

ECOLOGY 301 - EXAM 2

Wednesday 28 October 1998

SAQ #1. Please state and BRIEFLY explain the two major objectives of population ecology. Please use a diagram for each, AND write an explanation.

diagram and explain objective 1 - (4 pts)

explain the key “emergent properties” that this objective aims at explaining - (4 pts)

diagram and explain objective 2 - (4 pts)

explain the key “emergent properties” that this objective aims at explaining - (4 pts)

Consider the simple exponential model of single species population growth.

$$\frac{1}{N} * \frac{\Delta N}{\Delta t} = r$$

SAQ #2. (a). Describe this model. What do the terms to the left and right mean? (3 pts)

(b). What are the principal assumptions of this model? (3 pts)

(c). What is(are) the main prediction(s) of this model? (3 pts)

SAQ #3. (a). Sketch a graph BELOW at LEFT showing the curve of population size versus time for a population growing exponentially. Label the axes.

(b). Sketch a graph BELOW at RIGHT showing the curve of the per capita population growth rate versus population size for a population growing exponentially. Label the axes.

SAQ #4. An important finding of the computer simulations of population ecology was that breeding earlier confers a huge fitness advantage relative to delaying and breeding later in life. Show graphically that this is so below by comparing the growth rate of a population of females who breed once early versus late in a finite life. (Hint assume the females live for 60 yrs, and one type breeds at 15 and the other at 30) (5 pts)

SAQ #5. According to your field notes on a population of squirrels in southeastern PA, each female has six female babies per year, eight out of ten adult females are killed by hawks each year, two out of ten adult females are killed by snakes each year, none leave per year and none emigrate from elsewhere per year. Assume squirrels can breed as one year olds.

If there are 100 adult females alive and breeding now (N_0), how many would there be in one and two years from now? {Note 1: ignore the problem of males} {Note 2: you do not need a calculator to find the numerical values asked for. The calculations involve only simple arithmetic.}

SHOW ALL OF YOUR WORK!!

how many in one year (N_1)? (4 pts)

how many in two years (N_2)? (4 pts)

SAQ #6. Please offer a brief, but precise definition of evolution. (5 pts)

SAQ #7. Explain briefly what are the three conditions that are required for evolution to occur by natural selection? (5 pts)

SAQ #8. Please list and very briefly define four ways that evolution can occur besides Natural Selection.

SAQ #9. (a). Please list and very briefly explain three specific long term effects on a population of fish of a plan to build fish hatcheries to offset the effects of fishing?

(b). How “sustainable” is this plan? Please explain. (1.5 pts)

SAQ #10. How should the optimal life history phenotype allocate its limited assimilated energy (i.e., its net production) to maximize its fitness? Please use a diagram in your explanation. (5 pts)

LAQ#1. What was the take home message of Carol Collier's seminar on "Environmental Regulation in the 21st Century." at Widener University on Monday October 26, 1998? Please explain what, according to the speaker, were the principal challenges to reforming environmental legislation for the 21st century? In addition, what was the most important solution?

principal challenges –
 most important solution –
 take home message –

LAQ #2. This question will assess your understanding of current life history theory.

- What are three ways in which increasing present allocation to storage affects future reproduction?
- What are three ways in which increasing present allocation to growth affects future reproduction?
- What are two ways in which increasing present allocation to reproduction (i.e. the fraction to R vs. G+S) affects future reproduction?

LAQ #3. This question will test your knowledge of tradeoffs and constraints affecting life history evolution.

- Assume for a moment that resource supply/demand ratios completely determined the evolution of life history characters. Describe 4 individual life history characteristics in a population for which resource supply equals demand.
- The above life history theory has been referred to as r-K selection. Please list and adequately explain (note the space size!) three of the major problems/challenges to this theory. What is it missing?

LAQ #4. Consider the simple logistic model of single species population growth.

$$\frac{1}{N} * \frac{\Delta N}{\Delta t} = r * \left[1 - \frac{N}{K} \right]$$

- Describe this model by explaining what all of the terms mean to the left and right of the equals sign, and list what are the principal ecologically relevant assumptions?
- Without using any symbols, what is the main prediction of this model?
- Draw a little graph below showing the per capita population growth rate vs. the population size for this model. Indicate ALL relevant constants, and LABEL THE AXES!
- Draw a little graph below showing the population size vs. time beginning with an initially large ($N \gg K$) and with an initially small ($N \ll K$) population size for this model. LABEL THE AXES AND ALL CONSTANTS!

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