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An ocelot in South Texas with rodent prey. Ocelots are federally endangered in Texas, with as few as 120 individuals remaining in the United States. Ocelots are at risk to anticoagulant rodenticide exposure due to small rodents being their primary prey items.

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Could Use of Rat Poisons Be Affecting Non-target Wildlife in South Texas?

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If you were looking to contain a pervasive rat or mouse problem, what would you do? Many Texans, as well as businesses and local governments, will turn to the deployment of rodent baits to get rid of the problem once and for all. These baits are commonly sold in pellet or block form or even as bait stations, which are designed to keep out domestic animals such as cats and dogs and only allow entry to animals that are rat-sized or smaller. The rodents will ingest the poison-laced bait and, over the course of hours or days, will hopefully be a problem no longer.

Sounds like an open and shut case, right? Well, scientific studies are popping up all over the United States that suggest that, while the targets of rodent baits are rats and mice, the poisons used in these baits can impact other species in the

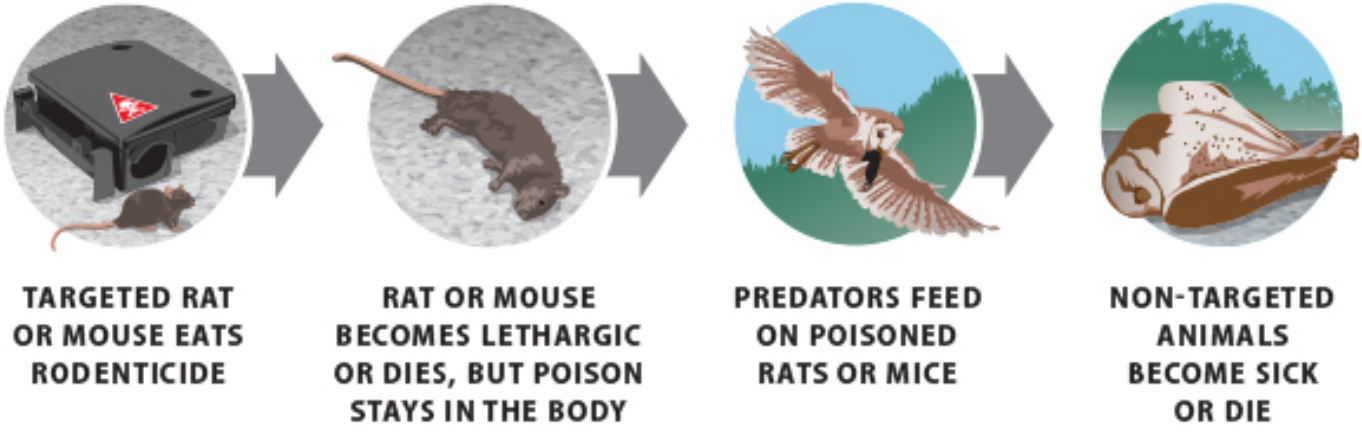
food web. And we have new research from South Texas that sheds a bit more light on these potential risks.

First, let's talk about how rodent baits work. The products sold at places like Tractor Supply, Lowe's, and Home Depot generally contain food that is attractive to rodents but also come laced with lethal compounds. These compounds are called "anticoagulant rodenticides," also referred to by the acronym ARs, and work by preventing the body from forming clots, leading to internal hemorrhaging and death.

Importantly, there are two levels of AR potency: first-generation, which are less potent and therefore require multiple feedings to be effective, and second-generation, which are lethal from a single dose and designed in response to rodents developing a tolerance to the first-generation compounds. The high lethal dosage of the second-generation compounds makes them particularly effective at fulfilling their purpose (killing rodents!), but linger at high doses longer in the rodent's body.

Most research into unanticipated impacts of ARs has involved avian scavengers, particularly raptors. A review led by researchers at Hokkaido University, Japan, found that at least 60% of individuals of various raptor species globally, including bald eagles, golden eagles, great horned owls, barred owls, long-eared owls, and turkey vultures here in the United States, had detectable levels of ARs in their tissues. Only more recently has attention shifted to mammals.

A recent global review of anticoagulant rodenticide exposure in wild carnivores, led by Meghan Keating at Clemson University, showed that eight families of carnivores had been exposed to ARs. The three families most exposed were mustelids (e.g., weasels, badgers, and martens), canids (e.g., wolves and coyotes), and felids (e.g., bobcats, lynx, and large-bodied wild cats such as jaguars and African lions). In addition, they found that ARs caused death to at least one individual in about one-third of studies.



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Overview of how anticoagulant rodenticides (ARs) can impact species in other parts of the food web, such as mammalian and avian predators and scavengers.

If you use rodenticides and are curious about whether the products you use are first-generation or second-generation, check out the label. Common first-generation compounds include warfarin and diphacinone, while common second-generation compounds include brodifacoum, bromadiolone, and difethialone.

A key thing to understand about the second-generation rodenticides is that, because they persist longer in rodent tissues, they also expose predators, such as bobcats, coyotes, and ocelots, and scavengers, such as vultures and caracara, that consume these rodents to that same high dosage of lethal compounds. These non-target wildlife species can die from eating poisoned rodents, or experience sublethal effects such as liver damage, internal hemorrhaging, poor immune response, and reproductive complications. As an example, work led by Dr. Seth Riley in California showed that exposure to ARs, in conjunction with mange, led to a decline in bobcat survival.

Given the growing evidence that anticoagulant rodenticides represent a pervasive issue among carnivores that feed on rodents, we at the Spatial and Population Ecology of Carnivores (SPEC) Lab, Caesar Kleberg Wildlife Research Institute, Texas A&M University – Kingsville, decided to launch new research to investigate this issue. This research was led by me and master's student Tori Locke, who successfully defended her thesis this past fall and will be continuing her studies in my lab as a Ph.D. student.

Tori's work answered two questions: (1) Have carnivores in South Texas, namely bobcats, coyotes, and endangered ocelots, been exposed to anticoagulant rodenticides? And (2) If yes, are the levels detected in bobcats, coyotes, and ocelots of concern? We mainly tested exposure to ARs via liver tissue, as that is the tissue where AR compounds accumulate. We collected liver samples from deceased animals that were roadkills, harvested by participating landowners, or died as part of our long-term monitoring efforts.

PHOTO BY RECONECTA PROJECT

An ocelot killed by vehicle strike. Our research found that one roadkilled male ocelot had a concentration of one anticoagulant rodenticide compound that was about four times higher than that detected in a bobcat in California that had died from exposure.

Game camera images of coyote and bobcat obtained by the Spatial and Population Ecology of Carnivores (SPEC) Lab, Caesar Kleberg Wildlife Research Institute, Texas A&M University – Kingsville. Both coyotes and bobcats are exposed to anticoagulant rodenticides through consumption of rodents.

Our data collection area spanned approximately 400,000 acres in South Texas and included private rangelands and public lands and roadways. We tested liver tissue from 39 individuals: 18 bobcats, 16 coyotes, and 5 ocelots. Anticoagulant rodenticides were present in 60% (n=3/5) of ocelots, 5.5% (n=1/18) of bobcats, and 25% (n=4/16) of coyotes. The compounds detected were largely second-generation (brodifacoum, bromadiolone, and difethialone), with only one first-generation compound detected (diphacinone). Of concern is that two of the three AR-positive ocelots had all four compounds detected in their liver samples.

Given the above, we knew that all three of our target species (ocelots, bobcats, and coyotes) had been exposed to anticoagulant rodenticides. But were the levels of compounds in these individuals something to worry about? Tori's work suggests that the answer is "maybe", given that the liver sample from one male ocelot had about four times the amount of a second-generation compound found in a bobcat in California that died from toxin exposure. The ocelot in Texas was killed by vehicle strike rather than ARs, but we still don't know what role AR exposure may have played in the animal's death. For example, ARs could increase an animal's susceptibility to injuries that cause internal bleeding.

Thus, we have evidence from South Texas that non-target species such as ocelots, bobcats, and coyotes are exposed to anticoagulant rodenticides. We do not know if this exposure has led to mortalities in South Texas, nor whether the use of ARs will have a negative effect on the populations of these three carnivore species. Tori's work is continuing this year as we try to collect more samples across a wider geographic area. If you are located in South Texas, employ predator control, and are interested in providing tissue samples, please get in touch with us ***victoria.locke@students.tamuk.edu***.

Importantly, our primary goal is to better understand anticoagulant rodenticide exposure in South Texas carnivores. However, we understand that scientific research can also provide new information that may assist with future decision-making. If you are a user of rodent baits, we encourage you to investigate the compounds used and to deploy them judiciously to reduce harm to non-target wildlife. We understand that there are benefits and tradeoffs to everything we do, and that there are often unintended consequences of well-intended actions.

If you are interested in the work that we do on the carnivores of Texas, please visit our research group's website at ***https://thespeclab.weebly.com/*** and the Caesar Kleberg Wildlife Research Institute website.