

POPULATION GENETICS PRACTICE EXERCISE #1

I'm sure you all remember the classic example of industrial melanism in *Biston betularia*.¹ The *typica* form is the light-colored form, while the *carbonaria* form is the dark-colored form. Here are some release-recapture data from two different places:²

	Number released	Number recaptured
Central Birmingham (city)		
<i>typica</i>	144	18
<i>carbonaria</i>	486	140
Dorset wood (forest)		
<i>typica</i>	163	67
<i>carbonaria</i>	142	32

To keep things simple, let's assume that any individual that was not recaptured died.

1. What are the viabilities of *typica* and *carbonaria* in each habitat?
2. What is the viability of *carbonaria* relative to *typica* in each habitat?
3. The color forms are determined by alternative alleles at a single locus. Assume that genotypes are in Hardy-Weinberg proportions in the individuals that were released and that there is no mutation or migration of individuals into these habitats. What will the frequency of the *typica* and *carbonaria* forms be in the next generation before selection?

Here are some more conceptual questions to test your understanding.

¹If you don't, pick up any good textbook on evolution, and look in the index. You're almost certain to find it there. You might also be interested in a fairly recent review by Cook and Saccheri (*Heredity* 110:207-212; 2013).

²I will reveal the source of the data on Sunday when I post my answers to these exercises. The source I'm referring to includes calculations that will give you the answers, and the whole point of this exercise is to give you a chance to try this on your own.

5. The lecture notes identify several different components of fitness, i.e., different types of natural selection that may be occurring. Natural selection at one locus always leads to a change in allele frequencies. For each type of natural selection identified below, identify the life history stage at which this change in allele frequency would be detected.
- (a) Segregation distortion
 - (b) Gamete (or gametophytic) competition
 - (c) Fertility selection
 - (d) Viability selection
 - (e) Sexual selection
6. I asserted in the last question that “Natural selection at one locus always leads to a change in allele frequencies.” In the notes I assert that if the relative fitness of heterozygotes is greater than that of either homozygote (stabilizing selection or heterozygote advantage), then the population will evolve to a stable polymorphic equilibrium where the allele frequency doesn’t change and both alleles are present. Explain why these statements aren’t contradictory.