SC.912.L.17.5 AA	Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.	High

A population consists of all the individuals of a species that live together in one place at one time. Every population tends to grow because individuals tend to have multiple offspring over their lifetime. A population grows when more individuals are born than die in a given period. But eventually, limited resources in an environment limit the growth of a population.

When population size is plotted against time on a graph, the population growth curve resembles a *J*-shaped curve and is called an exponential growth curve. An exponential growth curve is a curve in which the rate of population growth stays the same, and as a result, the population size increases steadily.

However, populations do not usually grow unchecked. Their growth is limited by predators, disease, and the availability of resources. Eventually, growth slows, and the population may stabilize. The population size that an environment can sustain is called the carrying capacity.

As a population grows, limited resources (that is, resources in short supply) eventually become depleted. When this happens, the growth of the population slows. The population model can be adjusted to account for the effect of limited resources, such as food and water. These resources are called density-dependent factors because the rate at which they become depleted depends upon the population density of the population that uses them. The population model that takes into account the declining resources available to populations is called the logistic model of population growth, after the mathematical form of the equation. The logistic model is a population model in which exponential growth is limited by a density-dependent factor. Unlike the simple model, the logistic model assumes that birth and death rates vary with population size. When a population is below carrying capacity, the growth rate is rapid.

However, as the population approaches the carrying capacity, death rates begin to rise and birthrates begin to decline. Competition for food, shelter, mates, and limited resources tends to increase as a population approaches its carrying capacity. The accumulation of wastes also increases. As a result, the rate of growth slows. The population eventually stops growing when the death rate equals the birthrate.

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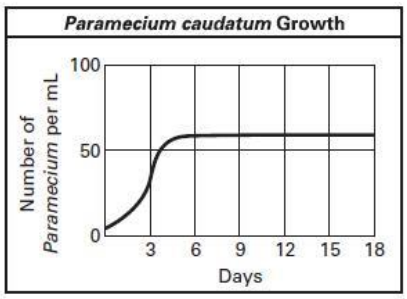
1. In a marsh ecosystem, what are the limiting resources for a frog population?

2. How does competition between frog population affect the population growth?

3. How would immigration affection frog population? How does emigration affect frog population?

4. The population size that an environment can sustain is called the carrying capacity. Which of the following factors would **not** decrease the carrying capacity of a pond environment?
   a. Drought c. Food shortages
   b. Flooding d. Unusually low temperatures

5. Your class has been observing the population growth of a species of *Paramecium*, a single-celled organism, for 18 days. Your data are shown in the graph below. Food was occasionally added to the test tube in which the paramecia were grown.



Look at the graph above. What is the carrying capacity of the test-tube environment?
F. about 10 paramecia
G. about 50 paramecia
H. about 65 paramecia
I. about 100 paramecia

6. **Justify your response with an SRE.**

Researchers have found that a local squirrel population fluctuates from year to year, increasing one year and decreasing the next. Which of the following factors would cause the squirrel population to grow?
A. the birth rate is equal to the death rate
B. emigration is greater than immigration
C. the death rate is higher than the birth rate
D. the birth rate is greater than the death rate

Statement	
Reason	
Evidence	