

# Learning Outcomes



- A species is a group of organisms **able to interbreed to form fertile offspring.**
- The process of speciation involves
  1. Separation of a population that stops breeding.
  2. Two populations subjected to different selection pressures.
  3. Different mutations occurring in different populations to give new characteristics (alleles).
  4. Natural selection favouring different characteristics (alleles) in both populations.
  5. Characteristics (alleles) of populations changing over time.
  6. Two species have been formed if when the barrier to breeding is removed no fertile offspring are produced.

## Species

A **species** is a group of organisms that are able to **interbreed** to produce **fertile offspring**.



Members of **different species** are unable to interbreed to produce fertile offspring.

**T**hese offspring cannot breed to create fertile offspring.

mule



liger

“pozee”



# SPECIATION

1. **Large freely interbreeding population** of one species who have the same gene pool.



2. **Isolation by barrier** (geographical, ecological or reproductive) interrupts the gene flow.

Population A



Population B



Geographical

Ecological

Reproductive



3. **Mutations** occur at random. This results in **new variations** arising within each group which is **not shared**

Population A

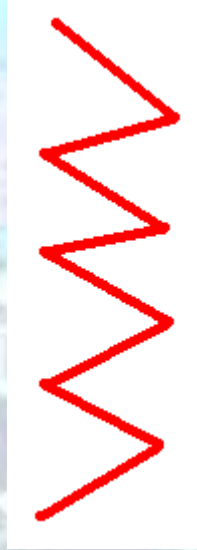


Dry warm environment

Mutations causing:

1. a thinner sandy coat
2. Large ears will help the fox to cool

Will help this group survive



Population B



Cold snowy environment

Mutations causing:

1. a thicker paler coat
2. smaller ears that radiate less heat

will help this group survive

4. Different **selection pressures** (climate, food, predation) act on each population and **Natural Selection** takes it's course

over a **very long period of time** the gene pools of the 2 sub-groups are so **genetically distinct** and isolated.

Population  
suited to  
environment A



Population  
suited to  
environment B





6. If the barrier was removed, they are no longer able to interbreed.  
**Speciation** has occurred

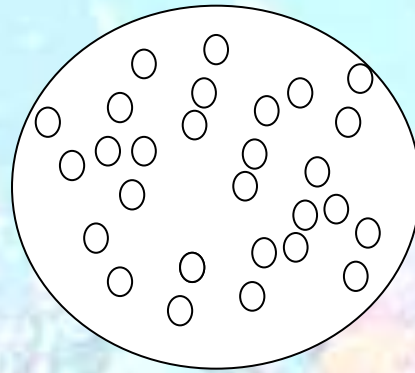


# SPECIATION - copy

1. large interbreeding population of the same species that share the same gene pool
2. population becomes split and isolated into two sub-populations by a **barrier** which **interrupts the gene flow**
3. **mutations** occur at random. This results in **new variations** arising within each group which is **not shared**

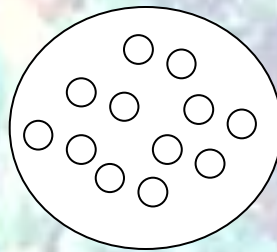
4. different **selection pressures** (climate, food, predation) act on each population and **Natural Selection** takes it's course
5. **over a very long period of time** the gene pools of the 2 sub-groups are so genetically distinct and isolated.
6. If the barrier was removed, they are no longer able to interbreed.  
**Speciation** has occurred

# Speciation

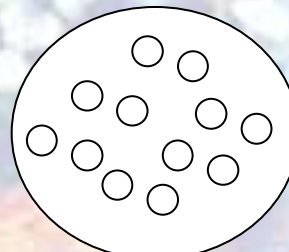


Species X forms one large inter-breeding population that share the **same gene pool**

Isolated by barrier



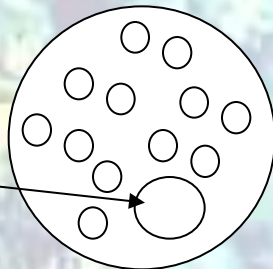
Population A



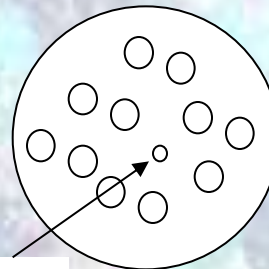
Population B

**Species separated by barrier** into two sub-populations e.g. A and B which **interrupts the gene flow**

Mutations occur at random



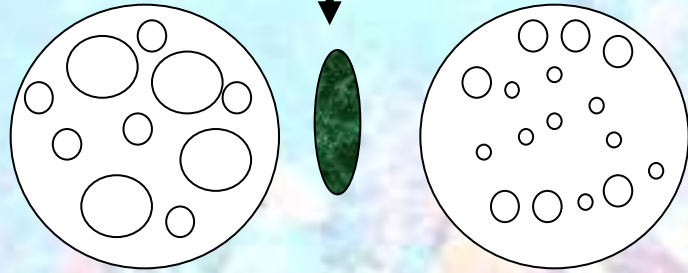
Large mutant



Small mutant

This results in **new variations** arising within each group which are **not shared**

Natural Selection



different **selection pressures** (climate, food, predation) act on each population and **Natural Selection** takes it's course

Over a very, very, very long time

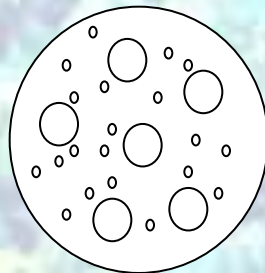


**over a very long period of time** the gene pools of the 2 sub-groups are so genetically distinct and isolated.

Species A

Barrier removed

Species B

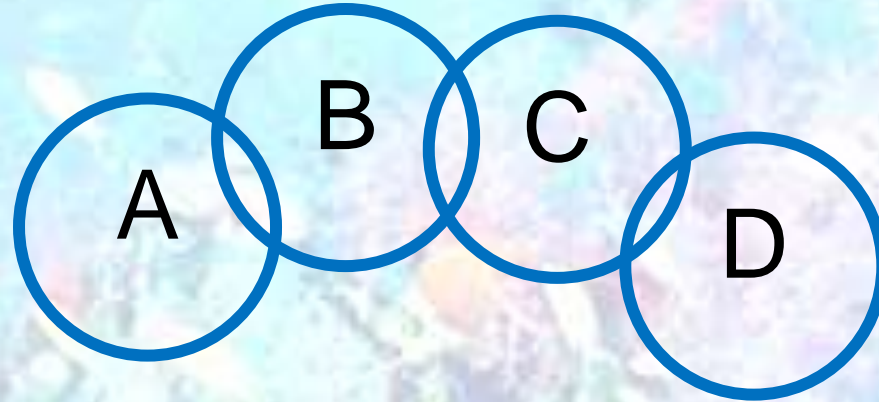


If the barrier was removed, populations A and B **cannot inter-breed** and **new species** have been formed

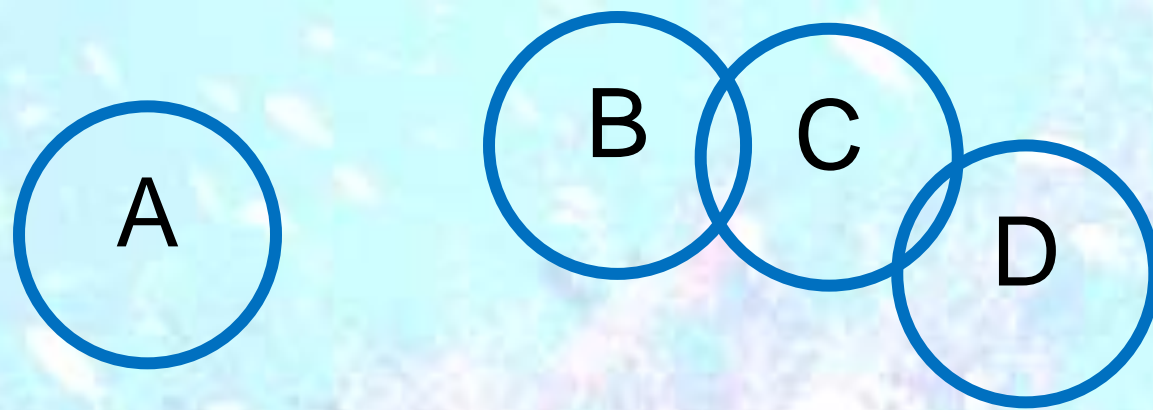
# Speciation Activity



# Interruption of Gene Flow



- These four population belong to the same species because each population can breed with it's immediate neighbour
- This allows genes to flow from A to B, B to C and C to D



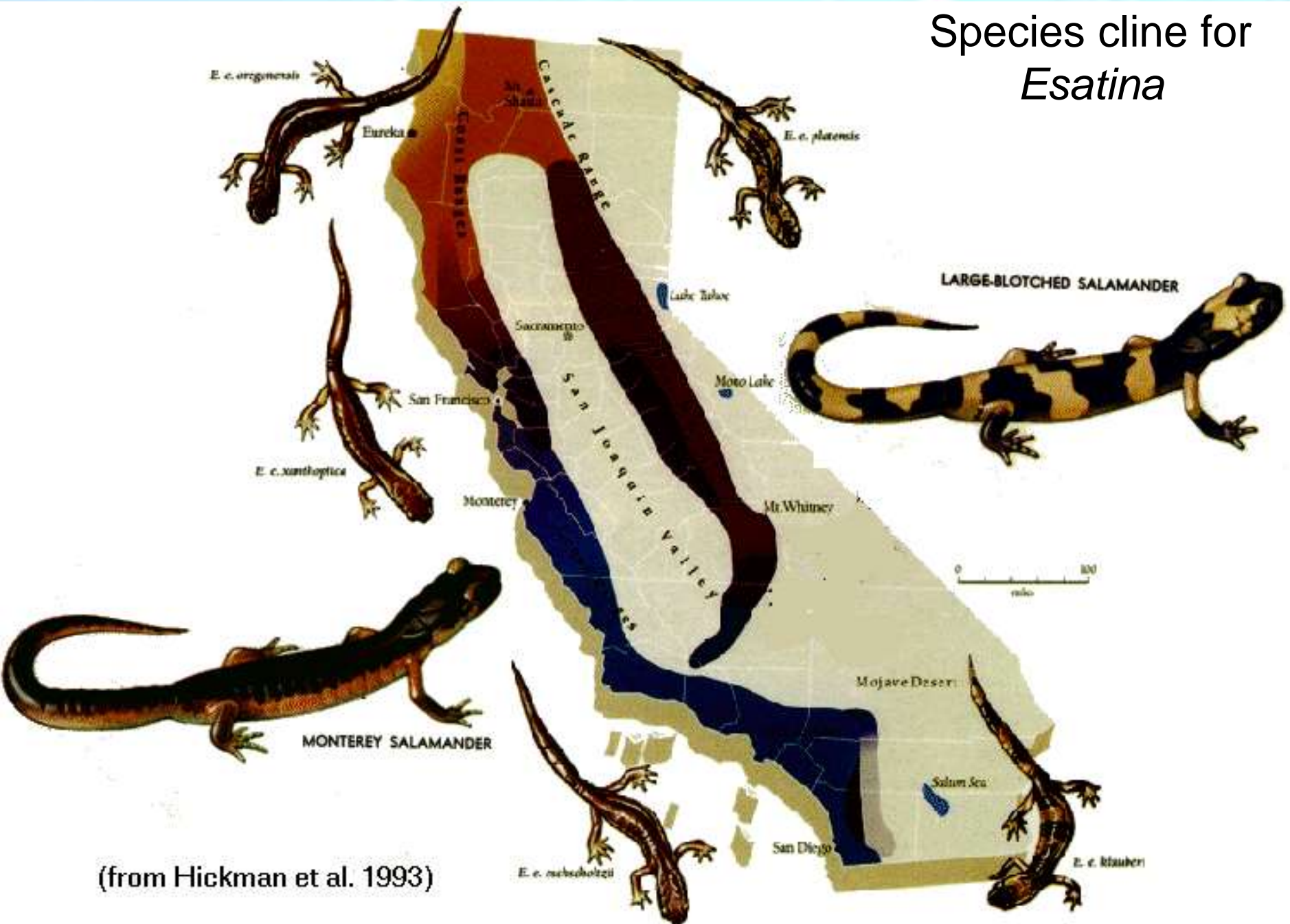
- In this diagram, there are 2 species.
- There has been an interruption to the gene flow ( by a barrier).
- Speciation has occurred and population A's gene pool is now genetically distinct and isolated to B, C and D.



# Speciation in Action

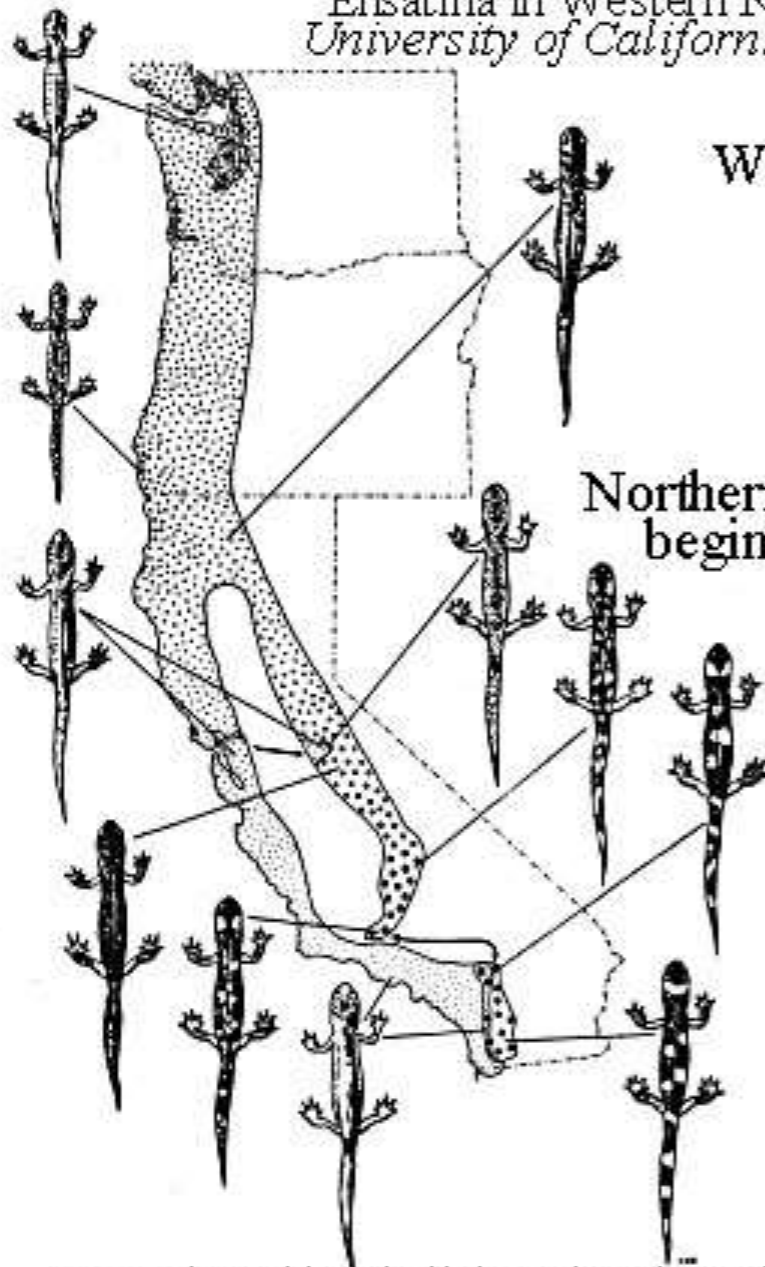


# Species cline for *Esatina*



(from Hickman et al. 1993)

Ensatina in Western North America, Stebbins, 1949.  
*University of California Publications in Zoology*, 48.



Washington and Oregon:  
single species.

Northern California: Differentiation  
begins as the population is split  
by the mountains.

Central California:  
Crossover area with  
interbreeding between  
the two forms.

Southern California:  
No interbreeding between  
the two forms observed.

Reproduced in Ehrlich and Holm, *The Process of Evolution*, 221.

# Continental drift creates barriers to inter breeding-



As a result of this over the last 320 million years Midlothian has really changed.

Selection pressures on the organisms that live here have really changed too!

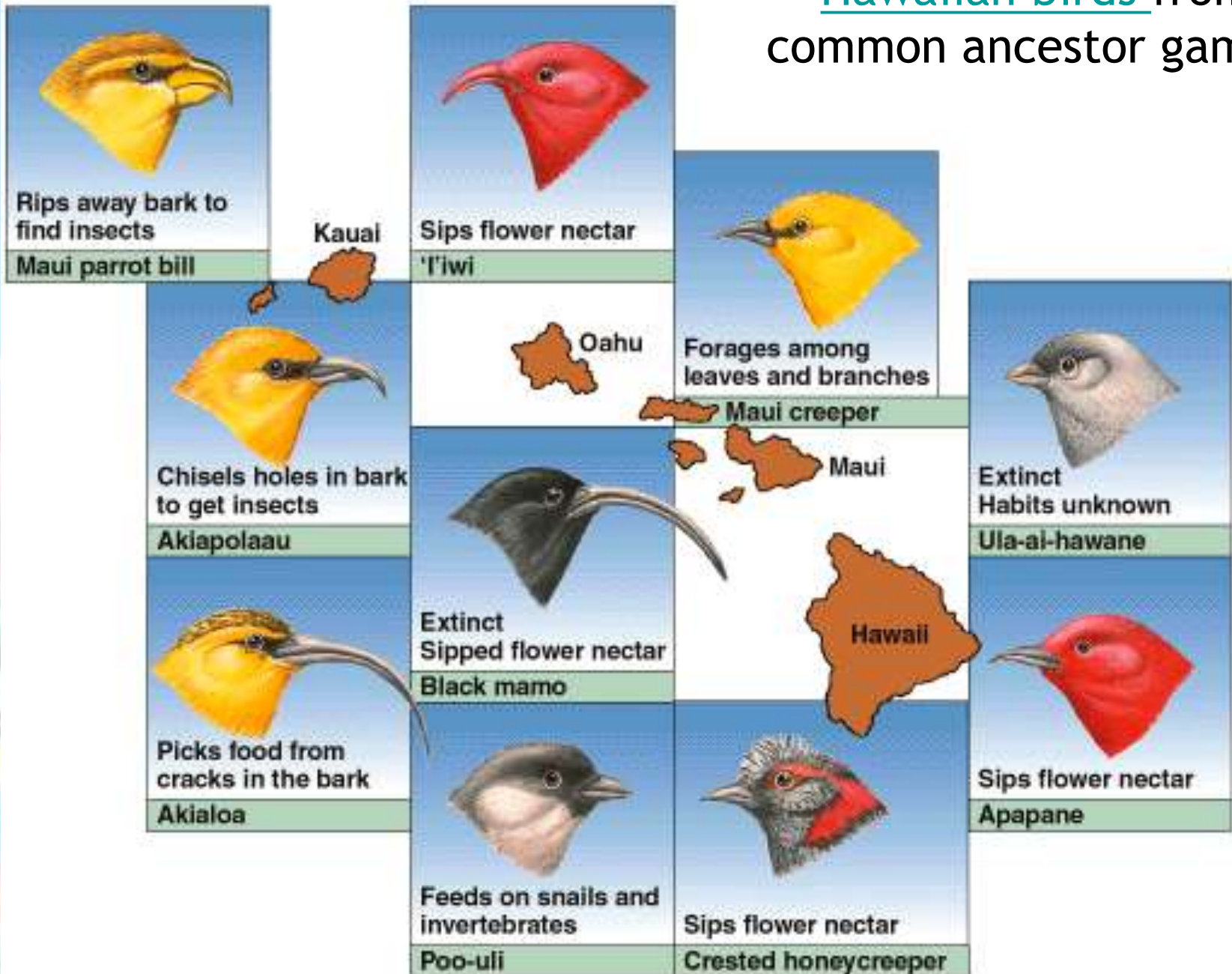
Equatorial Midlothian 320 Million Years Ago during the Carboniferous. These “Lepidedendron” trees formed the coal under the region!



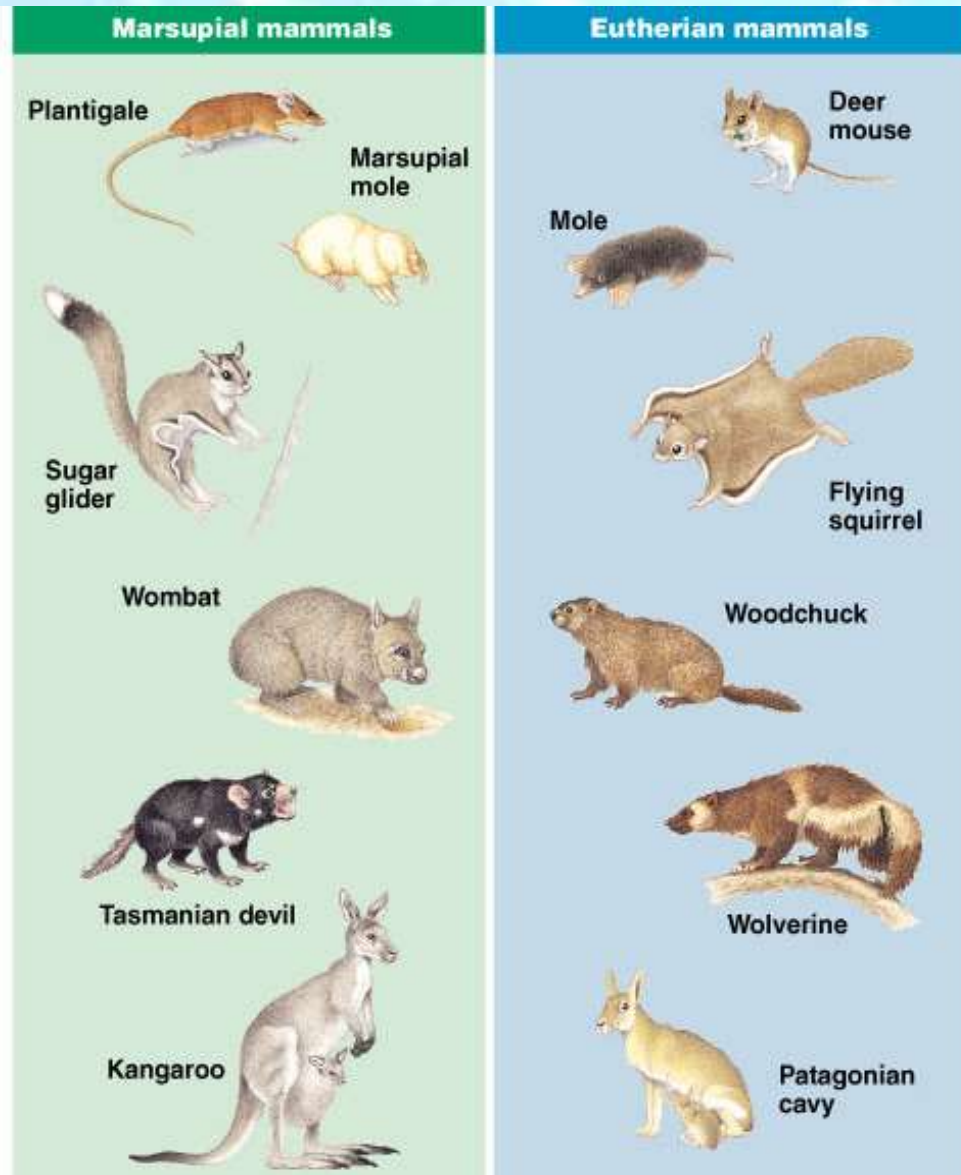
Midlothian about 15000 years ago.



Hawaiian birds from a common ancestor game.



Around 120 million years ago early in the development of placental mammals. The ancient landmass of Gondwana broke apart isolating one group of marsupials on the continental island of Australia.



In Australia the marsupials evolved into different species that filled all of the available “niches”. In the rest of the world the more competitive placentals took over these niches.

Introductions of more competitive placental animals to Australia by man have had disastrous consequences for the marsupials.

[Link to You tube clip of the Life of Mammals Part 1.](#)