



INTERACTIVITY

Analyze data to determine why a population has declined.

Populations

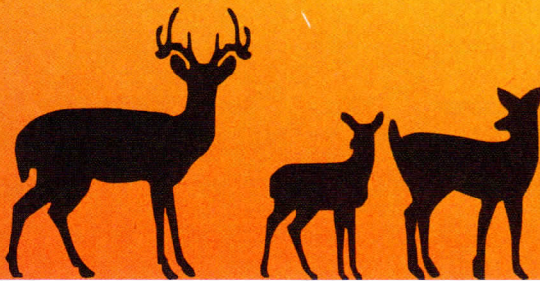
Remember from your reading that a population consists of all of the organisms of the same species living in the same area at the same time. For example, all of the pythons living in the same rainforest would be a distinct population. There are several things that can change a population's size.

Births and Deaths New individuals generally join a population by being born into it. A population grows when more individuals are born into it than die in any period of time. So when the birth rate (the number of births per 1,000 individuals for a given time period) is greater than the death rate (the number of deaths per 1,000 individuals for a given time period) a population may increase. When the birth rate is the same as the death rate, then the population usually remains stable. In situations where the death rate is greater than the birth rate, the population will decrease.

Math Toolbox

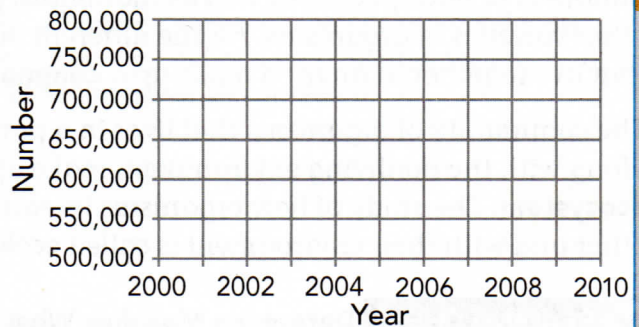
Graphing Population Changes

Changes over time in a population such as white-tailed deer in Ohio can be displayed in a graph.



Deer Population Trends, 2000–2010

Year	Population (estimated)	Year	Population (estimated)
2000	525,000	2006	770,000
2001	560,000	2007	725,000
2002	620,000	2008	745,000
2003	670,000	2009	750,000
2004	715,000	2010	710,000
2005	720,000		



SOURCE: Ohio Department of Natural Resources

1. Represent Relationships Use the data table to complete a graph of the changes in the deer population. Then describe the trend in the graph.

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2. Analyze and Interpret Data What factors do you think might be responsible for the changes in the deer population?

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Immigration and Emigration A population's size also can increase or decrease when individuals move into or out of the population. Immigration (im ih GRAY shun) means moving into a population. Emigration (em ih GRAY shun) means leaving a population. For instance, if food is scarce, some members of the antelope herd in **Figure 4** may wander off in search of a better habitat. If they become permanently separated from the original herd, they will no longer be part of that population.

Population Density If you are a scientist studying an ecosystem or population, it can be helpful to know the population **density**—the number of individuals in an area of a specific size. Population density can be represented as an equation:

$$\text{Population density} = \frac{\text{Number of individuals}}{\text{Unit area}}$$


For example, suppose an ecologist estimates there are 800 beetles living in a park measuring 400 square meters. The population density would be 800 beetles per 400 square meters, or 2 beetles per square meter.

READING CHECK Summarize Text How do birth and death rates affect a population's size?

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HANDS-ON LAB 

Investigate Model how space can be a limiting factor.

Academic Vocabulary

Have you heard the term *density* before? What did it mean in that other context?

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Emigration

Figure 4 Food scarcity is just one cause of emigration.

Cause and Effect What other factors might cause individuals in this antelope herd to emigrate?

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HANDS-ON LAB



Model a dam's effects on populations.

Factors That Limit Population Growth

In general, a population grows if conditions are favorable. Eventually, however, some factor in the environment, such as the availability of food, will limit the size of a population. An environmental factor that causes a population to stop growing or to decrease in size, such as a fatal disease infecting organisms, is a **limiting factor**.


Food and Water Food and water can be limiting factors for virtually any population. An adult elephant eats an average of around 180 kilograms of vegetation each day to survive. Suppose the trees in its habitat can provide 1000 kilograms of vegetation daily. In this habitat, not more than 5 adult elephants could survive. The largest population that an area can support is called its carrying capacity.

Climate and Weather Changes in climate can limit population growth. Warmer weather in the early winter, for example, can cause some plants to continue growing. Natural disasters such as hurricanes and floods can have immediate and long-term effects on populations.

Space and Shelter Other limiting factors for populations are space and shelter, as illustrated by the nesting site in **Figure 5**. When individual organisms must compete for space to live or raise young, the population can decrease. Competition for suitable shelter also can limit the growth of a population.

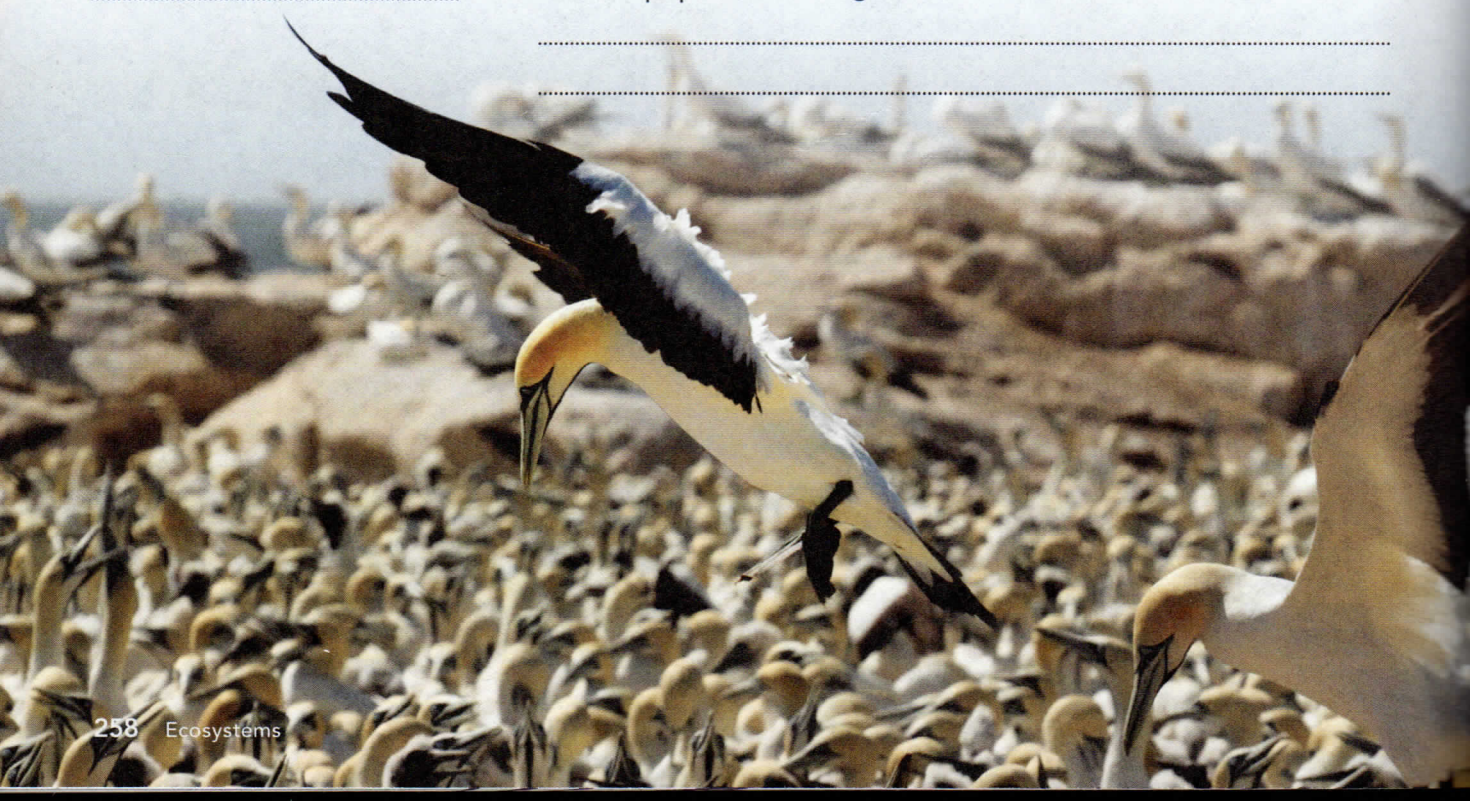
READING CHECK Summarize Text How do limiting factors affect a population of organisms?

Limited Space

Figure 5  In the image of the gannets, circle or shade the available space in the environment for nesting and raising young.

Cause and Effect How does the lack of space act as a limiting factor for these gannets?

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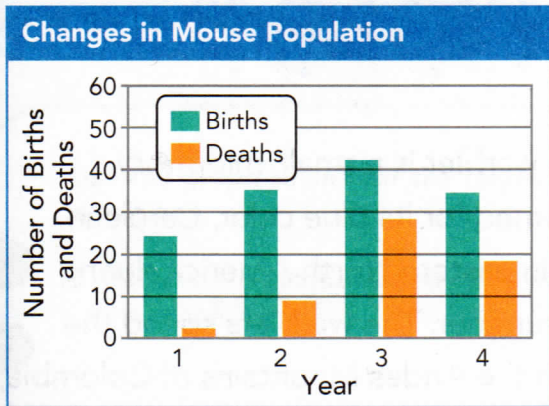
LESSON 1 Check

MS-LS2-1

1. **Identify** Identify the levels of organization in an ecosystem from smallest to largest.

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Answer questions 2 and 3 using the graph below.



2. **Analyze Data** What trends do you observe in the mouse population for the four years?

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3. **Interpret Data** Does the data support the idea that this population is relatively stable? Give evidence to support your answer.

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4. **Construct Explanations** How can biotic and abiotic factors in an ecosystem affect populations? Give two examples of each.

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5. **Analyze Systems** Why is climate considered to be a limiting factor for populations in an ecosystem?

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Quest CHECK-IN

In this lesson, you learned how ecosystems are organized and how different factors affect populations.

Cause and Effect What effect might an algal bloom in a pond have on populations of organisms that make their home there?

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INTERACTIVITY

Suspicious Activities

Go online to research and explore explanations for the algal bloom. Then, using the information you have gathered, identify three possible causes for the bloom.

Case Study

MS-LS2-1

THE CASE OF THE DISAPPEARING

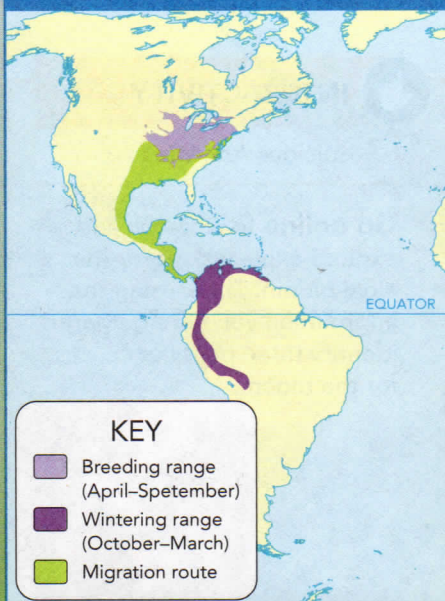
Cerulean Warbler



The cerulean warbler is a small, migratory songbird named for its blue color. Cerulean warblers breed in eastern North America during the spring and summer. The warblers spend the winter months in the Andes Mountains of Colombia, Venezuela, Ecuador, and Peru in northern part of South America.

The population of cerulean warblers is decreasing very quickly. No other population of songbirds is decreasing more rapidly in eastern North America. Populations of warblers have been declining at a rate of about 3 percent a year. This means that there are 3 percent fewer warblers from one year to the next. Habitat loss, especially in the region where the birds spend the winter, is thought to be the main reason. Look at the Cerulean Warbler Range Map.

Cerulean Warbler Range Map



Habitat Loss in the Wintering Range

By 2025, there will be 100 million more people in South America than there were in 2002. As human population size increases, the demands on the land and local habitats also increase. Forests are cleared and habitats for native plants and animals are lost to make room for planting crops and for raising cattle. These crops and cattle are needed to feed the increased population of people in the area.

Cerulean warblers inhabit the dense, evergreen forests that grow at middle elevations in the Andes Mountains. Their preferred habitat is tall, mature trees where they can feed on insects.

However, this habitat is also the preferred area to grow shade-coffee crops. The tall trees provide shade for the shorter coffee plants. Shade-coffee takes longer to grow and produces less coffee than sun-grown coffee crops. Forested areas are often cleared to make room for sun-grown coffee and other more profitable crops needing direct sunlight. This reduces the size of the warbler's habitat. As shown in the graph, the rate of clearing has decreased in recent years because the forests that are left are on steep slopes. These steep slopes and high elevations are not suitable for farming. Look at the bar graph below.

Use the graph to answer the following questions.

1. **Patterns** Describe any patterns you see in the graph.

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2. **Predict** What do you think the data will look like for each country until 2020? Why?

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3. **Construct Explanations** Explain how you think changing levels of deforestation in the wintering range affects the cerulean warbler population.

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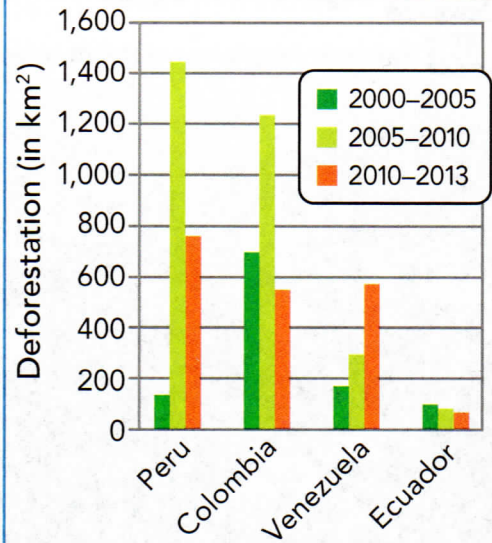
4. **Solve Problems** What are some strategies that you think can be used in northern South America to stabilize and protect the warbler populations?

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Deforestation in the Cerulean Warbler Wintering Range, 2000–2013



SOURCE: <http://news.mongabay.com>