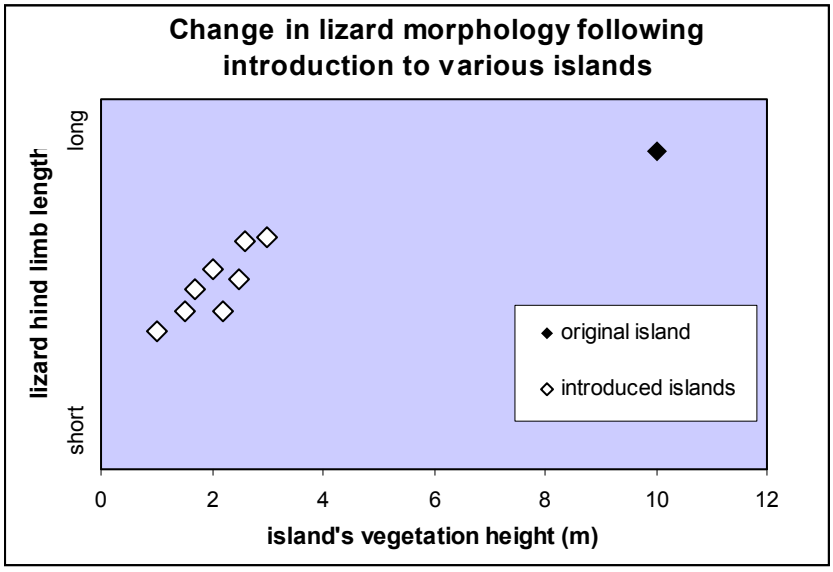
Ecology – Study Problems for Exam 1

Exam 1 will be on Thursday, February 12. At least 33% of the points possible on this exam will be based on problems selected from those below.

1. Some plants and grasshoppers in hot environments have reflective body surfaces, which make their heat gain less than it would be otherwise.
a. If you were to design a tiger beetle that could best cope with thermal conditions on black beaches, what color would it be? Justify your answer.
b. The beetles on the black beaches of New Zealand are black, and the beetles on the white beaches are white. What do the matches between the color of these beetles and their beaches tell us about the relative roles of thermoregulation and predation pressure in determining beetle color?
c. What does this example imply about the ability of natural selection to "optimize" the characteristics of organisms?

2. Starfish occur in intertidal zones from the arctic to Antarctica and many places in between.
a. Draw a graph in which you predict the optimal temperature for an enzyme from a starfish from the Alaskan coast and for the same enzyme from a starfish from the coast of Panama. Be sure to label axes.
b. How would starfish from these two regions fare in the lab at high temperature? Why? At low temperature? Why? (Be sure your explanations are complete.)
c. Explain how natural selection could result in the thermal optima seen in starfish from different regions. In your explanation, include at least two requirements for natural selection and discuss how these requirements could be met.

3. Populations of *Anolis* lizards demonstrated significant morphological change following introduction of the lizards to various islands differing in vegetative structure, as shown in the graph below.



a. Describe an experiment to determine whether the morphological changes observed in the study populations were based on genetic changes. Include enough detail that another ecologist could perform this experiment.
b. Draw two graphs, representing two possible outcomes of your experiment. In the first graph, show results that would indicate that the morphological changes *were* based on genetic changes. In the second graph, show results that would indicate that the morphological changes *were not* based on genetic changes.

4. Low activity levels help tadpoles survive when snakes, which eat tadpoles, are present in their environment. High activity levels allow tadpoles to find more food and are therefore beneficial when snakes are absent. The following data are from a reciprocal transplant experiment involving tadpoles from two populations, A and B.

	Activity level
tadpoles from population A, not exposed to snakes	0.60
tadpoles from population A, exposed to snakes	0.60
tadpoles from population B, not exposed to snakes	0.60
tadpoles from population B, exposed to snakes	0.20

a. Construct a graph showing activity levels of tadpoles from each population in the two environments. Be sure to label axes.
b. Which population shows greater phenotypic plasticity in activity level in response to snake presence?
c. Based on the results of this reciprocal transplant experiment, predict the abundance of snakes in the natural environment of each tadpole population.
d. What is the probable basis for the match between population A and its natural environment?
e. What is the probable basis of the match between population B and its natural environment?
f. Explain why ecologists do reciprocal transplant experiments.

5. An enthusiastic ecology student has predicted that birds in cold climates will require more calories than birds in warm climates.
a. Give the null hypothesis and the alternative hypothesis for this prediction.
b. The student experimentally tested this prediction. The results of the t-test were as follows: t=1.912476; p=0.071863. Would you reject the null hypothesis? Why or why not?
c. Describe an experiment to test this prediction that could be analyzed using a paired t-test. Describe another experiment to test this prediction that could be analyzed with an unpaired t-test. Be sure to include which experiment goes with which type of t-test and why.

6. You have been assigned to a task force to figure out how to prevent the spread of a newly discovered pathogen. You are the only ecologist on the task force. List three ecological questions that you would want to ask to help understand how to prevent the spread of this pathogen. Explain why each question is ecological, and explain why each question is important to preventing the spread of this disease.