39th Annual Gopher Tortoise Council Meeting

Program

October 12-15, 2017

National Wild Turkey Federation

Edgefield, South Carolina

Acknowledgements

The GTC would like to thank the following organizations and people for their help in making sure this meeting is a success. The National Wild Turkey Foundation has graciously provided the use of their facility for the meeting and Friday BBQ social. Thanks to Lynn Lewis and Cathy Marks and the staff of the NWTF for providing access and assistance during the planning and at the meeting. Thanks to SCDNR staff Jonathan Cooley, Trapper Fowler, Barry Kesler, Wade Kalinowsky, Michael Small and Derrell Shipes for support during the planning process, meeting, and the field trip to Aiken Gopher Tortoise Heritage Preserve. Kurt Buhlmann and Tracey Tuberville for guidance on hosting a meeting in the Aiken/Edgefield area and for assistance with Sunday's field trip. Mark Conrardy (SCDNR) for designing the 2017 GTC t-shirt. Staff of Newberry Hall, Aiken Center for the Arts, Don Odum and Jody Schaffer helped ensure everyone is sufficiently well fed. Special thanks to the GTC board for helping plan this meeting and cover many of the details. My thanks to, Lora Smith, Jen Howze, Keri Landry, Betsie Rothermel, Sharon Hermann, and Don Stilwaugh who helped with innumerable tasks, answered email after email, and phone call after phone call and helped guide me through the meeting planning process. Lastly, thanks to Michelle Dillman who's attention to detail kept the meeting on track. This meeting could not have been planned without each you, thank you!

Keynote Speaker - Dr. Whit Gibbons

Whit Gibbons is Professor Emeritus of Ecology, University of Georgia and the Savannah River Ecology Laboratory (SREL). Whit is author or editor of 25 books on herpetology and ecology and has published more than 250 articles in scientific journals. He has had commentaries on National Public Radio, written more than 1,000 popular articles for magazines and newspapers, including *Ecoviews*, a weekly environmental column distributed by the New York Times Regional Newspaper Group. For 30 years he wrote the Annual Summary of Zoology for *Encyclopedia Britannica.* In 1993 he wrote the merit badge booklet *Reptile and Amphibian Study* for the Boy Scouts of America. Whit's emphasis is on the importance of reptiles and amphibians in ecological research and environmental awareness. His latest book is *Snakes of the Eastern United States*.

Abstract- UPLAND SNAKES AGAIN:
WHY DO WE STILL HAVE SO MANY MYSTERIES?

Snakes are the quintessential hidden biodiversity among reptiles. Most lizards and crocodilians have no issue with showing themselves. Basking turtles are a common spectacle, and gopher tortoises leave their mark even when they are out of sight. But upland snakes go unseen most of the time, leaving little evidence, aside from a shed skin or track in the sand. What makes them different? Despite extensive research, many mysteries remain unsolved and basic questions go unanswered. Why do we know so little about these reptiles that share upland habitats with gopher tortoises?

Some scientists believe that humans innately fear snakes. Others think that ophidiophobia and anti-snake attitudes are taught. Whichever is true, how do we educate the public about these fascinating creatures? These and other snake questions will be addressed, based in part on anecdotal observations and reflections of a herpetologist who caught his first snake before the parents of most GTC members were born.

Gopher Tortoise Council Meeting

Agenda

Friday October 13, 2017

National Wild Turkey Federation, Edgefield, SC

Registration & Sign in Silent Auction Items

8:00-9:00 AM

Welcome and Keynote Address

9:00-9:15 AM	Welcome and Meeting Logistics. **Will Dillman,** GTC Co-Chair
9:15-9:30 AM	Welcome National Wild Turkey Federation. **NWTF**
9:30-10:00 AM	Keynote Address. **Dr. Whit Gibbons**
	Upland Snakes Again: Why Do We Still Have So Many Mysteries?

Session 1 Oral Presentations

10:00-10:20 AM	*International Turtle Conservation here in the Low Country: The Turtle Survival Alliance.* **Nathan Haislip** and Clinton Doak
10:20-10:40 AM	*Georgia's Gopher Tortoise Initiative.* Matt Elliott, **John B. Jensen**, Steve Friedman, and Donald W. Imm
10:40-11:00 AM	*The Use of Farm Bill Programs to Conserve Species and Enhance Habitat.* **Jessica L. McGuire,** M.A. Bush, C. Finley, G.B. Pessoney, M. Sampson, S. Thomas, and J. Thurmond, S. Worley
11:00-11:15 AM	**Morning Break**
11:15-11:35 AM	*Working Gophers: Evaluating Conservation Efforts for Gopher Tortoise on Private Lands.* **Thomas. J. Prebyl***, L. Smith, J. Martin, J. Hepinstall-Cymerman, and C. Moore
11:35-11:55 AM	*The Challenges, Logistics and Competing Interests in Attempting Habitat Restoration at Barefoot Beach Preserve, Collier County, Florida.* **Nora Demers**
11:55-12:15 AM	*Gopher Tortoise Habitat Use of Xeric and Mesic Habitats in South Florida.* **Rachel King,** M.C. Dziadzio, and D. Burr

Lunch at NWTF provided by Park Row Market No.1

12:15-1:30 PM

Session 2 Oral Presentations

1:30-1:50 PM *17 Years later: Changes in Vegetation Structure, Burrow Dispersion and Size-class Distribution at a Gopher Tortoise (Gopherus polyphemus) Site in Alabama.* **Rebecca C. Pudner*** and S.M. Hermann

1:50-2:10 PM *Go Find It! A Scent Detection Dog's First Venture into Gopher Tortoise Conservation.* **Lauren Moscar**, R.J. Lindborg, **J. Rachel Smith***, B.E. Witherington, and A. Savage

2:10-2:30 PM *Investigation of a Mortality Event at Lake Louisa State Park.* **Michelina C. Dziadzio**, Eric R. Sievers, and Deborah Burr

2:30-2:50 PM **Afternoon Break**

2:50-3:10 PM *Hematology and Upper Respiratory Tract Disease Status of Gopher Tortoises in the Abacoa.* **Lauren E. Fremont*,** J.A. Moore, and A. Schaefer

3:10-3:30 PM *Detection of Ranavirus (Frog Virus 3) in Translocated Gopher Tortoises (Gopherus polyphemus) in Northwest Florida.* **Rebecca A. Cozad*,** T.M. Norton, M.J. Aresco, T.D. Tuberville, M.C. Allender, and S.M. Hernandez

Poster Session

3:45-4:45 PM

BBQ Social and Shooting at the NWTF Palmetto Shooting Complex

4:45-8:00 PM NWTF will have skeet/trap open for GTC members to enjoy for a fee until 7:00 pm or dark. Shotguns are available for rent or may be brought to the Palmetto Shooting Sports Complex. Any firearm must be unloaded in a case or with actions open.

Gopher Tortoise Council Meeting

Agenda

Saturday October 14, 2017

National Wild Turkey Federation, Edgefield, SC

Meeting Logistics

9:00-9:10 AM **Will Dillman**

Session 1 – Gopher Tortoise Interactions and Other Upland Species

9:10-9:30 AM *Gopher Tortoise and Burrowing Owl Interactions in a Southwest Florida Urban Landscape.* **John E. Herman**

9:30-9:50 AM *Potential Interactions between Gopher Tortoises and Burmese Pythons in Southwest Florida.* **Kodiak Hengstebeck*,** C.M. Romagosa, P.T. Andreadis, and I.A. Bartoszek

9:50-10:10 AM *Look What We Found! Collecting Data on Other Rare Species during Gopher Tortoise Surveys.* **Matt Stoddard** and M. Elliot

10:10-10:30 AM *Eastern Diamondback Rattlesnake Demography Estimated from a South Carolina Sea Island Population.* **Jayme L. Waldron,** S.M. Welch, J. Cooley, and J. Holloway

10:30-10:45 AM **Morning Break**

10:45-11:05 AM *A Review of Frosted Flatwoods Salamander Sampling and Recovery Efforts at St. Marks National Wildlife Refuge, St. Marks, FL.* **Jonathan Chandler,** W.J. Barichivich, K.M. O'Donnell, T. Peacock, J. Reinman, and S. C. Walls

11:05-11:25 AM *Gopher Frog Calling Phenology.* **Shane Welch,** W. Dillman, and J.L. Waldron

11:25-11:45 AM *The Translocation of Southern Fox Squirrels (Sciurus niger niger) to Parris Island, SC.* **Kate Amspacher***, J. Holloway, E. Wiggers, J. Waldron, and S. Welch

Lunch at NWTF provided by Park Row Market No.1

11:45-1:15 PM

Session 3 -

1:15-1:35 PM *Improving Line-Transect Distance Sampling (LTDS) for Gopher Tortoise (Gopherus polyphemus) Populations.* **Heather Gaya*,** L. Smith, and C. Moore

1:35-1:55 PM *Behavior, Growth, and Survival of Captive-reared Yearling Gopher Tortoises following Hard Release.* **Thomas A. Radzio*** and Michael P. O'Connor

1:55-2:15 PM *Male Body Size Effects on Siring Success in the Gopher Tortoise (Gopherus polyphemus).* **K. Nicole White***, Betsie Rothermel, Kelly Zamudio, and Tracey Tuberville

2:15-2:35 PM *Gopher Tortoise Abundance and Patterns of Juvenile Recruitment in Scrub Communities at Avon Park Air Force Range, FL.* **Betsie B. Rothermel**, Jessica L. Fort, Kelly M. O'Connor, and Jennifer H. Beck

2:35-2:55 PM **Afternoon Break**

2:55-3:15 PM *Making Lemonade out of Lemons: Utilizing Displaced Gopher Tortoises to Restore Depleted Populations.* **Alex Kalfin** and Deborah Burr

3:15-3:35 PM *An Island of Misfit Tortoises: Using Waif Animals to Recover Populations on the Brink.* **Rebecca McKee*,** Kurt Buhlmann, Will Dillman, Barry Kesler, Clint Moore, and Tracey Tuberville

Business Meeting – *All members are encouraged to attend and participate. Elections, Committee Reports, etc…!*

3:40-4:40 PM

4:45 PM **Silent Auction Closes**

Awards Banquet and Social - Aiken Center for The Arts (122 Laurens St. SW, Aiken, SC 29801) $25/pre-registration required.

6:30-10:30 PM

Sunday, October 15, 2017

<u>Field Trip</u> - Aiken Gopher Tortoise Heritage Preserve

9:00 AM – 12:00 PM We will meet in the lobby of Hotel Aiken at 8:45 AM to depart. Carpooling is encouraged. Sign-up sheet will be available at the registration desk.

Abstracts for Oral Presentations

The Translocation of Southern Fox Squirrels (*Sciurus niger niger*) to Parris Island, SC

Katelyn Amspacher*[1], John Holloway[2], Ernie Wiggers[3], Jayme Waldron[1], and Shane Welch[1]

[1]Marshall University, 1 John Marshall Drive, Huntington, WV 25755, Email: amspacher@marshall.edu
[2]Marine Corps Recruit Depot Parris Island NREAO, PO Box 5028, Parris Island, SC 29905
[3]Nemours Wildlife Foundation, 161 Nemours Plantation Road, Yemassee, SC 29945

Southern fox squirrels (*Sciurus niger niger*) are closely associated with the longleaf pine ecosystem of the Southeastern Coastal Plain. However, the decrease and fragmentation of this ecosystem has led to a decline in southern fox squirrel numbers throughout its range. Restoration of this species is a priority among many conservation groups. Our project aimed to use translocation as a conservation tool to establish a breeding population of southern fox squirrels on Parris Island, South Carolina, a site that historically would have supported fox squirrels but had none prior to this study. We translocated 62 southern fox squirrels (31 male, 31 female) from 5 trapping locations to Parris Island during 2016-17. Squirrels were monitored ≥ 90 days post-release. Translocated squirrels had a 50% survival rate, and home ranges fell within previously reported ranges for the sub-species. Some evidence of breeding was observed during the first breeding season.

A Review of Frosted Flatwoods Salamander Sampling and Recovery Efforts at St. Marks National Wildlife Refuge, St. Marks, FL

J. Chandler[1], W.J. Barichivich[2], K.M. O'Donnell[2], T. Peacock[1], J. Reinman[1], S.C. Walls[2]

[1]St. Marks National Wildlife Refuge, U.S. Fish & Wildlife Service, PO Box 68, St. Marks, FL 32355, Email: jonathan_chandler@fws.gov
[2]Wetland and Aquatic Research Center, U.S. Geological Survey, 7920 NW 71 St, Gainesville, FL 32653

With a historical range stretching from Florida to South Carolina, populations of the federally threatened (1999) frosted flatwoods salamander (*Ambystoma cingulatum*) have been on the decline. St. Marks National Wildlife Refuge (SMNWR) remains one of the last species strongholds. To assist in recovery efforts, SMNWR staff and intra-agency partners initiated a multi-year, multi-faceted monitoring, research, and management approach. From 2014-2017, minnow trapping was used to determine larval activity in 50 historically occupied ponds. Captures were recorded at 62% of the sites. Previously undocumented ponds were discovered using the same minnow trap methods. During the 2016-2017 sampling seasons, captured individuals were moved to head-starting tanks to increase survivorship to metamorphosis (<10% to >80%). Prior to release to their natal ponds, head-started individuals were marked with visible implant elastomer (VIE) as well as a passive integrated transponder (PIT) tag. Three of the historical ponds were designated as specific research sites and had incomplete drift fences

installed to study the activity of breeding adults as well as the return of head-started individuals. Untagged individuals captured during breeding events were also given VIE and PIT tags. This enabled preliminary recapture studies. Future efforts will focus on the installation of a PIT tag recording array to monitor salamander movement on a regular basis and the installation of automated water monitoring data loggers.

Detection of Ranavirus (Frog Virus 3) in Translocated Gopher Tortoises (*Gopherus polyphemus*) in Northwest Florida

Rebecca A. Cozad*[1], Terry M. Norton[2,3], Matthew J. Aresco[4], Tracey D. Tuberville[5], Matthew C. Allender[6], and Sonia M. Hernandez[1,7]

[1]Warnell School of Forestry and Natural Resources, University of Georgia, 180 E Green St, Athens, GA 30602, Email: racozad@uga.edu
[2]Georgia Sea Turtle Center, Jekyll Island Authority, 214 Stable Road Jekyll Island, GA 31527,
[3]St. Catherines Island Foundation, 182 Camellia Road, Midway, GA 31320
[4]Nokuse Plantation, 13292 County Highway 3280, Bruce, FL 32455
[5]University of Georgia's Savannah River Ecology Lab, Drawer E, Aiken, SC 29802
[6]University of Illinois College of Veterinary Medicine, 2001 S Lincoln Ave, Urbana, IL 61802
[7]Southeastern Cooperative Wildlife Disease Study, UGA College of Veterinary Medicine, 589 D. W. Brooks Drive, Athens, GA 30602

Gopher tortoises (*Gopherus polyphemus*) are listed as threatened throughout most of their range and are facing population declines as a result of direct habitat loss and habitat fragmentation. Translocation of tortoises from lands that will be destroyed by development has become an important tool for conserving the species and minimizing losses of individuals. Infection with *Mycoplasma* spp, has been widely studied in gopher tortoises, yet other emerging pathogens (e.g. ranavirus, herpesvirus) have not received as much attention in either wild or translocated populations, and have only rarely been documented. Nokuse Plantation is a 53,802 acre protected conservation preserve located in the Florida panhandle that has received ~4,500 translocated tortoises since 2006. As part of a broader health assessment project, 48 previously translocated tortoises representing 13 counties were recaptured and sampled in Jun-Aug 2016. Whole blood and oral/cloacal swabs were tested for nine pathogens, including ranavirus (FV3), *Mycoplasma* spp., and herpesvirus, using Fluidigm qPCR assays. Whole blood samples were negative for all pathogens. Fifteen out of 48 (31.2%) oral/cloacal swabs were positive for FV3, 25/48 (52%) were suspect or positive for *Mycoplasma agassizii* and/or *M. testudineum*, and 3/48 (6.25%) were co-detected for FV3 and *Mycoplasma* spp. Out of positive tortoises, 33.3% (5/15) appeared healthy and the others had clinical signs such as eroded/asymmetrical nares, pale mucous membranes in the oral cavity, and/or were mildly thin. In other chelonian species, infections with ranavirus present as explosive outbreaks with mortality rates that approach 50-100%. Evidence of ranavirus has not been implicated in any mortalities at Nokuse thus far. Detection of ranavirus in these tortoises may suggest that these are carrier animals that are persistently shedding at a low rate. These results indicate the need for further research into true prevalence of this pathogen in seemingly healthy animals, especially as it relates to translocation.

The Challenges, Logistics and Competing Interests in Attempting Habitat Restoration at Barefoot Beach Preserve, Collier County, FL

Nora E. Demers

Florida Gulf Coast University, 10501 FGCU Blvd S, Fort Myers, FL 33965, Email: mbhendri@ncsu.edu

Barefoot Beach Preserve, in Collier County Florida has a significant population of gopher tortoises that are competing with humans for habitat. The Preserve is routinely on Dr. Beach's top 10 list bringing significant funds to the county coffers, and thousands of visitors, each arriving in their own vehicle. The management plan does not allow controlled burn, resulting in an ever smaller amount of forage available for the tortoises. Gopher tortoises at the Preserve are living on the edge, with roads and parking having led to the recorded crushing death of over 74 individuals between 2001 and 2013.

I started a habitat restoration project at the preserve in 2013 with the help of FGCU students completing their service-learning requirements for the University Colloquium course. We're attempting to simulate fire by pruning back sea grapes, raking up their leaves, and pulling the beach ragweed, that had created an essential monoculture in much of the Preserve. The habitat restorations is a challenge due to the competing interests at the Preserve: while removing sea grape to increase sunlight and forage area may benefit the tortoises, it is not desired by the Collier Parks due to the potential increased harm from a hurricane coming ashore since the sea grape leaves lessen catch sand, water and winds during a hurricane. Cutting the sea grapes back along the road is not acceptable since it would lead to more cars parking on the ever-diminishing habitat along the roadside, for which the managers have laid down additional gravel in an effort to meet ever expanding parking demand. The results is less forage and more cars. I'll present my progress to date, and hope to get good advice on how to proceed with this effort.

Investigation of a Mortality Event at Lake Louisa State Park

Michelina C. Dziadzio[1], Eric R. Sievers[2], and Deborah Burr[1]

[1]Florida Fish and Wildlife Conservation Commission, 620 South Meridian Street, 2A, Tallahassee, Florida 32399, Email: Michelina.Dziadzio@myfwc.com
[2]Wildlands Conservation, Inc. 15310 Amberly Drive, Suite 250, Tampa, FL 33647

In August 2015, 35 gopher tortoise (*Gopherus polyphemus*) shells were documented during a line transect distance sampling survey at Lake Louisa State Park (LLSP), Lake County, FL. Using shell locations collected during this survey, we determined the mortality event occurred on approximately 40-ha of ruderal sandhill (hereafter, study area). We conducted a comprehensive follow-up shell survey, which resulted in the discovery of 94 adult shells in the study area. To determine if mycoplasmal upper respiratory tract disease (URTD) may have induced the mortality event, we collected blood samples from tortoises in the study area in August 2016 and examined seroprevalence of *Mycoplasma agassizii* and *M. testudineum* using an enzyme-linked immunosorbent assay. We sampled a total of 42 tortoises, of which 31% (n=13) were positive,

17% (*n*=7) were suspect, and 52% (*n*=22) were negative for *M. agassizii* antibodies; all sampled tortoises tested negative for *M. testudineum*. Seropositive individuals were more likely to exhibit clinical signs of URTD (69%), but 32% of seronegative individuals also exhibited some clinical signs, including naris and eye abnormalities. Gopher tortoise density in the study area was 6.04 tortoises/ha (CL=3.32–11.01) following the die-off, compared to 2.17 tortoises/ha (CL=1.58–2.98) for LLSP in its entirety. It is unknown why the tortoise density in the study area was 2.7 times greater than the surrounding lands on LLSP, or how URTD was introduced to this population. However, we suspect the high density of tortoises on our study site, in conjunction with the introduction of URTD to the population, contributed to the mortality event at LLSP. Comprehensive health assessments, including presence of other diseases, will be necessary to further refine potential causes for this die-off.

Hematology and Upper Respiratory Tract Disease Status of Gopher Tortoises in the Abacoa Greenway

Lauren E. Fremont*[1], Jon A. Moore[1, 2], and Adam Schaefer[2]

[1]Florida Atlantic University, 777 Glades Road, Boca Raton, FL 33431, Email: lfremont2013@fau.edu
[2]Harbor Branch Oceanographic Institute, 5600 US-1, Fort Pierce, FL 34946

Upper respiratory tract disease (URTD) is an illness present in gopher tortoises that can cause a variety of symptoms. A population of gopher tortoises in Range VIa of the Abacoa Greenway in Jupiter, Florida, has been tracked for URTD for the last thirteen years. We have had individuals that have tested seropositive, seronegative, and/or suspect for URTD. In addition to the URTD testing, a blood protein electrophoresis test and a blood chemistry panel were conducted on the blood samples taken from the tortoises. Not every tortoise had all of the tests done on their blood samples. The goal was to connect a blood variable to a URTD status through ANOVA testing. Magnesium and cholesterol were found to be significant; however, this was due to gender and not to the URTD status. Further testing will be conducted over the next year in order to add to the pool of data.

Improving Line-Transect Distance Sampling (LTDS) for Gopher Tortoise (*Gopherus polyphemus*) Populations

Heather Gaya*[1], Lora L. Smith[2], and Clinton Moore[1,3]

[1]Georgia Cooperative Fish and Wildlife Research Unit, Warnell School of Forestry and Natural Resources, University of Georgia, GA, Email: heather.gaya@uga.edu
[2]Joseph W. Jones Ecological Research Center at Ichauway, Newton, GA
[3]U.S. Geological Survey

The gopher tortoise (*Gopherus polyphemus*) is a keystone species in upland habitats of the southeastern United States. The species is listed as threatened in the western part of its range and is currently being considered for federal listing throughout the remainder of its range. Gopher

tortoise surveys use a standard line-transect distance sampling (LTDS) protocol to find tortoise burrows and estimate populations in a given area. However, LTDS has two known challenges. Juvenile burrows are frequently overlooked – even on the transect line – leading to systematic underestimation of juvenile populations. Second, variation in vegetation leads to difficulty detecting burrows of all sizes, reducing precision of all demographic estimates. The goal of this project is to reduce bias and increase precision of tortoise density estimates by incorporating regularly-measured detection covariates and employing a double-sampling scheme to improve detection of juvenile burrows. In this study we investigate the effectiveness of adding systematically placed intensive search areas centered around the transects and measuring vegetation along the transect to obtain more accurate population density estimates. The relationship between burrow detection and vegetation obstruction will be modeled on the basis of vegetation measurements, and then integrated into our density estimates. We will compare the density and size-demography of burrows found using the standard LTDS methodology to burrows found with our double-sampling protocol. Preliminary evidence suggests that addition of intensive searching areas increases juvenile detection with minimal added effort (8-15% increase in sampling time relative to standard LTDS) and leads to improved density estimates. However, efficacy of the protocol may vary with tortoise density at the site. We hope this study will improve our ability to produce reliable population estimates and make informed decisions about management and conservation practices throughout the gopher tortoise's range.

International Turtle Conservation here in the Lowcountry: The Turtle Survival Alliance

Nathan Haislip and Clinton Doak

Turtle Survival Center, Turtle Survival Alliance, 1989 Colonial Parkway, Fort Worth TX, 76110, Email: nhaislip@turtlesurvival.org

The Turtle Survival Alliance (TSA) was established in 2001 in response to the "Asian Turtle Crisis" in which unsustainable numbers of turtles were being harvested from the wild for the food trade, pet trade, and traditional Chinese medicine. Initially a joint taskforce with the IUCN Turtle and Tortoise Specialist Group, the TSA began to establish programs throughout the world in areas where chelonians were threatened with extinction. Currently, the TSA is active with *in situ* conservation in 13 countries as well as a U.S. based facility in South Carolina. The goal of the TSA is "zero turtle extinctions" and utilizes relationships with zoos and aquariums, government organizations, other non-profit organizations, and the private sector to help chelonian species continue to persist both *in situ* and *ex situ*. The TSA's Turtle Survival Center (TSC) is the focus of *ex situ* conservation efforts. Species housed here are difficult, if not impossible, to work with abroad due to their population size, collection pressures, or other factors such as lack of suitable habitat or legal protection. The TSC is establishing assurance colonies of these species in the hopes that one day, future generations can be repatriated where these species once occurred.

Potential Interactions between Gopher Tortoises and Burmese Pythons in Southwest Florida

Kodiak C. Hengstebeck*[1], Christina M. Romagosa[1], Paul T. Andreadis[2], and Ian A. Bartoszek[3]

[1]University of Florida, 110 Newins-Ziegler Hall, Gainesville, FL 32611, Email: khengste@ufl.edu
[2]Denison University, Biology Department, Granville, OH 43023
[3]The Conservancy of Southwest Florida, 1495 Smith Preserve Way, Naples, FL 34102

Burmese pythons are established invaders of natural ecosystems in southern Florida. Their establishment has greatly affected many species with which they co-occur. The python's large appetite and ability to outcompete native species has made them highly successful in their invaded range, but also problematic. Pythons have been implicated in the severe declines of meso-mammal populations in much of their Florida range, and are likely affecting populations of large mammals and birds. In southwest Florida, Burmese pythons have increased access to dry upland hammocks and scrub, uncommon habitats in most of their Florida range. With these new habitat types comes new species interactions. One such interaction that has been documented on numerous occasions is that of Burmese pythons and gopher tortoises. Pythons use gopher tortoise burrows for refugia and reproductive purposes. Female pythons also frequently nest in gopher tortoise burrows when available, laying upwards of 90 eggs and incubating them for 2 months. In a 110 acre patch of scrub habitat, Burmese pythons were detected within tortoise burrows on 18 occasions from January to July 2017. To date, no direct predation events have been documented. However, the presence of Burmese pythons could negatively affect gopher tortoises via displacement or competitive interactions.

Gopher Tortoise and Burrowing Owl Interactions in a Southwest Florida Urban Landscape

John E. Herman

Florida Gulf Coast University, 10501 FGCU BLVD S, Fort Myers, FL 33965, Email: hermanj@fgcu.edu

Gopher Tortoises (*Gopherus polyphemus*) and Florida Burrowing Owls (*Athene cunicularia floridana*) are both considered ecosystem engineers who construct burrows that provide habitat for hundreds of other species. These two species occur sympatrically in high densities within urban landscapes of Southwest Florida, particularly Cape Coral and Marco Island. Very little information exists concerning the interactions of these two species. A 1-year study was conducted in 2014 using wildlife cameras to document the activity at the burrow entrance for both tortoises and owls. Well over 1 million still images were recorded during this time, which included some amazing and odd behaviors for each species as well as the interactions between them. Here, I report on two specific instances of tortoise and owl interaction with one being beneficial and the other being antagonistic. Additionally, a potentially new urban disease vector for Gopher Tortoises was identified and preliminary data will be presented. These field observations are particularly important given that Florida Burrowing Owls have been recently

listed as State Threatened by the Florida Fish and Wildlife Conservation Commission and their population strongholds are urban areas currently undergoing rapid development.

Georgia's Gopher Tortoise Initiative

Matt J. Elliott[1], John B. Jensen[2], Steve Friedman[3], and Donald W. Imm[4]

[1]Georgia Department of Natural Resources, Wildlife Resources Division, Nongame Conservation Section, 2067 U.S. Highway 278 S.E., Social Circle, GA 30025
[2]Georgia Department of Natural Resources, Wildlife Resources Division, Nongame Conservation Section, 116 Rum Creek Drive, Forsyth, GA 31029, Email: john.jensen@dnr.ga.gov
[3]Georgia Department of Natural Resources, 2 Martin Luther King Jr. Drive, S.E. Suite 1352 East, Atlanta, GA 30334
[4]United States Fish and Wildlife Service, Georgia Ecological Services, 105 West Park Drive Suite D, Athens, GA 30606

Georgia's Gopher Tortoise Initiative (GTI) aims to protect more than half of the known minimally-viable tortoise populations (MVPs; at least 250 adults) in the state, thereby reducing the possibility that the species will need to be federally listed. Rather than being reactive and face the consequences of increased federal regulation that would affect key parts of the state's economy, including commercial growth, agriculture, forestry, housing development, and military missions, GTI partners will raise an anticipated $150 million to acquire or establish conservation easements on many of the remaining unprotected MVPs. Prior to the development of the GTI, 36 of the 122 known tortoise MVPs in Georgia were permanently protected. At the close of fiscal year 2017 the GTI increased this number to 41, and as of early fiscal 2018 GTI was completing projects that will raise the number of permanently protected populations to at least 45. GTI's goal will be reached when 65 tortoise MVPs adequately distributed across the state are protected, which will also protect populations of numerous other imperiled sandhill species including the eastern indigo snake, Florida pine snake, southern hognose snake, eastern diamondback rattlesnake, gopher frog, southeastern pocket gopher, and hairy rattleweed. GTI partners include Georgia Department of Natural Resources, Georgia Forestry Commission, U.S. Department of Defense, U.S. Fish and Wildlife Service, Natural Resources Conservation Service, The Nature Conservancy, The Conservation Fund, Georgia Conservancy, Georgia Chamber of Commerce, The Orianne Society, Knobloch Family Foundation, Bobolink Foundation, and Robert W. Woodruff Foundation.

Making Lemonade out of Lemons: Utilizing Displaced Gopher Tortoises to Restore Depleted Populations

Alex Kalfin[1], Deborah Burr[1]

[1]*Florida Fish and Wildlife Conservation Commission, 620 South Meridian Street, Tallahassee, Florida, 32399, Email: Alex.Kalfin@MyFWC.com*

The removal of individual gopher tortoises (*Gopherus polyphemus*) from the wild by well-intentioned individuals presents a conservation challenge for wildlife managers who must decide the tortoise's disposition. These displaced tortoises, referred to as waifs, are typically of unknown origin, but are otherwise healthy and able to burrow and forage without human intervention. Historically, these tortoises would either have been released into existing populations or placed at an educational facility. The Florida Fish and Wildlife Conservation Commission (FWC), working with Florida counties, cities, and South Carolina, implemented the "waif recipient site program" to address this conservation issue, where waif tortoises can be released on suitable, publicly-owned conservation lands where populations have been depleted as a result of past land use or fire suppression. By minimizing the number of tortoises that are randomly released, FWC has reduced the likelihood for associated anthropogenic impacts on existing populations. Waif recipient sites have also assisted in keeping displaced tortoises wild, supporting their contribution to the proliferation of the species. In the five years since this program was first established, 233 waif gopher tortoises have been released to 7 recipient sites in Florida, and the Aiken Gopher Tortoise Heritage Preserve in South Carolina. As a result of ongoing outreach efforts by FWC, which provide our public partners with incentives for habit management, local gopher tortoise populations are being restored where previously depleted. Smaller waif recipient sites play a significant role in keeping gopher tortoises widely distributed in Florida, and help educate local communities through programs and guided nature walks. Larger waif recipient sites have the potential to sustain viable populations and contribute to the long-term, and range-wide conservation of the species. The success of these partnerships can be replicated to help restore depleted populations through the range, and conserve the species for many generations to come.

Gopher Tortoise Habitat Use of Xeric and Mesic Habitats in South Florida

Rachel L. King[1], Michelina C. Dziadzio[2], and Deborah Burr[2]

[1]*Florida Fish and Wildlife Conservation Commission, 8535 Northlake Blvd, West Palm Beach. FL, 33412, Email: Rachel.King@MyFWC.com*
[2]*Florida Fish and Wildlife Conservation Commission, 620 South Meridian Street, Tallahassee, FL, 32399*

Gopher tortoises (*Gopherus polyphemus*) are found in a variety of habitats throughout their range, but little is known about tortoise densities in habitats in southern Florida, particularly in mesic flatwoods. Platt Branch Wildlife and Environmental Area located in Highlands County, Florida contains both xeric and mesic habitats in relatively close proximity (<1.10 km). In early 2016, a gopher tortoise population survey using Line Transect Distance Sampling was initiated in the xeric habitat, but the survey could not be completed due to an abnormally wet winter that caused burrow

flooding in the mesic areas. To allow surveyors to complete the full survey, the survey was conducted during the winter in early 2017. Xeric habitats surveyed in 2016 were resurveyed in 2017 as tortoises may emigrate to more well-drained soils following flooding events in mesic habitats, potentially increasing densities in nearby xeric areas. We used Distance 7.1 software to examine the tortoise densities in xeric versus mesic habitats, and found that the tortoise density in xeric habitats (6.53 tortoises/ha, CL=4.87-8.77/ha) was significantly higher than in mesic habitats (2.53 tortoises/ha, CL=1.69-3.26/ha). We also noted that burrow occupancy varied between xeric (41.40%) and mesic (19.70%) habitat types. To determine if flooding of mesic habitats increased burrow occupancy in nearby xeric habitats, we compared data from the 2016 and 2017 surveys from the same area. We found no significant difference in the number and density of tortoises between the two years, which may indicate that tortoises do not emigrate from mesic habitats when they flood. Further surveys are needed to determine if other sites have similar densities and if this apparent lack of emigration due to flooding occurs on other sites with heterogeneous landscapes in South Florida.

The Use of Farm Bill Programs to Conserve Species and Enhance Habitat

J.L. McGuire[1], M.A. Bush[2], C. Finley[3], G. B. Pessoney[4], M. Sampson[5], S. D. Thomas[6], J. Thurmond[7], S. Worley[8]

[1]Georgia Department of Natural Resources, Wildlife Resources Division, Private Lands Program, 116 Rum Creek Drive, Forsyth, GA 31029, Email: Jessica.mcguire@dnr.ga.gov
[2] USDA, Natural Resource Conservation Service, 2614 NW 43rd Street, Gainesville, FL 32606
[3] USDA, Natural Resource Conservation Service, McCoy Federal BLDG, 100 W. Capitol Street, Suite 1321, Jackson, MS 39269
[4] USDA, Natural Resource Conservation Service, 113 Fairfield Drive, Suite 110, Hattiesburg, MS 39402
[5] USDA, Natural Resource Conservation Service, 355 East Hancock Ave, Stop Number 200, Athens, GA 30601
[6] USDA, Natural Resource Conservation Service, 904 F.R. Huff Drive, Suite 104, PO Box 528, St. Matthews, SC 29135
[7] USDA, Natural Resource Conservation Service, Natural Resources Conservation Service, P.O. Box 311, Auburn, AL 36831-0311
[8] USDA, Natural Resource Conservation Service, Strom Thurmond Federal Building, 1835 Assembly St., Rm. 950, Columbia, SC 29201

Farm Bill programs have had a significant impact on the restoration of habitat and conservation of wildlife. The Farm Bill provides over $57 billion in funding for conservation programs. It is the largest funding source for conservation on private lands. Programs offer both technical and financial assistance to landowners. In 2011, the Natural Resources Conservation Service (NRCS) launched the Longleaf Pine Initiative (LLPI). The Working Lands for Wildlife program (Wildlife Habitat Incentives Program- WHIP), a partnership between NRCS and The U.S. Fish and Wildlife Service (USFWS), soon followed in 2012, focusing efforts on gopher tortoise habitat. Landowners are restoring and enhancing longleaf pine ecosystems through prescribed burning, thinning, and other forestry practices. Since 2010, more than 278,000 of longleaf pine forest has been impacted. Landowners have initiated or enhanced restoration on over 300,000 acres since 2012, on behalf of the gopher tortoise. In 2016 alone, over 54,000 acres were

contracted through WLFW in six states, a $4,441,289 NRCS financial commitment. This presentation will provide a summary of Farm Bill programs benefiting the gopher tortoise and other priority species. We will also introduce another multi-state WLFW initiative for Bobwhite Quail and discuss how both can be used to impact multiple species over a large landscape.

An Island of Misfit Tortoises: Using Waif Animals to Recover Populations on the Brink

Rebecca McKee*[,1,2], Kurt Buhlmann[1], Will Dillman[3], Barry Kesler[3] , Clint Moore[2,4], and Tracey Tuberville[1,2]

[1]University of Georgia's Savannah River Ecology Lab, PO Drawer E, Aiken, SC 29802, Email: Rebecca.mckee25@uga.edu
[2]Daniel B. Warnell School of Forestry and Natural Resources, 180 E. Green Street, Athens, GA 30602
[3]South Carolina Department of Natural Resources, 1000 Assembly Street, Columbia, SC 29201
[4]U.S. Geological Survey, Georgia Cooperative Fish and Wildlife Research Unit, 180 E. Green Street, Athens, GA 30602

Due to many anthropogenic threats, the gopher tortoise (*Gopherus polyphemus*) is declining throughout its range. Although habitat management plays an important role in the species' conservation, alone it may be insufficient to recover populations that have experienced a severe decline. As a result, translocation—the movement of animals from one location to another—has become a valuable conservation tool. While there are risks associated with any translocation, waif tortoises—animals that have been collected illegally, been injured and rehabilitated, or have unknown origins—are generally excluded from translocations due to heightened concerns of introducing disease or altering the genetics of the recipient population. If these risks could be managed, waif tortoises could provide the needed numbers and genetic diversity to stabilize populations and prevent extirpations. In the early 1990s, a small population of gopher tortoises (n=<10) was discovered near Aiken, South Carolina. This discovery expanded the species' known range and resulted in the creation of the Aiken Gopher Tortoise Heritage Preserve (AGTHP). Due to the preserve's dire need for augmentation, the state's lack of suitable donor populations, and the site's isolation from other tortoise populations, the AGTHP provided the rare opportunity to study the effect of waif tortoise translocation without jeopardizing a viable population. Since 2006, over 280 waifs have been introduced to the preserve. Now that a decade has passed since the initial release, our study will assess the post-release survivorship and site fidelity of the waif tortoises, document evidence of reproductive success by surveying for nests and successfully recruited juveniles, genotype all tortoises to better understand reproductive and social integration in translocated waif populations, and measure the population's health by conducting health assessments and testing for common pathogens. Here we present a summary of the 2017 summer field season efforts and preliminary results.

Go Find It! A Scent Detection Dog's First Venture into Gopher Tortoise Conservation

Lauren Moscar[1], Rebekah J. Lindborg, J. Rachel Smith, Blair E. Witherington, Anna Savage

[1]Disney's Animals, Science and Environment, Disney's Animal Kingdom, PO Box 10,000, Lake Buena Vista, FL 32830, Email: Lauren.J.Moscar@disney.com

Uncertainty in determining burrow occupancy and underrepresentation of early life stages presents challenges for estimating gopher tortoise population size and structure. We present a new approach to measuring burrow occupancy using a scent detection dog. Tests of the dog's accuracy in a pilot study with sea turtle nest-finding were expanded to include detection of gopher tortoises in situ. We discuss the diverse benefits of using tortoise detection dogs, which include increasing efficiency and accuracy of burrow surveys, detection of juveniles outside burrows, and connecting kids and families with nature through the use of familiar animals as conservation ambassadors.

Working Gophers: Evaluating Conservation Efforts for Gopher Tortoise on Private Lands

T.J. Prebyl*[1], L. Smith[2], J. Martin[3], J. Hepinstall-Cymerman[3], C. Moore[4]

[1]Georgia Cooperative Fish and Wildlife Research Unit, Warnell School of Forestry and Natural Resources, The University of Georgia, Athens, GA, Email: tjprebyl@uga.edu
[2]Joseph W. Jones Ecological Research Center, Newton, GA 39870
[3]Warnell School of Forestry and Natural Resources, The University of Georgia, Athens, GA
[4]U.S. Geological Survey, Georgia Cooperative Fish and Wildlife Research Unit, Warnell School of Forestry and Natural Resources, The University of Georgia, Athens, GA

Open savanna-like habitat supporting gopher tortoise populations were reportedly common on woodlands and working plantations in the southeastern coastal plain prior to pervasive landscape changes following an era of fire suppression, agricultural conversion, urban development, and intensive plantation forestry. In an effort to restore this savanna-like habitat on private lands, the Natural Resources Conservation Service (NRCS) is incentivizing conservation practices including prescribed burning, forest stand thinning, and tree planting through the Working Lands for Wildlife partnership (WLFW). The primary objective of this research is to assess the response of vegetation and gopher tortoise populations to WLFW conservation practices implemented on forest stands. To evaluate these practices, we surveyed the vegetation community and gopher tortoise populations on approximately 100 privately-owned forest stands in Georgia, Alabama, and Florida in 2017 where practices had been previously implemented. We use a modified line-transect-distance-sampling survey design and a Bayesian hierarchical spatial distance sampling model to provide estimates of gopher tortoise density and effects of habitat parameters regarding the influence of vegetation structure and species composition. Our statistical models will provide tests of hypotheses regarding the relative influence of vegetation structure vs. herbaceous species composition on gopher tortoise density. Results from the 2017 field season will be presented. We expect this study will contribute to the design and targeting of conservation efforts on private lands which are an essential part of the larger conservation effort for gopher tortoises and savanna-like ecosystems in the Southeast.

17 Years Later: Changes in Vegetation Structure, Burrow Dispersion and Size-class Distribution at a Gopher Tortoise (*Gopherus polyphemus*) Site in Alabama

Rebecca C. Pudner* and Sharon M. Hermann

Department of Biological Sciences, Auburn University, Auburn, AL, Email: rcp0014@tigermail.auburn.edu

There are few studies that reevaluate vegetation structure at gopher tortoise (*Gopherus polyphemus*) sites after a long period of time and there appears to be no such previous effort in Alabama. We revisited research conducted in 1999 by J.H. Waddle at a site in Conecuh National Forest (south-central AL) 17 years after the original study. Three types of comparisons of vegetation structure were made: 1) 1999 random points versus 2016 random points, 2) burrows that were active in 1999 and remained active in 2016 (n=7), and 3) burrows that were active in 1999 but abandoned in 2016 (n=21). Compared to 1999, all 2016 plot categories had significantly 1) less litter and forbs and more legumes and shrubs in the understory, and 2) more hardwood stems in the midstory. Burrows that remained active in 2016 had no hardwood trees nearby in either sample year. The 1999 data suggested that tortoises were likely selecting the best habitat available for burrow construction while our new study indicates that the habitat may have become more homogenous over time, with few high quality areas to select from. A re-survey of all active/inactive burrows revealed a 3.5-fold increase. A density of 5.84 burrows/hectare in 2016 may indicate either 1) a robust population or 2) one responding to declining access to forage by increasing number of locations used. A healthy, recovering population is likely, in part because the distribution of burrow widths shifted to bi-modal from uni-modal. In addition, the spatial relationship among burrows shifted from random to clustered (*Z score* = -32.8, *P* = 0.001), and burrows in 2016 were likely to be near other burrows of similar sizes (*Z score* = 4.58, *P* = <0.0001). We recommend periodic monitoring of habitat structure and a variety of metrics to assess tortoise response to potential change.

Behavior, Growth, and Survival of Captive-reared Yearling Gopher Tortoises Following Hard Release

Thomas A. Radzio* and Michael P. O'Connor

Department of Biodiversity, Earth, and Environmental Science, Drexel University, 3245 Chestnut Street, Philadelphia, PA 19104, Email: tomradzio@hotmail.com

Biologists routinely rear animals in captivity for research or to augment declining wild populations. However, releasing animals into nature can present challenges, particularly if released individuals exhibit unnatural behaviors. We collected hatchling gopher tortoises from natural nests in southwest Georgia and raised them in the laboratory for physiology experiments that required keeping animals in controlled environments. After completing the experiments approximately one year later, we hard-released individuals (n = 30 with radio transmitters and 28 without) at their nest sites. Most transmittered yearlings constructed burrows soon thereafter, and, like wild tortoises, used deadwood and stumpholes as burrowing sites more frequently than would be expected by chance. Subsequent video observations indicated normal activity and

microhabitat use patterns, including overnighting in burrows, extensive basking on burrow aprons, and limited time spent away from burrow areas. Growth rates were also similar to those of wild juveniles at the site. Starting 10 days following release, we performed simulated predator approaches on transmittered individuals that had constructed deep burrows to assess antipredator responses. Despite daily contact with researchers when in captivity, released tortoises always hid in burrows during these approaches and exhibited flight initiation distances and hiding times indistinguishable from those of wild individuals. All known mortalities were apparently due to predators, and hard released tortoises exhibited survivorship comparable to those reported for wild and soft released juveniles. Notably, the occurrence of a small number of depredation events before individuals constructed deep burrows suggests that refined soft release measures have the potential to achieve slightly better results than hard release. Nevertheless, our data suggest that hard release represents an acceptable release approach in some situations and that captive-reared tortoises retain critical behaviors required for success in the wild.

Gopher Tortoise Abundance and Patterns of Juvenile Recruitment in Scrub Communities at Avon Park Air Force Range, FL

Betsie B. Rothermel, Jessica L. Fort, Kelly M. O'Connor, and Jennifer H. Beck

Archbold Biological Station, 123 Main Dr., Venus, FL 33960, Email: brothermel@archbold-station.org

Obtaining life-history and demographic information for every life stage is an important goal for any population monitoring program. However, it can be prohibitively time-consuming and difficult to obtain such data for early life stages of Gopher Tortoises (*Gopherus polyphemus*). Based on previous monitoring in 2009-2011, Avon Park Air Force Range (APAFR) supports one of the largest populations of Gopher Tortoises in peninsular Florida, numbering in the thousands. During 2015-2017, we implemented two types of surveys throughout the 2,470 ha of Florida scrub communities at APAFR: line transect distance sampling (LTDS) to estimate abundance of larger tortoise size classes; and juvenile burrow surveys to estimate site occupancy of smaller size classes (n = 60 sites stratified by time since fire; 3 transects per site). LTDS yielded estimates of 1,525 adult tortoises (95% CI: 1,117–2,083; CV 15.9%) and 1,847 subadults and adults combined (95% CI: 1,425–2,393; CV 13.2%). Estimated probability of site occupancy for juvenile burrows was 0.61 (SE 0.18). Detection of juvenile burrows was not affected by observer experience or habitat openness, although survey efficiency can be enhanced by conducting surveys after prescribed burns. Juvenile burrow site occupancy was positively associated with proportion of well-drained soils and negatively associated with canopy cover. Probability of occupancy also declined with increasing number of fires. Modeling site occupancy of juvenile burrows is a potentially viable approach to assessing spatial and temporal patterns of recruitment. However, greater statistical precision is needed and could be achieved with increased sample sizes. Further, more research is needed to assess effects of fire frequency on juvenile survival and to determine scrub management targets for this life stage. Results of our multi-faceted monitoring efforts imply that proper management of scrub communities on well-drained soils is critical for juvenile recruitment and long-term persistence of Gopher Tortoises in this landscape.

Look What We Found! Collecting Data on Other Rare Species during Gopher Tortoise Surveys

Matthew Stoddard and Matt Elliott

Georgia Department of Natural Resources, Wildlife Resources Division, Nongame Conservation Section, One Conservation Way, Suite 223, Brunswick, GA 31520, Email: matthew.stoddard@dnr.ga.gov

Gopher tortoise survey transects often pass through rarely-visited areas. Thus, survey crews may incidentally encounter previously unknown populations of rare plant or animal species. Survey personnel can consult knowledgeable biologists or use online resources to improve their chances of recognizing important species potentially present on survey properties. The use of burrow cameras also provides a unique opportunity to detect species of conservation concern. While most tortoise surveys record other vertebrates encountered while scoping burrows, identifying invertebrates is difficult. However, the caterpillars of the tortoise burrow commensal moth *Idia gopheri* can be quite distinctive, and Georgia DNR tortoise survey crews have documented numerous populations of this species. The value of gopher tortoise surveys is greatly enhanced when they are able expand our knowledge of many different at-risk plant and animal species.

Eastern Diamondback Rattlesnake Demography Estimated from a South Carolina Sea Island Population

J.L. Waldron[1], S.M. Welch[1], J. Cooley[1], and J. Holloway[2]

[1]*Marshall University, Dept. of Biological Sciences, Huntington, WV 25755, Email Waldron3@marshall.edu*
[2]*Natural Resources and Environmental Affairs Office, United States Marine Corps, Parris Island, South Carolina*

Eastern diamondback rattlesnake (*Crotalus adamanteus*; EDB) population declines necessitate insight into the species' demography. Using mark-recapture and radio telemetry data collected since 2008, we quantified life history parameters for the Marine Corps Recruit Depot Parris Island EDB population. Specifically, we quantified adult and neonate survival, recruitment intervals, and clutch size. We used radio telemetry data collect from 83 adults (45 males and 38 females) and 31 juveniles (18 males and 13 females) in known fate survival models to estimate monthly and annual survival and to evaluate survival covariates (e.g., body condition, body size). We estimated the percentage of adult females that gave birth annually (based on telemetry samples), and calculated apparent clutch size based on the number of neonates we observed with females following parturition. Annual adult survival averaged 0.86 ± 0.04. Body length (SVL) was negatively associated with adult survival. The probability that neonates survived until their second year was 0.18 ± 0.09. Approximately 32% of telemetry-equipped females reached parturition annually, and birthing intervals averaged 2.29 years (SD = 0.60). Apparent clutch size (N = 31) averaged nine neonates.

Gopher Frog Calling Phenology

S.M. Welch[1], W. Dillman[2], and J.L. Waldron[1]

[1]*Marshall University, Department of Biological Sciences, Huntington, WV 25755, Email Waldron3@marshall.edu*
[2]*South Carolina Department of Natural Resources, Wildlife and Freshwater Fisheries Division, PO Box 23205, Columbia, SC 29224-3205*

In light of gopher frog (*Rana capito*) population declines and the species' review for federal protection under the Endangered Species Act, we initiated an acoustic monitoring study to quantify gopher frog breeding phenology in South Carolina. Specifically, our goal was to examine the effects of weather on historical and current gopher frog calling activity. We gathered historical records of gopher frog choruses from the South Carolina Natural Heritage Database and the scientific literature. Additionally, we used autonomous recording units, which were deployed year-round, to sample calling activity in ponds that supported gopher frog populations. We developed a detector in program Raven so that gopher frog calls could be analyzed autonomously, which provided a list of candidate calls that we systematically verified to avoid false positives. We used NOAA's National Climatic Data Center to examine gopher frog calling activity as a function of local weather patterns. We detected gopher frog choruses multiple times per year, and choruses were not limited to winter/spring months. For example, we detected four discrete breeding events (Spring = 2, Fall = 2) in one pond that was monitored continuously with acoustic data loggers. It appears that gopher frog calling activity is plastic, and is tied to heavy precipitation events that affect wetland hydroperiod, regardless of season.

Male Body Size Effects on Siring Success in the Gopher Tortoise (G*opherus polyphemus*)

K. Nicole White*[1, 2], Betsie Rothermel[3], Kelly Zamudio[4], and Tracey Tuberville[1]

[1] *University of Georgia's Savannah River Ecology Laboratory, Aiken, SC 29808*, Email: knwhite21@gmail.com
[2] *Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA 30602*
[3] *Archbold Biological Station, Venus, FL 33960*
[4] *Department of Ecology and Evolutionary Biology, Cornell University, Ithaca, NY 14853*

In many vertebrates, male body size likely influences individual fitness; hence, it may be important to siring success. Fitter individuals may be more likely to dominate mating opportunities, skew siring success rates, and lower effective population sizes and genetic diversity. The mating system and reproduction of the gopher tortoise (*Gopherus polyphemus*) have been explored primarily through behavioral observations while just two studies have used molecular studies to investigate reproductive patterns. We evaluated the effects of male size on likelihood of siring offspring and count of offspring sired in a population of gopher tortoises at Archbold Biological Station in Florida. We also report incidence and patterns of multiple paternity observed in the study. We collected 31 nests in 2015 and 2016 and incubated the eggs through hatching. Using 11 previously-developed polymorphic microsatellite markers, we genotyped all hatchlings (n = 220) and most potential dams and sires in the population (n = 101). Using programs CERVUS and COLONY, we

assigned each hatchling to the most likely dam and sire. We evaluated the effects of male body size on probability of siring success (sire or non-sire) and reproductive success (number of offspring sired) using a zero-inflated Poisson mixture model. Larger males had significantly greater siring success than smaller males. Additionally, male body size was positively correlated with increased reproductive success. Our results support previous findings that larger males experience greater siring success than smaller males in this species. We observed multiple paternity in 8/31 of clutches, within range of previously reported rates. Understanding reproductive success and paternity distribution of this declining species may be important for developing effective management strategies.

Abstracts for Poster Presentations

Is the Gopher Tortoise Facilitating the Spread of Cocoplum in Southern Florida?

Corey Devin Anderson[1], Carolyn Hanish[2], and Jon Moore[2]

[1]Valdosta State University, Department of Biology, 1500 N Patterson Street, Valdosta, GA 31698, Email: coreanderson@valdosta.edu
[2]Florida Atlantic University, Wilkes Honors College, 5353 Parkside Drive, Jupiter, FL 33458

The gopher tortoise (*Gopherus polyphemus*) has a highly varied diet, and their tendency to swallow whole fruits makes them potentially effective seed dispersers. If seeds survive gut passage, tortoise grazing activity may change the abundance of plant species in their surroundings. In the present study, we used point process models to examine the potential spreading of the cocoplum bush (*Chrysobalanus icaco)* by the gopher tortoise in the Abacoa Greenway in Jupiter, Florida, USA. Inhomogeneous Poisson models indicated that as the distance from known movement paths of gopher tortoises increased, there was a significant decrease in the intensity of cocoplum. In addition, we found that cocoplum intensity was significantly lower in patches of saw palmetto and that there was a significant decrease in the intensity of cocoplum (from east to west), consistent the observation that the cocoplum bush has spread westward from its initial source population (of four individuals) on the east side of the study area. Inhomogeneous cluster models yielded similar results in terms of predictors and indicated that, if clusters of cocoplum exist, they are small (on average). Combined with laboratory results indicating that gopher tortoise passed cocoplum seeds germinate faster than unpassed seeds, our results provide strong evidence that the gopher tortoise is facilitating the spread of the cocoplum bush in the Abacoa Greenway.

Behavioral Thermoregulation and Social Effects on *Gopherus polyphemus* Growth Rates

Julie Cobb[1]* and David Rostal[1]

Department of Biological Sciences, Georgia Southern University, 1332 Southern Drive Statesboro, GA 30460, Email: jc00760@georgiasouthern.edu

The regulation of an ectotherm's internal body temperature (T_B) is highly dependent on the ambient temperature (T_A) of their environment. By performing certain behaviors, ectotherms are able to fluctuate their T_B around a set point to maximize growth rate. Nests were collected from the field on 20 August 2016 from Fort Stewart and George L. Smith State Park in southeast Georgia. Egg incubation was completed in the lab. Hatchling sex was already established in the field during the month of July prior to the eggs being brought into the lab. Forty-eight tortoises were separated into two groups with 24 tortoises in each section. Sections were divided into two social groups containing three tortoises (two females and 1 male) per enclosure and two isolated groups (one male or female). The social and individual groups were further distributed into groups with supplemental heat (heat rocks) to stimulate thermoregulation and those without supplemental heat (no heat rocks). The tortoises' growth rates were measured bimonthly with six measurements; straight carapace length, width, depth, mass, plastron minimum and maximum

beginning on 18 July 2017. Temperature and behaviors were recorded twice a week. The tortoises were fed weekly on a mixed greens diet with Mazuri tortoise diet supplemented once a month. Sex was confirmed via laparoscopy at one year of age. This study will conclude in the spring of 2018 and the tortoises will be released back to their respective habitats. Experimental design and preliminary results will be presented. At the conclusion of the study, tortoises placed in an isolated enclosure with heat rocks are expected to have increased the greatest in size relative to the other groups.

Preliminary Range-wide Status Modeling to Accelerate Conservation of the Gopher Tortoise

Brian A. Crawford[1], Clinton T. Moore[2], John C. Maerz[3], D. Todd Jones-Farrand[4], and Mike Harris[5]

[1] Georgia Cooperative Fish & Wildlife Research Unit, Warnell School of Forestry & Natural Resources, University of Georgia, 180 E. Green Street, Athens, GA, Email: bcrawfor@uga.edu
[2] U.S. Geological Survey, Georgia Cooperative Fish & Wildlife Research Unit, Warnell School of Forestry & Natural Resources, University of Georgia, 180 E. Green Street, Athens, GA
[3] Warnell School of Forestry & Natural Resources, University of Georgia, 180 E. Green Street, Athens, GA
[4] Gulf Coastal Plains & Ozarks Landscape Conservation Cooperative, Columbia, MO, USA
[5] U.S. Fish & Wildlife Service, Region 4, Atlanta, GA

The gopher tortoise is currently a Candidate species under review by the U.S. Fish & Wildlife Service for listing under the Endangered Species Act in the eastern portion of its range. With federal, state, and other partners, we are assessing the status of the gopher tortoise to inform this decision and where and how to invest conservation resources. This work addresses three objectives: 1) synthesize species data and expert knowledge from previous research, monitoring, and management efforts, 2) develop comprehensive, range-wide models of current species distribution and persistence, and 3) predict distribution and persistence in the next 100 years under scenarios incorporating potential threats and management strategies. We present our approach and progress, with emphasis on the development of prototype range-wide species distribution models. With the help of partners, we have assembled a database of ~62,000 tortoise occurrence records, which includes line transect distance survey data conducted by state agencies on 157 sites in SC, GA, FL, MS, and LA. Preliminary models highlight important predictors (habitat, elevation, soil, climate, landscape connectivity, and land-use) and their spatial scales that best predict tortoise presence based on species ecological needs. We will incorporate feedback from partners and gopher tortoise experts to improve future iterations of species models. This work will add to the ongoing cooperative efforts between federal, state, academic, and non-academic partners to recover the tortoise throughout its range. Research products will identify priority areas based on species metrics, enable regional partners to implement effective conservation strategies, and inform listing decisions of the U.S. Fish & Wildlife Service.

Conservation of Gopher Tortoises (*Gopherus polyphemus*) on Intensively Managed Pine (*Pinus* spp.) Landscapes

Duston Duffie[1]*, Scott Rush[1], and Darren Miller[2]

[1] *Mississippi State University Department of Wildlife, Fisheries, and Aquaculture, 775 Stone Boulevard, Mississippi State, MS 39762, Email: DRD143@msstat.edu*
[2] *Weyerhaeuser Company, P.O. Box 2288, Columbus, MS 39704*

The gopher tortoise (*Gopherus polyphemus*) is a keystone species in southern pine (*Pinus* spp.) ecosystems and is listed as threatened under the Endangered Species Act in the western portion of the range due to population declines over the last century. Much of the private land where gopher tortoises occur within this range is managed primarily for timber production. Although past research has shown that gopher tortoises are compatible with production forestry in these landscapes, more information on tortoise response to forest management such as forest openings created through timber harvest and mid-story vegetation control through herbicide and prescribed fire treatments is needed to guide management. Therefore, we are examining two gopher tortoise populations on commercial pine forests in Washington Parish, Louisiana and Perry County, Mississippi to evaluate population and movement responses to habitat conditions. We are using burrow surveys and radio-telemetry on these tracts for *ex situ* "benchmarking" or "model training" for a subsequent GIS modeling exercise to better define commercial forest landscapes suitable for gopher tortoises. We will also compare our data to previous studies at these sites to determine demographics and landscape level movement of populations in response to habitat management. Field work began in 2017; we have radio-marked 16 gopher tortoises and documented 265 burrows on the two landscapes. We documented 19 juvenile burrows in Perry County but only observed 1 unoccupied juvenile burrow and 3 failed nest attempts in Washington Parish. These results suggest minimal recruitment within the Washington Parish population. Within Perry County, we have observed a wide age distribution and preliminary surveys indicate opening the canopy through thinning is providing appropriate habitat conditions. We will continue to monitor gopher tortoises on both sites during active habitat management (e.g., thinning, prescribed fire) to better understand the species' response to such activities in managed forest landscapes.

Restoration Efforts at Tillman Sand Ridge Heritage Preserve

J. Fowler[1] and W. Kalinowsky[2]

[1] *Region IV Heritage Trust, South Carolina Department of Natural Resources, Georgetown, SC 29440, Email: FowlerJ@dnr.sc.gov*
[2] *Herpetology Project, South Carolina Department of Natural Resources, Ridgeland, SC, KalinowskyW@dnr.sc.gov*

The Tillman Sand Ridge Heritage Preserve (TSR) in Jasper County, South Carolina is a 1,437 acre heritage preserve that was acquired to protect a population of gopher tortoises and the associated xeric plant community. The gopher tortoise is listed as a state endangered species in South Carolina. Estimated density of the species on TSR is 1.43/ha (95% CI: 1.04 – 1.96) with

an estimated population size of N = 232 (95% CI: 169 – 320) (Will Dillman, unpublished data). Restoration efforts are underway to expand useable tortoise habitat and made possible through funding by a Multi-State Competitive State Wildlife Grant. Approximately 300 acres were considered suitable prior to the initiation of restoration activities. Through coordination efforts among SCDNR staff (state forester, herpetology staff, and heritage trust staff) approx. 200 acres will be restored into suitable tortoise habitat, offering an approximately 66% increase of available habitat. Restoration efforts include timber harvesting, herbicide application, prescribed fire, and native warm season grass/ wiregrass/ longleaf plantings. See Figure1. Reference plot for desired future condition of restoration efforts. Work is ongoing and will continue as we to reach our goals in restoring potential habitat into desirable tortoise habitat.

Figure 1: Reference Plot for Desired Future Condition

A Pilot Study: Gopher Tortoise (*Gopherus polyphemus*) Foraging Preferences at Barefoot Beach County Preserve

Monica B. Hendricks* and Nora Demers

Florida Gulf Coast University, 10501 FGCU Blvd S, Fort Myers, FL 33965, Email: mbhendri@ncsu.edu

Gopher tortoise populations have recently been on the decline, in part due to the disturbance of natural processes, such as wildfires. Since many preserves do not mandate burning as an appropriate habitat management practice, we propose a solution that could both be safe for humans and improve habitats for gopher tortoises. We tested whether areas within the Preserve that were treated with understory cutting were more preferable to gopher tortoises than those uncut. We observed foraging behaviors within cut and uncut areas, and predicted that the site with the most recent cutting would be preferred by tortoises over all other sites. Gopher tortoises were found to consume five various plant groups within the four research sites. Weeds underwent the highest amount of foraging behavior by gopher tortoises, followed by ragweed, flowers, prickly pear, then other species. Even though ragweed possessed high foraging

behavior, actual consumption of this species was rare. In descending order, foraging behavior was most commonly observed at the parking lot, then at the treatment, control, and mound sites. Finally, there were several instances when tortoises were found foraging in an area that was outside of the vicinity of their burrow site. The data suggests that gopher tortoises prefer sites with significant short-foliage-covered ground, and prefer weed species over all other plant groupings. To better understand the flora that has been utilized by the gopher tortoises in this pilot study, it is advised that a local botanist is contacted to identify the specific plant species observed in this study. Since gopher tortoises seem to prefer foraging in the parking lot area, it may prove wise to take measures to make it safer for tortoises in this area, as well as to restore areas that provide optimal foraging habitat away from human and vehicle traffic.

The Vertebrate and Invertebrate Gopher Tortoise Burrow Commensals in Southeast Florida

A. C. Hipps* and J. A. Moore

Harriet L. Wilkes Honors College, Florida Atlantic University, 5353 Parkside Drive, Jupiter FL 33458, Email: ahipps@fau.edu

Limited information is available regarding gopher tortoise burrow commensal species in southeast Florida. This study investigates the vertebrate and invertebrate gopher tortoise burrow commensals at six sites along the Atlantic Coastal Ridge in south Florida, consisting of three pine flatwoods and three scrub habitats with varying degrees of habitat management. Vertebrate commensal species are identified using a burrow camera scoping system. Several methods are being employed to collect invertebrate species to aid in their identification, consisting of insect pitfall traps, baiting with gopher tortoise feces, funnel traps, burrow facade traps, UV light, mesh tents, and active searching at burrow entrances. This project is ongoing and preliminary results will be presented. The objective of this research is to compile an account of vertebrate and invertebrate species dependent on gopher tortoise burrows, accumulate information on threatened, endangered, and invasive species, and to present information to land managers concerned with maintaining biodiversity.

Long-distance Translocation to Mitigate Imperilment of Eastern Diamondback Rattlesnakes (*Crotalus adamanteus*)

Michael T. Jungen[1*], Shane M. Welch[1], John Holloway[2], Ernie P. Wiggers[3], and Jayme L. Waldron[1]

[1]Biological Sciences, Marshall University, One John Marshall Drive, Huntington, WV 25755, Email: jungen@marshall.edu
[2]Natural Resources and Environmental Affairs Office, Marine Corps Recruit Depot, Parris Island, SC
[3]Nemours Wildlife Foundation, 161 Nemours Plantation Road, Yemassee, SC 29945

The eastern diamondback rattlesnake (*Crotalus adamanteus*; EDB) is a long-lived, large-bodied pit viper endemic to southeastern pine savannas and woodlands. The EDB is declining, and conservation efforts, including long-distance translocation, are being undertaken to aid in the species' recovery. Long-distance translocation to re-establish or supplement populations of viperids has yielded mixed results, with survival averaging less than 50%. We translocated EDBs (N = 21) from a sea island population to a pine savanna restoration area located on private property in South Carolina, 2016-2017, and estimated post-translocation survival probability. This study will further our understanding of the efficacy of translocation as a conservation tool for EDB restoration.

Outcomes of the Inaugural Striped Newt Working Group

Bradley M. O'Hanlon, Brooke L. Talley and Thomas E. Ostertag

Florida Fish and Wildlife Conservation Commission, 620 S Meridian St, Tallahassee, FL 32399, Email: Bradley.OHanlon@myFWC.com

Declining, rare and imperiled species often require comprehensive management strategies that span several scientific disciplines and are supported by diverse groups of stakeholders. Working groups have successfully been used in the past to generate informed management guidelines and have bridged the communication gap between stakeholders in differing disciplines or locations. The striped newt (*Notophthalmus perstriatus*) is a declining species with two distinct genetic haplogroups, and is a candidate for federal listing. Current conservation actions affecting the striped newt include surveying for the species near the periphery of its range, captive breeding and reintroductions, pond management, and a species status assessment. To address the conservation challenges and requirements of this species, the inaugural Striped Newt Working Group convened from 21 – 23 June, 2017. Over 50 stakeholders including scientists, students, land managers, curators and policy makers representing both governmental, educational and non-governmental organizations attended the meeting. A facilitated discussion lead to the creation of six subcommittees, including: research, policy, outreach, captive populations and husbandry, applied species management and habitat management. Subcommittees were tasked to identify top priorities, goals, and data gaps, as well as to devise a working schedule to address the species needs. Priority objectives identified by the subcommittees included a forum for easy communication, updating species rankings, a roadmap for potential U.S. Fish and Wildlife Service listing determination results, priority survey areas, and identified gaps in species knowledge. The Striped Newt Working Group is an open group and accepts members from any related discipline. To receive further information or join, please contact Bradley.OHanlon@myFWC.com or Brooke.Talley@myFWC.com. The 2018 meeting is tentatively scheduled for July in Central Florida.

Preliminary Findings: Inferring Social Network Dynamics among Relocated Gopher Tortoises (*Gopherus polyphemus)*

Philip A. Schulte* and Sharon M. Hermann

Auburn University, Department of Biological Sciences, 331 Funchess Hall, Auburn, AL 36849, Email: pas0008@auburn.edu

Translocations of gopher tortoises (*Gopherus polyphemus*) as a conservation measure are increasing throughout the species' range as human development expands. In Florida, relocations aggregate populations from multiple source sites into long-term conservation sites under addendums to Incidental Take Permits (ITPs) issued by the state. Although range-wide research has been conducted on the mating success of relocated tortoises, little has been done to understand the formation of social networks within release pens containing aggregations of gopher tortoises from multiple source populations. Our research on this important topic is based at Nokuse Plantation, a 54,000-acre private conservation site in Walton Co., FL. A long-term relocation project is in place and ITP gopher tortoises from the state are released into large pens containing multiple source populations; each pen remains in place for at least one year post-release. In May 2017, a silt fence pen was erected around a 20-acre site and starter burrows were dug along one side of the pen. Beginning in June 2017, ITP tortoises brought to Nokuse were measured (weight, max. carapace length, max. plastron length, total length, weight, height, plastron concavity and annuli), marked (via drill), affixed with a transmitter (refurbished American Wildlife Enterprises, Inc.) when size allowed, and painted with identification numbers. ITP tortoises were randomly released into starter burrows within the 20-acre enclosure following processing. Burrow usage and movements were tracked 5-7 days each week using radio telemetry and burrow scoping. We describe preliminary efforts to test whether relocated gopher tortoises will form social networks that include individuals from multiple source populations.

Determining Presence of Carolina Gopher Frogs and Frosted Flatwoods Salamanders Using eDNA and Conventional Surveys

Margaret Smith*, J.L. Waldron, and S.M. Welch

Marshall University, 1 John Marshall Drive, Huntington, WV, Email: Smith2562@marshall.edu

Frosted Flatwoods Salamanders (*Ambystoma cingulatum*) and Dusky Gopher Frogs (*Rana capito*) are two species endemic to the imperiled longleaf pine savanna ecosystem, consequently, both species have been reduced in abundance and range. Both species have life histories that largely limit surveys to the breeding season when adults and larvae may be found in ephemeral, upland isolated wetlands. The species' use of aquatic habitats suggests that survey data may be improved by including environmental DNA (eDNA) as protocol. In this ongoing study, we conducted eDNA surveys in combination with traditional trapping, auditory, and visual surveys to examine the presence of *A. cingulatum* and *R. capito*. Survey sites were located in the South Carolina coastal plain, and include areas where these species have historically been found as well as new sites that have been selected based on land use history and habitat characteristics. Currently, twenty-five sites have been surveyed using eDNA. Of these, only one site yielded

results positive for *Rana capito*, which was confirmed by several other survey methods. We plan to conduct further surveys throughout 2017 and 2018. We hope to gather further information on the reliability of eDNA data and survey new sites to determine the presence of gopher frogs and flatwoods salamanders within their historic range.

Gopher Tortoise Conservation Resulting from a Solar Development in Jasper County, South Carolina

Ryan Wenzel[1], JD Collins[1], Kurt Buhlmann[2] and Andrew Grosse[3]

[1]Sabine and Waters, Inc., 311 North Magnolia St., Summerville, SC 29483, Email: rwenzel@sabinc.net
[2] Buhlmann Ecological Research and Consulting, LLC, 600 Forest Circle, New Ellenton SC 29809
[3] Blackwater Environmental Consulting, LLC, 3822 Fifle Street, Mt. Pleasant, SC 29466

The gopher tortoise (*Gopherus polyphemus*) reaches the northern limit of its distribution in the southeastern region of South Carolina. Currently, gopher tortoises occur in limited areas in the sandhills of only three counties in South Carolina: Jasper, Hampton and Aiken. A solar development was planned for a large privately-owned land parcel in Jasper County that was historically managed as an industrial timber tract. The site included a known gopher tortoise population. Through a collaborative effort between the private landowners, South Carolina Department of Natural Resources, the solar development company, and biological consultants, a plan was developed to allow the solar development to proceed while designating a portion of the property as a privately-owned gopher tortoise preserve. The entire property was surveyed for gopher tortoise burrows and tortoises located within the proposed solar-impacted areas were translocated to 1-ha pens within the proposed tortoise preserve area. Monitoring of those tortoises is on-going and initial management of the preserve area via prescribed fire has occurred. The details and results of this collaboration are presented to provide insights to a story of gopher tortoise conservation that we hope will result in a viable population of gopher tortoises being maintained on the largest privately owned gopher tortoise preserve in the state.

Map for Saturday Social

Aiken Center for The Arts is located in downtown Aiken, SC, about 25 minutes from the NWTF facility on Edgefield. Doors will open at 6:30 PM.

Address:
Aiken Center for The Arts
122 Laurens St. SW
Aiken, SC 29801