

Biologists use unique tools to investigate squirrel sounds and gestures

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Thaddeus McRae poses in the Gifford Arboretum with his remote-controlled cat, after being interviewed by WSVN. Credit: University of Miami College of Arts & Sciences

Everyone has watched squirrels playfully climbing trees, gracefully leaping from branch to branch, and scurrying across parks. Thaddeus McRae, Ph.D '12, adjunct assistant research professor of biology in the University of Miami College of Arts Sciences, has taken these observations to a scientific level.

McRae studied squirrel colonies on the Coral Gables campus to see how their sounds and tail movements differ in response to different kinds of threats. He is looking to discover why squirrels interact using both vocalizations and gestures.

"These multimodal signals, which simultaneously send information via two or more sensory modalities to communicate, are ubiquitous," McRae said, adding that people and other mammals, birds, insects and spiders – and even some plants – communicate in this manner.

The different sounds, expressions and gestures might "reinforce each other, or maybe they contain different information, or maybe they reach different audiences," he said.

To conduct his research – the basis of his Ph.D. dissertation – McRae designed a unique tool: a remote-controlled cat, which he used to chase squirrels while recording their reactions to ground-based predators. Gliders painted to resemble hawks showed the squirrels' responses to threats from the air.

McRae has become somewhat of a local celebrity scientist, with recent and upcoming stories about his study appearing on the Miami New Times "Riptide" blog, and WSVN. He sees three reasons for this media attention.

Squirrels "are often most abundant in the same places people are most abundant," McRae said, adding that they're "cute and fuzzy with a bushy

tail, which for some people goes a long way toward earning goodwill."

He also conducted his research in a "very public setting, outdoors on UM's campus in the middle of the city." McRae believes that this helps to breakdown the "mysterious aura" of science, "putting scientific curiosity out there where passersby can see it and become curious themselves."

Finally, he admits that "there's something a little bit humorous" about his research process and his unusual tools.

"To me, this squirrel study isn't cool because I used remote control cats, although enjoying whatever tools you use is nice, it's cool because we learned something about squirrels that we didn't know before," McRae said.

Over two years of observation McRae, working closely with Professor of Biology Steven Green, found that he could quite accurately predict what type of predator was threatening a squirrel by analyzing its sounds and tail movements.

He measured the response of three distinct squirrel sounds: the "kuk" (a short bark), the "quaa" (a longer squeal) and the "moan" (a whistling sound).

He also looked for specific patterns for tail motions in combination with these noises. The "twitch" involves a controlled movement in an arc shape, while the "flag" can take the shape of an arc, figure eight, circle or squiggle.

McRae theorizes that the squirrels use the vocal and tail alarm calls for two purposes – to let predators know that they have been spotted, and to warn other squirrels of danger in the area. To this end, he is now

conducting follow-up research to determine how [squirrels](#) react to distress signals from their peers.

For both his current study and his dissertation research, McRae has worked extensively with undergraduate research assistants.

"I try to give them a taste of various steps in the process, from thinking about the organisms and asking questions, to collecting data, to the sometimes tedious task of converting those data into analyzable form, to drawing conclusions. I share with them the joy of discovery," he said.

"Even a small, fast research project can show us something we never knew before. It may not shake the earth, but it's another tiny piece of understanding. ... For a young student to be one of the first handful of people on Earth to share even a small discovery is, frankly, freaking awesome."

Provided by University of Miami

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