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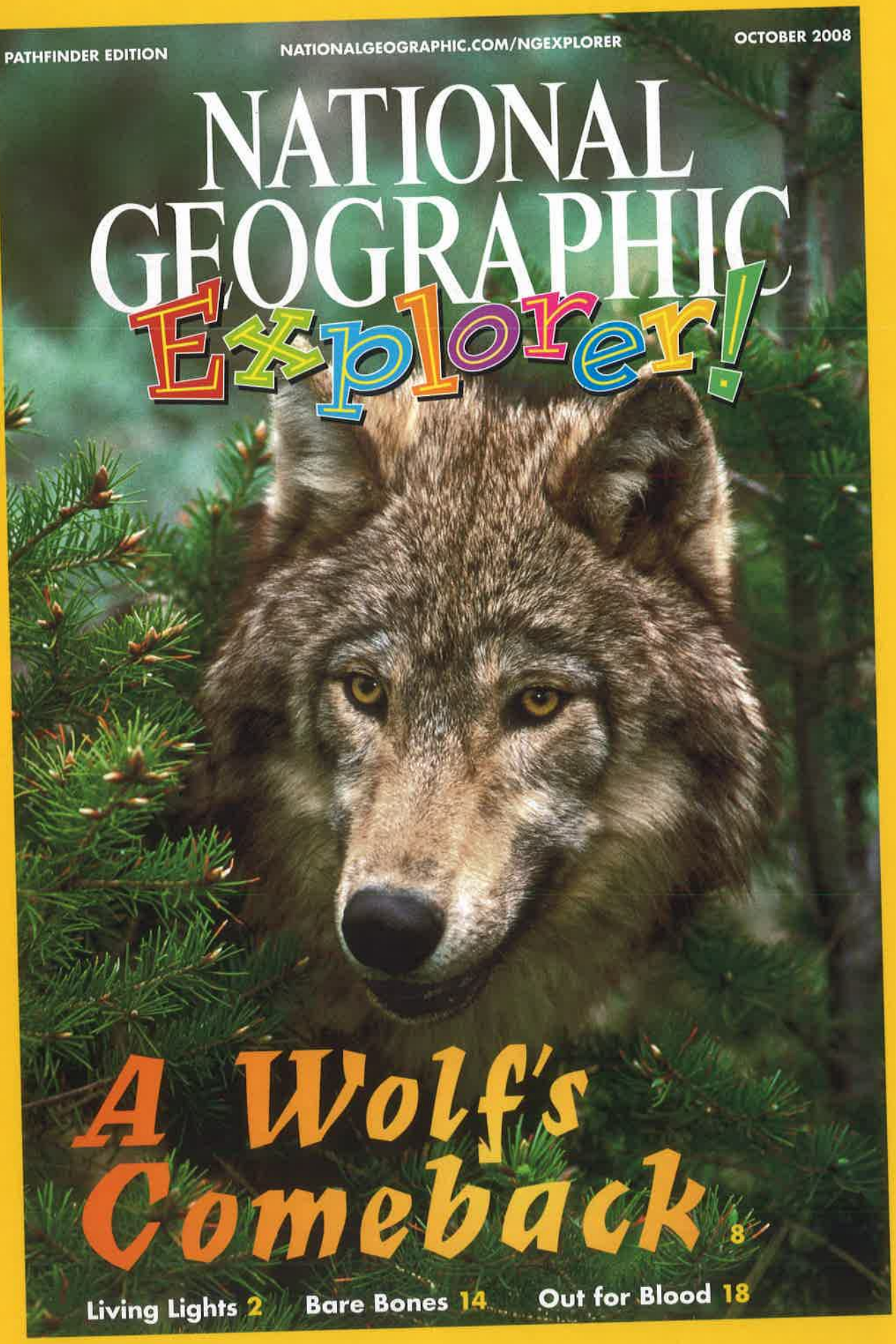

A Wolf's Comeback 8

LIFE SCIENCE

Reading Strategy: As you read, stop now and then to sum up what you have learned.

Firefly

© PHIL DEGGINGER/ALAMY

Living Lig

Pinecone fish

© KEN LUCAS/VISUALS UNLIMITED

Mushrooms

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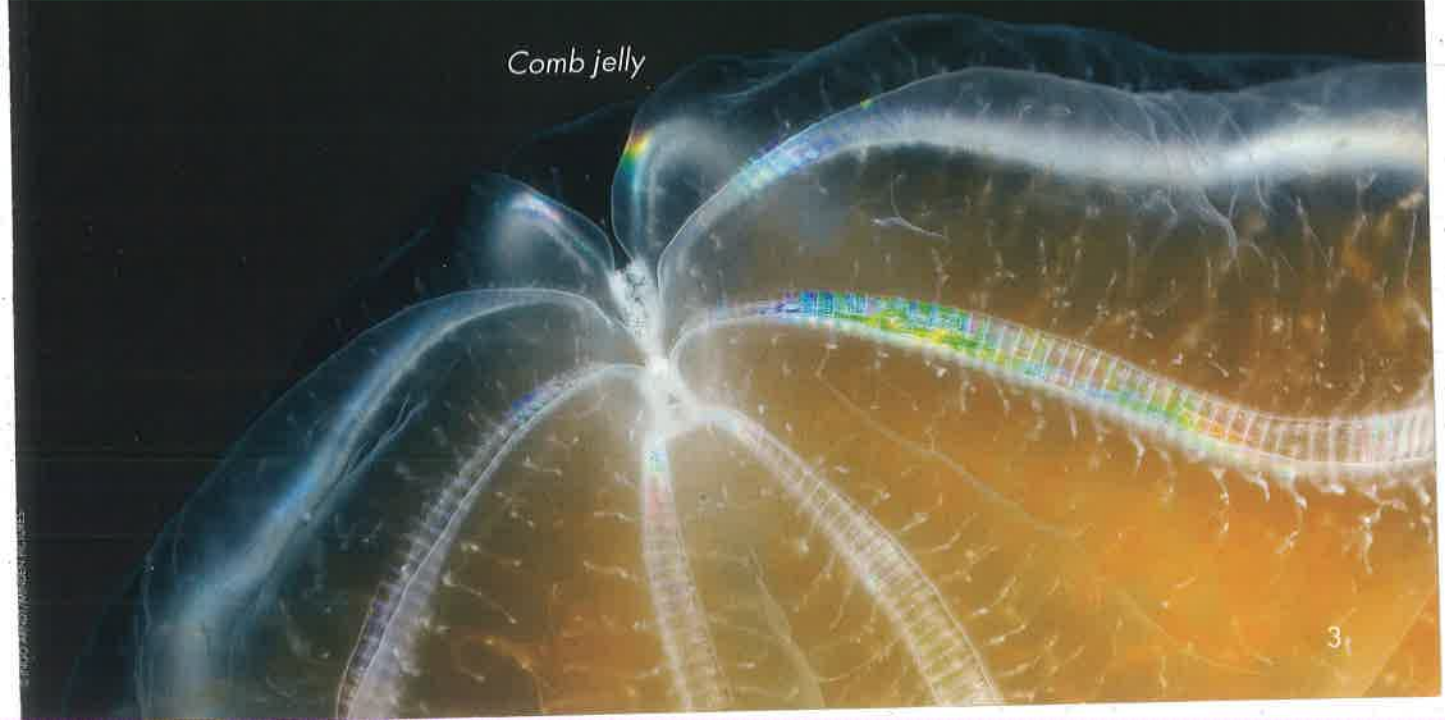
Glowing in the dark helps some living things survive.

By Dennis Desjardin
Professor of Biology, San Francisco State University



Comb jelly

The world looked upside down. Stars seemed to be glowing at my feet instead of shining overhead. I felt dizzy looking down at the dots of light. This strange scene took place in a forest in Brazil. Of course, the light didn't come from real stars. It came from mushrooms.

Yes, mushrooms. The mushrooms shone clearly in the coal-black night. That's because they were **bioluminescent**. They were living things with the ability to make light.

I'm a scientist who studies mushrooms. Very few mushrooms can make light, so I wanted to learn more about them. I'd gone deep into the forest, searching for those mushrooms.

There's a lot to discover about glowing mushrooms. One scientist is trying to figure out exactly which chemicals mushrooms use to make light. The answer is probably different for mushrooms than for other things that glow.

The biggest question, though, is why some mushrooms make light at all. It must help them in some way. But how? Right now, we don't know for sure. Yet we do have some ideas.

The light from bioluminescent mushrooms may attract insects. Scientists tested this idea. They let some insects loose in an area with glowing and nonglowing mushrooms. More insects went to the glowing mushrooms than to the others. So why would a mushroom want to attract insects? Well, it needs their help to reproduce, or make new mushrooms.

Tricky Mushrooms

When an insect lands on a mushroom, **spores** stick to the insect's body. A spore is a part that can grow into a new mushroom. When the insect flies away, it carries the spores to new places.

The spores can take root in the new places. In this way, new mushrooms can grow. The glowing mushroom reproduces itself, thanks to the part the insect plays.

Making light may also help mushrooms trick animals. Their weird glow may signal that they're bad to eat. No one has tested this idea. It's one example of how studying bioluminescent mushrooms will keep scientists like me busy!

Gorgeous Glowworms

Many kinds of animals make their own light, too. Other scientists are studying these living lights. Let's find out what they've learned.

Some living lights are world-famous. People travel from all over to see glowworms in parts of New Zealand. The glowworms live on the ceilings and walls of certain caves. Like spiders, they make sticky threads. A glowworm attaches its thread to the ceiling or wall. The thread dangles in the dark, making an invisible trap.

The glowworm sits, waits, and turns on its light. Insects see the shining light and fly toward it. If the glowworm is lucky, one of those insects will fly into the thread and get stuck. The glowworm pulls the thread up, draws the insect close, and eats it.

See It Now? *In the light, you cannot see that this mushroom glows (left). Yet in the dark, it's easy to spot its yellow-green light (right).*

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Bright Lights. *This is a close-up look at glowworms shining light.*

Light Show. *Like a starry night, glowworms light up the ceiling of Waitomo cave in New Zealand.*

BRIAN BRAKE/PHOTO RESEARCHERS, INC.

Flashy Fliers

You may have seen a living light much closer to home. It's the firefly. For this flashy flier, glowing is all about meeting a mate.

At mating time, females wait in grassy places. Males fly above them. As the male flies, he flashes a light in his abdomen, or the rear part of his body. This light tells females that he is looking for a mate. If a female is interested, she flashes back.

The male then flies toward the female. As he flies, he and the female flash back and forth. All that flashing helps the male and female find each other.

Luring With Light

Many living lights dwell in the deep sea. Scientist Michael Latz says that most deep-sea creatures make their own light. The anglerfish is one of the deep sea's best known living lights. In the dark world beneath the sea, spotting **prey** is tough. So the anglerfish has a way to get prey to come to it.

A long rod sticks out from the anglerfish's head. At the end of the rod is a lure, or something used to attract prey. Countless **bacteria** live inside the lure. The bacteria are bioluminescent. They make the lure glow.

Fish swim through the dark water to check out the light. When one gets close enough, the anglerfish opens its mighty mouth. Chomp! The fish becomes the anglerfish's meal.

Camouflage in Clear Water

For the anglerfish, making light is a hunting tool. For many other sea creatures, glowing in the dark is just the opposite. It's a way to protect themselves and avoid being eaten by **predators.**

Many ocean animals have dim lights on the bottom of their bodies. The lights are about as bright as the sunlight shining through the water. That's important, because ocean predators often look up toward the surface to spot prey. They are looking for a dark shape in the water above them. Predators know that the shape may be a tasty meal.

Bioluminescent animals, though, don't look dark. Thanks to their lights, they blend in with the sunlit water. This is called camouflage. Blending in makes an animal hard to spot. So the predator goes away hungry, and the living light goes on to shine for another day.

Deep-sea animals are a lot different from mushrooms in a forest. Yet both can be bioluminescent. To me, that makes both of them wonderful. It's amazing to see living things that make their own light.

It can also be puzzling. That's because there are still many questions to answer. For example, if making light helps mushrooms, how come so few do it? Why do some cave animals glow, and others don't? Why do mushrooms shine during the day as well as at night? For scientists of the future, diving into these questions will be a great adventure.

Go Away! *To scare predators, this jellyfish can make blue light (right).*

E. WIDDER

Do Not Disturb. *This comb jelly looks normal now. When it is in danger, though, it makes blue light to scare away predators.*

Wordwise

bacteria: tiny living things that are neither plants nor animals

bioluminescent: able to make light

predator: animal that kills and eats other animals

prey: animal eaten by another animal

spore: part of a mushroom that can grow into a new mushroom

LIFE SCIENCE

Reading Strategy: As you read, stay focused on your purpose for reading. Find out how the gray wolf has made a comeback in the U.S.

Return of

Making a Comeback. *Once nearly extinct, gray wolves are returning to some areas of the United States.*

By Gary Miller

The Gray Wolf

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You probably know the story of Little Red Riding Hood. The big, bad wolf devours a little old lady—and tries to snack on her granddaughter! Stories like that helped give wolves a bad rap. Do wolves really deserve their big, bad reputation?

In the past, most people thought they did. People feared and hated wolves. There's a reason for that. Wolves are fierce predators. Their jaws can take down a moose and even crush bone. Yet the fact is that wolves rarely attack humans today. Many people today understand that wolves are an important part of the natural world.

In most of the United States, the gray wolf is **endangered.** In some areas, people are working to bring wolves back. Soon, the sound of a wolf howling may echo in a wilderness near you.

Creatures in Conflict

Gray wolves are the largest wild members of the dog family. Long ago, gray wolves lived across most of North America. They stalked deer in the scorching deserts of Mexico. They chased caribou across the frozen Arctic plains.

When Europeans first came to America, conflicts with wolves began. Wolves sometimes killed livestock such as cattle and sheep. Wolves also killed deer and other animals that the people hunted for food. This made it harder for settlers to succeed. For these reasons, people tried to wipe out wolves. They used guns, traps, and poison to do the job. They even received a reward for each wolf they killed.

As you can imagine, that wasn't good news for wolves. By about 1940, there were hardly any wolves left in the U.S. outside of Alaska. Only 300 or so wolves survived. They all lived in northern Minnesota.

Survival in the wild is always a challenge. Wolves face this challenge in groups called packs. Packs hunt together and share food. This helps pack members survive.

Hoot and Howl

"A wolf pack is very much like a human family," says scientist L. David Mech. "It's a pair of adults and their offspring. The adults lead the pack just like human parents lead their own families."

Mech knows what he's talking about. He has studied wolves for more than 50 years. He's learned that wolves and people have more than one thing in common.

You talk to the people in your family. Wolves communicate with one another, too. How? One way is body language. A wolf pup might lick the mouth of an adult. That's a signal that the young wolf is hungry. In response, the adult spits up some food. Yuck! That may sound disgusting to you. To a hungry young wolf, it's a meal.

Wolves have another, famous way of communciating. They howl. Mech says that wolves howl to find each other when they get separated. They also howl to signal that it's time to hunt. In fact, the pack may gather for a big howling session before hunting. It's a lot like the pep rally before the big game!

© JEFF VANUGA/CORBIS (WOLVES RUNNING IN SNOW), NORBERT ROSING/NATIONAL GEOGRAPHIC IMAGE COLLECTION (GRAY WOLF PUP WITH ITS MOTHER)

Snack Time. *A wolf pup licks its mother's mouth to tell her it wants to eat.*

© ERWIN & PEGGY BAUER/ANIMALS ANIMALS - EARTH SCENES

Body Language. *For wolves, touching one another is a way of saying hello.*

Pack Attack!

For wolves, hunting is serious business. To stay healthy, an adult gray wolf needs to eat at least 2.2 kilograms (5 pounds) of meat a day. A wolf can eat more than 9 kilograms (20 pounds) at a time! Wolf packs tackle many types of prey. Their favorites are large **herbivores** such as elk and moose.

Rolf Peterson is an expert on the way wolves hunt. "The wolf's jaws are incredibly strong," Peterson says. "They help a wolf bring down and kill prey. A wolf's brain is important, too." Wolves choose their prey carefully before attacking. That's because prey animals can fight back. A moose, for example, has huge hooves and strong legs. One kick can kill a wolf.

To avoid injury, wolves try to pick the weakest animal to attack. How do wolves know an animal is weak? Scientists aren't sure. Maybe wolves use their eyes to see if an animal is limping or moving slowly. Believe it or not, a wolf might even use its nose to *smell* weakness in its prey.

"The nose of a wolf is very sensitive," says Peterson. "Some dogs can smell cancer in humans. Wolves may be able to smell disease in prey animals, too."

New Attitudes, New Hope

Chances are, you have never seen a wolf in the wild. This might soon change. In some parts of the United States, wolves are returning.

In 1973, the U.S. government signed the Endangered Species Act. This act made it illegal to harm endangered species, such as the wolf. It also gave some people hope that wolves might once again roam across the United States.

Why would people want wolves to come back? Some people's feelings about wolves have changed. Long ago, most people raised livestock. They had a reason to dislike wolves. Today, fewer Americans are ranchers. That means fewer people worry about wolves killing their livestock. People have learned more about wolf behavior, too. They know that wolves hardly ever attack humans today.

People also understand more about wolves' importance. In a single day, a pack may cover 80 kilometers (50 miles) while hunting. Wolves help keep an **ecosystem** in balance. They do it by killing deer, moose, and other plant-eating animals. Sometimes those creatures eat too many plants. That damages the ecosystem. Wolves help reduce the number of herbivores, making the wilderness healthier.

Family Ties. *A wolf pack usually has four to ten family members.*

© RONALD S. PHILLIPS/ALASKASTOCK.COM

Big Meal. *Working together in a pack, wolves can kill large animals, such as this elk.*

The Pack Is Back

The Endangered Species Act of 1973 helped wolves begin their comeback. Wolf numbers in Minnesota grew. Soon wolf packs roamed across Michigan and Wisconsin, too. Biologists helped wolves return to other areas. In 1995 and 1996, scientists released 66 wild wolves in Yellowstone National Park and nearby areas.

Yet the return of the wolves also meant a return to conflicts. Many ranchers fought against the idea. Why? Well, the ranchers worried that wolves would hurt their livestock. So to help ranchers, wildlife groups agreed to pay for any livestock killed by wolves.

Here to Stay

By 2008, about 1,500 gray wolves lived in and around Yellowstone. Some people think they are even ready to come off the Endangered Species list in that area. Other groups disagree and are working to keep wolves protected.

With their numbers growing, wolves are here to stay. Gray wolf numbers in the United States are rising by about 25 percent a year. As new packs form, wolves enter new areas. So keep your eyes open. On a walk in the woods, you may catch a glimpse of gray fur. You may hear a distant howl. If you do, howl back. It's the social thing to do.

Wordwise

ecosystem: community of plants and animals that depend on the same environment

endangered: at risk of dying out

herbivore: animal that eats only plants

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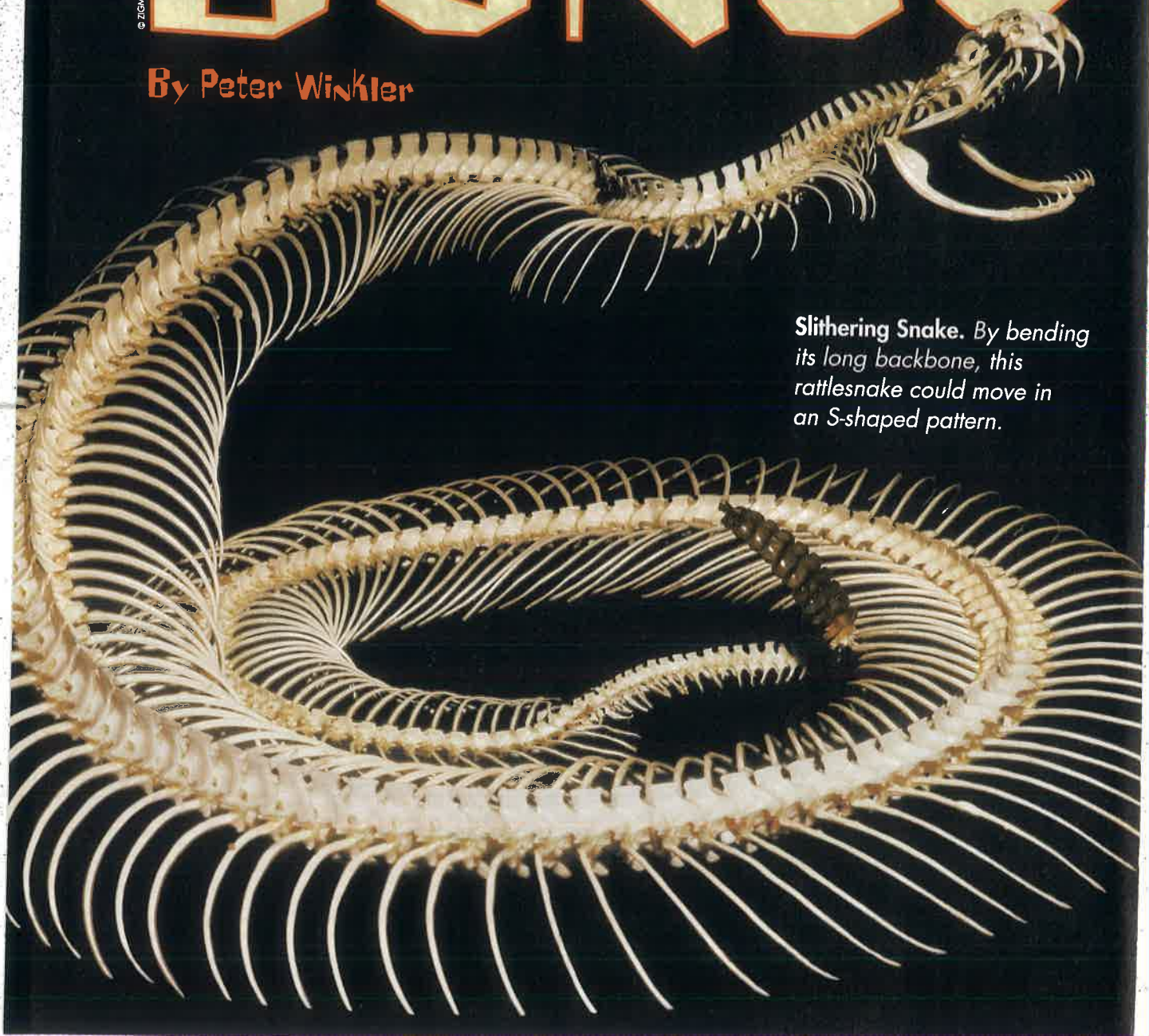
LIFE SCIENCE

Reading Strategy: Think of what you already know about bones and skeletons. Keep that in mind as you read the story.

Bare Bones

By Peter Winkler



Slithering Snake. *By bending its long backbone, this rattlesnake could move in an S-shaped pattern.*

A huge wave slammed into me. When I tried to swim, pain tore through my left arm. I knew something was wrong. One ambulance ride and many x-rays later, I learned that I'd broken a bone.

Suddenly, I was forced to think about something I usually ignored. My skeleton. It was hard to do even the simplest things. I could barely write, or eat, or even brush my teeth. I started to really appreciate my bones! Since breaking my arm, I've learned some important lessons about skeletons.

Making Things Move

When I broke my arm, I had to struggle just to write my name. My writing looked as though I'd flunked first grade! With a broken bone, my arm couldn't move the right way. That taught me *Lesson #1: Bones help bodies move.*

Since that time, I've discovered that bones help animals move in different ways. Whether they're flying, jumping, swimming, twisting or turning, skeletons keep animals moving.

Ever wish you could fly? Bones are the secret to flight. And bats are some of nature's most interesting fliers.

Bat Bones

I've always envied bats. They can fly. How come they can do what I can only dream about?

The answer lies in a bat's skeleton. For starters, a bat's bones are very thin and very light, like those of a bird. That allows them to take off and stay up in the air.

A bat also has amazingly long fingers. Some are almost as long as the bat's arms. Thin sheets of skin stretch between the fingers. They form the bat's wings. Bats also have big collarbones and shoulder blades. They support the large, mighty muscles that flap the bat's wings.

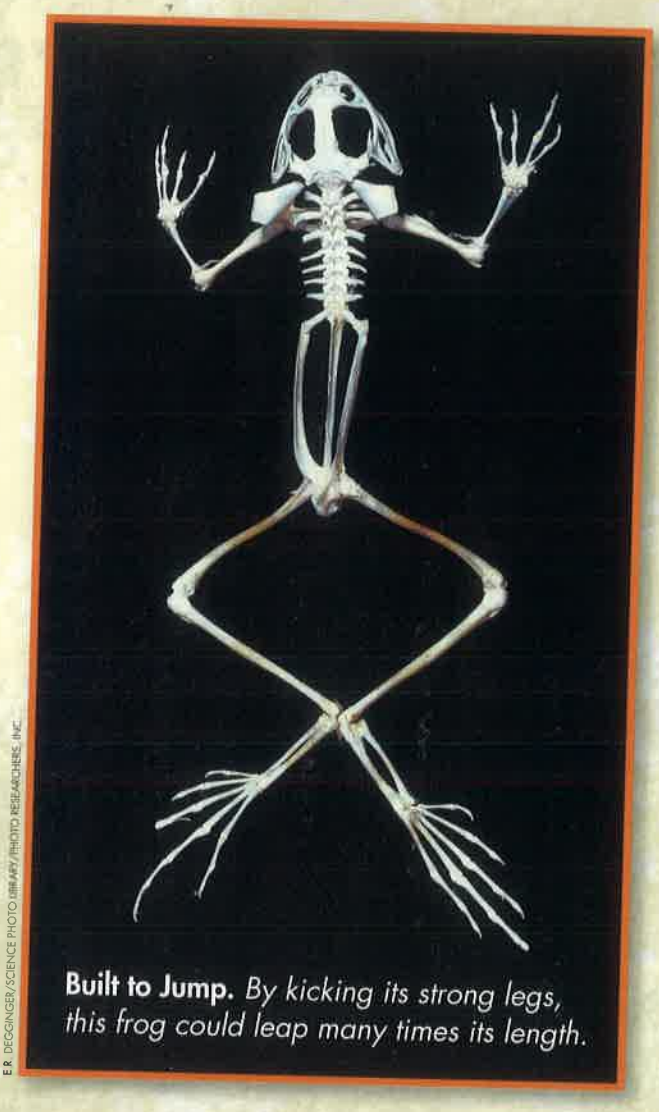
Got Wings? *A bat's arm and finger bones help support its wings.*

Leaping Legs

Now that I think about it, frogs make me kind of jealous, too. Not the eating-bugs thing, but their jumping skills. An ordinary bullfrog can jump ten times its body length!

What's a frog's secret? Its leg bones are really long compared to the rest of the animal's body. They give the frog the power for long leaps. To jump, the frog kicks its legs away from its body. Then it soars through the air.

Interestingly enough, another part of a frog's skeleton is unusually short. That's the spine. The spine is the line of bones along an animal's back. Besides being short, a frog's spine is very stiff. It barely moves at all. This short, stiff spine absorbs the shock when a frog lands back on the ground after a jump.



E.R. DEGGINGER/SCIENCE PHOTO LIBRARY/PHOTO RESEARCHERS, INC.

Built to Jump. *By kicking its strong legs, this frog could leap many times its length.*

Strong Swimmer

Like frogs, fish use their skeletons to move. A fish's skeleton differs from a frog's in key ways. Unlike a frog, a fish has a long spine. It runs almost the length of the fish's body. Many small bones, called vertebrae, make up the spine.

The difference doesn't end there, though. The frog's vertebrae are tightly connected. Not the fish's. Its vertebrae are only loosely connected. That allows the spine to move easily.

Good thing, because moving its spine is the main way a fish gets around. All it has to do is move its spine from side to side. That causes the tail fin to flap, pushing the fish forward through the water.

A fish's flexible spine helps it another way, too. You see, water doesn't sit still. It moves, sometimes very fast. Being able to bend its spine helps a fish survive in moving water.

Protective Parts

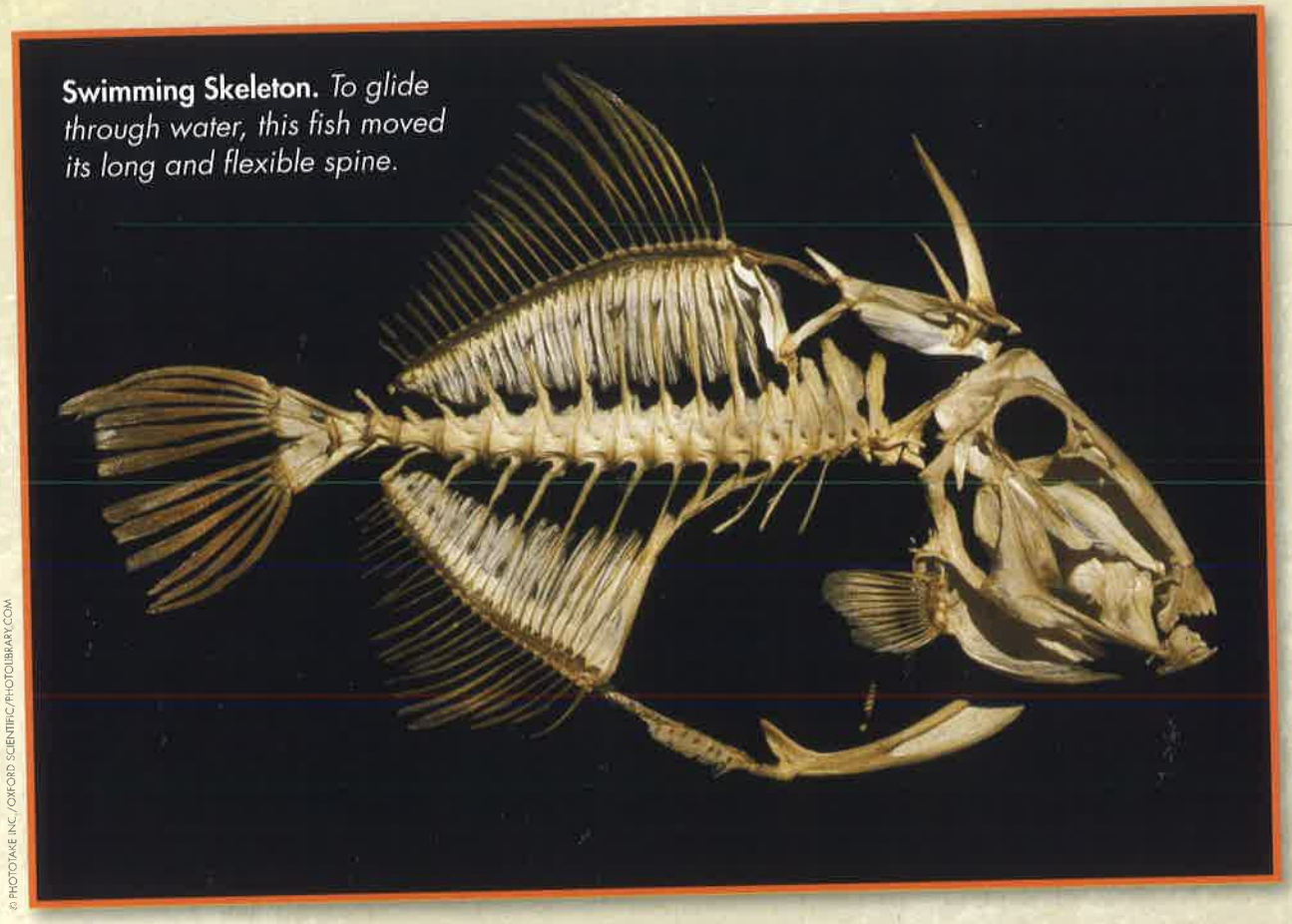
While I learned *Lesson #1* firsthand, I learned about bones' other important job by reading about skeletons. *Lesson #2: Some bones protect key parts of the body.*

Check out the lemur's skeleton at the bottom of the next page. Notice the big, white skull. That bony case protects the lemur's brain. Think of all the things the brain does! No wonder the skull is thick and strong.

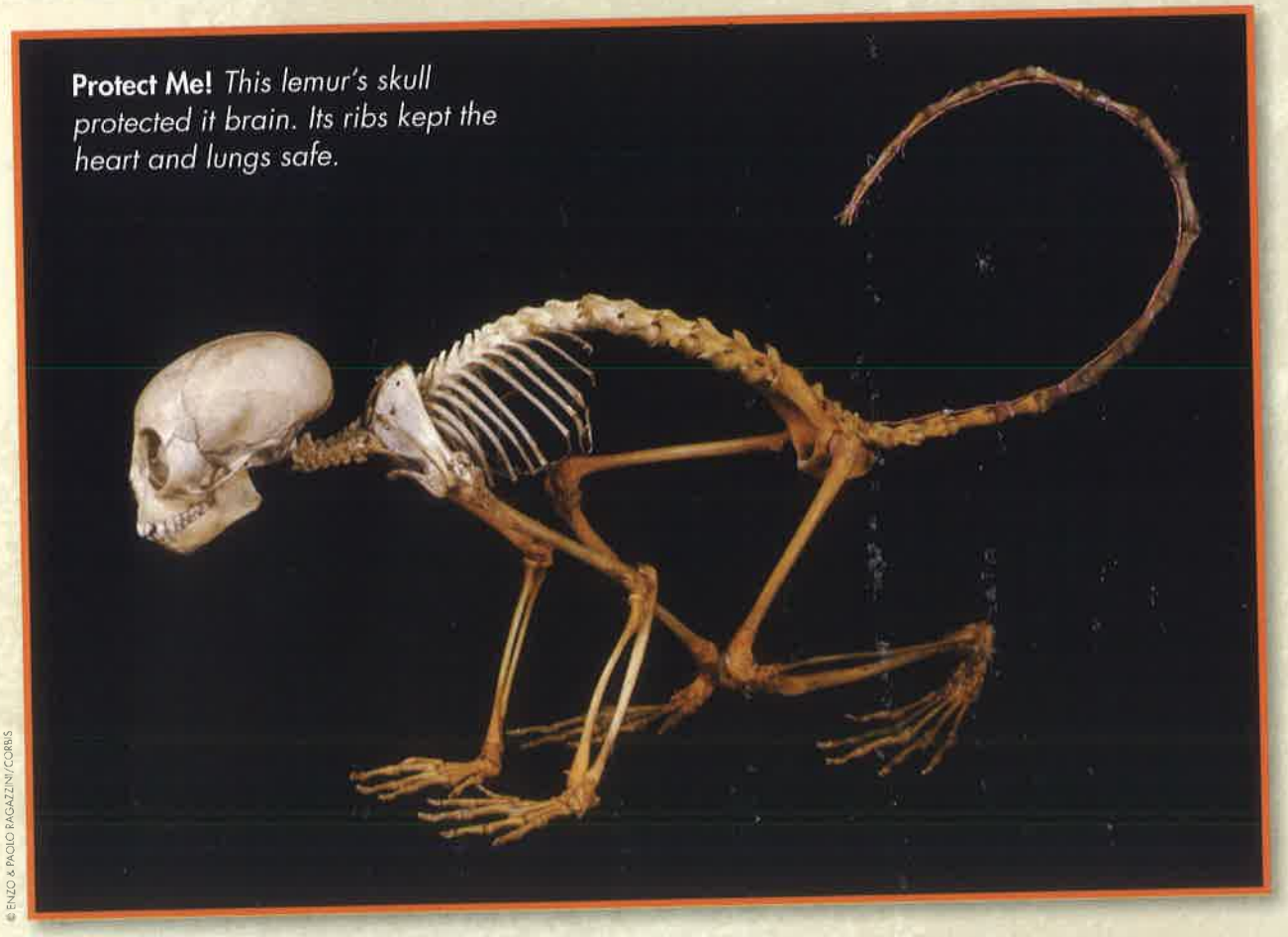
Now look at the thin bones sticking out from its sides. They make up the rib cage. It wraps around the lemur's heart and lungs, keeping them safe.

The cool thing about the ribs is that they can move. You see, the heart and lungs keep filling up and emptying out. When they fill up, they get bigger. When they empty out, they get smaller. If the ribs didn't move, the heart and lungs couldn't do that. So muscles push the ribs out and pull them back in as needed.

I can't fly like a bat, but I relate to the lemur. I have my own sturdy skeleton to protect me. You do, too. So don't wait to get hurt to learn *Lesson #3: Don't take your bones for granted.*



Swimming Skeleton. *To glide through water, this fish moved its long and flexible spine.*

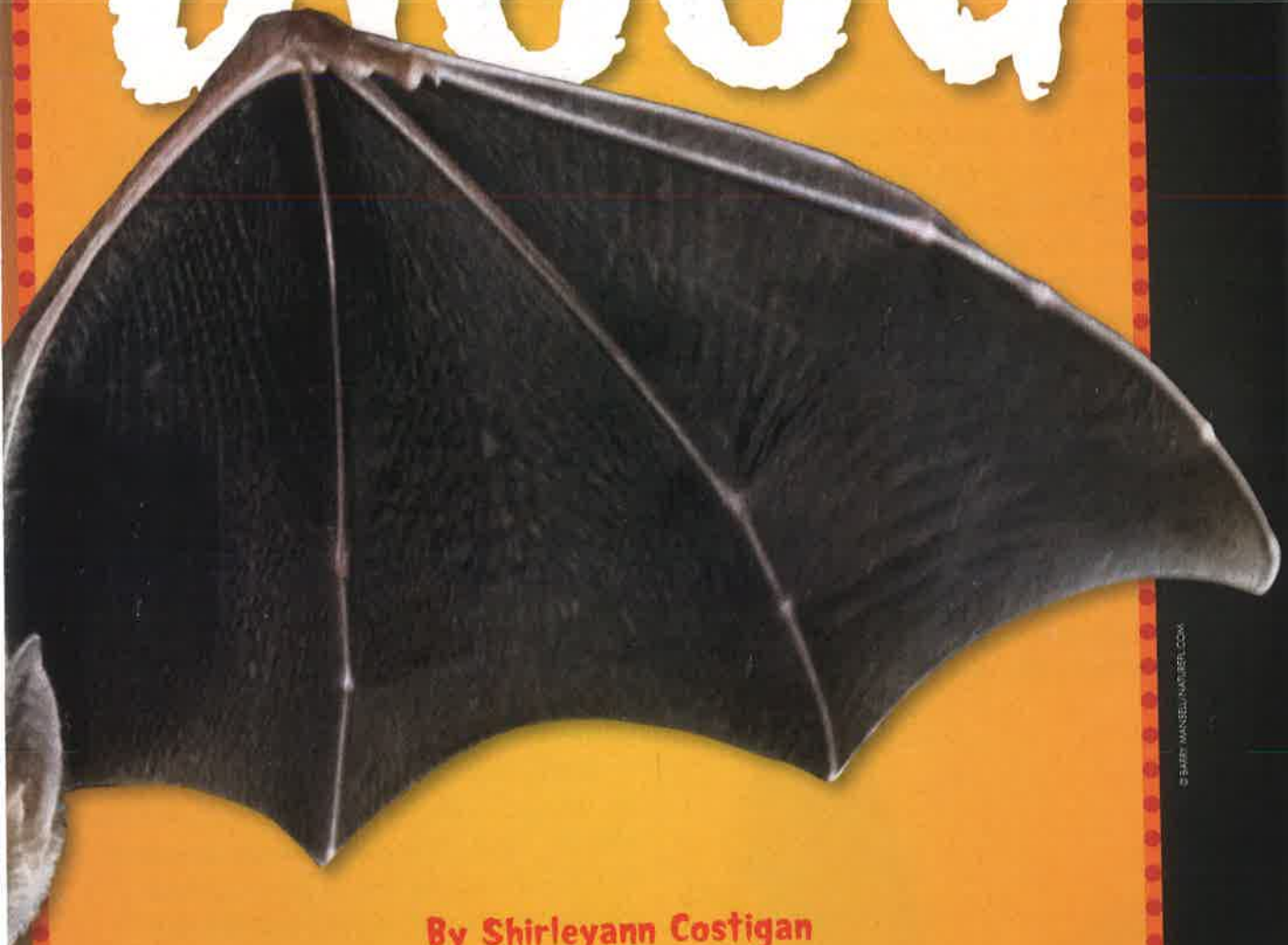


Protect Me! *This lemur's skull protected it brain. Its ribs kept the heart and lungs safe.*

Reading Strategy: As you read, compare and contrast the ways in which animals feed on blood.

Thirsty Creatures. *This vampire bat is just one of the animals that survive by feeding on blood.*

Out for Blood



By Shirleyann Costigan

The sun is setting over a farm near a tropical rain forest. The cows and horses begin to doze. Hundreds of tiny bats fly out of their caves.

The bats hear the sound of the animals quietly breathing. They focus in on their prey. These are vampire bats—and they are out for blood.