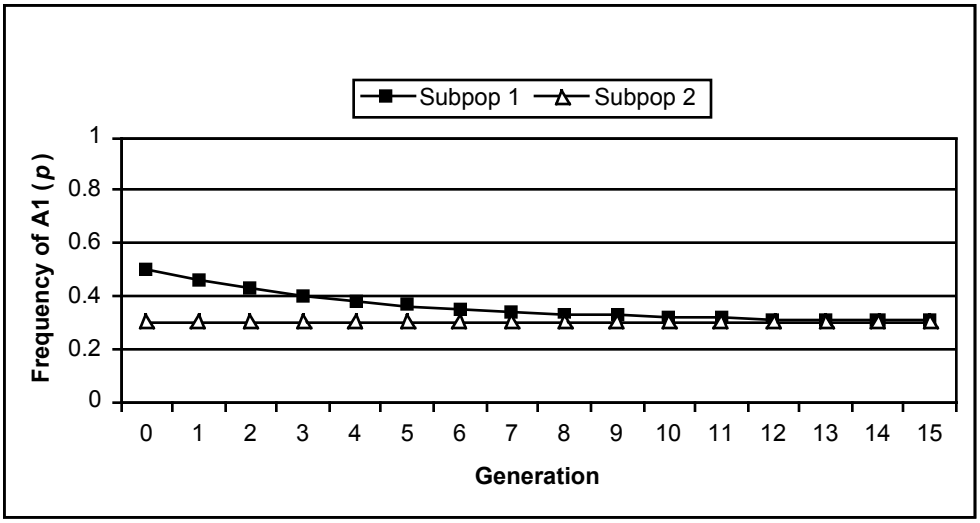
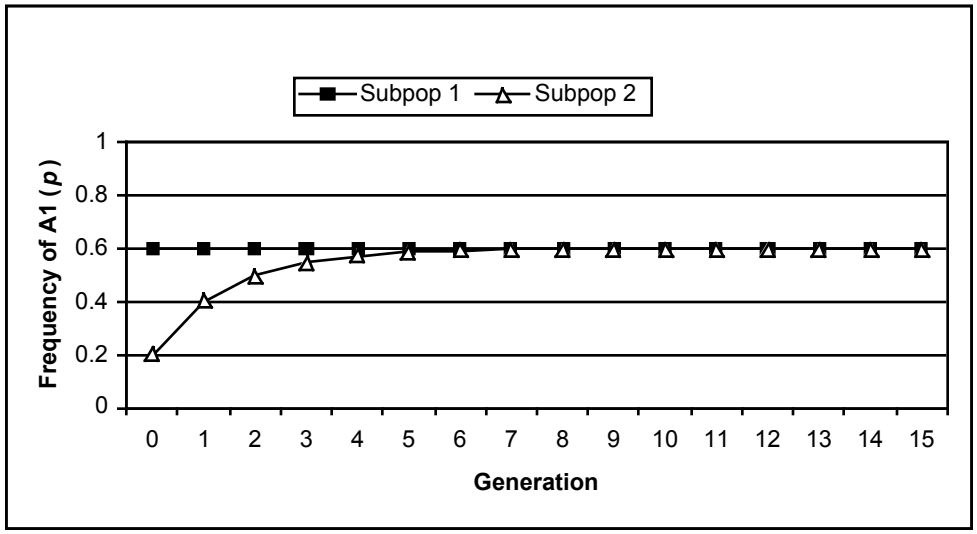
Answers Exercise 34

Gene Flow and Population Structure

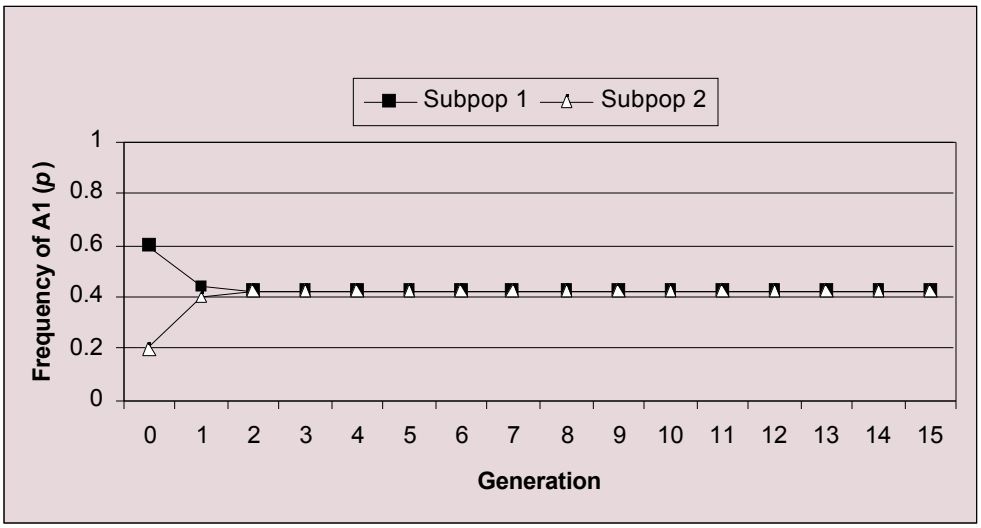
1. The equilibrium allele frequencies are $A_1 = 0.3$ and $A_2 = 0.7$. As m increases, the two subpopulations converge on the equilibrium value more quickly.



2. When gene flow is unidirectional, the allele frequencies in the "mainland" do not change over time, but the migration rate from the mainland to the island alters the allele frequencies of the island population until the frequency matches that of that mainland.



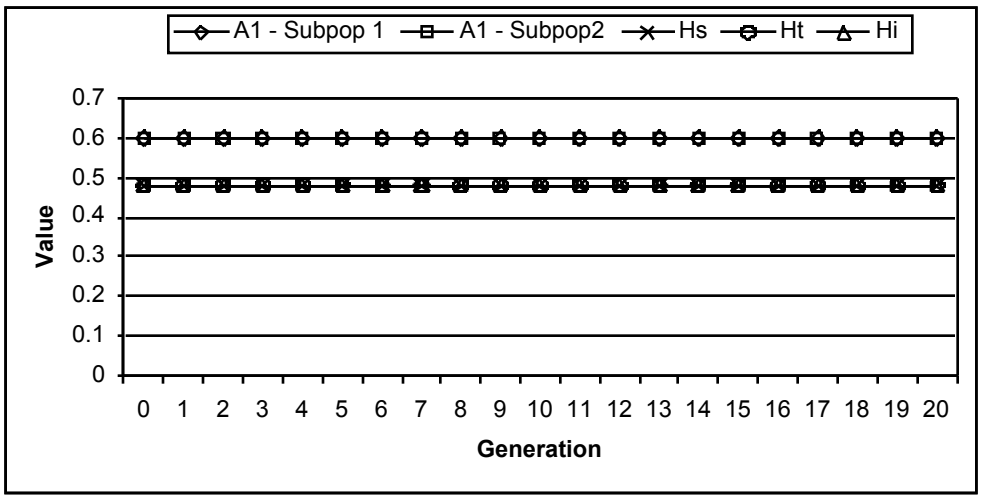
When both populations exchange individuals, the allele frequencies eventually come to an equilbrium. This value depends on *m* for each subpopulation, as well as the allele frequencies in each subpopulation.

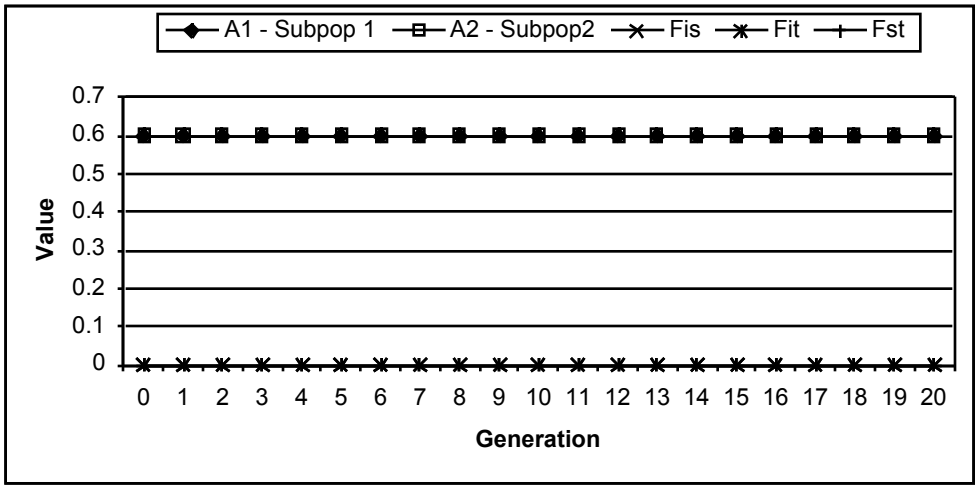


3. We have already seen that as *m* increases, the equilibrium allele frequency is attained earlier. For a fixed *m*, the differences in allele frequencies will determine the equilibrium value, as well as the time to reach equilibrium. For example, with the starting genotypes and *m* shown below, the equilibrium frequency of the A_1 allele is 0.38. When cells F6–H6 are altered to 0.36, 0.48., and 0.16, the equilibrium frequency of the A_1 allele is 0.54.

	Parameters			Genotype frequencies		
	N	***m***	***r***	**A1A1**	**A1A2**	**A2A2**
Subpopulation 1:	100	0.2	0.8	0.5	0	0.5
Subpopulation 2:	100	0.3	0.7	0.04	0.32	0.64

4. When the subpopulations are both in Hardy-Weinberg equilibrium, and have similar allele frequencies, H_i, H_s, and H_t are identical. In turn, all of the F statistics are 0 because the H statistics do not deviate from each other.





5. When both subpopulations are in Hardy-Weinberg equilibrium, but have very different allele frequencies, H_s and H_t will not be identical. You should see that all F statistics change, but the greatest change in is F_{st}, which is an indicator of genetic differentiation among the subpopulations. Because the allele frequencies in the two populations become so divergent, F_{st} will increase.