FOOD CHAINS and FOOD WEBS

A Science A–Z Life Series

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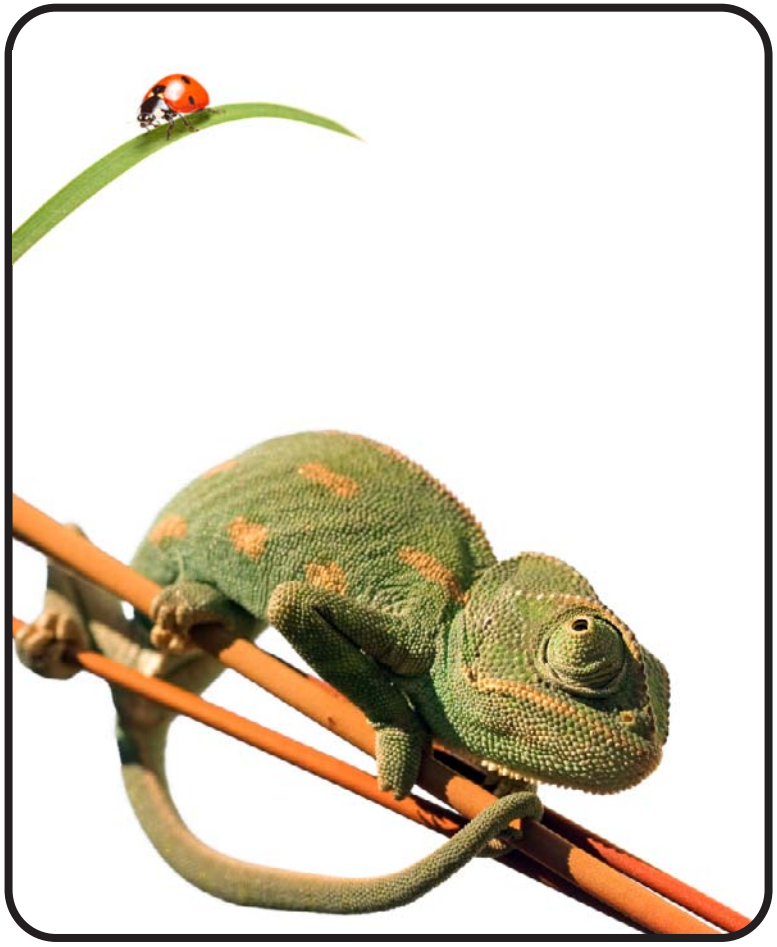

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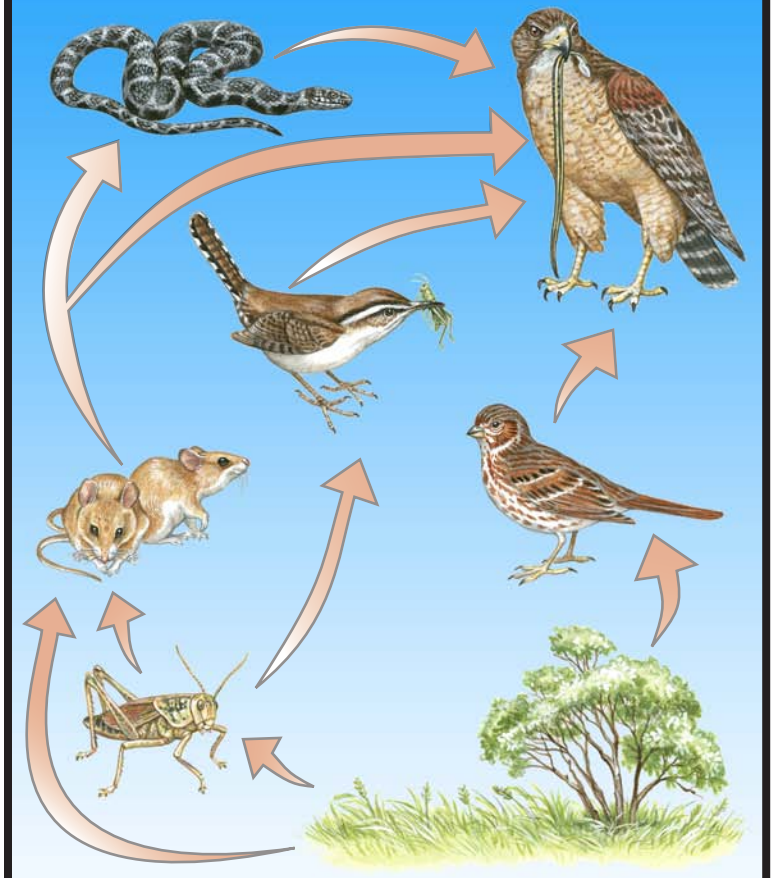

Written by Kira Freed

www.sciencea-z.com

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KEY ELEMENTS USED IN THIS BOOK
The Big Idea: Every living thing is part of a food chain as well as a more complex food web. There are various ways to categorize organisms within an ecosystem, including producers, consumers, and decomposers; predators and prey; and herbivores, carnivores, and omnivores. Whatever happens to one species can affect many others. Entire ecosystems can even be threatened due to changes. Humans are also part of food webs all around the world. Therefore, it is in our best interest to make a positive impact by protecting ecosystems and by reducing behaviors that can disrupt natural food chains.
Key words: adaptation, carnivore, change, competition, consumer, decomposer, diet, ecosystem, energy, energy pyramid, food chain, food web, global warming, herbivore, host, invasive species, link, omnivore, organism, parasite, photosynthesis, population, predator, prey, primary consumer, producer, scavenger, secondary consumer, species, survival, survive, tertiary consumer, top predator **Key comprehension skills:** Interpret graphs, charts, and diagrams *Other suitable comprehension skills:* Cause and effect; compare and contrast; classify information; main idea and details; identify facts; elements of a genre **Key reading strategy:** Summarize *Other suitable reading strategies:* Ask and answer questions; connect to prior knowledge; visualize; using a table of contents and headings; using a glossary and bold terms

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Mushrooms decompose a tree stump.

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Introduction

Ana sits down at the table for a breakfast of oatmeal, yogurt, and orange juice before going to school. The food she takes in will provide energy for learning, gym, and her other morning activities. Where did the energy in her oatmeal, yogurt, and orange juice come from?

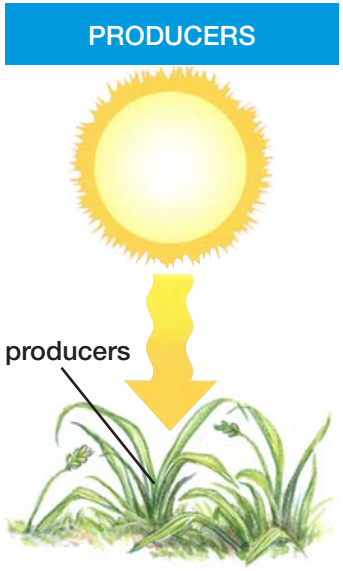
This book explores how living things get the energy they need to survive. You will learn how one living thing depends on another, and that ultimately all living things depend on energy from the Sun. You will also learn what happens when a food source is taken away.

Where did the energy in Ana's food come from?

Producers and Consumers

Living things are either **producers** or **consumers**. Producers make their own food. Green plants are the major producers. They produce food by using energy from the Sun to combine water, nutrients from the soil, and a gas in the air. This process is called **photosynthesis**. Without energy from the Sun and the producers that use it for photosynthesis, most living things on Earth would not survive.

Consumers are living things that cannot make their own food. Instead, they depend on producers for food. For example, grass is a producer. When a cow munches on the grass, the cow is a consumer. The cow cannot make food from sunlight. Consumers eat, or consume, producers or other consumers. The cow that munched on the grass was growing and making milk. When you sit down to drink a glass of milk or eat a hamburger that comes from a cow, you are a consumer, too.



Producers and consumers depend on each other in complex relationships. Let's look into some of these relationships.

Food Chains

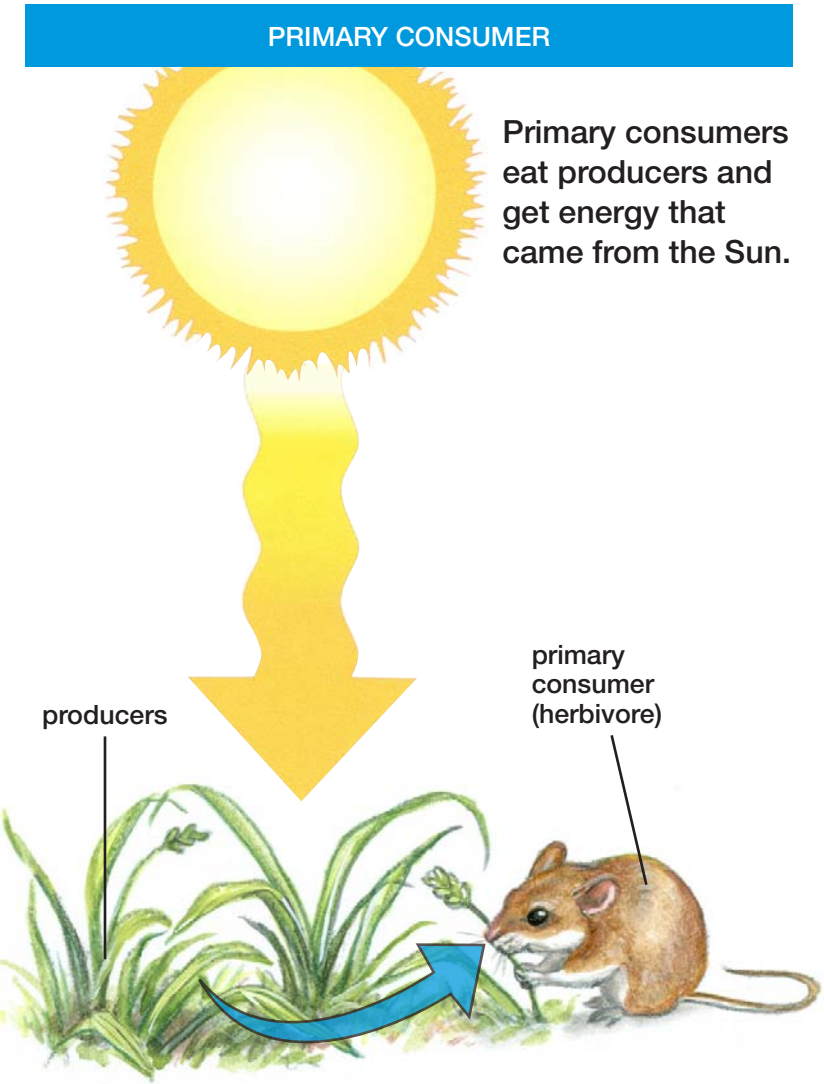
Scientists often use **food chains** to illustrate how one living thing depends on another living thing and how energy flows from producers to consumers. Food chains can be short or fairly long. Since producers make food, they are the first link in a food chain.

A food chain has only one link for producers but many links for consumers. *Primary consumers* are **organisms** that eat producers. They are the next link in the food chain. Primary consumers, called **herbivores**, can be as small as a grasshopper or as large as an elephant.

Special body parts help many herbivores break apart tough plant material so they can get the energy stored in certain plant parts. Parrots have tough beaks that can crack open the outer cases of tropical fruits and nuts. Elephants have special teeth to grind tree bark.


Parrots have hard beaks to crack nuts.

Even with special body parts, many herbivores must spend an enormous amount of time eating to obtain enough energy to stay alive. Giant pandas must eat for about sixteen hours each day to get enough nutrients and energy from their diet of bamboo leaves and stems.

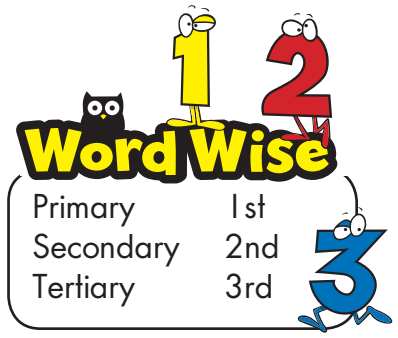


To review, the first link in a food chain is the producers, or plants. The second link is the primary consumers, or herbivores. The third link in a food chain is *secondary consumers*—animals that feed on the herbivores. These animals are **carnivores**, or meat eaters.

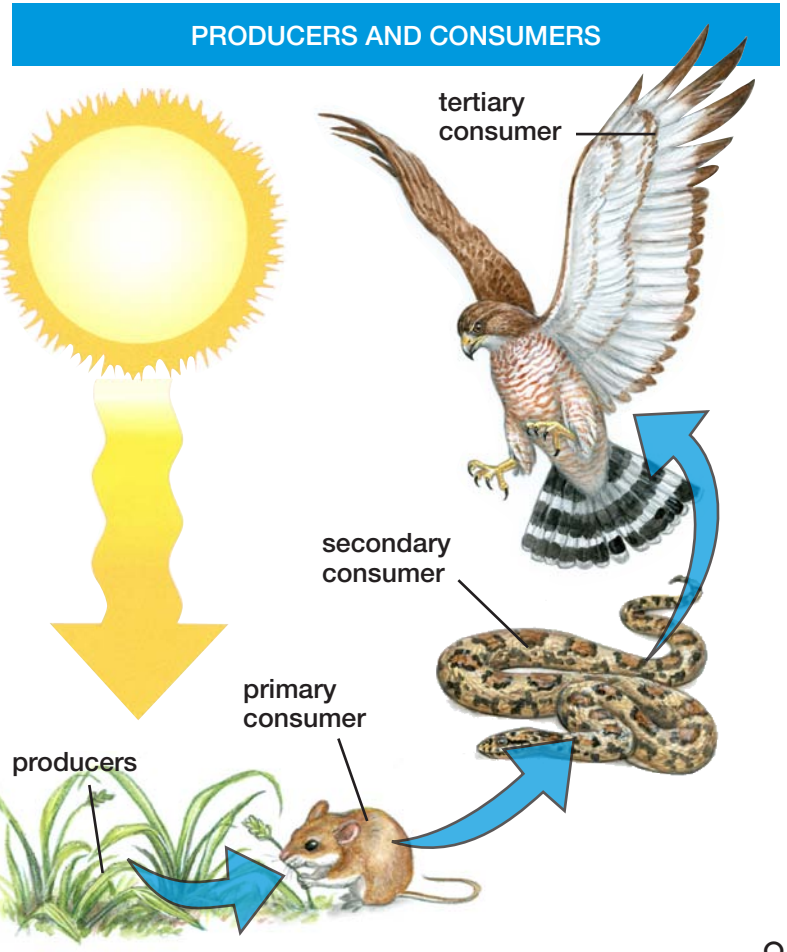

A spider eats a grasshopper.

When people think of carnivores, they often think of animals such as tigers and wolves. But other animals, such as insect-eating spiders, bats, and anteaters, are also carnivores. So are penguins, bald eagles, and other fish eaters.

Can you guess the next link in a food chain? After primary consumers (which eat plants) and secondary consumers (which eat herbivores), many food chains have *tertiary consumers*—animals that eat other carnivores. For example, let's say a mouse (primary consumer/herbivore) eats grass, and a snake (secondary consumer/carnivore) eats the mouse. A hawk that eats the snake is a tertiary consumer—a carnivore that eats another carnivore.



Some animals are **omnivores**—consumers of both plants and animals. Omnivores have flexible diets and can eat almost anything. Bears, raccoons, and humans are all omnivores. They may occupy many levels of a food chain. When you eat an apple, you're a primary consumer. When you eat a hamburger, you're a secondary consumer. Do you eat any carnivores? If so, you're also a tertiary consumer.



Predators and Prey

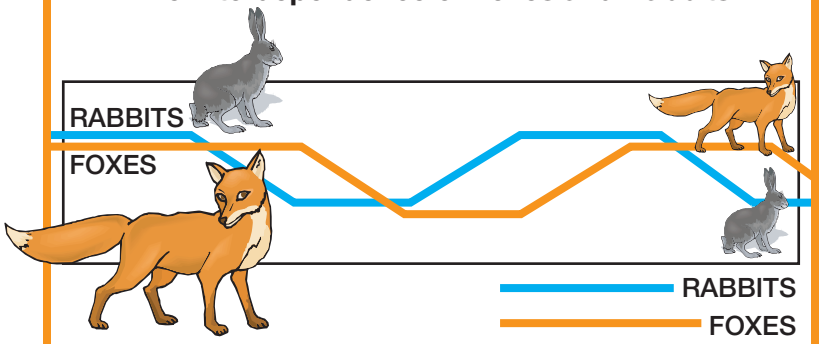
Let's learn a little more about the consumers in a food chain. Animals that hunt and eat other animals are **predators**. The animals they eat are their **prey**. Take another look at the diagram on page 9. Can you find the animal that is both predator and prey—that is both hunter and hunted?

At the top of a food chain are animals that are not food for any other animals. These animals are called *top predators*. In the natural world, top predators have no enemies—in other words, no one messes with them. Lions, orcas, alligators, and polar bears are all top predators in the ecosystems in which they live. People are the only animals that pose a serious threat to their survival. This makes humans the ultimate top predators.

All these animals are top predators.

Producers, predators, and prey, along with air, water, and other parts of an area are together called an **ecosystem**. In an ecosystem, **populations** of predators and prey help to regulate, or affect, each other. Let's look at rabbits and foxes.

The Interdependence of Foxes and Rabbits



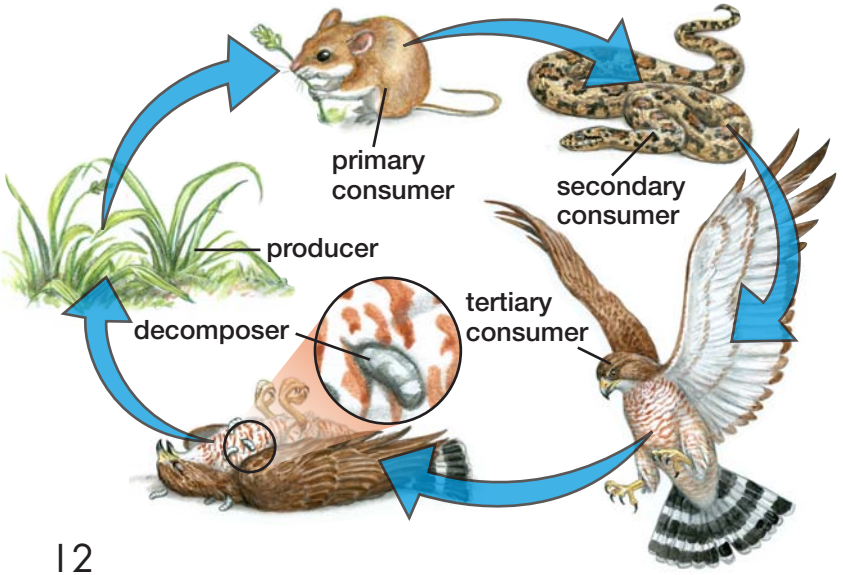
When foxes eat lots of rabbits, the rabbit population drops. As there are fewer rabbits to eat, the fox population drops. Then the rabbit population climbs again. Then the foxes have more food so their numbers climb again. The two species keep affecting each other's numbers.

Some carnivores in a food chain are not considered predators because they do not hunt. These carnivores, called **scavengers**, are like the cleanup crew of an ecosystem. They mainly feed on dead animals. Some scavengers eat the leftovers that other carnivores leave behind. Other scavengers eat road kill or animals that die in the wild of natural causes. Scavengers are important consumers in an ecosystem because they make use of the energy of dead animals so it is not wasted.

Decomposers, the last link in a food chain, are nature's recyclers. Their job is to make sure that none of the energy in an ecosystem is wasted. They break down, or decompose, any leftover living material and make the energy available for other living things. Many decomposers, such as bacteria and fungi, break down dead plant material, such as branches and autumn leaves, and return the nutrients to the soil. They also break down the waste and dead bodies of animals.

When decomposers recycle nutrients, the energy is again available to nourish producers (plants), and the cycle begins again. Without decomposers, Earth would be covered with trash and waste, and the flow of energy would be a one-way street instead of a cycle.

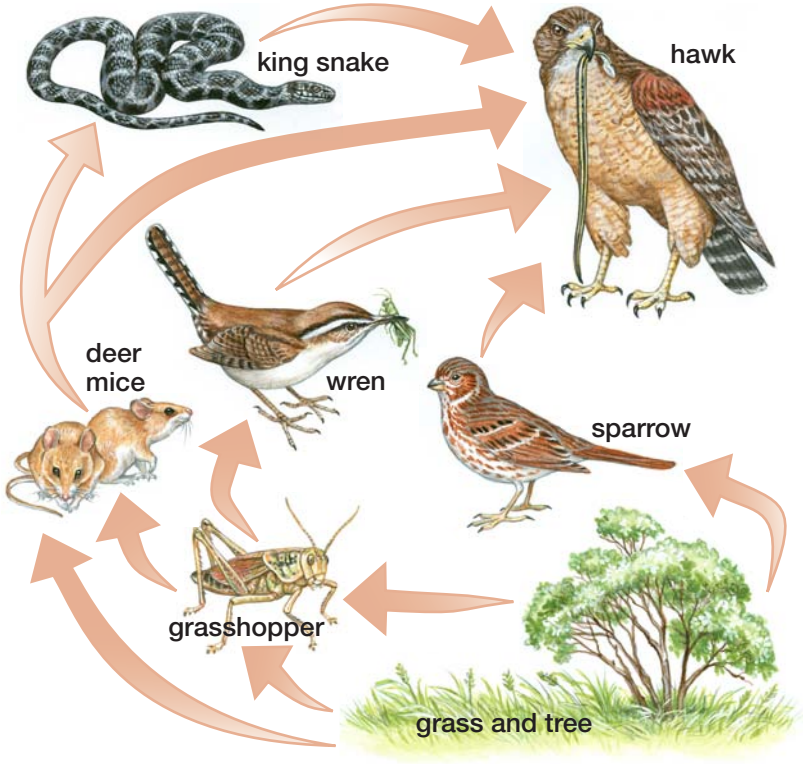
Decomposers Complete the Food Chain



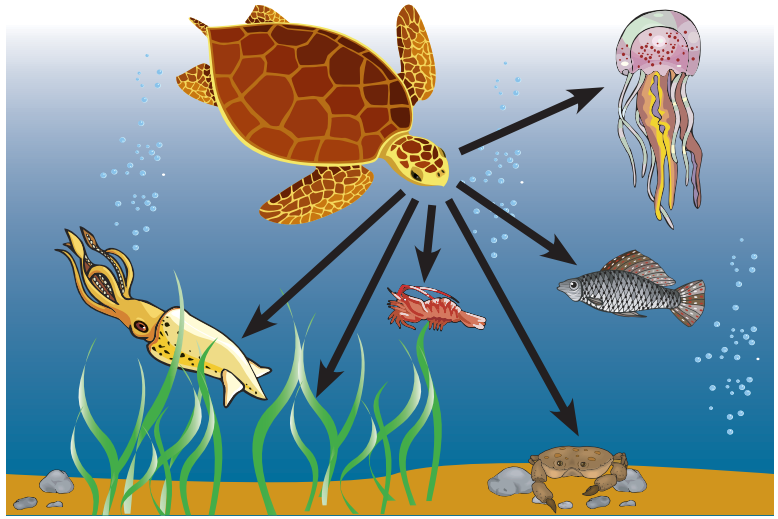
Food Webs

A food chain is a simple way to learn how energy passes through levels in an ecosystem. But in nature, the patterns of eating are rarely as simple as food chains represent them. Most animals eat a variety of foods to meet their energy requirements. Prey animals are usually hunted and eaten by a variety of predators. When we represent all these eating patterns in a diagram, we end up with a complex web of relationships between living things, which is called a **food web.**

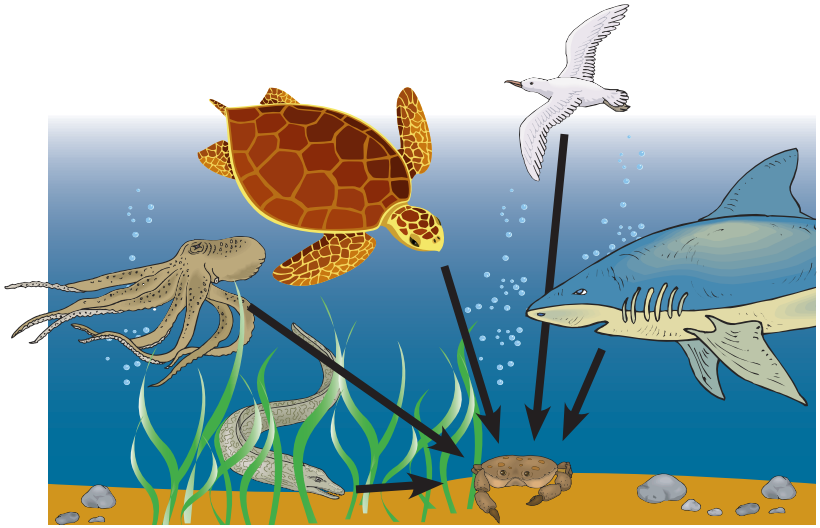
A FOREST FOOD WEB



Let's look closely at a few parts of a food web in an ocean ecosystem. The first diagram shows one predator that eats many types of prey as well as a few plants. The second diagram shows several predators that eat the same prey.

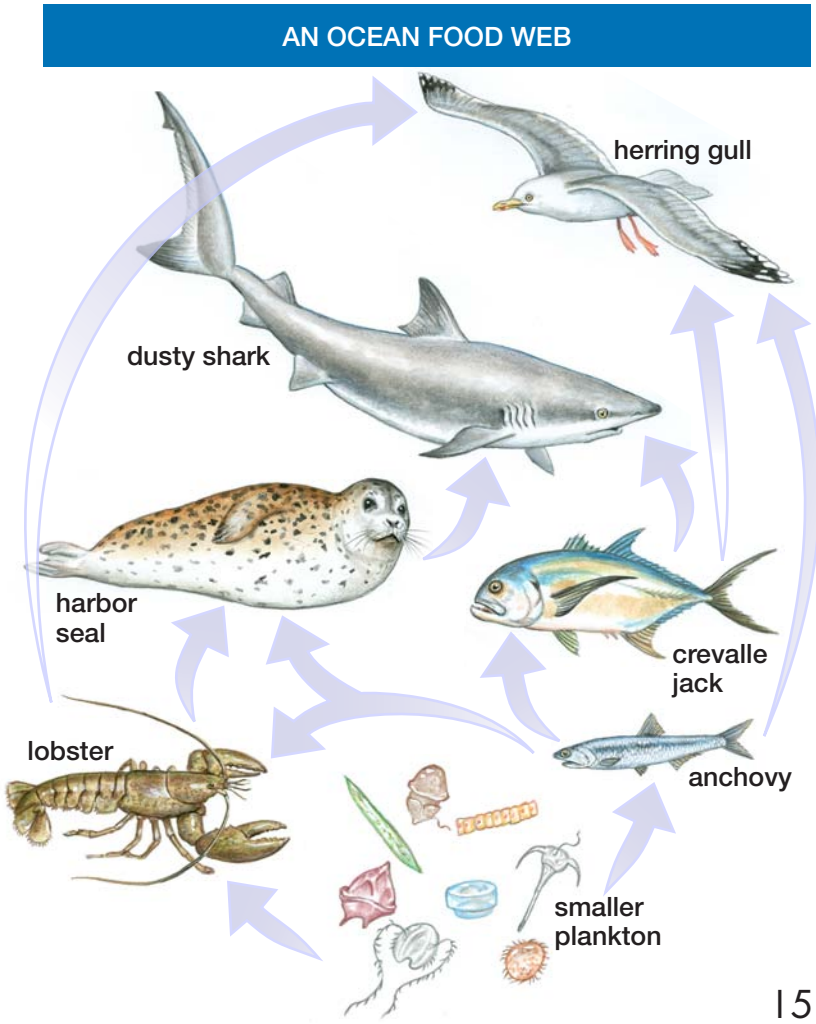


A loggerhead sea turtle eats many types of food.



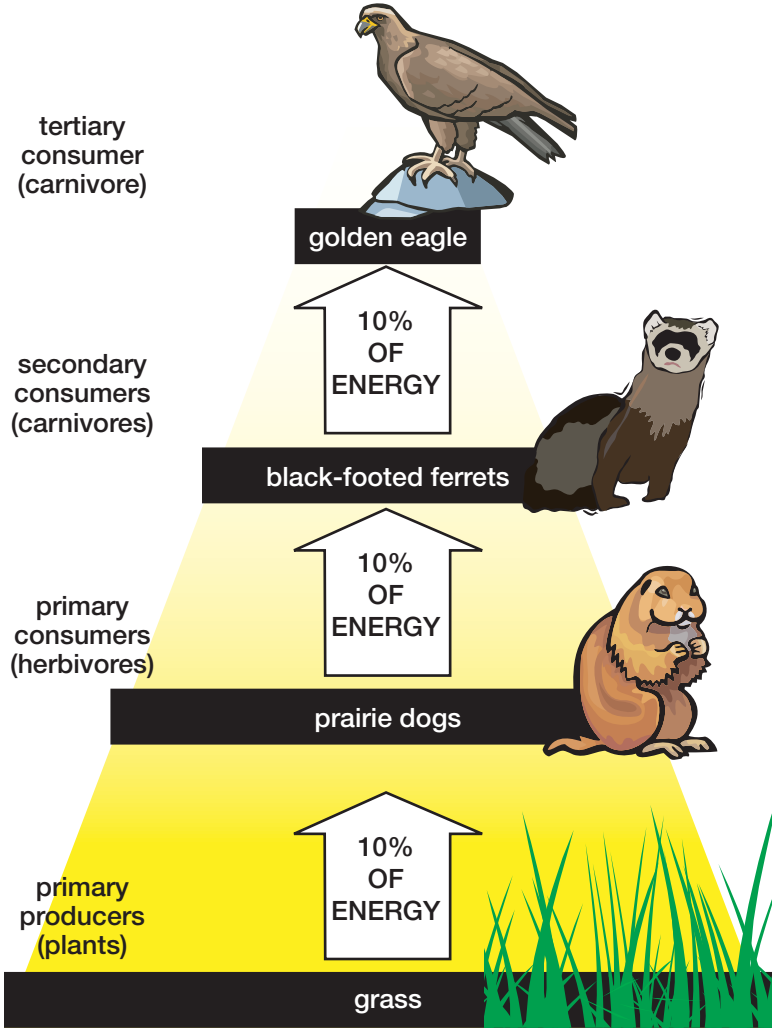
Many types of animals eat crabs.

Now imagine combining the diagrams on page 14 with diagrams showing the diets of other ocean species ranging in size from microorganisms to whales. The result is a food web, which is much more complex than a food chain. The diagram on this page gives you a basic idea of an ocean food web, but the page is not large enough to include all the details.



Energy Pyramid

Scientists use the phrase *energy pyramid* to describe how energy is lost as it passes from one part of the food chain or food web to the next. Let's explore how an energy pyramid works.



In an energy pyramid, only about ten percent of the energy passes to the next level.

When an herbivore—a primary consumer—eats plants, only a fraction of the energy from the plants is used by the animal to grow. The rest of the energy is lost as waste or is used by the herbivore to move, digest food, and reproduce. Because much of the energy is used, only some of it is passed on when the herbivore is eaten by a carnivore.

Scientists estimate that about one-tenth of the energy is passed along from one link in the food chain to the next. Because such a small amount of energy is passed along at each level, an ecosystem needs many more:

- producers (plants) than consumers (animals)
- primary consumers than secondary consumers
- secondary consumers than tertiary consumers

Most food chains have no more than four or five links before the decomposers. A food chain cannot have too many links because the animal at the end of the chain would not get enough food—or energy—to stay alive.

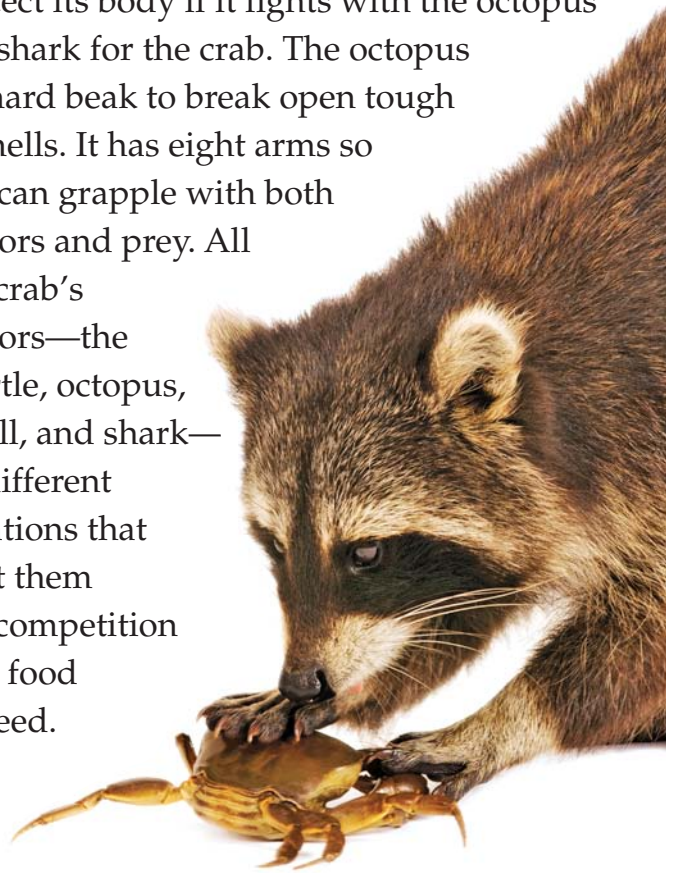
Do You Know?

Parasites are a special type of consumer. Parasites use another living thing—a **host**—as a food source. Tapeworms live in the digestive tract of mammals. They absorb food from their host's intestines. Most living things are vulnerable to parasites.

Survival

Take another look at the second diagram on page 14. All those animals are in **competition** with each other for the same crabs. How does nature help them all survive?

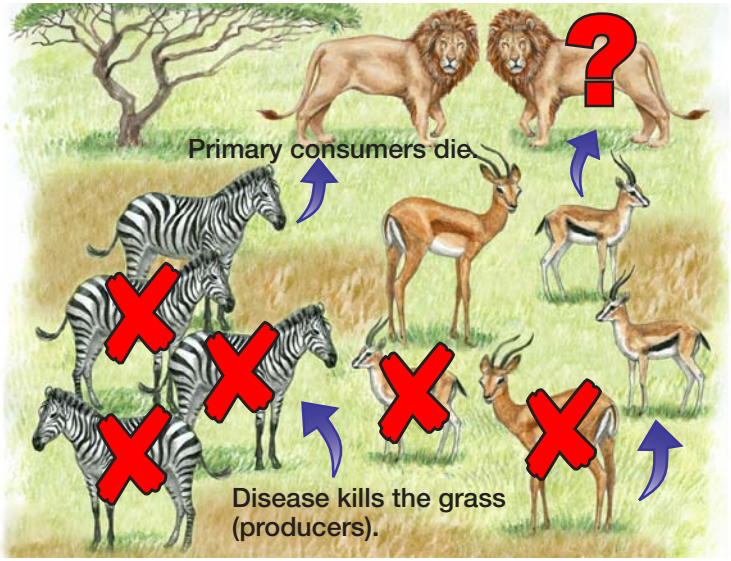
Each species has adaptations—special body parts or behaviors—that help them find what they need to survive. Often they must fight for food. A loggerhead sea turtle has a hard beak that helps it break open a crab, and it also has a hard shell to protect its body if it fights with the octopus or the shark for the crab. The octopus has a hard beak to break open tough crab shells. It has eight arms so that it can grapple with both predators and prey. All of the crab's predators—the sea turtle, octopus, eel, gull, and shark—have different adaptations that protect them in the competition for the food they need.



If changes in an ecosystem affect one organism's ability to survive, all the other organisms in its food web may be affected. Imagine that a disease destroys a type of grass (a producer) on an African savanna. Antelopes and other herbivores (primary consumers) that rely on the grass for energy will suffer. The herbivores with flexible diets will start eating other plants. The herbivores without flexible diets will move to another area or die. What will happen to the carnivores (secondary consumers) that rely on those herbivores for energy? All the links in an ecosystem are connected, and any disruption echoes through the entire ecosystem.

CHANGES IN AN ECOSYSTEM

What happens to secondary consumers?



A change at one level affects the living things at all higher levels of a food web.

Changes to an ecosystem can have many causes. Diseases, natural disasters, and human-created threats such as oil spills, pesticides, and other things can harm food chains and food webs. Scientists are now concerned about the impact of global warming on food webs. Even small increases in ocean temperatures are affecting the tiny organisms that are the foundation of ocean food webs.

black-footed ferret

prairie dog

Remember the black-footed ferrets on page 16? These animals, North America's most endangered mammal, depend on prairie dogs for their food. The ferrets are endangered in large part because people considered prairie dogs pests and tried to wipe them out. Most of the grassland habitat of prairie dogs was converted to farmland, which caused their numbers to plunge. Far fewer prairie dogs resulted in far fewer black-footed ferrets. The story of these two species is just one example of the problems that arise when one link in a food chain is removed.

Foxes were brought to the Aleutian Islands.

Another serious threat to food webs is caused by people introducing a species into an ecosystem. People have introduced some non-native species on purpose, such as bringing cattle and sheep to a new area to raise for food. Not all introduced species cause harm, but those that do are called *invasive species* because they invade an ecosystem.

An invasive species can devastate an ecosystem. In the eighteenth century, foxes were introduced to Alaska's Aleutian Islands to increase the fur trade. The foxes ate all the native seabirds. Then the Aleutians' lush vegetation disappeared, replaced by scrubby, low-growing plants. What happened?

The poor soil on the islands could only support lush plant growth with the help of bird droppings. With the decline of birds, the plants couldn't get the nutrients they needed.

Without the bird waste, the soil on the islands could not support lush plant growth.

Conclusion

In this book, you've learned about producers, which make their own food with the Sun's energy. You've also learned about a variety of consumers, decomposers, and parasites. In an ecosystem, each of these links in the food chain has an important role in passing energy to other living things. A change in one link can affect an entire ecosystem.

Remember Ana from the beginning of this book? She was a primary consumer when she ate oatmeal and drank orange juice. When she ate yogurt, a product of an herbivore, she was filling the role of a secondary consumer. And if you're wondering if she's ever a tertiary consumer, the answer is yes. Her mom is making crab wraps for dinner.

The energy that Ana takes in will one day be passed along to other living things. Nature doesn't waste energy.

Glossary

carnivores animals that eat only other animals (p. 8)

competition the struggle between organisms of the same or different species for limited resources, such as food, light, or territory (p. 18)

consumers organisms in a food chain that eat other organisms, especially live ones (p. 5)

decomposers organisms in a food chain that break down organic matter (p. 12)

ecosystem a biological community of organisms together with their habitat (p. 10)

food chains groups of plants and animals that all have a relationship with each other through what they eat (p. 6)

food web the interconnected feeding relationships within an ecosystem (p. 13)

herbivores animals that eat only plants (p. 6)

omnivores animals that eat both plants and animals (p. 9)

organisms living things (p. 6)

photosynthesis the process by which plants convert energy from the Sun into food (p. 5)

population all the members of one species in a particular area (p. 11)

predators animals that hunt and eat other animals to survive (p. 10)

prey animals that are hunted and eaten by a predator (p. 10)

producers organisms in a food chain that are able to make their own food (p. 5)

scavengers animals that eat animals that are already dead (p. 11)

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