**Chapter 8  
Natural selection: empirical studies in the wild**

Diversity in Darwin’s finches

* Medium ground finch
  + Variation in beak size influences efficiency at eating different types of seed
* Beak size evolution
* Drought resulted in more hard, woody seeds
  + Favored larger beaked birds

Natural selection is variable over time

So…

* Beak size influences fitness and is heritable
  + Natural selection can cause change
* Directional selection favors increases or decreases in the mean of a trait
* Stabilizing selection favors average values of a trait
* Long-term studies reveal fluctuation in the direction and strength of natural selection

Coat color variation affects fitness

* Light coat color evolved independently in different populations

Evolution in response to natural selection is inevitable if:

* + There is variation in a trait
  + Variation is heritable
  + Some variants reproduce more than others

Specific features of the environment can generate natural selection on a trait

Natural selection can be variable across space

* **Gene flow** can bring alleles to new locations
  + Alleles may increase or decrease fitness
* Ex: Aposematism favored only in areas where coral snakes co-occur

Stabilizing selection results when agents of selection act in opposing directions

* Gall flies induce plants to produce galls
* Gall diameter is variable and heritable
* Stabilizing selection on gall size

*Eda* geneinvolved in production of lateral plates in stickleback

Low *Eda* allele favored in freshwater populations

* Production of armor energetically costly
  + Little predation pressure to counterbalance
* Low *Eda* allele present at low frequency in marine environment
  + Favored when introduced to freshwater

Ability to digest lactose as adults found in certain populations

* Lactase expression persists into adulthood
* Correlates with domestication of cattle

Human influence

Artificial selection in crop production

* Gradual increase in cob size documented by archaeologists

Domestic dog diversity created in last 15,000 years

Pesticides and herbicides act as agents of selection

* Resistance to pesticides in houseflies
* Rapid evolution of herbicide resistance
* Alteration in EPSPS enzyme leads to Roundup resistance
* Creation of refuges can slow the evolution of resistance
* Bt crops select for resistance in pests
  + - Comes at a cost when Bt is not present
  + Creation of Bt-free refuges favors Bt-susceptible insects
    - Slows evolution of resistance
  + Refuges are now required by law
* Introduced cane toads have led to evolution of black snake populations
* Evolution of shorter male horns due to hunting
* Cod fishing has influenced life-history evolution

The speed of evolution depends on amount of genetic variation and strength of selection

* + Leads to rapid resistance in pest populations

An understanding of evolutionary biology can lead to novel management practices