Notes on migration

Symbols used

Symbol	Definition
N	number of individuals in the population ($= 100$)
N_m	number of migrants into the populations ($= 10$)
	number of *residents* $= N - N_m = 90$
p	allele frequency in the population *before* migration ($= 0.2$)
	equivalent to allele frequency *in residents*
p'	allele frequency in the population *after* migration
p_m	allele frequency in the migrants ($= 0.9$)
m	migration rate

Calculations

$$\begin{aligned} m &= \frac{10}{100} \\ &= 0.1 \end{aligned}$$

No. of A alleles *after* migration

$$\begin{aligned} &= \text{of } A \text{ alleles from residents} + \text{No. of } A \text{ alleles from migrants} \\ &= (\text{Fraction of residents})\,(\text{Population size})\,(\text{Frequency of } A \text{ allele in residents}) \\ &\quad + (\text{Fraction of migrants})\,(\text{Population size})\,(\text{Frequency of } A \text{ allele in migrants}) \\ &= (1 - 0.1)(100)(0.2) + (0.1)(100)(0.9) \\ &= 18 + 9 \\ &= 27 \end{aligned}$$

Note: $(1 - 0.1)(100) = 90$ is the number of residents, and $(0.1)(100) = 10$ is the number of migrants. The allele frequency in the population in the next generation, p' is $27/100 = 0.27$. Here's another way to calculate it:

$$\begin{aligned} p' &= (1 - m)p + mp_m \\ &= (0.9)(0.2) + (0.1)(0.9) \\ &= 0.27 \end{aligned}$$