Workshop on Population ecology

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I. Pre-workshop

A. Introduction.

Ecology is the study of the relationship between organisms and their environment. Population ecology is the study of the changes in growth and composition of single groups of species (populations). This workshop will help you gain an understanding of the numerous factors that may bring about population changes. For example, species vary in the timing of their growth, reproductive age, and death. Species compete with other species for resources, species are eaten, and species are limited by the conditions found in their environment. These factors can influence the distribution and abundance of a species.

B. Background knowledge.

1. Be able to distinguish between **biotic** and **abiotic** factors.
2. Be able to graph an example of **arithmetic** (linear) and **exponential** (J-shaped) growth.
3. Students should have read Chapter 52 of Campbell *et al.*, 6th ed. prior to the workshop.
4. Please review/define the following terms:
   a. population
   b. density
   c. dispersion
   d. fecundity
   e. cohort
   f. intrinsic rate of increase
   g. age structure
   h. generation time
   i. intraspecific competition
   j. exponential population growth
   k. logistic population growth
   l. environmental carrying capacity
   m. density dependent
   n. density independent
   o. life table
   p. survivorship curve
   q. K-selected species
   r. r-selected species

C. Benchmarks.

The objectives of this workshop are to enable the student to

1. understand the dynamic nature of population growth
2. graph and interpret age pyramid diagrams
3. understand what factors affect the growth and decline of populations

II. The workshop

A. Age Pyramids

1. Using age pyramids (see p. 1170 of Campbell), sketch and label pyramids for a population that is

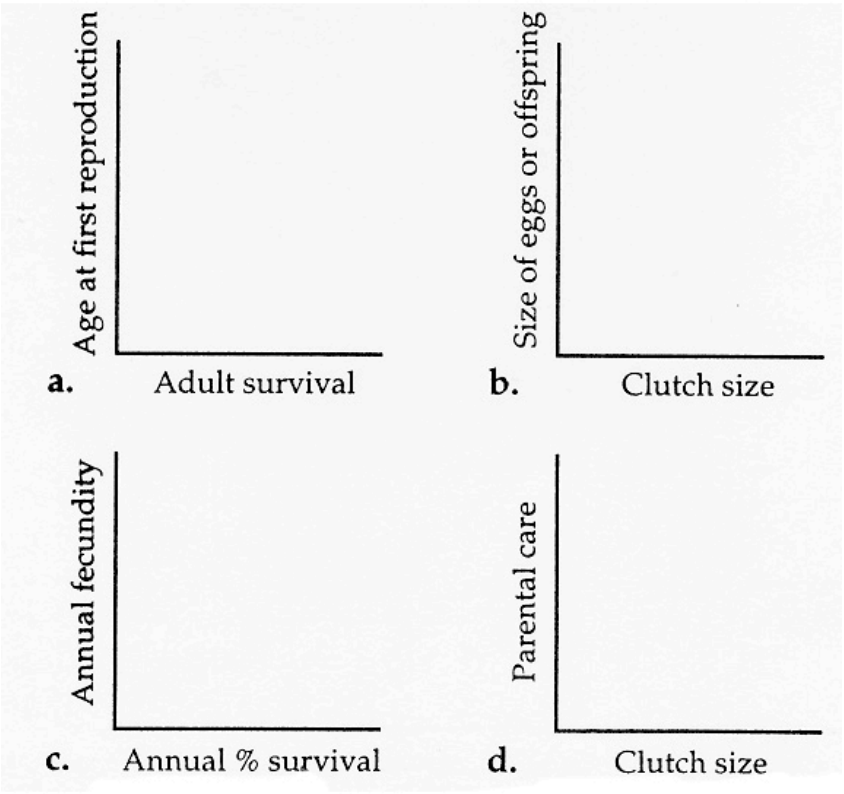
increasing: decreasing: stable:

2. Select one of the above pyramids. Project what would happen if a famine or economic prosperity occurred. Sketch the pyramid.

3. Write the equation for exponential growth. Label and explain the terms.

4. Write the equation for logistic growth. Label and explain the terms.

5. Fecundity, mortality, age at first reproduction, clutch size, and parental investment are usually interrelated. On the following graphs, sketch the relationship you would predict between the two variables.



6. There are numerous ways in which a population biologists examines his/her population of study organisms. Descriptions of population dynamics include numerous characteristics/ attributes. The next series of questions asks you to use terms to describe/ categorize population(s).

a. One may see clumped dispersion, random dispersion, or uniform dispersion of populations. Describe conditions which may result in these patterns.

b. There are three types of survivorship curves (Type I, Type II, and Type III). Describe the characteristics of populations which exhibit these curves. Name an animal that falls into one of each of these categories.

c. Define density-dependence. Explain how density-dependent factors affect population growth.

d. Describe how amount of rainfall and sunlight can function as density-independent factors in controlling population growth.

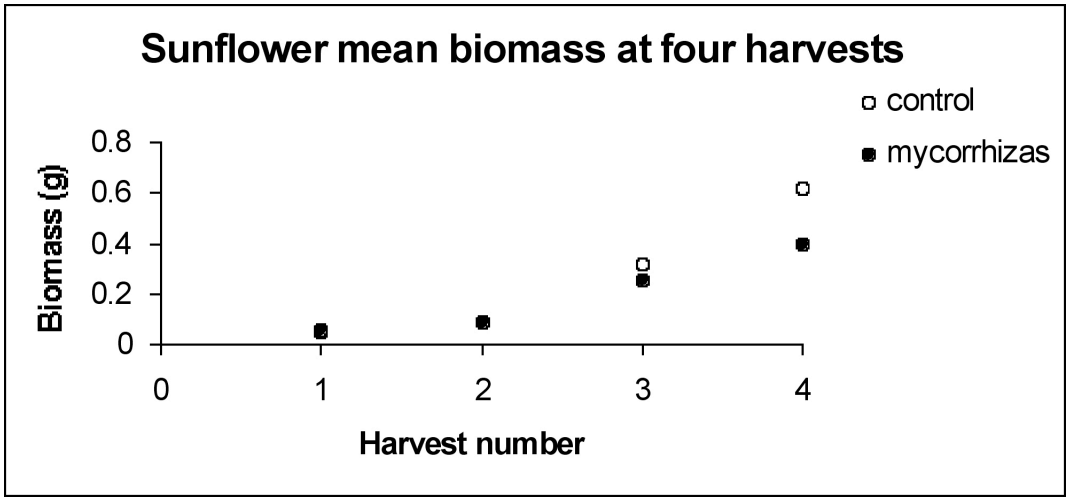
e. List the three major characteristics of a life history and explain how each affects the:
   i. Number of offspring produced by an individual
   ii. Population's growth

f. Distinguish between r-selected populations and K-selected populations.

g. Explain how predation can affect life history through natural selection.

III. Case Study

Mycorrhizae are plant root-fungus symbioses. They can have a profound impact on the growth and survival of individual plants and therefore plant populations. This can then lead to influencing plant community composition and succession of an area. Look at the following graph (modified from Maffia 1997). By final harvest, Sunflower plants grown at high density without mycorrhizas are twice the size of those grown with mycorrhizas. The total number of Sunflower plants grown without mycorrhizas are, however, only half that of the Sunflowers grown with mycorrhizas. Based on these data, describe a scenario where it is advantageous to have mycorrhizas; disadvantageous to have mycorrhizas. Speculate as to why Sunflowers continue to associate with mycorrhizas.



IV. Post-workshop review and practice

A. Explain how age structure, generation time, and sex structure of populations can affect population growth (hint: look over the age pyramid diagrams in Chapter 52 of your text).
B. List several examples of how a "stressful" environment may alter a population's structure.