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Population and Community Responses of Reptiles to Golf Courses

Scientists at the University of Arizona monitor the diversity, distribution, and abundance of reptiles on southwestern golf courses.

BY MATT GOODE



OBJECTIVES

- Examine diversity, distribution, and relative abundance of reptiles using the golf course as habitat.
- Implant radio transmitters into Gila monsters and use fluorescent powder tracking to examine movement patterns, habitat use, and behavioral responses to man-made features of the environment.
- Using radiotelemetry data, examine movement patterns and home range characteristics of tiger rattlesnakes in response to features of the golf course and surrounding residential development.
- Inform residents, golfers, and golf course personnel about local reptiles via interactions in the field and through formal presentations to club members and residents.
- Develop recommendations for golf course designers and managers that can be used to retrofit existing courses and design new courses to maximize benefits to reptiles.

Start Date: 2008

Project Duration: Two years

Total Funding: \$59,994

The demand for golf course communities in Arizona has steadily increased, especially as aging baby boomers transition into retirement. Presently, there is a lack of information on the potential role that golf courses can play in maintaining native reptile populations and communities, especially in arid environments like



(Left) The regal horned lizard (*Phrynosoma solare*) is able to blend into its desert habitat due to its coloration and spiny skin. This lizard primarily feeds upon ants, and it is capable of squirting blood from its eyes several feet to repel predators.

(Below) The tiger rattlesnake (*Crotalus tigris*) is the main focus of the research at Stone Canyon. Factors such as movement, diet, reproduction, and mortality are being analyzed to determine how these snakes are affected by the golf course and surrounding development.

(Bottom) A tiger rattlesnake is undergoing surgery to receive a radio transmitter implant. Over the course of the study at Stone Canyon, nearly 80 tiger rattlesnakes have been tracked using radiotelemetry.

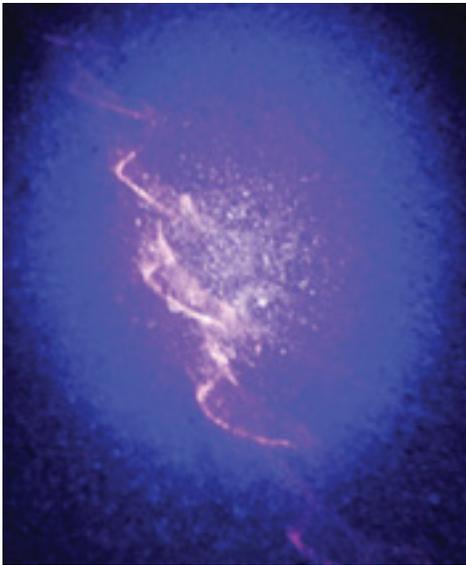
the southwestern United States. The more information we know about designing and managing golf course communities, the better we will be at maximizing the benefits that golf courses can provide for wildlife. We hope to strengthen these potential benefits by means of education and involvement of golf course professionals and the local community, and through development of recommendations for both retrofitting and design of new courses.

During the past year, we used mark-recapture to determine relative abundance and distribution of reptiles living on golf courses in Arizona. To date, we have documented literally thousands of tortoises, snakes, and lizards living on various features of golf courses. Using high-resolution imagery, we are analyzing distribution and abundance data in the context of landscape structure. We are finding that certain parts of the golf course are used by certain species, while others are avoided. For example, irrigated vegetation along fairways and surrounding greens and tee boxes are used well out of proportion to their availability, while open fairways appear to be avoided, especially by snakes. Areas of the golf course where natural desert has been incorporated into the design of the course correspond to areas of greater relative





(Left) Matt Goode holds a recently captured Gila monster (*Heloderma suspectum*). At Stone Canyon, the movements of Gila monsters are tracked using radiotelemetry and fluorescent powder tracking. (Right) Data from 102 Gila monster powder tracks greatly bolstered our data set. The technique involves the use of fluorescent powder applied to the Gila monster by gluing rabbit fur onto its belly and loading up the fur with the powder.



After loading the Gila monsters with fluorescent powder and allowing them some time to move about, researchers return after dark with a UV light and follow their exact tracks.

abundance of most species. Data on how reptiles use golf course features can be used in a practical way when trying to increase compatibility with reptiles, in particular, and wildlife in general.

We have been radio tracking Gila monsters to gain a better understanding of how they are responding to the golf course and its surroundings. We have observed a clear pattern of use by Gila

monsters, characterized by general avoidance of open fairways and other areas of turf. However, Gila monsters tend to spend more time on the edges of fairways and greens, presumably searching for prey in the dense, irrigated vegetation. We have observed individual Gila monsters change the location and use of their home ranges as newly constructed homes become more common. Interestingly, the Gila monsters have started to concentrate more of their activity in areas immediately adjacent to the golf course that are off limits to development.

Although radiotelemetry is an excellent tool for tracking the movements of Gila monsters, you can only obtain information on the animal's location by physically following its signal. In 2008, we began using a new technique that allows us to quantify the exact movement path taken by a Gila monster. This past year, we obtained data from 102 Gila monster powder tracks, greatly bolstering our data set. The technique involves the use of fluorescent powder that we apply to the Gila monster by gluing rabbit fur onto its belly and loading up the fur with the powder. After allowing the Gila monsters some time to

move about, we come back after dark with a UV light and follow its exact track. This technique allows us to determine if Gila monsters are avoiding certain features of their habitat, such as fairways and roads. Using radiotelemetry, we only get the straight-line distance between successive fixes, but fluorescent powder allows us to determine the exact distance moved. So far, we have found that Gila monsters typically move up to two times farther than their straight-line distances would indicate.

We added data from an ongoing, long-term study of tiger rattlesnakes to our objectives. This data set includes information from more than 60 individual snakes, located more than 8,000 times, which is an unprecedented sample size for snake radiotelemetry. We have observed changes in home range size, use, and configuration in response to both features of the golf course and the construction of new homes. This data set, which goes back to 2002, will add a rich context in which to examine the response of reptiles to golf courses and our ability to identify features of the golf course that maximize compatibility and coexistence.

CONNECTING THE DOTS

An interview with DR. MATT GOODE, University of Arizona, regarding his reptile research on southwestern golf courses.

Q: What reptile species are you commonly finding on southwestern golf courses?

A: The primary golf course where we have been conducting research is very diverse with regard to reptiles. We have documented 21 snake species, 15 lizard species, and one turtle species, the desert tortoise. Snake species include everything from tiny blindsnakes that look like worms, to gopher snakes that can grow to more than seven feet long. Lizards include strictly nocturnal species like the banded geckos to the iconic and venomous Gila monster. We also have three rattlesnake species present.

Q: Is historical data available regarding reptile populations for undeveloped landscape in that area?

A: Stone Canyon is a mosaic of different land use types and includes developed and non-developed areas. We have some historical data on reptiles from 1995 before the area was developed, but most of those data are part of another study funded by the Arizona Game and Fish Department. Those results also will be available and useful in enhancing our understanding of how reptiles respond to golf courses.

Q: Do your data suggest that the number of reptiles or the population mix of reptiles observed on the golf course differ greatly from undeveloped landscape?

A: Our data indicate that the abundance of certain reptile species increases on the golf course, but the overall diversity of species decreases over time. Certain species really like the golf course environment, so they become more numerous. We need to figure out ways to maximize reptile diversity on golf courses, or we risk creating a less diverse community comprised mostly of species that do well around people.

Q: To what extent does residential housing affect reptile populations compared to golf courses only?

A: Traditional housing development severely affects biodiversity of those areas, reducing the wildlife populations to a few species that are well adapted to human-dominated landscapes. In more naturalistic settings such as Stone Canyon, biodiversity is not compromised as much. There will always be an effect on wildlife populations when humans alter the environment, but, as in the case of some golf courses, we can design our developments to lessen our impact. In the end, it seems likely that the impact from residential development will be greater than the golf course component.

Q: What features of the golf course landscape attract reptiles and what reptile species are affected the most?

A: In environments like the Sonoran Desert where water is a limiting factor, there is a stark difference between the natural landscape and the golf course. Reptiles and other wildlife are drawn to the course due to the increased abundance of resources caused by the increased presence of water. More water means more plants, which means more seeds that lead to more rodents. And, of course, more rodents means more snakes. Everything is connected via a complex food web.

Q: To what extent are Gila monsters, rattlesnakes, or other reptiles a threat to golfers?

A: The threat that venomous reptiles pose to golfers is minimal. There has never been a legitimate bite documented from a Gila monster, which means a bite that was not received from handling or harassing the animal. As long as golfers exercise caution and common sense when retrieving lost balls, the threat is very small. Golfers should not stick their hands into thick brush or under rocks and should always watch where they step while off-course. Even if you come across a rattlesnake that is in a defensive posture and rattling, as long as you step away from the snake, you don't run the risk of getting bitten.

Q: The tracking powder technique is fascinating. Have you used it for other species in addition to Gila monsters?

A: The powder tracking technique is actually a fairly common way to track secretive animals because of the detailed information it can provide regarding an animal's path. It was developed in the 1980s as a way to track small mammals such as mice. Other researchers have since adapted it for use with everything from birds to lizards to frogs.

Q: Are those who play golf at dusk more likely to encounter reptiles?

A: It really depends on the season. In the summer months, most of the reptiles at our site will start becoming active around dusk. Golfers who are playing around dusk in the summer are more likely to encounter reptiles than they would be in the spring or fall. In the spring or fall, it is the golfers who are out in the late morning or afternoon who are more likely to encounter reptiles due to the cooler temperatures at dusk during these months.

Q: What is your general message to residents, golfers, and golf course personnel about local reptiles?

A: We would like to emphasize that reptiles are an integral part of the ecosystem, no matter if it is on a golf course or in a nature preserve. Reptiles make up a large portion of the wildlife in the Sonoran Desert. We hope that the people who chose to live in the desert view reptiles as an amenity to be conserved as much as any other resource in the Southwest.

JEFF NUS, PH.D., manager, Green Section Research.

SUMMARY POINTS

- Reptile species vary in their use of golf course features, but most species tend to avoid open fairways.
- We have observed a greater abundance of reptiles using thick, irrigated vegetation adjacent to fairways and greens.
- The placement and layout of the golf course helps to determine the distribu-

tion of reptiles, and certain species alter their distributions to take advantage of irrigated vegetation and natural areas that are incorporated into the golf course as hazards or rough.

- Using radiotelemetry and fluorescent powder tracking, we have determined that Gila monsters tend to avoid open fairways and tend to utilize irrigated areas along the edges of the golf course out of proportion to their availability.

- Tiger rattlesnakes change the configuration of their home ranges to accommodate features of the golf course and newly constructed homes.

RELATED INFORMATION

<http://turf.lib.msu.edu/ressum/2008/79.pdf>

MATT GOODE, PH.D., research scientist, Wildlife Conservation and Management, School of Natural Resources, University of Arizona, Tucson, Ariz.