Lecture 18 Selection on Quantitative Traits

→ 'Bean Bag Genetics' phenotype (=shape, in this case) determined by many 'invisible' genes (=beans) <u>plus</u> the environment (the little girl!)























Does phenotypic selection result in evolution?

- →We have established:
 - ➡The trait is variable
 - ➡There is an association of the trait with fitness
 - ➡Missing information? Yes.
 - ➡Is at least part of that variation heritable?

























Sample Problem



➡A breeder of American bison wishes to increase the mean body mass of his prize bison through artificial selection. The mean mass of his current herd is 500 kg. If he wants to increase this by 10% in one generation, and the heritability of body mass is 0.20, what should be the mean mass of the cows he allows to breed?







































Summary of Selection on Quantitative Traits • Most traits of ecological interest are quantitative traits, determined by many genes, and influenced by the environment

- Heritability (h²) is measured by the regression of offspring
- values (Y) on mid-parent values (X).
- → Directional selection quantified by regressing fitness (W) on X. → Model: R=h²S
- Stabilizing selection: mean X remains the same, variance in X declines
- Disruptive selection: mean X remains the same, variance in X increases

Re-visiting Darwin's theory

- ➡If a population is phenotypically variable...
- ➡If at least some of this variation is heritable...
- ➡If the phenotypic variation affects fitness...
- Then a population will evolve.
- ■***Each assertion has a counterpart in the evolutionary model for quantitative traits***

Summary of Selection on Quantitative Traits

- Most traits of ecological interest are quantitative traits, determined by many genes, and influenced by the environment
- Directional selection can be modeled simply, as an extension of a statistical regression analysis (R=h²S)
- Stabilizing selection: mean X remains the same, variance in X declines
- Disruptive selection: mean X remains the same, variance in X increases

Does Selection Lead to New Species?

→Darwin's arguments:

- I. Variation under domestication (i.e., artificial selection as an analogue of natural selection)
- ⇒2. Natural variation among varieties within species grades into species differences (i.e., ecotypes are common)
- ➡3. Consistencies in the fossil record (i.e., primitive to advanced forms in progressively younger strata)
- ➡4. Patterns of geographic variation among species on islands are consistent with evolution by natural selection (microevolution on islands is likely)