CHAPTER

2

Living Things Depend on One Another

Vocabulary Preview

interact
producer
consumer
herbivore
carnivore
omnivore
decomposer
food chain
energy pyramid
food web
predator
prey

Like all living things, you depend on plants and animals around you to meet your needs. You eat plants and animal products. You may live in a building made from wood. You wear clothes made from plant fibers. Plants and animals depend on one another to help them meet their needs.

Fast Fact

Hippopotamuses live in the rivers of central Africa. They eat grasses and other plants that grow in the water. The wastes they produce are rich in nutrients, which help the plants to grow.

Tropical rain forest

Fast Fact

Some areas of the world have more living things than others. If you want to get an idea of how productive an area is, you can compare how many plants live there with how many live in other areas.

Plant Material in Different Environments

Area	Plant Matter per Square Meter
Tropical Rain Forest	2000 g
Grassland	800 g
Arctic Tundra	140 g
Desert	80 g

LEARN ABOUT

Living Things and Food

FIND OUT

- how living things get food
- how plants and animals interact with the environment

VOCABULARY

interact
producer
consumer
herbivore
carnivore
omnivore
decomposer

Making and Getting Food

All living things need food. In the investigation you saw that an animal's teeth match the food it eats. But not all living things have teeth. Some living things get their food in other ways. For example, a bird uses its beak to get food. Plants make their own food.

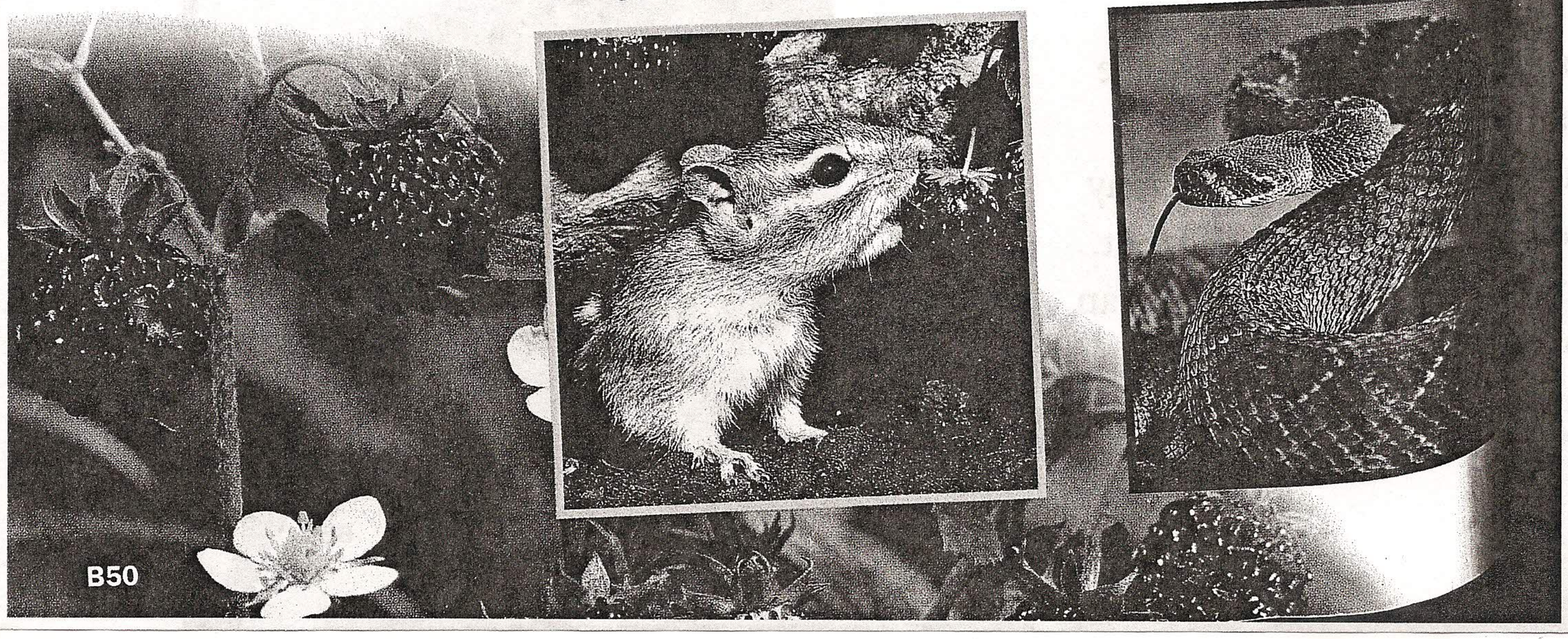
Plants and animals work together, or **interact** (in•ter•AKT), with the environment to get what they need. Plants interact with sunlight, air, and water to make food. Animals interact with plants or other animals to get their food. Animals also interact with nonliving things in their environment, such as water, sunlight, soil, and rocks. For example, a snake lies in the sun for warmth and drinks water. The same snake may make its home in the soil or under a rock.

✓ **Why do plants and animals interact with the environment?**

This strawberry plant uses energy from the sun to make its own food. ▼

This strawberry provides a chipmunk with some of the energy it needs to live. ▼

The chipmunk provides energy for a snake that catches and eats it. ▼



Producers

Plants are producers. A **producer** (proh•DOOS•er) is a living thing that makes its own food. Producers use the food they make to live and to grow.

Plants make more food than they need. This extra food is stored in roots, leaves, seeds, and fruit. People and other animals then eat this stored food as their own food.

✔ **What is a producer?**

▲ **These foods come from plants. Plants are producers that make their own food. Animals then eat plants as food.**

Consumers

Animals cannot make their own food. They must eat plants or other animals. An animal is a **consumer** (kuhn•SOOM•er). A consumer is a living thing that eats other living things as food.

Consumers can be grouped by the kinds of food they eat. Some consumers eat only plants. These animals are **herbivores**. Sheep, like this bighorn sheep, are herbivores.

A few consumers eat only one kind of plant. Giant pandas eat only bamboo. To survive, they must live where bamboo grows.

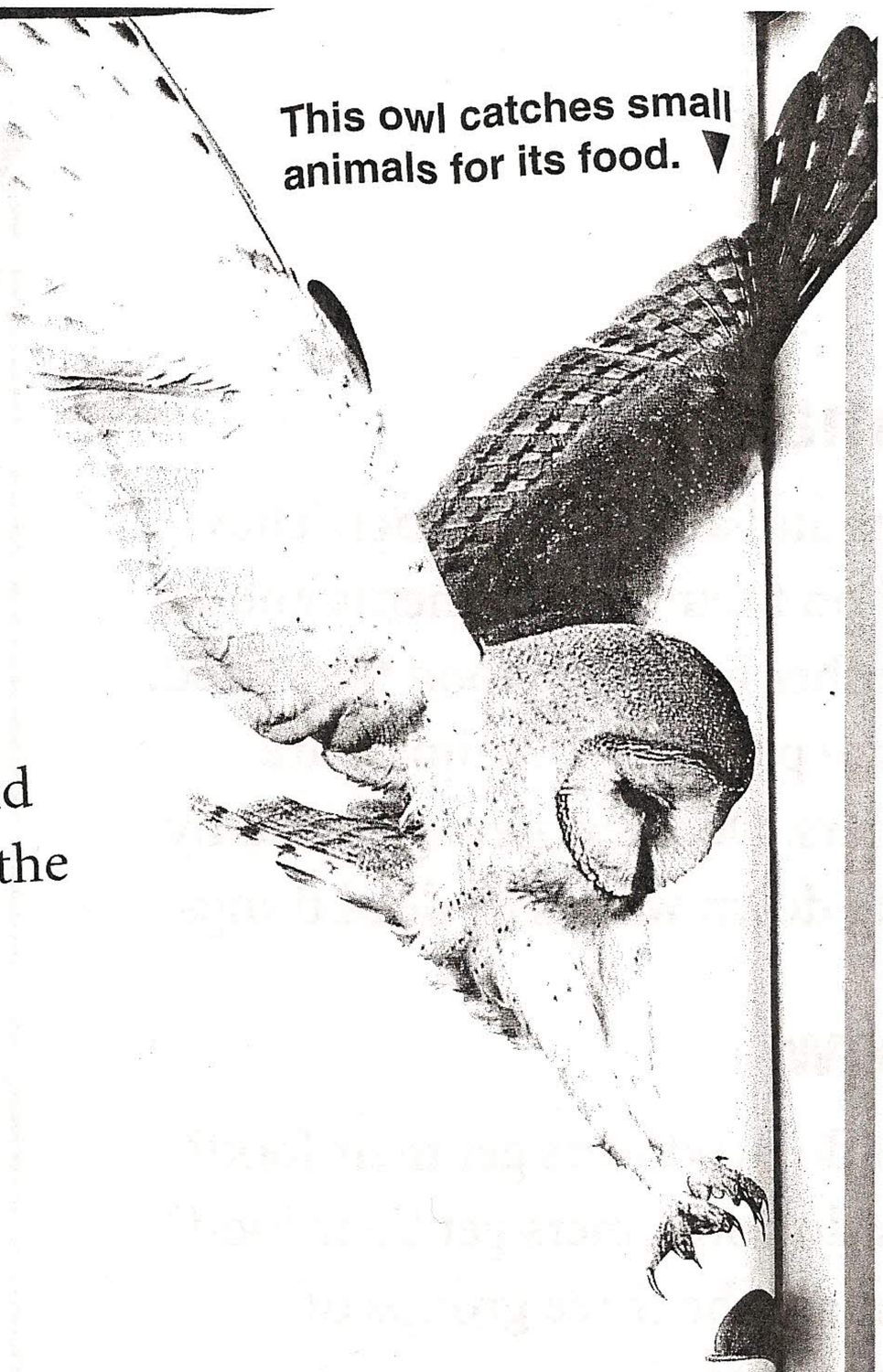
Animals that eat only plants may have body parts that help them eat. For example, the giant panda has an extra bone in its hand that helps it hold bamboo as it eats.

The bighorn sheep is a consumer that eats plants. ▼

Some animals get food by eating other animals. These animals are **carnivores**. Often they must hunt and kill their food. Animals that get food in this way have body parts that help them catch and eat their food. For example, an owl has strong claws that it uses to catch animals. Its sharp beak helps it tear meat.

Some animals, called **omnivores**, eat both plants and other animals. A box turtle eats both berries and insects. The meats you eat come from animals and the vegetables you eat come from plants.

✓ **What is a consumer?**

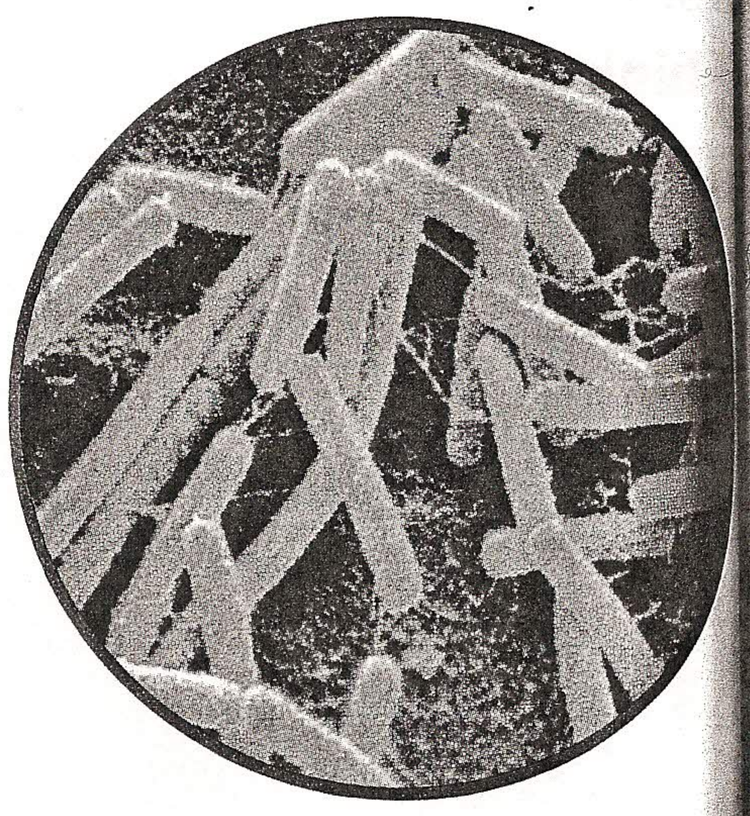


This owl catches small animals for its food. ▼

Decomposers

A **decomposer** (dee•kuhm•POHZ•er) is a living thing that breaks down dead things for food. Decomposers also break down the wastes of living things. As decomposers feed, they help clean the environment. Two decomposers you may know of are fungi, such as mushrooms, and earthworms.

✓ **What is a decomposer?**



▲ Many bacteria are decomposers.

The fungi growing on this log are decomposers. The fungi are using the dead log as food. ▼

Summary

Plants and animals interact. They depend on their environments and on one another to get the food they need. Plants are producers. Animals are consumers. Decomposers get food by breaking down wastes or dead things.

Review

1. How do producers get their food?
2. How do consumers get their food?
3. What are the three groups of consumers?
4. **Critical Thinking** How do decomposers help keep the environment clean?
5. **Test Prep** Which of the following is **NOT** a consumer?

   A bird **C** squirrel

   B tree **D** human

LINKS

MATH LINK

Solve a Problem Scientists studied 60 moose on an island. They found that during the summer, each moose eats the fruit of 25 blackberry bushes. What is the minimum number of blackberry bushes on the island?

WRITING LINK

Informative Writing—Explanation Suppose that the bushes on the island in the Math Link all die. Write a paragraph for your teacher explaining what you think might happen to the moose population.

HEALTH LINK

Teeth Think about how you use your teeth to eat. Which teeth do the cutting? The chewing? How are the teeth different?

GO ONLINE TECHNOLOGY LINK

Learn how scientists help injured animals get food by visiting the Smithsonian Institution Internet Site.

www.si.edu/harcourt/science

Smithsonian Institution®

LEARN ABOUT

Food and Energy

FIND OUT

- how living things get energy
- how energy moves through a food chain

VOCABULARY

food chain

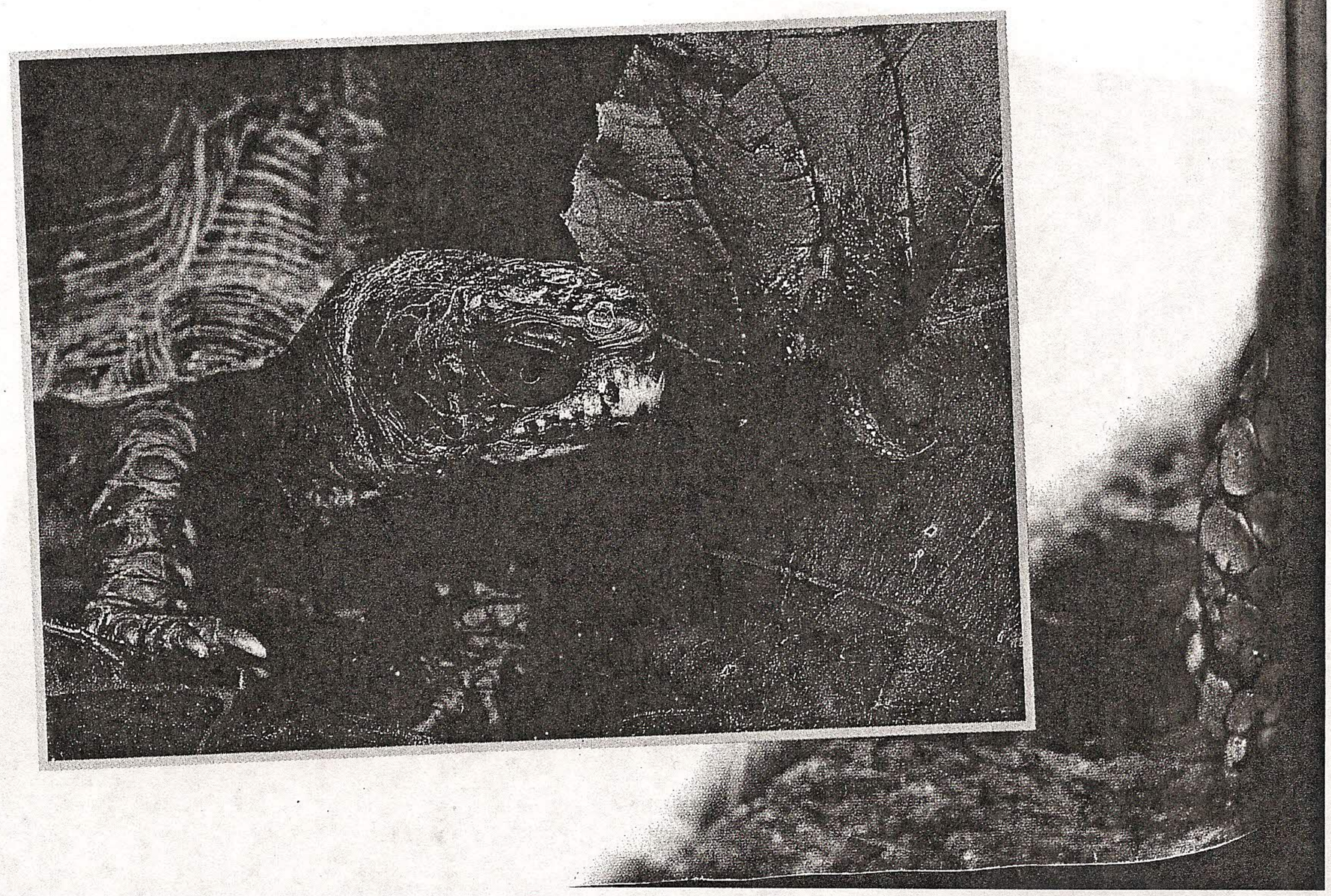
energy pyramid

Food Chains

All living things need energy to live. Producers get energy from sunlight. They store the energy in the food they make. Consumers can't make their own food. They get their food by eating other living things. In this way, the consumers get the energy they need.

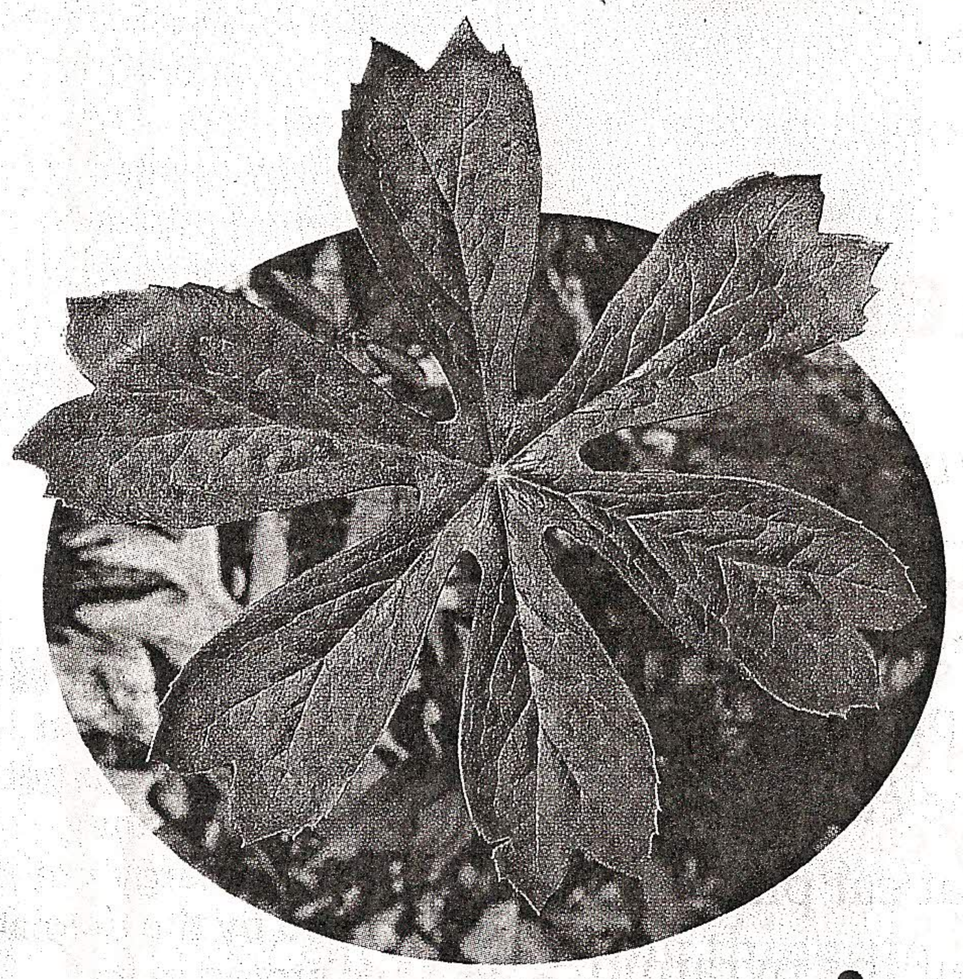
In the investigation you saw that the path of food from one living thing to another forms a **food chain**. A food chain also shows how energy moves through the environment. For example, grass uses the energy in sunlight to make its food. A cricket that eats the grass gets the energy stored in the grass. If a frog eats the cricket, it gets energy that is stored in the cricket. In this way, the energy that started with the sun is passed from the grass to the cricket to the frog.

✔ **What is a food chain?**

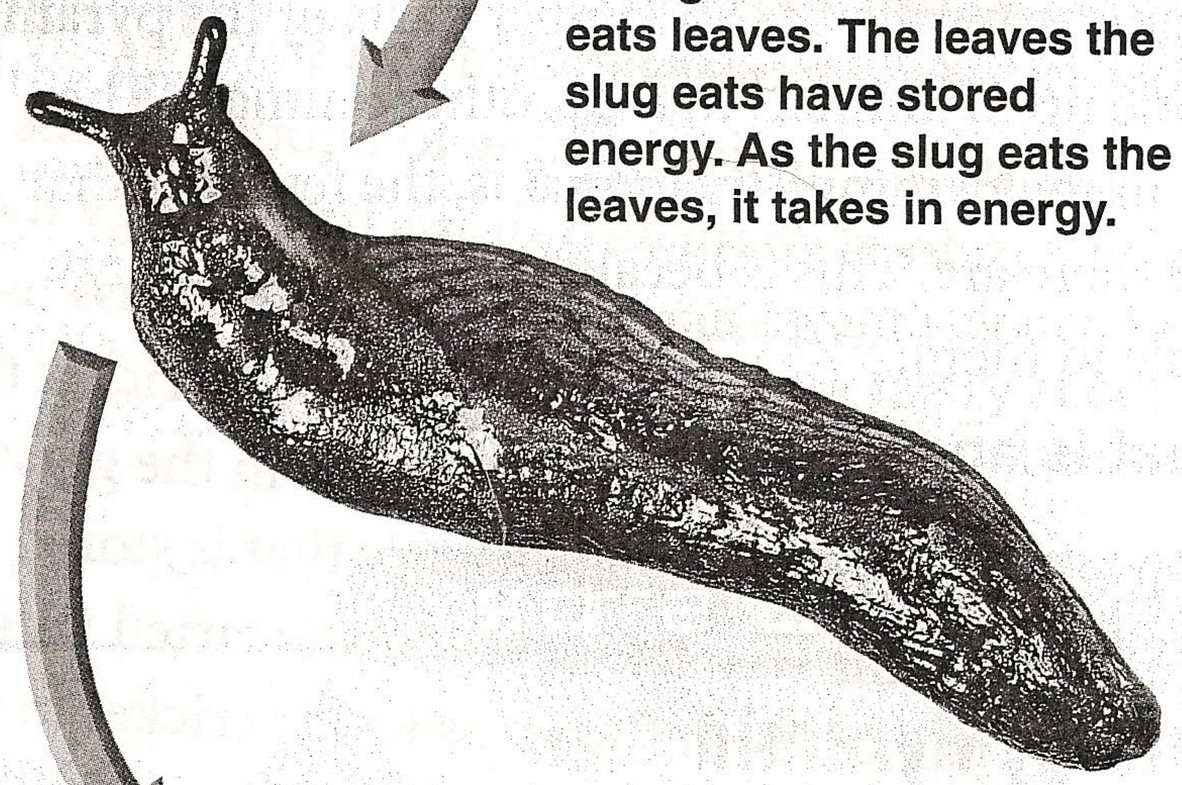


This turtle eats slugs that eat leaves. ►

A Food Chain

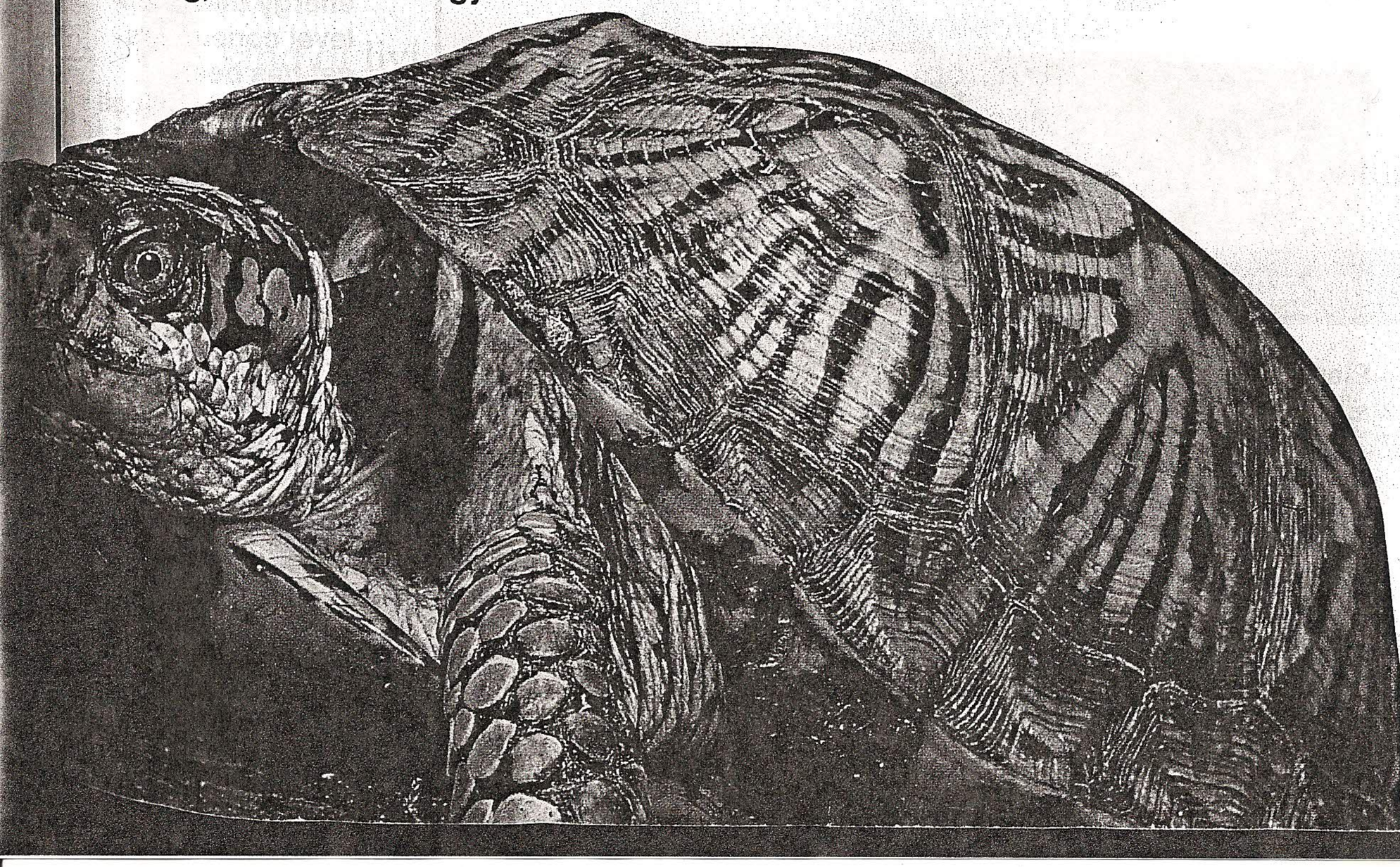


All plants are producers. The leaves of plants make food by photosynthesis. The plant stores the extra food it makes. This stored food has energy in it.



A slug is a consumer that eats leaves. The leaves the slug eats have stored energy. As the slug eats the leaves, it takes in energy.

This turtle is a consumer. One of the foods it eats is slugs. When the turtle eats a slug, it takes in energy.



Energy from Food

Every living thing uses energy to live and to grow. The energy that a living thing uses cannot be passed along through the food chain. Because of this, the higher on the food chain a living thing is, the less energy there is.

An **energy pyramid** shows that the amount of usable energy in an ecosystem is less for each higher animal in the food chain.

In an energy pyramid, there are more producers than any other kind of living thing. Most of the energy in an ecosystem is found in plants. Animals that eat plants make up the next level. The upper parts of the pyramid are made up of animals that eat other animals. The higher in the pyramid an animal is, the fewer of that animal there are. This is because there is less energy available to them.

✔ **What is an energy pyramid?**

1 Energy from the sun is taken in by plants and other producers. This energy is used by plants for growth and to make fruits and seeds. Energy that is not used by the plant is stored.

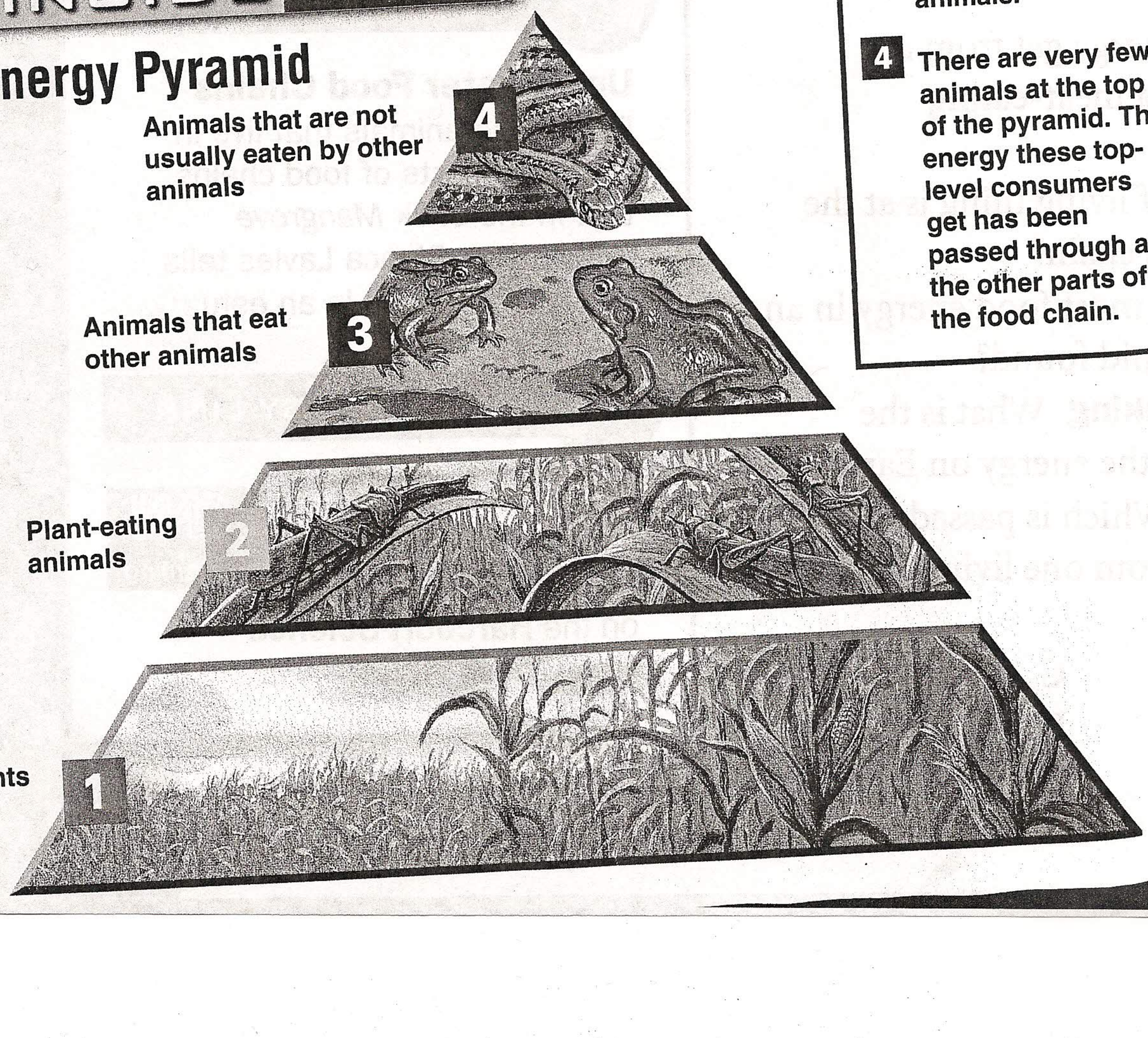
2 Animals that eat plants are called first-level consumers. These animals must eat many plants to get the energy they need. Energy not used by the animal is stored in its body.

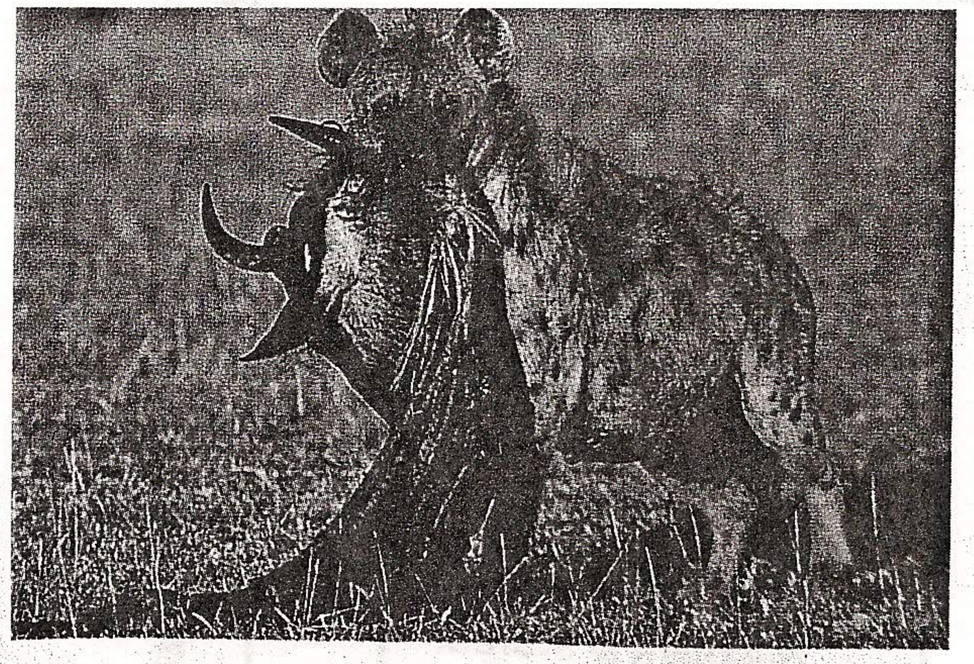
3 Animals that eat other animals are called second-level consumers. There are fewer of these animals. Some of the energy that is stored in first-level consumers can be passed on to these animals.

4 There are very few animals at the top of the pyramid. The energy these top-level consumers get has been passed through all the other parts of the food chain.

THE INSIDE STORY

An Energy Pyramid





▲ **A hyena is a *scavenger,* an animal that feeds on dead animals.**

Summary

Living things get their energy from food. Animals cannot make their own food, so they eat other living things to get energy. A food chain is the flow of food in an ecosystem from one living thing to another. An energy pyramid shows that the amount of usable energy in an ecosystem is less for each higher animal in the food chain.

Review

1. How does energy get from a producer to a meat-eating consumer?
2. What kind of living thing is at the top of a food chain?
3. Where is the most food energy in an energy pyramid found?
4. **Critical Thinking** What is the source of all the energy on Earth?
5. **Test Prep** Which is passed in a food chain from one living thing to another?

A producers C sunlight
B animals D energy

LINKS

MATH LINK

Name Fractions One food chain is made up of a producer, a consumer that eats plants, a consumer that eats both plants and animals, and a consumer that eats only animals. What fraction of living things in this food chain eats plants?

WRITING LINK

Expressive Writing—Poem You are part of many food chains. Pick your favorite dinner. Write a poem for your family about how the different foods fit into food chains.

LITERATURE LINK

Underwater Food Chains Plants and animals that live in water are parts of food chains, too. In the book *Mangrove Wilderness*, Bianca Lavies tells about food chains in an estuary.

TECHNOLOGY LINK

To learn more about food chains, watch the video *Poisoned Eagles* on the **Harcourt Science Newsroom Video.**

CNN Turner Le@rning

LEARN ABOUT

Food Webs

FIND OUT

- about food webs
- how living things interact in food webs

VOCABULARY

food web
predator
prey

Predator and Prey

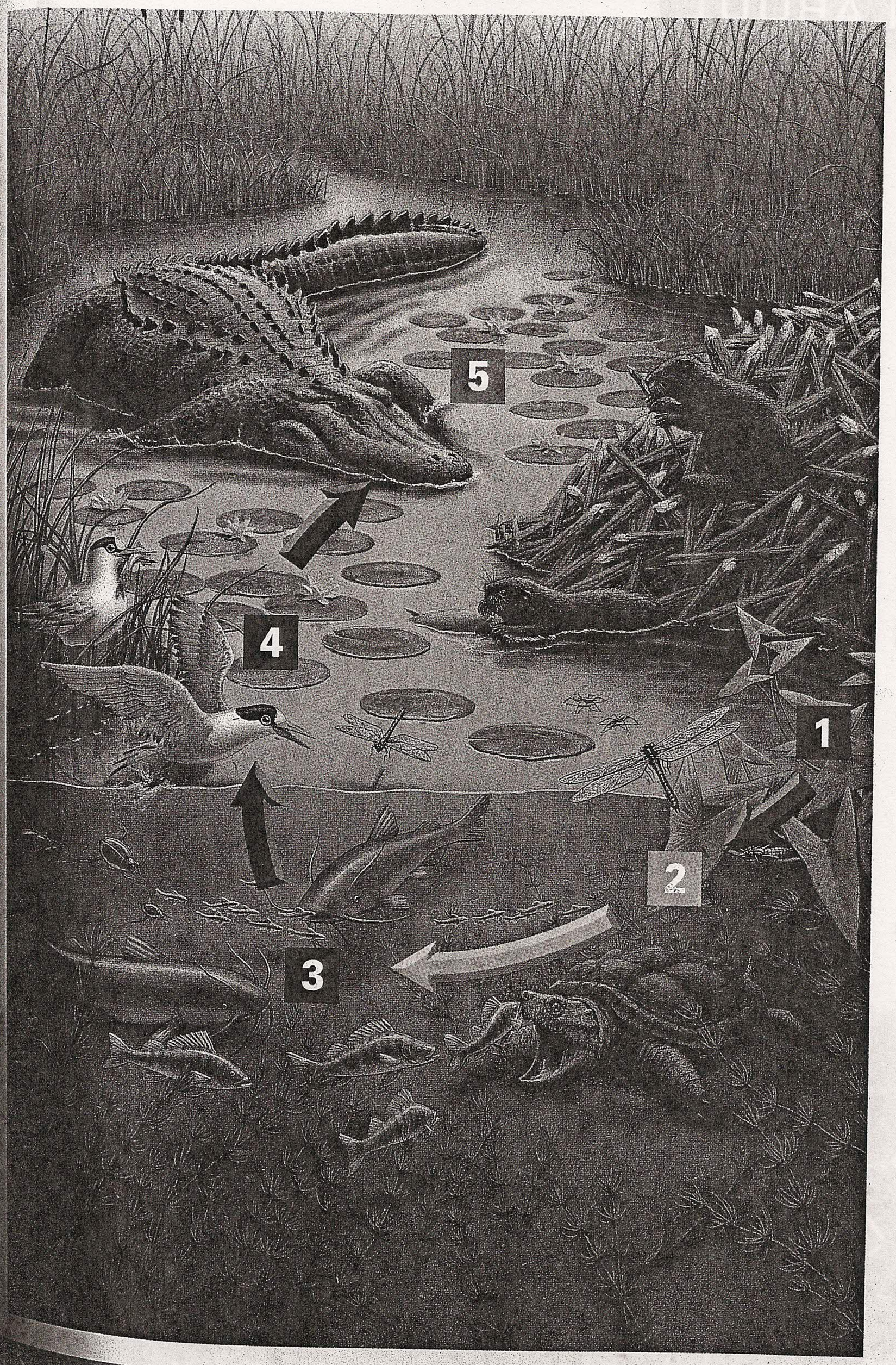
There are many food chains in an ecosystem. Sometimes these food chains overlap. A model that shows how food chains overlap is called a **food web**. A food web contains producers and consumers that are used as food by more than one living thing.

Food webs contain animals that eat other animals. An animal that hunts another animal for food is called a **predator** (PRED•uh•ter). The animal that is hunted is called **prey** (PRAY). Some animals can be both predator and prey. For example, when a snake eats a mole, the snake is the predator. The mole is the prey. If the snake is eaten by a hawk, the snake becomes the prey. The hawk is the predator.

✔ **What is a food web?**

This marsh ecosystem has many kinds of animals. These animals may be predators, prey, or both. ▼

Marsh Ecosystem



Many overlapping food chains make up the food web for this marsh ecosystem.

1 The plants in the marsh use the energy of the sun to make food.

2 Insects eat the plants that grow in the marsh.

3 Fish eat the insects. Some fish also eat the plants. Smaller fish are eaten by larger fish.

4 Birds eat the fish in the marsh. Some birds also eat the insects and the plants that grow in the marsh.

5 Alligators eat both fish and birds. Alligators are top-level consumers. They are not eaten by other animals in the marsh.

What other food chains can you identify in this food web?

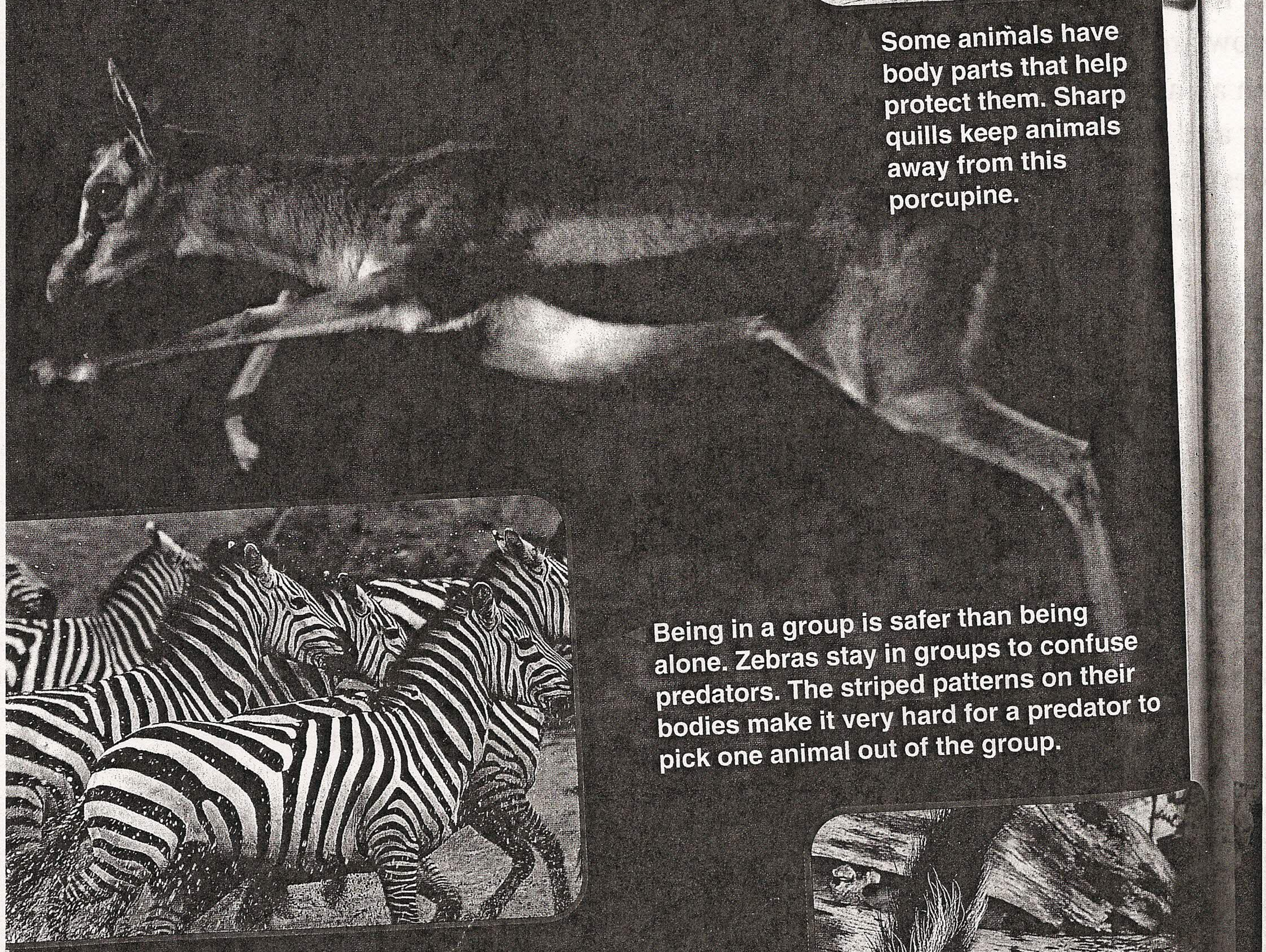
E INSIDE STORY

nimals Defend Themselves

nimals defend themselves from predators
many ways.

Sometimes they run away or fly away very fast. One of the fastest runners is the gazelle. It can run as fast as 100 kilometers per hour (62 miles per hour).

Some animals have body parts that help protect them. Sharp quills keep animals away from this porcupine.



Being in a group is safer than being alone. Zebras stay in groups to confuse predators. The striped patterns on their bodies make it very hard for a predator to pick one animal out of the group.

Skunks have a special way of defending themselves. When a predator gets close, the skunk will stomp its feet. If the predator ignores the warning, the skunk turns, lifts its tail, and sprays the predator. The spray smells awful, and it also burns the predator's eyes.

Summary

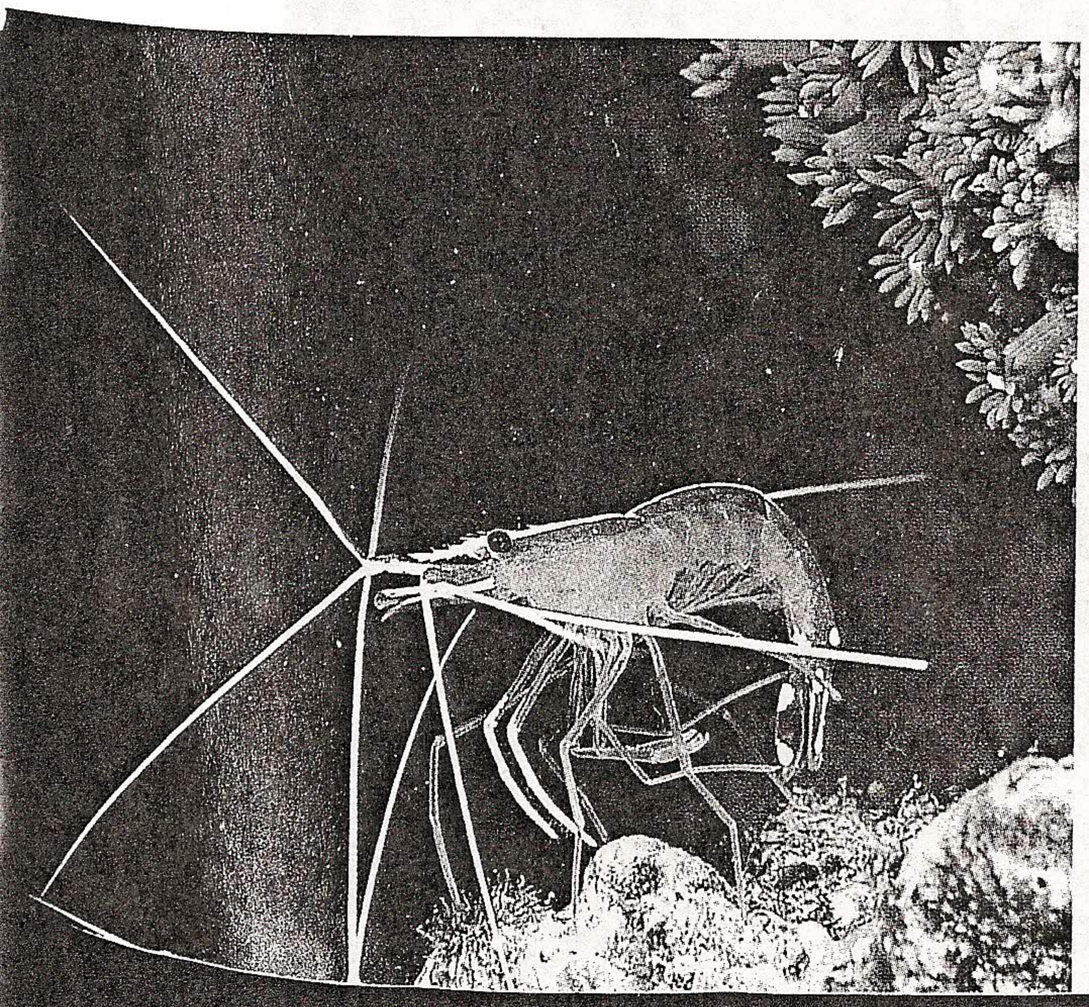
Most ecosystems have many food chains. These food chains overlap and link together to make food webs. An animal in a food web may be a predator, prey, or both.

Review

1. How are food webs and food chains alike? How are they different?
2. How can an animal be both predator and prey?
3. How does an alligator get energy?
4. **Critical Thinking** In the following food chain, name the predators and the prey.
   insect → frog → snake
5. **Test Prep** Which of the following is **not** a way animals defend themselves?

   A running away
   B staying in a group
   C fur
   D protective body parts

Other animals prey on shrimp. Just like animals that live on land, many ocean predators have body parts that help them catch and eat their prey. ▽



LINKS

Organize Data Choose a food web from this lesson. Count the different food chains in that web. How many animals in the web are predators, and how many are prey? Record your findings in a table.

WRITING LINK

Informative Writing—Explanation Study the Inside Story on page B64. Pick one of the animals and write a paragraph for your classmates that explains how the animal defends itself.

LITERATURE LINK

Read About Predators Learn about some amazing predators, such as a fishing spider or a vampire bat. Read *Extremely Weird Hunters* by Sarah Lovett.

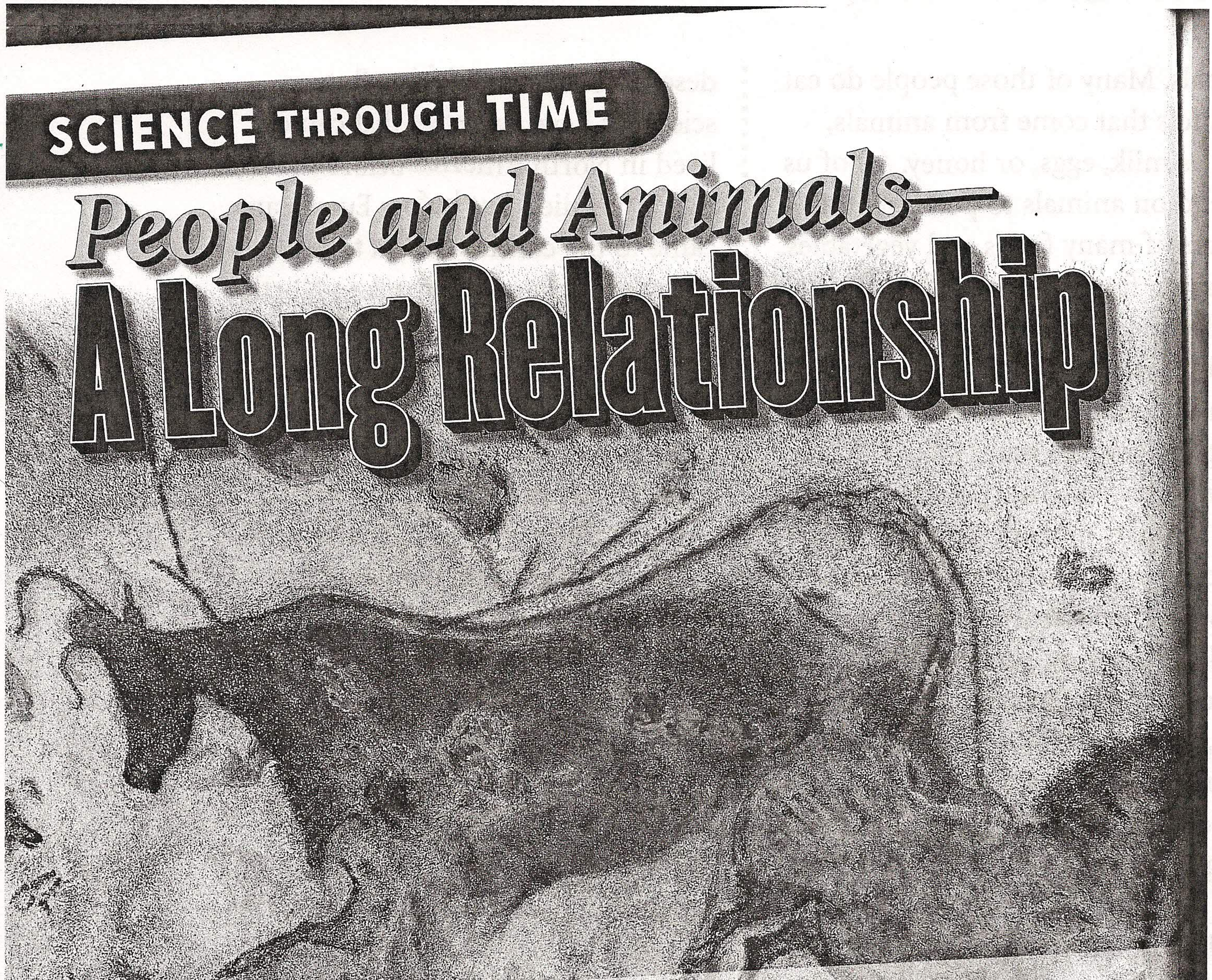
GO ONLINE TECHNOLOGY LINK

Visit the Harcourt Learning Site for related links, activities, and resources.

www.harcourtschool.com

SCIENCE THROUGH TIME

People and Animals—A Long Relationship



Animals and humans have had a long relationship. People learned many thousands of years ago to domesticate, or tame, animals. Animals have also been hunted for food and clothing for thousands of years.

Uses of Animals

Animals are part of the web of life. They are consumers, living off plants and smaller animals. But people use animals and animal products as food. Some people choose not to eat

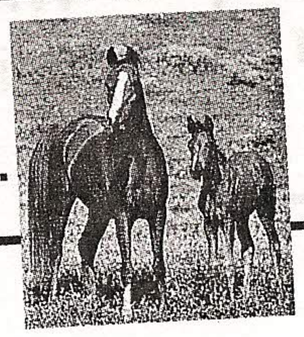
The History of People and Animals

15,000 B.C.
Horses are drawn in cave paintings in France.

15,000 B.C. | 7500 B.C. | B.C./A.D. | 1500 | 1600 | 170

8000 B.C.
People begin to tame animals.

1400 B.C.
Hittites who live in Turkey train horses.



1519
Spanish explorers bring horses to North America.

animals. Many of those people do eat products that come from animals, such as milk, eggs, or honey. All of us depend on animals to pollinate the flowers of many fruits and vegetables.

Animal fur or skins may be used for clothing. Perhaps some of the clothing you are wearing today came from an animal. We get wool from sheep. Silkworms make silk.

Over the centuries, people have used animals to work. Large animals like oxen can be used to plow fields. Horses, camels, and elephants are good for carrying people and goods. Some dogs can guard, rescue, hunt, herd, or guide. Cats catch mice.

For some of us, domestic animals are best friends. You may have a cat or a dog as a family pet. Some people have more unusual pets, such as small reptiles or birds from foreign countries.

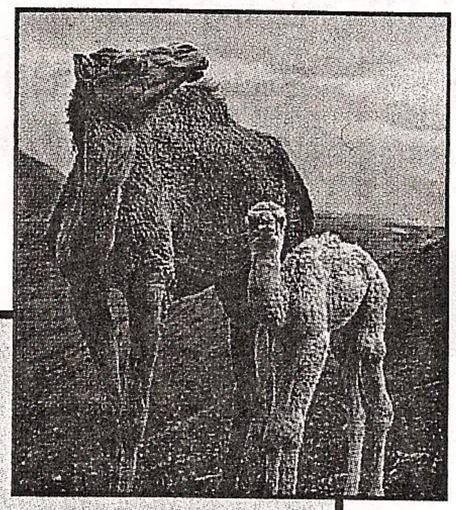
The Camel—A Very Useful Animal

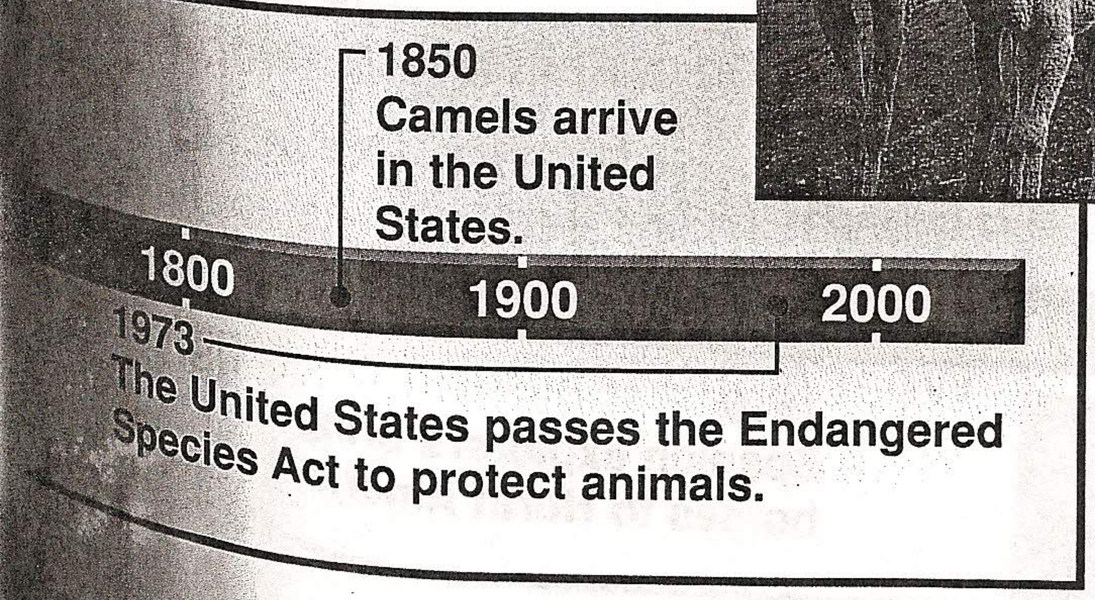
The camel is one animal that is very useful to humans. Most camels now live in the deserts of Asia and Africa. But scientists have evidence that camels lived in North America before the Ice Age. They died out before Europeans came to the continent. But the U.S. Army brought camels back to North America to carry cargo from Texas to California during the mid-1800s. The railroad was faster than camels, though. After the railroad across the country was finished, most camels went to live in zoos and circuses.

People in Asia still use camels to carry heavy loads, especially in desert areas. One camel can carry more than 136 kilograms (300 lb). A working camel travels about 40 kilometers (25 mi) a day at about 5 kilometers per hour (3 mph). Also, camels can go for a long time without water.

Camels provide meat and milk. People make cheese and butter from their milk. Camel hair makes warm blankets, clothes, and tents.

As you can see, the relationship of animals and humans is complicated. Think of all the types of animals you have studied—fish, reptiles, birds, amphibians, and mammals. Then look around at home and at school. What should you thank an animal for today?





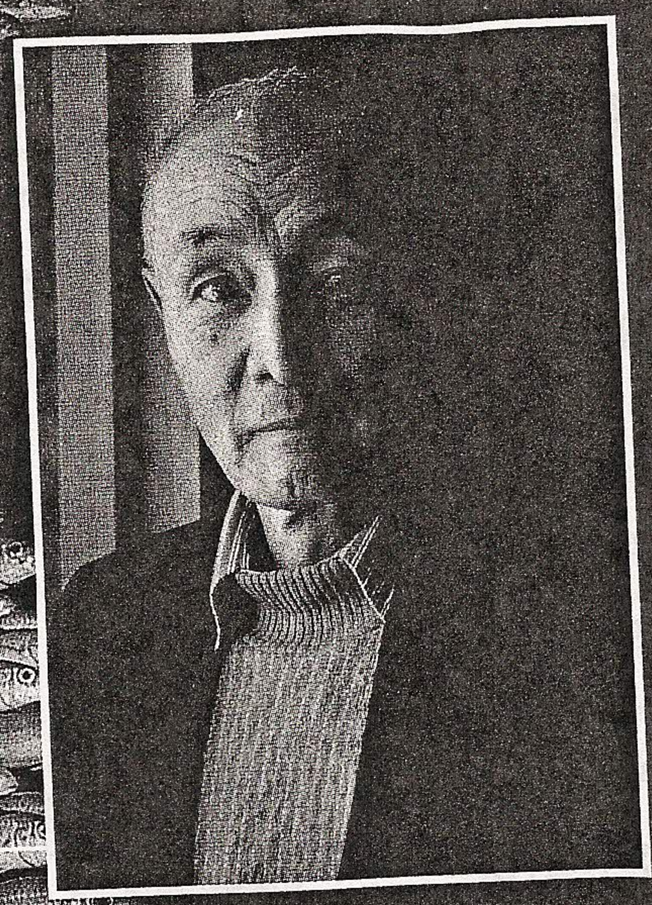
THINK ABOUT IT

- Why do you think people train animals to do specific jobs?

PEOPLE IN SCIENCE

Akira Akubo

OCEANOGRAPHER



Growing up in Japan, a country surrounded by water, Akira Akubo became interested in the ocean. His interest led him to study oceanography.

Questions Akubo has studied include why and how fish live in schools. Fish gather in schools for protection. A school may break up at night to feed, but the fish gather again the next morning. A school may have as few as two dozen fish or as many as several million. All the fish in a school are about the same size. Adult fish and young fish are never in the same school. Some fish form schools when they are young and stay together all their lives. Other species of fish form schools for only a few weeks after hatching.

Akubo has also studied plankton—tiny animal-like and plantlike living things that float near the water's surface. Most plankton are so small that they can be seen only with a microscope. Plankton is food for many other living things in the sea. Animal-like plankton eat the plantlike plankton. A lot of plankton is eaten by fish. Some whales eat nothing but tons of plankton!

Akubo is interested in land animals, too. He believes that studying land animals can help him learn more about animals in the water. He hopes that comparing ocean animals with land animals will help him predict animal behavior.

THINK ABOUT IT

1. Why is plankton important?
2. What is the advantage for fish of traveling in schools?

ACTIVITIES FOR HOME OR SCHOOL

FOOD CHAINS

How do animals get their food?

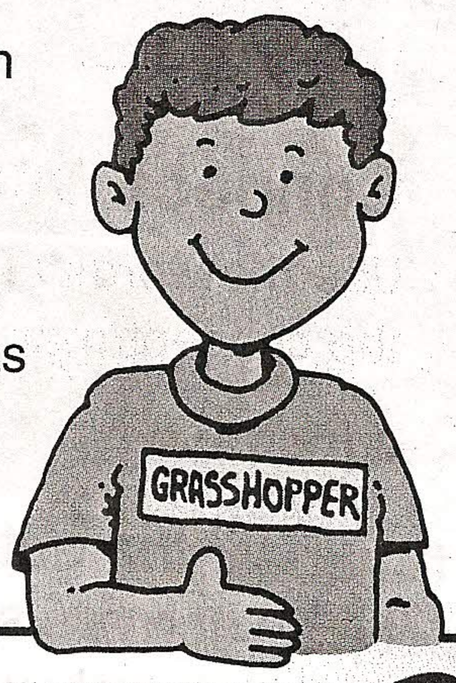
Materials

- name tags
- colored game markers
- small plastic bags

Procedure

Play this game with ten or more people.

1. Have each player wear a tag that names him or her as a grasshopper, a snake, or a hawk. Scatter the game markers over a large area. The game markers are food.



2. Each round of the game is 30 seconds. In the first round, only grasshoppers play. They collect as many markers as they can and put them in their bags.
3. In the next round, only snakes play.
4. In the final round, only hawks play.

Draw Conclusions

Which animals had the most food after three rounds? Talk about your answer.

ENERGY FLOW

How does energy flow through a food chain?

Materials

- index cards
- crayons
- pushpins
- yarn

Procedure

1. Divide the class into five groups: producers, plant eaters, plant and animal eaters, animal eaters, and decomposers.
2. Have each person in your group draw on an index card and label a kind of plant or animal that is from your group.
3. Form teams made up of one member from each group. Each team should make a food chain with the pictures. Use yarn and pushpins to connect the parts on a bulletin board.

Draw Conclusions

How does energy flow through the food chain?

CHAPTER 2 Review and Test Preparation

Vocabulary Review

Use the terms below to complete sentences 1 through 12. The page numbers in ( ) tell you where to look in the chapter if you need help.

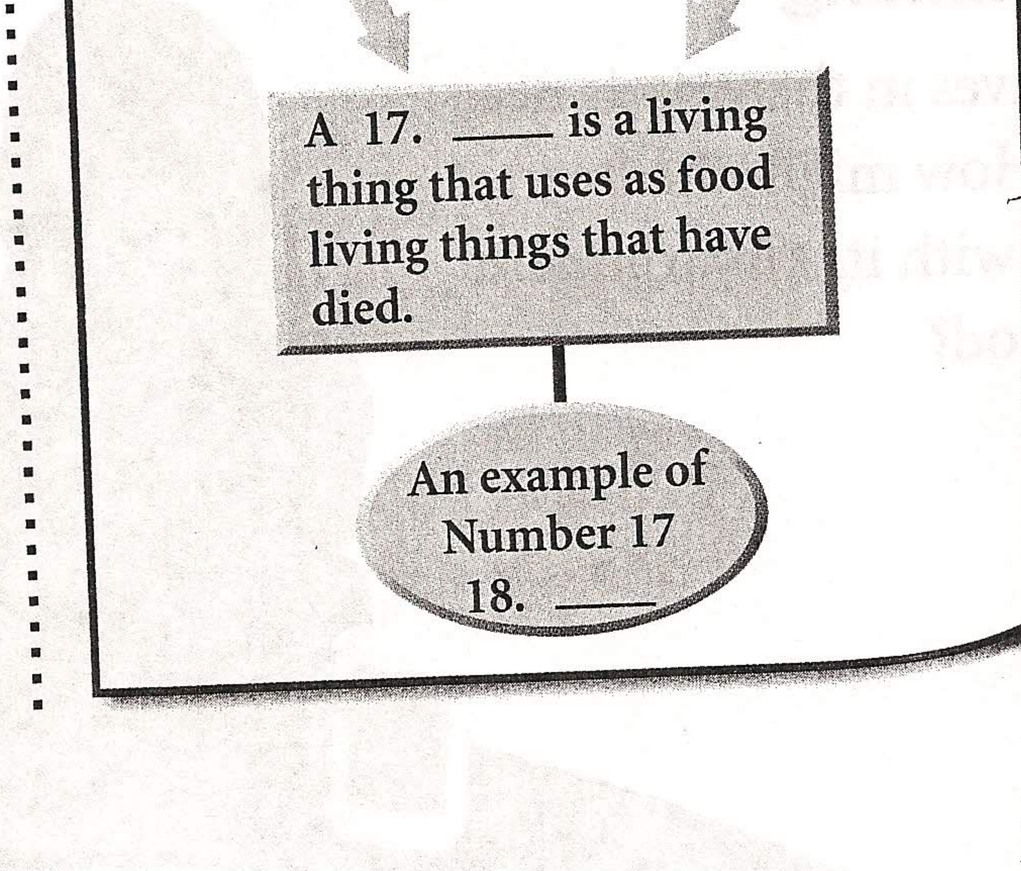
interact (B50)
producer (B51)
consumer (B51)
herbivore (B51)
carnivore (B52)
omnivore (B52)
decomposer (B52)
food chain (B56)
energy pyramid (B58)
food web (B62)
predator (B62)
prey (B62)

1. A ____ feeds on the wastes of other living things.
2. A fish that is hunted and eaten by another consumer is called ____.
3. The path of food in an ecosystem can be shown as a ____.
4. A ____ makes its own food.
5. A living thing that eats other living things is called a ____.
6. Consumers that eat both plants and animals are ____.
7. The living things in a community ____ with each other and with nonliving things.
8. Several linked food chains make up a ____.
9. Consumers that eat only plants are ____.
10. A shark is a ____ because it hunts its food.
11. A model of how energy moves through a food web is called an ____.
12. Consumers that eat only animals are ____.

Connect Concepts

Use the words listed below to complete the concept map.

consumer
decomposer
grass
horse
mushroom
producer



Check Understanding

Write the letter of the best choice.

19. Which is **NOT** a producer?

A tree **C** grass

B flower **D** bird

20. A model that shows how energy moves through a food chain is —

F a decomposer

G an ecosystem

H an energy pyramid

J a food web

21. A spider hunts and kills other animals for food. It is —

A prey

B a decomposer

C a predator

D a producer

22. Producers get their energy from —

F other living things

G the soil

H an energy pyramid

J the sun

Critical Thinking

23. A bear lives in the woods near a river. How might the bear interact with its environment to get food?

24. A cat and a dog meet. How does each animal defend itself?

Process Skills Review

25. How can you use **observation** to find out what a goat eats? How might you **infer** what the goat eats?

26. Use what you know about **models** to draw a food web that includes a bear, a water plant, berries, a big fish, a small fish, and a mouse.

Performance Assessment

Diagram a Food Web

Work with a partner. Choose an animal with which you are familiar. Draw a food web that includes the animal. Identify the producers and the consumers in each food chain. Identify predators and prey in as many food chains as you can.