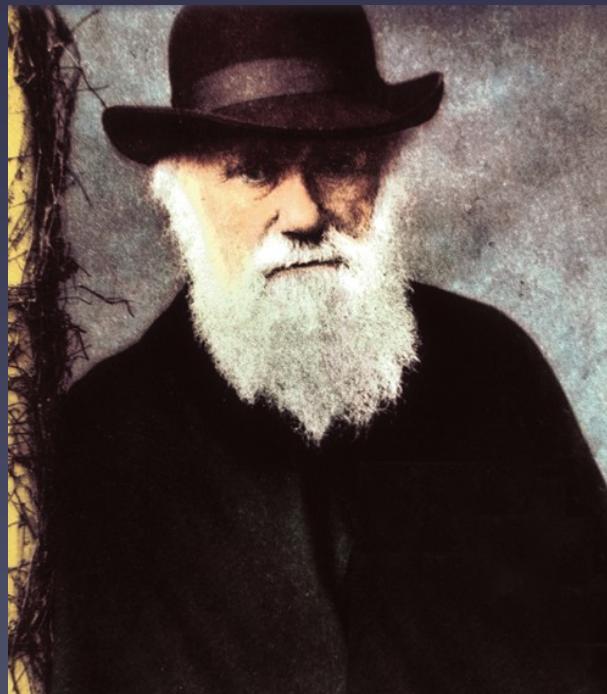
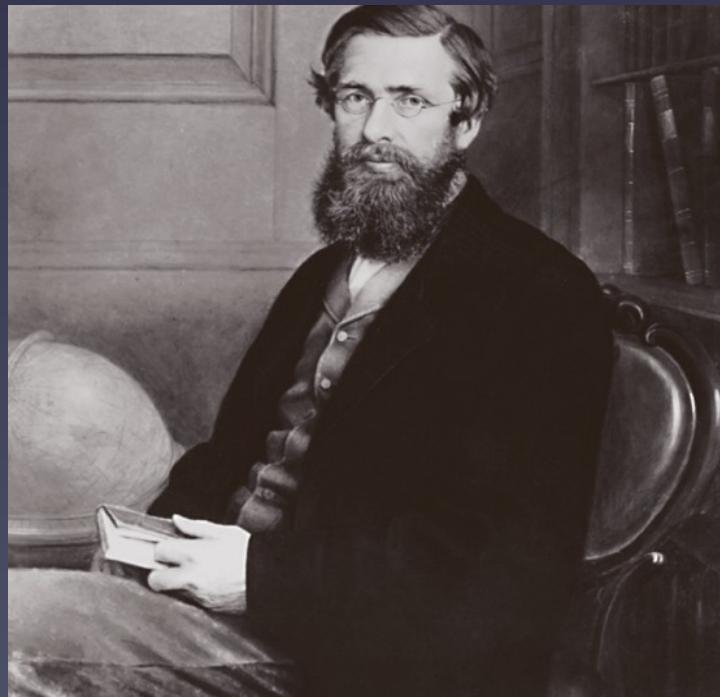


The theory of evolution by Natural Selection was proposed by Darwin and Wallace (1858)



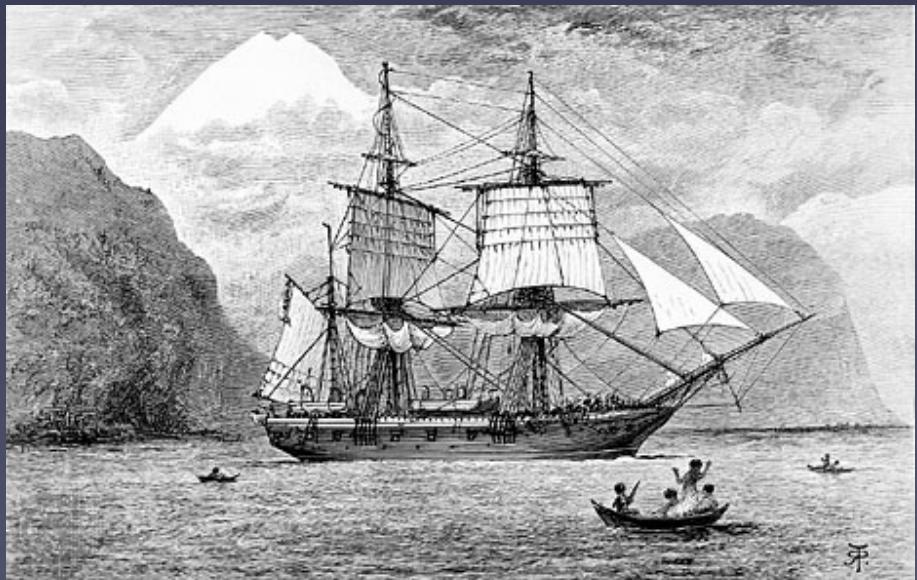
Charles Darwin (1809-1882)



Alfred Russel Wallace (1823-1913)

# Goals of Journey

- Map the Coast of S. America for trade routes
- Captain's (Fitzroy) secondary goals:
  - Make natural history collections
  - Start a mission(?)



From Darwin's 1890 *Journal of Researches*

# Darwin's travels

- HMS Beagle route (27 Dec. 1831- 2 Oct. 1836)



# The Galapagos Islands

- Darwin collected numerous specimens, and noted a great variety among giant tortoises and birds (e.g. Darwin's finches)

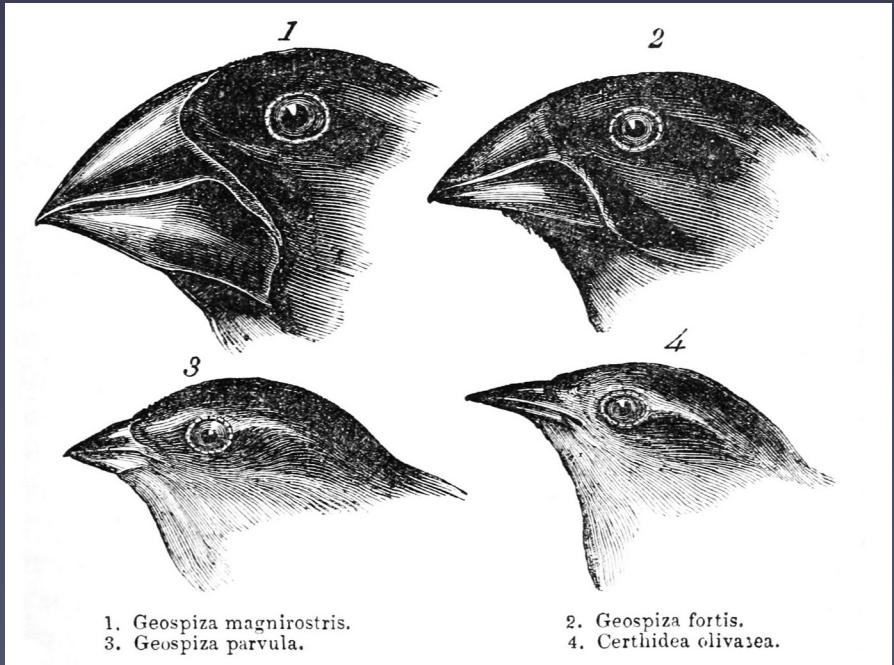


# The Galapagos Islands

- Species resembled those of the mainland, but had various adaptations

- Later realization:
  - All species came from small number of mainland spp. that diversified on islands

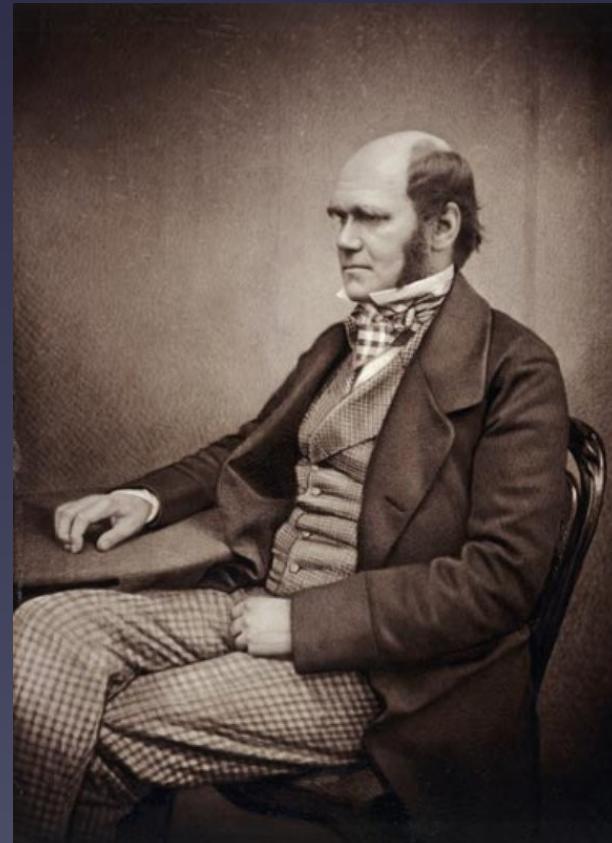
This is called an adaptive radiation



# Charles Darwin back home (1836-1858)

- Starts to organize his own notes and data
- Correspondence with animal breeders
- Outlines his theory in letters, keeps testing the idea

(Marries Emma Wedgwood 1839; Father dies 1848)

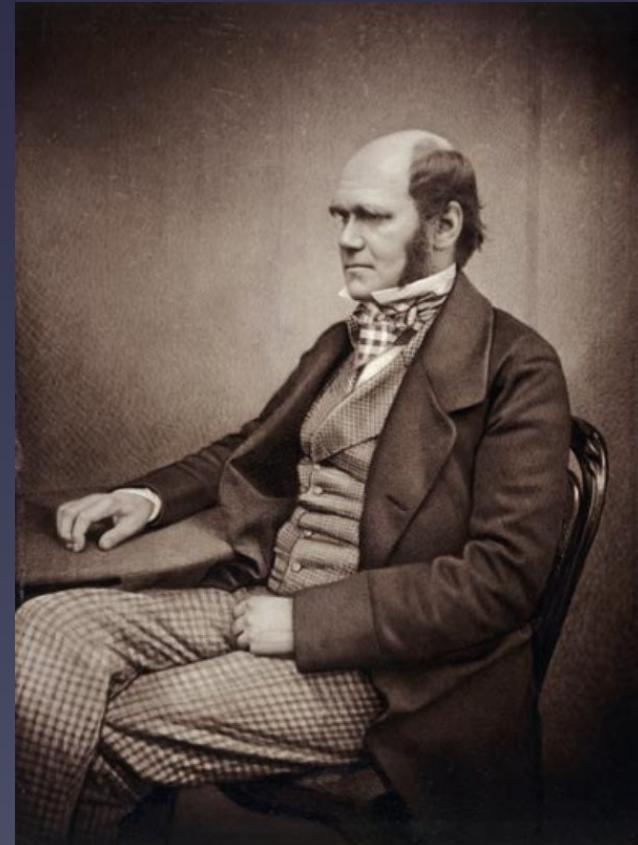


# Darwin back home (1836-1858)

- Starts to organize his own notes and data
- Correspondence with animal breeders
- Outlines his theory in letters, keeps testing the idea

(Marries Emma Wedgwood 1839; Father dies 1848)

- Then a letter arrives from Alfred Wallace in 1858



# What About Wallace? 1823-

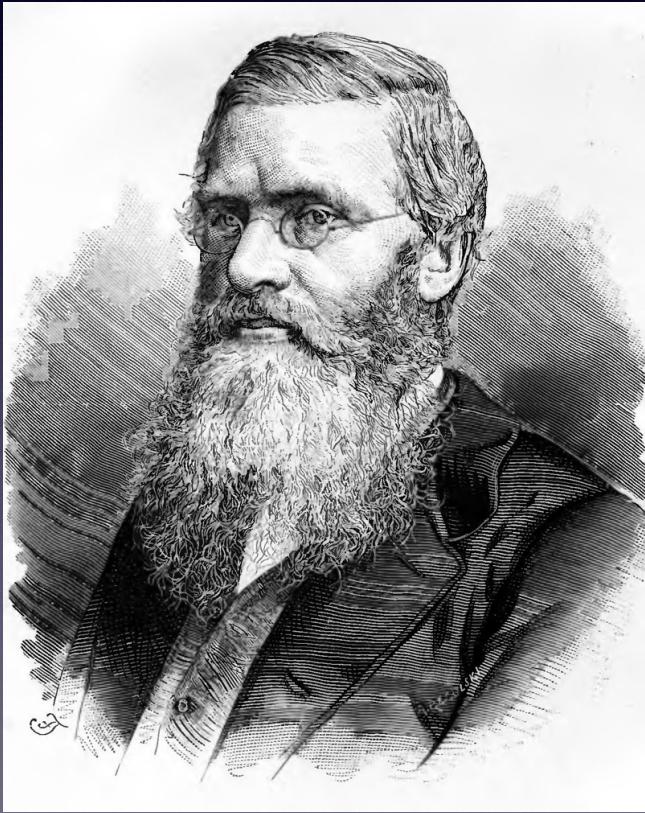


- Welsh, from poor family. Made a living collecting in South East Asia (e.g. Indonesia)

Video:

- <https://www.youtube.com/watch?v=u0-BxHWtGNQ&t=303s>

# Alfred Russell Wallace

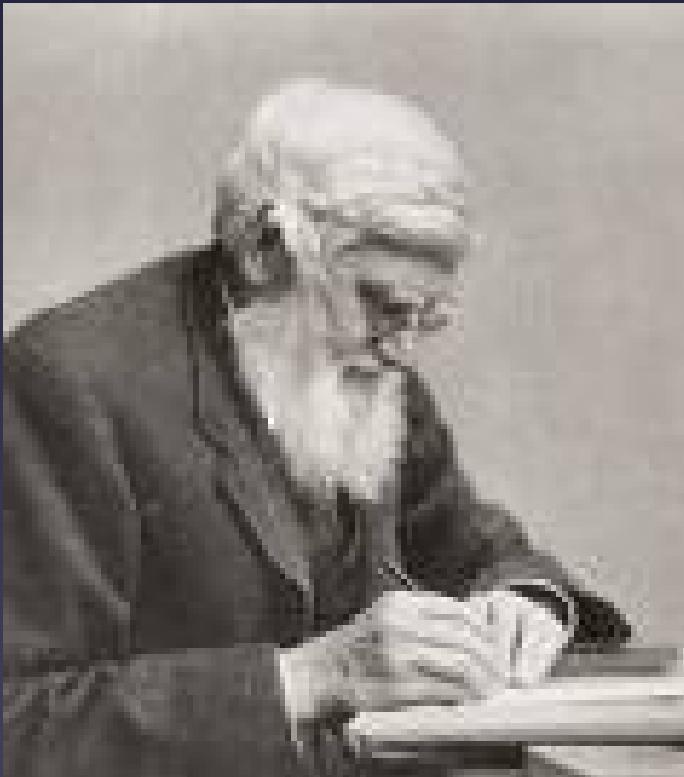


Letter explained natural selection in slightly different terms (Darwin's account is similar but a bit more accurate)

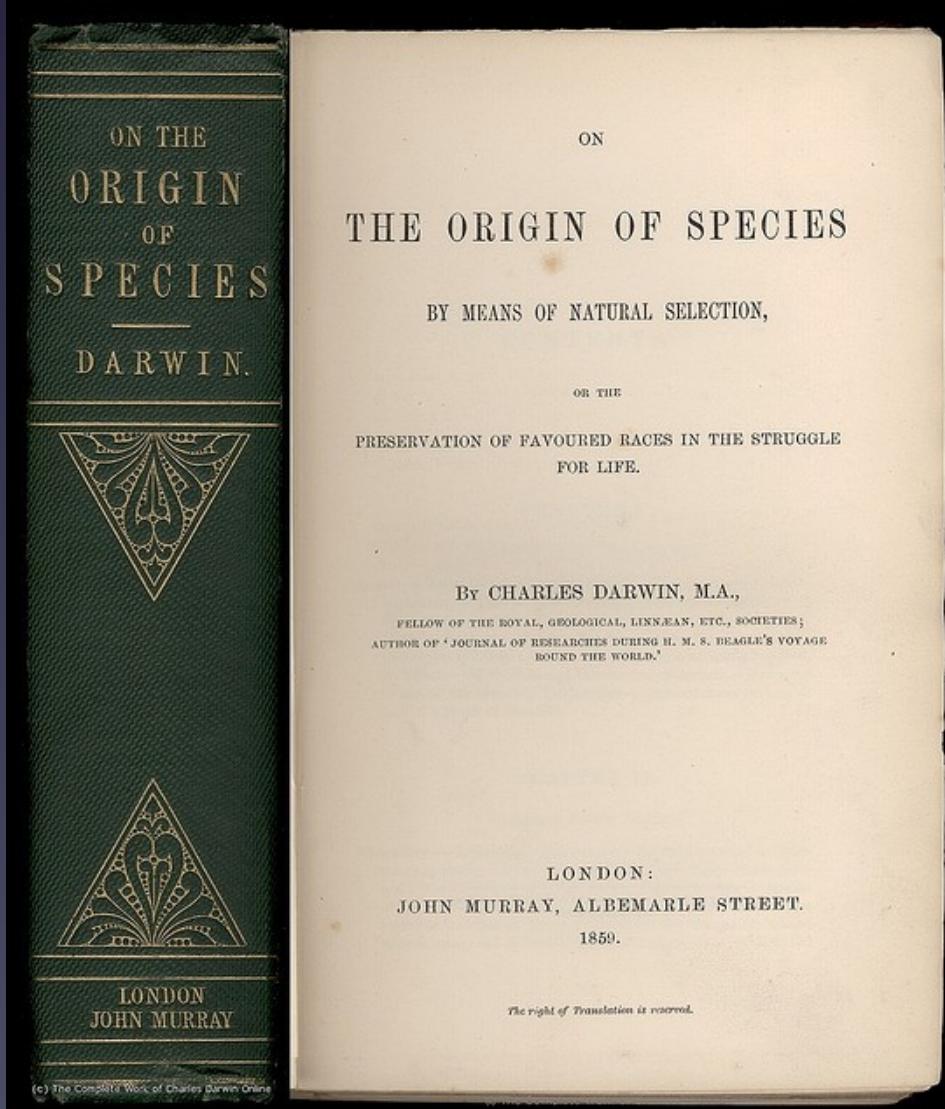
# Darwin & Wallace

- Linnean Society of London in 1858
- Natural Selection as Mechanism of Evolutionary Change resulting in adaptation



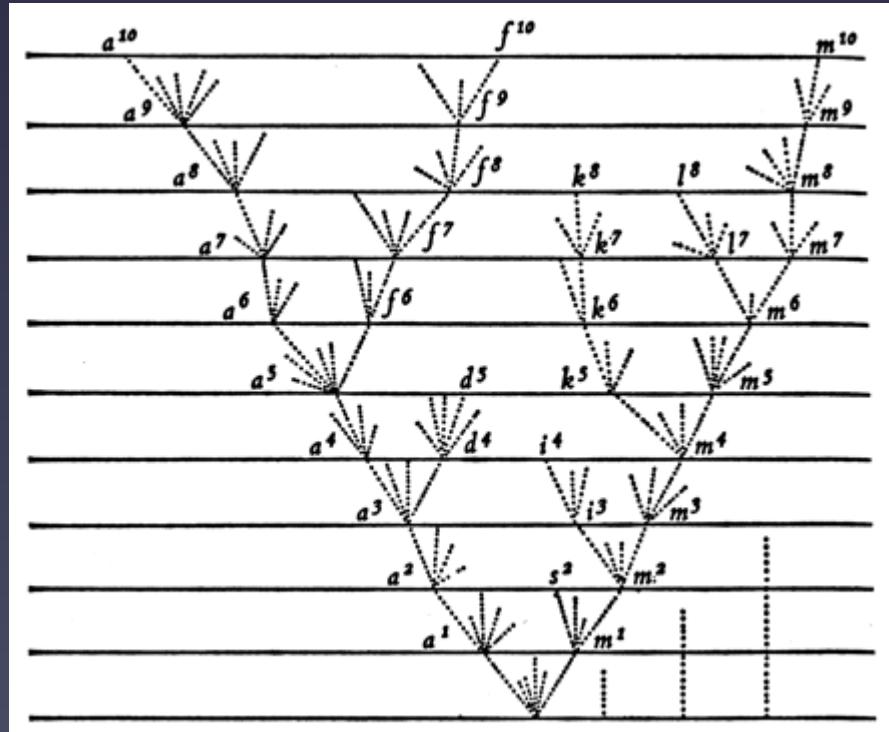


*On the Origin of Species by  
Means of Natural Selection  
(1859)*



# Theory of Natural Selection

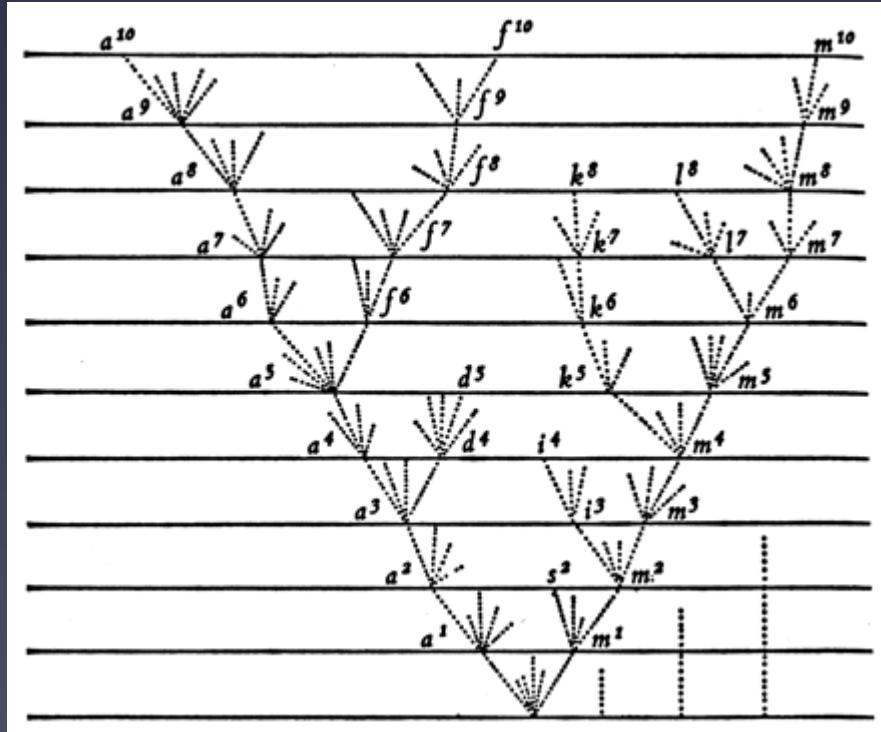
- **Observation 1.** Populations show heritable variation.
- **Observation 2.** All species have the potential for exponential growth. But the environment usually cannot support this; many individuals fail to reproduce
- **Inference 1.** Some variants are favored over others by nature
- **Inference 2.** There is an accumulation of favorable traits over time - adaptation



# Darwin-Wallace Theory of Natural Selection

- You need three main components:
  - Variation in traits
  - Heritability of traits
  - Selection results from differential reproductive success

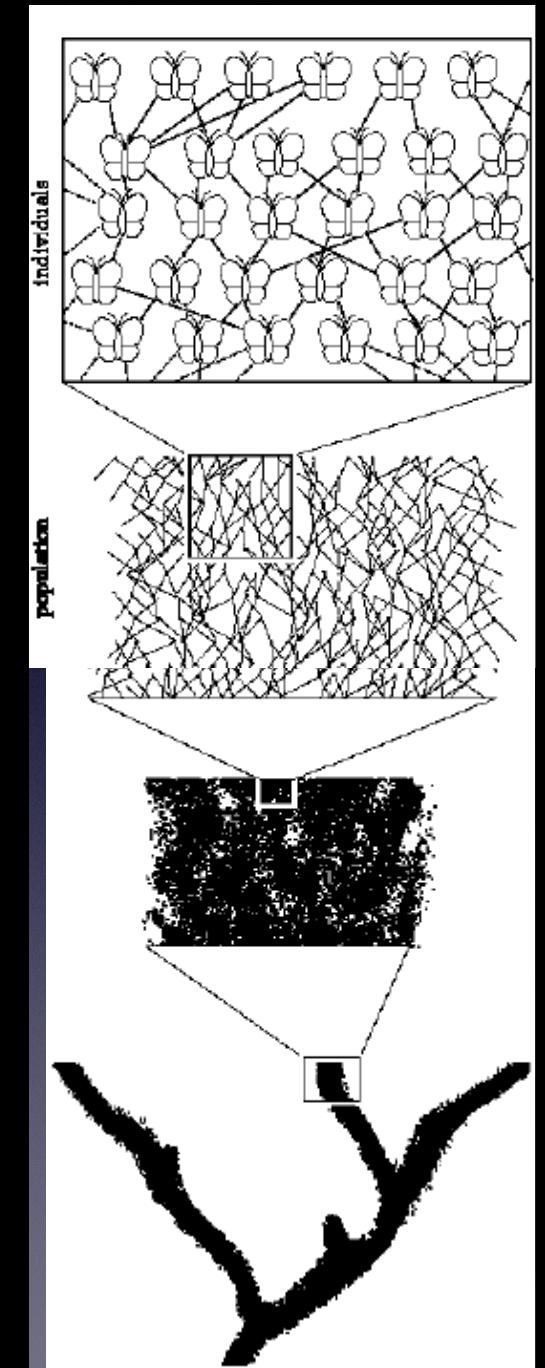
We say that individuals with higher reproductive success have higher biological fitness (relative fitness)



# Evolution: descent with modification

Individuals do not  
evolve

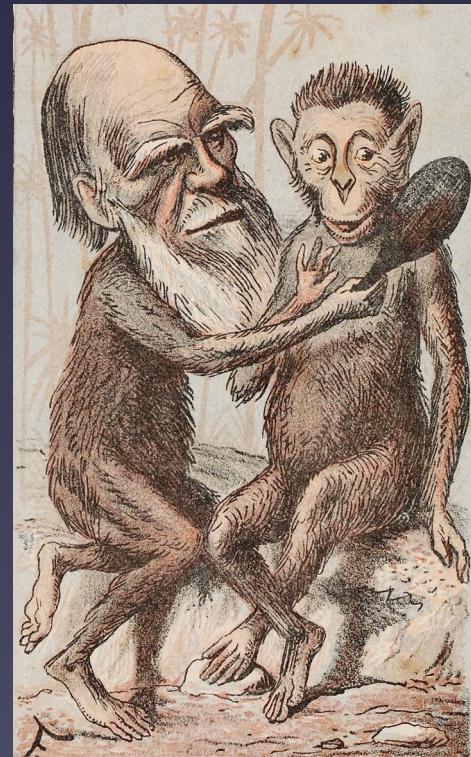
It is the  
population that  
evolves over time



# Darwin on human evolution

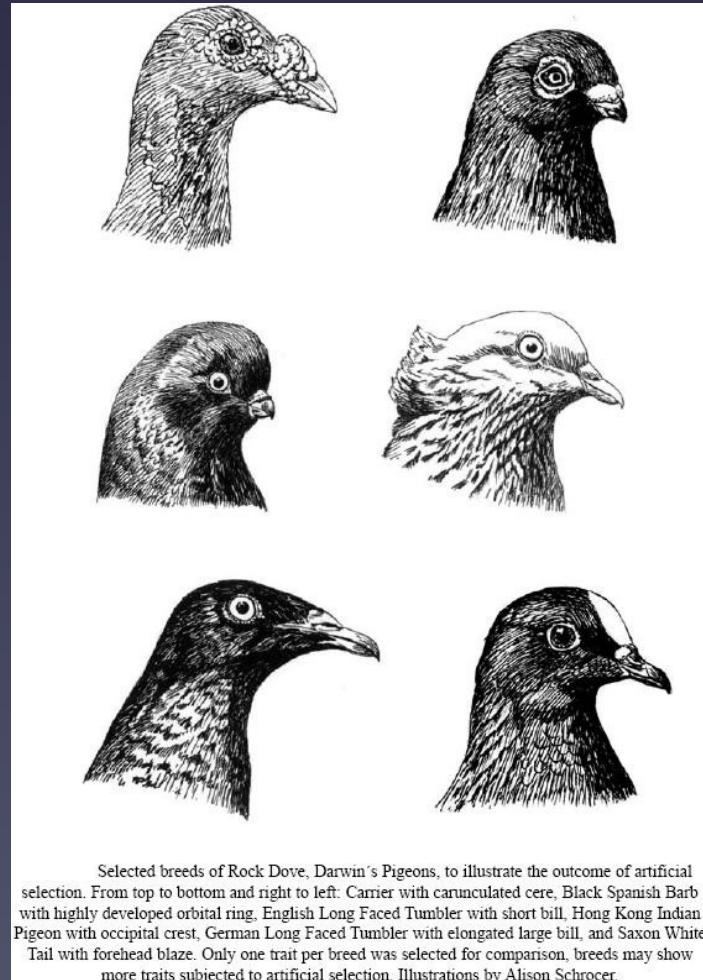
- Natural selection led to evolution of *Homo sapiens*
- Sexual selection important in humans too
- Suggested our closest relatives are African apes

“It is, therefore, probable that Africa was formerly inhabited by extinct apes closely allied to the gorilla and chimpanzee; and as these two species are now man's nearest allies, it is somewhat more probable that our early progenitors lived on the African continent than elsewhere. “



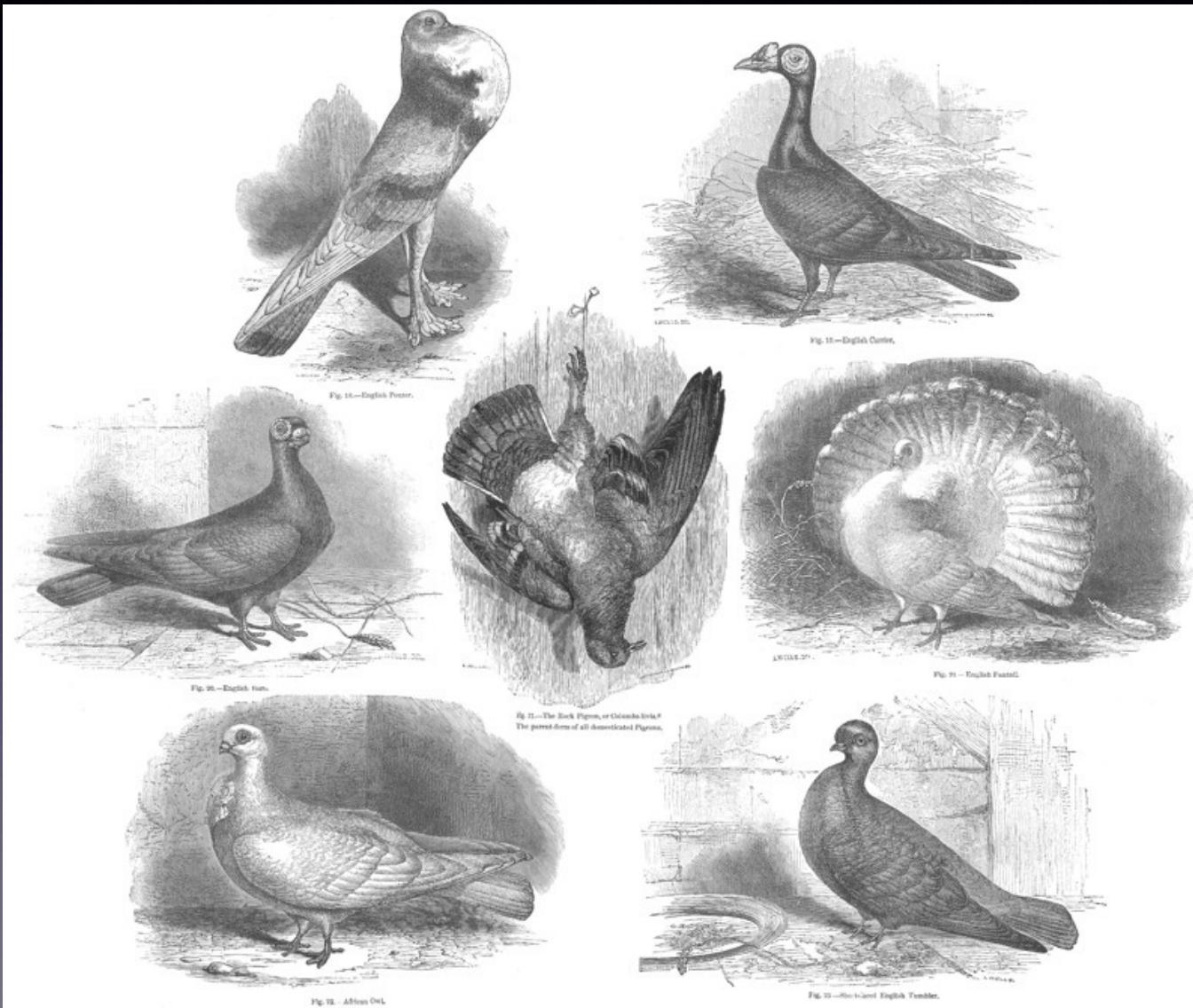
# Darwin-Wallace Theory of Natural Selection : Evidence

- Biogeography of closely related spp.
- Fossils
- Embryology – homologies, vestigial organs
- Also, Darwin emphasized similarities to artificial selection

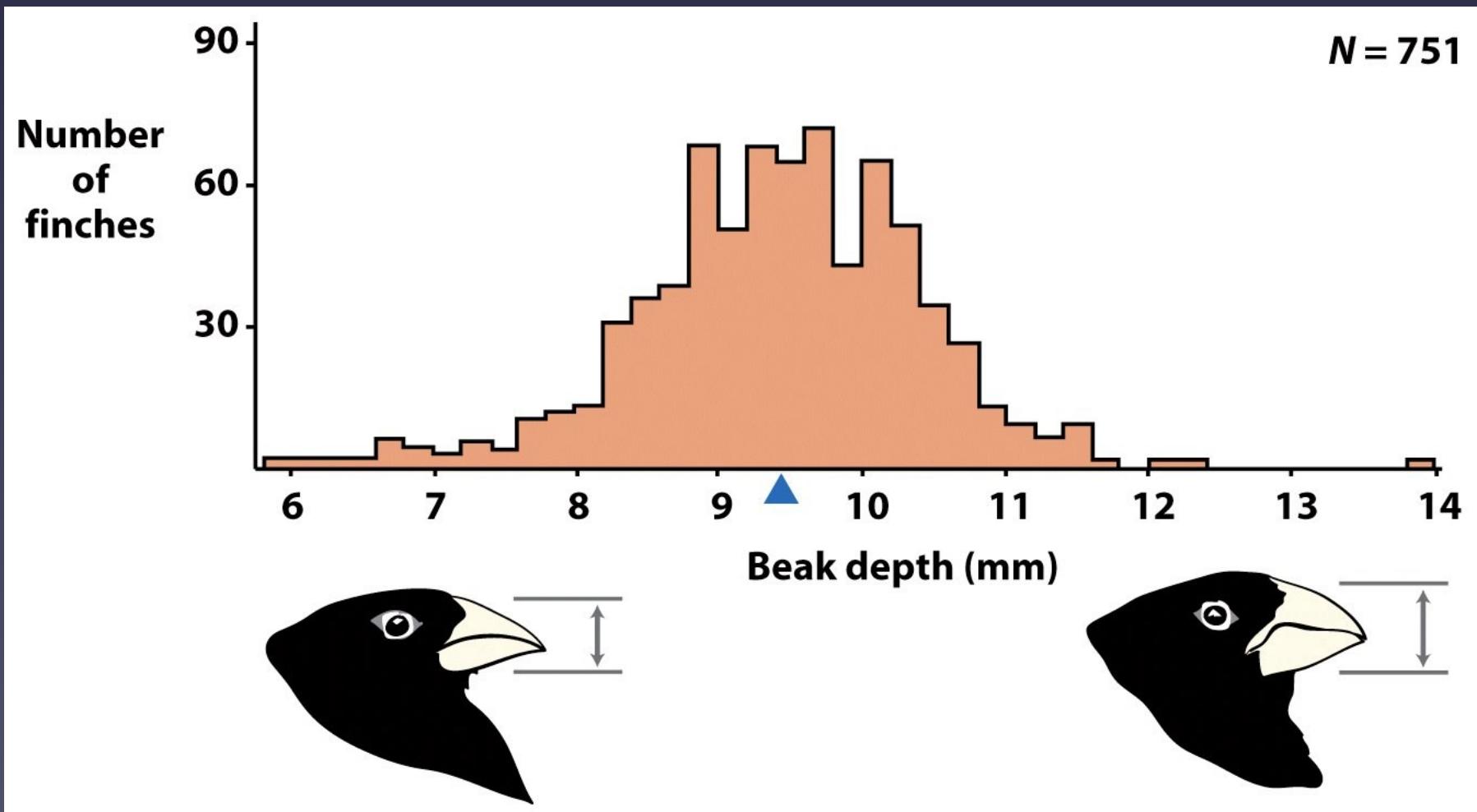


Selected breeds of Rock Dove, Darwin's Pigeons, to illustrate the outcome of artificial selection. From top to bottom and right to left: Carrier with carunculated cere, Black Spanish Barb with highly developed orbital ring, English Long Faced Tumbler with short bill, Hong Kong Indian Pigeon with occipital crest, German Long Faced Tumbler with elongated large bill, and Saxon White Tail with forehead blaze. Only one trait per breed was selected for comparison, breeds may show more traits subjected to artificial selection. Illustrations by Alison Schroer.

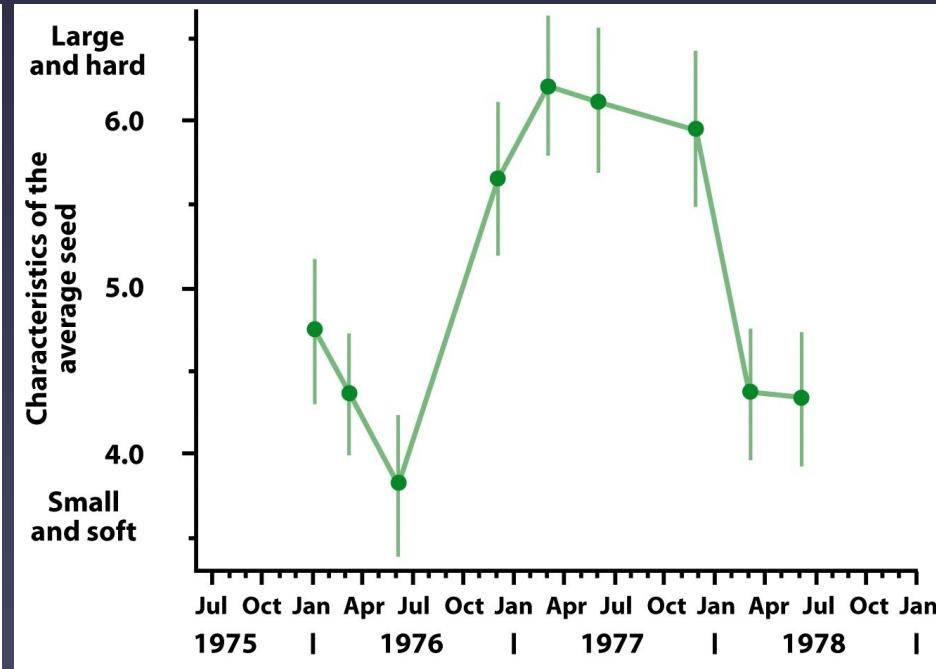
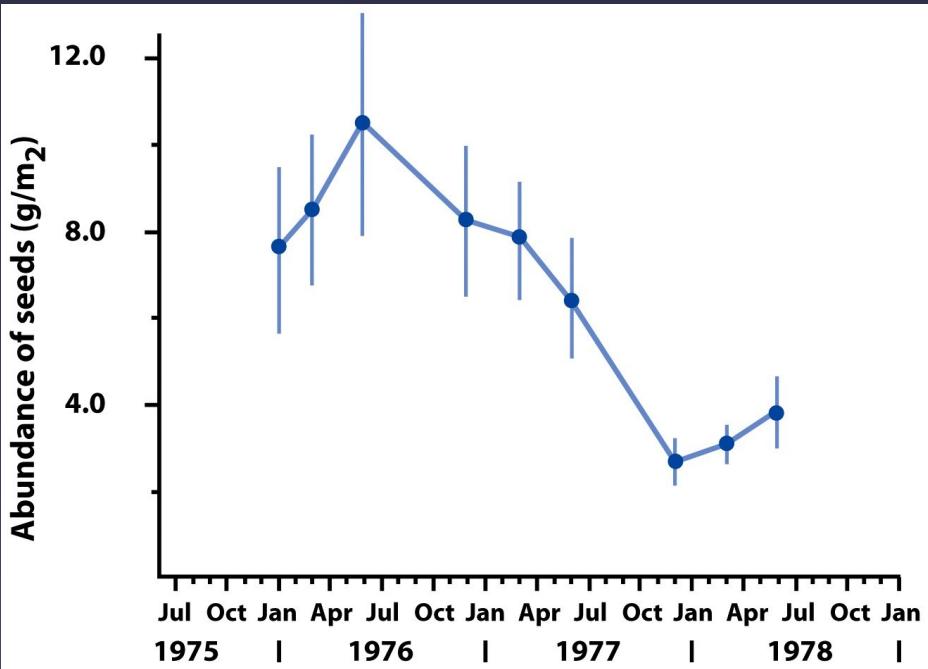
# Darwin observed extensive *artificial*

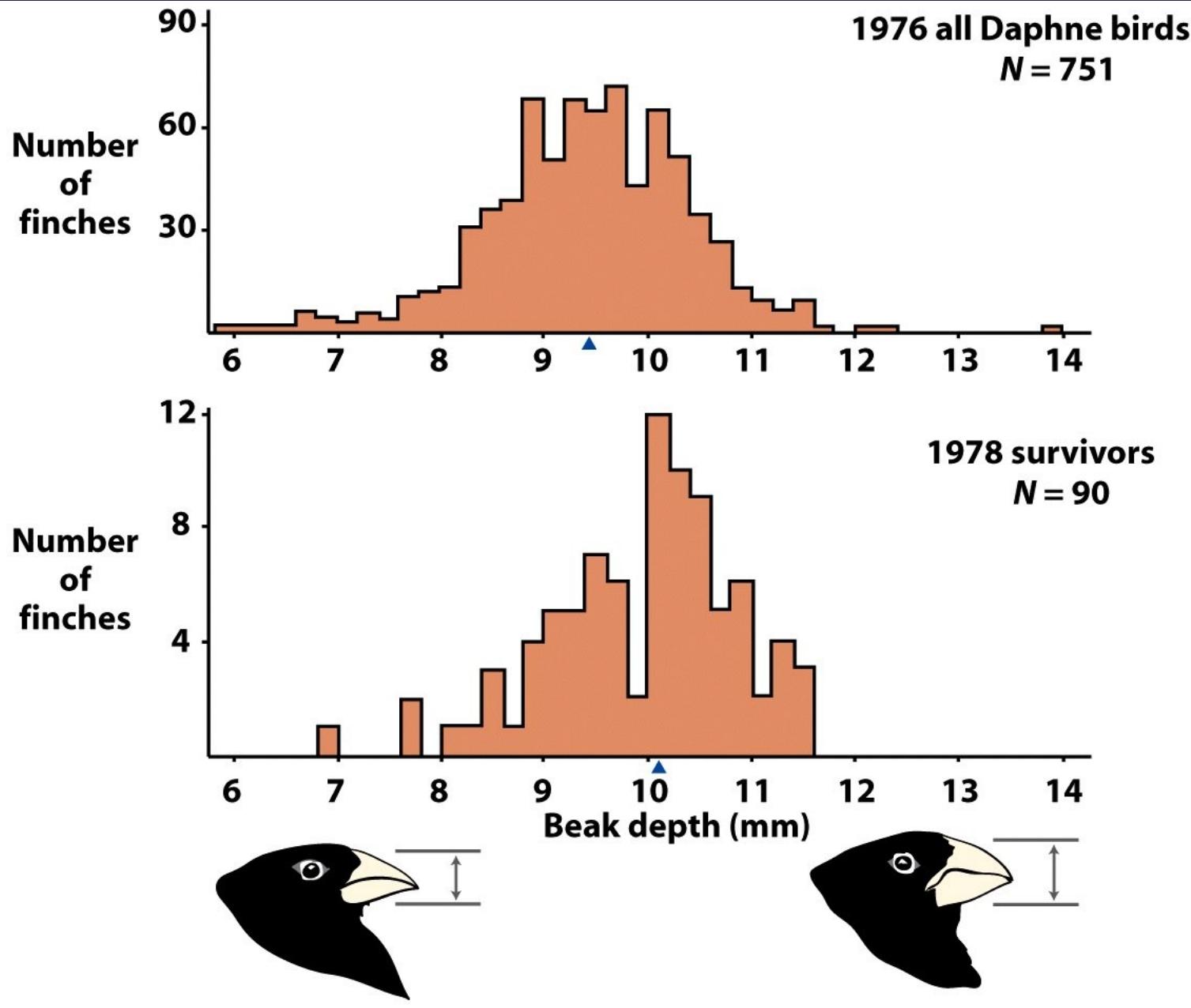


# After Darwin (modern evidence): Beak depth variation of medium ground finches in 1976



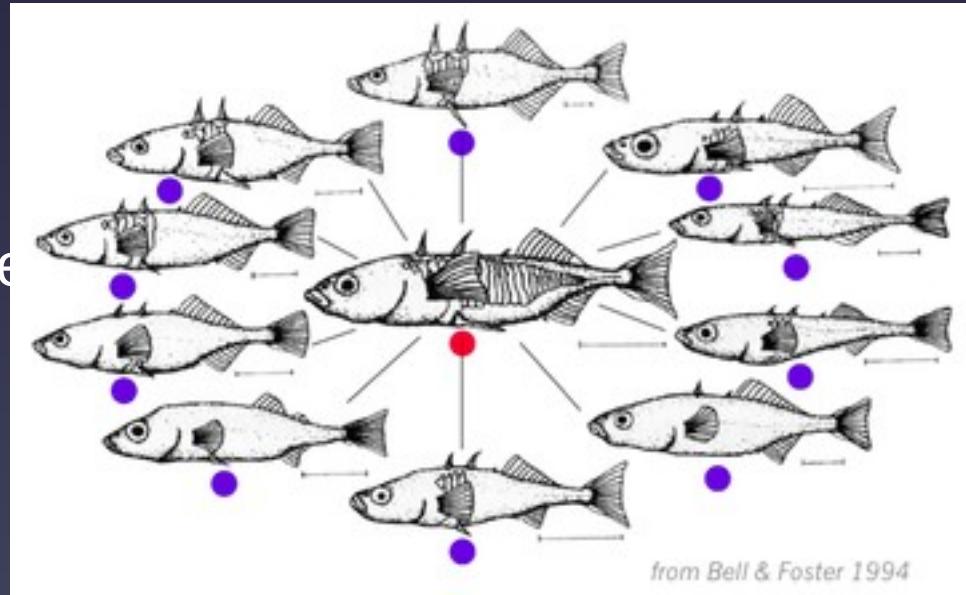
# Selection Event – 1977 Drought





# Natural selection: modern evidence

-Evidence from nature:  
three-spined stickleback  
Significant morphological changes  
within a few thousand years  
(less than 10 000)

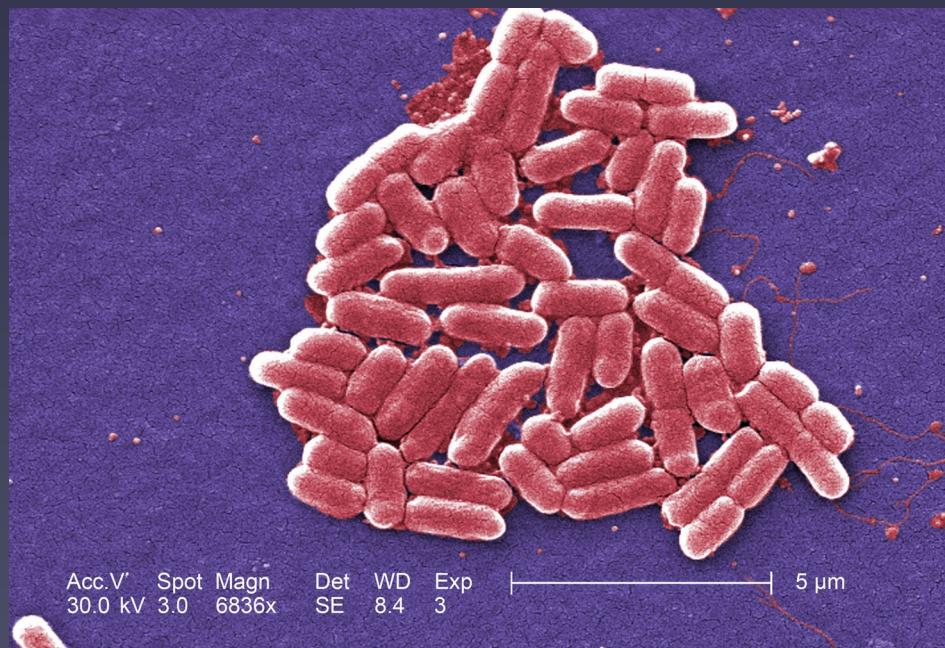


-Evidence from labs  
*Drosophila melanogaster*  
Incipient reproductive  
isolation



# Natural selection: modern evidence

-Medical studies: Rapid evolution of micro-organisms (e.g. resistance to multiple antibiotics)



# EVOLUTION CONT.

Descent with modification: occurs when there is a change in genetic makeup of a population over time

- Natural selection leads to adaptation (but this is only one of several mechanism of evolutionary change)



~ the peppered moth after Industrial Revolution ~-cryptic coloration

- Other forces of evolution include mutation, genetic drift (random changes in allele frequency), gene flow (migration), sexual selection