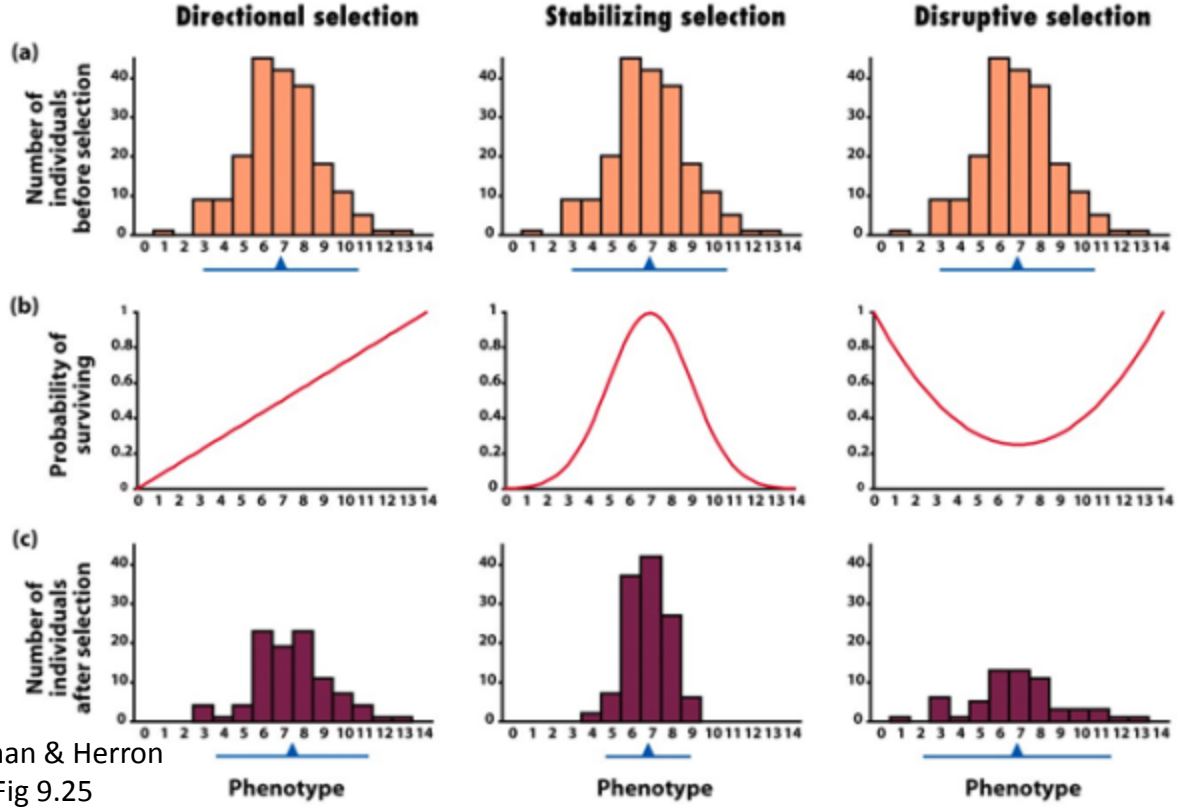
NATURAL SELECTION: Types acting on traits

Duke UNIVERSITY

Natural Selection: Quantitative Traits vs. Single Locus

- Natural selection can also be studied in the context of phenotypes, as in our discussions of heritability
  - Don't necessarily need to know underlying genes to infer type of selection operating

Types of selection, inferred from phenotypes

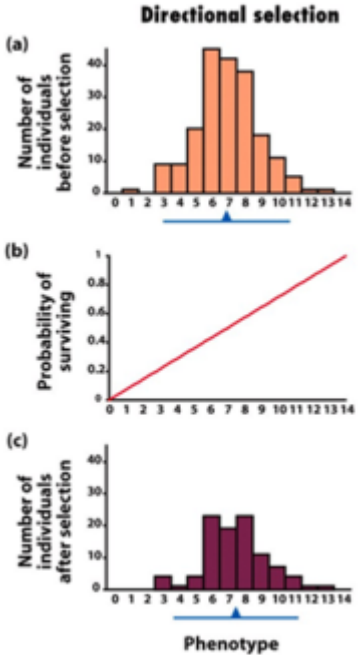


Freeman & Herron
Fig 9.25

Directional selection (phenotypes)

- Individuals at *one* end of distribution favored
  - e.g., “big” or “small individuals

- Causes change in ***mean*** of population over time



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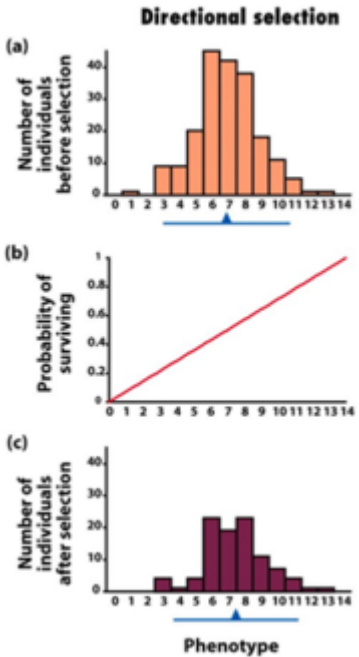


Pink salmon weight, in Canada

1951-1974

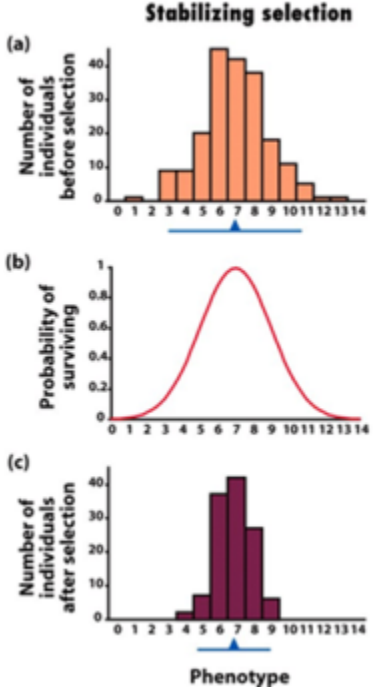
Directional selection (phenotypes)

Pink salmon weight, in Canada
1951-1974

Stabilizing selection (phenotypes)

- Individuals in *middle* of distribution favored

- No change in mean, but loss of extremes



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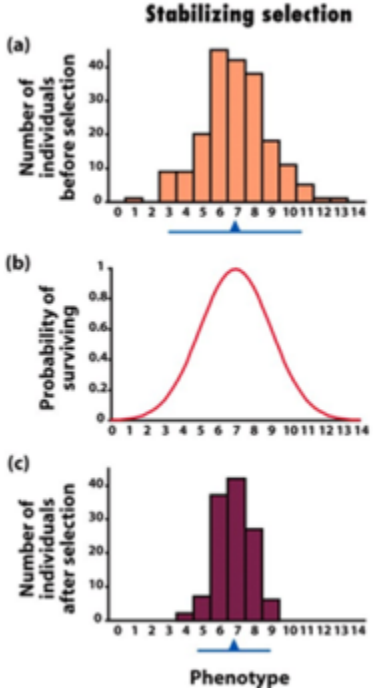
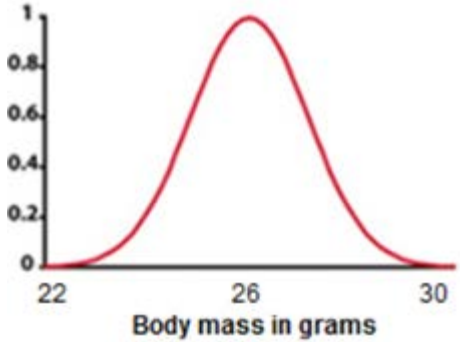


Bumpus 1898 study of 136 house sparrows after Rhode Island storm
64 died, 72 survived



Mean of survivors = Mean of dead
All >28 or <23 died

Stabilizing selection (phenotypes)

- Individuals in *middle* of distribution favored

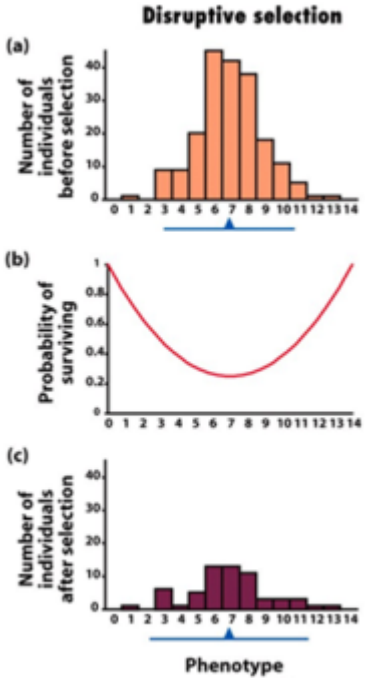
- No change in mean, but loss of extremes

Other example:
HUMAN BIRTHWEIGHT

Disruptive selection (phenotypes)

- Individuals at *both ends* of distribution favored

- No change in mean, but loss of intermediate phenotypes



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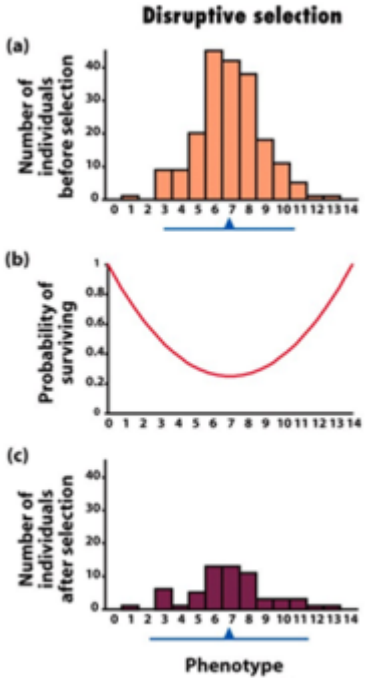
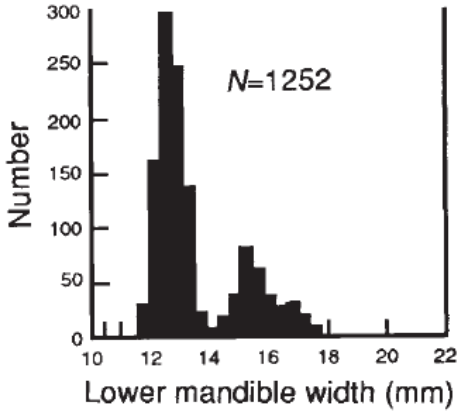
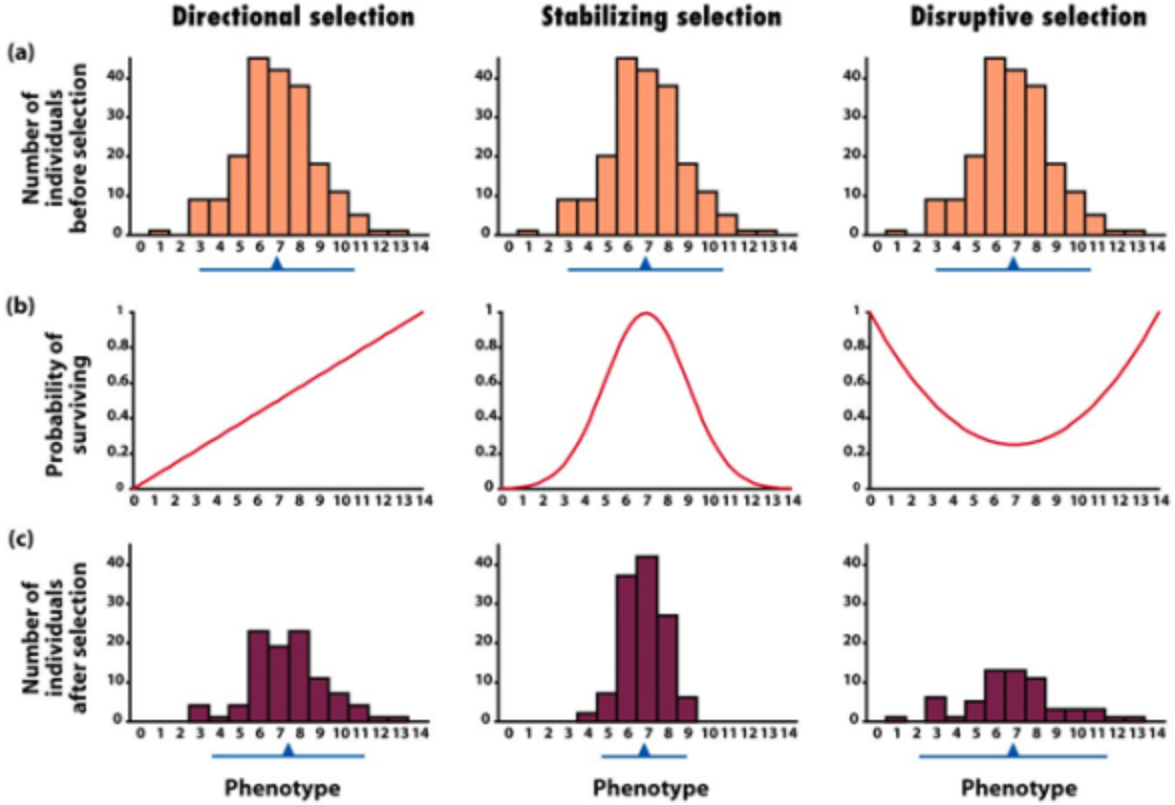


Beak size in female African finch:



Specializes on seeds of two sedge species

Types of selection, inferred from phenotypes



Final thoughts – is selection "good" or "bad" for population?

- Natural selection preferentially reduces/ eliminates "bad" genotypes

- "Average" fitness of all individuals *remaining in population after selection* goes up!
  - Since "bad alleles" are removed, simple directional selection gives long-term improvement to population

Directional selection improves average population fitness

- **Fisher's fundamental theorem of natural selection**
  - The rate of increase in fitness is
    equals the genetic variance in fitness.

Image Credits, Unit 12-3

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