Establishing Field Camera Trap Protocol to Monitor Gopher Tortoises at Okeeheelee Park

[1]James Rowland

[1] This paper and my academic career as it is currently would not be possible if it wasn't for my instructors and one of my key mentors who is also a dear friend, Doctor Valerie Burks. Valerie, you've been one of my inspirations for what honors could be. You have always been willing to lend an ear and provide review and commentary of work, thank you.

Abstract

This paper explores camera trap protocol and results of deployment to evaluate the success of relocation projects conducted by Russell Burke and various follow up studies. The purpose of this data is to help park officials with management of the gopher tortoise population at Okeeheelee Park. The questions posed for this and future studies include: What is the home range of the gopher tortoise? How many gopher tortoises can the park support? Are relocation efforts truly a success? Are predators reducing the number of hatchlings? Are tortoises reproducing successfully? The camera trap is used specifically to address questions on predation, mating and the activity level of the tortoises.

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Introduction

The purpose of this project is to report on and recommend protocols on the use of field camera traps for Gopher tortoise burrow monitoring at Okeeheelee Park. Russell Burke, in 1985 relocated the current turtle population to Okeeheelee Park Nature Center due to increased development in the area (1989). As part of the study, eighty-five tortoises were relocated, then there was a follow up visit two years later. Thirty-five of those were recaptured. They did find hatchlings and suspected that the population was viable. A later study of the population at Okeeheelee noted the concern about the viability of the population due to lack of recruitment. Specifically they only found two large juveniles during their study, compared to juveniles comprising 30% of the population with the 1985 study (Ashton and Burke 2007). These results led to the Okeeheelee Park Nature Center's proposal for continued research to answer the following questions

1. What is the home range of our gopher tortoises?
2. How many gopher tortoises can Okeeheelee's pine flatwood forest comfortably support?
3. Is the gopher tortoise relocation and introduction truly a success?
4. Are other factors such a large numbers of raccoons and other predators diminishing the number of hatchlings?
5. Are gopher tortoises reproducing successfully?

The use of a camera trap, cannot answer all the questions but it can contribute to the answering some, as part of the larger project. The camera trap can monitor burrows for predation -- were a large number of predators detected in the shot? -- which helps to answer question four. The

camera can also be used to answer questions three and five through observation of mating, nesting and general activity levels.

Okeeheelee Park is located on the corner of Forest Hill Boulevard and the Florida Turnpike in West Palm Beach, Florida. It comprises a total of 1,700 acres, primarily focused on public service with an equestrian center, public golf course, lakes for water sports, soccer fields, a BMX track, and the nature center. The nature center itself is a total of ninety acres at the back of the park. On the site, they have an interpretive visitor's center to help educate the public, and there are paved walking trails throughout the park. These trails serve as access points to allow visitors to explore the pine flatwoods ecosystem of the park.

Literature Review

To learn from what else has been done in the field, a literature review was conducted on two major tracks of thought: what we can learn from previous uses of field traps and more general field trap techniques. Overall, the articles on both tracks provided a good foundation for future information and an insight into the habits of gopher tortoises.

Through other uses of field traps to monitor gopher tortoises, it may be established how many hours they are normally active. According to one of the studies, they are normally active between 0700 and 1800 hours, with longer but rarer intervals in the morning, and more common but shorter intervals in the afternoon. (Alexy, Brunjes, Gassett, & Miller, 2003 p. 1240) In the same study, they did find a correlation between temperature and activity level. Specifically, "Foraging activity is related to temperature, with most activity occurring during the warmest part of the day" (Alexy, et al., 2003 p. 1240). The equipment used was a combination of infrared triggers "placed at six active burrows in three longleaf pine stands with two per stand from April

6 until June 20 1998" (Alexy, Et Al 2003. p.1241). They still used the traditional 35mm cameras for taking photographs.

A review of the history of remote photography for monitoring wildlife proves a long and viable history as a research tool. According to another study that delved deeply into the subject, "Remote photography enables the study of phenomena that are difficult to address through traditional methods of observation or capture. Photographs of elusive species are impressive and appealing and can be useful for educational purposes" (Cutler & Swann, 1999 p 571). The trends found in the study match the objectives of observing predation, mating, and activity levels. Specifically, out of one hundred and seven papers that they reviewed, common objectives included: "nest predation (21%), feeding ecology (18%), nesting behavior (18%), description of evaluation of remote photography equipment (18%), using remote photography to study activity patterns (12%), to study population parameters (7%), or to detect the presence of a species (6%) were less common" (Cutler & Swann 1999, p. 572-573). One important aspect that Cutler and Swann's review did contain was asking where predators avoid an area where camera traps are present. In a previous study, Leimgruber et al (1994) came to conclusion that the cameras did not affect the predation rates of ground based nests (Cited in Cutler & Swann, 1999 p.574). The other key conclusion of their research was that the use of camera traps saves money compared to having to pay researchers to sit in a field blind for observation purposes; it also records the exact time. A camera is also less invasive to the environment than setting up a blind. The primary downside to the use of camera traps is the fact that there is more of a risk of technical failure.

Another study take took place in southwestern Georgia to determine the mating habits of tortoises in relation to the distance in social interactions. Researchers found through various methods, including a camera system that used pressure sensitive pads, live trapping, and

observations from a tree stand that, "The degree to which female Gopher tortoises are isolated at the Green Grove site does carry measureable social consequences; an isolated female experiences fewer visitors than aggregated ones" (Boglioli, Guyer, & Michener, 2003 p.849). The same study and other studies have supported the idea that most tortoises do not travel more than 30 meters from their burrow. Their use of a camera trap was fairly successful with sixty-eight percent of their photos having some tortoise activity: "A total of 17,712 photos were taken, of which 12,165 contained at least one tortoise. The average time over which a camera recorded activity was 117 days, with a minimum of 58 and a maximum of 138. For the 20 females observed with cameras, 286 visits, 82 interactions, 145 courts and 162 mounts were captured on film" (Boglioi, Guyver, & Michener, 2003 p. 848) .

An older study by Danielson, Degraaf, and Fuller (1996) provides another option for additional field cameras at a reasonable price. It outlines the steps to design a field camera trap for less than one hundred and ten dollars using a 35mm camera. It could be modified to work with today's digital technology. The costs of digital camera traps have become low enough that it might be about the same price.

A final use in the exploration of other field camera uses would be move toward a web-based digital camera or a web cam. One of the studies researched used a simple digital camera in a security case, connected to a laptop, with a satellite phone and solar panels to upload the pictures automatically to the internet (Locke, Cline, Wetzel, & Pittman, 2005). Web-based access allows review of the photos from anywhere. The downside of the system is its high cost, $12,000 in 2005 - a figure that is impractical for most research purposes

Methods

As mentioned in the introduction, the primary purpose in using a camera trap was to observe predation, mating, and the general activity levels of selected burrows. The camera trap used was a camouflaged Bushnell Trail Sentry utilizing a high capacity secure digital card and equipped with infrared photography in addition to the normal lenses. The trap was triggered by a motion detector and took shots upon the detection of any motion still occurring after the trap has been activated for two minutes. Once the photographs were taken, they were transferred from the SDHC card to a laptop for visual analysis. The data sheets (Appendix A) for the study recorded the basic identifying information and a description of the activity, or lack thereof, in the photograph.

The active part of the survey ran from 12 September 2009 through 6 November 2009. The camera was placed on two female tortoise borrows, with three major photo collection periods during that time with the last on November 19th. As part of the survey, photographs from a test deployment over the summer from 27 June to 29 June 2009 were also reviewed.

Results

The results of the survey resulted in two hundred and ninety photographs, forty-three with at least one tortoise present, two with other mammals, and the rest with no presence of animals. The first group of analyzed photos from the female tortoise burrow F7 had seventeen photos. There were no tortoises and there was one picture of a raccoon. The other photos from that period were strictly foliage or pictures of setup. In a spread of seventy-three photographs, the most active burrow during the study period was F18,. Twenty nine had tortoises present, six photos with multiple tortoises present. The rest were strictly foliage. The final borrow in the study was F12 had two hundred photos taken in the last weeks of the study. There was one good

photo of a tortoise, and fourteen pictures with tortoises present at this burrow. There was one picture of a possible predator - a tan and orange cat.

Conclusions

The goals of monitoring predation, mating, and tortoise activity were fulfilled. Based on the number of photos of predators, the specific burrows do not appear to be suffering from over predation at this time. Mating and activity levels of the tortoises at the park seem to be high at very least at burrow F18. (About 40% of the photos have some tortoise activity from that site.) One sad trend: while mating was noted at the burrows, there were no hatchlings or juveniles in any photograph taken. All were fair sized adults. So while predators were detected, it is hard to conclude whether the low numbers of predators detected (less than 1%) was a cause of no hatchlings, or other food sources near the burrows, or if there actually are no hatchlings due to predation.

The results of the camera trap do support our observations in the field with a number of adult tortoises found but no hatchlings or juveniles. The camera trap did prove itself a viable tool for continued monitoring of burrows and the results can be incorporated into the larger project. For future studies based on the literature reviews and fieldwork, continued use of camera trap is highly indicated. Consideration should also be given to the use of web-based technology. The latter would involve an initial cost; but, once it is set up, a still or motion camera could allow remote field monitoring and help educate the public further via the Nature Center's website. Once established, there should zero to low residual costs. Given the urban nature of Okeeheelee Park, the costs should be lower than the project mentioned in Locke, et al . Another useful path to pursue for future studies is the grant from Sand Piper Technologies for the use of a burrow

camera for a year, instead of purchasing the camera (Martin 2005 p. 2). This would allow a better means for verifying the presence of tortoises in the burrow.

Works Cited

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Appendix A: Photo Datasheets

CAMERA TRAP DATA SHEET **PROJECT BSC1050L Fall 2009 (2010-1)** **SHEET NO. 1 OF 1**

DATES OF CAMERA DEPLOYMENT: BEGINNING: DATE 6/27/2009 TIME 11:46:00 END: DATE 6/29/2009 TIME 04:27:35

BURROW NO. F7 QUAD V1 SD CARD 1

FILE FOLDER Field Trap/ Card 1/6-29-2009 SITE DESCRIPTION Pine Scrub, Mild Cover, several pine trees, minor charred remains

GPS COORDINATES: ____________________ REVIEW CONDUCTED BY: James Rowland

NOTES: ____

Photo No.	Date	Time	Tort Pres? (Y,N)	Tort No.	Tort Activity	Other Tort No.	Nesting? (Y,N)	Pred. Act? (Y,N)	Other Activity?	Notes
0010	6/27/2009	17:20:29	N				N	Y	Raccoon	

Sheet 1 of 2

CAMERA TRAP DATA SHEET **PROJECT BSC1050L Fall 2009 (2010-1)**

DATES OF CAMERA DEPLOYMENT: BEGINNING: DATE 10/17/2009 TIME 09:11:15 END: DATE 10/21/2009 TIME 22:54:01

BURROW NO. F18 QUAD V1 SD CARD 1

FILE FOLDER Field Trap/ Card 1/10-24-2009 SITE DESCRIPTION Pine Scrub, Nice Cover

GPS COORDINATES: _____ REVIEW CONDUCTED BY: James Rowland

NOTES: _____

Photo No.	Date	Time	Tort Pres (Y,N)	Tort No.	Tort Activity	Other Tort No.	Nesting (Y,N)	Pred. Act (Y,N)	Other Activity	Notes
0029	10/17/2009	12:04:32	Y	N/A	Yes	N/A	N	N		Tortoise Entering Burrow
0030	10/17/2009	13:25:19	Y	N/A	Yes	Yes	N	N		Tortoise Mounting another Tortoise, no ID Found
0031	10/17/2009	13:52:59	Y	N/A	Yes	No	N	N		Tortoise, in Frame, but not fully visible
0032	10/17/2009	14:01:12	Y	N/A	Yes	No	N	N		Tortoise at Burrow
0034	10/17/2009	16:03:34	Y	N/A	Yes	No	N	N		Tortoise entering Burrow
0045	10/20/2009	12:10:19	Y	N/A	Yes	No	N	N		Tortoise leaving burrow
0046	10/20/2009	13:10:15	Y	N/A	Yes	No	N	N		Tortoise at Burrow
0047	10/20/2009	13:10:55	Y	N/A	Yes	No	N	N		Tortoise entering Burrow
0048	10/20/2009	13:11:59	Y	N/A	Yes	No	N	N		Tortoise entering Burrow
0049	10/20/2009	13:18:05	Y	F18	Yes	No	N	N		Tortoise leaving Burrow
0050	10/20/2009	13:19:53	Y	N/A	Yes	Yes	N	N		Tortoise Mounting another Tortoise, No ID Found
0051	10/20/2009	13:20:53	Y	N/A	Yes	No	N	N		Tortoise leaving burrow
0052	10/20/2009	13:31:29	Y	N/A	Yes	Yes	N	N		Tortoise Mounting another Tortoise, No ID Found
0053	10/20/2009	13:32:30	Y	N/A	Yes	No	N	N		Tortoise entering burrow
0055	10/20/2009	13:40:12	Y	N/A	Yes	Yes	N	N		Tortoise Mounting another Tortoise, No ID Found
0056	10/20/2009	13:40:49	Y	N/A	Yes	No	N	N		Tortoise at burrow

Sheet 2 of 2

Photo No.	Date	Time	Tort Pres (Y,N)	Tort No.	Tort Activity	Other Tort No.	Nesting (Y,N)	Pred. Act (Y,N)	Other Activity	Notes
0058	10/20/2009	14:39:04	Y	N/A	Yes	No	N	N		Tortoise entering burrow
0059	10/20/2009	14:44:51	Y	N/A	Yes	No	N	N		Tortoise Investigating Camera
0068	10/21/2009	12:00:49	Y	N/A	Yes	No	N	N		Tortoise entering burrow
0070	10/21/2009	13:58:34	Y	N/A	Yes	No	N	N		Tortoise at burrow
0071	10/21/2009	14:02:05	Y	N/A	Yes	No	N	N		Tortoise entering burrow
0082	10/21/2009	15:13:30	Y	N/A	Yes	No	N	N		Tortoise at burrow
0084	10/21/2009	15:25:04	Y	N/A	Yes	No	N	N		Tortoise at burrow
0085	10/21/2009	15:33:43	Y	F18	Yes	No	N	N		Tortoise leaving burrow
0086	10/21/2009	15:42:20	Y	N/A	Yes	No	N	N		Tortoise entering burrow
0087	10/21/2009	15:48:53	Y	N/A	Yes	No	N	N		Tortoise entering burrow
0089	10/21/2009	16:17:25	Y	F18	Yes	No	N	N		Tortoise leaving burrow
0092	10/21/2009	16:43:59	Y	N/A	Yes	No	N	N		Tortoise entering burrow
0093	10/21/2009	17:24:23	Y	N//A	Yes	No	N	N		Tortoise entering burrow

Sheet 1 of 2

CAMERA TRAP DATA SHEET **PROJECT BSC1050L Fall 2009 (2010-1)**

DATES OF CAMERA DEPLOYMENT: BEGINNING: DATE 10/24/2009 TIME 11:00:18 END: DATE 10/28/2009 TIME 01:17:38

BURROW NO. F12 QUAD V1 SD CARD 2

FILE FOLDER Field Trap/ Card 2/11-4-2009 SITE DESCRIPTION Pine Scrub, Grasses,

GPS COORDINATES: ____________________ REVIEW CONDUCTED BY: James Rowland

NOTES: ____________________

Photo No.	Date	Time	Tort Pres? (Y,N)	Tort No.	Tort Activity	Other Tort No.	Nesting? (Y,N)	Pred. Act? (Y,N)	Other Activity?	Notes
0075	10/27/2009	13:29:00	Y	N/A	Yes	N/A	N	N		Tortoise near burrow, no ID visible

Sheet 1 of 2

CAMERA TRAP DATA SHEET **PROJECT BSC1050L Fall 2009 (2010-1)**

DATES OF CAMERA DEPLOYMENT: BEGINNING: DATE 10/31/2009 TIME 10:15:08 END: DATE 11/06/2009 TIME 20:43:33

BURROW NO. F12 QUAD V1 SD CARD 1

FILE FOLDER Field Trap/ Card 1/11-19-2009 SITE DESCRIPTION Pine Scrub, Grasses,

GPS COORDINATES: _____ REVIEW CONDUCTED BY: James Rowland

NOTES: _____

Photo No.	Date	Time	Tort Pres (Y,N)	Tort No.	Tort Activity	Other Tort No.	Nesting (Y,N)	Pred. Act (Y,N)	Other Activity	Notes
0011	11/01/2009	08:08:26	N	N/A	N	N/A	N	Y		Tabby Cat
0028	11/05/2009	13:48:26	Y	N/A	Y	N/A	N	N		Tortoise lower left corner.
0029	11/5/2009	13:49:19	Y	N/A	Y	N/A	N	N		Tortoise lower left corner.
0030	11/5/2009	13:54:45	Y	N/A	Y	N/A	N	N		Tortoise lower left corner.
0031	11/5/2009	14:00:56	Y	N/A	Y	N/A	N	N		Tortoise lower left corner.
0032	11/5/2009	14:02:26	Y	N/A	Y	N/A	N	N		Tortoise lower left corner.
0033	11/5/2009	14:35:01	Y	N/A	Y	N/A	N	N		Tortoise lower left corner.
0049	11/6/2009	10:37:08	Y	N/A	Y	N/A	N	N		Tortoise lower left corner.
0050	11/6/2009	11:00:39	Y	N/A	Y	N/A	N	N		Tortoise lower left corner.
0090	11/6/2009	16:44:53	Y	N/A	Y	N/A	N	N		Tortoise off frame, center
0091	11/6/2009	16:46:08	Y	N/A	Y	N/A	N	N		Tortoise off frame, center
0092	11/6/2009	16:47:33	Y	N/A	Y	N/A	N	N		Tortoise off frame, center
0093	11/6/2009	16:50:37	Y	N/A	Y	N/A	N	N		Tortoise off frame, center
0094	11/6/2009	16:51:39	Y	N/A	Y	N/A	N	N		Tortoise off frame, center