**CHAPTER 6 Answers to Questions**

**Question 6.1.** A rare allele (e.g., $q = 0.1$) is likely to be lost in a bottleneck of 2 individuals: $(1 – 0.1)^4 = 0.66$. Therefore, we expect 1.34 (2-0.66) alleles to remain after a bottleneck of 2 individuals:

$$E(A') = 2 – (1 - 0.9)^4 – (1 – 0.1)^4 = 1.34$$

However, we are much less likely to lose alleles that are at high frequency ($p = q = 0.5$). There is only a 0.06 chance of losing each allele at a frequency of 0.5 in a bottleneck of 2: $(1 – 0.5)^4 = 0.06$. Therefore,

$$E(A') = 2 – (1 - 0.5)^4 – (1 – 0.5)^4 = 1.88$$

**Question 6.2.** Using expression 6.5

$$\Delta h = -\frac{1}{2N} = –0.08$$

Solving for $N$ yields 6.25. Therefore, the loss of 8% reduction in heterozygosity seen in Laysan finches is what we would expect after a single bottleneck of approximately 6 individuals.

**Question 6.3.** Using expression 6.5, a bottleneck of 10 individuals is expected to result in a loss of 5% of the heterozygosity in a population:

$$\Delta h = -\frac{1}{2N} = -\frac{1}{2(10)} = –5\%$$

In this case, there will be some 37 alleles all at a frequency of 1/37=0.027. Using expression 6.9, we expect to retain 15.6 alleles following the bottleneck:

$$E(A') = 37 – 37(1 – 0.027)^{20} = 37 – 37(0.578) = 15.6$$

We expect to lose 37-15.6 = 21.4, or 58% of the allelic diversity (21.4/37=0.58).

Therefore, we expect to lose 5% of the heterozygosity and 58% of the allelic diversity following a bottleneck of 10 individuals at a locus with 37 nearly equally frequent alleles.