Chapter 16

Populations

16.2 Population Growth

Population ecologists are often interested in how big a population is as well as in how population size changes over time. Sometimes, population ecologists count the total number of individuals in a population. Other times, they prefer to measure the *population density*, the number of organisms per unit area.

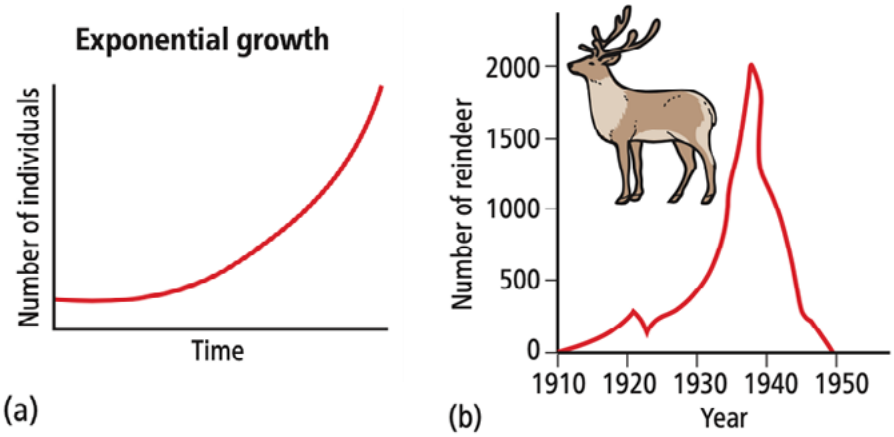
Four factors determine how a population's size changes over time: the birth rate, the death rate, the rate of immigration into the population, and the rate of emigration out of the population. Births and immigration increase population size. Deaths and emigration decrease population size. Whether a population is increasing or decreasing in size overall depends on the relative contributions of the four factors. Two models for how populations in the natural world grow are exponential growth and logistic growth.

Exponential Growth

Exponential growth occurs when a population grows at a fixed rate per amount of time (Figure 16.3). For example, a population that increases by 10% each year, which means a doubling of population every 9-10 years, grows exponentially. As you can see from the graph in Figure 16.3a, a population that is growing exponentially increases in size more and more quickly as time goes on.

FIGURE 16.3

(a) In exponential growth, a population grows at a fixed rate per amount of time. Population size increases faster and faster, as you can see from the way the curve gets steeper and steeper. (b) This graph shows exponential growth followed by a crash in the Saint Paul Island reindeer population.



What kind of population grows exponentially in the real world? Exponential growth occurs when a population has unlimited resources. In this case, nothing limits population growth, and a bigger and bigger population continues to produce more and more offspring. Although resources are never truly unlimited in the real world, they are sometimes extremely plentiful. For example, organisms may find very plentiful resources when they colonize a new habitat, and their population may begin to grow exponentially. When reindeer were introduced on Saint Paul Island near Alaska, the population grew exponentially for many years (see Figure 16.3b). However, exponential growth cannot continue forever. On Saint Paul Island, the reindeer eventually ran out of food and the population crashed.

Exponential growth is often seen in populations that live in unstable environments. These populations may go through cycles of exponential growth and crash. Good conditions start exponential growth. When resources run out, the population crashes. When good conditions return, the population explodes again, and so on.

Logistic Growth

Logistic growth occurs when population growth slows as the population approaches the habitat's carrying capacity (Figure 16.4). The **carrying capacity** is the maximum number of individuals or the maximum population density that a habitat can support. A certain lake may be able to support 250 trout, for example. Or, a certain grassland may be able to support 35 weasels per square kilometer.

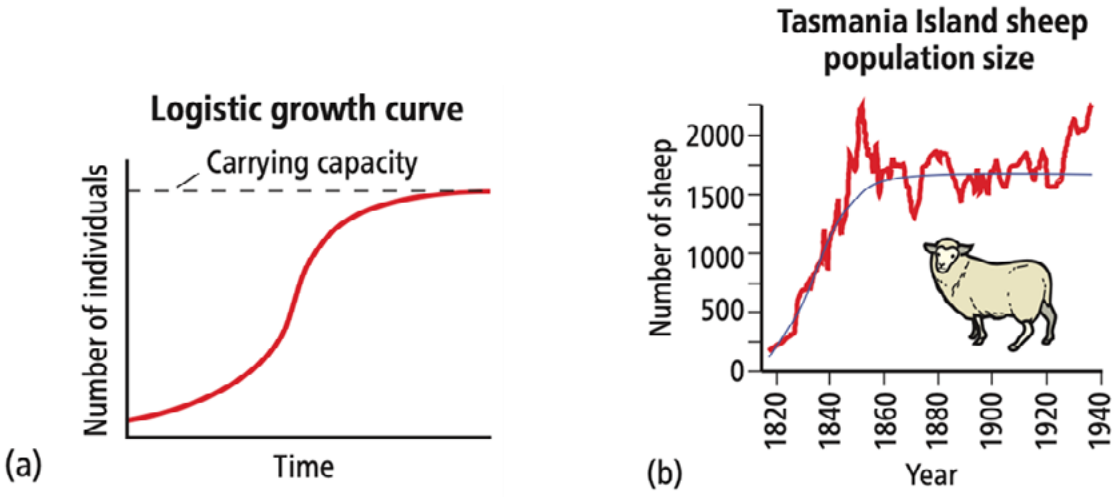


FIGURE 16.4

(a) In logistic growth, population growth slows as the population approaches the carrying capacity of its habitat. (b) This graph shows logistic growth in the Tasmanian sheep population.

Why would population growth slow as the population approaches carrying capacity? There are many possible reasons. When a population is large, there may be more competition for resources such as food and space. This could make it more difficult to get enough resources to reproduce, causing birth rates to fall. Or, crowded conditions at large population sizes could increase the death rate. In the real world, logistic growth is often seen in stable habitats. Logistic growth in the Tasmania Island sheep population is shown in Figure 16.4b.

READING CHECK

A population of shorebirds occupies a habitat where there are a limited number of safe nesting sites. What kind of population growth do you expect to see in this population?

CHECK YOUR ANSWER

Because only a limited number of nesting sites are available, the population's growth will slow as the population size increases. The population will grow logistically.

You can read more about exponential and logistic population growth here:

https://sciencing.com/difference-exponential-logistic-population-growth-8564881.html