Animal forensics, DNA used to estimate river otter population

February 28 2014, by Jeff Mulhollem

River otters originally lived throughout all of Pennsylvania's river systems. But by the 1950s, water pollution, the loss of more than half of the state's wetlands and overtrapping had reduced them to one population in the northeastern Pocono Mountains. Credit: Hal Korber/Pennsylvania Game Commission

The restoration of Pennsylvania's river-otter population has been, by all accounts, a great success, and a study being conducted by researchers in

Penn State's College of Agricultural Sciences will soon quantify the accomplishment by yielding population information.

The two-year research project based in the Poconos region involves collecting otter scat—excrement—at hundreds of waterside locations, called latrines, in Monroe, Wayne, Carbon, Luzerne and Lackawanna counties, and subjecting it to DNA analysis to identify different animals. Data from those collections will be fed into a computer population model to calculate otter numbers.

"By summer we hope to have a pretty concrete idea of the otter population in northeastern Pennsylvania and be able to make some statements about the density and genetic diversity of that population," said Nick Forman, the lead researcher, who is pursuing a master's degree in wildlife and fisheries science.

Forman, working under the guidance of David Walter, adjunct assistant professor of wildlife ecology, noted that the cutting-edge "molecular scatology" method employed in the otter study involves forensics, "sort of like the TV show CSI, but with animals." On the other hand, the research is built around the old standard mark-and-recapture method used for decades by wildlife scientists to estimate animal populations—but with a twist.

"Because otters are so elusive and secretive, we can't interact with the animals personally," said Forman, a Mundelein, Ill., native who earned bachelor's degrees in biology and environmental studies at Guilford College in North Carolina.

"When you're dealing with animals that are hard to spot and capture for tagging or taking blood samples, the noninvasive process allows you to monitor them without interfering with their daily routines. With the genetic data we pick up from the scat, we can identify individuals.

Because we revisit the sites, we then get 'capture histories,' and from those we eventually can project population densities."

Researcher Nick Forman displays "scat." The two-year research project involves repeatedly collecting otter excrement at hundreds of waterside locations and subjecting it to DNA analysis to identify individual animals. Credit: Penn State

By early April, researchers will have collected scat from otter latrines over two consecutive winters. Forman explains that winter's cold

temperatures preserve the DNA and keep the scat from breaking down. This winter has been a particular challenge, he pointed out, because repeated heavy snows and frigid temperatures have made conducting field work difficult.

"During the winter, otters tend to shrink their home ranges and their populations are relatively stable—meaning there are no births occurring and little dispersal—so they concentrate their activities, which helps with some of the assumptions we make with our modeling," he said. "Also, around February and March, they increase their scent-marking behavior and deposit more scat because it's the breeding season and there's a lot more communication going on between otters."

River otters, Lontra canadensis, are top predators in river, lake and wetland ecosystems, with adults consuming between 1 and 2 pounds of food a day. They eat primarily fish, as well as amphibians, reptiles, insects, mussels and crayfish. Their latrines usually are located on prominent river points near deep pools containing lots of fish and other aquatic life, Foreman surmises, because "they want to be able to communicate with other otters at these places, and they don't want their scent being washed away.

"Typically, latrines are on higher banks where there is no flooding—they seem to avoid places with shallow, sloping banks, especially along rivers," he said. "We find them on dry land where there is a sharp bend in the river or on a rock jutting out into a lake. Also, for some reason, they tend to establish latrines near stands of white pine, perhaps because those trees are prominent landmarks for the animals and because those trees provide shelter from deep snow."

Foreman's research is just the latest chapter in the story of river otters returning to Pennsylvania in large numbers that first involved Penn State almost three decades ago when doctoral degree candidate Tom Serfass

and his adviser, Robert Brooks, now professor of geography and ecology, worked with the Pennsylvania Department of Conservation and Natural Resources, the state Game Commission and other groups to bring more otters to the state.

Serfass, now a professor and chairman of the Biology Department at Frostburg State University in Maryland, has emerged as one of the leading experts on the species.

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Pollution abatement and watershed restorations in the 1970s created conditions in which otters again could flourish. Then, starting in 1982, more than 150 wild otters captured in Louisiana, Maryland, New York and northeastern Pennsylvania were released into the Allegheny River, Tionesta Creek, the Youghiogheny River, Laurel Hill Creek, Pine Creek, Kettle Creek, Loyalsock Creek and the Raystown Branch of the Juniata River. Over the 30-plus years since those early reintroduction efforts the animals thrived, reproduced and a new population was created.

Forman's research is a collaboration between Penn State, the Pennsylvania Game Commission and the U.S. Geological Survey. The results will inform the commission's management of river otters and will help the agency decide when the animal's population is robust enough to support a limited trapping season. All but three eastern states allow the trapping of otters, and their fur is prized for its high quality.

Game Commission biologist Tom Hardisky said Forman's findings will be incorporated into the state's otter management plan, and the noninvasive genetic sampling technique is being watched closely for its

potential use in other wildlife research.

"Finding a method to estimate densities without trapping otters has been a holdup for a long time," he said. "The problem is, you have to safely capture them and then recapture them to collect any data. Using radio collars is very expensive and time-consuming as well, so this Penn State research involving extracting DNA from scat seems to be ideal."

Provided by Pennsylvania State University

Citation: Animal forensics, DNA used to estimate river otter population (2014, February 28) retrieved 19 April 2024 from
https://phys.org/news/2014-02-animal-forensics-dna-river-otter.html