CHAPTER 6 Answers to Problems

Problem 6.8. *Mu51*

$$E(n') = n - \sum_{j=1}^{n} (1 - p_j)^{2N} =$$

$$8 - (0.920)^2 - (0.759)^2 - (0.902)^2 - (0.989)^2 - (0.994)^2 - (0.902)^2 - (0.592)^2 - (0.943)^2$$

$$= 8 - 5.22 = 2.78$$

Mu61

$$E(n') = n - \sum_{j=1}^{n} (1 - p_j)^{2N} = 3 - (0.528)^2 - (0.699)^2 - (0.773)^2 = 3 - 0.67 = 2.33$$

We expect to lose 25% of the heterozygosity in this population ($\Delta h = -1/2N$). However, we expect to lose most of the alleles present at the *Mu51* locus because it has several rare alleles. We expect to lose less of the allelic diversity at *Mu61* since it contains only 3 alleles and they are nearly equally frequent.

Problem 6.10.

		Australia	
	France	Perth	Rottnest
Prop loci polymorphic (P)	0.440 100%	0.240 55%	0.160 36%
Heterozygosity (H_e)	0.168 100%	0.080 48%	0.061 36%
Average alleles per locus	1.92 100%	1.32 35%	1.16 17%

The Perth population has 52% less heterozygosity than the population in France. This is compatible with the Perth population being founded by a single individual (assuming that these snails can reproduce hermaphroditically).

The Rottnest population has 24% less heterozygosity than the Perth population:

$$\frac{(0.080 - 0.061)}{0.080} = 0.238$$

We know from expression 5.2 that the expected loss in heterozygosity per generation is $1/2N$. Therefore,

$$0.238 = \frac{1}{2N}$$

and solving for N (see Question 5.2 on page 94)

$$N = \frac{1}{2(0.238)} = 2.1$$

Thus, the further reduction in heterozygosity on Rottnest is compatible with this population being founded by two individuals from the Perth population.