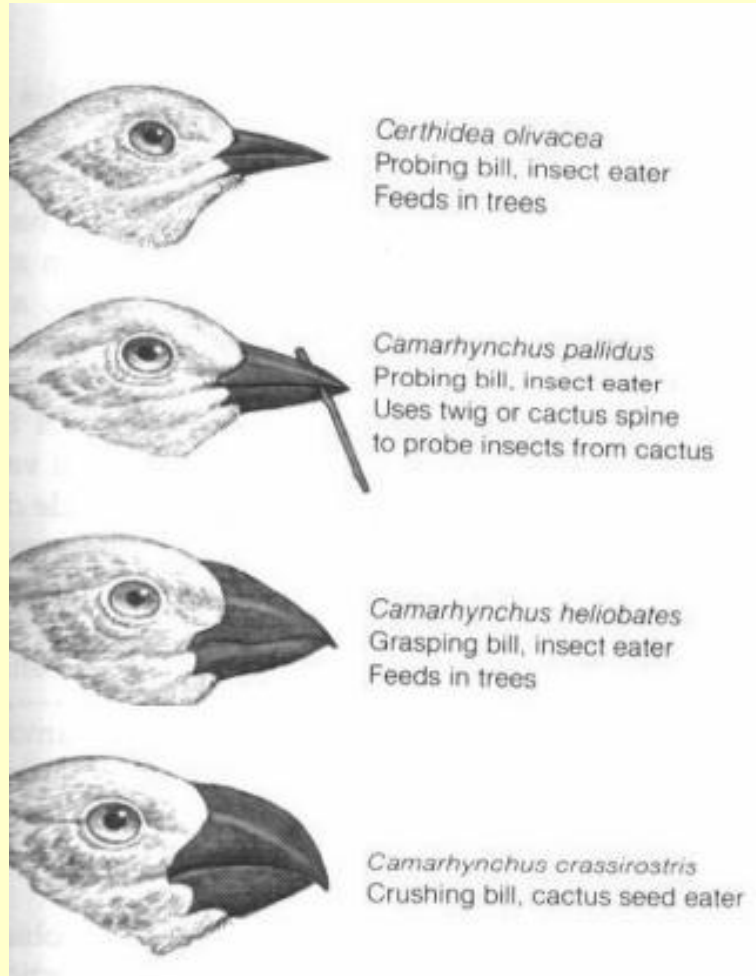
**Local populations
adapted to local
conditions**

**(directional selection
changed beak sizes &
shapes)**

The Process of Speciation

Speciation in Darwin's Finches

3. Changes in the Gene Pool (continued)



If island's food required short, thin beaks, then short, thin beaks were selected

If another island's food required larger, thicker beaks, then larger, thicker beaks were selected

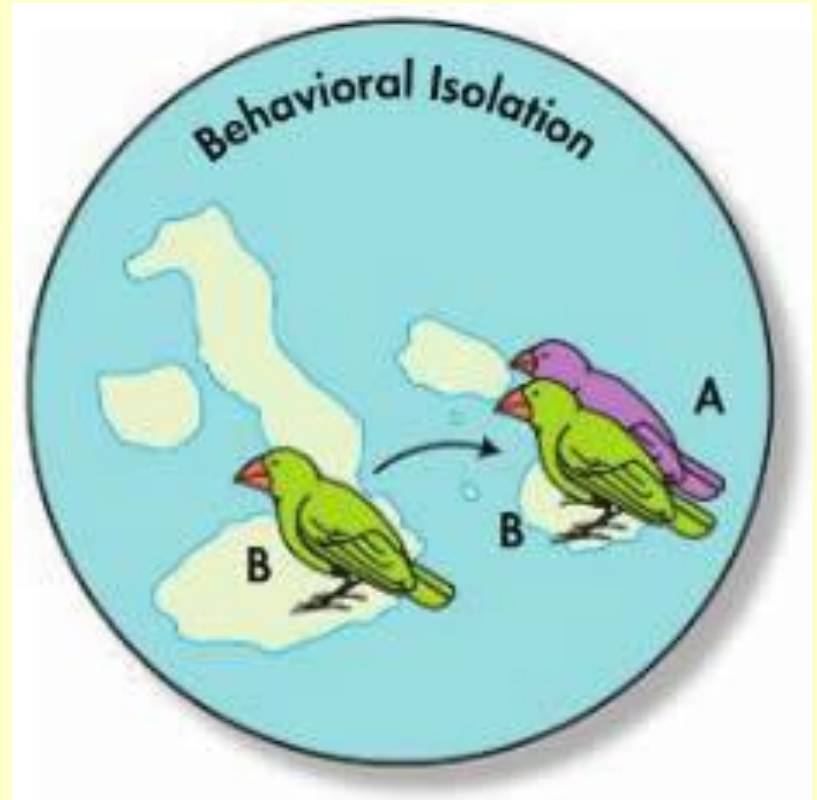
The Process of Speciation

Speciation in Darwin's Finches

4. Reproductive/Behavioral Isolation

With enough differences between two populations, they would no longer mate with each other

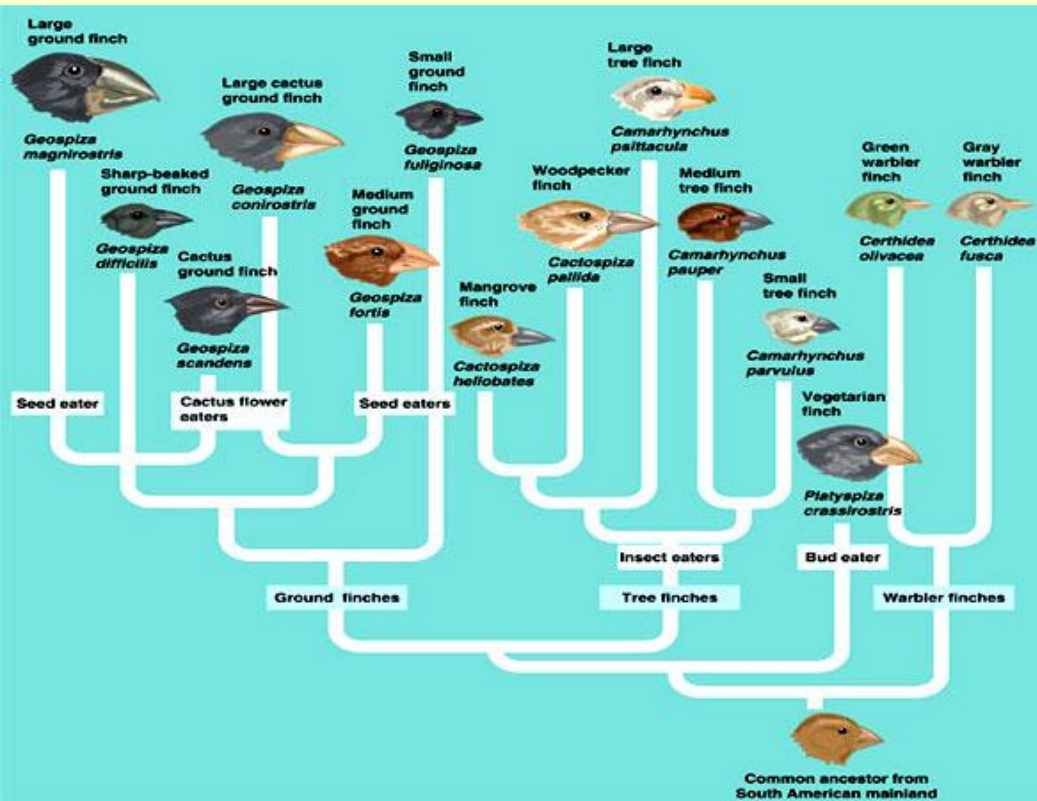
Finches pick mates based on beak size, therefore, finches with different beak sizes would not mate



The Process of Speciation

Speciation in Darwin's Finches

4. Reproductive/Behavioral Isolation (cont.)



Finches pick mates based on beak size, therefore, finches with different beak sizes would not mate

Result was reproductive isolation between two populations

The Process of Speciation

Speciation in Darwin's Finches

5. Ecological Competition



Two species on the same island, resulting from reproductive isolation, compete for food

With a lot of food (during the wet season), both species could survive and have no reason to change

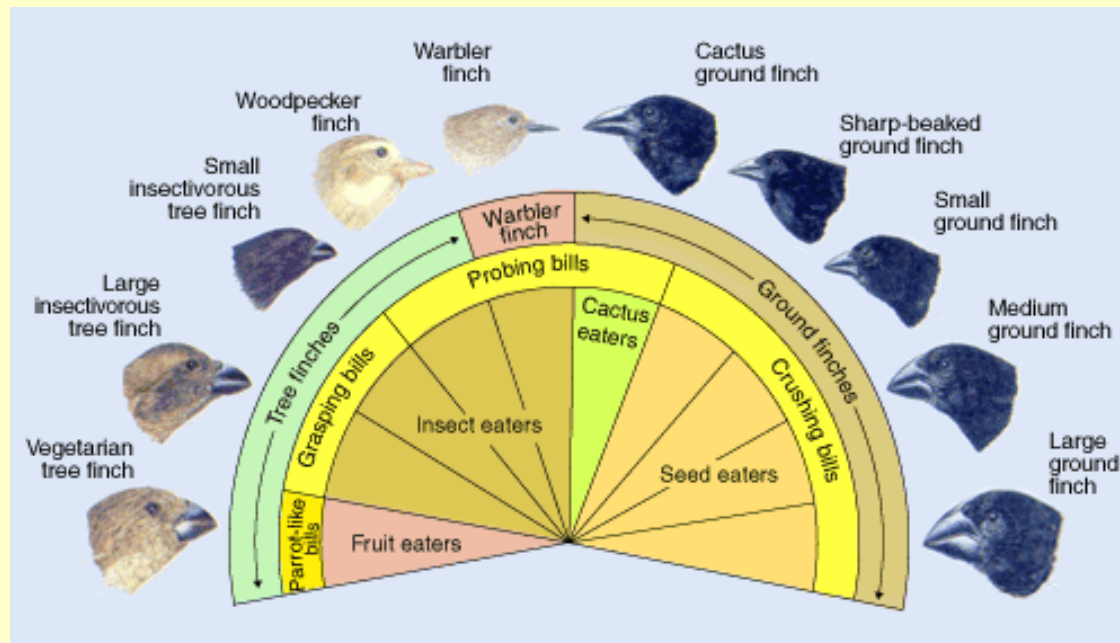
With little food (during the dry season), both species would become even more specialized

The Process of Speciation

Speciation in Darwin's Finches

5. Ecological Competition (continued)

Short, thin beaked finches with the greatest fitness would best be able to eat food with their beaks



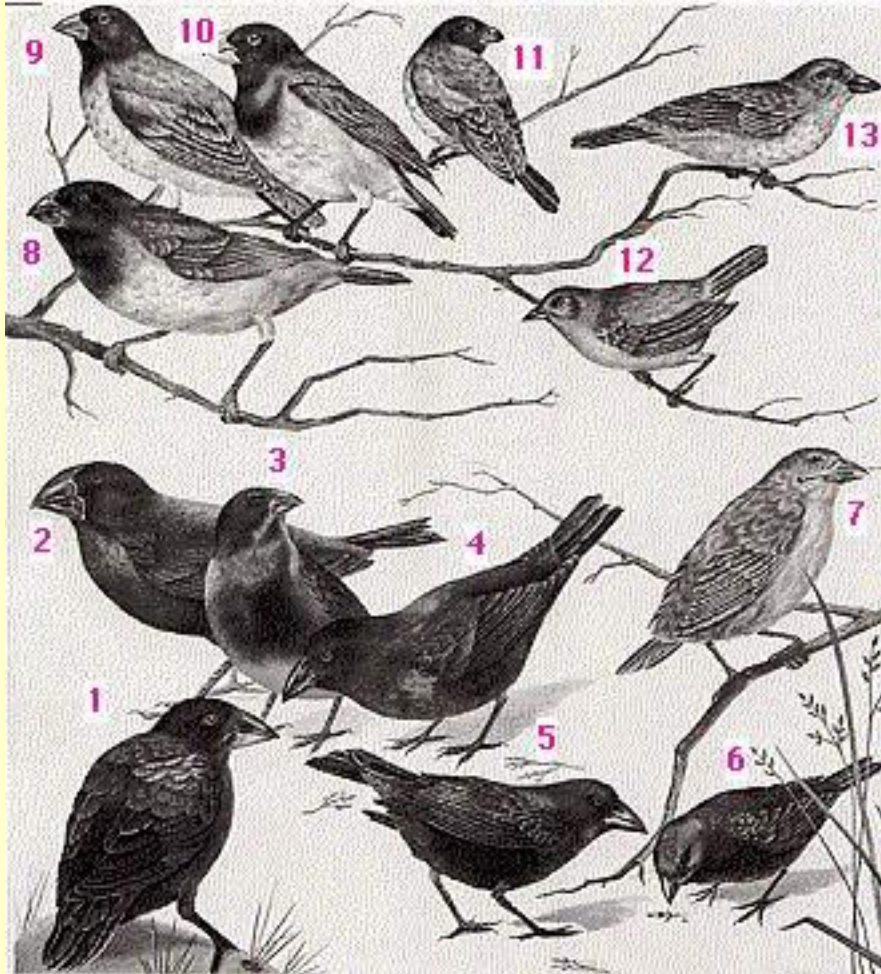
Long, thick beaked finches with the greatest fitness would best be able to eat food with their beaks

Thus, both populations would become even more different as beaks became more specialized

The Process of Speciation

Speciation in Darwin's Finches

6. Continued Evolution



Processes described above occurring over thousands of years produced 13 finch species

Number of species on an island depends on the number of different types of food present