

Evolution by Natural Selection

What is it?
Does it happen? *Really?*
Why should wildlife biologists care?

Evolution

- A change over time in the gene pool of a population.
- The peppered moth (*Biston betularia*)

Industrial Melanism of The Peppered Moth

- Kettlewell 1950's
- Melanistic (dark) forms became abundant only in industrial areas
- Birds had lower success finding camouflaged forms
- Prediction: pollution control should lead to the light form becoming more common again

How Does Evolution Happen?

- Mutation – creates genetic variation
- Genetic drift
 - random changes in small populations
- Migration between populations
- Nonrandom mating
- Natural selection

- Of these, only natural selection results in **adaptation**

Adaptation by Natural Selection

- Adaptation: (n) a characteristic (anatomy, physiology, behavior) of an organism that is well suited to its environment

Or

- the process by which a population becomes better suited to its environment (better adapted)
- Adaptation isn't perfect, just an improvement on what came before.

Requirements for Natural Selection

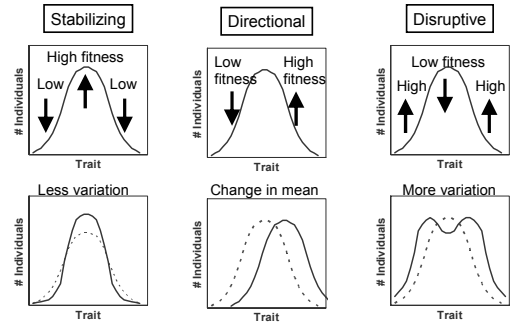
- Individuals differ from one another.
- Some differences are inherited.
- Some inherited differences affect fitness.

- THAT'S ALL.
- Heritable variation affecting fitness

What Affects Fitness?

- Timing of reproduction
- # offspring
- Size of offspring
- Length of gestation/incubation
- Body growth rate
- Maturation rate
- Parental care
- Offspring sex ratio
- Sperm motility
- Body size
- Fast vs. slow-twitch muscles
- Speed, strength
- Skin/coat insulation
- Mouth/beak/teeth morphology
- Foraging behavior
- Diet selection
- Habitat selection
- Nocturnal vs. diurnal activity
- Response to threat
- Gastric pH
- Camouflage
- Renal efficiency
- Blah, blah, blah....

Types of Selection



Does Natural Selection Really Happen?

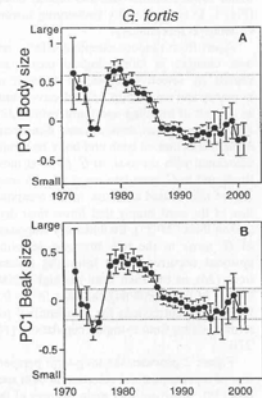
Answer: Yep.

Evidence for natural selection

Resistance to pesticides, antibiotics
Galapagos finches (Peter & Rosemary Grant)

Evolution in
Medium ground finches
(*Geospiza fortis*):

Selective effects of
1977 drought



Does Natural Selection Really Happen?

guppies of Trinidad: consequences of predation
(Reznick et al. 1990)

- Guppies in streams with predators breed earlier, have more & smaller offspring
- When guppies from predator-free streams were transplanted into predator streams, they evolved these traits in only a few generations

Important Points

- Speed of selection depends on
 - the strength of selection
 - the amount of heritable variation
- Selection acts most strongly at the level of the individual
- Natural selection results in adaptation to past and/or present conditions
 - Cannot “anticipate”

So what? Why should I care?

- Evolution by natural selection provides
 - A framework to understand current patterns of adaptation
 - Predictive power
 - What not to expect

So what? Why should I care?

- Humans affect selective factors
- Humans affect gene pools

The Florida Panther Controversy

- *Puma concolor coryi*
- Florida's state mammal
- By 1967 only about 30 left
- Inbreeding effects became evident
 - Kinked tails (recessive mutation)
 - Male infertility
 - Heart disease

The Florida Panther Controversy

- Endangered Species Recovery Plan
 - 1995: instead of captive breeding, released 8 female Texas cougars (*P. c. stanleyana*) to increase genetic diversity
 - Concerns: S. Florida is a very different environment from west Texas!
 - Are genetic differences between subspecies adaptive?
 - Will Texas genes swamp the population, reducing fitness?
 - By 2001, 24% genetic representation from Texas

Things to Remember

- Definitions of terms
- Mechanisms of evolution
- Requirements for natural selection
- Limitations of natural selection
- Examples: peppered moths, Galapagos finches, guppies, Florida panthers