

CHAPTER

32



Wildlife

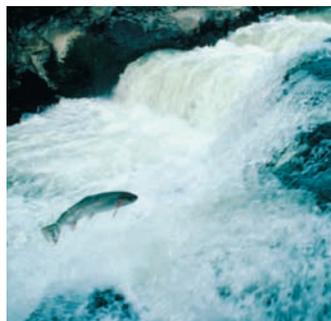
“Knowing the names that humans have given to other creatures or things is far from the most important lesson you will teach.”

—Rachel Carson (1907–1964), American ecologist and writer



A cocoon warming in the sunlight slowly breaks open, and a majestic butterfly emerges, greatly changed from the caterpillar it once was. A salmon hurls itself against a thundering cascade, fighting upstream to lay its eggs. Bats swirling from the mouth of a cave find their evening meal of flying insects by carefully monitoring the echoes of their high-frequency clicks. A bullfrog watching a newly hatched butterfly dry its wings flicks out its sticky tongue, and the butterfly is no more.

The world’s animals are profound in their complexity, astonishing in their variety, and fascinating in their activities and habits. Wildlife thrive almost everywhere—from the depths of the sea to the highest mountain ranges, from the driest deserts to the wettest rain forests, from a city park near your home to the wilderness areas of national forests and parks. By gaining an understanding about animals, you can begin to see how species interact with one another within their ecosystems.



Salmon swimming upstream

No matter what habitat is home—desert, alpine, forest, prairie, aquatic—every animal needs food, water, shelter, and space. Changes in the combination of an ecosystem’s basic resources (and changes are constant) affect all species and their abilities to thrive.

"We and the beasts are kin."

—Ernest Thompson Seton,
author, wildlife illustrator,
and the BSA's first Chief Scout



A badger and a mountain lion settle a territory dispute.

Adaptations

Exploring what an animal eats—and what might eat it—is a good starting point for discovering a species' particular traits. An animal's diet and efforts to keep from becoming part of another creature's diet can influence everything from its color and shape to its body covering, ways of perceiving the world, and manner of enduring winter.

Herbivores eat vegetation. Bison and elk are herbivores with mouths adapted for grazing and four stomachs for digesting grasses. Worms, caterpillars, grasshoppers, and thousands of other insects devour the leaves of trees and shrubs. Hummingbirds, nuthatches, and many other birds feed exclusively on plants.

Carnivores eat other animals. They might have talons, claws, or fangs shaped for capturing and tearing apart their prey. Many spiders build elaborate webs to capture insects, and many insects feast on other insects.

Omnivores eat both vegetables and animal matter. For example, grizzly bears dine on berries but also eat grubs, small animals, salmon, and the carcasses of larger beasts. Humans are omnivores, though some people choose to follow a vegetarian diet.

Color and Shape

An animal's adaptation of color or body shape can be surprisingly obvious—once you are aware of it. For example, the walking stick is an insect whose body mimics the surrounding twigs, camouflaging its approach upon tiny insects that become its food. Likewise, the walking stick's natural disguise keeps it hidden from most birds that would feed upon it.

Many fish have dark backs and pale bellies, which naturally blend from above with dark lake or pond waters and from below with the bright sky, so no matter what a predator's position, it will have a tough time seeing the fish in water. A deer's tawny shades allow it to blend into the

underbrush, and a fawn's spots enhance its natural camouflage. Some lizards and tree frogs gradually shift color to match their surroundings. The ptarmigan is a grouselike mountain bird whose brown summer plumage begins to turn white with the first snow. Also white in the winter, the snowshoe hare's fur takes on the tundra's earthy hues when summer rolls around.

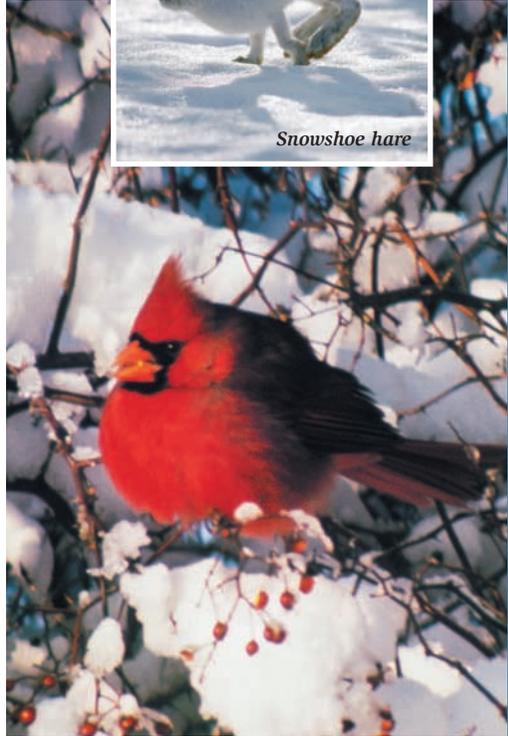
Not all animals blend with their backgrounds, however. Many birds display brilliant plumage, and some insects are very colorful. The bright red, yellow, and black bands of the poisonous coral snake serve as a warning to the curious.

Body Covering

Some animals' bodies have adapted to physically protect them from predators. A turtle cannot easily flee danger, but it can draw itself into the protection of its shell. A porcupine does not move quickly, but its quills will discourage all but the most persistent predators. An armadillo can curl into a ball, hiding its soft underbelly and presenting an attacker with nothing but bony armor plate.

Body covering also can help protect animals from the elements. Mammals' fur, for example, provides insulation against the cold. Waterfowl are covered with warming layers of down and outer feathers rich with natural oils that shed moisture so the birds stay dry. Scales on snakes' underbellies allow them the traction they need for motion, and the sleek hides of beavers, seals, and other aquatic mammals help them slip smoothly through the water.

To realize the degree to which animals have adapted to their environments, think of an animal outside its natural role. For example, imagine a hummingbird diving out of the sky to snatch a fish in its claws and lift it to a nest on a distant cliff. Now imagine the impossibility of a bald eagle hovering motionless above a field of flowers, sipping nectar from the throat of a blossom.



Cardinal

Perceiving the World

Animals use a variety of strategies to gather information about their surroundings. Humans use combinations of five senses—sight, sound, touch, smell, and taste. Other species use those senses and a range of others not available to humans.

Seeing

Some animals see extremely well, while others are nearly blind. A soaring hawk notices the slight movement of a ground squirrel far below, and a falcon diving on a smaller bird can identify its prey at a glance and gauge its altitude and speed.

Most animals see the world in shades of black rather than in color, which is why game animals like deer and elk do not notice hunters' fluorescent orange hats and vests. Many insects have compound eyes that gather data from a wide arc of vision. Animals with eyes on the sides of their heads can find it difficult to focus both eyes on a single object and might not be able to judge distances well. Moles and bats are blind, at least in the conventional sense of the word, forcing them to rely on organs other than their eyes.

Smelling

Some animals, like wolves, coyotes, bears, sharks, and snakes, have a very keen sense of smell. A faint scent in the breeze or water is all it takes to alert them to danger or lead them to carrion and other food sources.

Sharks' sense of smell does not work like mammals' noses, but they can perceive the presence of blood in the water from great distances. Similarly, many insects can detect odors through specialized organs in their antennae and bodies.



A snake's tongue ranks among the most remarkable sense organs of the animal world. Flicking out in search of predators and prey, a snake's forked tongue delivers particles of air, soil, and water to the roof of its mouth, where a specialized organ called the *Jacobson's organ* interprets the particles much like the human sense of smell.

Hearing

Many animals such as rabbits and owls have ears that are large in proportion to their body size, which can help them pinpoint the sources of faint sounds that give them an early warning of danger or help them locate prey.

Humans can be so accustomed to city noises that the silences of the outdoors can be startling. Listen carefully, though, and you might hear the songs of birds, the splash of water, and the rustle of leaves in the wind. Unique sounds like the snort of a deer, the rhythmic beat of a woodpecker,

or the slap of a beaver's tail may help you locate and identify wildlife you might not have noticed otherwise.

Touching

Whiskers, tongues, feelers, antennae, toes—animals rely on all manner of body parts to touch the world around them. Fish have a sensory organ along a lateral line of nerves and pores on their sides that picks up small vibrations in the water and alerts them to changes in their surroundings. When you walk along a stream bank, fish might dart away even if they can't see you; their lateral lines alert them to the weight of your footsteps upon the ground.

Surviving Winter

Perhaps the most profound changes in an ecosystem are driven by Earth's tilt and orbit as it makes its annual trip around the sun. Each season of the year offers wildlife challenges and opportunities, but for many species a central focus of survival is preparing for, and then living through, winter.

Some animals remain active year-round, foraging and hunting despite cold, snow, and shortages of browse and prey. Bison use their large heads to push away snow to reach frozen grasses. Foxes stalk hares and birds that increase their chances of winter survival by turning white when the first snows cover the ground.

Another strategy for winter survival is stockpiling food. Squirrels spend much of summer and autumn hiding nuts in tree hollows or burying them in the ground in hopes of finding them later. Honeybees build up surpluses of comb honey. Ants gather grass and leaf clippings. Bears and chipmunks preparing to hibernate eat voraciously through the summer to add fat to their bodies before they bed down in their dens and burrows. By the time they awaken in the spring, they might have lost up to a third of their body weight.

Mammals are not the only animals that hibernate. As a pond's water temperature drops in the autumn, frogs burrow into the mud beneath the water. Buried deep enough to be safe from freezing, their bodies undergo complex physiological changes that slow their metabolism, circulation, and other processes until they are expending just enough energy to stay alive. Frogs pass the winter in deep slumber, emerging from the mud only when the temperatures of spring have risen enough for them to again thrive in the water and on land.

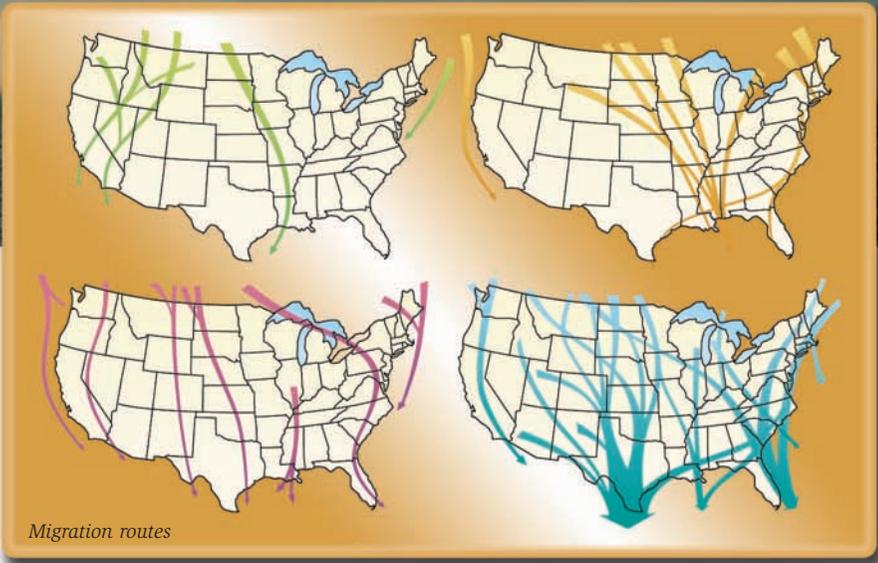


Even with its natural camouflage, the hare might soon become dinner for the fox.

Chipmunk



Canada geese



Migration routes

Migration

An ecosystem is habitable for a species only while conditions remain within certain bounds. In the winter, many animals cannot endure the cold and snow of alpine meadows. However, as the drifts melt and plants make the most of the short growing season, deer, elk, mountain goats, and bighorn sheep in search of good grazing will move up from the shelter of the forests. With them come the predators that feed upon them—mountain lions, cougars, bobcats, and others. Vultures, ravens, magpies, and other scavengers drift higher, too, waiting to pick at the remains of the carnivores' meals.

Some animals migrate tremendous distances. Ducks and geese wing their way from summer breeding grounds in Canada and Alaska to winter havens in the southern United States, Mexico, and South America. Monarch butterflies migrate, too, as do whales, bluefish, and salmon, which swim from the ocean back to the streams where they were hatched to lay and fertilize their own eggs.

- Seabirds, gulls, and terns
- Shore and wading birds
- Waterfowl
- Land birds and birds of prey

Animal Classification

Every species has traits that set it apart from all other animals. Each species also shares characteristics in common with certain others. Zoologists and biologists use those similarities and differences to organize animals into a classification system. All creatures, for example, can be divided into one of two large groups—*vertebrates*, which have backbones, and *invertebrates*, which do not. Mammals, birds, reptiles, amphibians, and fish are vertebrates. The other 95 percent of the planet’s creatures, including worms, spiders, insects, and crabs, are invertebrates.

As the classification process continues, vertebrates and invertebrates are sorted into increasingly specific groups until only one kind of animal—one *species*—fits a description. The American black bear, for example, is classified this way:

Kingdom—*Animal*. There are five kingdoms: animals, plants, fungi, protists, and monerans.

Phylum—*Chordata*, which includes all animals with backbones

Class—*Mammalia*, which includes all mammals

Order—*Carnivora*, which includes carnivorous mammals

Family—*Ursidae*, which includes all bears

Genus and Species—*Ursus americanus*, which includes only American black bears

By comparison, grizzly bears share so many similarities with American black bears that they are members of the same kingdom, phylum, class, order, family, and genus. The grizzly bear’s classification is *Ursus arctos horribilis*, differentiating it from every other creature on Earth.

An animal’s genus is always capitalized; the species is not. Together, genus and species are shown in *italics*.



American black bear, *Ursus americanus*



Grizzly bear, *Ursus arctos horribilis*



Elk

A Sampling of North American Animals

Mammals

What do a field mouse and a grizzly bear have in common? For one thing, they are both *mammals*—warm-blooded animals that have backbones, fur or hair, and mammary glands for feeding their young. More than 400 species of mammals are found in North America, many of them sharing the same landscapes where humans hike and camp.

Watch mammals closely to figure out what they are eating, how they find shelter, and the ways they defend themselves. A chipmunk, for instance, scurries among the grasses in search of nuts and seeds. When startled, it relies on speed to carry it to a safe hiding place.

Rabbits also use bursts of speed to escape predators. Powered by muscular hind legs, they scamper from danger in a zigzag course that larger animals cannot easily follow. Rabbits and mice use their smaller front legs to hold the grasses on which they feed.

Squirrels' long tails provide balance as they run along branches, and their claws allow them to grip tree bark. Like chipmunks, they can fill their cheeks with nuts and grains to stash in trees or in the ground, returning to these caches when other sources of food are scarce.

The opossum does not share the rabbit's speed. Instead of fleeing when threatened, it lies limp and still until danger has passed. Close relatives of Australia's kangaroos, opossums are *marsupials*—pouched mammals. A mother opossum carries her newborns in a pouch formed by a fold of skin on her abdomen.

Dolphin

When crowded too closely, the porcupine slaps its tail to drive quills into an attacker's flesh. Skunks can spray an attacker with a chemical that stings the eyes and leaves a foul, long-lasting odor. Omnivorous skunks, close relatives of weasels, feed on insects, reptiles, eggs, and small rodents.

As you hike along a stream, you might notice the stumps of trees cut by beavers. They eat the bark of smaller branches and use some of the wood for constructing and improving their dams. The pond formed behind a dam gives beavers quiet water that is deep enough for swimming and feeding. They build dome-shaped lodges from sticks and mud. Although a beaver's teeth are worn down by chewing through tree trunks, they continue to grow throughout the beaver's life.

Ponds also are home to muskrats, which use sticks to build lodges just as beavers do. The entrances are beneath the water so that the animals can slip in and out unseen, while the interior room is above water level.

Otters dig burrows in the banks of lakes and streams. Strong, sleek swimmers, they prey on fish. You may come upon an "otter slide" where otters have been tobogganing on their bellies down stream banks and into the water. Otters once were found throughout much of America, but they were hunted and trapped so aggressively for their fur that today they are rarely seen.



Beaver dam

Beaver dams often are important to an area's natural succession. Slowed by a beaver's dam, a stream will drop its silt. The beaver pond eventually fills with silt and dries, becoming land where grasses and trees can take root.

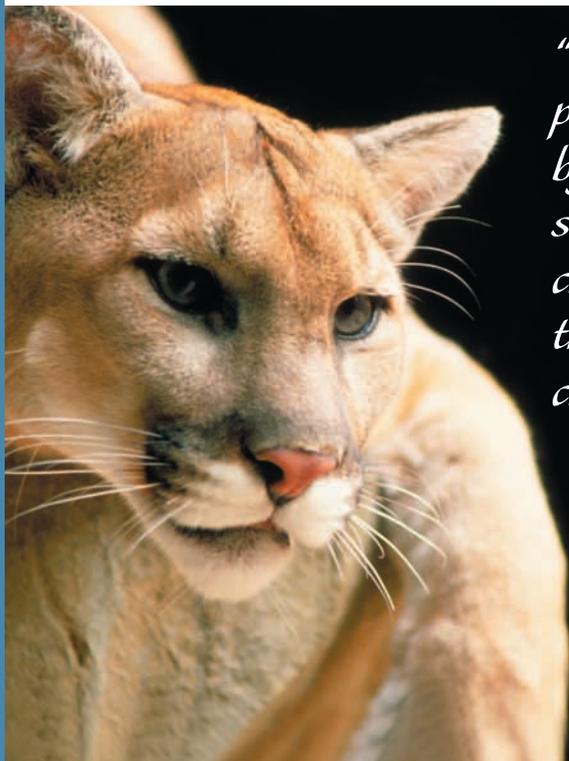
In the damp soil along a stream, tracks that look like small hands with five long fingers are the marks of a raccoon. Usually traveling at night, raccoons come to the water to feast on frogs and crayfish. Raccoons also are expert climbers, and many live in hollow trees.

Bears have a varied diet that includes berries, grubs, fish, and small animals. Black bears are good tree climbers and can be found in much of North America, weighing as much as 500 pounds. Despite their name, black bears range in color from black to light brown.

Grizzly bears grow to be much larger than black bears and require more territory in which to roam. They once ranged throughout the western United States, but the development of farms, ranches, and cities has led to severe reductions in grizzly bear populations. Most grizzlies now are concentrated in Canada, Alaska, and an ecosystem that stretches from the Grand Tetons north through Yellowstone and Glacier national parks.

Wolves have highly developed social structures and cooperative hunting strategies that can involve up to a dozen members of a pack. Feeding on small animals and on old and sickened deer, elk, and caribou, wolves help keep animal populations in check. Although wolves have been vital members of numerous food chains, they have been driven almost to extinction in much of the nation. Today many land managers are working to return wolf populations to some of our national parks.

Bobcats, mountain lions, and cougars also have suffered from humans' actions. Each must have plenty of open space in which to thrive, and each can be a tempting target for hunters. Their disappearance from America's forests is a reminder that the ways we choose to conduct ourselves in the outdoors can have a dramatic impact upon entire species.



"We're not just afraid of predators, we're transfixed by them, prone to weave stories and fables and chatter endlessly about them, because fascination creates preparedness, and preparedness, survival. In a deeply tribal sense, we love our monsters."

—E. O. Wilson, Eagle Scout, entomologist, and Pulitzer Prize-winning author

Deer live in almost every part of North America. As their names suggest, white-tailed deer can be identified by their distinctive coloration. The larger mule deer, a native of the Rocky Mountain foothills, has a white tail tipped with black and has longer ears.

Moose are the largest members of the deer family. They range through the northern forests of the United States and far into Canada. Like all deer, a moose is a *ruminant*—an animal with four stomachs for digesting grasses, leaves, and twigs.

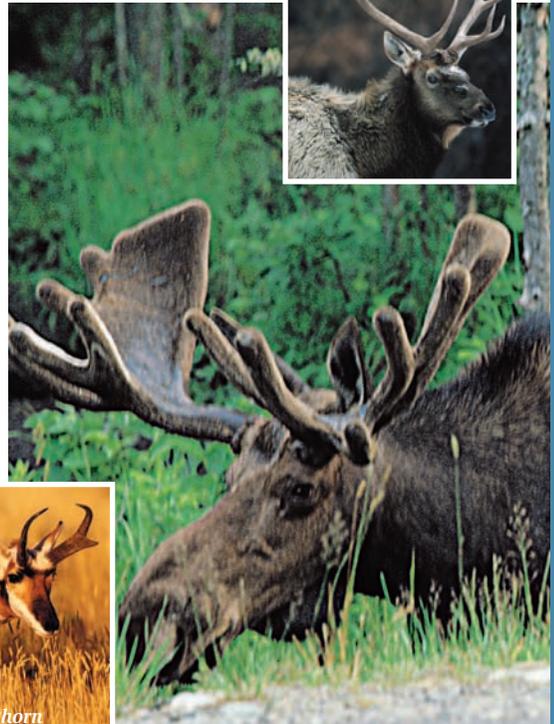
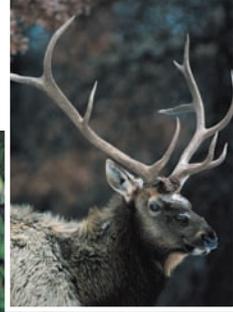
Wapiti is an Indian name for the American elk, another large deer that makes its home mostly in the western United States. Like other members of the deer family, male elk grow antlers each year, shedding them in the autumn after the mating season.

Caribou, found in Alaska and northern Canada, are unusual deer in that both females and males grow antlers. In herds as large as several thousand, caribou migrate long distances to find food. Caribou calves are able to run soon after they are born, which helps them keep up with the herd and evade predators during migration.

Although deer can kick with their sharp hooves, most flee their enemies rather than trying to fight. Pronghorn antelope are the fastest land animals of North America, able to reach speeds of more than 60 miles an hour.

Mountain goats and bighorn sheep are surefooted enough to scale steep mountain cliffs, while American bison can be seen grazing on the lower grasslands.

Elk

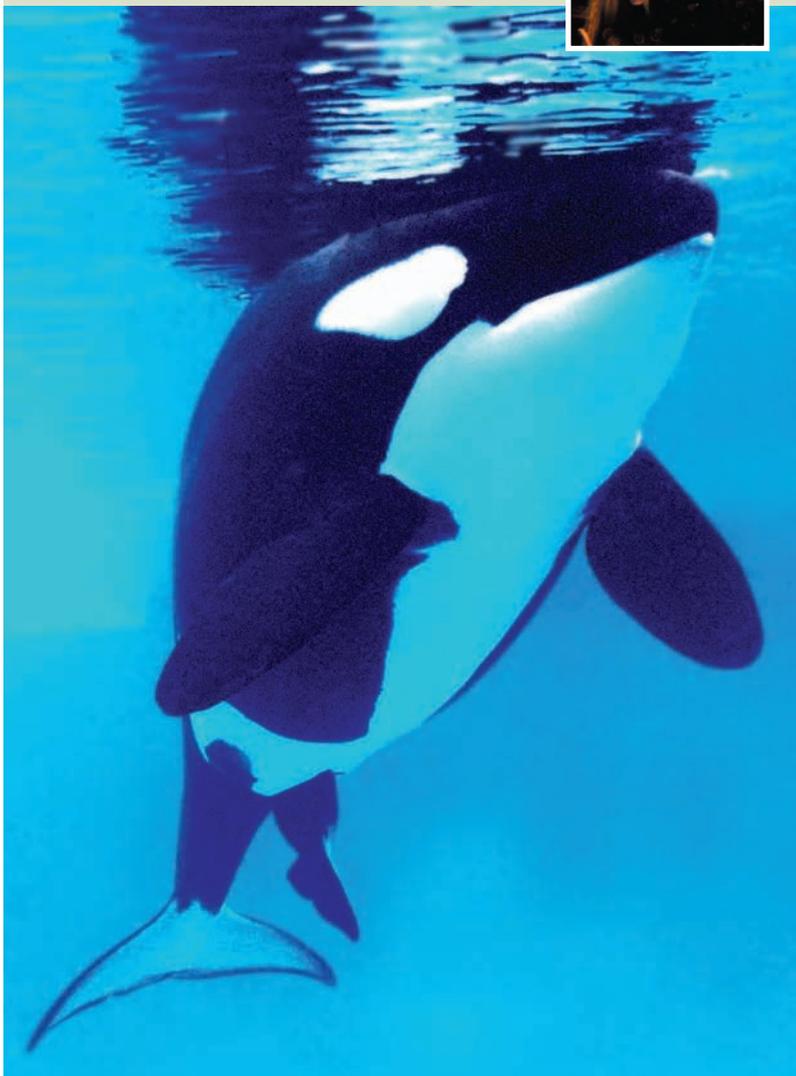
Pronghorn
antelope

Moose

Mountain goat

Plankton—masses of tiny organisms drifting in the water—serves as food for small sea life and also for some whale species, the largest animals on Earth. Whales strain water through their mouths, trapping food in bristled screens called *baleen*.

Plankton



Captive killer whale giving birth

Although they spend their lives in seawater, whales are mammals, not fish. They are warm-blooded and breathe with lungs rather than through gills, coming to the ocean's surface to inhale fresh air. Instead of laying eggs as fish do, whales bear their young alive and nurse them with milk.

Reptiles

Reptiles such as snakes, lizards, alligators, and turtles have backbones like mammals do, but they are cold-blooded and do not have fur. Their bodies are covered with scales or plates, and they reproduce by laying eggs. More than 300 species of reptiles are found in the United States.



Iguana

Reptiles and people have had a stormy history. Humans often look more kindly upon furry and feathered animals than they do upon cold-blooded, scaly creatures. Despite their appearances, reptiles play important roles as both predators and prey in their ecosystems.

The secret to a snake's forward motion is *lateral undulation*—the way it makes S-shaped bends with its body and then pushes against the ground. Snakes prefer to use their mobility to get away from a potential threat rather than confront it.

Rattlesnakes, copperheads, and cottonmouths are all pit vipers—snakes that have a distinctive pit beneath each eye that locates prey by detecting small differences in the temperatures of warm-blooded animals and their surroundings.

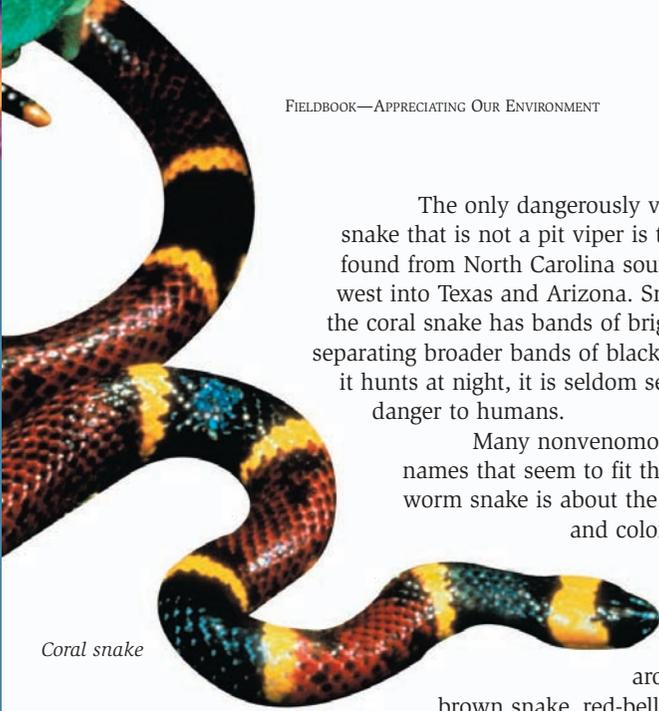
Perhaps the best known of venomous snakes, the rattlesnake has a tail equipped with dry rattles that sound a warning. Rattlesnakes live throughout much of the continental United States, Mexico, and some parts of Canada.

The copperhead snake can be found in woodlands and rocky outcroppings in the eastern half of the nation. You can recognize it by its copper-brown color with darker, hourglass-shaped cross bands.

The cottonmouth, also known as the water moccasin, lives in streams and marshes of southern states. A chunky, muddy-brown snake, it sometimes rests in tree branches that hang low over the water. Its name comes from the cotton-white color of the inside of its mouth.



Sidewinder

*Coral snake*

The only dangerously venomous American snake that is not a pit viper is the coral snake, found from North Carolina south to Florida, and west into Texas and Arizona. Small and slender, the coral snake has bands of bright yellow scales separating broader bands of black and red. Because it hunts at night, it is seldom seen and rarely a danger to humans.

Many nonvenomous snakes have names that seem to fit their appearance. The worm snake is about the same size, shape, and color as an earthworm.

The ring-necked snake is black to steel gray, with a light-colored ring around its neck. The

brown snake, red-bellied snake, and green snake take their names from their colors. The hognose snake, or puff adder, is named both for the shape of its head and for its habit of puffing itself up when frightened. Like all snakes, their jaws are hinged so that they can swallow prey larger than their heads.

Among the larger American snakes, the king snake eats rats, mice, and other snakes. The common king snake is black with white or yellow bands, while the bright red, yellow, and black bands of the scarlet king snake make it look much like the venomous coral snake.

The black racer of the eastern states has a smooth, black back. The coach whip snake of the South and the striped whip snake of the West are the racer's close relatives.

Bull snakes are one of the largest nonvenomous snakes in the United States. They are grayish brown with large patches on their backs. An eastern variety is often referred to as the pine snake, and a western form is called the gopher snake.

For guidelines on treating a snakebite, see the chapter titled "Managing Risk."

Lizards share many similarities with snakes, but they differ by having legs, moveable eyelids, and small ear openings on their heads. Many lizards make their homes in arid regions. The thick, rough skin of the horned lizard protects it from its enemies and helps it conserve moisture. Collared lizards and swifts are desert dwellers, whose speed and long, slender tails set them apart from their sluggish neighbor, the Gila monster. Covered with raised round scales that look like beadwork, the Gila monster is America's only venomous lizard.

*Gila monster*

A turtle's shell, composed of hard scales attached to a cage-like skeleton, encloses the animal's vital organs and protects its head, legs, and tail. Some turtles spend most of their lives on dry land, while others dwell in ponds, streams, and marshes. A few thrive in the open sea.

Turtles have no teeth, but the edges of their jaws are tough enough for them to feed on insects, snails, and small aquatic animals. The snapping turtle settles to the bottom of a pond and lies with its mouth open. A worm-like appendage on the floor of its mouth lures fish close enough for the turtle to catch them.

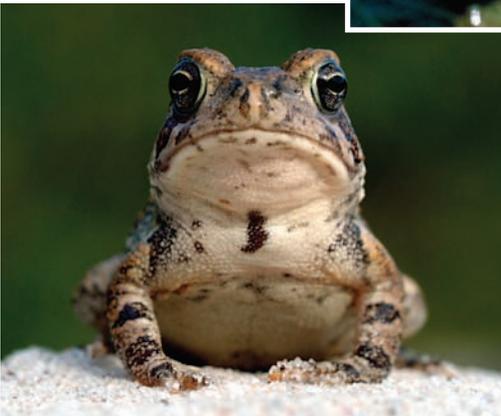
Amphibians

Frogs, toads, newts, and salamanders are all amphibians, and about 4,000 species of amphibians can be found worldwide. The name *amphibian* comes from two Greek words—*amphi*, meaning “both,” and *bios*, meaning “life.” After hatching from eggs laid in the water, most amphibians live in the water as *tadpoles*, swimming and eating a vegetarian diet. As they mature, they develop legs and begin spending some of their time on land where they feed on plant and animal matter. Frogs and toads lose their tadpole tails by the time they become adults, while salamanders keep theirs.

Frogs and toads look a lot alike, but frogs' skin is moist and smooth while toads' skin is bumpy and dry. Frogs and toads use their powerful hind legs to propel themselves over the land and through the water.



Frog



Toad

Toads are less mobile than frogs because of their shorter legs and heavier bodies, but as a defense, some toads can secrete a poison that irritates their predators' eyes and mouths.

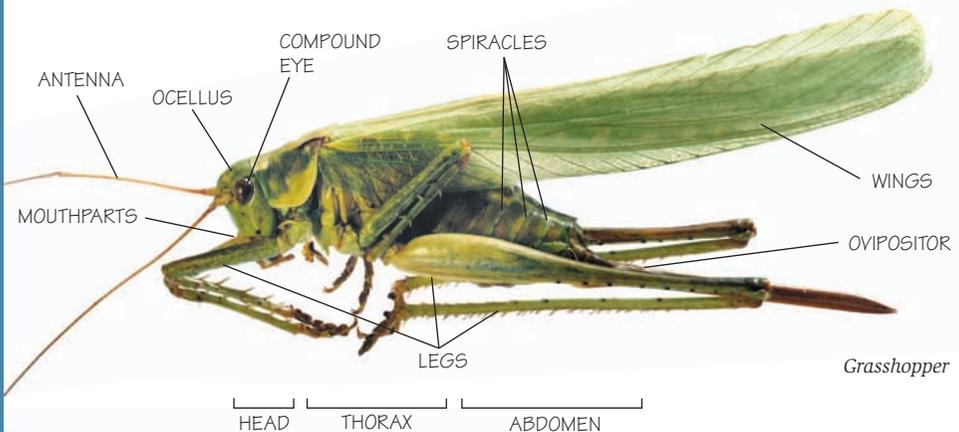


Bullfrog

The croaking you hear near a pond may be a bullfrog, the largest American frog. Seldom away from water, it eats insects, spiders, snails, and crayfish, and is the prey of snakes, birds, and many mammals.

Spring peepers and tree frogs have sticky pads on their toes that allow them to hang onto branches and leaves. Some tropical tree frogs lay their eggs in pockets of water in tree knots, and the tadpoles that hatch then mature high above the ground.

Adult salamanders live both in and out of water. While the bodies of salamanders and newts resemble that of a lizard, salamanders and newts have smooth, naked skin—not scales.



Grasshopper

Spiders are sometimes confused with insects, but they are arachnids—animals with eight legs and two body parts.

Insects

In terms of sheer numbers, insects rule the world. Five out of six animals are insects. Some insect species fly, some swim, and some scurry across the ground. They eat everything from leaves and flower nectar to blood, dead animals, and each other. Many display brilliant hues, while others are drab in color and are shaped like dried leaves or twigs. All insects have six legs and a body with three sections—head, abdomen, and thorax.



Tarantula

Butterflies and moths have four broad wings covered with scales so tiny they appear to be fine dust. At rest, butterflies tend to hold their wings upright, while moths keep theirs flat or curled around their bodies. Butterfly antennae are shaped like tiny clubs; those of moths look more like feathers.

Irregular color patterns on moths' and butterflies' wings can play tricks on their predators' eyes, making the insects harder to see. For example, wing spots that look like eyes might cause birds to perceive these insects as much larger animals that should be left alone.

Many species of ants, bees, and wasps live in nests or hives. As a community member, each insect carries out duties that help feed, defend, and maintain its home. Some ants look after tiny insects called *aphids*. When stroked on the back, the aphids produce a sweet liquid that the ants feed to their own larvae. Other ants are farmers, preparing soil in their nests and raising small fungi for food. Some species of wasps feed on insects. Bees collecting nectar for honey aid in plant fertilization by scattering pollen among the flower blossoms.

Forty percent of all insects are beetles. Ranging in size from the 1/4-inch-long snout beetle to the stag beetle which, with its great pincers, can be several inches long, beetles are distinguished from other insects by having two pairs of wings—a back pair used for flying and a protective front pair covering the abdomen.

The ladybug is a very beneficial beetle able to eat many times its own weight in other insects. Many other beetles are scavengers that devour dead plants and animals, helping to continue the energy cycle.

The firefly is one unusual beetle. A chemical reaction in an organ near its tail creates a glowing light, allowing it to flash signals into the darkness as part of the mating ritual.

Flies and mosquitoes each have just two wings. The mosquito has a long *proboscis* that can pierce a mammal's skin and draw blood. The fly's mouthparts are like a sponge made for lapping up liquids. Mosquitoes lay their eggs in still water, while



Polyphemus
moth



Stag beetle

*Grasshopper*

flies often leave their eggs in dead and decaying matter. While important to ecosystems, flies and mosquitoes can carry diseases harmful to humans.

Grasshoppers, crickets, and their relatives are among the musicians of the insect world. Grasshoppers click and whirl when they fly, and sometimes they make a raspy sound by stroking their wing covers with their hind legs. Male katydids rub their front wings together to produce a rhythmic buzzing. Cicadas do the same by vibrating a timbrel organ in their abdomens.



Cicada nymphs hatch from eggs laid in trees. The young insects burrow into the ground and suck sap from roots, staying buried for up to 17 years. When they do come back out they crawl up trees, shed their old shells, and emerge as full-grown adults ready to lay eggs and keep the cycle going.

Many people call all insects *bugs*, but true bugs form a definite group. Like a beetle, each bug has four wings, the front pair serving as a shell over the abdomen and flight wings. Where a beetle's shell halves form a straight line down its back, though, those of a bug fold into an X shape. All true bugs also have mouthparts made for sucking.

One member of the bug group is the spittlebug, the larvae of which hide in frothy spittle they hang on plant stalks. The water strider is a bug that hurries along the surface of the water, as do the back swimmer and the water boatman.

*Water strider**Elephant beetle*

Fish

Fossil evidence suggests that fish were thriving in Earth's oceans before animals with backbones walked on land. Fish have endured for so many eons because they are well-suited to their environment. With more than 30,000 kinds of fish alive today, they also are the most numerous vertebrates. You can find them in nearly every body of water except for very salty, alkaline waters such as that in Utah's Great Salt Lake, or in water that has become badly polluted.



Rather than lungs, fish have gills through which they absorb oxygen from the water. Inside the fish is an air-filled organ called a *swim bladder* that provides buoyancy. Fins help the fish stay upright, move forward, turn, and stop. The long, sleek shapes of many fish allow them to swim fast enough to catch their prey and to escape being devoured themselves.

A fish's many sense organs help it find food, escape predators, and locate mates. Most fish can see, smell, hear, taste, and feel, and they use sensory organs running the length of their bodies to pick up vibrations in the water.

Many fish rely on coloration for protection. Perch, bluegills, and other fish that live among underwater plants sport a camouflage of stripes. Catfish and other bottom-dwellers might be colored so much like a streambed that, when lying motionless, they seem almost to disappear.



Catfish

Catfish have mouths designed for vacuuming food from the bottoms of rivers and lakes, and long, whiskerlike organs on their faces for feeling their way through murky waters. Thin, sharp, flesh-tearing teeth allow muskellunge, pike, and barracuda to feed on other fish. Trout, crappie, and similar fish with a diet of insects can get along with less fearsome teeth.



Frigate birds on Johnson Island in the Pacific Ocean

Birds

Today there are more than 9,000 species of birds spanning nearly the entire globe. Birds are differentiated from other warm-blooded animals by the fact that they have feathers.

Contour feathers make up the visible plumage that gives a bird its shape. Down feathers next to the skin provide insulation to keep a bird warm.

All birds lay eggs, but the different species are as unique as those of any other animal class. Some birds swim, some spend their lives walking on land, and some rarely come down from the sky. Diets, reproductive strategies, and migratory habits also can help define bird species.

Birds that fly have thin, strong, lightweight bones. Their wing shapes help determine how they maneuver in the air. The hummingbird's small, short wings enable it to hover and move both backward and forward. Soaring birds have broader wings to catch updrafts so they can hang in the sky with little motion. With pointed wings, peregrine falcons are able to dive faster than a hundred miles an hour and maneuver quickly to attack airborne prey.

Small birds must eat often. Hummingbirds expend so much energy that they are engaged in feeding activities much of the day and might be so weakened after a night without nourishment that they need the help of the sun to warm them enough to fly. Larger birds can go longer between meals but still are almost constantly in search of food for themselves and their offspring.



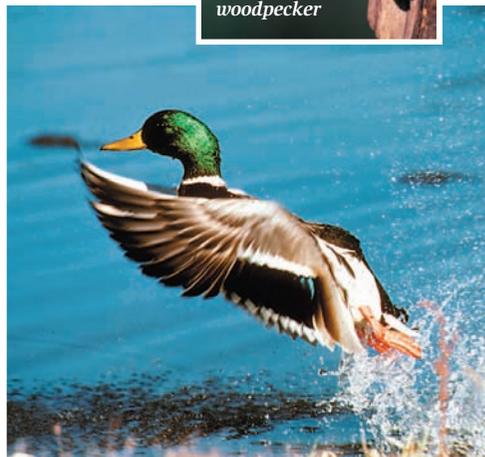
Bald eagle

The bills of birds offer clues as to their diets. Woodpeckers have beaks that can be used as chisels. Birds that eat seeds and nuts have short, thick beaks and powerful jaw muscles, while those eating grasses and water plants have wider bills adapted to foliage. Some shorebirds use their long, slender bills to probe the waters for small fish, and other fish-eating birds have sharp, hooked beaks.

The legs and feet of birds are other indicators of diets and mobility. Waterfowl have webbed feet that are perfect for swimming, and the talons of raptors are just right for grasping prey. Birds that perch tend to have long toes and short legs, while those that walk on the ground have both long legs and toes. Penguins and other cold-water birds have short legs and compact feet that are adapted for keeping them warm and helping to steer.



Acorn woodpecker



Mallard drake

Birds are not the first animals to have flown, nor are they the only flying creatures today. Paleontologists have found evidence of *pterosaurs*—prehistoric winged reptiles. The *archaeopteryx* had feathers rather than scales, so it is considered the first true bird.



Oil spills can be disastrous to all kinds of wildlife.

Wildlife Protection

Ecosystem changes cause animals to adapt to new conditions, migrate to more hospitable locations, or suffer reductions in population. Fires moving across woodlands and prairies alter the habitats of many creatures. An early winter storm might catch many animals unprepared for migration or hibernation. Floods can wash away beaver dams and fish spawning grounds. Drought can reduce food for grazing animals and, in turn, for species that depend on those animals for food. While natural changes affect many animals, they often are important to maintaining a healthy balance of wildlife populations. Unfortunately, the same cannot always be said for the disruptions caused by humans.

In the past, overhunting has severely reduced the numbers of many species. The passenger pigeon, a magnificent bird once thriving in the eastern United States, was hunted to extinction, and the bison of the Great Plains almost disappeared from the planet. Laws now protect endangered species, but an even greater threat to the survival of wild animals is the destruction of their habitats. Water pollution upsets entire ecosystems and lessens the carrying capacity of lakes and streams. Industrial and power plant smokestack emissions can cause rain to become acidic enough to harm vegetation and pollute water even miles away. Crop pesticides kill beneficial insects as well as those considered pests. Chemicals introduced into the environment cause some birds' eggs to become so thin that they break before the chicks are ready to hatch.

Humans' economic interests often are based on expansion and development. We transform native prairie into cropland. Our cities push into undeveloped areas, covering them with pavement and seeded lawns. Forests fall to the logger's saw. Dams and irrigation projects flood areas that once were arid and dry out those that were wet. All of these changes present wildlife with increasingly difficult challenges to their continued existence.

Fortunately, generations of Americans have had the wisdom to protect vast tracts of unspoiled land in parks, wilderness areas, forests, and wildlife habitats. As individuals come to realize the effects human actions can have on the environment, many people have adjusted their lifestyles to improve waste disposal processes, city maintenance, and land management.

Humans must adapt to change just as other animals do, including seeing with new wisdom the importance of wildlife, and then deciding to live in harmony with the environment and its animals.

For more on the role of change in ecosystems, see the chapter titled "Understanding Nature." For more on improving wildlife habitat, see the chapter titled "Being Good Stewards of Our Resources."



"The wild things of this earth are not ours to do with as we please. They have been given to us in trust, and we must account for them to the generations which will come after us and audit our accounts."

—William T. Hornaday,
author, wildlife advocate,
and founder of the National
Zoo in Washington, D.C.