

Read carefully. Work accurately and efficiently. Some useful equations:

$N_t = N_0 \lambda^t$	$dR/dt = rR - cRP$	$dN_1/dt = r_1 N_1 (K_1 - N_1 - \alpha_{12} N_2) / K_1$
$N_t = N_0 e^{rt}$	$dP/dt = acRP - dP$	$dN_2/dt = r_2 N_2 (K_2 - N_2 - \alpha_{21} N_1) / K_2$
$H' = - \sum [p_i * \ln(p_i)]$	$dN/dt = rN(1-N/K)$	$dU/dt = \Lambda_0 v^* \epsilon + \epsilon^c * \theta_\lambda \theta^* \gamma^y$

Provide **precise descriptions** of the four, easily observed characteristics of natural selection. (2.5 pts ea., 10 pts total)

- a. _____
- b. _____
- c. _____
- d. _____

Short answers and multiple guess. Provide or choose the **best** answer (4 pts ea., 30 pts total)

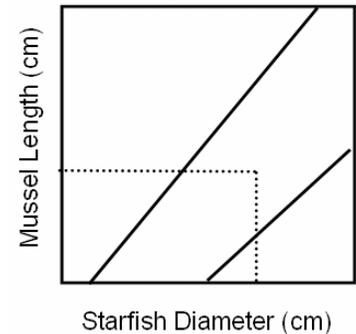
1. If p = the proportion of the A₁ alleles in a one-locus, two-allele system, which of the following is p if the number of individuals that are A₁A₁ = 50, A₁A₂ = 100, and A₂A₂ = 50?
 - a. 0.25
 - b. 0.33
 - c. 0.4
 - d. 0.5
 - e. 0.75
2. *Plasmodium* exhibits a complex life cycle. Your book went into depth about the two hosts required for this protozoan, which included:
 - a. humans and tapeworms.
 - b. humans and mosquitoes.
 - c. dogs and annelids.
 - d. horses and flies.
 - e. none of the above.
3. Plants have two basic defenses against herbivores. Identify these and give an example:
 - a. _____
example: _____
 - b. _____
example: _____
4. The paradox of enrichment refers to the finding that
 - a. it seems that lakes should not benefit from agricultural runoff, but they do.
 - b. it seems that lakes should benefit from agricultural runoff, but they do not.
 - c. if herbivore food resources are increased, predator populations usually decrease because herbivores are stronger and better able to defend themselves.
 - d. increasing prey resources destabilizes predator-prey systems.
 - e. increasing prey resources stabilizes predator-prey systems.
5. Herbivores
 - a. consume very little primary productivity.
 - b. consume moderate levels of primary productivity.
 - c. consume large amounts of primary productivity.
 - d. all of the above.
 - e. none of the above.

6. The “competitive exclusion principle” states that
- only one species can survive in a given ecosystem.
 - multiple species can work together synergistically to exclude other groups of species.
 - if two species are limited by a resource only one species will survive.
 - if one species exhibits intraspecific competition, other species will likely invade.
 - all of the above.

Short Answer Questions. Answer two of four. (10 pts ea., 20 pts total)

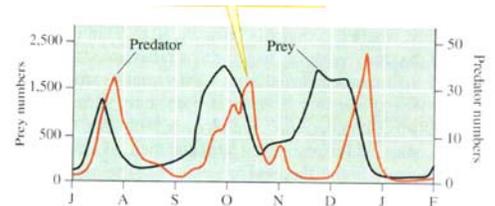
- Briefly discuss two reasons we might find a difference between the frequency of an allele at a locus and what would be expected by the Hardy-Weinberg Law? Be specific.
- Fully describe the two terms of the prey equation (one increases population growth, the other decreases it) of the Lotka-Volterra predator-prey system using an example.

- The size of prey is important in many predator-prey systems (e.g., lions don’t tend to eat elephants or mice). We discussed this with regards to mussels and starfish (graph to the right). Explain



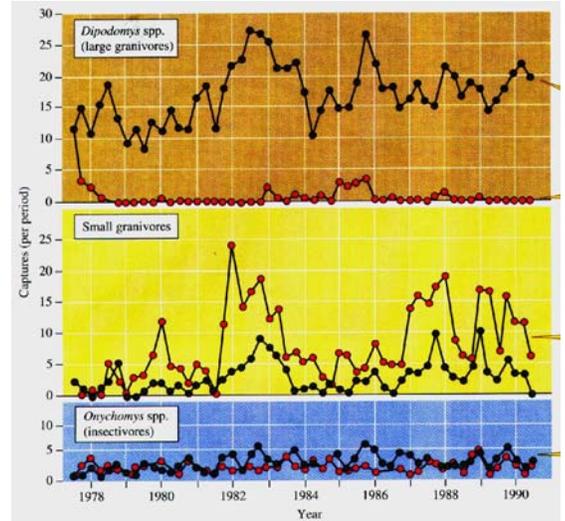
- the main result of the graph. (6 pts)
- what specifically are the zones in this graph? (4 pts)

- Huffaker (1958) was able to modify an herbivorous-predatory mite system so that they were able to persist for a long time, although they oscillated over time (see graph). How was he able to do this, in terms of the Lotka-Volterra predator-prey model? Provide a graph of this.



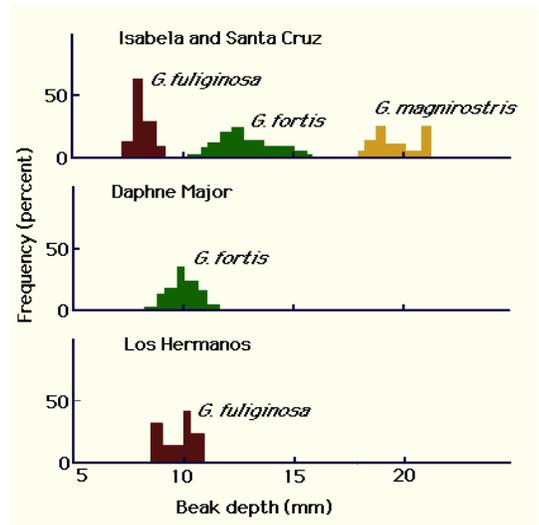
Interpret-the-Graph Question. Answer one of two. (10 pts)

1. Based on the graph complete the following:
 - a. What treatment was done in this experiment? (2 pts)
 - b. What is the main conclusion? (3 pts)
 - c. What two supporting lines of evidence support this conclusion? (3 pts)
 - d. What is one alternative explanation? (2 pts)



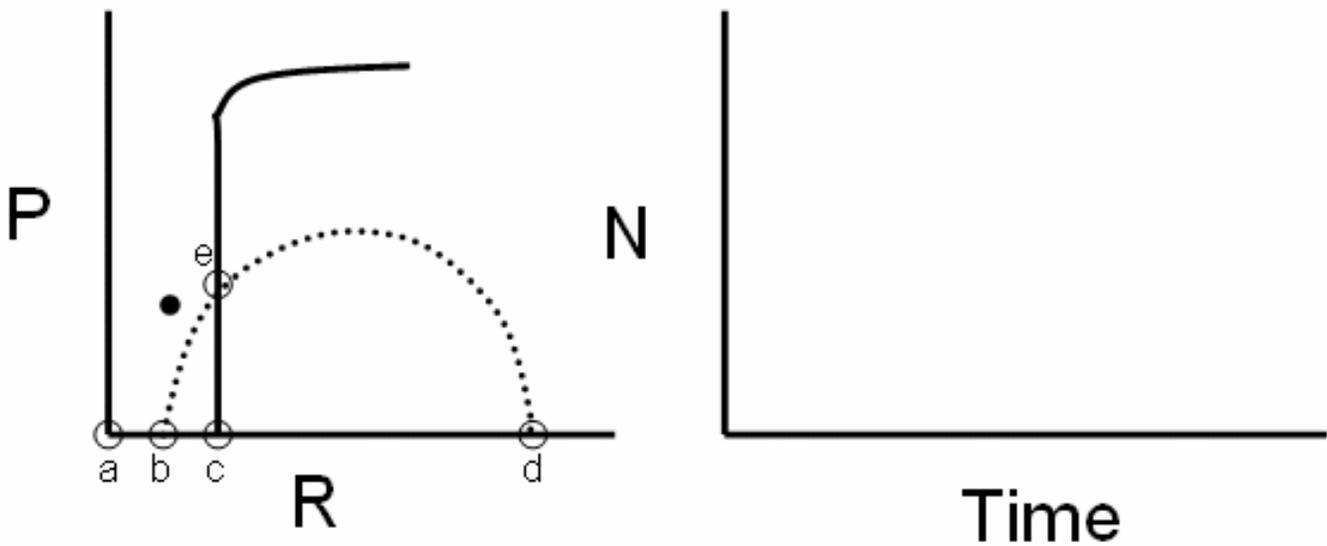
2. As seen in the figure *G. fuliginosa* and *G. fortis* have different beak depth distributions in the top graph (large islands) and similar distributions when compared from the two small islands (lower two graphs). Explain in detail

- a. the best hypothesis to explain this pattern. (4 pts)
- b. two alternative hypotheses by which this pattern might have been produced. Provide a small graph to depict each hypothesis. (3 pts each)
 - i.
 - ii.



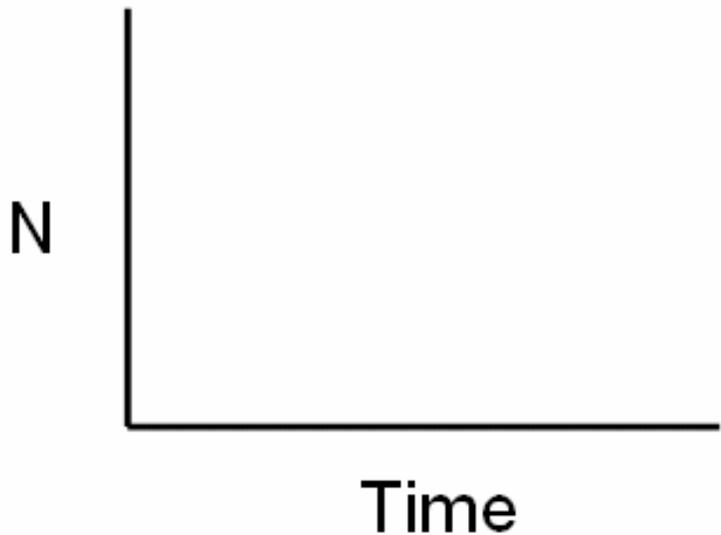
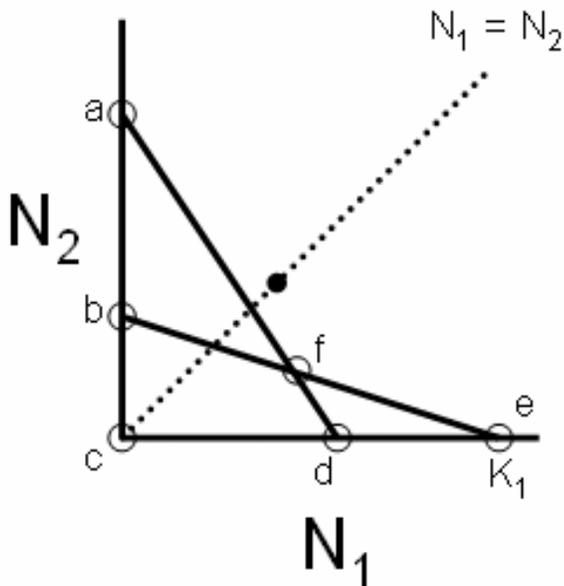
Community Ecology Models. Answer both (15 pts ea., 30 pts total)

- 1a. Identify the model in the left graph by name: (1 pt) _____.
- 1b. We bent the horizontal line down on the left (to point “b”) and on the right (to point “d”).
- i. In words, what does this line represent? (1 pts) _____
 - ii. What ecological principle is represented by the downward bend on the left? (1 pts) _____
 - iii. What ecological principle is represented by the downward bend on the right? (1 pts) _____
- 1c. Analyze the graph on the left in the space below for each circled point. (1 pts ea. for 5 pts)
- a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
- 1d. The dark dot in the left graph represents the initial condition (starting place). On the left graph draw the trajectory until it reaches an equilibrium. (3 pts)
- 1e. Draw this trajectory from start to finish on the graph on the right. (3 pts)



- 2a. Identify the model in the left graph below by name: (1 pt) _____.
- 2b. What does the line connecting points a and d represent? (1 pts) _____

- 2c. Analyze the graph on the left in the space below for each circled point. (1 pts ea. for 6 pts)
- a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
 - f. _____
- 2d. The dark dot represents the initial condition. On the left graph draw the trajectory until it reaches an equilibrium. (3 pts)
- 2e. Draw this trajectory on the graph on the right. (4 pts)



Extra Credit (≤ 7 pts)

1. We discussed a new method to treat tumors. What was it (generally = 1 pt, specifically = 2).

2. Provide a specific example of natural disaster (type & location) from our “what’s new” discussions since the last exam. (1 pt)

3. A Nobel Laureate recently suggested that Africans are somehow not as smart as others.
 - a. Name that person: _____ (1 pt)
 - b. Name the lost job: _____ (1 pt)
 - a. Nobel for what? _____ (1 pt)

4. What human trait was reported to be doomed in the next 2000 or so years? (1 pt)