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Pilot Studies Keep Me Flying High

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ABSTRACT: Those who have been in the field of wildlife damage management very long probably have a file drawer full of half-baked ideas and ill-fated research projects that never should have seen the light of day. This paper will be a tongue-in-cheek look at the scientific method and saving grace of pilot studies. A pilot study is a small-scale test of the procedures to be used in a large-scale study. The goal of pilot work is not supposed to be the testing of hypotheses, but sometimes researchers just can't help themselves. Beware of small sample sizes and the potential for false negative and false positive results. I have been involved in more pilot studies than I care to admit that ended up being a total bust, but there have been some that led to well-informed modifications of study designs and results that were immediately publishable because the variation in resultant data was low and results were clear cut. Pilot studies have expanded my knowledge of systems, study design, methodology, and the behavior of individual animals. I encourage the use of pilot studies in research associated with vertebrate pest management.

KEY WORDS: human-wildlife conflicts, pilot study, research, science, truth, wildlife damage management

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INTRODUCTION

What is truth? This question has been pondered for centuries by philosophers and philanderers, constructionists and cretins, barristers and barstool biologists. Aristotle's time-honored definition of truth, "To say of what is that it is not, or of what is not that it is, is false, while to say of what is that it is, and of what is not that it is not, is true" from about 350 B.C. (David 2005) should set the record straight, but it doesn't. In fact, any mere mortal would be hard pressed to take into account all of the theories and views of truth that have been debated over the years. Bringing it down to my level, Merriam-Webster (2020) define truth as "being in accord with facts or reality." But how do we secure facts and ponder reality? The answer is through research. Research is a systematic process used to gain knowledge. As scientists, we often use the scientific method to establish hypotheses, conduct experiments, collect data, estimate parameters, interpret results, and draw conclusions. Ultimately, we establish mathematical models to describe reality. I know this discourse is fascinating and we could go on, but we need to bring this conversation around to the subject at hand … pilot studies.

A pilot study is a small-scale preliminary test of procedures to be used in a larger research project. It is used to evaluate the feasibility, scope, design, methodology, and cost of a full-scale study. It provides guidance for work to be done. Pilot studies are not supposed to be engaged at the level of testing hypotheses, but sometimes researchers inappropriately use them this way. Since pilot studies are designed to be small and inexpensive, sample sizes typically are small, so any conclusions drawn may lead to false positive results (Type I Errors) or false negative results (Type II Errors), that would be a significant detraction from the truth.

I have been involved in several pilot studies that have resulted in various conclusions. In some, the projects were scrapped. In others we saved considerable funds by using different approaches. In a few, we just let the projects run and enjoyed the fruits of our labors. The objectives of this paper are to provide 1) a brief review of truth, research, the scientific method, and pilot studies, 2) examples of several pilot studies that have been fruitful, and 3) a discussion of how pilots studies can be used to enhance research in the field of vertebrate pest management.

EXAMPLES OF PILOT STUDIES

Lasers for Deer

In the early 2000s, I watched with envy as researchers repeatedly demonstrated the efficacy of lasers in dispersing several species of birds (Glahn et al. 2000, Blackwell et al. 2002, Gorenzel et al. 2002). Of course, being a "deer guy," I had to try it on white-tailed deer (*Odocoileus virginianus*). So, we borrowed a red laser, truck, and a field technician from the National Wildlife Research Center [NWRC, the research branch of the United States Department of Agriculture-Animal and Plant Health Inspection Service-Wildlife Services (USDA-APHIS-WS)] with plans to evaluate the efficacy of red lasers on dispersing white-tailed deer from crop fields. The night before the study was to begin, I took the $6,000 U.S. laser out for a test drive at the Desoto National Wildlife Refuge in eastern Nebraska. In the low moonlight, I spotted four deer about 150 m away in a grassy field. When I shined the red laser on them, they immediately bolted from the field like their tails had been lit on fire. My immediate reaction was, "Wow, we found the Holy Grail of frightening devices!" I continued shining deer (n = 253) that night, but by sunrise not a single other deer had responded to the laser at long range (250 m), short range (25 m), and everything in between. We went ahead with the study anyway, with a well-stated hypothesis and an elegant experimental design with treatments and controls. We spent seven nights in the field and observed no response by deer to shining by a red laser. The variance essentially was zero and the write-up was easy. Reviewer comments were few and the editor of the Wildlife Society Bulletin couldn't wait to publish (VerCauteren et al. 2003).

Of course, deer can't see red, but they can see the blue-green component of the spectrum of light (VerCauteren and Pipas 2003). So, being the eternal optimists, we explored the possibility of using a blue-green laser to disperse deer. It turns out nothing of the sort existed, so we worked with a company to develop a field prototype that could be used on deer. It came to us with wires and components exposed, mounted on a small sheet of plywood. They said it cost them $32,000 to build. We repeated the study done with the red laser to the letter. Same area and fields, same time of year, same truck and technician. Again, we experienced no response by deer to the laser. The variance was essentially zero and the write-up was easy. One week later, we were ready to publish again in the "Journal of Negative Results," but settled for the Wildlife Society Bulletin (VerCauteren et al. 2006a).

The continuous search for frightening devices that disperse deer led us down several dead end roads. Electronic guards, propane cannons, Critter-Gitters, and others fell short of expectations (Gilsdorf et al. 2004b). We came to believe that frightening devices are "for the birds," but not deer. We conducted a review of frightening devices for wildlife damage management and concluded that the greatest opportunities lay in animal-activated and bio-acoustic devices (Gilsdorf et al. 2003). Later we were able to evaluate deer-activated bio-acoustic devices and found them to be effective at dispersing deer (Gilsdorf et al. 2004a, Hildreth et al. 2013). More recently we tested a spank-and-release procedure for deer, with limited effectiveness, and a magnum snap trap, which scares the bejesus out of deer but has not been found socially acceptable.

Fences for Wild Pigs

Wild or feral pigs (*Sus scrofa*) can be a significant problem by damaging crops, disrupting native ecosystems, and transmitting diseases to livestock (Beasley et al. 2018, VerCauteren et al. 2019). Over the years, I collaborated with others on several studies of various fence designs for excluding white-tailed deer (Hygnstrom and Craven 1988, VerCauteren et al. 2006b,c, Lavelle et al. 2010, Hildreth et al. 2012), but we never had the opportunity to test our wares on feral pigs. The opportunity finally came in 2011, with colleagues at Texas A&M University-Kingsville to evaluate the effectiveness of fences for enclosing and confining wild pigs in a simulated disease outbreak. Our first step was a pilot study to determine if any known fence types could contain wild pigs. We released captive wild pigs out of a chute and challenged them with electric poly-tape, electronet, electric high-tensile wire, plastic mesh, and welded-wire fences. Only welded-wire (appropriately known of as "hog panels") kept wild pigs from breeching the fence line. We developed an elegant study with repeated measures to test the ability of hog panel fences to enclose feral pigs under different types of depopulation (stalkers, drivers, shooters, and helicopter gunners). Essentially none of the increasing levels of motivation could blow feral swine out of the hog panel enclosures. This time, it was an eight-week study and we were off to the printers again (Lavelle et al. 2011).

Wild Rice Establishment

I had an opportunity to work with colleagues from the University of Wisconsin-Madison on a noble project on wild rice (*Zizania palustris*) that had ramifications for Native Americans and a struggling cranberry industry. Wild rice is culturally critical to the Ojibwe and other indigenous people but is declining across the upper Midwest. Cranberry acreage and production have increased dramatically in the Midwest, but overproduction has depressed crop prices significantly and has left many producers searching for other options. We developed a pilot study to determine the feasibility of establishing wild rice in marginal cranberry acres. In 2016, we seeded three flowages and one converted cranberry bed with wild rice seed. Wild rice seedlings emerged and were growing well at densities up to 40 stems/m^2. Unfortunately, seven families of Canada geese (*Branta canadensis*) frequenting the area started feeding on the wild rice seedlings and eliminated every single stem. No wild rice grain was produced from any of the flowages or former cranberry beds. I would have (should have) tried to disperse the geese from the area, but "waterfowl use" was one of the metrics we were using to evaluate environmental services provided by the reestablished wild rice. Scratch Year 1. In 2017, we seeded four flowages and two converted cranberry beds with wild rice seed. This year we were ready for the geese. We established six 25-m^2 netted exclosures in the treatment areas and when the geese showed up, we threw the proverbial kitchen sink at them. Consistent use of pyrotechnics moved 56 geese from the area for the entire summer. Wild rice seedlings emerged and were growing well again at similar densities to the previous year. I thought we were in the clear and took a week-long vacation in mid-July. During this break, muskrats (*Ondatra zibethicus*) found the area and went to work. Unbeknown to me, they started clipping the seedlings and cleared the entire stock in two weeks. Again, no wild rice grain was produced from any of the flowages or former cranberry beds. It nearly broke my heart. Without a single grain of wild rice available to compare treatments or develop a paper, all seemed lost, but we did learn that wild rice could be raised in flowages and marginal beds of cranberries. We also learned that it is critical to practice diligent vertebrate pest management in such a system, so we passed that information on in an educational video (https://www.uwsp.edu/cnr/WCW/Pages/Wild-Rice.aspx).

Bat Exclusion

I have been studying the effects of exclusion on the protection of valued resources for a long time, but few have studied the effects of exclusion on wild animals. Considering all of the animals that are excluded from structures, you would think we would know a lot about their response to exclusion by now, but the details largely have escape us (O'Donnell and DeNicola 2010, Stone et al. 2015). I once had a graduate student working on a telemetry study of the now federally listed (threatened) northern long-eared bat (*Myotis septentrionalis*) in Wisconsin. White-nose syndrome dramatically reduced the number of northern long-eared bats across their range and we hoped to add to the collective knowledge of this species in peril. To radio-equip bats, you have to capture them first and our capture rate plummeted from 56 to 23 to 4 over 2015, 2016, and

2017, reflecting the decline in the population (Meyer 2018). So, we had 50 bat transmitters sitting on a shelf at the start of 2019 with nothing to do. Seizing upon the opportunity, I hired three assistants who, simply put, are "bat-crap crazy," to conduct a study on the response of bats to exclusion from fall roost sites. We approached the President of the Wisconsin Wildlife Control Operators (WCO) Association to identify some WCOs in central Wisconsin who might be willing to allow us to capture and radio-equip bats that they were planning to exclude from homes. In Wisconsin, bats cannot legally be excluded from structures from June 1 through August 15 without extenuating circumstances. So, there I was on August 10, climbing up and down ladders and crawling around on pitched roofs setting bat traps to secure a sample of volant volunteers for our pilot study. The bat-crap crazy technicians stayed on the ground. I now know why they invited me along. We captured 23 big brown bats (*Eptesicus fuscus*) from six sites, attached small transmitters to their backs with glue, and released them at the openings to the structure in which they were roosting. The life of these transmitters is only about 10 days, so we followed them with diligence and learned that over half fled the roost immediately and set up shop elsewhere in nearby trees, houses, sheds, and commercial buildings. These results concerned me because the research procedures employed should not affect behavior of the study animals. Clearly ours did. The remaining bats behaved and stayed in their structural roosts until excluded five days later, when they set up shop elsewhere in trees, houses, sheds, and commercial buildings. This is an example of a pilot study that performed perfectly by informing that our procedures were questionable and that we would have to invest a lot more energy, time, and money to divine the the true response of big brown bats to exclusion. Nonetheless, we were able to publish an abbreviated form of our results in a local publication for folks in Wisconsin who are bat-crap crazy (Summers and Taylor 2020).

Elk Hazing with Drones

Back to cervids. For several years, I conducted projects on the use of frightening devices to disperse white-tailed deer from areas (see above), but never was successful with proposals to work some magic on elk (*Cervus canadensis*). Early ideas ranged from sticks and stones to remotely delivered pyrotechnics, but it wasn't until 2018 that I came upon the brilliant idea of using an Unmanned Aerial Vehicle (UAV or the also erringly gender-specific "drone") to haze elk out of crop fields. Scientists in northern Tanzania scooped me by reporting on the use of drones to haze elephants (*Loxodonta africana*) out of crop fields (Hahn et al. 2017). I explored YouTube, looking for videos of drone pilots chasing elk across the landscape, but mostly found operators who were more interested in taking pretty videos of elk rather than scaring them. Not me. I had delusions of grandeur, flying a drone like a crazed fighter pilot, zooming directly at the faces of elk and ultimately their tails as they ran away in fear of this freaky aerial predator. After more searching, I found a video by a drone that was used to chase about 20 mule deer (*O. hemionus*) out of crop fields (https://www.youtube.com/watch?v=XVL5UoBVEt4). I think the deer are still running. Now, several videos of drones chasing deer can be viewed on YouTube. In 2017, a boneheaded drone pilot caused a stampede of about 1,500 elk for over 1 km from the National Elk Refuge in Jackson Hole, Wyoming (https://trib.com/outdoors/drone-pilot-ticketed-after-sparking-stampede-at-national-elk-refuge/article_0d7ad733-85f0-5a8d-bd9f-e8601317a74e.html).

My thought was, "If they can do it, I can do it," which fueled a collaborative effort with the Wisconsin Department of Natural Resources to explore the use of drones to haze reintroduced elk and disperse them from crop fields in west-central Wisconsin. In 2017, I conducted risk assessments, secured all the necessary authorizations, purchased a drone (good ones are not cheap!), and hired a student to pilot the project. I did not know that the student had to pass a Federal Aviation Administration exam to fly a drone. I guess flying wasn't in his future, because he failed the exam. I hired another student in 2018, this time a certified pilot, but things didn't work out. In 2019, I hired a technician for the project who secured their certification, communicated with landowners, coordinated flight plans, and even talked me into buying a newer and more expensive drone. Then the elk chose to not cooperate. They quit coming out into the crop fields or were doing so only at night. Three years have passed since the pilot study was put into action, and we still have yet to try hazing elk with a drone.

CONCLUSIONS

Pilot studies are a valuable component of research, the scientific method, and the search for truth. I provided several examples of pilot studies that have either worked flawlessly or gone awry, and I suspect the readers of this article, few as they may be, have several others examples that could be added to the list. Pilot studies can help scientists evaluate the feasibility, methodology, and costs of research projects. On occasion, for one reason or another (ok, time and money), I have not been able to implement full-blown studies, but pilot studies have expanded my knowledge of systems considerably. When expanded, they may be repeatable and yield publishable results, but care must be taken to not use pilot studies as a cheap replacement for true hypothesis testing and systems modeling.

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