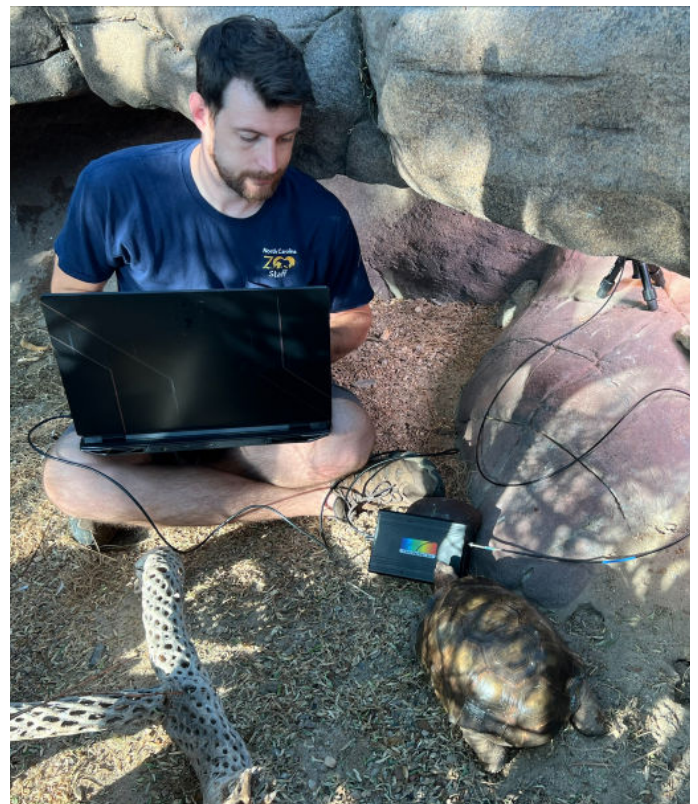


Lighting the Way to Better Welfare: Spectrometer Use in Zoos



Eric Mahan — Light is the essence of life, shaping the evolution of every living creature on this planet. By better understanding light, we better understand life itself — a crucial mission for zoos, whose primary role is not just to care for animals but to ensure their well-being. Animals rely on sunlight for a multitude of reasons, from birds using UVA rays to judge mate quality to reptiles absorbing Infrared A and B to regulate their body temperature. Even a nocturnal lemur may emerge from its tree cavity nest to soak up some sun during the day, thus aiding in its biological processes.

However, in zoos, we can't always allow animals outdoors due to a variety of factors like humidity, weather, or local disease risks. To mitigate this, we use glass roofs and skylights, but these can alter the wavelengths of light that reach the animals. Human-made lights are then added, yet with so many types and styles — many of which don't accurately convey their light output — it's difficult to know what the animals are receiving. In fact, to approximate the full spectrum of sunlight, it often takes three different types of bulbs. While animal-specific bulbs are effective for UV light, they can vary dramatically, with some producing intense or unnatural UV rays that may endanger the animals. Additionally, in larger



Top: North Carolina Zoo Desert Dome Bottom: Keeper checking on spectrum of new lighting set up with help from desert tortoise

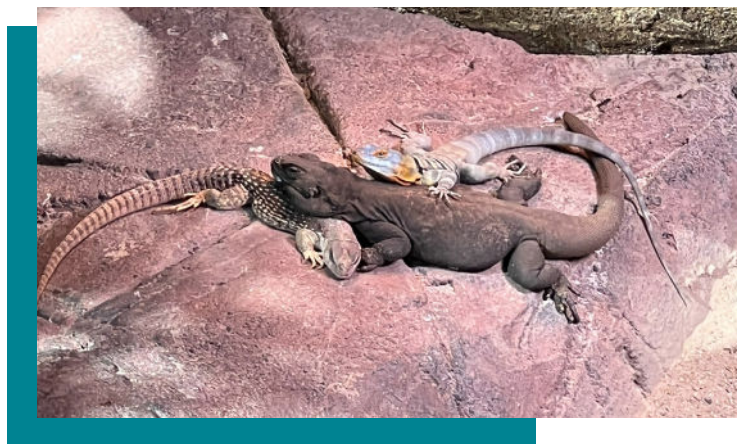
zoo habitats, commercial animal lights, often designed for small home aquariums, may fall short in providing adequate visible and infrared light from these further distances.

A spectrometer, however, eliminates these uncertainties by allowing us to compare readings from the ultimate source — the sun — with those from various lights and combinations, safely opening the full marketplace of lighting options to us. With a spectrometer, we test what light penetrates our skylights and identify parts of the solar spectrum that are lacking and need supplementation. This also enables us to use lights, sometimes commercially sold as work lights or high-bay warehouse lights, in larger habitats without fear of introducing dangerous, unnatural levels of different wavelengths.

We can ensure that the light truly matches that of the sun, not just appearing correct to human eyes, since many animals perceive colors differently, so lights designed for only humans may sometimes be confusing or even distressing for animals. Furthermore, we have started to learn the spectrums of sunlight

not just of a 24-hour period but across an entire year, helping us ensure the proper internal biological processes of the animals are triggered correctly all year.

To ensure natural light replication with the Stellarnet's spectrometer is helping we look to our animals' behaviors. By conducting behavioral studies and other data collection methods, we've observed significant changes in animal behavior — from more vibrant colors in reptiles, to increased appetites, and even heightened activity levels in nocturnal species like mouse lemurs, proving that full-spectrum light benefits all animals even those typically thought not to need it. Our goal is not only to ensure the animals in our care thrive but to share our findings and redefine the minimum lighting standards for captive animals across all facilities. In doing so, we set these animals up for success, helping them thrive and breed, ultimately aiding in the preservation of many different species from extinction.



Below: Vampire bats under blacklight to show UV patterns and possible indication of a vision range. Top left: The nocturnal mouse lemurs enjoying breakfast. Bottom left: Native North American desert lizards enjoying the new full spectrum lighting setup.

