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The Night Life: Many Animals Are Becoming Increasingly Nocturnal in an Effort to Avoid Humans

Dawn Stover

The Night Life

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It is a warm summer night in 2013 at my house in southwest Washington when I discover a bat flying from room to room in search of an exit from what must seem like a big, warm, mysteriously sealed-off cave. I turn off the lights and open the front door, knowing that the bat will soon find its way out. With the door ajar, though, I catch a whiff of skunk. Uh-oh. It has been five months and several baths since the dog's last encounter, but he still reeks when his coat gets wet. I snap a leash on him and venture outside with a flashlight in hand, cautiously scanning the yard and the woods beyond for white stripes.

Skunks and bats are creatures I come upon only in the nighttime, and then I'm at a considerable disadvantage. A bat can navigate from one end of my house to the other in an instant, while I slowly feel my way along in the dark—probing with my feet and hands like a blind person tapping a cane. Even with a flashlight, I'm not entirely sure I can outrun a skunk across my so-called lawn, a terrain rugged enough to ruin almost any croquet shot.

The outdoors at night humbles me, cripples my vision, and prevents me from moving quickly or gracefully. I am both literally and figuratively *in the dark*, sightless and rather clueless about what's out here. But nighttime is also an eye-opening time to be out and about. The wildlife community active at this hour is entirely different than during my normal waking hours. The difference is like . . . well, night and day.

Nighttime is a simpler, wilder time. It's an opportunity to experience the world in a fresh way. And I have realized that if I want to understand animal behavior, and how humans are changing it, going out at night is essential. Animals have noticed our encroachment onto their landscapes, and many of them have responded by retreating into the night, waiting until we are asleep—or at least indoors—to go about their business. I don't wish to make their lives even more difficult, but now and then curiosity compels me to wander into the night, and these forays often turn out to be more illuminating than my daytime explorations.

Volunteers around the United States capture wildlife in their increasing nighttime movements. At left, a bear ambles through Thurmond Chatham Game Land in North Carolina. EMAMMAL PROJECT

Shifting Patterns

Scientists generally classify animals into three groups: diurnal (active during the day), nocturnal (active at night), and crepuscular (an unlovely word for activity occurring primarily at the loveliest hours, dawn and dusk). Some animals are dedicated to one of these categories and never change. The kinkajou, a rainforest mammal that lives in Central and South America and has large eyes adapted for night vision, "is not going to go out during the daytime no matter what," says Roland Kays, director of the biodiversity lab at the North Carolina Museum of Natural Sciences and a research associate professor at North Carolina State University. Conversely, the agouti, a large rodent that lives in the same part of the world, never goes out at night. Many animals, however, have much more complicated patterns of behavior. "Simplifying into diurnal, nocturnal, and crepuscular doesn't even come close to describing all of what we see out there," Kays says.

A number of factors determine daily patterns of activity. Some animals, such as bats, work the night shift because that is when moths, mosquitoes, and other prey are available. Moths, in turn, may be nocturnal because they are avoiding birds and other predators that are active during the day. And it's not just animals: Some flowers, for example, release their perfume at night to attract pollinators such as moths and bats.

Temperature can also play a role in determining whether an animal is nocturnal. For example, biologists at Arizona State University have learned that Gila monsters living in the Sonoran Desert are diurnal in the spring but become mostly nocturnal between June and September, when daytime temperatures sometimes rise above 115 degrees Fahrenheit.

Nocturnal behavior can also be an adaptation to environmental change, most often to human disturbance. Because human activity outdoors is typically much lower at night than during the day, some large predators and other animals living in close proximity to humans have become increasingly nocturnal in their behavior patterns.

Studies using radio collars to track bobcats and coyotes, for example, have shown that these animals are more nocturnal in urban, suburban, and agricultural areas than in undeveloped areas. Coyotes in a Wyoming suburb are more active at night than are coyotes in nearby Grand Teton National Park. Switching to nighttime activity helps large predators avoid encounters with humans, collisions with vehicles, and competition with domestic dogs.

This behavioral flexibility has enabled coyotes to thrive even in densely populated cities. Stan Gehrt, an Ohio State University ecologist who has

Coyotes are often active at night, but studies show they are more nocturnal in developed areas than in the backcountry. A field camera captured these in Prince William Forest Park, which adjoins a U.S. Marine base, in Virginia. EMAMMAL PROJECT

tracked coyotes in the Chicago metropolitan area for more than a decade, estimates that there are about 2,000 coyotes living in Chicago and its suburbs. Because the coyotes are active mainly at night, humans are usually unaware of their presence.

A study done in southeastern Colorado, by Utah State University researchers, found that coyotes were much more active during the day in 1996 and 1997 than during an earlier period—from 1983 to 1988—when ranchers were trapping and shooting them. Other studies have found that cougars in northern Arizona and southern Utah delayed their activities until after sunset in response to logging and other human disturbances; female spotted hyenas in Kenya's Masai Mara National Reserve were less active during the day in areas with livestock than in undisturbed areas; and white-tailed deer in Florida's Osceola National Forest became more nocturnal during hunting season. In China, when endangered Eld's deer were translocated from predator-free areas of Hainan Island's Datian Nature Reserve to agricultural areas with small villages, the reintroduced deer became increasingly nocturnal—even though the villagers did not hunt them.

The Wildest World

Darkness transforms a place. When night falls, I find myself in a landscape unlike the everyday one. In this unfamiliar world, everything looks different, sounds different, even smells different. Gone are the bright colors and other visual cues that my retinas are built to decipher. Thus handicapped, I find I must rely more heavily on my other senses, which have dulled from lack of use. Just as dining by candlelight enhances taste, being outdoors in the dark makes me hyper-aware of the whispering pine, the snapping twig, the sticky-sweet smell of young cottonwood leaves, the sharp prick of a ground-creeping vine that snags my ankle. It's as if broad daylight, along with the lamps and electronic screens of my indoor world, has overexposed my senses. At night, with the light dialed down, the world around me "pops" with detail. A shooting star plunges through the night sky. On the ground, I can make out a field of white daisies, echoing the constellations above. I take great comfort in this sensual, primal connection with nature.

Not everyone sees it this way. Even at a campground deep in the forest, where I imagine few visitors are afraid of the dark, I notice that most people are reluctant to embrace the night. The campers gather around their fires, arming themselves with headlamps and lanterns when they leave the circle of flickering light. Occasionally they pause in darkness to appreciate an especially brilliant night sky. But the lights snap back on if there is any sudden, unidentified sound in the forest.

They're missing out. The alien world of darkness is where some of the wildest of all wildlife can be found. It is where I can observe otherwise unseen animals, escape from ugliness and clamor, and leave behind the distractions of daily life. Even when I visited the Tiputini Biodiversity Station deep in the Ecuadorian rainforest in early 2013—one of the least developed places on the planet—the sound of a boat engine, a generator, or a cabin door slapping against its wooden frame occasionally intruded. Not in the middle of the night, though. That is when I lay awake on my bunk in the screened cabin, or sat on the porch in defiance of the mosquitoes, and listened to a symphony unlike anything played in the daytime. Instead of the deep *rum-rum-rum* sound of the bullfrogs near my home, I heard their tiny Amazonian cousins calling from inside bromeliads, using the plants' leaves like gramophone horns to amplify their voices. Higher-pitched insects accompanied the frogs, and bats of all sizes darted through the camp—some of them large enough to eat other, smaller bats.

Midnight Migrations

Back home in Washington, I awaken at 4 A.M. to the scratching sounds of a bat squeezing its way through a tiny crack in the eaves above my bedroom window. He's probably turning in for the night—or for the day, in his case. The endless day–night cycle of activity and inactivity can result in spectacular migrations. At dusk, an entire colony of bats may spiral out of a cave, or stream from beneath a bridge, in one massive "emergence" to feed. The largest of all migrations occurs every 24 hours in the world's oceans and lakes, where many organisms move closer to the water's surface at night and then sink back to deeper waters during the day. Scientists discovered this vertical migration during World War II, when Navy sonar readings inexplicably showed a sonar-scattering layer in the ocean that appeared to be shallower at night than during the day; it turned out to be a concentration of plankton and other organisms.

More recently, scientists at the U.S. Fish and Wildlife Service have used radar to reveal the nighttime migrations of birds and bats, which are difficult for humans to observe directly. In a project funded by the Great Lakes Restoration Initiative, the scientists have positioned mobile radar units at more than a dozen locations around the shorelines of the Great Lakes during the spring and fall migration seasons, beginning in 2011, to try to get a better idea of when and where migrations occur and how they might be affected by future wind energy development. The radar antennas are the same type used to detect ships but with extensive software modifications.

During most 24-hour cycles, the radar shows that activity is low during the day, builds up just after sunset, peaks in the middle of the night, and tapers off before dawn. A typical radar image taken at 5 P.M. during the fall migration has only a few streaks, representing the movements of a small number of birds traveling in random directions. An image taken at midnight, however, shows intense, mostly southbound activity. "We knew this was occurring, but we had never been able to show it to anybody," says Jeff Gosse, regional energy coordinator for Region 3 of the U.S. Fish and Wildlife Service. "Now people actually get to see it."

Although larger birds such as raptors and waterfowl often travel during the day, most songbirds and bats migrate under cover of darkness. A common theory among scientists is that nighttime migration is an effort to avoid predators. "If you're 'snackable,' it's better to fly at night," says Gosse.

A 10-point buck moves freely in Shenandoah National Park in Virginia. EMAMMAL PROJECT

Gosse and his colleagues are also using acoustic and ultrasonic monitors to record the calls of migrating birds and bats. On quiet nights in the spring and fall, I sometimes hear songbirds calling to each other as they pass unseen overhead. These night flight calls are different from birds' other calls, and identifying them is "a new frontier in birding," according to Rob Fergus, an ornithologist and avid birder who has been recording and analyzing the flight calls of migrating birds passing over his home in New Jersey since April 2012.

The timing of migrations can have profound consequences for predators. For example, the introduction of opossum shrimp in Montana's Flathead Lake—the largest natural freshwater lake west of the Mississippi—led to an explosion of nonnative lake trout in the early 1980s. In the daytime, the shrimp hang out in the lake's deep waters, where the lake trout feast on them. At night, the shrimp rise to the surface to feed. The native westslope cutthroat and bull trout that once thrived in Flathead Lake have mostly disappeared—not only because they are eaten by the much bigger lake trout but also because they don't swim deep enough in their daytime feedings to take advantage of the shrimp buffet.

Of course, some nocturnal activities have nothing to do with predation. Birds, seals, and at least one insect rely on the night sky for navigation. In a study published last year, scientists in Sweden and South Africa used a Johannesburg planetarium to demonstrate that African dung beetles, which roll balls of feces along unerringly straight paths, rely on the Milky Way for orientation.

Night Visions

I bought my first trail camera a few months ago to investigate the comings and goings of the nightlife—starting with a suspected stray cat in the barn. To my surprise, the images revealed not one but two feuding cats—appearing on camera only at night. Since then, I have repositioned the camera on a trailside tree in the woods near the house but have so far only captured images of domestic animals (the cats, the dog, my husband) and a few deer wandering past. Tracks, scat, and the occasional sighting tell me that coyotes, bears, bobcats, and cougars are also regular visitors, but photos can help me learn more about individual characteristics such as the size and age of these animals.

Many inexpensive trail cameras capture black-and-white still or video images at night and even record sound. They have become very popular with hunters as well as amateur scientists. Some hunters are taking to the woods with night-vision goggles, too. Night hunting is legal in some states but not in others. In the never-ending game of coevolution, human predators are only one step behind their increasingly nocturnal prey.

At the North Carolina Museum of Natural Sciences, Roland Kays is collaborating with the Smithsonian Institution on a citizen science project, called eMammal, that will use data from motion-triggered cameras to document what animals live where and to study how they are affected by activities such as hunting, trapping, hiking, and biking. Now in its second field season, the project has signed up 85 volunteers, has amassed more than a million pictures, and is poised for a major expansion.

Camera traps are already revolutionizing biology, providing rare peeks at how wild animals behave when they think nobody is watching. This is particularly true for nighttime behavior, which has always been difficult to observe firsthand. At the research station I visited in Ecuador, for example, researchers are snapping photos of elusive species such as the jaguar, giant armadillo, short-eared dog, and nocturnal curassow.

Still, there's nothing like observing wildlife in person. That requires a little tolerance for cooler temperatures and insect bites, as well as some patience. It takes 30 minutes or more of darkness before the human eye fully shifts to its scotopic, or dark-adapted, vision. The rods of the eye—photoreceptors that respond to light but not to color—contain molecules of a biological pigment called rhodopsin that is extremely light sensitive. Rhodopsin is what enables us to see in low light conditions, but when it is exposed to brighter light, the pigment bleaches instantly and takes time (and darkness) to regenerate.

In the modern world, we bleach our rhodopsin every time we glance at a cell phone screen or flip a light switch. That's why you can easily find your way to the bathroom in the night but stumble on the way back to bed. In many places, nighttime light pollution is interfering with animal behavior and making it difficult to see the constellations that captivated our ancestors. Even in my rural community, some of my neighbors habitually keep a bright light burning from a high perch all night long, bleaching the rhodopsin of anyone looking in that direction.

Although artificial lighting has made it possible for many humans to stay up late to work or play, as a species we are in some ways less nocturnal than we once were. Evidence suggests that humans living in an earlier time often rose in the middle of the night to stoke the fire, engage in a few hours of quiet reflection, or make love—rather than sleeping for an entire eight-hour stretch, as is commonly prescribed today.

In an experiment conducted in the early 1990s at the National Institute of Mental Health, psychiatrist Thomas A. Wehr placed seven volunteers in totally dark bedrooms for fourteen hours a night. By the final week of the four-week-long experiment, the volunteers were sleeping an average of eight hours a night—but not all at once. They tended to rouse after several hours of sleep and then spend one to three hours in quiet wakefulness before falling asleep again for several hours. This polyphasic sleep pattern is common in chimpanzees, baboons, and other animals. Perhaps it is also natural for humans to be awake in the middle of the night. "Consolidated sleep in human beings may be an artifact of modern lighting technology," Wehr wrote in a 1992 paper describing the experiment.

I think of Wehr when I wake in the wee hours to the song of the Western screech owl, which is not a screech at all—more like a bouncing ball, the bounces coming faster and faster until the ball comes to rest. Ten seconds pass and the ball drops again: *hoo-hoo-hoo-hoohoohoohoohoo*. The loud call rouses me from my dreams, so I open the bedroom window and lie back to listen. Perhaps I was meant to be awake for this.

Dawn Stover is a freelance science and environmental writer based in White Salmon, Washington.

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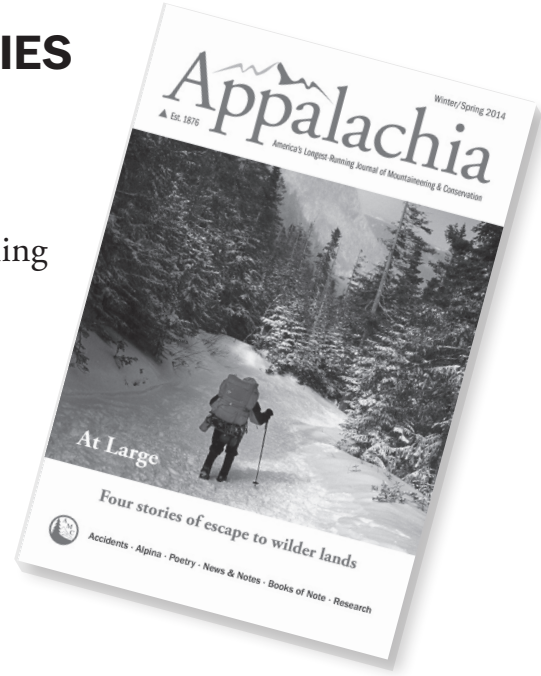

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