EarthDate

Beating the Heat

A young elephant steps from cooling mud, its oversized ears acting as natural radiators. From wallowing in water to flushing heat through blood-rich ear tissue, elephants use both behavior and biology to beat the heat.

Credit: : By Bernard DUPONT from FRANCE - African Elephant (Loxodonta africana) young getting out of the mud with help from its mother ..., CC BY-SA 2.0, https://commons.wikimedia.org/w/index.php?curid=75648250

Before modern energy gave us modern air conditioning, we had sweat to keep us cool. And shade. And maybe a jump in a lake. Animals still rely on those today to beat the heat.

Horses, like humans, sweat. When the sweat evaporates, it cools the skin. Dogs, antelopes, and some birds pant, drawing breath rapidly across their tongues and throats, where evaporative cooling brings down the temperature of blood near the skin surface.

Other birds vibrate the flaps of skin on their throats to circulate air around blood vessels found there. Elephants do something similar, cooling blood vessels in their huge ears, by flapping them. Camels and toucans draw air across blood vessels in their noses.

Rodents and amphibians burrow in the soil or under leaf litter, where it's cooler and moister. Some toads burrow and go dormant until the next rain comes. Some even form a protective cocoon of their own shed skin. Deer, doves and many other creatures seek shade during the heat of the day, resting silently to keep metabolic rates low.

Even fish seek shade underwater, under overhanging rocks or docks. Or they retreat to the dark depths, where the water's cooler. Speaking of water, buffalo and birds splash in shallow pools. Vultures, maybe not surprisingly, go so far as to pee on their own legs to cool themselves off.

Which just goes to show, when the heat rises, animals have found amazing ways to adapt.

I'm Scott Tinker.

SWITCH ENERGY ALLIANCE

Background: Beating the Heat

Synopsis: Animals, including humans, function best within a narrow range of temperatures. When heat pushes those limits, survival depends on adaptation, through specialized body systems, behavioral shifts, and finely tuned responses that allow life to endure even the hottest conditions.

Beating the Heat

- On a sweltering, hot, and sticky summer day, we do whatever we can to stay cool. If we are fortunate, we retreat indoors to an air-conditioned space and don't think twice about the heat. Or perhaps we plop in front of a fan, run through a sprinkler, or savor the relief of an icy treat.
- Animals face the same relentless sun, but without modern comforts. Instead, over generations, they have evolved physical features and behavior strategies that help them endure the hottest days of the year.

Hedgehogs are night-lovers who don't like the heat. By foraging at night, it not only keeps its body temperature in check but also reduces water loss and lowers its risk from daytime predators.

Credit: By Richard Croft, CC BY-SA 2.0, https://commons.wikimedia.org/w/index.php?curid=13096660

Mammals: Masters of Cooling

- Survival becomes a battle against overheating when searing heat builds. While winter's cold demands holding on to the warmth, summer requires letting heat go.
- Some sweat it out. Mammals like humans and horses release moisture across their skin. As it evaporates, it carries heat away. Coyotes, antelope, and other mammals pant instead. Rapid breathing evaporates water from the tongue and airways, cooling the blood before it returns to the body.
- Others are built for ventilation. Elephants and jackrabbits unfurl enormous ears laced with blood vessels. As warm blood flows through them, heat radiates outward into the air. A simple flap of the ears becomes a living fan.
- For some, this method runs much deeper. Far inside the heads of camels and many antelope is a dense network of tiny blood vessels called the carotid rete. Warm blood headed for the brain passes through this web, where it is cooled by blood returning from the nasal passages during breathing. This keeps the brain cooler than the body, allowing these animals to tolerate higher core temperatures without losing as much water to sweat.
- Escape becomes an option for many desert and savanna species by becoming nocturnal or crepuscular, meaning active during the cooler hours at dusk and dawn. During the day, they rest in burrows, dens, or the shade of shrubs, emerging to feed when temperatures fall. Underground, just a few feet below the surface, the Earth holds a steadier, cooler climate.
- Some species conserve both water and energy. Kangaroo rats rarely sweat or pant. Instead, they allow their body temperature to rise slightly during the day, storing heat rather than fighting it, then release it safely at night.
- On oppressive summer days, people gather at swimming pools, lakes, and shady parks, seeking relief where water and breeze offer comfort.
    - Large mammals do much the same. In Yellowstone, bison stand together in rivers or linger in breezy uplands. African buffalo cluster beneath acacia trees, lions stretch into narrow bands of shade, waiting for dusk to hunt.

Background: Beating the Heat

    - Like us, they turn to water, wind, and shadow as natural air conditioning, letting the landscape help carry away the heat.
- Mammals survive the heat by wisely releasing it through breath, blood, behavior, and the quiet refuge of shade.

Birds: Engineers of Evaporation

- Birds cannot sweat, but they are masters of moving heat with air and water.
- When temperatures soar, robins, crows, and many songbirds open their beaks and pant, increasing evaporation from moist surfaces in the mouth and throat.
- Some take it further. Herons, cormorants, and many raptors perform gular fluttering, rapidly vibrating the thin skin of the throat to speed evaporation without the muscular effort of heavy panting. It is a delicate, energy-saving fan built into the body.

Even in full midday sun, this Common Nighthawk manages the heat. The subtle flutter in its throat helps release excess warmth, allowing the bird to remain active when temperatures climb.

Credit: By Ammodramus - Own work, Public Domain, https://commons.wikimedia.org/w/index.php?curid=10855944

- Bills can help too. The oversized bill of a toucan is threaded with blood vessels. When blood flow increases, heat radiates outward, turning the bill into a living heat exchanger.
- Water offers relief beyond drinking. On hot afternoons, sparrows and cardinals splash in shallow pools, soaking feathers before perching in a breeze to let evaporation carry warmth away.
- Vultures even urinate on their own legs, a behavior called urohidrosis, cooling themselves as the liquid evaporates in the sun.
- And when heat peaks, many birds simply retreat. Doves and hawks rest quietly in dense foliage, reducing activity until evening shadows appear. By conserving energy and avoiding direct sunlight, they limit internal heat buildup and wait for cooler air to take flight and forage again.
- Through breath, skin, water, and well-timed stillness, birds release heat to the wind while waiting for cooler skies.

Fish: Finding Cool in Warm Waters

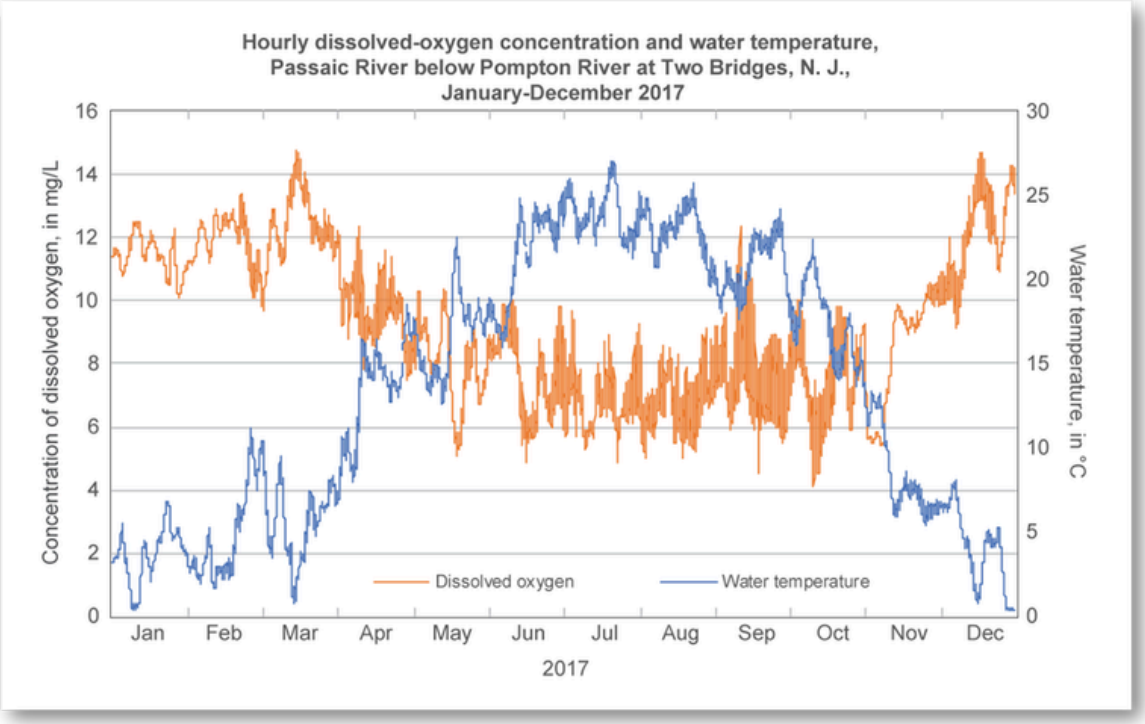
- When summer heat settles in, it is not only the air that warms. Sunlight raises the temperatures of lakes, rivers, and coastal waters as well, sometimes pushing them close to the limits that fish can tolerate.
- In this heated world, fish have more limited options than land animals. They cannot pant, rest beneath a tree, or splash on the shoreline, but they can seek cooler refuge within deeper water and the currents than run through it.
- Many fish simply move downward, diving below the sunlit surface into darker, denser water that resists warming. When lakes separate into warm upper layers and cooler depths, a process known as thermal stratification, those lower waters become a quiet oasis in summer's heat.
- Shade still matters below the surface. Overhanging trees, docks, bridges, and thick aquatic plants cast cool shadows that fish slip into, avoiding direct solar heat streaming through sunlit waters.

Background: Beating the Heat

- Currents and springs become safe harbors. Fast-moving water pushed by winds, rapids, or= bubbling up from underground springs tends to be= both cooler and richer in oxygen. Fish are drawn= toward these flowing, life-giving corridors when= the day grows hot.
- In mid-day heat, many fish simply slow down. Like= mammals resting in shade and birds tucked into= foliage, they reduce activity to avoid generating= excess metabolic heat. Moving less means= conserving energy and limiting internal= temperature rise, a quiet patience that helps them= endure the hottest hours.
- Some species go even further. In extraordinary= cases, the mangrove rivulus has been observed= leaving the water to rest on damp surfaces, using= evaporation from its skin to shed heat before= dropping back into cooler aquatic refuge.
- Because warm water holds less dissolved oxygen, fish often gravitate toward aerated zones near waterfalls, riffles, or turbulent inflows. There, bubbles and constant motion mix air into the water, boosting oxygen levels and helping them breathe easier, despite rising temperatures.
- In depth, shade, current, and stillness, fish find their version of relief, adjusting to rising temperatures by working with the layered, moving waters around them.

Amphibians: Dependent on Water

- Amphibians and reptiles do not generate their own body heat the way mammals and birds do. As ectotherms, their body temperatures rise and fall with the environment.



Seasonal changes in the Pompton River reveal a clear pattern: as water temperatures rise through the summer months, dissolved oxygen levels decline. Warmer water holds less oxygen, creating more stressful conditions for fish and other aquatic life during the hottest part of the year.

Credit: https://d9-wret.s3.us-west-2.amazonaws.com/assets/palladium/production/s3fs-public/styles/full_width/public/thumbnails/image/do_temp_0.png?itok=Kn9M7A6n

Background: Beating the Heat

- Warmth allows them to move and hunt, but too much heat, especially when paired with dry air, can quickly become dangerous.
- When temperatures climb, many retreat to moisture. Frogs and salamanders slip beneath logs, into shaded streams, or down into damp soil where the ground holds cooler air. American bullfrogs linger at pond edges, while spotted salamanders burrow below the leaf litter to keep their thin, permeable skin from drying out.
- Reptiles use similar refuges. Box turtles rest in shaded thickets, and garter snakes disappear into cool crevices or underground burrows during the hottest part of the day, emerging again when evening lowers the heat.
- Some amphibians endure shrinking waters with remarkable strategies.
    - Plains spadefoot toads burrow deep into the soil when temporary ponds dry, remaining dormant until heavy rains return.
    - In other regions, water-holding frogs form protective cocoons of shed skin to trap moisture while they wait out drought.
- Yet summer warmth is not always harmful. Higher temperatures can speed the growth of tadpoles in ponds, helping them transform into froglets more quickly. But if heat persists and ponds evaporate before metamorphosis is complete, entire broods can be lost.
- For creatures tied so closely to water, survival depends on shade, soil, and the fragile persistence of ponds. Amphibian's resilience depends on staying close to the moisture that makes life possible.

Tucked beneath cool, flowing water, the Cascade Torrent Salamander avoids overheating by staying close to cold, well-oxygenated streams. Its survival depends on clean, moist habitats, making this small amphibian both a heat-avoider and a sensitive indicator of freshwater health.

Credit: By USFWS Pacific - Cascade Torrent Salamander, Public Domain, https://commons.wikimedia.org/w/index.php?curid=165977180

Survival Strategies for Summer Heat

- From flapping ears to fluttering throats, from deep water dives to damp burrows, the animal kingdom reveals countless ways to endure rising temperatures. Each species faces the same relentless force of heat, and each has evolved its own response.
- Some shed warm through breath or blood. Others seek shade, depth, or stillness, shifting their hours to cooler dawn and dusk.
- As global temperatures trend upward, these time-tested strategies may be tested further, pushing species to adjust their ranges, timing, and behaviors once again.
- And as we learned on another Earth Date, colder temperatures are more deadly than warm temperatures.
- Life persists not by resisting heat, but by adapting to it.

References: Beating the Heat

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