Real science challenge:

Use the More Snails excercise in Darwinian snails to conduct an experiment that answers a quesiton that was not addressed in the formal tutorial.

My example:

What is the relationship between the strength of selection and the speed of evolution?

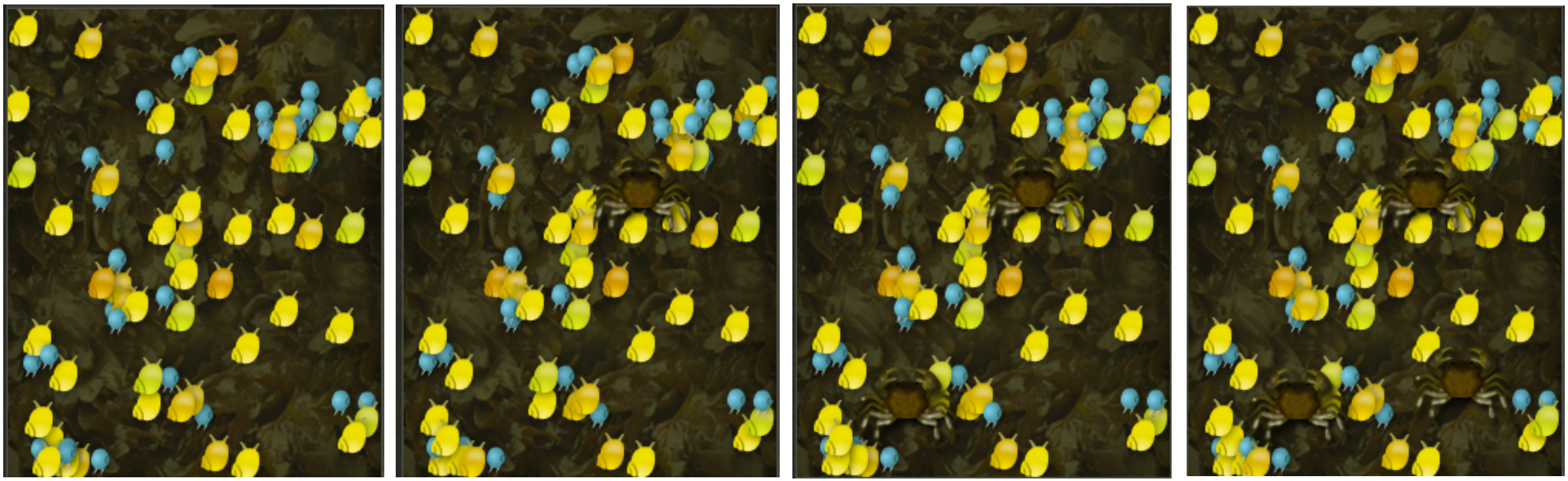
My question:

What is the relationship between the strength of selection and the speed of evolution?

Hypothesis:

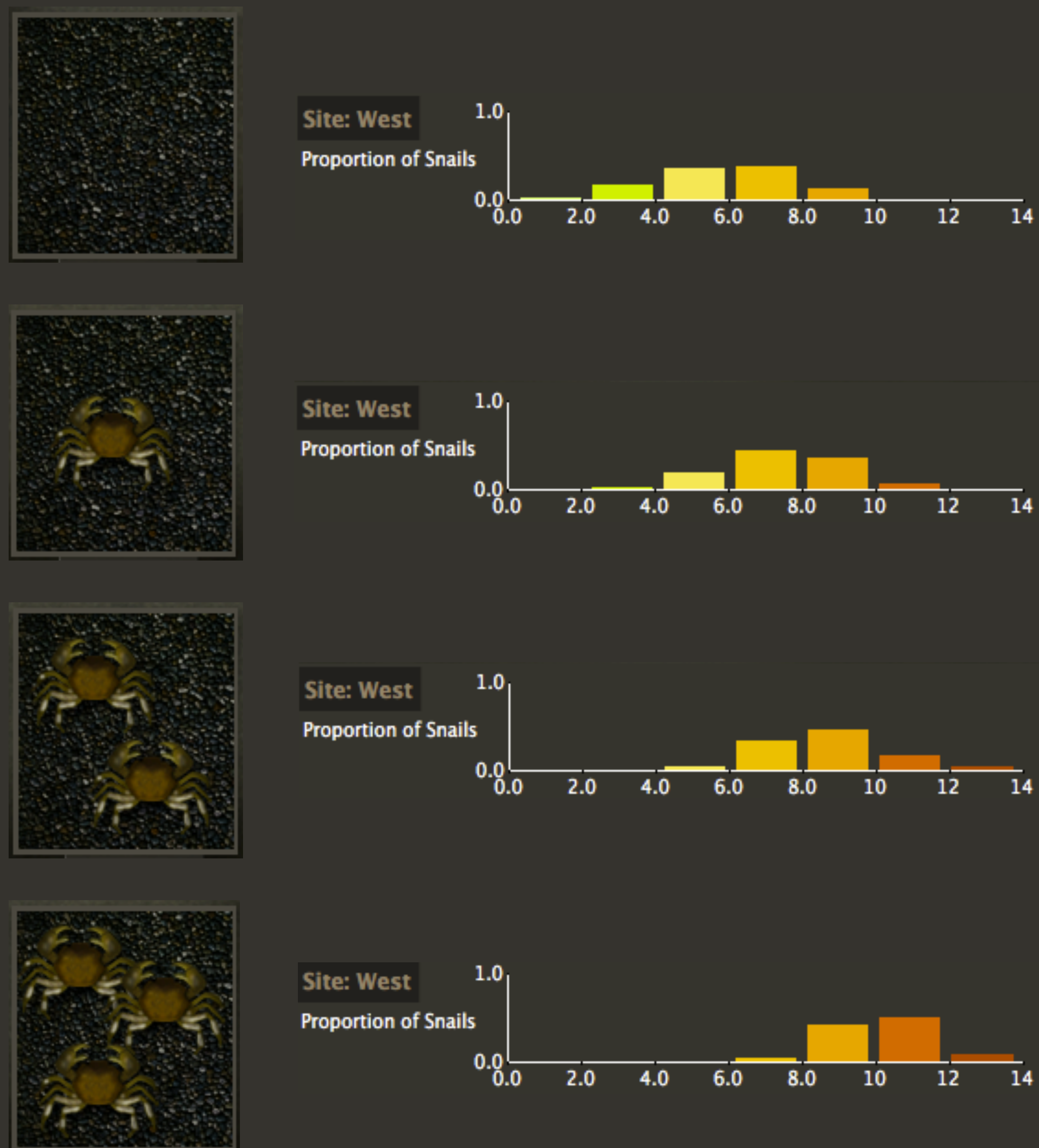
Stronger selection means faster evolution.

Experimental design:

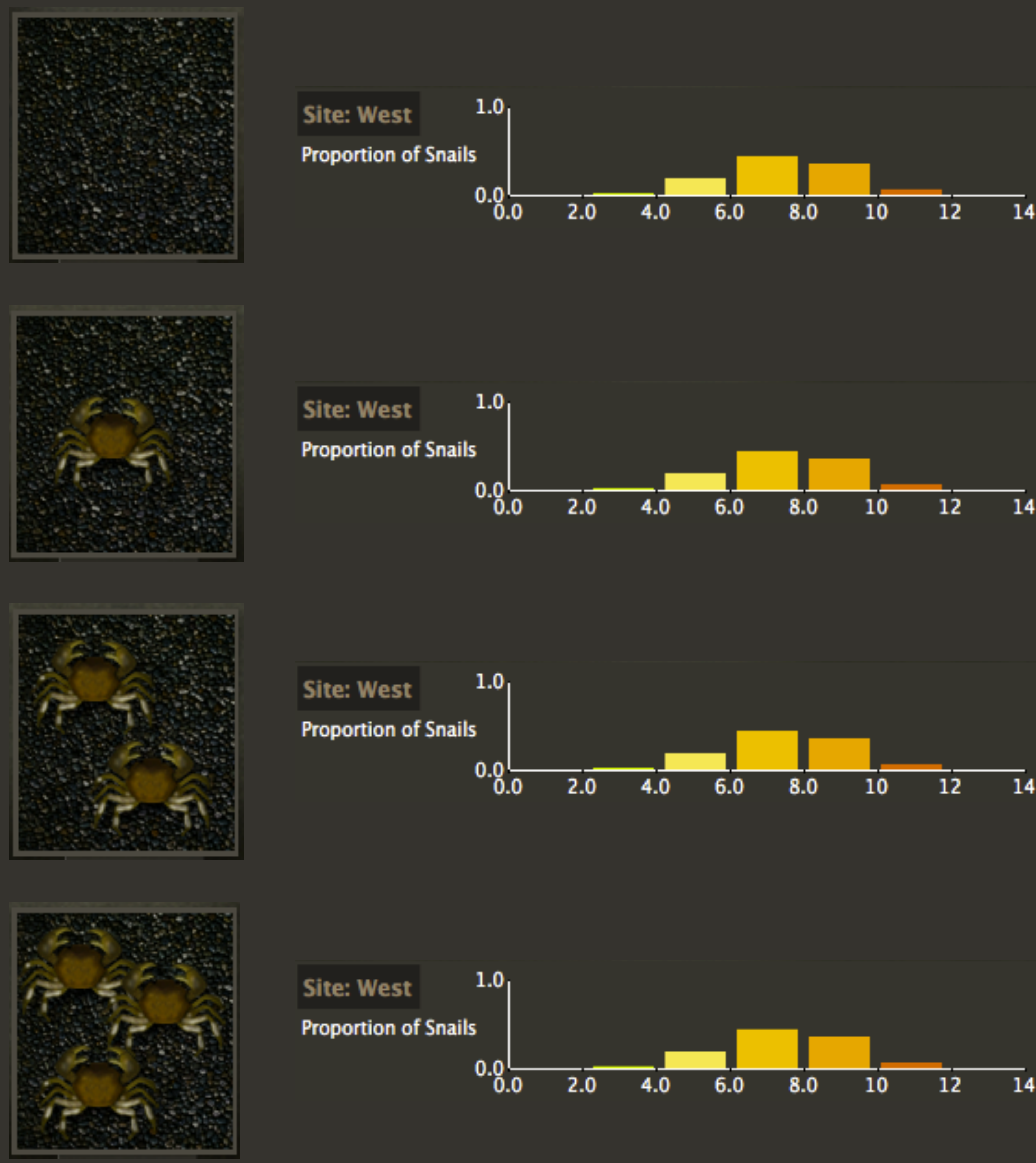


Run West population for 500 days with 0, 1, 2, or 3 crabs

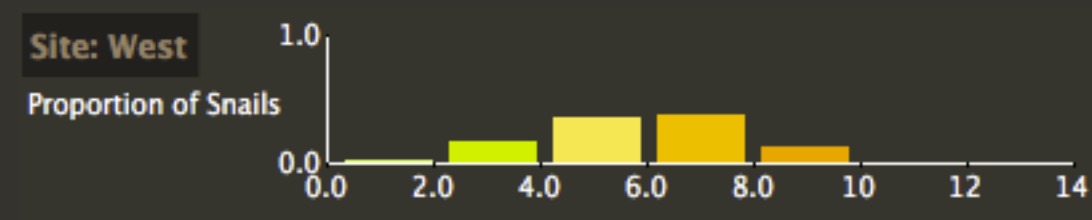
Predicted result if hypothesis is correct:

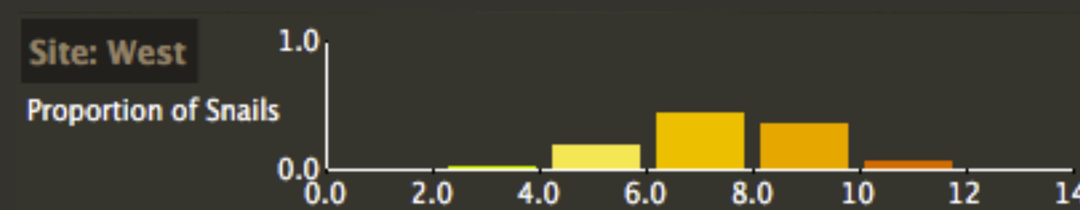


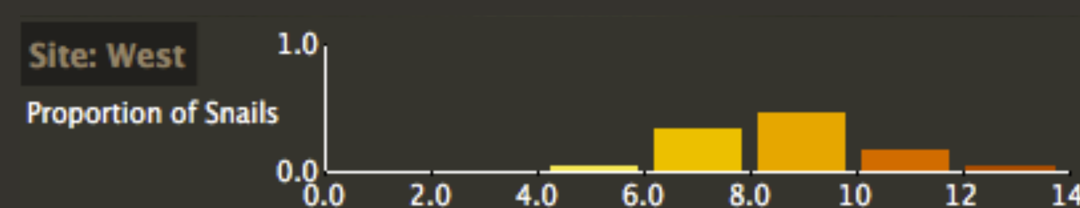
Predicted result if null hypothesis is correct:

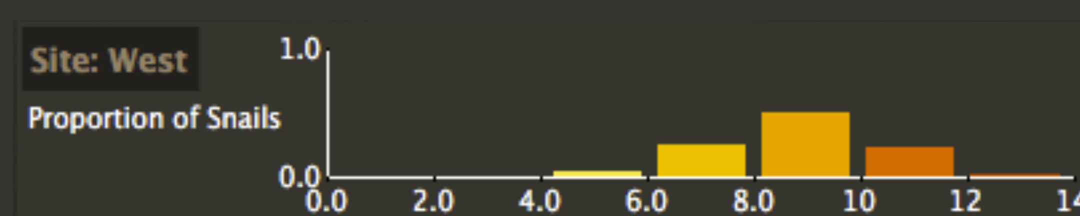


Actual result:









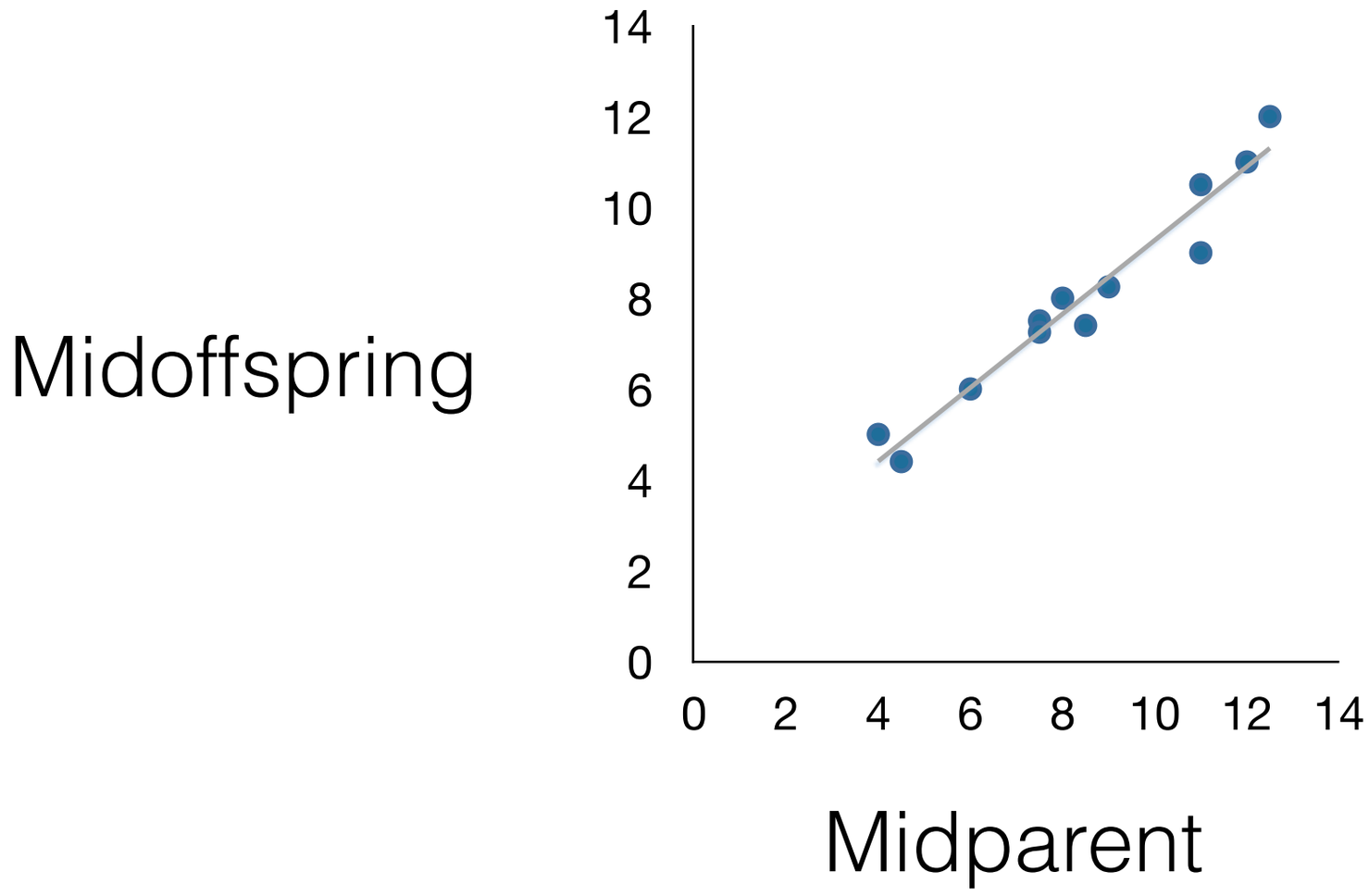
Notes:

- Among the advantages of working with collaborators is that you can run the same experiment many times. That is, you can perform many replicates.
- You should devise graphs that aggregate the results of your replicates in a more useful and informative way than I have done here. I can help you think about how to do this.
- The experiment I just described has a big flaw. **IF** your group can spot the flaw in my experiment **AND** you can design a better experiment that overcomes this flaw, then you can address the question: Does the strength of selection influence the rate at which a population evolves?
- For other questions your group could address, read on.

More Ideas for Darwinian Snails

What is the heritability of shell thickness?

- Set up pairwise matings in tanks, record thickness of parents and of offspring
- Calculate the mean thickness for parents and offspring in each family
- Plot midoffspring vs. midparent
- Take slope of best-fit line as an estimate of the heritability.



What will this graph look like if the heritability is high? If the heritability is low?

Does the number of founders influence the diversity in a new population?

Before starting, create a highly variable population:

- Combine the East and West natural populations
- Let simulation run for ~125 steps to allow some breeding and death

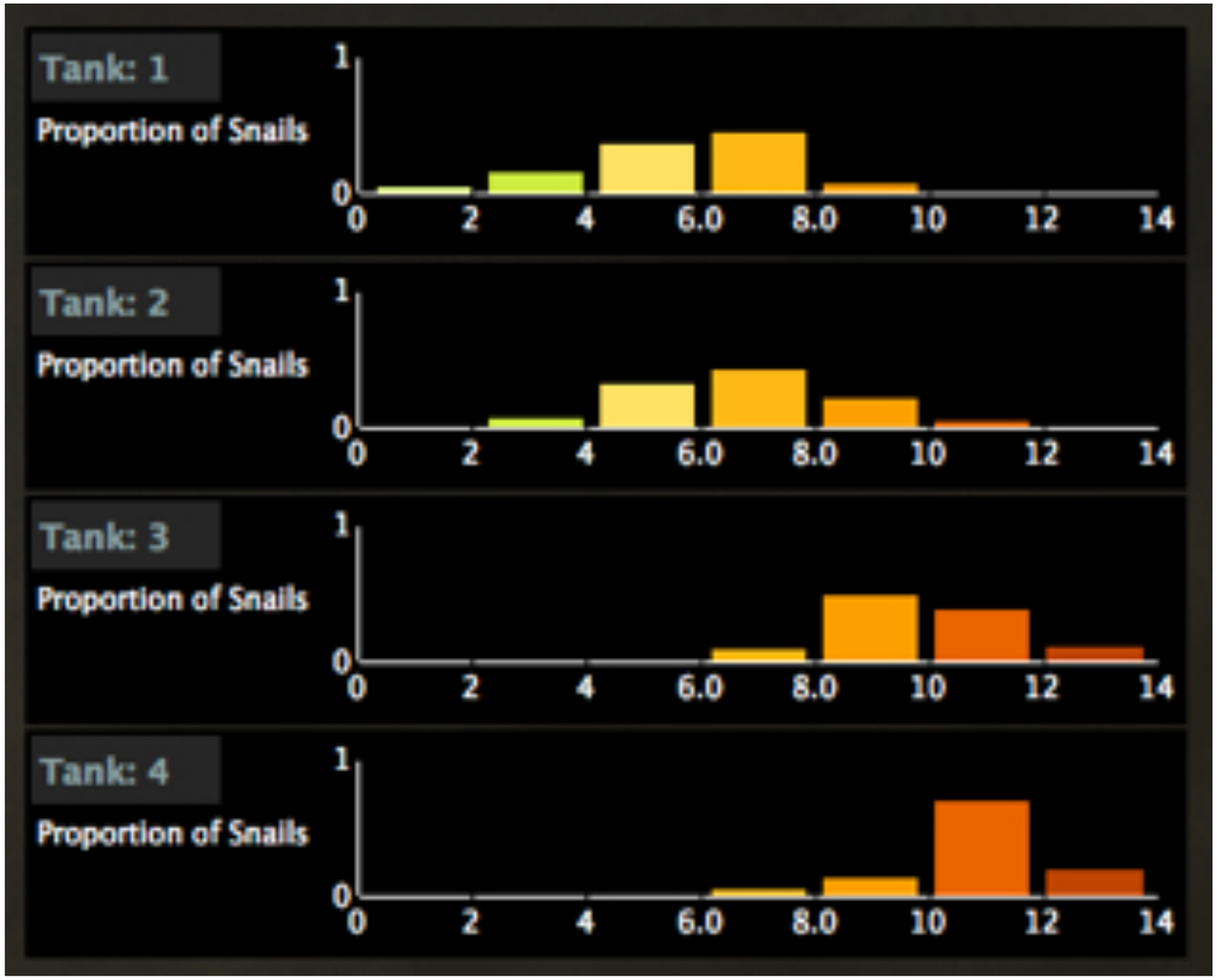
Now:

- Sample different numbers of individuals at random and drag them into experimental tanks.
- Across populations, compare the number of founders to some measure of the variation in the population.

How will you quantify the amount of variation in each population? How will you summarize the data? What will your summary graph look like if the number of founders influences the diversity in a new population? If it does not?

Does migration among populations impede local adaptation?

- Note that 1 generation = ~150 days
- Set up these experimental populations:
  Tank 1: West snails; no crabs.
  Tank 2: West snails; no crabs
  Tank 3: East snails; 1 crab.
  Tank 4: East snails; 1 crab.
- Run for 300 days
- Move 5 juveniles from Tank 2 to Tank 3, and 5 from Tank 3 to Tank 2.
- Run for 150 days
- Move 5 juveniles from Tank 2 to Tank 3, and 5 from Tank 3 to Tank 2.
- Run for 150 days
- Move 5 juveniles from Tank 2 to Tank 3, and 5 from Tank 3 to Tank 2.
- Run for 150 days
- Result is at right. Compare Tanks 2 and 3, which have been experiencing migration, to Tanks 1 and 4, which have not.
- Could repeat the experiment and vary number of migrants

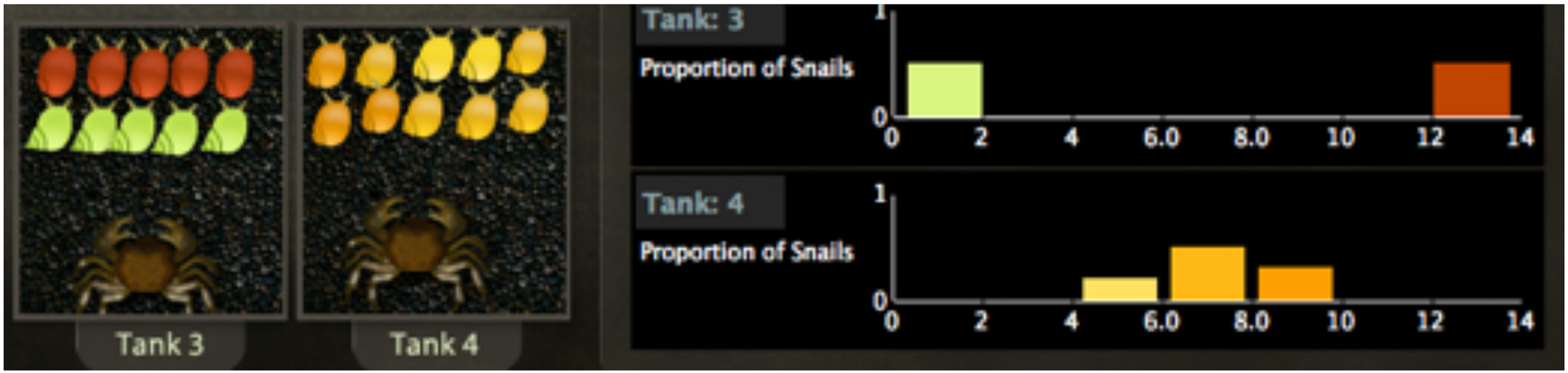


How will you summarize the data? What will your summary graph look like if migration impedes local adaptation? If it does not?

How does the genetic variation in a population influence the rate of evolution?

Before starting, use the experimental tanks and selective breeding to create a population of very thin-shelled snails and a population of very thick-shelled snails. Keep an unselected population as well.

Now, set up experimental populations as shown here:



Note that Tank 3 and Tank 4 have similar means but different amounts of variation. And each has a crab. Which will evolve more quickly toward high mean thickness?

How will you summarize your data? What will your summary graph look like if the amount of variation influences the rate of evolution? If it does not?