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ABSTRACTS FOR ORAL PRESENTATIONS

Down the regulatory tortoise burrow: History and future of federal listing for gopher tortoises

Elise Pautler Bennett[1]* and Matt Aresco[2]

[1]Center for Biological Diversity, P.O. Box 2155, St. Petersburg, FL; [2]Nokuse, 13292 Co Hwy 3280, Bruce, FL; EMAIL: ebennett@biologicaldiversity.org

The federal Endangered Species Act is widely considered to be one of the most powerful laws in the world aimed at halting and reversing species extinction. The Act does this successfully through a suite of regulatory tools, informed by the best available science, that protect both species and their habitat. In 1987, western populations of gopher tortoises (*Gopherus polyphemus*) received the Act's protections; but eastern populations waited for decades for a protection decision despite continued declines. In 2022, federal officials concluded that eastern gopher tortoises did not warrant protection, and the Center for Biological Diversity and Nokuse Education Inc. filed a lawsuit alleging that the agency violated the Act in reaching that decision. The case brings the tortoise's long and winding path to protection into focus and presents opportunities to reassess the species' current status and put in place a comprehensive and collaborative framework under the Act's authority. This presentation will provide a brief introduction to the Endangered Species Act, an overview of the relevant regulatory history, a review of the claims in the pending litigation, and a roadmap for potential regulatory and conservation outcomes for one of the Southeast's most beloved reptiles.

Analysis of the relationship between soft ticks (*Ornithodoros turicata*) living in gopher tortoise (*Gopherus polyphemus*) burrows and wild pigs (*Sus scrofa*) in Florida: Implications for African Swine Fever Virus introduction to the United States

Nicholas Canino[1]*§, Sebastian Botero-Cañola[1], Carson Torhorst[1], Lorenza Beati[2], Kathleen O'Hara[3], Angela James[3], Samantha M. Wisely[1]

*Denotes presenter; § Student Award Presentation

[1] Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, FL; [2] US National Tick Collection, Institute for Coastal Plain Science, Georgia Southern University, Statesboro, GA; [3] Center for Epidemiology and Animal Health, Veterinary Service), Animal and Plant Health Inspection Service, USDA, Fort Collins, CO; EMAIL: nicholas.canino@ufl.edu

The ongoing global panzootic of African Swine Fever (ASF) has highlighted the need for a comprehensive understanding of the risk of disease spread in the United States. This concern is of special interest in Florida, which harbors a large population of feral swine overlapping the distribution of the soft tick *Ornithodoros turicata*, a proven vector of ASF. To assess the risk of ASF spread, it is important to gain a better understanding of the relationship between feral swine and soft ticks. For this purpose, we used a stratified random sample design across the major ecoregions of Florida to quantify contact rates between soft ticks and wild pigs. Contact was measured as a wild pig bloodmeal in a soft tick or evidence of rooting near the collection location of a tick. We sampled for soft ticks inside gopher tortoise burrows at 113 sites across Florida and collected ticks from five burrows at each site. Collected soft ticks were identified to species using morphological features and DNA extraction was performed on a maximum of 10 pools of 5 ticks from each burrow. Tick-swine interaction was assessed using qPCR and analysis was replicated three times. In total, we collected 3,093 soft ticks from 61 of the 113 sites (54%), with all the ticks identified as *O. turicata*. We analyzed pools from the 61 sites and found that 10 sites (16.4%) had pools that were positive for swine DNA. When considering pig activity within 5 meters of the burrow, a proxy for potential tick-swine contact, there were 12 sites (19.7%) with potential or confirmed interactions. These results suggest that ASF could become persistent in Florida, which would complicate ASF outbreak and response efforts. Results highlight the need to further quantify the potential risk of sylvatic maintenance of the disease cycle posed by this species.

Gopher tortoise movement and burrow selection in endangered scrub habitat in southwest Florida

Victoria Carter [1]***§** and Phil Allman [2]

[1] Florida Gulf Coast University, Department of Biological Sciences, 10501 FGCU Blvd, Fort Myers, FL; [2] Goshen College, Biology Program, J.N. Roth Marine Biology Station, 131 S Layton Dr, Long Key, FL; EMAIL: vpcarter0983@eagle.fgcu.edu

Gopher tortoises (*Gopherus polyphemus*) face increasing threats from habitat fragmentation and translocation practices. Conservation efforts often focus on population-level strategies, yet understanding individual spatial behavior and microhabitat preferences is crucial for ensuring long-term survival of this threatened species. This study investigates the movement ecology and burrow characteristics of gopher tortoises on a

135-acre scrub preserve in Southwest Florida. Using radio telemetry to track 12 tortoises over a year, we assessed how home range size, site fidelity, and burrow selection varied across individuals, demographic groups, and over seasons. We also evaluated tortoise movement within a right-of-way (ROW) area slated for road development. Autocorrelated Kernel Density Estimation (AKDE) analyses showed the home ranges of 9 tracked tortoises intersect with the ROW, suggesting road development will impact their movement and burrow use. Analyses revealed no significant differences in estimated home range size between males, females, and subadults. Eight tortoises exhibited movement patterns that fit an Ornstein-Uhlenbeck (OU) anisotropic model, suggesting directional movement tendencies towards a central point within estimated home range. Post-hoc Dunn's tests revealed significant differences in canopy cover of burrows between females and males ($Z = -10.99$, $p < 0.001$) and subadults ($Z = -14.38$, $p < 0.001$). Burrow entrance orientation significantly varied across individual tortoises, as indicated by the Watson-Williams test ($F = 47.07$, $p < 0.001$), and was further supported by the mixed-effects model accounting for individual burrows. Demographic differences were also significant, with males, females, and subadults exhibiting distinct orientation patterns ($F = 94.41$, $p < 0.001$). These findings suggest that demographic-specific spatial behaviors and microhabitat preferences are important considerations in managing gopher tortoise populations, particularly in the context of impending habitat fragmentation from road development. Understanding these patterns can contribute to more informed conservation efforts aimed at reducing the impacts of environmental changes on this threatened species.

Habitat and Body Size Effects on Long-term Space Use of Female Gopher Tortoises

Rachel B. Fedders[1]***** and Betsie B. Rothermel[1]

[1]Archbold Biological Station, 123 Main Drive, Venus, FL ; Archbold Biological Station, 123 Main Drive, Venus, FL; EMAIL: rfedders@archbold-station.org

Gopher Tortoises (*Gopherus polyphemus*) excavate many deep burrows throughout their long lives, making them an influential ecosystem engineer in upland communities of the southeastern U.S. Thus, their spatial ecology has implications not only for managing their declining populations but also for maintaining biological diversity and ecosystem function. Annual space use of Gopher Tortoises has been shown to vary among seasons and life stages and between sexes. Our study examines effects of resource availability, individual traits, and habitat management on longer term space use of female Gopher Tortoises occupying Red Hill at Archbold Biological Station, Florida. Beginning in 2015, we tracked 37 radio-tagged females weekly for an average of 6.7 years (range 27 – 84 months). Using all tracking points, we calculated cumulative individual home ranges (95% weighted AKDEs) and averaged all pairwise distances between centroids of the annual 80% MCPs for each tortoise. We also calculated maximum annual displacement as a metric of annual

space use. We used linear models to examine effects of habitat (i.e., proportion of cumulative HR that was ruderal versus sandhill) and body size on home range size. In our global model ($R^2 = 0.56$), home range size was negatively associated with proportion of grass-dominated ruderal habitat ($p = 0.0001$) but was not affected by body size ($p = 0.38$). Mean interannual centroid distance was strongly correlated with ruderal proportion (Spearman Rho = -0.72, $p < 0.0001$) and weakly correlated with body size (-0.47, $p = 0.004$). Maximum annual displacement distances differed significantly among years (Friedman's test, $p < 0.0001$), which could be related to changes in habitat availability as we began restoring areas of long-unburned sandhill. We attribute the smaller home ranges in ruderal habitat to greater forage availability. Tortoises in this habitat may also exhibit more stable space use over time, a hypothesis we are testing in ongoing analyses.

Demography of a coyote (*Canis latrans*)-induced mass mortality event of gopher tortoises (*Gopherus polyphemus*)

Jeffrey M. Goessling[1]* and George L. Heinrich[2,3]

[1]Eckerd College, 4200 54th Ave. S., St. Petersburg, FL; [2]Heinrich Ecological Services, 1213 Alhambra Way S., St. Petersburg, FL; [3]Florida Turtle Conservation Trust, 1213 Alhambra Way S., St. Petersburg, FL; EMAIL: goessljm@eckerd.edu

As uplands across the southeastern US confront a burgeoning human population, native ecological communities are increasingly stressed by increased predators via urban subsidies to native and invasive predators. Due to a long-standing successful habitat conservation and management program, a natural population of gopher tortoises (*Gopherus polyphemus*) remains in an urban nature preserve in St. Petersburg, Florida. An ongoing long-term study of tortoises at the site has identified more than 200 unique individual tortoises in this population. Between summer 2023 and 2024, however, more than 20% of the adult tortoise population was found to have been killed by coyotes, which are an invasive species in Florida. The depredated shells of many previously marked, healthy, and reproductive adult tortoises were found across the site and frequently cached and surrounded by coyote scat. Many of these shells were broken throughout individual bones (consistent with a large-gaping canine predator), not just along bone sutures. Three caches of tortoise shells also included other similar-sized carcasses of two other species (domestic cat, *Felis catus*, and nine-banded armadillo, *Dasypus novemcinctus*). An unquantifiable number of juvenile and hatchling gopher tortoises have also recently been killed by coyotes at the site, as evidenced by coyote scat in an adult tortoise shell cache containing hatchling tortoise shell scutes. Given the high number of previously-marked and well-studied but recently-depredated tortoises that have been recovered, this presentation will focus on the demographic features of the depredated population (including, sex, size, social network status, and reproductive output of the dead animals). Lastly, we will put this

mass mortality event of gopher tortoises into a broader context and discuss the viability of >20% annual adult mortality and how this should impact regional management of invasive coyotes and this rapidly-declining ecological community.

Collaborative gopher tortoise disease research within FWC Wildlife Health

Rebecca Hardman[1]*

[1]Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, 100 8th Ave SE, St. Petersburg, FL; EMAIL: rebecca.hardman@myfwc.com

The Florida Fish and Wildlife Conservation Commission Fish and Wildlife Health (FWC-FWH) team provides response and research regarding morbidity and mortality events of wildlife throughout the state of Florida. The herpetological and avian health program within the FWH focuses on herpetological species of concern and diseases affecting populations. Over the past two years we have adjusted monitoring protocols and increased proactive and targeted disease surveillance with particular focus on chelonian pathogens including Turtle Fraservirus (TFV), *Ranavirus* (RV) and multiple pathogens of gopher tortoises. We surveyed antemortem and postmortem swabs and blood, and postmortem tissues from opportunistically encountered individuals from multiple collaborative partners including rehabbers and state and private field biologists. We also performed two cross sectional "health bioblitzes" in two areas of disease concern in peninsular FL which included above mentioned pathogen sampling of 112 individuals with additional collection of morphometrics, physical exams, and various blood based health parameters. TFV testing was via RT-qPCR at the University of Florida Wildlife and Aquatic Veterinary Diagnostic Laboratory. RV qPCR testing from whole blood and tissue samples was performed at the Fish and Wildlife Research Institute. Gopher tortoise swab samples were tested for multiple pathogens via qPCR Fluidigm chip at the University of Illinois Wildlife Epidemiology Laboratory. Many samples are still pending, but a major finding is diagnosis of several cases of severe ranavirosis in free- ranging gopher tortoises, and implications of this will be discussed.

Conserving gopher tortoise (*Gopherus polyphemus*) populations on small public lands in urbanized central Florida

George L. Heinrich[1,2]*, Jeffrey M. Goessling[3], and J. Sean Doody[4]

[1]Heinrich Ecological Services, 1213 Alhambra Way S., St. Petersburg, FL, [2]Florida Turtle Conservation Trust, 1213 Alhambra Way S., St. Petersburg, FL; [3]Eckerd College, 4200 54th Avenue S., St. Petersburg, FL; [4]University of South Florida, 140 7th Avenue S., St. Petersburg, FL; EMAIL: george@heinrichecologicalservices.com

*Denotes presenter; § Student Award Presentation

The Gopher Tortoise (*Gopherus polyphemus*) is an imperiled, keystone species occurring in upland habitats within the Southeastern Coastal Plain of the United States. This herbivore is dependent on fire to maintain open upland habitat with abundant rich forage species. Listed as Threatened by the Florida Fish and Wildlife Conservation Commission (FWC), this species is in steep decline primarily due to habitat loss and modification. Gopher Tortoises are ecosystem engineers that excavate extensive burrow systems (provide refugia for nearly 400 other documented species range wide) and disperse seeds, significantly contributing to upland biodiversity. We report on tortoise research and management on 60.7 ha (150.0 ac) of upland habitat in a remnant natural area (Boyd Hill Nature Preserve) in urban St. Petersburg, Florida. This population is of regional significance and the preserve is recognized by FWC as being relevant to the species' conservation in Florida. Mark-recapture was conducted from 1991-2013 and 2018-present. Biennial 100% burrow surveys started in 2011 generate data that inform habitat management and allow assessment of strategies long-term. In addition to this method, we used mark-recapture and line transect distance sampling to estimate population size. Studies on demographics, diet, movement, physiology, reproduction, and social behavior were added beginning in 2018. Nest site choice was studied in 2020 and revealed nesting up to 1m inside the burrow. We will review threats, including a recent mass mortality event due to Coyote (*Canis latrans*) predation. We will also discuss long-term habitat restoration efforts (e.g., prescribed fire, thinning of trees, and control of invasive non-native plant species), as well as the challenges of managing a natural area bordered by urban interface.

Gopher tortoise nesting decisions and outcomes across the latitudinal range and implications for climate change

Elizabeth A. Hunter[1,2]*****, Kevin J. Loope[2], J. Nicole DeSha[3], Betsie B. Rothermel[4], Lora L. Smith[5], David C. Rostal[3], Alicia G. Arneson[6] and Kevin T. Shoemaker[7]

[1]U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit,; [2]Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA; [3]Department of Biology, Georgia Southern University, Statesboro, GA; [4]Archbold Biological Station, 123 Main Drive Venus, FL; [5]The Jones Center at Ichauway, 3988 Jones Center Drive, Newton, GA; [6]Department of Biology, Virginia Tech, Blacksburg, VA; [7]Department of Natural Resources and Environmental Science, University of Nevada, Reno, 1664 N. Virginia Street, NV; EMAIL: ehunter1@vt.edu

Understanding how populations maintain demographic viability across existing rangewide climatic variation can provide insights into species' responses to climate change. We studied gopher tortoise (*Gopherus polyphemus*) nesting outcomes (hatching success and hatchling mass) in 2018-2020 across five sites that span the species' latitudinal range to make inferences about the sensitivity of nesting outcomes to climate change. We hypothesized that climate during the nesting period would vary across sites such that

tortoises in different sites would need to correspondingly vary either in behavior (e.g., nest placement) or physiology (e.g., thermal tolerance) to achieve similar nesting outcomes across the range. Most of the temperature differences across the range occur during the non-nesting season, and maximum temperatures were similar across our sites. However, southern sites warm up earlier in the year and have higher average temperatures during the nest incubation season (May – October). In response to these conditions, tortoises lay eggs 20 days earlier on average at the southernmost site compared to the northernmost site (lay dates were inferred based on temperature data collected in the nest, ambient temperature data, and an embryonic development model). Varying lay date appeared to be the mechanism by which tortoises achieved similar nest incubation temperatures across the range, as nesting behaviors (e.g., nest depth) did not vary by latitude. Nest incubation temperatures were within a range (27-31°C) that consistently results in high hatching success in lab studies. Due to these moderate nest temperatures, we saw high hatching success across the latitudinal range and little sensitivity of hatching success and hatchling mass to experienced nest temperatures. At this early life stage, gopher tortoises appear to be tolerating any climate warming that has already occurred through both timing of laying and thermal tolerance. We expect warming at the northern range edge could expand the duration of the nesting season, with warmer springs triggering earlier laying.

A Collaborative approach to save gopher tortoise habitat: A case study from the South Carolina sandhills

Peter Kleinhenz[1]*****

[1]Aiken Land Conservancy, 302 Park Avenue SE., Aiken, SC; EMAIL: peter@conserveaiken.org

The permanent of remaining populations of gopher tortoises has been identified as a key method for the conservation of the species. This is particularly true in South Carolina, where only three natural populations are known to exist. In late 2023, a property containing a small population of gopher tortoises in South Carolina went up for sale and was threatened with habitat conversion. Aiken Land Conservancy, an accredited land trust, along with state and local partners, took a collaborative approach to ensure that the property was not only protected, but managed properly in the future. This approach highlights the sometimes-complex mechanics of land conservation while highlighting the importance of collaboration to protect remaining gopher tortoise habitats.

Introducing the Desert Tortoise Council with a focus on the Ecosystems Advisory Committee

Ed LaRue[1]*

[1]*Ecosystems Advisory Committee, Chair, Desert Tortoise Council; EMAIL: ed.larue@verizon.net*

Founded in 1975, the non-profit Desert Tortoise Council continues to be committed to the protection and conservation of desert tortoises in the wild and advancing the public's understanding of desert tortoise species. Our primary focus is on *Gopherus agassizii*, which is listed as both a federally-Threatened species in four states and state-Endangered in California, and *Gopherus morafkai*, which is designated as a Sensitive Species by the Bureau of Land Management in Arizona. Our 15 Board members and Operations Manager comprise a working group of mostly biologists (employed and retired) from state and federal agencies, consultants, and one retired professor. Our 50th Annual Symposium is planned for February 2025 in Las Vegas, NV, and the 33rd Annual Introduction to the Mojave Desert Tortoise, which includes a one-day online course and one day in the field demonstrating field techniques, is scheduled this fall. Board members serve both as officers (Chairperson, Chairperson-elect, Treasurer, Recording Secretary, and Corresponding Secretary) and committee members for Membership, Nominating, Media, Strategic Planning, Grants, Agency Coordination, Mexican Tortoise Conservation, Training, Education and Outreach, Annual Symposium Program, Fundraising, Awards, and Ecosystems Advisory Committee (EAC). Between 2013 and 2023, the EAC had 530 opportunities to comment on projects affecting tortoises and responded to 487 of those opportunities, or 92%, which ranges from a low of 76% in 2018 to a high of 97% last year. These have included 211 letters in California, 94 in Nevada, 85 on national issues, 62 in Arizona, 34 in Utah, and 1 in New Mexico on behalf of the Bolson tortoise. Project types on which we have commented include solar fields, travel management plans, military issues, grazing allotments, mine sites, pipelines, communications infrastructure, and various resource management plan documents

Gopher tortoise nest-site selection at burrows and the influence of nest environment on hatching success (STUDENT)

Garrett R. Lawson[1,3]*§, Elizabeth A. Hunter[2], Lora L. Smith[3]

[1]*Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA;* [2]*U.S. Geological Survey, Virginia Cooperative Wildlife Research Unit, Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA;* [3]*The Jones Center at Ichauway, 3988 Jones Center Rd, Newton, GA; EMAIL: grlawson@vt.edu*

*Denotes presenter; § Student Award Presentation

Nesting and early life stages are periods of high mortality for many turtle species. In gopher tortoises, few studies have investigated nest-site selection and, to our knowledge, none have evaluated the effects of differing natural nest environments on hatching success. We investigated gopher tortoise nest-site selection and the impact of nest environment on clutch hatching success at the Jones Center at Ichauway in Southwest Georgia. In 2022 and 2023 we conducted repeated searches at burrows to locate nests, excavated and collected nest data, and re-buried nests as they were found. We collected soil samples, measured canopy and ground cover at nest locations (n=132) and collected the same samples at an equal number of burrows where no nests were found. At nest sites, we also monitored temperature and moisture throughout incubation. We found that canopy cover and understory vegetation cover significantly predicted nest presence at burrows, with tortoises in our sites nesting at burrows with lower understory and canopy cover. We quantified the direct and indirect effects of nest environment on hatching success using a structural equation model (SEM). We found that nest microclimate could be predicted moderately well from the nest environment (R^2=0.25-0.49), with lay date, vegetation, nest position, and percent clay influencing nest microclimate. Hatching success was highest at lower mean temperatures and moistures and at intermediate levels of temperature and moisture variability, but our ability to predict hatching success from our model was low (R^2=0.10). We observed very high hatching success overall (87.5%) and, thus, there was not much variation in hatching success to explain. This framework may be useful for investigating environmental causes of lower hatching success at less robust tortoise populations that may be experiencing low rates of natural hatching success.

How does translocation affect the reproductive rate of female gopher tortoises?

Kevin J. Loope[1]*, Derek B. Breakfield[2], Rebecca A. Cozad[2], Matthew J. Aresco[2], Kevin T. Shoemaker[3], J. Nicole DeSha[4], Joan Diemer Berish[5,] David C. Rostal[4], Betsie B. Rothermel[6], Richard A. Seigel[7], Elizabeth A. Hunter[8]

[1]Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA; [2]Nokuse, 13292 County Highway 3280, Bruce, FL; [3]Department of Natural Resources and Environmental Science, University of Nevada, Reno, Reno, NV; [4]Department of Biology, Georgia Southern University, Statesboro, GA; [5]20 Kiva Ct., Sandia Park, NM; [6]Archbold Biological Station, Venus, FL; [7]Department of Biology, Towson University, Towson, MD; [8]U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit; Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA; EMAIL: kjloope@vt.edu

Animal translocation has the potential to alter the demographic rates, including survival and reproduction, that influence the long-term persistence of populations. Understanding how translocation can reduce demographic rates can improve translocation practices. Here, we investigate how translocation distance, measured in terms of geographic and

climatic difference between source and translocation sites, influences the probability that female gopher tortoises reproduce each year. We also analyze years since release to test for temporary effects of the translocation process on reproduction, and compare release pen areas to look for potential effects of habitat on reproduction. We collected 133 ultrasound observations of gravidity status from 98 females across six years and three release sites at Nokuse, a large translocation site in the Florida Panhandle (Walton Co.). Because fieldwork took place at the onset of the nesting season, some observations necessarily occurred after females had nested, resulting in a detection problem where post-reproductive females appear non-reproductive on ultrasound. We account for this bias with a novel Bayesian modeling framework that treats detection probability as a non-linear function of observation date that declines after the onset of nesting. To generate comparable estimates of reproductive rate from natural populations, we obtained previously-published datasets from several non-translocated populations across the range and used the same modeling framework to account for observation date. At Nokuse, we found no effects of female origin or years since translocation on reproduction rate. However, females reproduced at different rates across release areas at Nokuse, suggesting habitat quality may influence reproduction. Overall probability of reproduction at Nokuse was estimated to be 0.80 (CI: 0.64 – 0.95), at the low end of rates estimated from five native, non-translocated populations using the same statistical approach. We also discuss preliminary results examining links between overwintering behavior and reproduction in translocated females.

Assessing the reproductive ecology of the federally threatened gopher tortoise in Louisiana

Emily Mailhos[1]*[§], Daniel U. Greene[2], Keri L. Lejeune[3], and Rachel Wallace Clostio[1]

[1]Department of Biological Sciences, The University of New Orleans Computer Center Room 200, 2000 Lakeshore Drive New Orleans, LA; [2]Weyerhaeuser Company, Environmental Research South, Columbus, MS;[3]Louisiana Department of Wildlife and Fisheries, 200 Dulles Drive, Lafayette, LA; EMAIL: ermailho@uno.edu

The gopher tortoise (*Gopherus polyphemus*) is an important keystone species that thrives within well managed longleaf pine (*Pinus palustris*) ecosystems in the southeastern United States. Gopher tortoise populations are experiencing declines primarily as a result of continued habitat loss and degradation, among other stressors. In Louisiana, the gopher tortoise is listed as federally endangered, and state threated where it is restricted to Washington, Tangipahoa, and St. Tammany parishes. To better understand gopher tortoise ecology in Louisiana, we are conducting surveys at two sites, Bens Creek, a private working forest owned and managed by Weyerhaeuser Company in Washington Parish, and Sandy Hollow, a Wildlife Management Area owned by the Louisiana Department of Wildlife and

Fisheries in Tangipahoa Parish. Our goal is to provide insight on important life history traits, including mating, nesting and rate of predation for gopher tortoise populations on the western periphery of their range. Monitoring mating and nesting within these populations will allow us to evaluate reproductive activity, temporal patterns, and sex ratios; locate and protect nests; and describe differences in microhabitat structure around burrows within and between study sites. Additionally, monitoring predation will allow us to identify nest predators and determine relationships between predation attempts and habitat conditions. To date, we have deployed 33 trail cameras across two sites in Louisiana. Each site contains two distinct cover types: longleaf pine forests and cleared rights-of-way. Images gathered from these two sites will be analyzed with comparison between two artificial intelligence programs. An overview of study methods, project deliverables, and preliminary data will be discussed.

Gopher tortoises (*Gopherus polyphemus*) along Florida's roads: Monitoring, mortality, and management

Eli McEuen[1*§], J. Sean Doody[1], and George L. Heinrich[2,3]

[1]Doody Lab, University of South Florida, 140 7th Ave S, St. Petersburg, FL; [2]Heinrich Ecological Services, 1213 Alhambra Way S., St. Petersburg, FL; [3]Florida Turtle Conservation Trust, 1213 Alhambra Way S., St. Petersburg, FL; EMAIL: emceuen@usf.edu

Habitat loss and degradation make turtles among the most threatened taxa on earth. These threats are exacerbated by the building of roads, which adds road mortality as a nominal threat and possible population sink. There are four objectives for this study. The first objective is to establish a population baseline for gopher tortoise (*Gopherus polyphemus*) living along roadsides across eight counties in west-central Florida. The second objective is to determine the minimum population density and prevalence in the same area. The third objective is to determine if these roadside populations of gopher tortoises are incurring road mortality. The fourth objective is to compare the habitat quality among tortoise populations residing on roadside edges, their immediately adjacent habitats, and habitats with healthy populations through canopy cover percentage. Thus, the fourth objective will directly test the hypothesis that tortoises are marginalized to reside on roadside edges due to unsuitable adjacent habitats. The methods utilize vehicle and walking surveys for data collection on gopher tortoises, their burrows, and related metrics including canopy cover percentage. Survey data points include tortoise burrow mouth width as a proxy for tortoise body size, burrow distance from the road, and the activity classification (active/inactive/abandoned) of burrows. Road mortality data includes shell length, exact location with GPS point, and the distance of the carcass from the road. The canopy cover percentage is recorded using a camera with a specialized fisheye lens during surveys to be

analyzed using gap light analyzer computer software. When the field data have been recorded and analyzed, management suggestions will be made to protect roadside tortoise populations. Finally, a population estimate, minimum population density, and prevalence of gopher tortoises residing along roadsides will be published to establish a baseline for future monitoring to determine if roadways act as population sinks.

Culex erraticus (Diptera: Culicidae) utilizes gopher tortoise burrows for overwintering in North Central Florida

Timothy Daniel McNamara[1], Mba Mosore[1], Alex Urlaub[2], Markus Lashley[3], Nathan Burkett Cadena[2], Larry Reeves[2], and Estelle Martin[1]*

[1]Department of Entomology and Nematology, Institute of Food and Agricultural Sciences, University of Florida, 1881 Natural Area Drive, Gainesville, FL;[2]Florida Medical Entomology Laboratory, Department of Entomology and Nematology, Institute of Food and Agricultural Sciences, University of Florida, 200 9th St SE, Vero Beach, FL; [3]Department of Wildlife Ecology and Conservation, University of Florida, 110 Newins-Ziegler Hall, Gainesville, FL; EMAIL: estellemartin@ufl.edu

Mosquito-borne diseases represent a significant threat to human and animal health in the United States. Several viruses, including West Nile, Saint Louis encephalitis, and Eastern equine encephalitis are endemic. In humans, the disease is typically detected during the summer months, but not during the winter months. The ability of these viruses to reemerge year after year is still not fully understood, but typically involves persistence in a reservoir host or vector during periods of low transmission. Mosquito species are known to overwinter at different life stages (adults, larvae, or eggs) in manufactured or natural sites. Gopher tortoise burrows are known to serve as refuge for many vertebrate and invertebrate species in pine savannas. In this study, we surveyed the interior of gopher tortoise burrows for overwintering mosquitoes. We identified 4 species (*Anopheles crucians* s.l., *Culex erraticus*, *Mansonia dyari*, and *Uranotaenia sapphirina*). *Cx. erraticus* was the most abundant, and its presence and abundance increased in winter months, implying that this species utilized gopher tortoise burrows for overwintering. Bloodfed *Cx. erraticus* and *An. crucians* s.l. females were detected. While An. crucians s.l. fed exclusively on the white-tailed deer, *Cx. erraticus* had a more diverse host range but fed primarily on the gopher tortoise. Tortoises and other long-lived reptiles like the American alligator have been shown to sustain high viremia following West Nile virus (WNV) and Eastern equine encephalitis virus (EEEV) infection and therefore could play a role in the maintenance of these viruses. In addition, *Cx. erraticus* is naturally infected with WNV and is a known bridge vector for EEEV. As such, these overwintering sites may play a role in perpetuating over-winter arboviral activity in Florida.

*Denotes presenter; [§] Student Award Presentation

Pathogen prevalence in gopher tortoises in the Red Hills

Deanna Riente[1,2*§], Kim Sash[2] , Rebecca Hardman[3],Marcus Lashley[1]

[1]University of Florida, 110 Newins-Ziegler Hall, Gainesville, FL; [2]Tall Timbers Research Station and Land Conservancy, 13093 Henry Beadel Dr, Tallahassee, FL; [3]Florida Fish and Wildlife Conservation Commission FWRI, 100 8th Ave SE, St. Petersburg, FL; EMAIL: deanna.riente@ufl.edu

Habitat loss attributed to anthropogenic activity has resulted in an increase in wildlife displacement and mortality. The gopher tortoise (*Gopherus polyphemus*) is a threatened keystone species and ecosystem engineer native to the southeastern United States. Gopher tortoises are commonly translocated to new environments to mitigate human development, but this strategy comes with the risk of introducing various disease-causing pathogens to new populations. Understanding the baseline prevalence of important pathogens in gopher tortoise populations before they receive translocated tortoises is a necessary step to monitor disease risks during translocations. To investigate pathogen prevalence, we implemented seasonal gopher tortoise trapping and pathogen sampling on seven properties within the Red Hills of north Florida and south Georgia, with some being candidate populations to receive translocated tortoises. My results indicate that resident wild tortoise populations in this region have been exposed to known pathogens *Mycoplasmopsis agassizii*, *Helicobacter* sp., and *Terrapene adenovirus* as well as a previously undocumented pathogen of tortoises: *Leptospira* spp. Future pathogen monitoring may require the inclusion of additional pathogens to those typically screened for such as *M .agassizii* or *Ranavirus* sp.

Longleaf pine restoration, habitat management, and pathogen prevalence: Insights into upland squamate ecology in William B. Bankhead National Forest

Sam Robinson[1*§], Donald M. Walker[2], Allison Cochran[3], and William B. Sutton[1]

[1]*Wildlife Ecology Laboratory, Tennessee State University, 3500 John A Merritt Blvd, Nashville, TN; [2]The Microbiome Ecology Laboratory, Middle Tennessee State University, 1301 E Main St, Murfreesboro, TN; [3]Partnership Coordinator National Forests in Alabama, U. S. Forest Service, 1070 Hwy 33 North; PO Box 278 Double Springs, AL; EMAIL: sammccaberobinson@gmail.com*

Open-canopied longleaf pine (*Pinus palustris*) forests support a diverse array of squamate species. However, this ecosystem has widely declined over the past four centuries due to fire suppression and overharvesting. Alongside habitat loss, the emergence of novel pathogens poses a significant threat to squamate populations. In recent decades, a fungal pathogen, *Ophidiomyces ophidiicola* (Oo), has been detected in wild snake populations

throughout much of the eastern United States. Oo is one of the primary infectious agents responsible for Ophidiomycosis (commonly known as “Snake Fungal Disease”). Despite an increase in monitoring efforts for Oo, the potential impacts of this pathogen are poorly understood. The combination of habitat loss and a novel pathogen has created important questions for land managers seeking to conserve diverse squamate assemblages. The United States Forest Service is working to restore longleaf pine forests across the southern range of the William B. Bankhead National Forest through strategic thinning, replanting, and prescribed burning. To monitor how herpetofaunal communities responded to these efforts, we deployed 16 drift fence arrays with funnel traps and pit fall traps across a chronosequence of longleaf pine restoration. Traps were open from May to August in 2021-2024. In 2023, we expanded sampling efforts to monitor surrounding habitats using road cruising surveys, visual encounter surveys, and additional drift fence funnel trap arrays. We visually inspected snakes for clinical signs of Ophidiomycosis and collected skin swabs to monitor for the presence of Oo. In total, we collected 417 samples representing 387 individual snakes across 19 species. Oo was detected in approximately 17% of individuals. Prevalence of Oo was greatest in *Agkistrodon contortrix*, *Crotalus horridus*, *Lampropeltis nigra*, and *Pantherophis spiloides*. Habitat characteristics such as herbaceous ground cover, leaf litter, basal area, and burn history were found to be the primary drivers behind distributional patterns for squamate assemblages.

WILD – CAM: Wildlife investigation landscape diversity using cameras around Miami

Emily M. Sanchez[1]*, Kinga L. Brihammar[1]*, Imani Douglas[1,2], Luke O. Poessy[1], Lucas Medina[1], Evelyn Garcia[1], Jason Lois[1], Gloria Binett[1], and Daniel A. Valle[1]

[1]BioTECH @ Richmond Heights 9-12 High School, 15020 SW 102nd Ave, Miami, FL; [2]Florida International University, 11200 SW 8th St, Miami, FL 33199; Email: 0478643@students.dadeschools.net, 0618820@students.dadeschools.net

As South Florida becomes increasingly more populous and urban sprawl continues to claim green spaces, native fauna face decreased refuge, suitable habitats to forage in, and smaller fragments not conducive for supporting stable populations. However, our research has shown that areas with the gopher tortoise - a keystone species - have more wildlife activity than natural areas without them. Using trail cameras and artificial intelligence software for identification purposes in multiple preserves, we have observed the movement and behavioral patterns of various species, many of which can be seen near gopher tortoise burrows and firebreak roads nearby. This correlation between gopher tortoises and increased biodiversity helps us better understand the wildlife system in South Florida, especially in a region with only small fragments of undisturbed habitat remaining. This understanding has identified that animal movement is constricted by heavy

traffic, often time leading to animal endangerment or even death due to vehicular collisions. With this in mind, placing animal crossing signs around these preserves is one step in the right direction in protecting South Florida's wildlife.

Brief introduction to the Gopher Tortoise Council

Kim Sash[1]* and Michelina Dziadzio[2]

[1]Gopher Tortoise Council co-chair, Tall Timbers Research Station, 13093 Henry Beadel Drive, Tallahassee, FL; [2]Florida Fish and Wildlife Conservation Commission, 620 South Meridian Street 2A, Tallahassee, FL; EMAIL: ksash@talltimbers.org

The Gopher Tortoise Council was established in 1978 by a group of biologists and citizens from the southeastern United States who were concerned about declines of gopher tortoises across their range. The Council's primary functions are to provide expertise on the management and conservation of tortoises, commensal species, and upland habitats; advocate for initiatives that ensure the survival of gopher tortoises, their habitat, and other upland species; support gopher tortoises and management; provide opportunities for conservation education; and promote habitat conservation. Membership is open to those interested in research, management, or conservation related to gopher tortoises, their commensals, or other animals that co-occur with tortoises or similar habitats. In addition to holding an annual meeting, the Council leadership convenes throughout the year to discuss operations and business matters. Over the nearly 50 years since our establishment, we have achieved numerous accomplishments. This presentation will provide an overview of the Gopher Tortoise Council's activities, introduce our board members, highlight some of our significant achievements, and outline how you can get involved.

'Scaling up' our understanding of ophidiomycosis: Urbanization, distribution, and novel hosts in southeastern snake populations (STUDENT)

Shivam Shukla[1]*§, J. Sean Doody[1], Zachary Gray[2], Ashby Barbee[1], and Michael Shamblott[1]

[1]Department of Integrative Biology, University of South Florida, St. Petersburg Campus, 140 7th Ave. South, St. Petersburg, FL; [2]School of Biological, Environmental, and Earth Sciences, University of Southern Mississippi, 118 College Drive, Hattiesburg, MS; EMAIL: shuklas1@usf.edu

Ophidiomycosis, an emerging infectious disease affecting diverse snake species, is caused by the invasive fungal pathogen *Ophidiomyces ophiodiicola* and often results in mortality. This study investigated the prevalence, distribution, and factors influencing ophidiomycosis in Florida, Louisiana, and Mississippi, with a focus on the impact of

urbanization. We examined 497 free-ranging snakes across 42 species between 2022 and 2024, detecting *O. ophiodiicola in* 22.38% of individuals. Our research uncovered the first cases of ophidiomycosis in six snake species and provided the first record of the disease in Mississippi. Employing generalized linear mixed models and linear regression analyses, we evaluated various factors affecting disease prevalence and severity. Urbanization demonstrated a statistically significant, albeit weak, correlation with both prevalence and severity. Other factors, including subfamily and sex, also played roles in disease dynamics. A focused analysis of paired urban and non-urban sites revealed no significant difference in prevalence but showed a statistically significant difference in infection severity between urban and natural environments across all systems. These results underscore the intricate interplay between urbanization, taxonomic classification, and ecological factors in ophidiomycosis transmission and progression. Our research establishes baseline data for future ophidiomycosis monitoring and emphasizes the necessity of long-term surveillance to comprehend the disease's impact on snake populations in the southeastern United States.

Using gopher tortoise monitoring data to inform habitat restoration and translocations

Lora L. Smith[1]*****, Colin P. Shea[2], Michelina C. Dziadzio[3], Jennifer M. Howze[1], Kyle Brown[4], and Katherine Richardson[5]

[1]Jones Center at Ichauway, 3988 Jones Center Drive, Newton, GA; [2]Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, 100 8th Avenue SE, St. Petersburg, FL; [3]Florida Fish and Wildlife Conservation Commission, 620 South Meridian Street 2A, Tallahassee, FL; [4] South Carolina Department of Natural Resources, 1000 Assembly Street, Columbia, SC; [5]Tall Timbers Research Station, 13093 Henry Beadel Drive, Tallahassee, FL; EMAIL: lora.smith@jonesctr.org

ABSTRACT Translocation has become an increasingly important tool for mitigating the loss of wildlife populations; however, determining appropriate stocking levels for recipient sites is particularly challenging for species that occur across a wide array of habitats. The gopher tortoise (*Gopherus polyphemus*) occurs in nearly all terrestrial habitats in the southeastern U.S. and is one of the most frequently translocated reptiles in North America. We used existing line transect distance sampling data collected from 2014 through 2020, as part of Florida's gopher tortoise monitoring program for 58 conservation lands, and two metrics of habitat condition, soil depth to water table and an index of canopy cover, to predict tortoise densities in different land cover types using a Bayesian implementation of a hierarchical distance sampling model. Predicted gopher tortoise densities varied by land cover type, but generally increased with decreasing canopy cover and increasing depth to water table. Among land cover types, coastal strand, sandhill, coastal grassland, and coniferous plantation had the highest predicted tortoise densities (>1 tortoise/ha). The lowest

predicted densities occurred in upland pine, upland coniferous, xeric hammock and mesic flatwoods (<0.30 tortoise/ha). This study demonstrates how extensive monitoring data and metrics of land cover condition can be used to inform stocking recommendations for translocations and inform habitat restoration.

Evaluating gopher tortoise behavior in southeast Florida (STUDENT)

Charles Thériault[1]*§ and Evelyn Frazier[1]

Florida Atlantic University, 777 Glades Rd, Boca Raton, FL; EMAIL: ctheriault2014@fau.edu

The temperature range at which gopher tortoises are most active is between 21 °C and 32 °C . While gopher tortoise reproductive behavior is typically observed between May and June, in most of its range, latitudinal and climatic differences across the tortoises' range are known to affect behavior and reproduction. The warmer year-round temperature in Southeast Florida opens the possibility of an extended or even year-round gopher tortoise mating season. Additionally, while gopher tortoises are primarily diurnal, nocturnal behavior has been observed and may likewise relate to the gopher tortoise's preferred temperature range. We hypothesize that gopher tortoise populations in Southeast Florida will be active and display reproductive behaviors year-round. Data was collected from 2016-2018, using 24 motion-triggered cameras secured onto metal mounts facing the entrance of the burrow at 3 sites in Southeast Florida: Pine Jog Preserve, Jonathan Dickinson State Park, and on the Florida Atlantic University Preserve. We observed four different categories of behavior (standing, excavation, defensive behavior, and reproductive behavior) and compared the frequency at which each behavior was observed in relation to each month of the year as well as whether the behavior was observed during the daytime or nighttime. Gopher tortoises are active year-round and seem to display reproductive behavior mostly in Fall.

Vertical lead transmission in gopher tortoises

Kim Titterington[1]*

[1]*Rescue Research Rehabilitation Conservation Of Reptiles Amphibians, 5083 Biscayne Rd Kissimmee, FL; EMAIL: dir@swampgirladventures.org*

Hatchling gopher tortoises tested in my previous study, Prevalence of Lead in Chelonians, showed that gopher tortoises were the most likely to have elevated lead (pb) levels through bioaccumulation and raised some questions about hatchling gopher tortoises with positive lead levels within just a few weeks to months of age. Many of the individuals had signs of metabolic bone disease and failure to thrive but how does a hatchling get lead so quickly? Could they hatch out lead positive? This study tested lead positive females and their

hatchlings to see if vertical transmission was possible and could be the cause and if so, what part of the egg production and development cycle could lead be introduced? Not only the hatchlings were tested but also parts of the eggs to track lead contaminates and answer these very questions.

POSTER PRESENTATIONS

Using roadkill to assess health and ecological dynamics of Florida's snake populations

Ashby Barbee[1]*, Shivam Shukla[1], J. Sean Doody[1]

[1]Department of Integrative Biology, University of South Florida; EMAIL: ashbybarbee@usf.edu

Snakes play a crucial role in Florida's ecosystems, yet face increasing threats from habitat loss, emergent diseases, and road mortality. This study aims to comprehensively evaluate the health status and ecological dynamics of Florida's snake populations to inform effective conservation strategies. Our research focuses on three key areas: the impact of Ophidiomycosis, an emerging fungal disease caused by *Ophidiomyces ophidiicola*; the presence and effects of internal parasites, particularly nematodes; and the extent of road mortality. Data is collected through necropsies of road-killed snakes submitted by researchers and community members statewide. The necropsy procedure includes testing for Ophidiomycosis, measuring specimens, documenting external abnormalities, and performing internal examinations. This multifaceted approach provides a broad overview of the health challenges facing Florida's wild snake populations, quantifies the impact of road mortality, and emphasizes the importance of collaborative efforts in wildlife health monitoring. Our findings will contribute valuable data to inform targeted conservation efforts, including disease management strategies and measures to mitigate road mortality, ultimately aiding in the protection of both snakes and their habitats.

Crowdsourcing conservation success: Monitoring eastern indigo snakes at the Apalachicola Bluffs and Ravines Preserve

Richard "Rhett" Barker[1], Michelle Hoffman[2], Catherine Ricketts[3], and Bradley O'Hanlon[1]*

[1]Florida Fish and Wildlife Conservation Commission, 620 S. Meridian Street, Tallahassee, FL; [2]Central Florida Zoo's Orianne Center for Indigo Conservation, 30931 Brantley Branch

Road, Eustis, FL; [3]The Nature Conservancy, 10394 NW Longleaf Drive, Bristol, FL; EMAIL: Bradley.OHanlon@MyFWC.com

To meet recovery criteria, captive bred eastern indigo snakes (*Drymarchon couperi;* federally threatened) are being reintroduced to a portion of the species historic range in the Florida Panhandle. Beginning in 2017, 167 snakes have been released at The Nature Conservancy's Apalachicola Bluffs and Ravines Preserve in Liberty County, and offspring from these snakes have been detected on the landscape. To measure project success three monitoring techniques are being used: pedestrian surveys, automated PIT tag scanner systems, and camera traps. Each technique has benefits and drawbacks. Specifically, for camera traps, cameras are deployed at gopher tortoise burrows or in drift fence arrays with the goal of documenting eastern indigo snakes. These traps have so far collected over 10 million photos, which create logistical challenges for review and limits the effectiveness of this technique. In August 2024, reintroduction partners launched the Indigo Snake Watch project on the Zooniverse platform to leverage participatory science for photo review. Through structured crowdsourcing and repeated subject verification thresholds, we have observed detection rates over 98% on photos containing eastern indigo snakes. Our preliminary photo validation statistics indicate over 2,400 volunteer participants, and nearly 1.5 million unique classifications resulting in over 219,000 photographs reviewed. This classification allows for the creation of a curated dataset which includes indigo snakes, black racers (*Coluber constrictor*; visually similar to eastern indigo snakes), gopher tortoises (*Gopherus polyphemus*), and higher-level taxa of species (i.e., mammal, bird, invertebrate). Photos categorized as eastern indigo snakes will require further review by project personnel. The primary challenge with this project is pre-processing photos for upload to Zooniverse, as volunteer contributions have so far out-paced photo availability. Because Zooniverse is internet based, this participatory science initiative allows engagement with a wide volunteer base and promotes the intrinsic value of often misunderstood creatures to a global audience.

Reassessment of the upland snake community in the Red Hills Region

Ashlynn Canode[1]*****, Kim Sash[2], and Steve A. Johnson[1]

[1]University of Florida, Department of Wildlife Ecology & Conservation, 110 Newins-Ziegler Hall PO Box 110430, Gainesville, FL; [2]Tall Timbers, 13093 Henry Beadel Drive, Tallahassee FL; EMAIL: a.canode@ufl.edu

The Red Hills is a region in the southeastern United States just north of Tallahassee, Florida. The area is known for its red clay hills, rolling terrain, and diverse plant and animal communities, which includes the gopher tortoise. Tall Timbers (TT) is in the heart of the Red Hills. The last study of the snake community at TT occurred twenty years ago. Since that

time habitats have changed mostly due to hardwood removal and by allowing prescribed fires to burn into bottomlands and naturally extinguish. Using the same methodology and trap locations we are repeating that study. Our research is important for assessing the current status of the upland snake community and understanding how it has responded to changes in habitat over the past 20 years. We are also, for the first time, evaluating disease prevalence in the snake community at TT. We are swabbing snakes to test for *Cryptosporidium serpentis* (Crypto) and snake fungal disease (SFD). SFD is caused by the fungus *Ophidiomyces ophiodiicola* and is proving detrimental to already declining snake populations. We are also sampling for the invasive pentastome, *Raillietiella orientalis,* which was introduced by Burmese Pythons and is an emerging threat to native snake species. Understanding the expanding range of this invasive pentastome and the pathogens impacting native snakes are important for their management and conservation.

Feasibility of Effective Relocation to Urban Lots in the City of Cape Coral, Lee County, Florida

Lori Haus-Bulcock[1], Cheryl Anderson[1], Pascha Donaldson[1], Carl Veaux[1], Nora Demers[2]*****

[1] Cape Coral Wildlife Trust, PO Box 152761, Cape Coral, FL 33915; [2] Department of Biological Sciences, Florida Gulf Coast University, Fort Myers, FL; EMAIL: ndemers@fgcu.edu

The Cape Coral Wildlife Trust (CCWT) Inc. was formed in 2017 to acquire land for education, research, and for the preservation of Cape Coral's indigenous wildlife. They hold the title to 71 city lots, totaling nine acres, to be preserved and maintained in perpetuity for wildlife. These lots are providing a necessary haven for Gopher tortoises and burrowing Owls that serve as ambassadors of native wildlife for residents and visitors alike. The city of cape Coral is developing at a brisk pace and with it, Gopher tortoise fatalities and relocations. According to the FWC relocation data, there have been 1,313 relocation permits issued for projects in Lee County with 607 of them in the city of Cape Coral (46%) since 2009. A total of 608 tortoises have been relocated, 29% of the Lee County animals removed. The city of Cape Coral has documentation showing more than 39 tortoises on a single quarter-acre lot! We are proposing a research program to determine if relocating gopher tortoises from city lots destined for development to the CCWT-owned lots will be successful in keeping the animals surviving in city limits. We are proposing to relocate juveniles and subadults, and only one sub-adult male, ideally from the same, or nearby lots in the hopes to reduce inter-species confrontations. Our presentation today provides an overview of our proposal and we ask for advice and insight from the membership present at the meeting for our proposed research project.

State-threatened gopher tortoise (*Gopherus polyphemus*) gut microbiome analysis reveals health insights into southeastern Florida population

Dimitrios S. Giakoumas[1†]*, Jon Moore[1,2], Ericca Stamper[1], Kelsie M. Bernot[1], Tracy J. Mincer[1]*

[1]Harriet L. Wilkes Honors College, Florida Atlantic University, 5353 Parkside Dr, Jupiter, FL; [2]Harbor Branch Oceanographic Institute, Florida Atlantic University, 5600 US-1, Fort Pierce, FL; [†]College of the Liberal Arts and Sciences, Department of Biology, University of Florida, 521 Bartram Hall, 876 Newell Drive, Gainesville, FL; EMAIL: dimitriosgiakoumas@gmail.com; tmincer@fau.edu

The gopher tortoise (*Gopherus polyphemus*), endemic to the southeastern part of the United States is a keystone species with over 350 known (non-microbial) species relying on it and its burrows for survival. Over the past 100 years, more than 80% of its habitat and population have declined. Habitat loss is mainly driven by urbanization. To a lesser extent, disease contributes to population decline. Diseases include endoparasites and upper respiratory disease. Consequently, in the state of Florida, it is considered a threatened species. Due to the development and streamlined access of next-generation metagenomic sequencing (NGS), resolute microecological data can be generated of previously unculturable microbes. In tandem with this technological revolution, the relationship between the gut-microbiome—i.e., the bacteria, fungi, and protozoa that inhabit the gut—and host immune function has been elucidated. Gut microbiome analyses can provide ecological data associated with health and disease transmission. The reptile gut microbiome is understudied; only two gopher tortoise studies were carried out a decade ago. Utilizing NGS, this study investigated the microbiome 26 fecal samples from 23 tortoises in the Abacoa Greenway located in southeastern Florida. Results included: a predominance of phyla associated with fiber fermentation and short-chain fatty acid (SCFA) metabolism, primarily Firmicutes and Bacteroidetes. Interestingly, known pathogens, such as gopher tortoise *Helicobacter* and *M. agassizii* were not detected. Additionally, this study found no significant differences in α-diversity between male and female tortoises, though β-diversity was greater among females. A *post-hoc* investigation revealed a potential transmission pathway of an emerging pathogen inferred from related datasets. These findings contribute to the developing understanding of the reptile gut microbiome and its implications for gopher tortoise conservation, emphasizing the need for further investigation into the role of gut microbiota in host health and disease transmission in this threatened species.

*Denotes presenter; [§] Student Award Presentation

Physiological responses of eastern indigo snakes (*Drymarchon couperi*) infected with *Cryptosporidium serpentis*

William Hansen Hawthorne[1]*, James E. Bogan, Jr.[2], Ray Ball[1], Jeffrey M. Goessling[1]

[1]Eckerd College, Natural Sciences Collegium, 4200 54th Avenue South, St. Petersburg, FL; [2]Central Florida Zoo & Botanical Gardens'Orianne Center for Indigo Conservation, 30931 Brantley Branch Road, Eustis, FL; EMAIL: whhawtho@gmail.com

A significant disease of concern in captive populations of snakes is gastric cryptosporidiosis, caused by *Cryptosporidium serpentis*, a gastrointestinal, protozoal parasite that can cause varying degrees of morbidity and mortality. The purpose of this study was to understand physiological responses of eastern indigo snakes (EIS; *Drymarchon couperi*) infected with *C. serpentis*. Body condition index (BCI), hetero-phil:lymphocyte ratio (HLR), bactericidal ability (BA), sheep red blood cell hemolysis-hemagglutination assays (SRBC), and plasma corticosterone levels (CORT) were compared between EIS across cryptosporidiosis infection states including cryptosporidia infection positive with clinical signs, infection positive without clinical signs, infection-recovered, and infection-free snakes. We found snakes that had recovered from *C. serpentis* had significantly lower SRBC titers than *C. serpentis*–negative snakes ($P < 0.05$). Recovered snakes had significantly higher BCI than infection positive with clinical signs, infection positive without clinical signs, and infection-free snakes ($P = 0.00198$). Female EIS had significantly higher CORT levels than males ($P = 0.0112$), BA had a significant positive relationship with HLR ($P = 0.0333$), and BA had a significant relationship with SRBC ($P = 0.0170$). These results give meaningful insight into reptilian physiology of disease and show that snakes recovered from *C. serpentis* may have remaining negative effects of cryptosporidiosis on their immune system. Results from this study may aid conservation projects in determining suitability for release of EIS that have been infected with *C. serpentis*.

Your Gopher Tortoise Council money at work!

Rochelle Hood[1]* and Becky Bolt[2]

[1]Merritt Island Wildlife Association, Merritt Island National Wildlife Refuge, PO Box 2683, Titusville FL; [2]Bolt Outdoors, LLC, 2250 Newfound Harbor Drive, Merritt Island, FL; EMAIL: miwascrubjay@gmail.com

his year, the Merritt Island Wildlife Association was awarded a $950 Gopher Tortoise Day grant. The purpose of the award was to support development of an educational program to increase awareness and appreciation for the tortoise, and to promote Gopher Tortoise Day. We created educational content that could be utilized year-round at outreach and community learning events we host. Our goal was to highlight the gopher tortoise, but to

also capitalize on the opportunity to teach the general public about other ecological and natural resource management concepts that reach beyond a single species. Information on commensals, fire management, biodiversity, and keystone species was included on two large storyboards and a tri-fold brochure. Our method of attracting attention through the graphics on the storyboards and brochure, leveraging the popularity of the gopher tortoise, worked very well and helps us reach audiences of all ages.

Metapopulation dynamics of gopher frogs (*Rana capito*) in Georgia

Eva Kerr[1,2]*, Jade Samples[1,2], Helen Bothwell[1], Brian Shamblin[1], Lora L. Smith[2], John C. Maerz[1]

[1]Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA; [2]The Jones Center at Ichauway, Newton, GA; Email: Eva.Kerr@uga.edu

Habitat loss and fragmentation lead to the breakdown of important population dynamics that determine population resilience on a landscape. The longleaf pine-wiregrass ecosystem of the southeastern U.S. has been reduced to less than five percent of its original distribution, leading to the imperilment of endemic, pond breeding species like the Gopher frog. In Georgia, Gopher frogs now exist primarily in small, highly isolated populations with few managed sites large enough to support more than one or two breeding wetlands. We know little about how Gopher frog population dynamics function in large intact landscapes that would have supported metapopulations for which the species evolved. Particularly, there is a lack of information on historical patterns of gene flow across unfragmented landscapes that were characteristic of Gopher frog habitat prior to wetland draining and land conversion. We have a relatively poor understanding of the factors that are important for structuring Gopher frog metapopulations and what factors may be important for management focus to increase connections among breeding sites and increase population persistence. There are only two sites in Georgia with Gopher frogs that are logistically feasible to study metapopulation dynamics: Ceylon Wildlife Management Area and the Jones Center at Ichauway. These sites have extensive areas of managed open, pine forest habitats with abundant terrestrial refugia and a high density of wetlands suitable for Gopher frog breeding. We will identify metapopulations, subpopulation structure, and how dispersal among subpopulations is affected by various habitats through the integration of genetic and historic occupancy. This will inform conservation actions by defining management units, prioritizing wetland and upland habitats for restoration, and identifying areas for future translocations to increase subpopulation connectivity. Knowledge from these two sites will be applied to restore metapopulation dynamics on additional managed properties where Gopher frog populations are imperiled or have gone extinct.

How might translocation distance limits affect outbreeding-depression-mediated hatching success in the gopher tortoise?

Kevin J. Loope[1] and J. Nicole DeSha[2]*

[1]Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA; [2]Florida Fish and Wildlife Conservation Commission, Tallahassee, FL: EMAIL: kjloope@vt.edu

Mitigation translocation is a common wildlife management tool, and can be used to bolster or create sustainable populations that could assist conservation efforts for imperiled species. However, long-distance translocation is not always successful. One potential challenge to partially translocated populations is outbreeding depression, where divergent parental genomes combine to produce offspring with reduced fitness. Here, we use simulation to examine the effects of a previously documented negative association between nest hatching success and the geographic distance between parents' source populations in a translocated population of gopher tortoises (*Gopherus polyphemus*) in Florida, USA (Loope and DeSha et al. 2024. Animal Conservation doi: 10.1111/acv.12977). We find that mean hatching success at simulated translocation recipient sites in most scenarios and regions is relatively insensitive to alternative management rules, and that hatching success is predicted to lie within the range of observed rates from natural populations. However, for recipient populations in northwestern Florida (the "Panhandle") that contain numerous resident (non-translocated tortoises), hatching success is predicted to be substantially lower when there are no limits on translocation distance compared to the strictest limits simulated (mean of 60% vs 80%). Managers may wish to consider flexible rules that are conditioned on the presence of local tortoises to limit the effect of outbreeding depression in the Panhandle region. Our results suggest that the nuances of translocation methodology, including source and destination locations and the presence of local individuals, are likely to modulate the effect of outbreeding depression in translocated populations.

Inflated predictions from a flawed model influenced the decision to deny federal protection for the gopher tortoise

Kevin J. Loope[1]*, H. Resit Akçakaya[2], Kevin T. Shoemaker[3]

[1]Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA; [2]Department of Ecology and Evolution, Stony Brook University, NY; [3]Department of Natural Resources and Environmental Science, University of Nevada, Reno, Reno, NV: EMAIL: kjloope@vt.edu

The United States Fish and Wildlife Service (USFWS) recently withdrew the gopher tortoise as a candidate for federal protection under the Endangered Species Act across the vast majority of the species range. The scientific grounds for this decision, documented in a

Species Status Assessment (SSA) commissioned by USFWS, were derived in part from a rangewide demographic simulation model predicting the fate of 457 gopher tortoise populations over the next 80 years (Folt et al. 2022 Glob. Ecol. Conserv., 36, e02143). We have identified two serious flaws in this analysis that call into question the results and conclusions derived from the gopher tortoise SSA model, including the recent USFWS listing decision. The most consequential error is an incorrect specification of the immigration process that introduces inadvertent strong positive feedback between focal populations and their associated metapopulations. This positive feedback produces extreme and unrealistic growth in a small subset of populations that, at the end of the simulation, constitute the majority of the surviving individuals. A second error involved the use of an outdated method for estimating maturation rate for juveniles that was previously shown to produce biased and incorrect growth estimates (Kendall et al. 2019. Ecol. Model. 406, 33–43); the bias resulting from this error also contributed to population overestimation. Correcting these two errors but retaining all other model features yields population size predictions dramatically lower than those reported in the SSA and in Folt et al. (2022), suggesting near extinction in 80 years. The USFWS should re-evaluate the listing decision based on predictions from a valid population viability analysis that correctly models immigration and age structure. More generally, the species status assessment process, and other conservation decision-making processes, should employ additional specialist review mechanisms to help identify modeling problems before they are used in conservation practice.

Hurricane Effects on a long-term monitored southwest Florida barrier island gopher tortoise population

Mike Mills[1]*****, Chris Lechowicz[1], and Nadine Cobb[1]

[1]Sanibel-Captiva Conservation Foundation, 3399 Sanibel Captiva Road, Sanibel, FL; EMAIL: mmills@sccf.org

The gopher tortoise is threatened throughout its entire southeastern United States range due to the loss, fragmentation, and reduced quality of habitat. They face additional threats on islands where there is limited space and resources, as well as infrequent gene flow into the population compared to their mainland counterparts. On a southwest Florida barrier island, gopher tortoise burrows were surveyed annually on two different preserves, beginning in the year 2000, and on three additional preserves in the year 2007 to current. Burrows are classified as active, inactive, or abandoned to determine the estimated tortoises per hectare. From the year 2007-2021, all preserves maintained a relatively stable active burrow count. In September 2022, Hurricane Ian caused up to 12 feet of storm surge on the island, flooding burrows and drastically altering gopher tortoise habitat. The 2022

survey, following the hurricane, found most active burrows were lost within four preserves, as well as total loss on one preserve. Although these preserve populations have suffered a significant loss of active burrows, the aftermath of the hurricane has accelerated our upland management efforts due to fire hazard, fire line loss and hurricane debris. This provided the opportunity to clear out hardwood hammocks and replant forage plants to increase open-canopy habitats preferred by gopher tortoises. Many of these tortoises were displaced on the island from the high water and providing optimal habitat should encourage recruitment back to these areas.

Recent and in-progress regulatory status changes for herpetofauna in Florida

Peyton E. Niebanck[1]* and Bradley M. O'Hanlon[1]

[1]*Florida Fish and Wildlife Conservation Commission, 620 S. Meridian Street, Tallahassee, FL; EMAIL: Peyton.Niebanck@MyFWC.com*

State level protections are an important component of wildlife management and the conservation of imperiled species. Florida follows federal designations for listed species and has one category for imperiled wildlife at the state level, State-designated Threatened. The state listing process requires developing management plans and permitting guidelines which provide protections from intentional and incidental take. The Florida Fish and Wildlife Conservation Commission (FWC) has recently listed the striped newt (*Notophthalmus perstriatus*) as State-designated Threatened, and is evaluating two other species, the Florida reef gecko (*Sphaerodactylus notatus*) and the Southern dusky salamander (*Desmognathus auriculatus*). Florida's listing process is complex and involves significant stakeholder input to determine regulatory protection needs for these species. Important milestones that lead to listing a species includes receiving a Species Evaluation Request, convening a Biological Status Review Group, adding the species to Florida's Imperiled Species Management Plan, and developing Conservation Measures and Permitting Guidelines. These products provide collaborative management actions, offer avoidance and minimization measures, inform when incidental take may be considered, and provide mitigation strategies when incidental take is unavoidable. When the cause of the decline is known, successful implementation of these state level protections is focused on reducing additional population declines and endorsing actions that would ultimately improve the species conservation status so listing can no longer be required. The Florida reef gecko is currently protected as a Candidate Species and will become State-designated Threatened once management guidelines are approved. The agency recently completed a Biological Status Review for the Southern dusky salamander, where it met several criteria to inform a listing recommendation.

Modeling amphibian and plant community responses to wetland restoration techniques in Georgia

Jade Samples[1 2]*, Eva Kerr[1], Mia Cinello-Smith[2], Kristina Hefferle[1], Vanessa Terrell[1], Lora Smith[2], John C. Maerz[1]

[1]The University of Georgia, 180 E Green St, Athens, GA; [2]The Jones Center at Ichauway, 3988 Jones Center Dr, Newton, GA; EMAIL: jade.samples@uga.edu

Conservationists rely heavily on habitat restoration as a foundational management tool to counteract declines of threatened and endangered species. Effective restoration requires a multifaceted approach, including adaptive management, which integrates monitoring, evaluation, and feedback. The Coastal Plain of the United States has experienced widespread loss and degradation of geographically isolated wetlands (GIWs) primarily due to fire suppression and the resulting encroachment of hardwood vegetation. These wetlands are crucial to a suite of endemic amphibian species' that rely on them for reproduction like the State-threatened Gopher frog (*Rana capito)*. Thus, there is high conservation value to restoring GIWs to enhance regional biodiversity. However, there is limited information on the effectiveness of restoring these wetlands for wildlife such as amphibians. In this study, we are conducting acoustic for calling anurans and dipnet surveys to detect larval and adult anurans and salamanders at four field sites in southern Georgia, including more than 30 wetlands across a gradient of condition from reference wetlands representing historic conditions to unrestored and restored wetlands with varying degrees of hardwood removal and prescribed fire. Vegetation surveys will characterize pre- and post-restoration conditions using a belt-transect method. Amphibian and plant monitoring data will be analyzed using an integrated Bayesian hierarchical community occupancy model in R, originally developed for forest buffer management, and modified for this project. We predict that restored wetlands will exhibit higher amphibian and plant species richness than non-restored wetlands. Wetlands treated with both mechanical hardwood removal and prescribed fire are expected to show the least hardwood regeneration and the largest change in amphibian and plant community composition. The results from this study are expected to inform future wetland restoration management in the southeast, providing quantitative insights into amphibian-plant community interactions within an adaptive management framework that targets key plant species and rare amphibian taxa.

Gopher tortoise IUCN Red-List Status Assessment

Leyna Stemle[1]* and Hunter Howell[1,2]

[1]University of Miami [1]Department of Biology, University of Miami, 1301 Memorial Dr, Coral Gables, FL; [2]Susquehannock Wildlife Society; EMAIL: leynastemle@miami.edu

*Denotes presenter; [§] Student Award Presentation

An update to the Gopher Tortoise's IUCN Red List Status and species report was last conducted in 1996, nearly 30 years ago, despite IUCN recommending that these assessments be updated every ten years. In 1996, as in every prior assessment, the Gopher Tortoise was listed as Vulnerable. However, in the interim period, Gopher Tortoises have faced an increasing diversity and magnitude of threats. These threats include climate change, introduced species and diseases, and anthropogenic development and agriculture leading to widespread habitat loss and fragmentation. Here we re-analyzed the Gopher Tortoise's IUCN Red List Status by examining all published literature since 1996 to include as information on their biology and ecology in the report. We first examined Gopher Tortoise population trends (Criterion A4) over 120 years (three tortoise generations) and found a ~95% decline in suitable longleaf pine habitat. This decline is well over the amount to reach the habitat availability and quality threshold for Critically Endangered for the IUCN. There are also large projected and observed population declines, past direct exploitation from take, as well as additional and continued impacts from mesopredators (like raccoons), invasive species (like tegus and fire ants), and disease (Criterion A4). We also examined population viability analyses and integral projection models (Criterion A4 and E), which predict a 90% population decline in the next 80 years (Folt et al. 2022; Loope et al. 2024). Both these inferred and projected declines are well above the 80% decline threshold needed to be classified as Critically Endangered under the IUCN (Loope et al. 2024). Therefore, our finding is that the Gopher Tortoise should be listed as Critically Endangered under criteria A4bceE and we have updated the summary report of the species for the IUCN website accordingly.

The trials and tribulations of tracking the gopher tortoise (*Gopherus polyphemus*)

McKayla C. Susen[1,2,3], Lora, L. Smith[2], Steven B. Castlebery[3], and Kimberly M. Andrews[4]*****

[1] Florida Fish and Wildlife Conservation Commission, Russell Complex, Tallahassee, FL; [2] Jones Center at Ichauway, Newton, GA; [3] University of Georgia, Warnell School of Forestry, Athens, GA; [4] University of Georgia, Marine Extension and Georgia Sea Grant, Brunswick, GA; EMAIL: kma77@uga.edu

Most researchers would think that tracking gopher tortoises would be easy - they are slow-moving fossorial species and when using traditional methods, such as very high frequency (VHF) transmitters, they are easy to track. However, locations acquired using VHF transmitters often correspond to burrow locations as tortoises spend most of their time in burrows or flee into burrows when threatened. As a result, there is limited published research on fine-scale movements of gopher tortoises. Over the last few years, researchers have modified low-cost GPS loggers in an effort to acquire fine-scale movement data. We will present a case study highlighting the issues associated with deployment of GPS units, GPS failure and location error, and analysis of data. This case study attempted to assess

the effect of fencing on gopher tortoise movement patterns by comparing home range size and overlap of tortoises within a long-term fenced plot compared to that of tortoises in an unfenced plot. Due to the fossorial nature of the gopher tortoises, we experienced high GPS failure and location error which complicated data processing and restricted home range analyses to a short tracking time frame of 30 days. Overall, we will discuss the GPS unit selection, modification methodology and complications, major issues processing and analyzing data, and future directions for using GPS data loggers to obtain fine-scale movement patterns of gopher tortoises.

Gopher tortoise habitat restoration and education program at The Great Outdoors (Titusville, FL)

Robert W. Taylor[1]*****

TGO NatureScape, Inc., 828 Plantation Drive, Titusville, FL 32780; rtaylor1131@hotmail.com

TGO NatureScape was formed in 2023 and is certified as a 501(c)(3) charitable and educational organization. It is an entirely volunteer organization that was created to foster habitat improvements, wildlife diversity, and the use of native plants in landscaping. Our first project is the restoration of a degraded gopher tortoise habitat within The Great Outdoors (TGO) residential community in Titusville, FL. The project is centered around two main themes: 1) fostering the long-range survival of *Gopherus polyphemus* through awareness, appreciation, and protection of the species, and 2) improvements to gopher tortoise habitat at TGO in order to ensure the long-term stability of our on-site tortoise population. Although the gopher tortoise population at TGO is relatively small (approximately 50 known individuals, but potentially more), it appears to be a healthy and viable assemblage, with juveniles, sub-adults, and mature adults included in the total number. One of TGO NatureScape's main pursuits is to continue making improvements to the gopher tortoise habitat at TGO in order to ensure the long-term stability of our on-site tortoise population. The 1,625-unit development is completely built-out (about 3,000 acres) and much of the tortoise habitat is within an easement that precludes development or construction. Consequently, our population is likely to remain stable or to grow, and to be an asset for the species if population declines continue to occur in other parts of the species' range. Our poster presentation will describe our habitat restoration efforts and education activities, including the Gopher Tortoise Day event that was supported by a grant from The Gopher Tortoise Council.

Evaluating the efficacy of passive drift-fence camera traps for detection of black pinesnakes (*Pituophis melanoleucus lodingi*) in Southern Mississippi

William B. Sutton[1]*, John Tupy[2], Carlin R. Frost[1], C.J. Hillard[3], Matthew Grisnik[1,4], and Sidney Godfrey[5]

[1]Wildlife Ecology Laboratory, Tennessee State University, 3500 John A. Merritt Blvd, Nashville, TN 37209; [2]U.S. Fish and Wildlife Service, Mississippi Ecological Field Services Office, Jackson, MS; [3]Mississippi Department of Wildlife and Fisheries Program, Jackson, MS; [4]Department of Biology, Coastal Carolina University, Conway, SC; [5]Camp Shelby Joint Forces Training Center, The Nature Conservancy, Camp Shelby, MS; EMAIL: wsutton@tnstate.edu

The Longleaf Pine ecosystem of the southeastern United States provides habitat for a vast array of unique and endemic wildlife species. One such species, the Black Pinesnake (BPS; *Pituophis melanoleucus lodingi*), was historically found in southern Mississippi and Alabama, eastern Louisiana, and western Florida. Due to habitat destruction and conversion, urban development, and fire suppression, BPS populations have declined throughout its range and are considered extirpated from Louisiana. The BPS was subsequently designated as Federally Threatened under the Endangered Species Act (ESA) in 2015, yet relatively few studies have evaluated its contemporary distribution. In March 2024, we began an effort to evaluate the efficacy of passive drift-fence camera traps for detection of BPS. We installed 19 trapping units comprised of 100-ft or 200-ft drift fences with one or two trail cameras mounted under a 5-gallon bucket at a variety of locations within the De Soto National Forest, Mississippi. All locations occurred within critical habitat units and spanned localities where the species was detected historically, currently undetected, and along a gradient of habitat management. As of September 2024, we have recorded 11 total BPS detections via drift-fence camera traps at 8 out of the 19 sampling sites. One site accounted for 4 out of the 11 detections, and 9 out of the 11 detections occurred in sites with recent prescribed fire management. Lastly, we detected an additional 15 snake species, as well as 7 lizard, 4 anuran, and 2 chelonian species. Future research objectives will be discussed.

***Presenting author**

[§]Student

*Denotes presenter; [§] Student Award Presentation