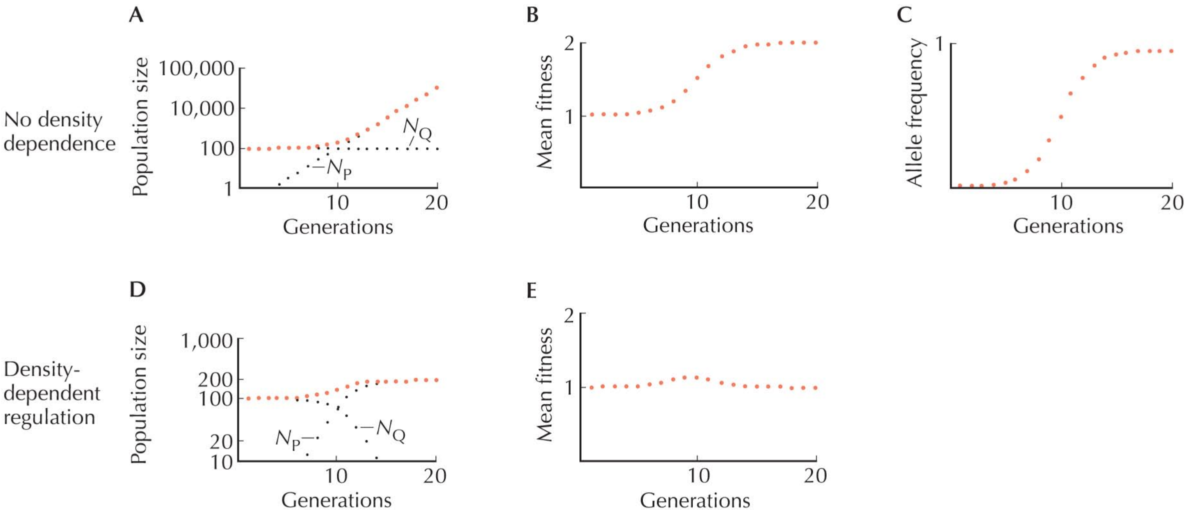

FIGURE 17.15. The time course of selection in the simplest case of two alleles (P, Q), with and without density-dependent regulation of population size. The *top row* is for the case where fitnesses are constant, regardless of population size. (*A*) If $W_Q = 1$, numbers of type Q stay constant at $N_Q = 100$. If type P is twice as fit ($W_P = 2$), then its numbers increase geometrically, as 2^t. On a logarithmic scale, this appears as a straight line. The total population size ($N_P + N_Q$; *red dots*) remains close to 100 until around ten generations, when P becomes common and the population as a whole increases geometrically in size. (*B*) The rate of population growth (i.e., the slope of the *red dots* in *A*) is equal to the mean fitness. This increases from 1 to 2 as P replaces Q. (*C*) The allele frequency, $p = N_P/(N_Q + N_P)$. (*D*) If the fitness of both types decreases geometrically with population size, then the population stays within bounds ($W_Q = 2^{1 - N/100}$, $W_P = 2W_Q$, say), and equilibrates when $\overline{W} = 1$. Type Q reaches an equilibrium at $N_Q = 100$ (*left*); type P is twice as fit and in this example reaches an equilibrium at $N_P = 200$ (*right*). (*E*) Now, the mean fitness increases above $\overline{W} = 1$ as P replaces Q, but then returns toward equilibrium as population size increases. However, because the *ratio* in fitness between the two types is constant ($W_P/W_Q = 2$), the time course of allele frequency change is exactly the same (*C*).