

2010年10月12日

生態学 I 第2回

自然淘汰 natural selection

Question

- In everyday English, the word “adaptation” means an adjustment to environmental condition. How is the evolutionary definition of adaptation different from the everyday English sense?

Adaptation : best answers

- 日常生活では一個体が一生の間に後天的に環境に順応していることを「適応」と呼ぶが、生物学ではある種が世代交代を繰り返す中で遺伝と自然選択によってより環境に適した形質を受け継ぐことを「適応」と呼ぶ。
- In everyday English, the word “adaptation” means adjustment; however, the evolutionary definition of adaptation includes heritable variation and reproduction. It does not just means adjustment but the ability of heredity under the environment.

自然淘汰の4つの前提

- There is variation among individuals.
- Some of the variation is heritable.
- Individuals vary in their success at surviving or reproducing.
- Reproduction is nonrandom.

ガラパゴス諸島 Galapagos Archipelago

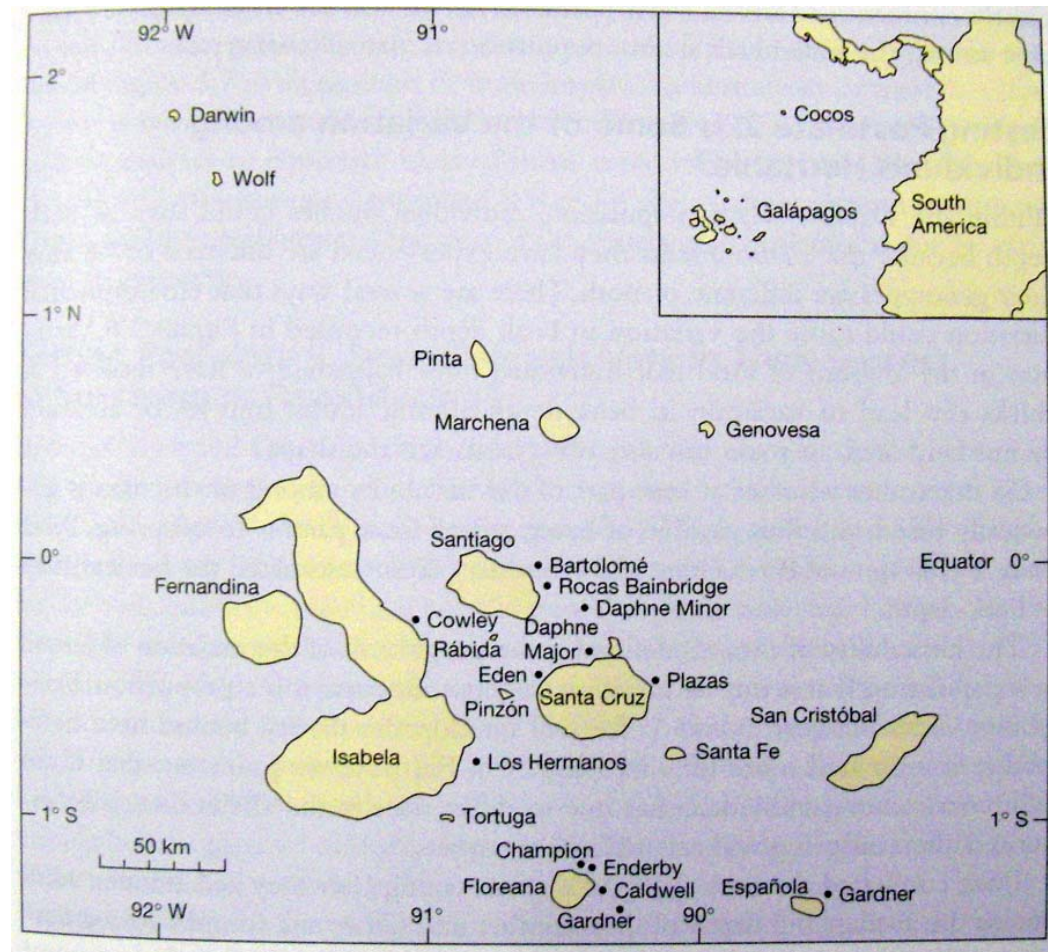


Figure 3.8

「大ダフネ島」=小さな無人島
Isla Daphne major = a small island

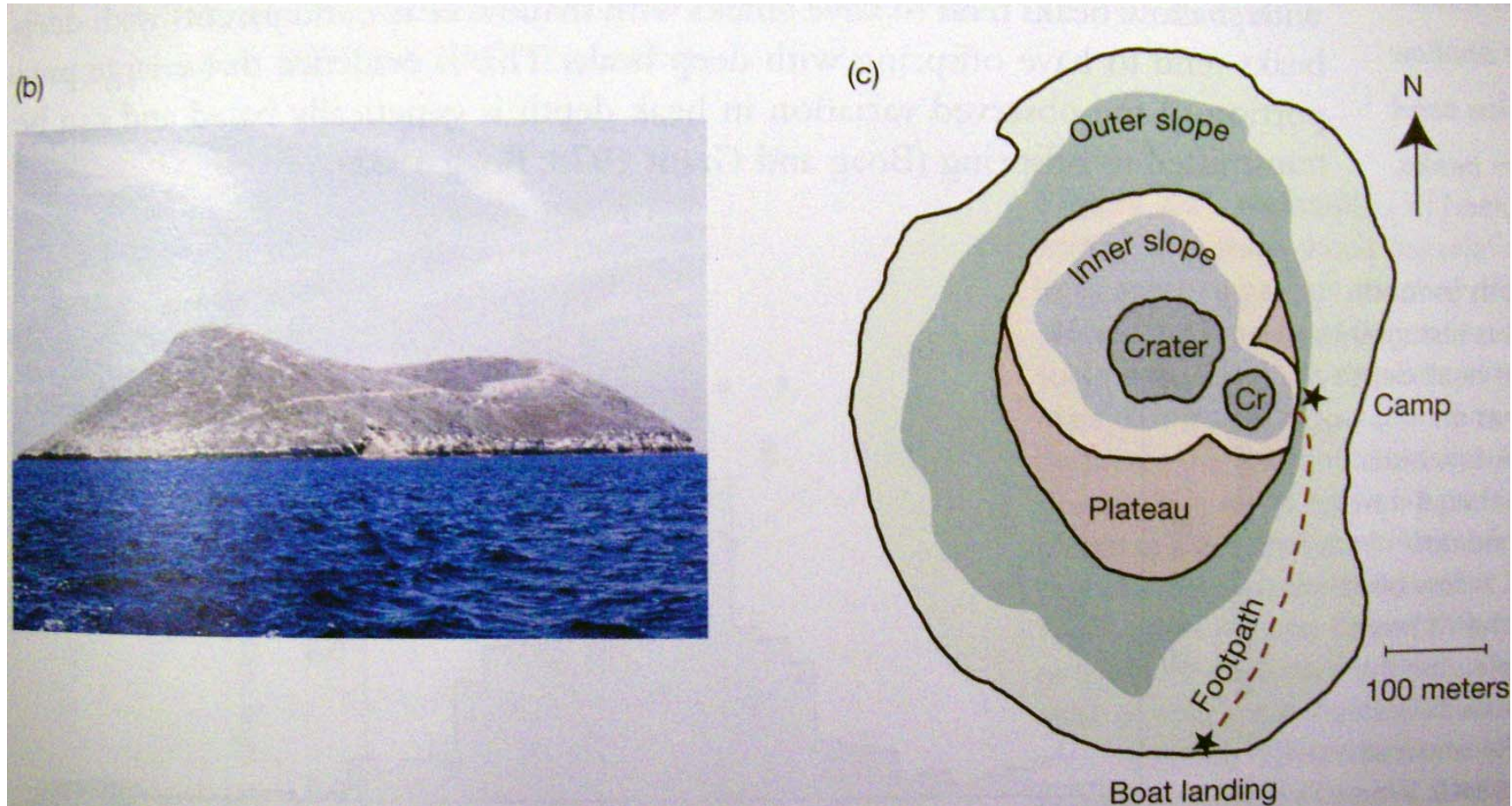


Figure 3.8

ダーウィンフィンチの個体数変動

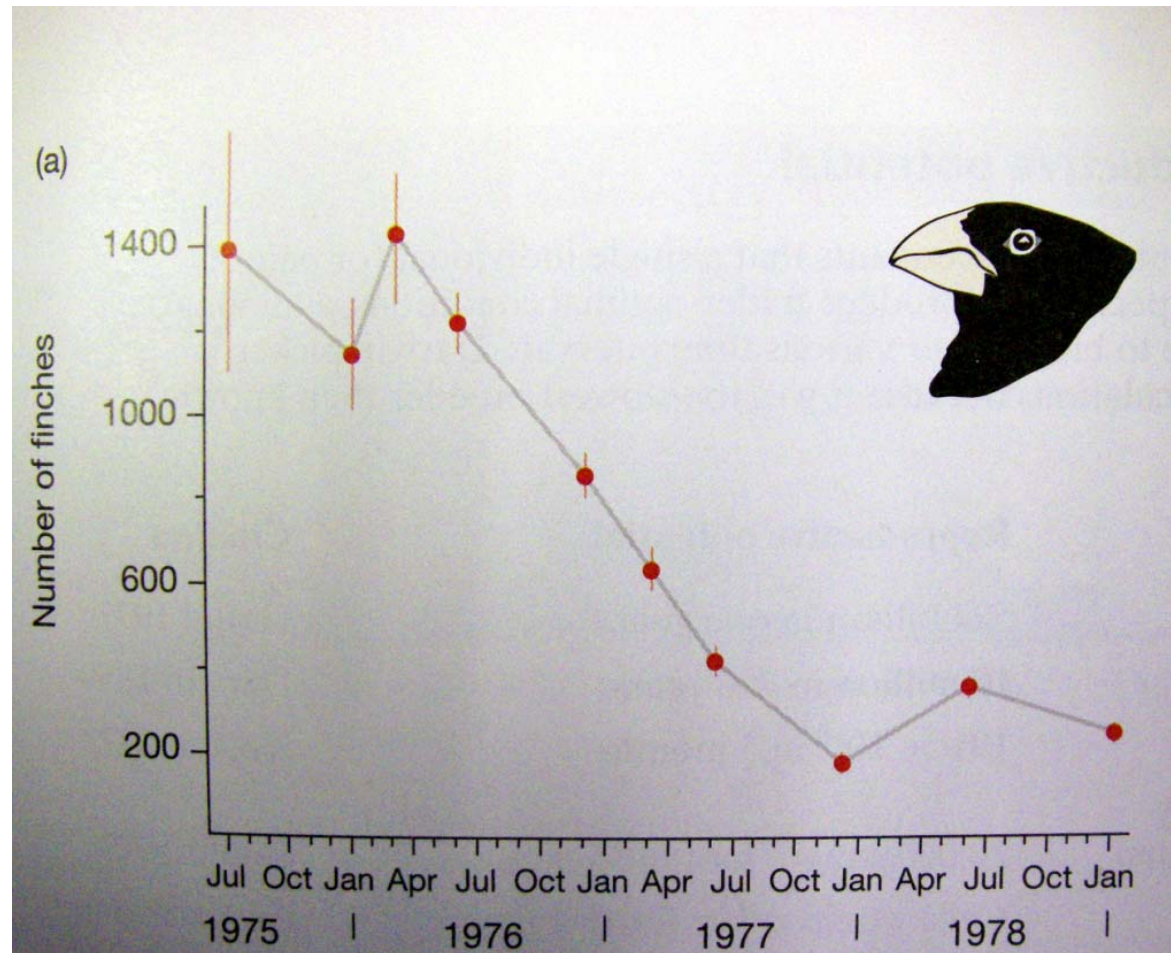


Figure 3.12

餌となる種子の量と質の変化

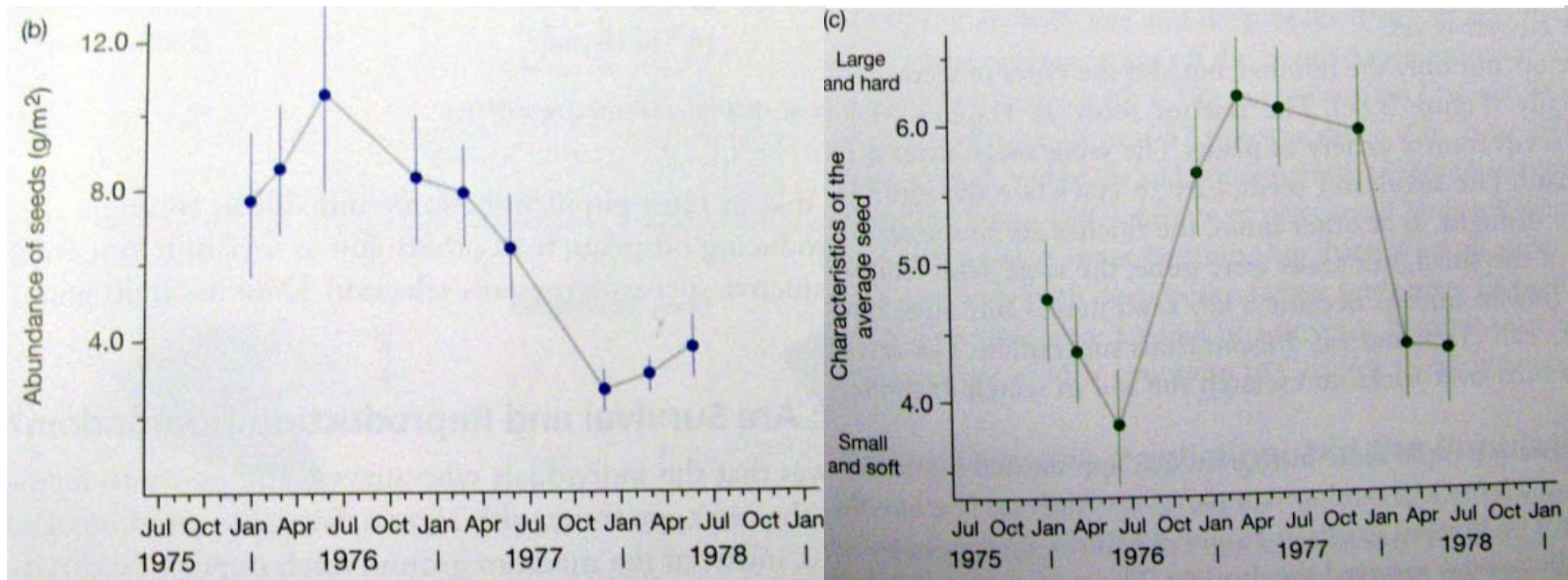
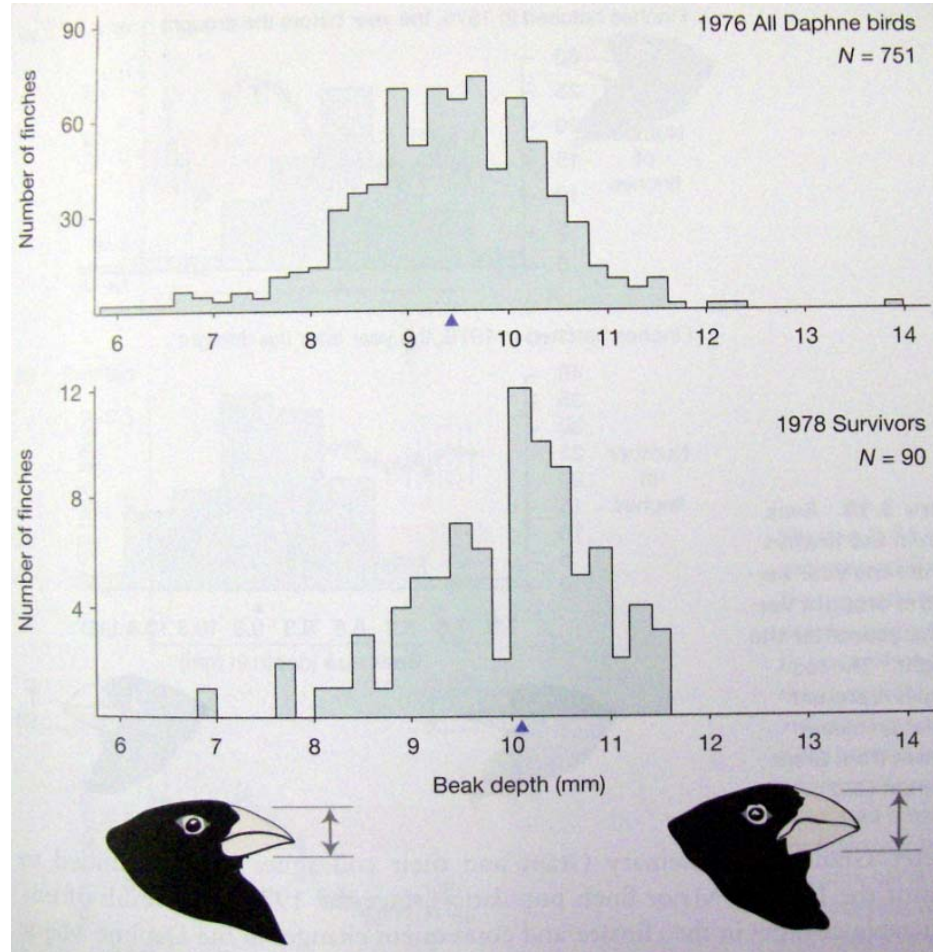


Figure 3.12

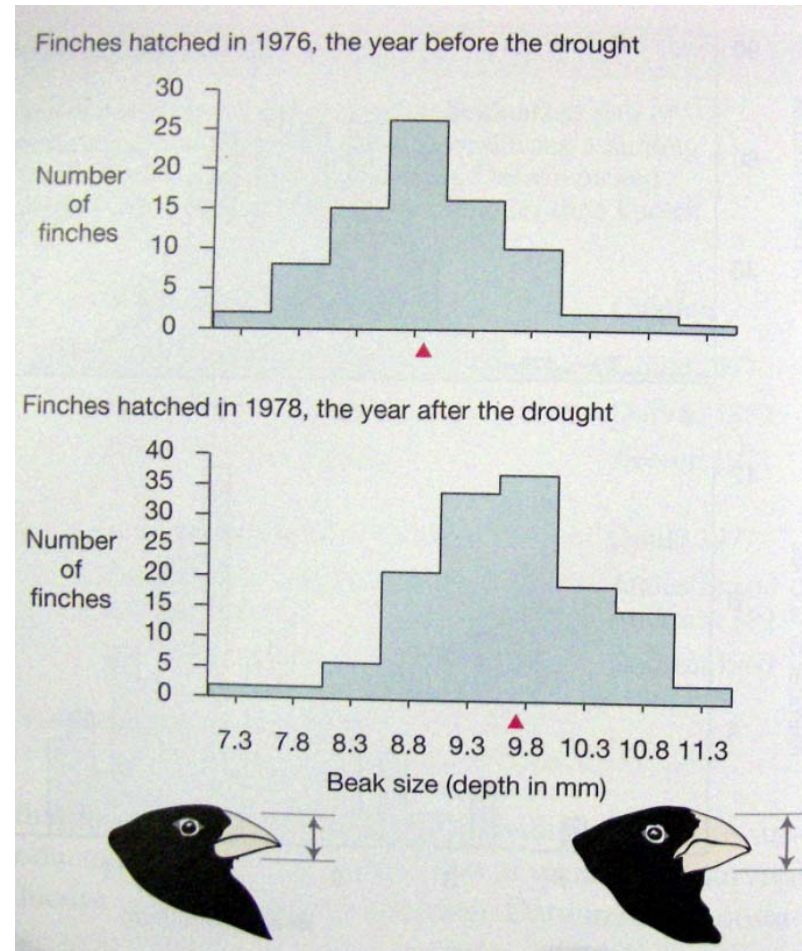
選択差S: 選択前後の形質差



$$S = 10.1 - 9.3 = 0.8$$

Figure 3.13

選択への反応R: 世代間の形質差



$$R = 9.7 - 8.9$$

$$= 0.8$$

$$R/S = 0.8 / 0.8$$

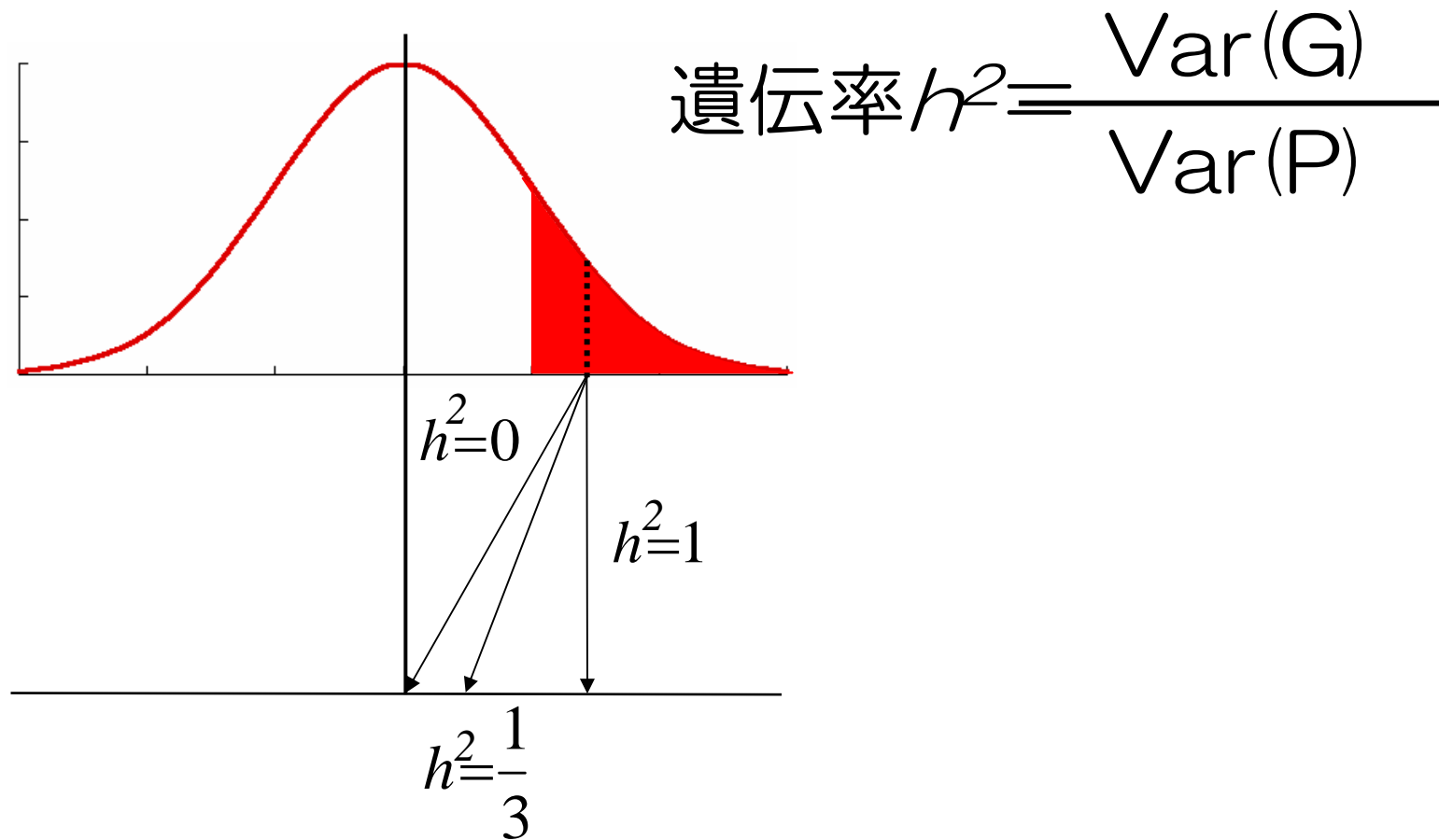
$$= 1$$

この比は
何を表すか

Figure 3.14

遺伝率と選択への反応

- $\text{Var}(P) = \text{Var}(G) + \text{Var}(E)$



親子回帰による遺伝率の推定

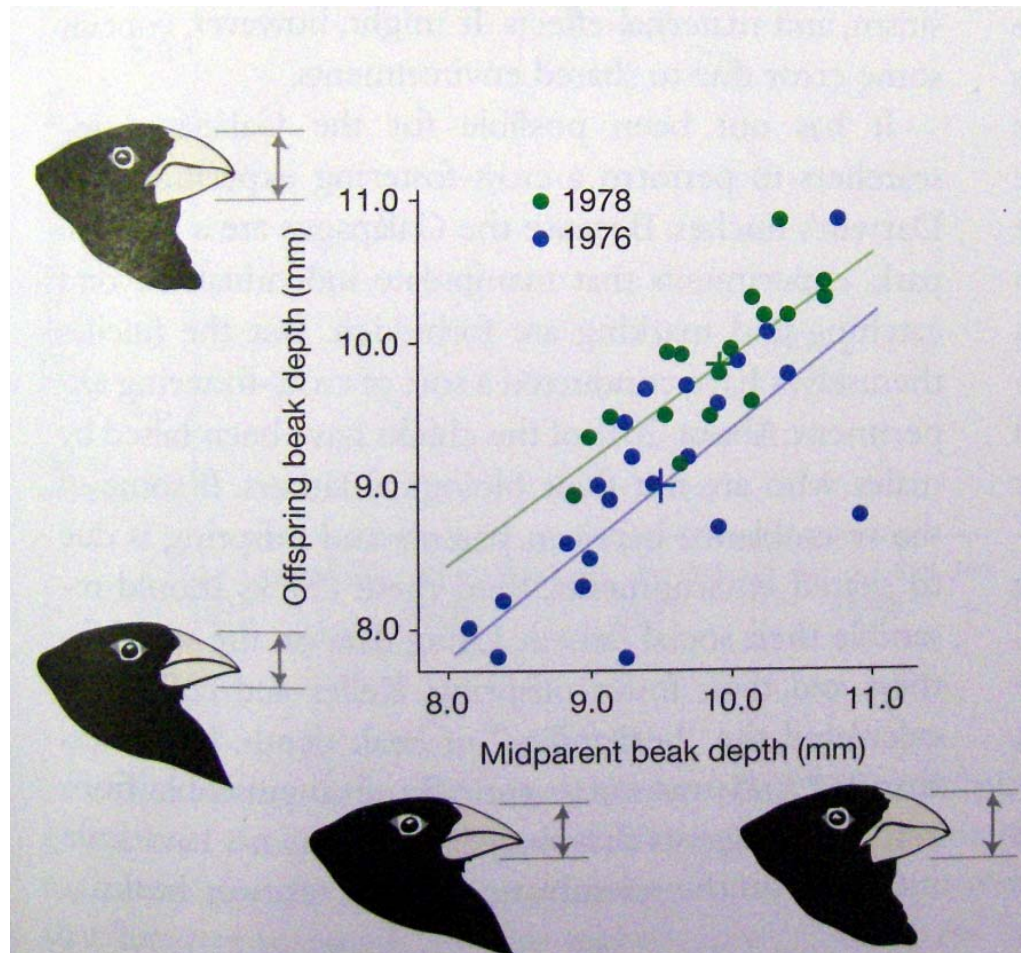


Figure 3.10

分散と共分散：変異と相関を表わす量

Variance and covariance

$$\frac{\text{Var (a)}}{\text{aの分散}} = \frac{1}{N} \sum_{i=1}^N \frac{(\text{Ave (a)} - a_i)^2}{\text{aの平均値}}$$

$$\frac{\text{Cov (x, y)}}{\text{xとyの共分散}} = \frac{1}{N} \sum_{i=1}^N \frac{(\text{Ave (x)} - x_i)}{\text{xの平均値}} \frac{(\text{Ave (y)} - y_i)}{\text{yの平均値}}$$

相関係数と回帰係数

- 相関係数 correlation coefficient b/w x & y

$$r = \frac{Cov(x, y)}{\sqrt{Var(x)Var(y)}}$$

- 回帰係数 regression coefficient of y on x

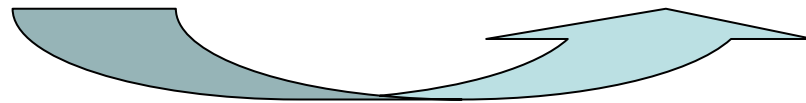
$$b = \frac{Cov(x, y)}{Var(x)}$$

分散の分割 variance partitioning

$$\text{Var} (X+Y) = \text{Var} (X) + \text{Var} (Y) + 2\text{Cov} (X, Y)$$

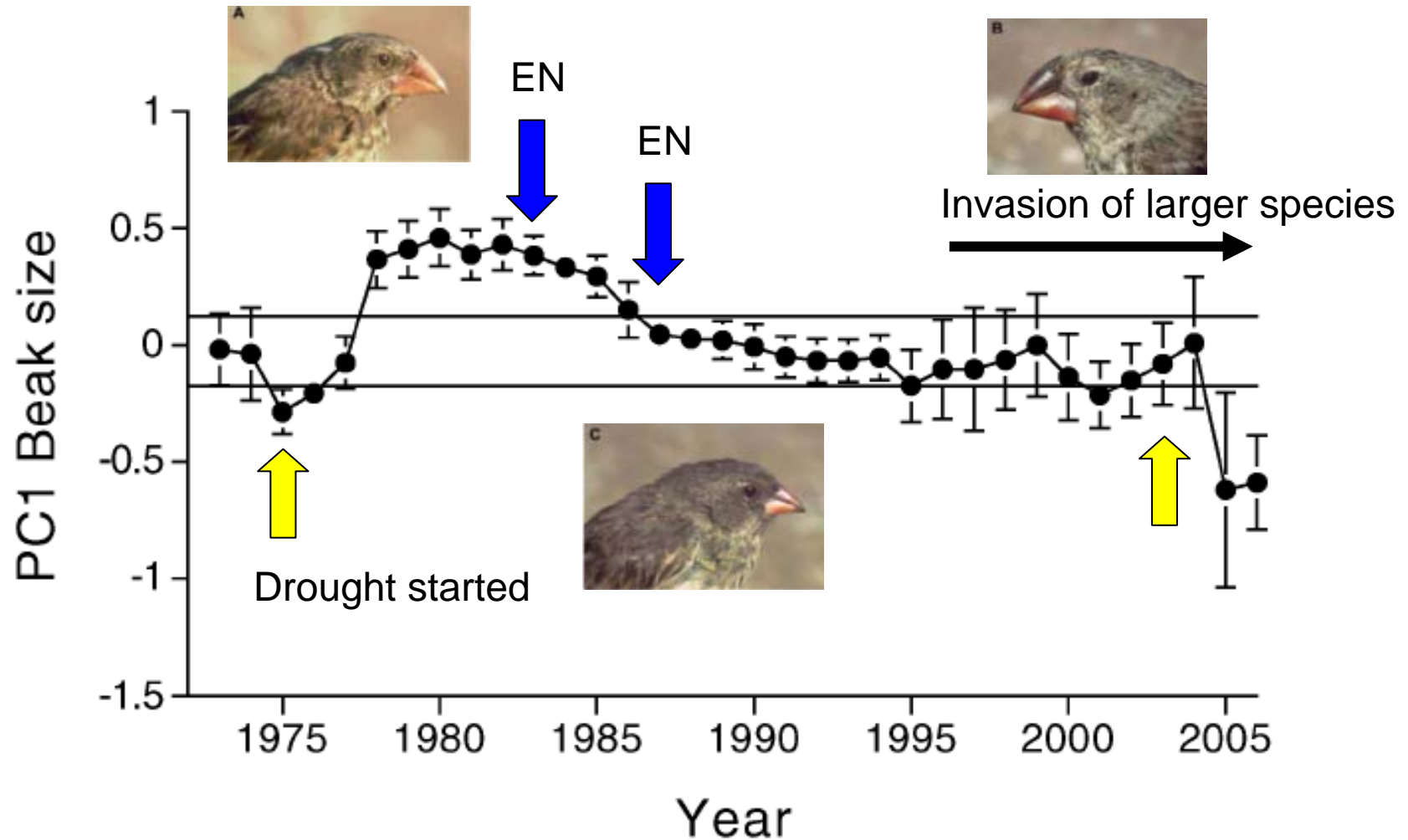
X と Y に相関がなければ (X と Y が独立に変異していれば)

$$\text{Var} (X+Y) = \text{Var} (X) + \text{Var} (Y)$$



全分散を2つの分散成分に分割できる

Beak size adaptation in medium ground finches



From Grant and Grant (2002)

The nature of natural selection

- NS acts on individuals (p. 90-91)
 - but its consequences occur in populations
 - not for the good of species
- NS acts on phenotypes
 - but with changes in allele frequencies
- NS is not forward looking, not perfect, not progressive