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Cat Scat Lessons

by Lisa K. Harris

I struck gold, thought Ashwin Naidu when handed a cardboard box of mountain lion poop. Some people would have been repulsed to sort through the 105 sealed baggies of sun-dried droppings, but not Naidu.

On the contrary, he knew the wealth of knowledge that could be gleaned by processing "leave behinds," or scat (from scatology, the biologically oriented study of excrement), as poop is called in the field of conservation biology. He would analyze it as part of his studies for a master's degree at the University of Arizona.

"Scat tells us so much about the animal and the community it lives in," says Melanie Culver, U.S. Geological Service Conservation Geneticist at the University of Arizona's School of Natural Resources and the Environment. By using forensic techniques to extract DNA from body samples, biologists learn the species of animal that defecated, its gender, its paternity, and its genetic condition (for example, if inbreeding is occurring).

Analyzing scat DNA from a predator reveals even more. "We learn about the individual that left the scat behind as well as the entire community of animals the predator ate," Culver explains. At Saguaro National Park, scientists "learned all the small mammals that lived within the park by analyzing scat from coyotes, bobcats, mountain lions and foxes."

The information is used to help manage and conserve species. "Studying scat DNA replaces more invasive techniques where biologists captured animals and extracted blood samples to learn about their genetics or watched them for hours at a time to learn about what they ate," Culver says. Studying scat DNA is efficient and, more often than not, uncovers information that biologists using old-school methods are not as readily able to glean.

For example, the poop in Naidu's box was collected by U.S. Fish and Wildlife Service biologists on the Kofa National Wildlife Refuge near Yuma, Arizona. The Kofa, named after the area's once prosperous King of Arizona gold mine, was established for bighorn sheep conservation. Periodic aerial surveys showed the numbers of sheep had plummeted to 400 individuals from 800 just three years

Ashwin Naidu

Mountain lion tracks are clearly visible in this image from the Kofa National Wildlife Refuge.

Ashwin Naidu

The scale of mountain lion scat is revealed when positioned next to a utility tool.

earlier. Mountain lion predation was suspected as the cause of the sheep's demise, although only five mountain lions were known to exist within the refuge.

"Our job," explains Naidu, "was to figure out how many mountains lions there were and if they were eating sheep."

Determining information about the animal that deposited the scat is done by extracting DNA from the top layer of the sample. "The outer part contains sloughed off cells from the predator's large intestine," says Naidu. Mitochondrial DNA is amplified and compared to GenBank, a database of genetic sequence maintained by the U.S. National Institutes of Health, to find the best match. Currently, GenBank contains DNA from 100,000 organisms.

To find scat, biologists walk lines, or transects, often following trails or washes. They collect poop that fits the morphology—size and shape—being studied.

It's hard though, even for a trained biologist, "to discern if a specimen was left behind by a small mountain lion or a large bobcat," says Culver. To collect the right samples, scent dogs have been trained to detect species-specific scat. She explained that, "Dogs like Belgian Malinois and German wirehaired can differentiate 20 different scents. They can find scat under bushes and tell the difference between mountain lion and bobcat [scat]."

The Kofa cardboard box ended up containing more than mountain lion scat. "We were successful in distinguishing between mountain lions and coyotes in 60 percent of our samples," Naidu says.

The scat wasn't fresh when it was collected or analysis could have identified the specific individuals that left behind all the poop samples. Deposited on the ground, the scat had been exposed to sun, rain and microbial growth, all of which degrade DNA.

Of the identified mountain lion samples, Naidu further studied their nuclear DNA and determined that 11 mountain lions—six males and two females—lived within the Kofa.(DNA from the remaining individuals was too degraded for further analysis.)

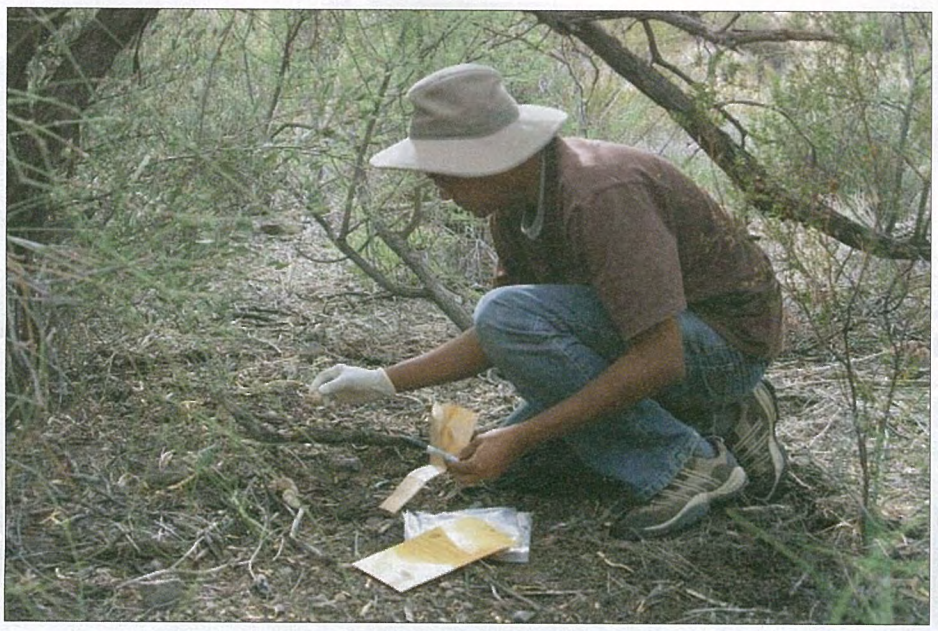
Digging deep within the samples, Naidu pulled out bone fragments and muscle tissue from prey species. "We had 100 percent success identifying what the cats ate," he says. This was possible because the DNA material inside the scat had been protected from the elements.

From this analysis, Naidu learned the cats' diet: 50 percent mule deer, 25 percent bighorn sheep, and the remainder from gray fox, badger and domestic sheep. "The presence of domestic sheep raised further questions, as the nearest ranch was 40 miles away," says Naidu. "Did the mountain lion travel that far or are there domestic sheep on the Kofa?"

This photo of a mountain lion mother and her two kittens was taken by a motion-sensor wildlife camera in the Tucson Mountains.

A lone mountain lion was "captured" in a photo taken by a motion-sensor wildlife camera in the Tucson Mountains.

University of Arizona Wild Cat Research and Conservation Center/Pima County.



Ron Thompson

Ashwin Naidu collects mountain lion scat at the Kofa National Wildlife Refuge.

Domestic sheep carry diseases that are fatal to bighorn sheep, and if they were on the Kofa, their presence would be of concern to refuge managers.

Naidu, originally from Hyderabad, India, met Culver at a wild-cat conservation conference in England. Previously, he had earned a biotechnology engineering degree and volunteered for the Hyderabad Tiger Conservation Society.

Understanding firsthand how elusive big cats are, Naidu wanted to apply noninvasive research techniques to cat conservation. He joined Culver's research team in 2008 and is now working toward his Ph.D. Both are part of the University's Wild Cat Research and Conservation Center (www.uawildcatresearch.org), an umbrella organization that brings together researchers, students and the public for conservation, outreach and education of wild cats worldwide.

With the Kofa box as their starting point, Culver and Naidu are collecting mountain lion scat throughout southern Arizona. "We are developing a genetic database," says Naidu. The results will be used to study mountain lions on a landscape level and discern genetic flow between populations scattered across many remote mountains.

"We'll be able to tell if the mountain lions in the Tucson Mountains travel to other ranges such as the Silverbells or the Catalinas," Culver says.

"I think it's ironic that I started with a box of scat from the Kofa," Naidu smiles. "Because the King of Arizona certainly continues to be a goldmine."

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Lisa Harris is a local freelance writer. Comments for publication should be sent to letters@desertleaf.com.

HOUSE CALLS continued

Unfortunately, urine iodine testing is not performed by the major laboratories, and doctors are not trained to order it. However, several specialty labs in the U.S. do perform the test. This should be done before starting on an iodine program and be supervised by a knowledgeable physician.

Recipe for Breast Health Disaster

The National Health and Nutrition Examination Survey (NHANES) between 1971-74 and 2000 showed that iodine levels have dropped 50 percent in the U.S.

During this same period the amount of iodine-related minerals (called halides) such as bromine (Mountain Dew, commercial baked goods, sports drinks, flame retardant in car upholstery and bedding, hot tubs, pesticides), chlorine derivatives such as perchlorate (contaminate in Colorado river water irrigating crops), and fluoride (fluorinated water, toothpaste), all of which block the beneficial iodine effects in all tissues of the body, have increased exponentially.

The NHANES survey of 1988-1994 indicated that 15 percent of U.S. women were iodine-deficient based on urine levels, i.e., about one in seven women, which roughly corresponds to current rates of breast cancer.

Medical reports over the past 100 years indicate a relationship between hypothyroidism and breast cancer. Other studies show a twofold increase in breast cancer in women who take thyroid hormone replacement.

It is time for a reevaluation of this misunderstood essential nutrient.

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