

THE GREAT OUTDOORS



According to New Jersey Division of Fish and Wildlife, "Black bears are not true hibernators and may be active all year long. During the winter, black bears enter a state of winter dormancy called torpor. While in the state of torpor their heart rate and respiratory rate slow and their body temperature slightly drops, but not as much as in true hibernators (such as chipmunks or woodchucks)."

Stayin' Alive

Animals have evolved with a variety of adaptations to survive the winter cold.

By J. Morton Galetto

For most of us, surviving winter means paying a utility bill and adjusting the thermostat. Hopefully we also have some

strategies for conserving fossil fuels and keeping the bill low. We make use of technology to stay warm and we generally stay indoors when it's coldest. Today's clothing also has many technological innovations to keep our winter apparel less bulky.

Animals don't have these luxuries, or implements for survival but are naturally better equipped than we are to survive winter. That is not to imply that they don't have strategies, evolved over millennium, to endure the cold. These strategies are often used in tandem.

One of the common tactics is simply to get out of Dodge and go to some place warmer – in other words, to migrate but others, such as winter ducks, simply come from tundra regions and the northwestern United States to our more southerly area to avoid the cold. Snow geese are leaving arctic areas that will commonly become -22 to -31 degrees Fahrenheit, and even as low as -50°degrees below, and relocate to our comparatively milder climate. So cold is often relative to the area the animal is leaving.

Many birds that summer here to raise their young will fly south as fall settles in. Some are neotropical migrants that will winter in Central and South America. Because of

climate change, many birds that formerly migrated to our area in Southern New Jersey may not get this far south unless there is a freeze north of us to push them our way. Global warming means that snow geese and eagles are not coming in as large numbers as they once did, even as recently as 10 years ago.

Migrations involving birds, although some of the most obvious but are not the only type. Insects like monarchs and buckeye butterflies leave their summer homes. Caribou can travel thousands of miles between their warm-weather habitats and their more southerly winter feeding grounds. Arctic terns migrate further than any other animal, flying from Antarctica to Greenland each spring. Around the globe animals travel for more favorable weather conditions, food, and safety.

Animals that stay and endure the cold climates have different bodily adaptations and strategies. Dormancy and hibernations are two approaches. Both strategies involve conserving resources and energy so as not to burn muscle. Maintaining body fats for insulation is often critical to staying warm. Because expending energy burns fat reserves, some animals really slow down.

Hibernation lowers the metabolic rate and reduces the need for oxygen and body heat. Examples of hibernators are bats, woodchucks, and ground squirrels like marmots and prairie dogs. In reptiles and amphibians hibernation is called brumation. Some actually manufacture antifreeze to keep from their cells to keep from dying.

Some frogs – the wood, gray tree, and spring peeper – produce a kind of antifreeze. Their liver converts glycerol into sugars to create the same effect. Some insects like the Alaskan upis beetle store a sugar-based substance in their cell membranes to displace ice crystals.

According to the Phinizy Center for Water Sciences, “Wood frog cells contain a concentrated sugar solution that protects them from freezing while water on the outside of the cells freezes. These frozen frogs have no heartbeat, no blood circulation, no breathing, and no detectable brain activity. When the temperature warms up, the frogs thaw within 1-2 hours, and all vital functions resume.”



This wood frog's version of antifreeze allows it to survive temperatures as low as 3 degrees F. Photo credit: Accuweather video.

These animals are often are dehydrated and look freeze-dried. Their recovery takes on an almost miraculous aspect.

As already alluded to, fat reserves are important ways of staying warm. Not only is fat fuel but it is also insulation. Polar animals rely on blubber: seals, polar bears, and penguins all use this special fat as insulation to save energy. During the warmer months marine animals eat fatty foods to build these reserves. The main difference between fat and blubber is its consistency and blood supply. Blubber has a greater amount of blood vessels than fat and it is more dense.



Bats often huddle together to stay warm as displayed by these leaf nosed bats in Belize – just hanging out in a huddle. Photo Jane Morton Galetto

Many animals use a combination of strategies to stay warm. Huddling and shelter are two other common methods for coping with cold, and bats often hibernate, shelter, as well as huddle. Huddling is used by snakes that make use of dens. Some snakes will share dens with other species of herptiles. Small mammals like rodents and tree squirrels often huddle. One frigid day, watched over a dozen squirrels leave one leafy tree nest.



*This tree's cavity provides shelter for this gray squirrel.
Photo: J. Morton Galetto*

One of the most famous huddlers is the emperor penguin that lives in Antarctica's frigid climes. These animals are three and half to four feet tall. Five thousand congregate in a huge circle, and they will continually march in a slow cadence, taking turns being on the outside of their large flock's huddle. Nineteen of these large birds will pack into a square meter. Each male adult will be protecting an egg on the surface of his feet under the blubber of his belly; this incubation will last 65-75 days.

Strategies employed for warmth are often consecutively employed, including huddling, rotation, and reliance on blubber.

In the fall many animals fatten up. Small mammals and birds make use of autumn forest mast to make ready for the winter. Many even store resources like acorns and other seeds for cold weather meals.

One type of fat called "brown fat" is rich in mitochondria; these are compartments in cells known for their role as powerhouses. They control cellular function that enables our bodies' biological processes. The fat actually generates body heat by layering around internal organs. Dr. Curt Stager, Professor of Natural Sciences, Paul Smith College, described brown fat as "[l]ike putting a heating pad around your guts inside your body, basically." In humans, babies have brown fat making up about 2 - 5% of their body weight around their shoulders and spine. With age brown fat decreases.

Mammals often have a summer and a winter coat of fur. Caribou actually develop a hollow layer of guard hairs in the winter, which trap air and provide greater insulation.

Some animals' hair turns white in the winter to help provide camouflage in snow. Ermine

and snowshoe rabbits are two examples. This is yet another means of surviving the cold.

Sheltering is another way to survive winter's chill. We've already mentioned snake dens. Cavities in trees, caves, leaf litter, and ground dens all provide protection from the cold. Ground squirrels, woodchucks, foxes, bear, snakes, insects, otters, raccoons, and many birds are some of the species that use shelters. The hollows of dead trees above and below ground also offer important refuges.

For many mammals, when their core body temperature drops a reflex is triggered to maintain homeostasis or a balance within the organism despite external changes such as dropping temperatures. Shivering generates heat, and is characterized by the rapid contraction and relaxing of muscles that in turn helps to warm the animal.

Birds have an interesting strategy for keeping warm called piloerection. This the fluffing of feathers to trap air and control heat. Specialized muscles at the base of each feather allow a bird to move nearly every feather on its body.



A snowy owl fluffs its feathers to stay warm in cold conditions. The technical term for fluffing feathers control heat is ptiloerection. Photo: J. Morton Galetto.

A number of birds have a fluffy down close to their body that traps warm air and is an efficient insulator. Ducks and geese are the best known for their down, but the chicks of many species initially sport downy feathers to keep them warm before developing other sets of feathers as they mature.

All this talking about cold has me thinking of putting on another layer. It makes me contemplate how we rely on technical advances and the expertise of others to stay warm. Think of those who weave our fabrics, machines and people who sew, HVAC experts, insulation manufactures...

Wouldn't it be nice to just – literally - ruffle one's feathers? All told, I hope your holidays and winter are cozy.

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