chapter 24

Interactions of Life

section 2 Populations

What You'll Learn

- how population sizes are estimated
- how competition limits population growth
- what factors influence changes in population size

Before You Read

Is the human population in your area getting larger or smaller? What is causing the increase or decrease?

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Study Coach

Create a Quiz As you study the information in this section, create questions about the information you read. The questions can be used to review the section's content.

Read to Learn

Competition

Sometimes organisms living in the wild do not have enough food or living space. The Gila woodpecker makes its nest by drilling a hole in a saguaro (suh GWAR oh) cactus. Sometimes Gila woodpeckers have to compete with each other for these living spaces. Competition occurs when two or more organisms are looking for the same resource at the same time.

How can competition limit population growth?

Competition can limit the size of a population. For example, if enough living spaces are not available, some organisms will not be able to raise their young. If there is not enough food, organisms might not live long enough to reproduce. Competition for living space, food, and other resources can limit population growth.

In nature, the most intense competition usually occurs among individuals of the same species. This is because they need the same kinds of food and shelter. Competition also takes place among different species. For example, after a Gila woodpecker has moved from its nest, owls, snakes, and lizards might compete for the empty hole.

Reading Check

1. **Explain** What do organisms compete for?

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Population Size

Ecologists often need to measure the size of a population to find out whether or not the population is healthy and growing. Measuring the size of the population can help ecologists know if a population is in danger of disappearing. One measurement ecologists use is population density. Population density is the number of individuals of one species in a specific area.

How are populations measured?

Imagine having to count all the crickets in an area. They look alike, move a lot, and hide. You might count a cricket more than once. Or you might miss other crickets completely. One method ecologists use to count populations is called trap-mark-release. When ecologists want to count wild rabbits, for example, they set traps that catch the rabbits without hurting them. Each captured rabbit is then marked and let go. Later, another set of rabbits is caught. Some of these rabbits will have marks, but others will not. The ecologists compare the number of marked and unmarked rabbits in the second sample. By doing this, they can estimate the size of the rabbit population.

How are sample counts used?

To estimate the size of large populations, ecologists use sample counts. For example, pretend you wanted to estimate the number of rabbits in an area of 100 acres. You might count the rabbits in one acre and then multiply by 100.

How does a limiting factor affect population?

In an ecosystem, food, water, space, and other resources are limited. A **limiting factor** is anything that restricts the number of individuals in a population.

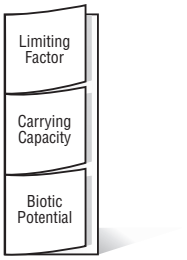
A limiting factor can affect more than one population. For example, when the plants in a meadow do not get enough rain, fewer plants survive. Because there are fewer plants, fewer seeds are produced. The seeds are a source of food for the seed-eating mice that live in the meadow. The smaller food supply could become a limiting factor for mice. In turn, a smaller mouse population could be a limiting factor for the hawks and owls that eat the mice. Limiting factors include living and nonliving parts in a community of an ecosystem.

Reading Check

2. Explain Why do ecologists measure the size of a population?

FOLDABLES™

B Describe Make a three-tab Foldable, as shown below. Use the Foldable to describe factors that affect population size.



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How does carrying capacity affect population?

The largest number of individuals of one species that an ecosystem can support over time is the **carrying capacity.** For example, if the number of robins living in a park increases, nesting space might become difficult to find. Available nesting space limits the robin population. If the population gets larger than its carrying capacity, some individuals of a species will not have enough resources. They could die or have to move somewhere else.

Reading Check

3. **Explain** How is a population affected when it goes beyond the carrying capacity of the ecosystem?

What is biotic potential?

If a population had an unlimited supply of food, water, and living space, and was not limited by disease, predators, or competition with other species, the population would continue to grow. The highest rate of reproduction under ideal conditions is a population's biotic potential. The more offspring organisms produce, the higher the species' biotic potential. Tangerines have a higher biotic potential than avocados because tangerines have many seeds in each fruit, while an avocado has only one seed in each fruit.

Changes in Populations

A population's birthrate and death rate also influence the size of the population and its rate of growth. A population gets larger when the number of individuals born is greater than the number of individuals that die. A population gets smaller when the number of deaths is greater than the number of births. As the table below shows, countries with a faster population growth have birthrates much higher than death rates. Countries with a slower population growth have only slightly higher birthrates than death rates.

Picture This

4. **Identify** Highlight the country listed in the table that has the fastest growing population. Circle the country that has a population that is getting smaller.

Population Growth			
	Birthrate*	Death Rate*	Population Increase
Countries with Rapid Growth			
Jordan	38.8	5.5	3.3%
Uganda	50.8	21.8	2.9%
Zimbabwe	34.3	9.4	5.2%
Countries with Slow Growth			
Germany	9.4	10.8	-1.5%
Sweden	10.8	10.6	0.1%
United States	14.8	8.8	0.6%

*Number per 1,000 people

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How does moving around affect population size?

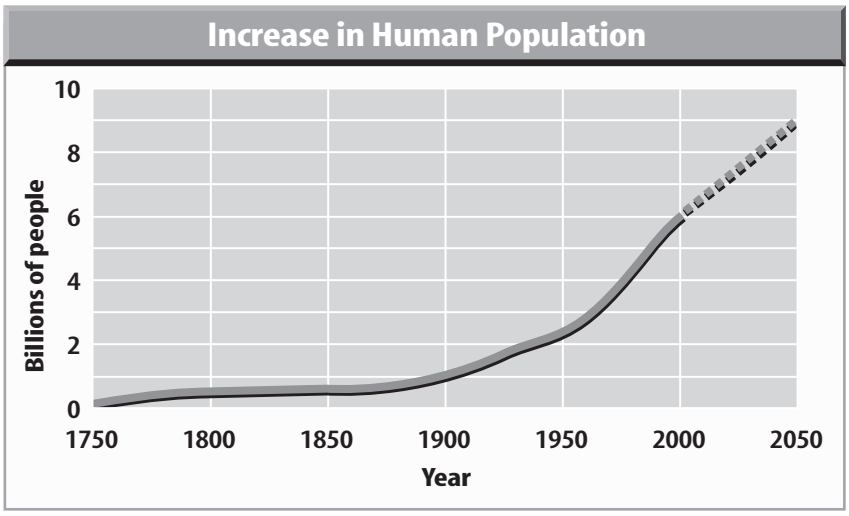
When animals move from place to place, the movements can affect population size. For example, a male animal may move many miles to find a mate. After he finds a mate, their offspring might start a completely new population, far from the male's original population.

Plants and microscopic organisms also can move from place to place. The seeds of dandelions, for example, have special parts that allow them to be carried to other places by the wind. Many kinds of seeds can be moved to new places by water currents. Animals also spread seeds from place to place.

What is exponential growth?

When a species moves to a new area that has plenty of food, living space, and other resources, the population can grow quickly. This pattern of growth is called exponential growth. Exponential growth means that the larger a population gets, the faster it grows. Over time, the population will reach the carrying capacity of the ecosystem for that species.

The figure below shows the exponential growth of the human population. By the year 2050, the population could reach 9 billion people.



Reading Check

5. **Identify** three things that move plant seeds from place to place.

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_____

Picture This

6. **Estimate** Use the graph to estimate the increase in the human population from 1950 to 2000.

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After You Read

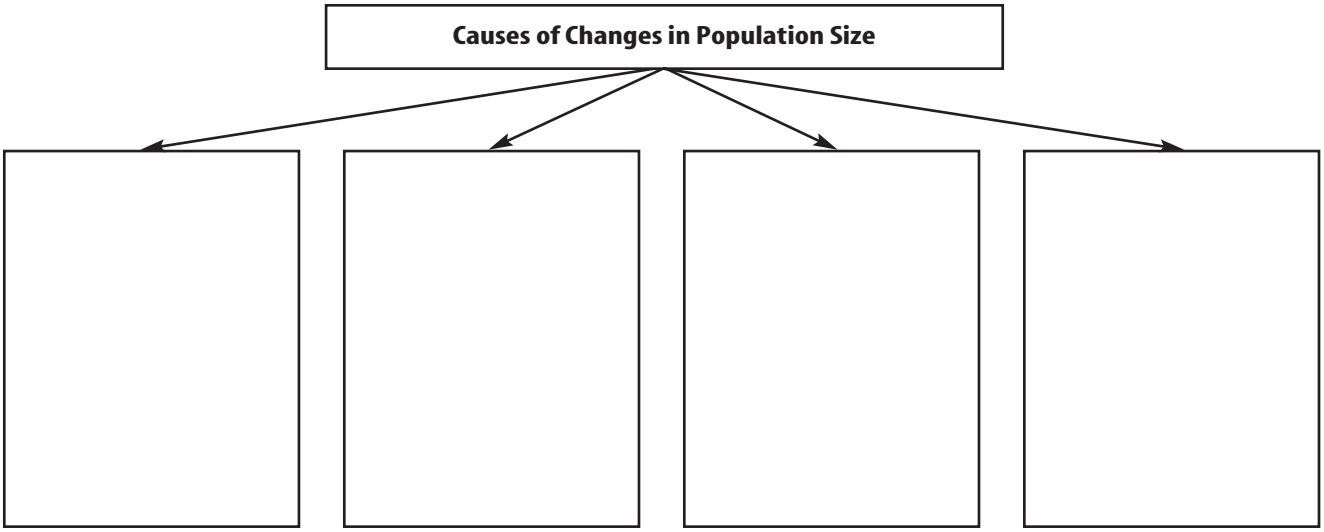
Mini Glossary

carrying capacity: the largest number of individuals of one species that an ecosystem can support over time

limiting factor: anything that restricts the number of individuals in a population

1. Review the terms and their definitions in the Mini Glossary. Choose one of the terms and explain how it can affect the population size of a species.

2. Complete the diagram below to help you describe the things that affect changes in population size.



3. How do the quiz questions and answers help you review what you have learned?

End of Section

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chapter 24 Interactions of Life

section 3 Interactions Within Communities

Before You Read

How do you get the energy you need to do the things you want to do?

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What You'll Learn

- how organisms get energy for life
- how organisms interact
- that every organism occupies a niche

Read to Learn

Obtaining Energy

Living organisms need a constant supply of energy. The Sun provides the energy for most of life on Earth. Some organisms use this energy to make energy-rich molecules through photosynthesis. The energy-rich molecules are food for the organism. They are made up of different combinations of carbon, hydrogen, and oxygen atoms. Chemical bonds hold the atoms of these molecules together. Energy is stored in the chemical bonds. During digestion, the molecules break apart and release energy. The organism uses the energy to grow, develop, and stay alive.

What are producers?

Organisms that use an outside energy source like the Sun to make energy-rich molecules are called **producers.** Most producers have chlorophyll (KLOR uh fihl). Chlorophyll is needed for photosynthesis. Green plants are producers.

Not all producers have chlorophyll or use energy from the Sun. Some use chemosynthesis (kee moh SIHN thuh sus) to make energy-rich molecules. These organisms live near volcanic vents on the ocean floor. Inorganic molecules in the water provide the energy for chemosynthesis.

Mark the Text

Defining Important Words Read the headings in this section and circle any word you cannot define. At the end of each section, review the circled words and underline the part of the text that helps you define the words.

FOLDABLES™

Organize Make Foldables, as shown below, to organize information as you read. Take notes to define the two types of living organisms.

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Think it Over

1. **Draw Conclusions** To which consumer group do humans belong? Why?

What are consumers?

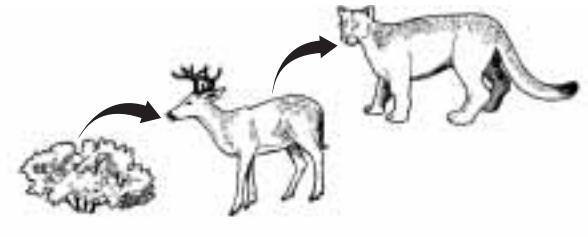
Organisms that get energy by eating other organisms are called **consumers.** There are four kinds of consumers. Herbivores, such as rabbits, eat plants. Carnivores, such as frogs, eat other animals. Omnivores, such as pigs, eat both plants and animals. Decomposers, such as earthworms, consume wastes and dead organisms. Decomposers help recycle once-living matter.

What are food chains?

Ecology includes the study of how organisms depend on each other for food. A food chain is a simple model of the feeding relationships and energy flow in an ecosystem. For example, shrubs are food for deer. Deer are food for mountain lions, as shown in the figure below.

Picture This

2. **Identify** Beneath the figure, write the food chain in words, using arrows to show relationships.



Symbiotic Relationships

Organisms may share food and other resources. Any close relationship between species is called **symbiosis.**

What is mutualism?

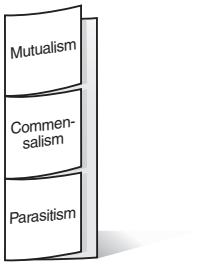
A symbiotic relationship in which both species benefit is called **mutualism** (MYEW chuh wuh lih zum). Ants and acacia trees illustrate mutualism. The ants protect the tree by attacking any animal that tries to feed on it. The tree provides food and a home for ants.

What is commensalism?

A symbiotic relationship in which one organism benefits and the other one is not affected is called **commensalism** (kuh MEN suh lih zum). For example, a sea anemone has tentacles that have a mild poison. The clown fish is not harmed by the poison. It swims among the tentacles and is protected from predators. The clown fish benefits, but the sea anemone is not helped or hurt.

FOLDABLES™

D Contrast Make a three-tab Foldable, as shown below. Use the Foldable to describe the three kinds of symbiosis.



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What is parasitism?

A symbiotic relationship in which one organism benefits and one is harmed is called **parasitism** (PER uh suh tih zum). An example of this relationship is a pet dog and roundworms. A roundworm sometimes attaches itself to the inside of the dog's intestine. It feeds on the nutrients in the dog's blood. The dog may have abdominal pain and diarrhea. Sometimes the dog may die. In this relationship, the roundworm benefits, but the dog is harmed.

Niches

Hundreds of species might live in one habitat. For example, a rotting log is home to many species. Spiders, ants, termites, and worms are some species that live on or under the rotting log. Although many species use the log as their habitat, the species do not compete for resources. This is because each species needs different things to survive. So, each species has its own niche (NICH). An organism's **niche** is its role in its environment—how it obtains food and shelter, finds a mate, cares for its young, and avoids danger.

Reading Check

3. Explain What is a niche?

Special adaptations that improve survival are often part of an organism's niche. For example, a poison in milkweed plants stops many insects from eating them. Monarch butterfly caterpillars have an adaptation that lets them eat milkweed. When they eat milkweed, the caterpillars become slightly poisonous. Birds avoid eating these caterpillars because they know that the caterpillars and adult butterflies have an awful taste and can make them sick.

How do predator and prey fit in a niche?

An organism's niche includes how it avoids being eaten and how it gets its food. Predators are consumers that capture and eat other consumers. The prey is the organism that is captured by the predator. Having predators in an ecosystem usually increases the number of species that can live in the ecosystem. Predators limit the size of the prey population. So, food and other resources are less likely to become difficult to find. Competition between species is reduced.

Reading Check

4. Explain How do predators increase the number of different species that can live in an ecosystem?

How do species in a niche cooperate?

Individual organisms often cooperate, or work together, in ways that improve survival. For example, a white-tailed deer that detects the presence of a wolf will warn other deer in the herd. These cooperative actions are part of the species' niche.

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After You Read

Mini Glossary

commensalism (kuh MEN suh lih zum): a symbiotic relationship in which one organism benefits and the other is not affected

consumer: an organism that gets energy by eating other organisms

mutualism (MYEW chuh wuh lih zum): a symbiotic relationship in which both species benefit

niche (NICH): an organism's role in its environment

parasitism (PER uh suh tih zum): a symbiotic relationship in which one organism benefits but the other is harmed

producer: an organism that uses an outside energy source like the Sun to make energy-rich molecules

symbiosis: any close relationship between species

1. Review the terms and their definitions in the Mini Glossary. Write a sentence that explains the difference between consumers and producers.

2. Choose one of the question headings in the Read to Learn section. Write the question in the space below. Then write your answer to that question on the lines that follow.

Write your question here.

End of Section

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