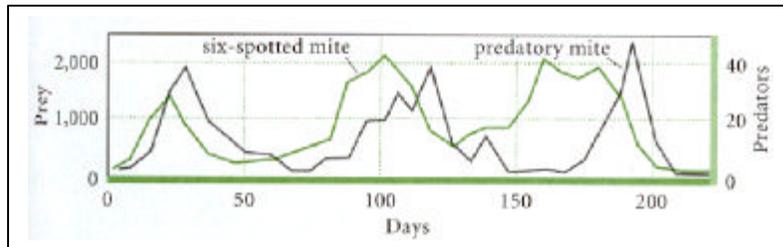


I. Short Answer Questions

SAQ #1. One of the most important lab studies of predator prey dynamics was Huffaker's (1957) mite study. Please briefly explain his experimental design. (5 pts)



SAQ #2. Please briefly explain what were the specific results of Huffaker's experiments? (Hint: see figure below from the handout)



(5 pts)

SAQ #3. What major conclusion can we draw from Huffaker's studies about why predators and prey might coexist in nature? What is the main generality we can draw from this study? (5 pts)

The next two questions will test your knowledge of the consequences of trophic interactions at the community level on the evolution of individual life histories.

SAQ #4. Assume for a moment that resource supply/demand ratios completely determined the evolution of life history characters. Describe at least 5 individual life history characteristics in a population for which resource supply equals demand, (i.e. competition was at a maximum).

- 1 -
- 2 -
- 3 -
- 4 -
- 5 -

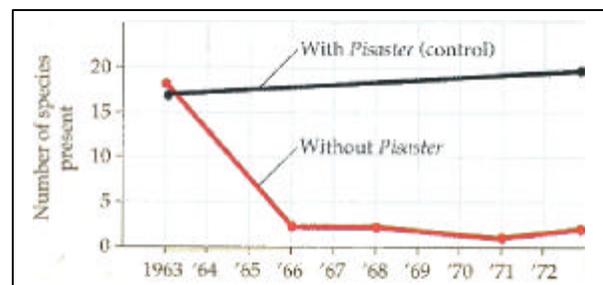
(5 pts)

SAQ #5. Assume for a moment that the environment were variable and unpredictable and that the relationship between juvenile and adult mortality completely determined the evolution of life history characters. Describe at least 5 individual life history characteristics in a population for which juvenile mortality were relatively high and unpredictable, (because of either competition for food or due to intense predation on juveniles by small bodied predators with bottomless appetites).

- 1 -
- 2 -
- 3 -
- 4 -
- 5 -

(5 pts)

SAQ #6. Paine's (1963) studies showed the importance of a keystone predator (the sea star *Pisaster*) in affecting species diversity in the intertidal in the pacific northwest (see figure at right). What exactly is a "keystone predator" and how did *Pisaster* function as one?



(8 pts)

SAQ #7. Of what economic value is biodiversity to humans? Please list three totally different ways in which biodiversity is of economic value. {Hint: this question is NOT about aesthetics, it's about economics. }

1 – 2 – 3 – (6 pts)

SAQ #8. Please BRIEFLY explain the three major objectives of **ecosystems ecology**. Please use a diagram for each, AND write an explanation.

diagram and explain objective 1, and explain the key “emergent properties” that this objective aims to explain – (4 pts)

diagram and explain objective 2, and explain the key “emergent properties” that this objective aims to explain – (4 pts)

diagram and explain objective 3, and explain the key “emergent properties” that this objective aims to explain – (4 pts)

SAQ #9. This question will assess your understanding of the "intermediate disturbance hypothesis" for the maintenance of local species diversity.

On the axes at right plot the relationship between disturbance and diversity according to the "intermediate disturbance hypothesis." Please LABEL THE AXES!



(4 pts)

SAQ #10. According to the "intermediate disturbance hypothesis," why is diversity low at very low levels of disturbance? (5 pts)

SAQ #11. According to the "intermediate disturbance hypothesis," why is diversity low at very high levels of disturbance? (5 pts)

SAQ #12. According to the "intermediate disturbance hypothesis," why is diversity high at intermediate levels of disturbance? (5 pts)

Longer Answer Questions

LAQ #1. According to Dr. David Reznick, who has studied life history evolution in guppies that live in streams on the Caribbean Island of Trinidad, there are major differences in guppy life history for mountain vs. lower elevation populations.

Reznick found that at upstream sites a small predatory fish is very common and is a voracious predator of smaller guppies, and that larger guppies have few predators. In contrast, at downstream sites, a different species of large-bodied predatory fish is very common and is a voracious predator of larger guppies, but that smaller guppies are not eaten.

Given these different predation regimes, what life history characteristics would you expect to evolve in the guppies at the high and the low elevation sites?

- Specifically address your predictions about the relative differences at each population regarding:
- juvenile and adult mortality – (2pts)
 - body size and age at sexual maturity – (2pts)
 - egg size and number of eggs per reproductive event – (2pts)
 - adult reproductive life span – (2pts)

LAQ #2. This question will assess your understanding of the role of coevolutionary mutualisms in the origin of biological diversity.

- (a). Please briefly explain what is a coevolutionary mutualism. (5 pts)
- (b). According to a simple model of two species **mutualism** such as:

for species 1:

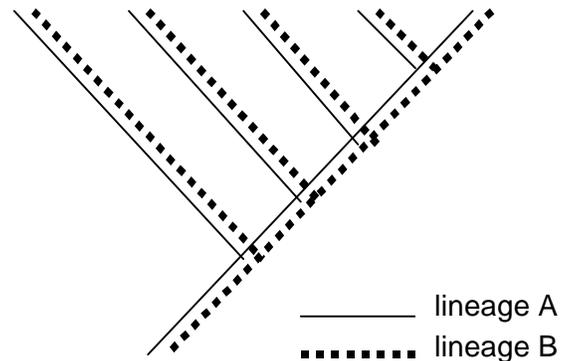
$$\frac{1}{N_1} * \frac{\Delta N_1}{\Delta t} = -r_1 + a * N_2$$

for species 2:

$$\frac{1}{N_2} * \frac{\Delta N_2}{\Delta t} = -r_2 + b * N_1$$

...recall that it is not possible for these species to regulate each other – either they go to extinction or infinity.

What does this finding imply about the mechanisms of regulation for these species, and why does this implication lead to the argument that tight obligatory mutualisms, for which essential needs of each species are met by the other, should directly lead to rapid speciation of both lineages in phylogenetic parallel (their phylogenetic trees perfectly overlap)?



(10 pts)

- LAQ #3. (a). Please use a diagram and briefly explain what is the greenhouse effect? (6 pts)
- (b). What are four of the principal greenhouse gasses and what are their main sources? (4 pts)
- (c). Current models predict that +2-5°C warming is likely by 2100 if nothing is done and atmospheric CO₂ concentration is allowed to double. Please list at least three of the principal predictions for what is likely if global warming on this magnitude were to occur. (5 pts)

LAQ #4. According to archeologist Gary Rollefson, the dramatic abandonment of the Neolithic settlements such as the 'Ain Ghazal at 6000 b.c. was due to anthropogenic degradation of the fragile Jordan Valley ecosystem.

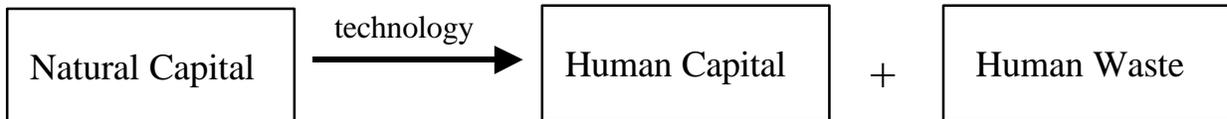


Imagine yourself as one of the members of this community at about 6100 b.c., just prior to its abandonment. What were the major environmental signposts that the 'Ain Ghazal culture and way of life were nearing a collapse?

(7.5 pts)

Please list 5 major global environmental signposts that our "modern" culture and way of life are not sustainable. (note: precision is not expected for any numbers you give)
(7.5 pts)

LAQ#5. This question will test your understanding of ecological economics. Below is a sketch of the relationships between "natural capital," "human capital," and "human-generated waste" that we used in class to describe the present unsustainable economic system (referred to as the "Neolithic" model).



- (a). List and briefly explain the three basic assumptions under which this economic model operates:
- (b). List and briefly explain the three basic assumptions under which a "sustainable" economic system (or the "post-Neolithic" model) would operate:
- (c). Herman E. Daly, an internationally recognized economist, once wrote that "There is something fundamentally wrong in treating the earth as if it were a business in liquidation..." Please briefly explain what he meant by this comment. Exactly what is being liquidated?

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