

Reading Preview

Key Concepts

- What are the characteristics of most fishes?
- What are the major groups of fishes and how do they differ?

Key Terms

- fish
- cartilage
- swim bladder

Target Reading Skill

Previewing Visuals Before you read, preview Figure 12. Then write two questions that you have about the diagram in a graphic organizer like the one below. As you read, answer your questions.

Structure of a Fish

Q. What is a swim bladder?
A.
Q.

Lab zone

Discover Activity

How Does Water Flow Over a Fish's Gills?

1. Closely observe a fish in an aquarium for a few minutes. Note how frequently the fish opens its mouth.
2. Notice the flaps on each side of the fish's head behind its eyes. Observe how the flaps open and close.
3. Observe the movements of the mouth and the flaps at the same time. Note any relationship between the movements of these two structures.



Think It Over

Observing What do the flaps on the sides of the fish do when the fish opens its mouth? What role do you think these two structures play in a fish's life?

In the warm waters of a coral reef, a large spotted fish called a graysby hovers in the water, barely moving. A smaller striped fish called a goby swims up to the graysby. Then, like a vacuum cleaner moving over a rug, the goby swims slowly over the larger fish, eating dead skin and tiny parasites. The goby even cleans inside the graysby's mouth and gills. Both fishes benefit from this cleaning. The graysby gets rid of unwanted materials, and the goby gets a meal.

Gobies cleaning a graysby ▶





Characteristics of Fishes

Both the goby and the grayby it cleans are fishes. A **fish** is a vertebrate that lives in water and uses fins to move. **In addition to living in water and having fins, most fishes are ectotherms, obtain oxygen through gills, and have scales.** Scales are thin, overlapping plates that cover the skin.

Fishes make up the largest group of vertebrates. Nearly half of all vertebrate species are fishes. In addition, fishes have been on Earth longer than any other kind of vertebrate.

Obtaining Oxygen Fishes get their oxygen from water. As a fish swims, it opens its mouth and takes a gulp of water, as you observed if you did the Discover Activity. The water, which contains oxygen, moves through openings in the fish's throat region that lead to the gills. Gills, which look like tiny feathers, have many blood vessels within them. As water flows over the gills, oxygen moves from the water into the fish's blood. At the same time, carbon dioxide, a waste product, moves out of the blood and into the water. After flowing over the gills, the water flows out of the fish through slits beneath the gills.

Circulatory System From the gills, the blood travels throughout the fish's body, supplying the body cells with oxygen. Like all vertebrates, fishes have a closed circulatory system. The heart of a fish has two chambers, or inner spaces. The heart of a fish pumps blood in one loop—from the heart to the gills, from the gills to the rest of the body, and back to the heart. You can trace this path in Figure 5.

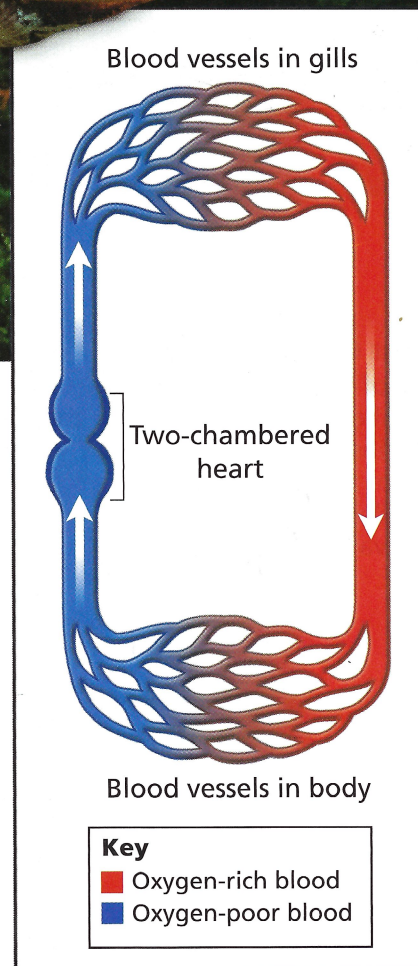
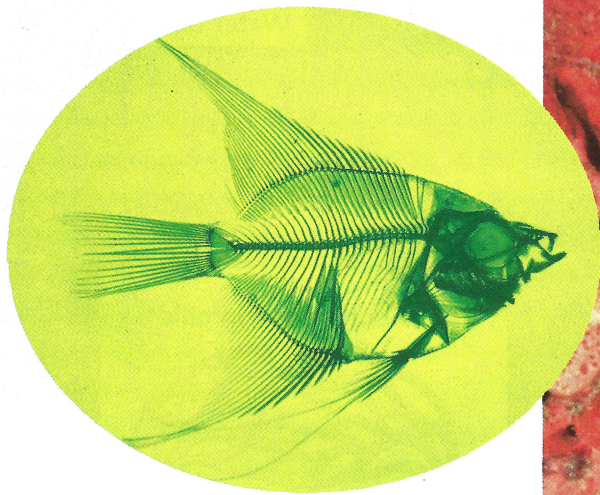


FIGURE 5

Respiration and Circulation

Water flows into the mouth of this fish and then over its gills. Oxygen moves into the blood and is delivered to the cells of the fish.

Interpreting Diagrams Where does oxygen get into the blood of a fish?



▲ Skeleton

FIGURE 6

Fins of an Angelfish

The skeleton of a fish shows that the fins have bony support. The fins of this angelfish act like paddles as the fish moves through the water.



Movement Fins help fishes swim. Look at the fins on the angelfish in Figure 6. Each fin has a thin membrane stretched across bony supports. Like a canoe paddle, a fin provides a large surface to push against the water. The push allows for faster movement through the water. If you have ever swum wearing a pair of swim fins, you probably noticed how fast you moved through the water. Most of the movements of fishes are related to obtaining food, but some are related to reproduction.

Reproduction Most fishes have external fertilization. In external fertilization, the eggs are fertilized outside the female's body. The male hovers close to the female and spreads a cloud of sperm cells over the eggs she releases. The young develop outside the female's body.

In contrast, some fishes, such as sharks and guppies, have internal fertilization. In internal fertilization, eggs are fertilized inside the female's body. The young develop inside her body. When they are mature enough to live on their own, she gives birth to them.



What is the structure of a fin?

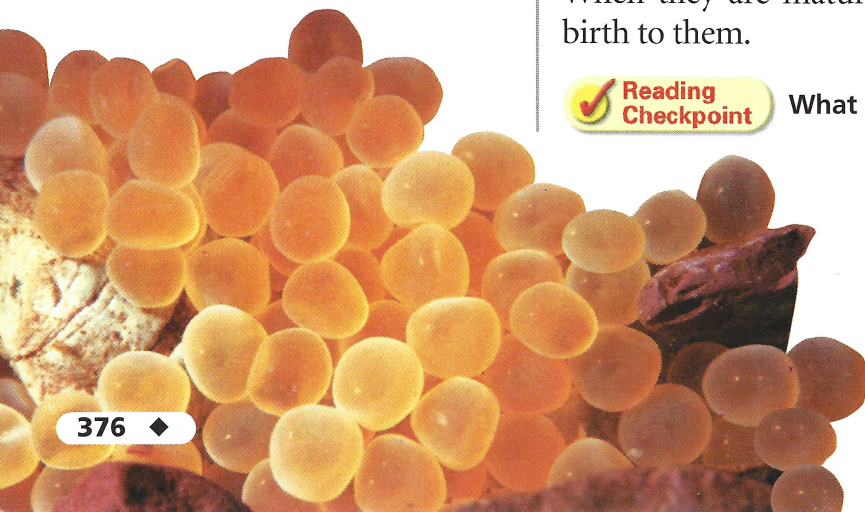


FIGURE 7

Trout Eggs

Young brook trout fish are developing in these eggs on the bottom of a stream.

Nervous System The nervous system and sense organs of fishes help them find food and avoid predators. Most fishes can see much better in water than you can. Keen senses of touch, smell, and taste also help fishes capture food. Some fishes have taste organs in unusual places. For example, the catfish shown in Figure 8 tastes with its whiskers.

Jawless Fishes

Fishes have lived on Earth longer than any other kind of vertebrate. Fishes are organized into three main groups based on the structures of their mouths and the types of skeletons they have. **The major groups of fishes are jawless fishes, cartilaginous fishes, and bony fishes.**

Jawless fishes are unlike other fishes in that they have no jaws and no scales. Jaws are hinged bony structures that allow animals to open and close their mouths. Instead of jaws, jawless fishes have mouths containing structures for scraping, stabbing, and sucking their food. Their skeletons are made of **cartilage**, a tissue that is more flexible than bone.

Hagfishes and lampreys are the only kinds of jawless fishes that exist today. Hagfishes look like large, slimy worms. They crawl into the bodies of dead or dying fishes and use their rough tongues to scrape decaying tissues. Many lampreys are parasites of other fishes. They attach their mouths to healthy fishes and then suck in the tissues and blood of their victims. If you look at the lamprey's mouth in Figure 9, you can probably imagine the damage it can do.



What material makes up the skeleton of a jawless fish?

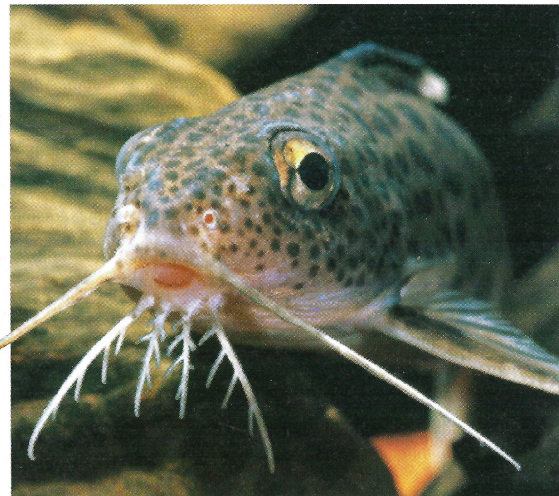


FIGURE 8

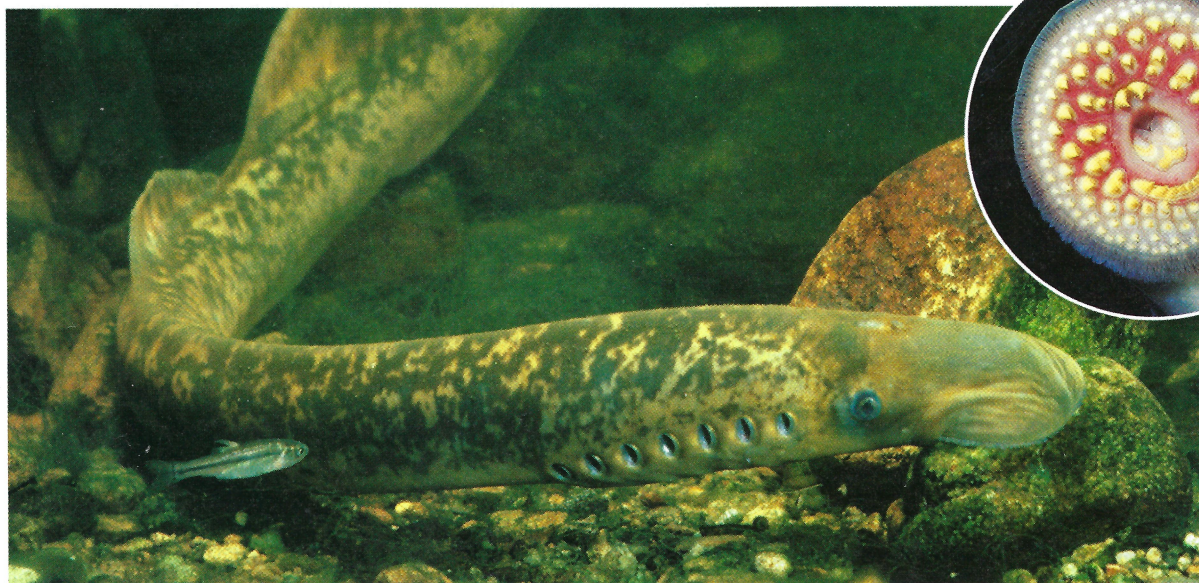
A Catfish

The whiskers of a catfish have many taste buds. To find food, the catfish drags its whiskers along muddy lake or river bottoms.

FIGURE 9

A Lamprey

Lampreys have eel-shaped bodies. They use sharp teeth and suction-cup mouths to feed on other fishes. **Classifying** To which group of fishes do lampreys belong?

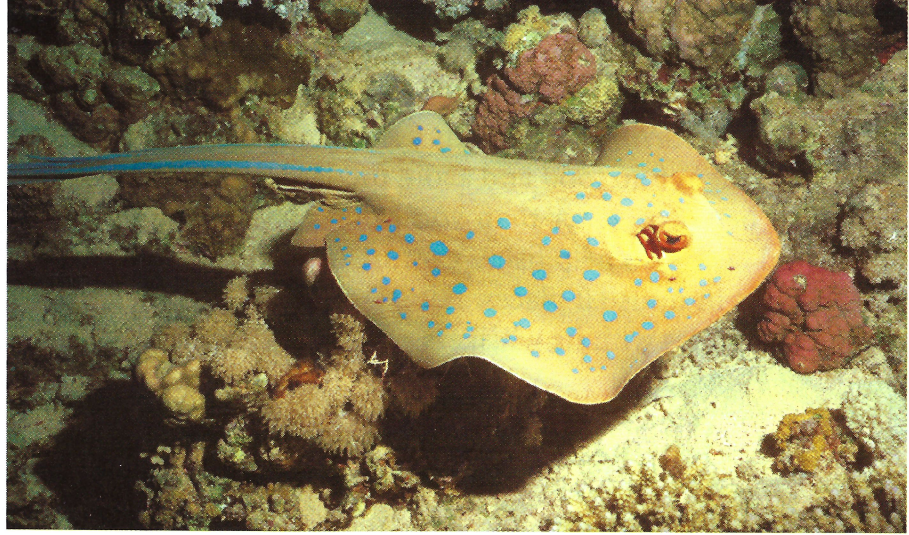


▲ Mouth

FIGURE 10

Blue-Spotted Ray

This ray is a cartilaginous fish that lives on the ocean floor.



Cartilaginous Fishes

Sharks, rays, and skates are cartilaginous (kahr tuh LAJ uh nuhs) fishes. **The cartilaginous fishes have jaws and scales, and skeletons made of cartilage.** The pointed, toothlike scales that cover their bodies give their skin a texture that is rougher than sandpaper.

Obtaining Oxygen Most sharks cannot pump water over their gills. Instead, they rely on swimming or currents to keep water moving across their gills. For example, when sharks sleep, they position themselves in currents that send water over their gills.

Rays and skates are not as active as sharks. They spend a lot of time partially buried in the sand of the ocean floor. During this time, they take in water through small holes located behind their eyes. Water leaves through gill openings on their undersides.

Obtaining Food Cartilaginous fishes are usually carnivores. Rays and skates hunt on the ocean floor, crushing mollusks, crustaceans, and small fishes with their teeth. Sharks will attack and eat nearly anything that smells like food. They can smell and taste even a tiny amount of blood—as little as one drop in 115 liters of water! Although sharks have a keen sense of smell their eyesight is poor. Because they see poorly, sometimes they swallow strange objects. Indeed, one shark was found to have a raincoat and an automobile license plate in its stomach.

The mouth of a shark contains jagged teeth arranged in rows. Most sharks use only the first couple of rows for feeding. The remaining rows are replacements. If a shark loses a front-row tooth, a tooth behind it moves up to replace it.

FIGURE 11

Great White Shark

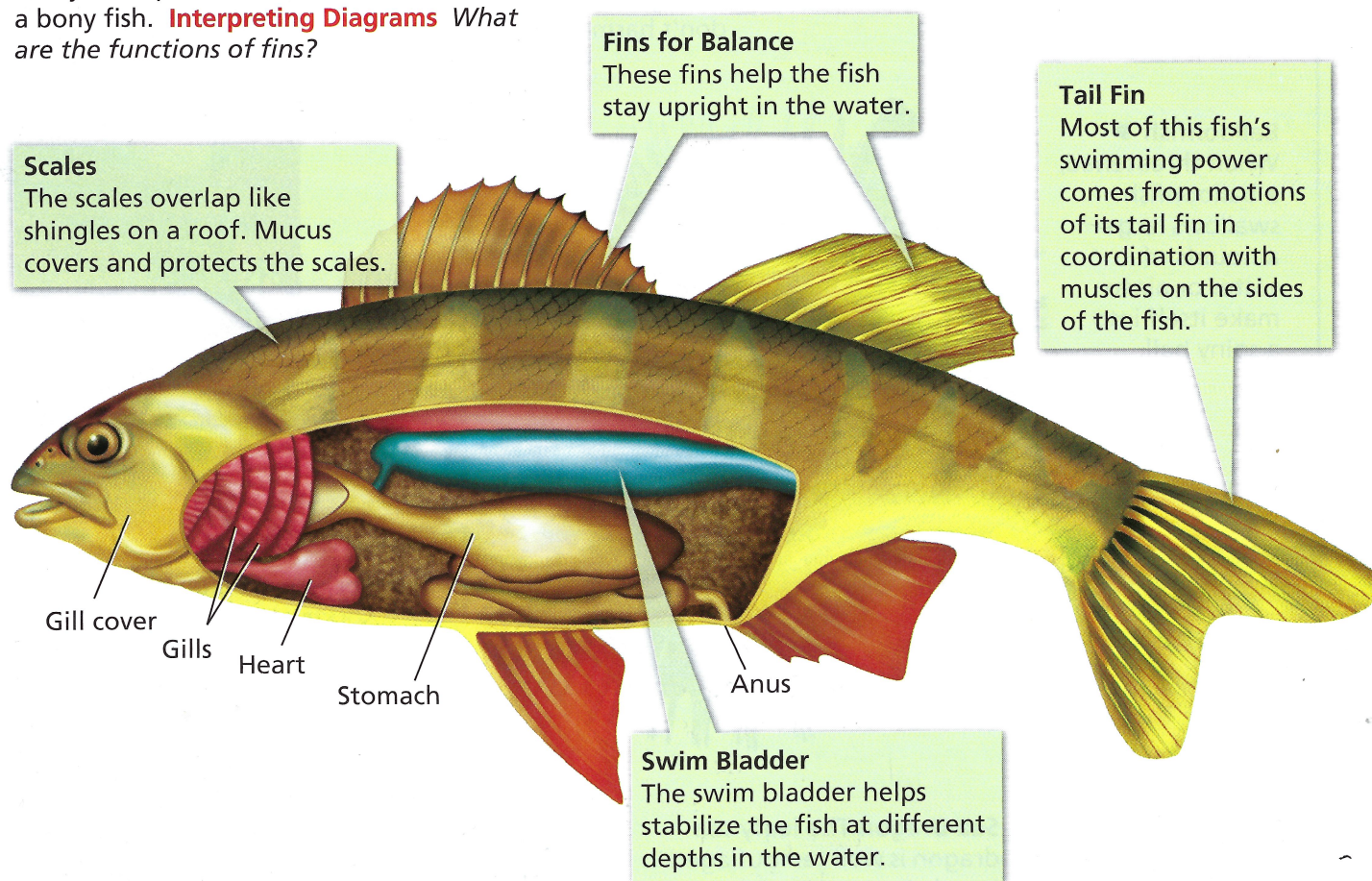
This great white shark has a familiar shark trait—many sharp teeth.



FIGURE 12

Structure of a Bony Fish

This yellow perch has the characteristics of a bony fish. **Interpreting Diagrams** What are the functions of fins?



Bony Fishes

Most familiar kinds of fishes, such as trout, tuna, and goldfishes, are bony fishes. A **bony fish** has jaws, scales, a pocket on each side of the head that holds the gills, and a skeleton made of hard bones. Each gill pocket is covered by a flap that opens to release water.

The major structures of a bony fish are shown in Figure 12. Notice that a bony fish has an organ called a **swim bladder**, which is an internal, gas-filled sac that helps the fish stay stable at different depths in the water. Gas levels in the swim bladder are adjusted after the fish reaches its desired depth. By adjusting these levels, the fish can stay at a depth without using a lot of energy.

Bony fishes make up about 95 percent of all fish species. They live in both salt water and fresh water. Some live in the dark depths of the ocean. Others thrive in light-filled waters, such as those around coral reefs. Figure 13 on the next page shows some of the great variety of bony fishes.



Reading Checkpoint

Which organ helps a bony fish maintain its position in the water?

Lab zone

Skills Activity

Observing

Put on your goggles and disposable gloves. Place a preserved fish on newspaper on your desk and examine it closely. Note its size and shape, and the number and locations of its fins. Lift the gill cover and observe the gills with a hand lens. Use your observations to make a diagram of the fish. Wash your hands when you are finished.

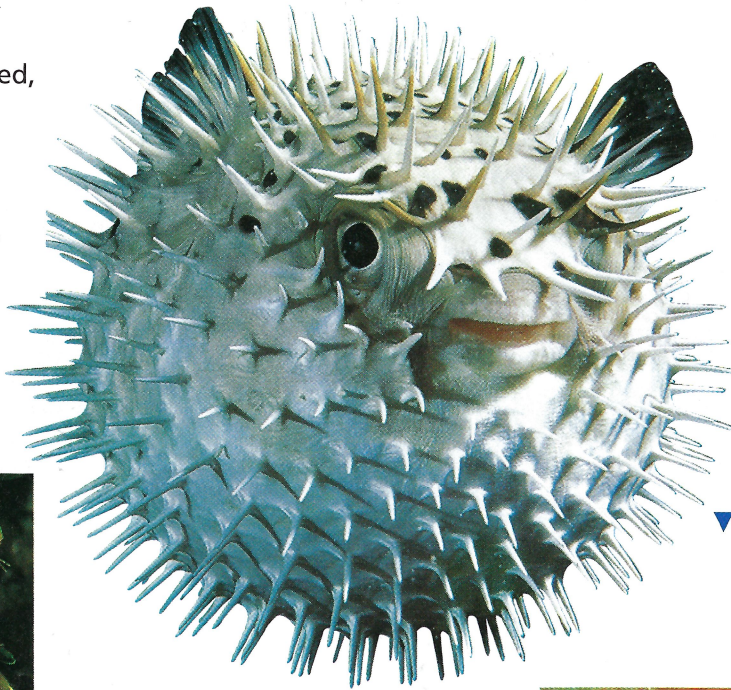
FIGURE 13

Diversity of Bony Fishes

These photographs show just a few species of bony fishes.

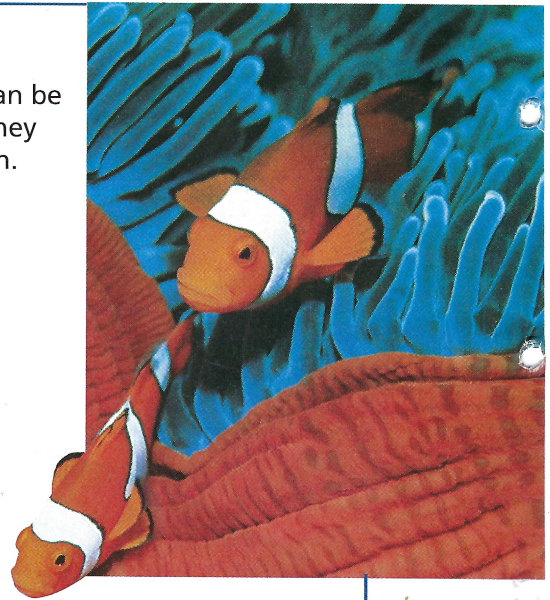
Balloonfish ▶

When threatened, a balloonfish swallows large amounts of water or air to make itself into a spiny ball.



Anemone Fish ▶

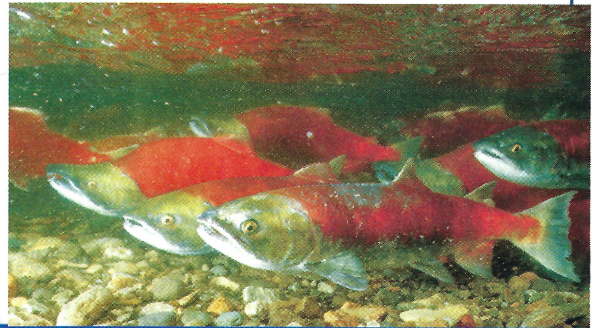
A sea anemone's tentacles can be deadly to other fishes, but they don't harm the anemone fish.



▼ Sockeye Salmon

Sockeye salmon are Pacific Ocean fishes that migrate from ocean to inland lakes to reproduce.

▶ **Sea Dragon** The leafy sea dragon is well camouflaged in weedy bays and lagoons.



Section 2 Assessment

Target Reading Skill Previewing Visuals Use the information in your graphic organizer about the structure of a fish to quiz a partner.

Reviewing Key Concepts

- Reviewing** What are the main characteristics of fishes?
 - Explaining** Why do fishes have gills?
 - Applying Concepts** What would happen to a goldfish that could not open its mouth? Explain.
- Identifying** What are three major groups of fishes?
 - Classifying** Into which group of fishes would you classify a fish with jaws and a skeleton made of cartilage?
 - Comparing and Contrasting** How do sharks and hagfishes obtain food?

Writing in Science

Wanted Poster Design a "Wanted" poster for a lamprey. Present the lamprey as a "criminal of the ocean." Include the lamprey's physical characteristics, feeding habits, and any other details that will allow people to track down this fish.