Population fitness and selection
BIOL 01104 Spring 2020
Dr. Spielman

1. You are studying a population of Amazonian poison dart frogs, some of which have blue stripes and some of which have green stripes, and you have prior knowledge that this is a heritable trait. You want to determine the relative fitness and selection acting on each phenotype. You randomly collect 100 blue-striped frogs and 100 green-striped frogs, and you expose them to their predators: bats! You then ask how many survive the exposure (assume the experiment is fine!) as a proxy for fitness. You determine that 85% of blue frogs survived, and 72% of green frogs survived. **These numbers represent direct measures of fitness and are therefore called "absolute fitness"**

    A. Calculate the *relative fitness* of each frog morph by dividing by the highest absolute fitness.

    B. Calculate the strength of selection acting against each frog morph, i.e. the *selection coefficient* using the formula: $s = 1 - w$, where "s" is the selection coefficient and "w" is the *relative* fitness.

    C. Calculate the *average fitness* for a hypothetical population with 172 blue-striped frogs and 136 green green-striped frogs.

    D. Assume that 100 blue frogs survive an attack. Based on your calculations, how many green frogs would you expect to also survive this attack? Hint: use RELATIVE FITNESS!

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2. You are studying a *different* population of the same species of Amazonian poison dart frogs that lives two miles away from the first population. Let's call this "population 2", and page 1 was "population 1". You perform the same experiment with population 2 frogs. You determine that these blue frogs survived 56% of the time, and green frogs survived 67% of the time. **As before, these numbers represent direct measures of fitness and are therefore called "absolute fitness"**

    A. Again, calculate the i) relative fitness, and ii) selection coefficients for both frog morphs.

    B. Without doing any calculations, imagine you have some blue and green frogs from each population, and you have the amount of blue/green frogs each. Which population (1 or 2) likely has the HIGHER average fitness?

    C. Without doing any calculations, is the DIRECTION of selection (i.e., who is the fittest?) the same or different between population 1 and population 2?

    D. Calculate the *average fitness* for a hypothetical population (of population 2 frogs!) with 57 blue-striped frogs and 82 green-striped frogs.