Population Growth and Balance
Fundamentals of Populations and Population Growth
Growth Rate Curves
http://www.arcytech.org/java/population/index.html

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Read the information presented and answer the following questions.

1. What defines the complexity of an ecosystem?
   The plants and animals in that forest depend on each other for survival. What is more difficult to see are the interrelationships between the living organisms (some which can't be seen without a microscope) and the environment. The dependencies between all of these elements can be very complex. Complex systems like this, with different organisms and their interrelationships with the physical environment and contained in a specific unit of space (or area) are called ecosystems.

2. What is the objective of an ecologist?

   Their objective is to understand what every element brings into the system and what every element needs from the system. They try to understand, from a scientific point of view, what keeps everything living and existing in a balanced and stable way for very long periods of time.

3. Read the definition of a population. Analyze and answer the questions below.

   a. Do squirrels and chipmunks belong to the same population? Why or why not?

      No, these 2 animals are 2 different species. A population consists of a single species.

   b. Do the squirrels that inhabit 2 different city parks separated by an interstate highway belong to the same population? Why or why not?

      No, while they might be able to immigrate and emigrate they are most likely not a single population due to the physical barriers (highway) that separate the 2 groups. A population is generally thought of as a group of individuals that are capable of freely reproducing with other members of the same population.

4. Population numbers (density) change due to 4 different parameters; births, deaths, immigration, and emigration. Identify which of these 4 increase population densities and which decrease population densities.

INCREASE	DECREASE
Natality	Mortality
Immigration	Emigration

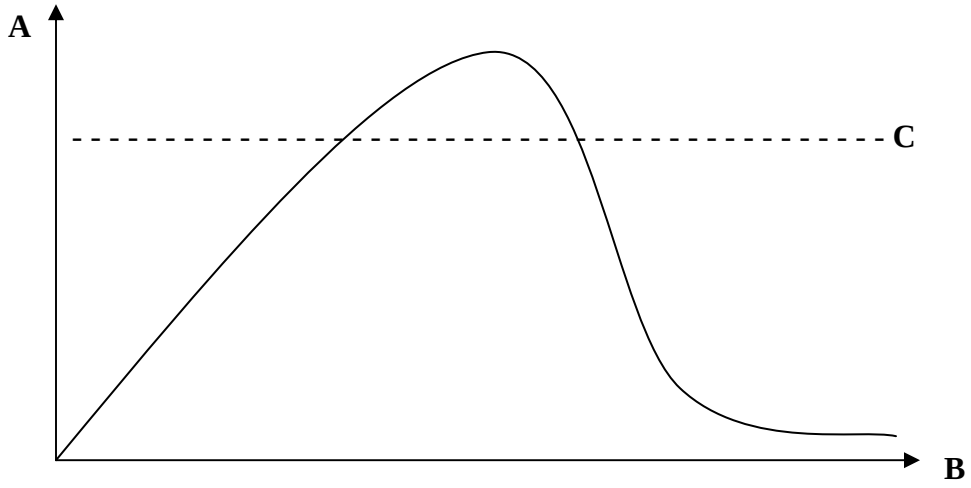
5. Is a growth rate that represents biotic potential typical or rarely seen? Why?

Rarely seen – resources become limiting (limiting factors) and growth rates are checked as they near carrying capacity.

6. When a population does grow at its biotic potential, what type of growth rate pattern occurs?

   Exponential (doubling)

7. This type of growth rate is represented in the graph below.



   a. Which axis is indicated by "A"_____Y_____ and is it the independent or dependent variable?_____dependent_____

   b. Which axis is indicated by "B"_____X_____ and is it the independent or dependent variable?_____independent_____

   c. Which axis plots the population density?_____Y_____

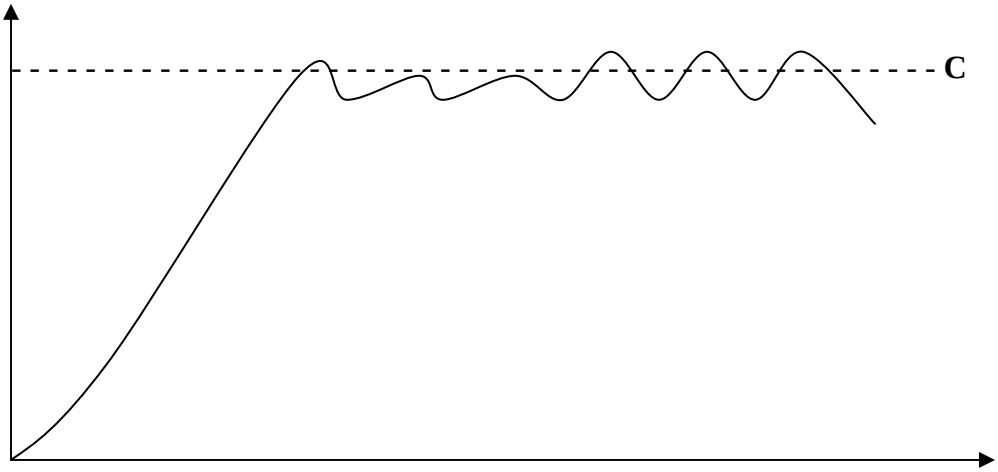
   d. Which axis plots the time interval?_____X_____

   e. What happens at "C" and why? "C" represents the carrying capacity of this environment; the total sum of all available resources needed to support the individuals of the population.

8. What limits biotic potential? List several of these limiting factors.

   Food and water supplies **Light** **Space**
   Predators **Diseases** **Parasitism**

9. The type of growth rate pattern that occurs when biotic potential is limited is represented in the below graph. This is a sigmoid or "S"-shaped curve.



a. What is the primary difference in the population's growth when one compares exponential to S-shaped growth?

While initial colonization phase of a population in a new environment will follow an exponential growth pattern, the growth slows as carrying capacity is approached. The population oscillates around this carrying capacity achieving an equilibrium in its growth pattern. This is a healthier population strategy.

b. How does the population's response change when it **FIRST** reaches "C"?
The limiting factors begin to inflict negative pressure on the ability to sustain continual growth and growth slows down.

c. What does "C" represent on both graphs.

Carrying Capacity

10. Define carrying capacity.
The area occupied by a population does not have unlimited resources such as food, water, and supplies to build and keep a dwelling. These factors limit the population growth and many times bring about death rates that equal the birth rates. When this happens, the population size reaches a stable balance. So one could say that there is a certain number of individuals of the population that can be supported by the environmental resources in a given ecosystem.

11. Must limiting factors always exert negative pressure against a population's growth rate? Explain.
No – an abundance of limiting factors encourages and supports continual growth in population size.

12. A population of deer mice experienced the following changes in population density. Plot the data from the table on a separate sheet of graph paper. Choose appropriate number lines for each of the two axes. Label the variables for both the x- and y-axis. Finally, identify whether this is an exponential or sigmoid growth curve.

Month	Population Density	
Jan '01	15	
March	12	
May	39	
July	97	
Sept	148	
Nov	103	
Jan '02	37	
March	29	
May	51	
July	126	
Sept	203	
Nov	111	
Jan '03	36	
March	17	
May	39	

Students will plot time (months) along the X-axis and density along the Y-axis

This is an exponential (Boom and Bust) growth curve with carrying capacity exceeded somewhere beyond a density of 97 mice.