SE PARC 2019 Oral Presentation Abstracts

Thursday Evening

5:15 NATIONAL PARC: SPECIES CONSERVATION, HABITAT CONSERVATION, AND NETWORK GROWTH. Chris Petersen.

WHAT IS ARC, HOW DOES IT AFFECT PARC, AND HOW CAN YOU HELP. Joseph J. Apodaca, Amphibian and Reptile Conservancy, jjapodaca@amphibiansreptiles.org; Jeff Holmes, Amphibian and Reptile Conservancy.

The ARC PARC relationship is one that causes a lot of confusion within the PARC network. Partners in Amphibian and Reptile Conservation (PARC) is an unincorporated professional association with no collective legal status to accept, hold and spend funding, such as meeting registrations and expenses. The Amphibian and Reptile Conservancy (ARC) is PARC’s non-profit fiscal sponsor, meaning we collect, curate and disperse your funds as needed to support your activities. We also cover your accounting, administrative overhead and related core operational expenses. In addition, ARC provides a vehicle for public and private grants, contract and agreements to help PARC and its constituent members implement research, inventory/monitoring, management, policy, education/outreach and related conservation goals. Finally, ARC provides an aggressively marketed non-profit platform for donors from the general public to make private, tax-deductible donations in support of ARC and PARC’s shared mission. We are YOUR non-profit organization. This talk is to update you on the Exciting changes happening in ARC and how they relate to PARC and amphibian and reptile conservation.

Friday

9:15 HOW RESEARCH HAS CONTRIBUTED TO PROACTIVE, ADAPTIVE, AND RESPONSIVE MANAGEMENT OF THE ENDANGERED DUSKY GOPHER FROG. Joseph H. K. Pechmann*, Western Carolina University, jpechmann@wcu.edu.

Research on endangered species is important for finding new management strategies, measuring the effectiveness of current management actions, and setting recovery goals. Experiments demonstrating that larval growth and survival of *Rana sevosa* were higher in open-canopy than in closed-canopy ponds led to removal of trees from translocation sites and
helped justify management burns of pond basins. Use of herbaceous open-canopy litter rather than tree leaves in rearing tanks has increased the size of head-started metamorphs. Designation of the size of critical habitat units was informed by radio telemetry studies of \textit{R. sevosa} and \textit{R. capito}. Finding that juvenile growth of \textit{R. sevosa} is higher in frequently-burned than in fire-suppressed terrestrial habitat will help prioritize burning. This study also found that providing artificial burrows increased growth in both habitat types and can mitigate the effects of fire suppression, suggesting that use of artificial burrows could aid recovery. Research found that zoospores of a lethal protozoan parasite affecting \textit{Rana} hatched at pH 5.5-7.0. These data ended the practice of pumping well water into a drying pond to prevent tadpole loss, because it raised the pond pH above 5.5. Metamorphs rather than head-started tadpoles are now translocated because research found low survival of the latter due to the parasite. Demographic studies have documented population sizes, survival rates, ages at first reproduction, and reproductive success, and the need for head starting to insure consistent juvenile recruitment during recovery. Data will be used to construct demographic models and projections to inform recovery plans and targets.

\textbf{10:00 RECRUITMENT AUGMENTATION AND HABITAT RESTORATION IN TWO DECLINING NORTH CAROLINA BOG TURTLE POPULATIONS.}

Michael Knoerr*, Clemson University, mike.knoerr@gmail.com; Susan Cameron, United States Fish and Wildlife Service; Gabrielle Graeter, North Carolina Wildlife Resources Commission; Kyle Barrett, Clemson University.

Analysis of long-term data and recent research suggest that several NC bog turtle populations are in decline. Reduced adult survival compounded by failed recruitment has a strong negative effect on population growth rate. In 2018, we conducted management in two declining populations characterized by low to moderate adult survival and limited recruitment. These sites experienced very high rates of nest predation in 2016-2017. In an effort to stabilize these populations, we conducted extensive recruitment augmentation in the form of vegetative and hydrological restoration, predator trapping, and predator exclusion via caged nests and an electric fence system. Mammalian predation was reduced to zero and hatch rates were higher than compared to historical literature. Over 60 hatchlings were marked and released into these populations, making this hatch season likely the most robust in decades at these sites. Although the effects of these manipulations are not fully understood, modeling that incorporates augmented survival probabilities suggests that these efforts will not stabilize these populations alone. Population stability or growth may be achieved when recruitment augmentation is in coordination with other efforts that address site-scale issues linked to mortality and emigration. This robust hatch season provides a unique opportunity to generate more precise vital rates that will better inform our understanding of population status. Continued monitoring will also allow us to assess the long-term viability of recruitment augmentation towards stabilizing these declining populations.

Since 2011, the North Carolina Aquarium at Fort Fisher (NCA) has partnered with the North Carolina Wildlife Resources Commission (WRC) to head start Carolina gopher frogs Rana capito. In North Carolina, gopher frogs are state listed as endangered and under consideration for federal listing under the ESA. Only 7 of 23 historical populations of this species are currently extant in ponds scattered in the coastal plain. To bolster declining populations, the NCA and WRC have developed successful protocols for collecting eggs from ponds, rearing the frogs through metamorphosis, and releasing them back into their natal ponds. We describe egg collection procedures, egg and tadpole husbandry, methods and tank systems for metamorphosis to froglet stages, and release strategies. Visible Implant Elastomer (VIE) is injected into froglets prior to release, enabling long-term assessments of the programs successful contribution to wild gopher frog populations. Over 1300 froglets have been head started at the NCA and released. Similar head starting occurs at the North Carolina Zoo for an inland population of gopher frogs. Additionally, the NCA supports analyses of the gopher frog populations’ genetic structure which is being conducted at the University of North Carolina Wilmington. Together, these projects support the WRC comprehensive strategy to conserve and enhance gopher frogs in the state.

10:30 LONG TERM TRENDS AND CONSERVATION STATUS FOR GREEN SALAManders (ANEIDES AENEUS COMPLEX) IN NORTH CAROLINA. Joseph J. Apodaca, Amphibian and Reptile Conservancy, jjapodaca@amphibiansreptiles.org; Alan Cameron, Lori A. Williams, NC Wildlife Resources Commission; and Alex J. Novarro, Swarthmore College.

Green salamanders (Aneides aeneus complex) have long been a research and conservation interest in North Carolina, with studies and collections beginning in the 1920s and 30s by early herpetologists such as Brimley and Weller. The North Carolina database for green salamanders dates back to the late 1940s, with long term monitoring being established by the state in the 1980s. Within the last 40 years, several state-wide population crashes have been documented, leading to the listing of A. aeneus as endangered in the state. Here, we present a comprehensive dataset and analysis for green salamanders in NC in order to assess the status, trends, long-term viability, and conservation targets. We used over two decades of survey data, from over 5,000 individual salamanders and 1,000 sites, and Dail-Madsen (DM) models to estimate green salamander abundance, temporal trends in abundance and population growth rates, and to estimate extinction probabilities for each population. Results indicate that populations within the state have seen precipitous declines since the early 2000s, indicating a greater need for active conservation within the state. Model results were
combined with conservation genetic data in order to identify potential conservation targets and strategies.

10:45 ESTIMATING EXTINCTION RISK FOR THE SOUTHERN HOGNOSE SNAKE TO INFORM LISTING DECISIONS UNDER THE U.S. ENDANGERED SPECIES ACT. Brian Crawford*, Georgia Cooperative Fish and Wildlife Research Unit, Warnell School of Forestry and Natural Resources, University of Georgia; John C. Maerz, Warnell School of Forestry and Natural Resources, University of Georgia; Clinton T. Moore, U.S. Geological Survey, Georgia Cooperative Fish and Wildlife Research Unit, Warnell School of Forestry and Natural Resources, University of Georgia; D. Todd Jones-Farrand, Gulf Coastal Plains and Ozarks Landscape Conservation Cooperative; Mike Harris, U.S. Fish and Wildlife Service.

Estimates of demographic rates, population abundance, and risk of extinction are valuable criteria for conservation decisions. However, acquiring these estimates is challenging for most rare, cryptic species due to data limitations. The southern hognose snake (Heterodon simus) is a highly cryptic species currently undergoing a Species Status Assessment (SSA) that will be used for a listing decision under the Endangered Species Act. To inform the SSA, we used a comprehensive dataset of southern hognose occurrences to estimate persistence of 205 populations across the species’ range under current conditions and future scenarios representing various levels of urbanization, sea level rise, and management. We adapted a Bayesian formulation of the Cormack-Jolly-Seber model, designed to estimate survival of individuals, to analogously estimate persistence of populations between 1950 and 2018. We used estimates to simulate population persistence through 2080. We accounted for imperfect detection by developing a search effort index from HerpMapper.org occurrence records of 13 snake species commonly observed in southern hognose habitats. Estimated persistence varied considerably by population but was positively influenced by habitat suitability and proportion of protected area and was negatively related to time since last observation. Future habitat loss due to sea level rise and urbanization substantially decreased persistence probability for most populations, but predicted persistence increased with modest improvements to habitat suitability and land protection. Our results will be used in the SSA to help decision makers characterize the current and future risk to southern hognose populations in their listing decision and aid partners in prioritizing sites and strategies at the population, regional, and range-wide level.

1:30 THE AMPHIBIAN REPORT CARD, A NEW TOOL FOR AMPHIBIAN CONSERVATION. Kirsten A. Hecht*, University of Florida/Foundation for the Conservation of Salamanders, kirstenhecht@ufl.edu; Robb Krehbiel, Defenders of Wildlife; Clarice Brewer, White Oak Conservation Foundation.
According to the IUCN almost 40% of amphibians are currently threatened with extinction. Due to these conservation concerns, we have seen an increase in the amount of scientific research and conservation efforts focused on this taxonomic group. However, communicating issues about amphibian declines to non-scientists who can help reverse these trends remains problematic. Challenges with current information sources include availability, language and writing style, negative messaging, and a lack of presented actions for individuals to take. To address these concerns, a team from the 2016-18 cohort of the Emerging Wildlife Conservation Leaders (EWCL) worked with several partners to develop a new website, www.amphibianreportcard.org. The site uses expert input to create easy to interpret analyses of the status and threats of North American amphibian species for non-scientists while also creating opportunities for individuals to take specific actions to help a species or counter specific threats. Each grade assessment is created from expert input using a standardized methodology. The site launched in November 2018 with six species report cards, but we are recruiting volunteer experts to help the site grow. Registered experts can help improve the impact and accuracy of the website while increasing their broader impacts by taking a survey on an existing species, submitting information for a new species, submitting photographs, and/or posting a comment on an existing assessment. We also encourage experts to submit information on their amphibian research or conservation programs which can then be added directly to species report cards.

1:45 IMPACTS OF INVASIVE *XENOPUS LAEVIS* ON DISEASE ECOLOGY OF NATIVE FLORIDA AMPHIBIANS. Matthew Atkinson*, Eric Hoffman, Emily Karwacki, and Anna E. Savage. University of Central Florida.

Invasive species can strongly influence the native communities they colonize and may alter community composition. One of the ways invasive species accomplish this is by serving as hosts for native and non-native pathogens. The African clawed frog (*Xenopus laevis*) is thought to play a role in altering the pathogen communities of anurans where they are introduced and appear to increase the number of pathogens in a given area. Recently, *X. laevis* has become established in the Tampa bay area of central Florida. We sought to determine the influence of invasive *X. laevis* on infectious disease dynamics in native amphibian communities within the Florida invasion range. We focused on the three most common pathogens causing amphibian die-offs in the United States: *Batrachochytrium dendrobatidis*, Ranavirus and Perkinsea. We collected anurans (both *X. laevis* and native species) at 8 wetlands (four with *X. laevis*, four initially without) within the invasion site beginning in August of 2018 and quantified the pathogen load of these individuals using established qPCR protocols for each pathogen. Additionally, we collected eDNA samples to screen for both *X. laevis* presence and pathogen presence. We then compared the infection prevalence within a pond and infection intensity within each individual against the location, species, *X. laevis* presence, and other environmental parameters using generalized linear modeling to determine significance of specific and combined factors. Understanding the
pathogen community in areas where *X. laevis* have colonized allows for a better understanding of the role invasive species play in driving amphibian disease dynamics.

**2:00 LINKING IN-SITU AND EX-SITU POPULATIONS OF ENDANGERED AMPHIBIANS FOR CONSERVING GENETIC VARIABILITY IN ASSURANCE POPULATIONS.** Allison R. Julien*, Mississippi State University, arj323@msstate.edu; Diane Barber, Fort Worth Zoo; Kristen R. Counsell, Andrew J. Kouba and Carrie K. Vance, Mississippi State University.

With over 30% of all amphibian species currently listed as threatened, the need to establish sustainable captive assurance colonies is critical as a hedge against extinction. Unfortunately, captive collections are at risk for low genetic variability and often require acquisitions of new animals from wild populations. However, obtaining gametes from wild individuals rather than the animals themselves offers an alternative means for management of genetic variability within captive populations. For this study, we collected and cryopreserved sperm from two federally-listed amphibian species, *Lithobates chiricahuensis* and *Peltophryne lemur*, in the field and conducted in-vitro fertilization (IVF) of eggs from captive females at zoological institutions. In coordination with the Species Survival Plan (SSP) program coordinators and U.S. Fish and Wildlife Services, researchers traveled to each species’ respective habitat and collected sperm from wild males through the use of exogenous hormones. Sperm collection, analysis, and cryopreservation were performed in the field. Average sperm motility for field-collected males ranged from 63-65%, while sperm concentrations ranged from 1.26 x 10^5 to 2.74 x 10^6 in *P. lemur* and *L. chiricahuensis*, respectively. Post-thaw motilities averaged 17-30% in the two species. IVFs were performed at Fort Worth Zoo and Omaha’s Henry Doorly Zoo and Aquarium using each institution’s captive females. Fertilization was successful and resulted in 14 viable tadpoles in *L. chiricahuensis*. This study demonstrates a first step in the collection of genetics in-situ from amphibian populations and their integration into captive breeding programs for federally-listed endangered species without removing the animal from the wild.

**2:15 A COOL-LOVING FUNGUS – TEMPERATURE DRIVES VIRULENCE OF BATRACHOCYTHRIUM SALAMANDRIVORANS (BSAL).** E. Davis Carter*, Debra L. Miller, Markese L. Bohanon, Brittany A. Bajo, Daniel A. Malagon, Rajeev Kumar, Bailee J. Augustino and Matthew J. Gray, University of Tennessee Center for Wildlife Health, ecarte27@utk.edu.

*Batrachochytrium salamandrivorans* is a recently discovered fungal pathogen that is emerging and causing population declines of fire salamanders (*Salamandra salamandra*) across Europe. Initial in vitro growth experiments suggested that Bsal has an optimum growth temperature between 10 – 15 °C and an upper thermal threshold of 25 °C. However, field studies in Vietnam, detected the pathogen on amphibians in aquatic systems with water temperatures as high as 26 °C. In order to better understand the role of temperature in Bsal
invasion potential in the southeastern USA, we exposed adult eastern newts (*Notopthalmus viridescens*) to one of four Bsal doses (5 x 10^3-6) at 14 or 22 °C. All newts except one that were exposed to Bsal at 14 °C became infected and died within 50 days, while no newts became infected at 22 °C. Mortality rates at 14 °C were dose dependent, with median survival times of 26, 20, 14 and 7 days post-exposure to 5 x 10^3, 10^4, 10^5 and 10^6 zoospores, respectively. Our results indicate that the invasion potential of Bsal may be geographically restricted more than previous risk analyses predicted, and greatest in areas with cooler temperatures, such as the high elevations of the southern Appalachian Mountains in the southeastern USA.

2:30 **THE EFFECT OF VEGETATION TYPE ON LARVAL DENSITY-DEPENDENCE IN CRAWFISH FROGS.** Chelsea S. Kross*, University of Arkansas, ckross@uark.edu; and John D. Willson, University of Arkansas.

Density-dependence is a key aspect of population regulation for many species, especially for species with complex life cycles. For this reason, amphibians have often been used as model organisms for addressing questions related to density-dependence. However, patterns of density-dependence have been characterized for only a few species and little work has evaluated how rearing habitat might alter density-dependent interactions. Specifically, changes in land-use surrounding larval habitats might alter density-dependent relationships through changes in vegetation used as food and cover for developing larvae. We used a mesocosm approach to investigate how vegetation composition (native prairie or non-native agriculture-associated vegetation [tall fescue grass; *Festuca arundinacea*]), surrounding breeding wetlands affected density-dependence in larval Crawfish Frogs (*Lithobates areolatus*), a species of conservation concern. We measured survival, time to metamorphosis, and snout-vent-length and mass at metamorphosis of larvae reared at densities of 5, 15, 45, 135, and 405 per mesocosm in the two different litter treatments. Overall, density dependence was overcompensatory, suggesting that *L. areolatus* exhibit scramble competition as larvae. Both vegetation treatments had low survival at high densities, but more individuals survived to metamorphosis at moderate densities in fescue treatments compared to prairie treatments. Metamorphs from the fescue tanks metamorphosed faster and were larger than prairie-reared metamorphs at moderate densities. At low and high densities size differences were ameliorated. Differences in density-dependence at the larval stage have important implications for population regulation and dynamics in stochastic environments.

2:45 **ANURAN TRAITS OF THE UNITED STATES (ATRAIU): A COMPREHENSIVE TRAITS DATABASE FOR BASIC AND APPLIED RESEARCH.** Chloe E. Moore*, Virginia Tech, chloe9mo@vt.edu; Jacob Helmann, Ye Chen, and Meryl C. Mims, Virginia Tech.
The United States is home to many anuran species, each with defining traits, characteristics, and habitats that set them apart from one another. Understanding trait variation within and between anurans is key to many successful conservation, management, and research efforts, but the references and methods for reporting information on species traits are just as variable as the species themselves. We present a comprehensive anuran traits database of the contiguous United States that compiles trait data from an assortment of references into a single, accessible location to counter the issue. We digitized trait values for 108 unique native and nonnative species using a hierarchical search protocol. We first digitized data from 39 regional guide books. We focused on 18 traits that were commonly reported and commonly used in the literature, such as minimum age at maturity, longevity, and maximum body size. We then conducted a primary literature search for species’ trait values unavailable from regional guides, compiling 159 primary references. All traits are traceable to their original reference, which represents a major improvement in transparency as compared to many existing trait databases for other taxa. Overall, all compiled traits currently have more than 60% of species with corresponding trait data. Following completion of a quality assurance and quality check protocol, ATraiU will be published and openly available. Our goal is for ATraiU to be accessible to a wide variety of users and purposes, from managers in charge of anuran conservation to researchers addressing knowledge gaps in anuran ecology.

3:15 | NORTH AMERICAN BSAL TASK FORCE – PLANS TO PREVENT AN INVASION. Matthew J. Gray*, University of Tennessee Center for Wildlife Health, mgray11@utk.edu.

The North American Bsal Task Force was created in 2016 following awareness of the potential threat of the recently discovered fungus, *Batrachochytrium salamandrivorans* (Bsal), to salamander diversity in North America. The goal of the Task Force is to facilitate communication about Bsal and ensure that response to an outbreak is rapid and effective. A Technical Advisory Committee (TAC) that is composed of scientists from government organizations, academia, and private industry leads the Bsal Task Force. The TAC interacts with several working groups that focus on various Bsal-related tasks in specific areas: research, response, management, decision support, communications, surveillance, data management and diagnostics. The Task Force recently completed a Strategic Plan that outlines the goal of each working group, completed tasks, and future initiatives. Organizations can use this plan to justify support for Bsal-related activities. In addition, a Response Plan that can serve as a template for states to respond to Bsal outbreaks is included. I will discuss the North American Bsal Strategic Plan and how it can be used to leverage support for proactively preparing for a Bsal invasion.

3:20 | PREVALENCE ASSESSMENT OF THE AMPHIBIAN CHYTRID FUNGUS *BATRACHOCHYTRIUM DENDROBATIDIS* ACROSS TWO HABITAT TYPES IN EAST TENNESSEE. Paul-Erik M. Bakland*, UT Chattanooga,
In light of the biodiversity crisis facing amphibian populations globally, studies investigating the pathogenic amphibian fungus *Batrachochytrium dendrobatidis* (Bd) are a foremost priority for biologists. Understanding effects of habitat variation on Bd prevalence is important for identifying populations that are most at risk and can help to inform management decisions. Using American Bullfrogs (*Lithobates catesbeianus*) and Green Frogs (*Lithobates clamitans*) as study organisms, this research sought to investigate how prevalence of Bd varies between natural wetlands and urban retention ponds in East Tennessee while also examining relevant habitat factors and morphometrics. A total of 373 frogs were sampled across six retention ponds and six wetlands distributed evenly between two basin level hydrologic unit codes. Of the frogs sampled, 11 tested positive for Bd. These data provide new insights into the status of Bd prevalence and distribution in Tennessee and provide information useful in future conservation and remediation efforts.

3:25  **MONITORING HEADSTARTED DUSKY GOPHER FROGS (*Lithobates sevosus*): SURVIVAL, MOVEMENTS, AND HABITAT USE OF A CRITICALLY ENDANGERED SPECIES.** Elizabeth A. Roznik*, Memphis Zoo, betsy.roznik@gmail.com; Steven B. Reichling, Memphis Zoo.

The success of reintroduction programs depends on the survival of the animals released, and ultimately on the establishment of self-sustaining populations. Post-release monitoring is useful to examine survival rates and the factors that influence them. Furthermore, detailed studies on the survival, movements, and habitat use of all life stages is needed to guide reintroduction and habitat management efforts. The dusky gopher frog (*Lithobates sevosus*) is a critically endangered species that historically occurred across the coastal plain of the southern USA. Memphis Zoo is leading a reintroduction program for this species that aims to establish a new population in restored habitat in coastal Mississippi by releasing headstarted frogs produced in captivity using assisted reproductive technologies. We used radiotelemetry to follow headstarted dusky gopher frogs for up to 30 days post-release to investigate their survival, movements, and habitat use. Of 53 frogs tracked, 75% survived until the end of the study or until transmitter belts slipped off. Mortality occurred due to fire ants, snakes, hogs, and unknown causes. Frogs moved up to 350 m during the study through grassy habitat and avoided areas of thick vegetation. Frogs sheltered in the burrows of gopher tortoises and small mammals, as well as in stump holes and other crevices. Overall, we found that frogs successfully transitioned to their natural habitat, and the initial outlook for the reintroduction program is promising. The findings of this study will be used to guide future plans for releasing dusky gopher frogs and improving their habitat.

3:30  **RESILIENCY OF ARTIFICIAL HELLBENDER SHELTERS IN NORTH CAROLINA.** Lauren Diaz*, Clemson University, ldiaz@clemson.edu; Catherine M.
B. Jachowski, Clemson University.

The eastern hellbender (*Cryptobranchus alleganiensis alleganiensis*) is a giant salamander inhabiting streams in the eastern United States that has experienced range-wide declines. Hellbenders are habitat specialists, and stream degradation from increased sedimentation is suspected as a leading cause of decline. Artificial shelters have recently been designed for hellbenders and may be useful for mitigating habitat loss from high sedimentation. A challenge of using artificial shelters in the wild is the fact that shelters can be dislodged during flooding events and sediment can block tunnel entrances. There are currently two main shelter designs in use, the original boot-shaped design (with and without an open bottom), and the hydrodynamic design. While the latter was designed to address dislodgement and tunnel blockage, no study has compared function of these designs under natural stream conditions. Our objective was to compare three shelter designs (boot with open bottom, boot with closed bottom and hydrodynamic) in terms of the probability of remaining available to hellbenders. We installed 90 shelters across three stream reaches in Macon County, North Carolina and monitored them monthly from June-August 2018. Preliminary results indicate that the probability of a shelter remaining available to hellbenders depended on shelter type and site, ranging from 33%-98%. Within a given stream, the probability of a shelter being available varied by as much as 37% and was always highest for the hydrodynamic shelter and lowest for the open-bottom boot shelter. For a given design, the probability of availability varied by as much as 59% between two streams.

**3:35 IMMUNE GENE DIVERSITY IN THE FEDERALLY ENDANGERED RETICULATED FLATWOODS SALAMANDER (*AMBYSTOMA BISHOPI*).**
S. Tyler Williams*, Louisiana State University, TylerWil@lsu.edu; Jean P. Elbers, University of Veterinary Medicine Vienna; James H. Roberts, Georgia Southern University; Carola A. Haas, Virginia Tech; Sabrina S. Taylor, Louisiana State University.

Populations of reticulated flatwoods salamanders (RFS; *Ambystoma bishopi*) have decreased drastically since the 1950’s, largely because of shrinking longleaf pine habitat. Remaining populations are small, isolated, and possibly susceptible to inbreeding and emerging infectious diseases. Genetic variation of endangered populations is crucial to adaptive potential and persistence, and variation at immune genes (the immunome) is especially important as it influences disease susceptibility and adaptation to novel pathogens. Understanding RFS immune gene variation will provide crucial information for the future management of remaining populations. We used tissue samples collected from six ponds on Eglin Air Force Base (AFB), Florida to examine immune gene diversity two ways: (1) Sanger sequencing major histocompatibility complex (MHC) class I genes; and (2) sequencing the immunome of the RFS with a next-generation target enrichment experiment. Overall, variation at the MHC region was very low but immunome diversity was modest. MHC sequencing revealed only two highly similar alleles with an amino acid divergence of...
Immunome-wide average allelic richness was 1.668 (±0.047), average expected heterozygosity was 0.295 (±0.005) and, average observed heterozygosity was 0.456 (±0.023). To infer population structure, genetic differentiation (F ST ) was measured between ponds, values ranged from 0.00 to 0.026 with an average F ST of 0.006 (±0.009). These results indicate that there is little immunome differentiation among ponds and that genetic variation is low in certain key immunome regions. Future management of RFS populations should consider genetic diversity as a crucial aspect of conservation planning.

3:40 HABITAT MEDIATED RESPONSES OF TERRESTRIAL SALAMANDERS TO WILDFIRE IN THE SHORT-TERM. Meaghan R. Gade*, Gade.15@osu.edu; Philip R. Gould, and William E. Peterman, School of Environment and Natural Resources, The Ohio State University.

Wildfire is an important natural disturbance event that promotes landscape heterogeneity and regulates many wildlife communities. The compounding effects of fire suppression and climate change have increased the frequency and severity of wildfire, but the responses of many organisms to wildfire is unknown. Further, microhabitats embedded in the landscape may mediate and buffer the effects of wildfire. Terrestrial plethodontid salamanders are likely disproportionality influenced by wildfire events as a result of their lungless anatomy and reliance on cool and moist habitats; but our knowledge of salamander responses to wildfire in the short-term is limited. We used a combination of mark-recapture data and repeated count surveys to assess the short-term (6 to 18-month post-fire), habitat-mediated responses to the Camp Branch wildfire on Wayah Mountain in North Carolina. We observed precipitous declines of the red-legged salamander, Plethodon shermani, in exposed upland forests but no apparent negative effects in riparian forests 18-months after the wildfire event relative to unburned sites. We also saw a loss of juvenile size-classes in the upland forest with only the largest adult individuals remaining 18-months post-fire. There was no size class differences in the riparian forests. Our results suggest riparian forests may be buffered from the canopy cover, vegetation, and soil duff layer loss and removal following a wildfire event, and salamanders inhabiting riparian forests may be at less risk to declines than those in exposed habitats. Our results underscore the need to assess wildfire effects across a landscape to determine the effects of disturbance to populations.

Climate change is anticipated to exacerbate extinction risk for species whose persistence is already compromised by a variety of other stressors. Yet, explicit adaptive management strategies for climate change are often underrepresented in recovery planning and implementation. Here we document the recent environmental and biological impacts of Hurricane Michael at St. Marks National Wildlife Refuge, located in the Florida panhandle region. We highlight the potential impact of this storm event on freshwater coastal wetlands and the federally-threatened Frosted Flatwoods Salamanders (*Ambystoma cingulatum*) that use them for breeding. On 10 October 2018, the Refuge experienced storm surge that was 2.3 to 3.3 m above sea level, which swamped some freshwater ponds occupied by *A. cingulatum* with saltwater. Compared to water chemistry measurements taken in Spring 2018, percent change in specific conductance after this event ranged from -19.5% to 21,566.7%. Not all occupied wetlands were inundated by storm surge. After the storm, specific conductance ranged from 80–23,100 µs/cm (compared to 75–445 µs/cm in Spring 2018). Although it is not yet possible for us to estimate the demographic consequences of this storm, our on-going searches have found live individual salamanders at both overwashed and non-overwashed sites. We outline actions that could be incorporated into climate adaptation strategies for imperiled species such as *A. cingulatum*. We issue a “call to action” for higher prioritization of strategic planning for imperiled species faced with the increasing threat of catastrophic hurricane events in a changing climate.

4:45 UPLAND SNAKE COMMUNITY IN MONTANE LONGLEAF PINE HABITATS IN PAULDING AND SHEFFIELD WILDLIFE MANAGEMENT AREAS. Miranda L. Gulsby*, Kennesaw State University, Mgulsby@students.kennesaw.edu; Thomas McElroy Ph.D., Kennesaw State University.

The Paulding and Sheffield Wildlife Management Areas (WMA) in northwest Georgia have been undergoing montane longleaf pine ecosystem restoration over the past 15 years. Habitat management using prescribed fire and canopy thinning have been shown to benefit reptile communities creating increasing diversity of species. It’s accepted that many reptile communities are in decline however, no surveys have been conducted to determine occupancy of reptiles within these WMAs undergoing restoration. This study serves as an initial survey of the upland snake community after many years of ecosystem restoration occurring. This community includes the northern pine snake (*Pituophis melanoleucus melanoleucus*), a species of concern in Georgia, however, this species was assumed to not be
present in these habitats. We utilized drift fence arrays to survey the upland snake community in both WMAs during May - June, and Late-August - Late-October in 2018. Snakes captured in the funnel traps and found incidentally on roads were handled to collect morphometric data and swabbed to collect samples to evaluate the presence of Snake Fungal Disease pathogen (*Ophidiomyces ophiodiicola*). This survey confirmed the presence of northern pine snakes in these WMAs. Sheffield contained a higher species diversity during both seasons. Seasonal variation was observed with higher species richness and evenness in Sheffield during the first season then higher in Paulding during the second season. We found that the mosaic of disturbance-maintained habitats in these WMAs are supporting high species diversity and can be used as a baseline for future studies of managed habitats in northern Georgia.

5:00 **IMPAIRTS OF ENVIRONMENTAL AND LANDSCAPE VARIABLES ON DETECTION OF SNAKES DURING ROAD SURVEYS.** Shawn Snyder*, Tennessee State University, ssnyder1@my.tnstate.edu; William Sutton, Tennessee State University.

Impacts of environmental and landscape variables on detection of snakes during road surveys

With global biodiversity declines occurring at alarming rates, it is imperative to develop sampling methods for rare, endangered, or cryptic species. Snakes are an organismal group that can be difficult to study due to cryptic behaviors, minimal or sporadic activity patterns, and frequent use of inaccessible habitats. These factors have led to gaps in our knowledge about snakes and it is important to improve understanding of these species to implement effective conservation plans. Our study used standardized road cruising as the primary method to detect snake species in west-central Tennessee. We completed surveys at 44 individual road transects and surveyed 30 locations during three occasions throughout the active season. Over 254 surveys, we detected 155 individuals of 23 species. The three most commonly detected were the Copperhead (51), Garter snake (18), and Dekay’s Brown snake (17). We detected 23 of a possible 29 snake species that co-exist in west-central Tennessee. We evaluated multiple occupancy and detection-based models for three model species (Copperhead, Garter snake, Dekay’s Brown snake) to examine covariates that determine the presence and detection of these species. Standardized road cruising surveys not only allowed us to detect a wide variety of species, but also allowed us to sample across a large geographic area, unlike most other sampling techniques used to detect snakes. We recommend that road cruising transects be conducted in either early spring or late summer/early fall, which will optimize detection and will provide researchers with valuable data that will be used in the conservation of these species.

5:15 **MODELING STRATEGIES AND EVALUATING SUCCESSES DURING REPATRIATIONS OF AN ELUSIVE AND ENDANGERED SNAKE, DRYMARCHON COUPERI.** Brian Folt*, Auburn University, brian.folt@gmail.com; David A. Steen, Georgia Sea Turtle Center; Craig Guyer, and Conor P. McGowan, Auburn University.
Wildlife repatriations have become an important tool used to decrease extinction risk for imperiled species. However, repatriations are long-term and expensive processes that are challenging to monitor for success, particularly for species that are difficult to detect. Here, we sought to evaluate how detection probability in monitoring contexts might influence perceptions of success during wildlife repatriations of cryptic species. We used a predictive modeling exercise to simulate repatriation efforts for the Eastern Indigo Snake (*Drymarchon couperi*), a federally Threatened species that is currently being repatriated in southern Alabama and western Florida. We built a fully-stochastic stage-based population model for the species and modeled population growth and extinction risk of populations under different release scenarios. Simulations revealed that scenarios releasing older, head-started snakes in greater abundance and frequency created wild populations with greater population growth and decreased extinction risk relative to scenarios releasing fewer and younger snakes less frequently. Population growth observed under realistic detection probabilities was lower than true population growth and at times caused evaluations of repatriation failure. Our results suggest that repatriations of *D. couperi* can maximize probability of success by releasing older snakes in greater abundance and at greater frequency. However, project managers should not become discouraged with limited signs of success early within projects; repatriated populations may be growing, but researchers may be unable to detect accurate population trends. Projects seeking to monitor success during the repatriation of secretive, long-lived organisms should consider a priori how detection processes influence population monitoring and evaluations of repatriation success.

5:30 TRANSLOCATIONS OF NUISANCE TIMBER RATTLESNAKES (*CROTALUS HORMIDUS*): A POSSIBLE MANAGEMENT SOLUTION.

Danny L. Bryan*, Cumberland University, dbryan@cumberland.edu.

As human populations expand and encroach upon wildlife habitat, conflicts between humans and wildlife and destruction of habitat will increase, resulting in species decline worldwide. Translocation of many vertebrate and endangered plant species for augmentation of declining populations or repatriation of extirpated populations have been attempted, with varying degrees of success. Translocation of timber rattlesnakes (*Crotalus horridus*) offers an opportunity to remove snakes from areas near human habitation and restore or augment populations in more remote locations. Eleven, apparently healthy, nuisance timber rattlesnakes were captured or provided by Tennessee Wildlife Resources Officers and were implanted with radio transmitters. Nuisance rattlesnakes were released at known hibernacula of resident snakes at the time of ingress. All translocated snakes were moved 2 km from their original capture site. Snakes were tracked using radio-telemetry periodically to determine if ingress occurred, and they were monitored to determine over-winter survival and movement patterns. All but one translocated rattlesnakes in this study survived the winter and three were killed shortly after egress. Sufficient data were collected for three translocated snakes to estimate home ranges. Over half of translocated rattlesnakes in this study appeared to
establish residence in the area and displayed typical foraging patterns during the active season. They were also frequently observed in close proximity to resident snakes, perhaps indicating that conspecific trailing was occurring. These findings were consistent with other studies, indicating that translocation of adult rattlesnakes has potential as a management strategy.

5:45 **OPHIDIOMYCES OPHIOIDIICOLA: OCCURRENCE IN SOUTH GEORGIA SNAKE FAUNA AND A NEW CONCERN FOR EASTERN INDIGO SNAKE CONSERVATION.** Benjamin S. Stegenga*, bstegenga@orionnesociety.org, Houston C. Chandler, Dirk J. Stevenson, and Christopher L. Jenkins, The Orianne Society.

Snake Fungal Disease (SFD), caused by the fungus *Ophidiomyces ophiodiicola*, has warranted increased research by biologists in recent years, as more snakes have tested positive for the fungus from across the United States. Currently, little is known about the prevalence of the fungus, susceptible taxa, and its effects on snake survival. In September 2016, we began examining the prevalence of *Ophidiomyces* in snake taxa across the Coastal Plain of Georgia. For two years we captured snakes and collected swab samples to test for the presence of *Ophidiomyces*. Snakes were captured using a variety of methods, including drift fences, road cruising, and visual encounter surveys. We collected 962 swab samples from 786 snake encounters and 34 snake species. 276 snakes (35.1%) had dermal lesions indicative of ophidiomycosis, and 137 snakes (17.4%) tested positive for the fungus. Eastern Indigo Snakes (*Drymarchon couperi*) had the second highest prevalence of *O. ophiodiicola*, including several severe infections that negatively impacted the overall health of individuals. Since they have already experienced range-wide population declines, these results indicate that additional work is needed to better understand how infection impacts individual survival and fecundity. A high incidence of disease in wild populations could influence long-term population stability and the success of future conservation efforts.

Saturday

9:00 **AMERICA’S LONGEST RESEARCH STUDY ON DIAMONDBACK TERRAPINS (MALACLEMYS TERRAPIN): STATUS AND REVIEW.** J. Whitfield Gibbons*, University of Georgia; Cris Hagen, Turtle Survival Alliance; Jeffrey E. Lovich, U.S. Geological Survey; Tony M. Mills, Low Country Institute; Thomas R. Rainwater, Clemson University; Meg Hoyle, Botany Bay Ecotours; Michael W. Gibbons, Mt. Pleasant, SC; Parker W. Gibbons, Oceanside Collegiate Academy.

The longest ongoing study of diamondback terrapins (*Malaclemys terrapin*), the only turtle in the world restricted to brackish waters between freshwater habitats and the sea, began in the coastal salt marshes and tidal creeks bordering Kiawah Island, South Carolina, more than 35
years ago. A point of irony is that the first one was caught by a child as by-catch in a crab trap, a recreational practice later indicted as a cause of decline in the Kiawah terrapin populations. At the time, in the early 1980s, upon discovery that terrapins were abundant in the Kiawah marshes, a spontaneous response was to try to catch more. The next 22 terrapins were captured in a single seine haul in 15 minutes by three children and their father in a tidal creek. Today, a dozen trained college students with seines and trammel nets can no longer repeat such a success rate in a full day. Against this historical backdrop there are unanswered questions, including, why had herpetological surveys conducted on the island beginning in the early 1970s not revealed the presence of terrapins? How did giant slider turtles in fresh waters on Kiawah Island and endangered loggerheads in the sea shift the focus away from the only turtle in the brackish waters separating the island from the mainland? We chronicle the decline of terrapins at Kiawah Island, discuss what factors have determined their status today, and suggest ways to ensure that future generations of children can see and experience this iconic turtle.

9:15 IT TAKES A VILLAGE TO SAVE A SPECIES: HOW 10 YEARS OF WETLAND RESTORATION EFFORTS ON MULTIPLE NEIGHBORING CONSERVATION LANDS EXEMPLIFIES THE NEED FOR COLLABORATION AMONG DIVERSE PARTNERS. Kelly C. Jones*, Virginia Tech, kcjones7@vt.edu; Mark Winland and Megan Keserauskis Kunzer, Florida Fish and Wildlife Conservation Commission; Brandon K. Rincon, Carola A. Haas, and Nicholas M. Caruso, Virginia Tech; Thomas A. Gorman, Washington Department of Natural Resources.

Developing and effectively implementing solutions to conservation challenges is as much about functional partnerships as it is about the ideas or techniques used. Here, we tell you the story of those partnerships and the creative solutions that were reached. Eglin AFB and Escribano Point WMA contain the last remaining wetland complexes with multiple occupied reticulated flatwoods salamander (Ambystoma bishopi) breeding sites, and Eglin and Blackwater SF contain all known Florida bog frog (Rana okaloosae) sites. Wetland habitats supporting these species are largely fire-dependent, but integration of fire has generally been unsuccessful, despite improvements in burning upland habitats over recent decades. Ultimately, the effective use of routine seasonally-appropriate fire will be the most efficient and powerful means for restoration and maintenance of these imperiled wetland systems, however the need for fire surrogates to accelerate this process is undeniable. Most of the ideas put into use on our focal landscape were not new, but the creativity in identifying potential funding sources and the refinement of techniques, only possible through continuity among organizational partnerships, has led to a much more hopeful overall outlook for these rare animals and the diverse ecosystems upon which they rely.

9:30 THE TURTLE SURVIVAL ALLIANCE: 18 YEARS OF GLOBAL TURTLE CONSERVATION. Cris Hagen*, Turtle Survival Alliance,
The Turtle Survival Alliance (TSA) was formed in 2001 as an International Union for Conservation of Nature (IUCN) partnership for sustainable captive management of freshwater turtles and tortoises, and initially designated a task force of the IUCN Tortoise and Freshwater Turtle Specialist Group. The TSA arose in response to the rampant and unsustainable harvest of Asian turtle populations to supply Chinese markets, a situation coined the Asian Turtle Crisis. Since forming, the TSA has become recognized as a global force for turtle conservation, capable of taking swift and decisive action on behalf of endangered turtles and tortoises. The TSA employs a comprehensive strategy for evaluating the most critically endangered chelonians that identifies whether a species is prioritized for a captive program or through range country efforts, or a combination of both. The TSA secured nonprofit 501(c)(3) status in 2005 and centralized its base operations in South Carolina since opening the Turtle Survival Center (TSC) in 2013. The TSC is home to a collection of 700 turtles and tortoises, representing 22 endangered and critically endangered species. The TSA has grown both internationally and domestically, with significant field programs in Madagascar, Myanmar, and India, and additional projects in Belize, Colombia, the United States, and throughout Asia. The TSA is an action-oriented global partnership, focusing on species that are at high risk of extinction, and has made a bold commitment to zero turtle extinctions in the 21st century.

THE IMPACT OF CLIMATE VARIABILITY ON BODY SIZE VARIATION IN LARVAL SALAMANDERS. Thomas L. Anderson*, Appalachian State University, anderstl@gmail.com; Brittany H. Ousterhout, National Great Rivers Research and Education Center; Dana L. Drake, University of Connecticut; William E. Peterman, Ohio State University; Jacob J. Burkart, Appalachian State University; Freya E. Rowland, University of Michigan; Jon M. Davenport, Appalachian State University.

One expected consequence of climate change is increasing variability in climatic conditions. For organisms that depend on suitable climatic conditions for certain life history events, such increases in climate variability may alter ontogenetic patterns, with subsequent ramifications to population and community dynamics. Altered breeding phenology in pond-breeding amphibians has already been shown for numerous taxa, though typically only shifts in the mean or median date. We tested whether greater variability in temperature and rainfall patterns, expected proxies for greater variation in breeding phenology, resulted in increased body size variability of larval ringed (Ambystoma annulatum), marbled (A. opacum) and spotted salamanders (A. maculatum). We collected data on body size of each species from 162 ponds over a 7-yr period (2012-2018) at Fort Leonard Wood, MO. We calculated the coefficient of variation to describe variability in body size, precipitation and temperature. Variability in the amount of rainfall during the fall breeding season significantly increased over the study period, with the number of rainfall events > 3 mm decreasing. Increasing
variability in the number of days with suitable breeding conditions was negatively related to body size variability of *A. annulatum*. Body size variability of *A. opacum* increased when there were more days of rainfall > 3 mm. For *A. maculatum*, the number of rain events and variability in both temperature and precipitation resulted in increased body size variability. However, for all species, models had low explanatory power, indicating other factors (predators, abiotic stressors) may affect body size variability more than breeding phenology.

10:15  **ESTIMATING BIOMASS AND IDEAL SAMPLING PERIOD FOR A CRYPTIC, STREAM-BREEDING SALAMANDER (*Ambystoma barbouri*) USING ENVIRONMENTAL DNA.** Nicole A. Witzel*, Tennessee State University, nwitzel@my.tnstate.edu; William B. Sutton, Tennessee State University.

Cryptic species present significant challenges when attempting to create range maps and conservation plans and are often overlooked in comprehensive traditional surveys. This is specifically true for the Streamside Salamander (*Ambystoma barbouri*), which is listed as endangered in Tennessee. This species is only surface-active when they emerge to breed in low-order, ephemeral streams during the winter months and can be difficult to detect using traditional survey methods. Surveys that target DNA that the salamanders shed into their aquatic environment may provide an effective method for detecting this species. From December 2016 to May 2017, 17 ephemeral streams were sampled four times for environmental DNA (eDNA) and salamander biomass within a 50-meter stretch. Our objectives were 1) to determine if there was a relationship between salamander biomass and eDNA copies and 2) identify the best time during this period to sample for eDNA. Using a linear mixed-effects model, we examined the relationship between streamflow, biomass, and eDNA copies per sample, using site as a random effect. Environmental DNA copy number was logarithmically related to salamander biomass found in the stream after ~1,000 copies, but became less accurate as copy number increased. The best time to survey for *Ambystoma barbouri* eDNA occurred during the month of February, which coincided with the greatest period of larvae emerging from eggs. This information provides an efficient, accurate method which can be utilized by wildlife agencies to identify species presence and roughly estimate the population status of this cryptic, and locally rare amphibian in ephemeral streams.

10:20  **STATUS ASSESSMENT: DISTRIBUTION, OCCUPANCY AND ABUNDANCE OF *AMBYSTOMA BARBOURI* (STREAMSIDE SALAMANDER) IN CENTRAL KENTUCKY STREAMS.** Andrea N. Drayer*, University of Kentucky, andrea.drayer@uky.edu; Steven J. Price, University of Kentucky; Jacquelyn C. Guzy, University of Arkansas; John MacGregor, Kentucky Department of Fish and Wildlife Resources.
*Ambystoma barbouri* (Streamside Salamander), a regional endemic thought to be affected by deforestation, has >50% of its range within Kentucky. We surveyed gaps in *A. barbouri* distribution in Central Kentucky and analyzed relationships between salamander occupancy and abundance and catchment-scale (forest, agriculture, urban) and local (water chemistry, sunfish presence) variables. We sampled 80 streams (30 agriculture, 34 forested and 16 urban) over two years (2017-2018) and identified 76 new *A. barbouri* localities (56 of 80 sampled sites, 20 additional sites) across 14 Kentucky counties. Estimated mean occupancy (90%) and detection (73%) were high. Streams without sunfish and >50% forested or agricultural land within their catchments had the highest estimated abundances of *A. barbouri*; while urban streams had the fewest animals. At sites where we did not detect sunfish, there were on average 35.25 (95% CI=32.04 to 38.67) *A. barbouri* in forested sites, 24.47 (95% CI = 19.86 to 25.14) in agricultural sites and 0.66 (95% CI = 0.14 to 1.59) in urban sites. Water chemistry varied across our site types with conductivity (F (2, 58) = 7.72, p = 0.001), nitrates (F (2,58) = 11.18, <0.001), and sodium (F (2,58) = 37.49, <0.001) all being significant; however, only maximum sodium (α = -0.51, 95% CI = -0.58 to -0.43) had a relationship with *A. barbouri* abundance. Although *A. barbouri* was widespread and common in our study area, reforestation of urban and agricultural stream catchments may be an effective management strategy to increase local population size.

10:25 **ECOLOGY OF SIREN INTERMEDIA IN WESTERN KENTUCKY: PRELIMINARY RESULTS USING A SPATIAL CAPTURE-RECAPTURE APPROACH.** Allison G. Davis*, University of Kentucky, ada283@uky.edu; Wendy Leuenberger, Andrea N. Drayer, and Steven J. Price, University of Kentucky.

*Siren intermedia* (*Lesser Siren*) is a paedomorphic, aquatic salamander widely distributed through the Southeast US. Despite a broad distribution, few ecological investigations of *S. intermedia* exist, especially in the northern expanse of their range. Our objective is to explore the use of spatial capture-recapture (SCR) analysis to estimate *S. intermedia* population density and movement within and between water bodies in a 2.5-ha wetland complex in the West Kentucky Wildlife Management Area (McCracken County). We set minnow trap stations every 10–15 meters around the perimeter of the wetlands one night per month from July to December 2018 with a mean of 51.7 trap nights per month. Captured and recaptured *S. intermedia* were measured, weighed, and injected with passive integrated transponder (PIT) tags. In addition to trapping, wetland perimeters were also scanned for PIT tagged salamanders during winter months. In the first six months of this study, we trapped and PIT-tagged 41 *S. intermedia*; most captures occurred in July-September, with only 2 captures in October-December. We obtained one recapture by minnow trap and three individuals were detected by scanning. Total length averaged 277 ± 9 mm, snout-vent lengths were 185 ± 6 mm, and weights averaged 31.1 ± 2.6 g. Maximum distance traveled was 31 m. The current detection history is insufficient for SCR analyses, but monthly trapping and scanning will continue through summer of 2019.
Plethodontid salamanders provide compelling models for studying the evolution of reproductive behaviors, including courtship, mate choice, and parental care. Within populations of three putative species in the two-lined salamander (*Eurycea bistlineata*) species complex, two alternative male reproductive tactics coexist. Searching males have mental glands, premaxillary teeth that pierce the upper lip, and elongate cirri—traits well-suited for locating and courting females. Guarding males (also known as “Morph A” males) lack all of these features and instead have hypertrophied jaw musculature—a trait well-suited for agonistic behavior. These morphological differences are accompanied by behavioral differences, where only guarding males exhibit mate-guarding behavior. In this study, I used terrestrial and aquatic surveys at Highlands Biological Station to show that during the breeding season, searching and guarding male *Eurycea cf. wilderae* are strongly spatially segregated, indicating that these alternative reproductive tactics have strongly divergent reproductive phenologies.

Snake fungal disease (SFD) is considered a serious threat to snakes, yet assessing the impacts of SFD on populations has been challenging due to the difficulty associated with collecting health data on a large number of individuals. We used Passive Transponder Tag (PIT) telemetry and a multi-state, capture-mark-recapture model to assess the effects of SFD on short-term survival, movement, and behavior of Queensnakes (*Regina septemvittata*) and Common Watersnakes (*Nerodia sipedon*) in central Kentucky streams. In 2016, we marked and processed 232 *R. septemvittata* and 293 *N. sipedon* and considered 42.24% of *R. septemvittata* and 19.11% of *N. sipedon* to have SFD based on clinical signs and results of PCR testing for *Ophidiomyces ophiodiicola*, the causative agent of SFD. Monthly survival estimates were high (0.99, 95% CRI:0.96-1.00) for both species from June-October and did not differ between diseased and non-diseased individuals. However, snakes afflicted with SFD moved less frequently; for example, permanent emigration was lower in *R. septemvittata* with SFD (0.07, 95% CRI: 0.01-0.14) compared to non-diseased *R. septemvittata* (0.23, 95% CRI: 0.16-0.30). Furthermore, visual detection probability was higher for diseased snakes of
both species (*R. septemvittata*: 0.61, 95% CRI: 0.54-0.68; *N. sipedon*: 0.52, 95% CRI: 0.40-0.64) than for non-diseased snakes (*R. septemvittata*: 0.42, 95% CRI: 0.35-0.49; *N. sipedon*: 0.44, 95% CRI: 0.39-0.50), indicating a greater degree of surface activity. Although we found no evidence that SFD impacted short-term survival, SFD does appear to result in potentially risky behavior that may ultimately lead to long-term effects on populations.


As population growth and urban sprawl continues to increase, so does the amount of human-wildlife interactions that occur daily. This coupled with constantly changing desires for communication outlets with local government resources is causing many state agencies to re-evaluate how they interface with the public, and how they can better respond to wildlife mitigation requests. In an effort to address this demand, the North Carolina Wildlife Resources Commission opened a Wildlife Helpline in April of 2017 staffed with experienced wildlife biologists who could provide technical guidance over the phone and via email for a variety of wildlife-related questions such as: general wildlife biology, how to solve damage issues, animal health concerns, and reporting rare/endangered species. In the first nine months of operation the helpline handled 15,522 calls and 1,123 emails. Of these, calls related to herpetofauna were among the top five types of calls by taxa. We used a combination of inferential and descriptive statistics to evaluate differences in herpetofaunal perceptions, call volume, and spatial and temporal activity between the first and second year of operation. These analyses allowed us to detect fine-scale peaks in public interactions with reptiles and amphibians across the state allowing for more targeted outreach efforts. Overall, this database offers tremendous potential for exploring temporal and spatial relationships of reptiles and amphibians in urbanized areas, detecting invasive, rare, or endangered species, and asking human dimensions related questions—such as differences in the public’s perceptions of herpetofauna and identification skills.

**11:05 THE CONTRIBUTION OF WETLAND SUCCESSION TO DECLINES OF THREATENED AMPHIBIANS IN THE LONGLEAF PINE ECOSYSTEM.** Angela K. Burrow*, akb40353@uga.edu, and John C. Maerz, Warnell School of Forestry and Natural Resources, University of Georgia.

Historically, habitat conversion for agriculture and development was the primary threat to geographically isolated longleaf pine wetlands, but today remnant isolated wetlands are often overgrown and hydrologically altered due to fire exclusion or incompatible, cool season fire
regimes. In the absence of warm season fires when wetlands are dry, shrubs and trees succeed herbaceous plants, which alters wetland productivity via effects on light and detritus quality. In turn, wetland productivity determines larval amphibian performance including survival and size at metamorphosis, which are large determinants of amphibian population growth. Therefore, the objectives of our work are to quantify the effects of hardwood encroachment on the growth, development, and survival of gopher frog (*Lithobates capito*) and ornate chorus frog (*Pseudacris ornata*) tadpoles. Tadpoles were reared in outdoor aquatic mesocosms containing either leaf litter of an encroaching hardwood or a grass/sedge with and without a shading treatment. Preliminary results for *P. ornata* suggest that survival was minimally affected by light and litter treatments with the exception of sweetgum. Larval periods were significantly increased in shade while mass decreased with shading and hardwood litters. Preliminary results for *L. capito* suggest that survival tends to decrease in shade and hardwood litters. Larval periods were significantly increased in hardwood litter and shading while mass decreased with shading. Our results suggest that successional changes within geographically isolated longleaf pine wetlands due to fire exclusion may negatively impact *P. ornata* and *L. capito* populations through reduced survival, prolonged development and reduced mass.

11:20 **EFFECTS OF FOREST MANAGEMENT ON HABITAT STRUCTURE AND UPLAND PINE-ASSOCIATED HERPETOFANAAL COMMUNITIES.** Ethan Royal*, University of Arkansas, ejroyal@uark.edu; Jessica Homyack, Weyerhaeuser Company; John D. Willson, University of Arkansas.

Longleaf pine (*Pinus palustris*) savannah once covered much of the southeastern Coastal Plain and was characterized by open canopy, diverse herbaceous vegetation, and high amounts of bare soil. The unique structural and vegetative conditions of this habitat support many endemic species, including several reptiles and amphibians. Managed pine (*Pinus spp.*) stands now occur throughout the southeastern U.S. and have replaced much of the historic longleaf pine savannah. These managed stands can provide suitable habitat conditions for some open canopy-associated wildlife species if certain structural characteristics are maintained. However, little work has examined herpetofaunal communities. After performing repeated, low intensity herpetofauna surveys and vegetation surveys, we used hierarchical Bayesian occupancy modeling techniques to assess the ability of managed pine stands in sandy soil regions of Northwestern Louisiana to support open pine-associated herpetofauna. We selected 81 sites across 7 management regimes: mechanically managed young and thinned mid-age loblolly pine (*P. taeda*) stands, fire-maintained young, mid-age and mature longleaf stands, and fire-maintained mid-age and mature loblolly stands. We performed repeated visual encounter surveys at each site over two field seasons. We quantified vegetation characteristics including canopy cover, overstory, midstory, understory, and groundcover. Preliminary results suggest that young stands and some mid-age fire-maintained sites most closely resembled open-canopy, fire-maintained mature pine stands in vegetation characteristics and herpetofaunal community composition. Some closed-canopy
mature sites supported the most diverse herpetofauna communities, but lacked upland pine associated species. Our results provide insight into how forest management practices affect herpetofaunal communities and will help guide management strategies.

11:35 ROLE OF DENSITY AND HABITAT STRUCTURE ON EASTERN NEWT CONTACT RATES AND PATHOGEN TRANSMISSION. Daniel A. Malagon*, University of Tennessee; Luis Melara, Shippensburg University, Suzanne Lenhart, University of Tennessee; Olivia F. Prosper, University of Kentucky; E. Davis Carter, University of Tennessee; Debra L. Miller, University of Tennessee; and Matthew J. Gray, University of Tennessee.

Batrachochytrium salamandrivorans (Bsal) is an invasive fungal pathogen that is emerging in Europe and appears to be highly pathogenic to many salamander species, particularly those in the family Salamandridae. The Eastern Newt (Notophthalmus viridescens) is a member of Salamandridae and known to be susceptible to Bsal. This species is one of the most widely distributed salamanders in North America. Given their widespread distribution and high abundance, this species has the potential to significantly influence Bsal epidemiology if the pathogen emerges in the USA. We designed two studies to estimate contact rates given different densities and habitat structure, and the probability of transmission from infected to susceptible individuals. We found that Bsal transmission due to contact was very efficient between infected and susceptible newts even at early stages of infection when pathogen loads were low. We also found that contact rates were density dependent, and that adding habitat structure (i.e., plants) reduced contact at higher newt densities. Simulations from a system of ordinary differential equations show rapid transmission of Bsal among individuals, such that an entire population can become infected quickly under most scenarios. Disease-induced mortality of susceptible individuals following contact with an infected individual was relatively high (>75%) and fast (<30 days post-contact). These results demonstrate that Bsal can have severe population impacts on eastern newts. Moreover, this abundant species could play a major role in Bsal emergence if it is introduced. Reducing newt density or increasing habitat structure at Bsal positive sites might reduce transmission and outbreak size.

11:50 DISENTANGLING ARBOREAL HABITAT USE IN GREEN SALAMANDERS (ANEIDES AENEUS). Walter H. Smith*, whs2q@uvawise.edu, Burley Ball, McKayla Grasham, Faith Jackson, and Richard Turner, The University of Virginia’s College at Wise; M. Kevin Hamed, Virginia Highlands Community College.

Designing conservation efforts for Green Salamanders (Aneides aeneus), a rock outcrop specialist, is hampered by the species’ seasonal use of arboreal habitats, particularly standing trees adjacent to rock faces. We used data from a multiyear study of an abundant Green Salamander population in the Cumberland Mountains of Virginia and Kentucky to clarify the
nature of arboreal habitat use in this species. While salamanders’ arboreal behavior was restricted to the active season, occupancy and detection modeling indicated that individual animals’ use of arboreal refugia was periodic in nature and tied to periods of high humidity and moisture, particularly those related to rainfall events. Salamanders also non-randomly selected trees as habitat, preferring trees with a higher number of available refugia (hollow limbs, loose and scarred bark) in close proximity to rock faces. We also found anecdotal evidence that salamanders preferred species prone to experiencing hollow limbs and bark damage, such as rhododendron and ash, as opposed to randomly selecting trees from the surrounding forest. Our results indicate that arboreal habitat use in this species is a non-random process performed in response to specific tree attributes that are common in older forests with more complex habitat structure. Conserving habitat for Green Salamanders may therefore be more complicated than simply protecting generalized forest buffers around rock outcrops, and we will provide recommendations for future work on arboreal habitat use in this species.

12:05  **REPRODUCTIVE OUTPUT IN SOUTHERN POPULATIONS OF SPOTTED TURTLES (CLEMMYS GUTTATA).** Houston C. Chandler*, hchandler@oriannesociety.org; and Benjamin S. Stegenga, The Orianne Society.

Freshwater turtles are one of the most endangered groups of vertebrates. The Spotted Turtle (*Clemmys guttata*) is a small freshwater turtle that has an expansive range, covering a majority of the eastern United States and stretching into southeastern Canada. Currently, there is a lack of published ecological research and survey work from southern populations of Spotted Turtles, despite these populations varying significantly from their northern counterparts. During 2018, we measured female fecundity and identified nesting sites using a combination of radio telemetry and thread spooling. We attached radio transmitters to 17 female turtles at two sites in southern Georgia during spring of 2018. We located each turtle approximately once per week, palpating for shelled eggs and then x-rayed all turtles when shelled eggs were present. We found evidence of 32 clutches produced by these 17 turtles, and 15 of 17 (88%) female turtles produced at least one clutch of eggs. Eleven turtles laid at least two clutches, and six turtles laid at least three clutches. Clutch sizes ranged from 1–4 eggs (mean clutch sizes ± SE: 1st = 2.3 ± 0.2, 2nd = 2.5 ± 0.2, 3rd = 1.5 ± 0.3). The total number of eggs produced was between 65 and 77. We located 16 nests, half of which survived until hatching. The other 50% of nests were predated or did not hatch for other reasons. Our results demonstrate that multiple clutching is common in these populations, which has important conservation implications for southern Spotted Turtle populations.

1:30  **HEALTH AND DENSITY EFFECTS ON OVERWINTERING BEHAVIOR OF TRANSLOCATED GOPHER TORTOISES IN NORTHWEST FLORIDA.**
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 fragmentation. Translocation of tortoises from lands that will be developed has become an important conservation tool. Temperature plays an important role in tortoise health, as tortoises can thermoregulate and induce a fever response by altering their behavior, such as emerging to bask. This change is most noticeable during the winter, when tortoises are thought to be relatively inactive. We investigated overwintering behavior of healthy (H) translocated gopher tortoises and tortoises deemed “at risk” (AR) for developing disease, determined through health assessment, at two release sites with different tortoise densities (DB1, 18 tortoise/ha; SR1, 7.7 tortoises/ha) during the 2016-17 inactive season using temperature loggers epoxied to the carapace. Overwintering onset, duration, and termination were determined for 23 tortoises representing seven Florida counties. Ten tortoises (three H, seven AR) did not overwinter. AR tortoises had shorter overwintering periods (mean=83 days) than H tortoises (mean=101.7 days) with combined sites (p=0.006). DB1 tortoises had shorter overwintering periods (mean=83 days) than SR1 tortoises (mean=109.6 days) with combined health groups (p=0.02). When separated by both health group and site, H tortoises in the lower density site demonstrating the longest overwintering durations (p=0.007). Though overwintering was most affected by health, tortoise density had an additional effect. Lack of overwintering during the cooler months may result in further decreased health and body condition, potential cold stunning, and an increased risk for predation.

1:45 GOPHER TORTOISE (*Gopherus polyphemus*) MOVEMENT AND HABITAT ASSOCIATIONS ON WORKING FOREST LANDSCAPES. Duston Duffie*, DRD143@msstate.edu, and Scott Rush, Mississippi State University, Department of Wildlife, Fisheries, and Aquaculture; Darren Miller, NCASI; Daniel Greene, Weyerhaeuser Company.

Gopher tortoises (*Gopherus polyphemus*), a keystone species in southern pine (*Pinus spp.*) ecosystems, are listed as threatened under the Endangered Species Act in the western portion of their range. Much of the private land where gopher tortoises occur is managed primarily for timber production. However, gopher tortoise ecology on these private, working forests remains poorly understood. Therefore, we are examining habitat conditions associated with gopher tortoise activity on working pine forests in Washington Parish, Louisiana and Perry County, Mississippi. We used burrow surveys, radio-telemetry, and vegetation surveys to evaluate working forest landscape conditions suitable for gopher tortoises. During 2017 and 2018, we radio-tagged 19 gopher tortoises with VHF radio-transmitters and attached GPS
data loggers to 10 of those individuals. Of the radio-tagged tortoises, we calculated home ranges for 15 individuals. Average home range size (95% minimum convex polygon) differed significantly by sex (male=1.52 ha, SE=0.49; female=0.39 ha, SE=0.36; p-value=0.04), but not by site (Washington Parish=0.90 ha, SE=0.39; Perry County=1.10 ha, SE=0.58; p-value=0.75). At the Washington Parish site, gopher tortoises were mostly constricted to utility right-of-ways and road sides; whereas, tortoises were dispersed throughout forest stands within the Perry County site. Our results concur with past studies, where a combination of factors, including forest management history, midstory and understory vegetation density, and soil conditions (e.g., drainage class) affect spatial ecology of gopher tortoises. Using these data, we will recommend components of best conservation practices for gopher tortoises on managed working forests, compatible with forestry objectives.

2:00  **MAKING HASTE SLOWLY: THE PURSUIT OF TANGIBLE RESULTS FOR GOPHER TORTOISE RECOVERY ON A MILITARY INSTALLATION.**


Eglin Air Force Base, located in the Florida Panhandle, offers the most expansive potential gopher tortoise (*Gopherus polyphemus*) habitat of all Department of Defense lands, but contains diminished tortoise densities well below carrying capacity. The gopher tortoise in Florida is currently listed as state threatened, but is a candidate for federal listing. The species has been monitored on Eglin at five sites over the last eight years to assess population status and trends. One site was surveyed annually and four others were surveyed on a 3-5 year rotation using the 10 m-transect burrow survey method. All but one site showed apparent declines greater than 60%. None of the sites supported a minimum viable population (MVP), which constitutes at least 250 adults. With federal listing posing unknown impacts to mission flexibility, Eglin recognized that action must be taken now to avoid regulatory constraints. Eglin leadership saw that population growth from reproduction alone was insufficient to influence final listing determination. A plan was drafted with USFWS and FWC that included both internal and external translocations in an effort to create viable populations in fire maintained habitat. To date, 1,300+ offsite tortoises have been translocated to Eglin and more than 200 have been relocated from isolated, non-viable populations in unmanaged/highly disturbed habitats on the installation. The tangible results from these efforts will not only help to ensure tortoise viability and avoid additional regulatory constraints, but also benefit burrow associates and set the stage for future repatriation efforts.

2:15  **DOUBLE VISION: THE SYMPATRIC INTERACTIONS OF TWO CLOSELY-RELATED MUSK TURTLES (GENUS: *STERNOTHERUS*) IN THE PASCAGOULA RIVER SYSTEM.** Grover J. Brown*, University of Southern
The Southeastern United States is a well-known hotspot of turtle diversity, driven in large part to the endemism of highly aquatic turtle species to Southeastern rivers (e.g., *Graptemys*, *Macrochelys*, and *Sternotherus*). The musk turtles (genus: *Sternotherus*) also follow this pattern by one species replacing another in geographic sequence, but in South Mississippi, the Pascagoula River System marks an intriguing region for two of the genus’ lotic species. The Pascagoula lies near the westernmost extent of the Stripe-necked Musk Turtle’s (*Sternotherus peltifer*) geographic range and is the easternmost extent of the Razorback Musk Turtle’s (*S. carinatus*). This narrow range of overlap between two ecologically similar turtle species provides interesting insight to the forces that create and maintain biodiversity. Where the two musk turtle species are allopatric, they occupy nearly identical lotic habitats and fulfill a very similar ecological niche, such that in sympatry (and subsequently syntopy) they seemingly violate the “Principle of Competitive Exclusion.” To better understand how these species are able to co-occur within the Pascagoula River Drainage, we examined their interaction by 1) using nuclear and mitochondrial markers to determine whether they are maintaining reproductive isolation or if the two species are hybridizing, and 2) comparing species’ habitat preferences within the Pascagoula River System to evaluate levels of niche overlap. To date we have caught 198 *S. peltifer* and 178 *S. carinatus* from the Pascagoula River System. Less than 5% of the turtles indicated any evidence of mixed ancestry. Our data suggest habitat segregation and opposing sexual dimorphism may facilitate sympatry and syntopy of these species.

2:30 CONSERVATION GENETICS OF TWO IMPERILED GRAPTEMYS SPECIES (*G. GIBBONSI* AND *G. PEARLENSIS*) PETITIONED FOR FEDERAL LISTING. Luke Pearson*, University of Southern Mississippi, Luke.Pearson@usm.edu; Will Selman, Millsaps College; Brian Kreiser, University of Southern Mississippi; Peter V. Lindeman, Edinboro University of Pennsylvania; Robert L. Jones, Mississippi Museum of Natural Science.

*Graptemys gibbonsi* and *G. pearlensis* were part of the *G. pulchra* “species complex” until their description in 1992 and 2010, respectively. Since their description, little formal research has been published on these species, and there is no available data to determine the rate of gene flow among populations and/or if distinct genetic populations exist. Further, both species have relatively small and declining populations compared to the sympatric federally threatened *Graptemys* species; *G. flavimaculata* (Pascagoula drainage) and *G. oculifera* (Pearl drainage). In response to this, the Association for Zoos and Aquariums recently received approval from the U.S. Fish and Wildlife Service to establish captive assurance colonies for *G. gibbonsi* and *G. pearlensis*. However, because no genetic data currently exists for either species, there is a limited ability to understand if the captive population’s genetic diversity will mirror the wild genetic diversity. To fill this knowledge gap, our objectives are
to determine if population structure exists throughout the ranges of *G. gibbonsi* and *G. pearlensis*, assess the rates of gene flow among populations, compare levels of genetic diversity among sites, and characterize the demographic history through testing for genetic bottlenecks and estimating effective population size. Currently, 292 *G. gibbonsi* tissue samples from 16 sites have been collected throughout the Pascagoula River system, while 139 *G. pearlensis* tissue samples from 16 sites have been collected throughout the Pearl River system. We are in the process of obtaining microsatellite genotype data for both species to inform captive management decisions and reintroduction strategies, should they become necessary.

3:00 **SURVIVAL, GROWTH, AND MOVEMENT OF HEAD-STARTED ALLIGATOR SNAPPING TURTLES IN SOUTHWEST LOUISIANA.** Brad M. Glorioso*, gloriosob@usgs.gov, J. Hardin Waddle, Cory J. Hillard, Brittany R. Maldonado, U.S. Geological Survey; Lindy J. Muse, Cherokee Nation Businesses; Charles D. Battaglia and Jared Streeter, Louisiana Department of Wildlife and Fisheries.

Declines have been noted or suspected in populations of Alligator Snapping Turtle (AST), *Macrochelys temminckii*, across their range. In response, many state agencies have employed captive propagation and release of ASTs to bolster existing populations or reintroduce them to formerly occupied areas. A total of 53 head-started ASTs, equipped with both internal PIT and external metal tags, were released by the Louisiana Department of Wildlife and Fisheries between Nov 2015 and Oct 2016 at multiple locations along an approximately 4 km stream stretch in southwest Louisiana. From Jun–Oct 2018 we trapped each of the release locations for one week (4 trap nights) using baited hoop nets. We had 15 total AST captures representing 12 individuals (8 of which were head-starts). An additional head-start individual that was captured on rod and reel by a landowner was also processed. Growth rates of the nine head-starts ranged from 0.2–2.2 mm/month in carapace length and -4.5–100.5 g/month in mass. Distances from release site ranged from 113–3129 m. Two of the nine head-start individuals drowned in nets due to entanglement of their external tags. These two individuals had the lowest growth rates (by carapace length and mass) and were captured the furthest from their release site of any head-starts. It appears head-starting has been successful in this area in that we recaptured ca. 17% of the released ASTs with minimal trapping effort (268 trap nights), and most individuals remained in the area they were released and exhibited good growth over time.

3:05 **STAYING ALIVE: WAIF TORTOISE SURVIVAL AND POPULATION DYNAMICS FOLLOWING TRANSLOCATION.** Rebecca K. McKee*, University of Georgia, Rebecca.mckee25@uga.edu; Kurt Buhlmann and Tracey Tuberville, Savannah River Ecology Lab; Will Dillman and Barry Kesler, South Carolina Department of Natural Resources; Clinton Moore, U.S. Geological Survey,
Due to anthropogenic threats, the gopher tortoise (*Gopherus polyphemus*) is declining throughout its range. Although habitat management is important for the species’ conservation, alone it may be insufficient to recover populations that have experienced a severe decline. As a result, translocation has become a valuable conservation tool. While there are risks associated with any translocation, waif tortoises—animals that have been collected illegally or have unknown origins—are generally excluded from translocations primarily due to concerns of pathogen introduction. Additionally, because waif tortoises are often housed in captivity for extended periods, the survival of translocated waifs may be lower than the survival rates reported for translocated wild tortoises. However, if these risks could be managed, waif tortoises could provide the needed numbers to prevent extirpations. In the early 1990s, a small population of gopher tortoises (n=10) was discovered near Aiken, South Carolina, expanding the species’ known range and resulting in the creation of the Aiken Gopher Tortoise Heritage Preserve (AGTHP). Due to the preserve’s dire need for augmentation and its isolation from other tortoise populations, the AGTHP provided the opportunity to study waif tortoise translocation without jeopardizing a viable population. Since 2006, over 280 marked tortoises have been introduced to the preserve. We trapped tortoises from May-July in 2017 and 2018. Using release information and individual recapture histories, we constructed Bayesian multistate models to assess post-release apparent survival. We will present our recapture results and initial survivorship estimates. Ultimately, we hope to identify waif or release characteristics that promote survival.

**COMPARING UAVS TO TRADITIONAL FIELD METHODS IN SURVEYING OF FRESHWATER TURTLES.** Kelly A. Daniels*, University of Tennessee at Chattanooga, kelly-daniels@utc.edu; Andy Carroll, Skytec LLC, acarroll@skytecllc.com; Thomas Wilson, University of Tennessee at Chattanooga, Thomas-wilson@utc.edu

Unmanned aerial vehicles (UAVs), an emerging technology, show promise in ecological research. In this comparative study, we compared UAVs to a traditional sampling method, observations using spotting scopes. UAVs have been used with mixed success for monitoring mammals and birds yet are less common in the realm of freshwater turtles. Herein, we formally assessed the conservation utility of UAVs in the field to gather insight for future adaptive conservation and management decisions. We quantitatively and qualitatively evaluated the use of UAVs using a mixed methods approach in contrast to a proven field method. When comparing UAVs to spotting scopes in both pond and river settings, we found no significant difference between the presence-absence data collected. Being able to successfully use UAVs for ecological surveying proposes an easy, efficient, and less invasive way to study basking turtles.
Wetlands are being lost at an alarming rate to anthropogenic disturbance and this has negative consequences for biodiversity, such as turtles, which rely on habitat provided by these ecosystems. Biodiversity indices can be used to evaluate the condition of environments, including freshwater wetlands. Further evaluations such as of species richness between turtles and their ectoparasites (leeches) can be used to understand the fluctuating dynamics between parasites and their hosts based on habitat quality and host species diversity. To better understand the effects of human influence on wetland turtles, we sampled 19 wetlands across an anthropogenic disturbance gradient for turtle and leech biodiversity. Wetlands were scored into three categories of anthropogenic impact; low disturbance (n=6), medium disturbance (n=6), and high disturbance (n=7) using two land-use, land-cover databases. Over the months of June through October of 2018 (total sample events n=50), wetland sites were sampled on two occasions per site (n=36) with 7 randomly selected sited resampled twice more (n=14), with 6 baited hoop-net traps deployed for 24 hours per each sampling event. Each captured turtle was weighed, measured, sexed, PIT tagged, examined for leeches, and returned to the site of capture. There were a total of 612 turtles; 99 *Chelydra serpentina*, 436 *Trachemys scripta elegans*, 76 *Sternotherus odoratus*, 9 *Apalone spinifera*, and 1 *Graptemys geographica*. Collectively, the interpretation of these data can be used to understand how the effects of anthropogenic disturbance affect wetland turtle-leech communities.

The Chelonians are among the most threatened groups of vertebrates on Earth. However, much about their distribution and community ecology is still poorly understood. The Southeastern United States is an area of high species richness for freshwater turtles, and several of these species are of conservation concern. Over the course of 2018, we deployed traps and conducted basking surveys for turtles at 16 different sites across the four national wildlife refuges that comprise the North Louisiana Refuge Complex, totaling 473 trap nights. Through these surveys we confirmed the presence of 11 turtle species, including 3 classified as state and/or federal species of concern: the alligator snapping turtle (*Macrochelys temminckii*), the razorback musk turtle (*Sternotherus carinatus*), and the Ouachita map turtle (*Graptemys ouachitensis*). As this project continues through 2019, we intend to sample at least 15 new sites within the refuge complex, as well as sampling again at most of the sites.
surveyed in 2018. In addition, more detailed trap site environmental data will be recorded with the goal of assessing habitat preferences for each species within the community. Nest surveys will also be conducted during peak nesting season (March-June).