

SNRE Virtual Student Research Symposium Abstracts

Session 1: Humans and the Environment

Philipp Maleko

MS Student, Affiliate Dept: Wildlife Ecology and Conservation

Common Redshank nest presence in relation to landscape features and the possible impacts of heavy duty all-terrain vehicles in the Russian Far East

Shorebirds throughout the East Asian-Australasian Flyway (EAAF) are rapidly declining. To enact efficient conservation, filling knowledge gaps on their life-histories, ecologies, and factors affecting local population dynamics is imperative. Studying ubiquitous but potentially declining Common Redshank (*Tringa totanus*) may be particularly meaningful as they are indicator species of coastal meadows and marshes. I assessed how Common Redshank nest presence and the prevalence of an anthropogenic disturbance, specifically vezdekhod (or “heavy duty all terrain vehicle”) tracks, coincide with various landscape features in Schaste Bay, Khabarovsk Krai, Russian Far East. Although no model assessing nest presence had strong support (six models had Akaike Information Criterion values ≤ 2), the leading model included pond and meadow habitats. The leading model assessing vezdekhod track prevalence also included pond and meadow habitats. This overlap suggests vezdekhod use may be an ecological trap for breeding Common Redshanks. Limiting, concentrating, or restricting the use of vezdekhods to specific routes or certain times of the year may prevent undue disturbance, the crushing of nests or broods, and the further degradation of suitable habitats. Schaste Bay should also be designated as a regional Nature Park, a protected area that would legally protect the site for breeding and migrating shorebirds and prohibit unsustainable natural resource extraction, yet allow for recreational and subsistence activities.

Rebecca Rash

MS Student, Affiliate Dept: Environmental and Global Health

Environmental and Human Behavioral Risk Factors for Traumatic Stingray Puncture Injuries in Cedar Key Clam Harvesters

Commercial shellfish aquaculture in Cedar Key, Florida, has rapidly expanded over the past decade into a multimillion-dollar industry. However, occupational health and safety challenges are not well understood. 13/16 (81%) of clam harvester participants in an occupational health and safety survey considered stingray puncture injuries a top concern, and 6/16 clam harvesters (38%) reported experiencing these injuries. Stingray puncture injuries are associated with excruciating pain, secondary infection, and lost workdays. Risk factors for stingray injuries were examined using: (1) fisheries-independent monitoring data from 2000-2018 to discern the importance of environmental factors to Atlantic stingray (*Hypanus sabinus*) abundance, and (2) self-reported clam harvester behavior and stingray puncture injury experience while working in the water. Results demonstrated that *H. sabinus* were present inshore throughout the year, with the highest monthly average number of stingrays in March. Average depth and bottom type had highly significant effects on stingray abundance ($p < 0.01$). In addition to environmental risk factors, clam harvester behavior such as shuffling feet in-water was negatively associated with the number of stingray injuries. Although environmental factors may

influence the likelihood of encountering stingrays, clam harvester behavior could influence risk of injury. Therefore, this study empowers clam harvester to better understand and mitigate stingray puncture injuries.

Robert Botta

PhD Student, Affiliate Dept: Fisheries and Aquatic Sciences

Evaluating the economic impacts of bass tournaments on Lake Okeechobee

Florida's tourism-based and overall economy rely on a number of natural resources, including freshwater recreational fisheries. The most high-profile freshwater fishing in Florida is tournament competition fishing for largemouth bass (*Micropterus salmoides*), and the most popular lake for these tournaments is Lake Okeechobee. This lake attracts hundreds of bass tournaments every year, ranging from small tournaments for fishing local, regional, and statewide fishing clubs, to national "major" tournaments for professional fishing organizations. It is well known that these tournaments involve fishers making purchases that infuse dollars in the region surrounding Lake Okeechobee. However, the economic impacts of this spending have not been assessed. This information is critical for local policy makers to understand the importance of tournament fishing to the region and may help inform decisions about future Lake Okeechobee facilities and tournament advertisements and permitting. We attempt to calculate the economic impacts of fishing tournaments that occurred in 2020 on Lake Okeechobee. Using approximately 300 survey responses, we calculated tournament participant's total direct expenditures on local goods and services that could be attributed to fishing tournaments. An input-output analysis framework was used within IMPLAN© software to measure the extent of which the direct expenditures generate additional economic activity and support additional jobs. These metrics are important for policy makers to understand the economic role that recreational fishing tournaments play within Florida's regional economy and can allow for more informed management decisions in the future.

Session 2: Humans and the Environment 2

Ashpreet Kaur

PhD Student, Affiliate Dept: Sociology

Governance and sustainable solid waste management on college campus. A case study of University of Florida

Waste generation and disposal of that waste is as big of an issue as climate change. Different factors come into play in developed and developing world. In developing countries litter is a big issue whereas in developed it is recycling. Developed countries always play a role model for developing nations as they have money resources and economic power to invest in the technology. Universities on the other hand are the epitome of making and implementing effective policies on solid waste management. Due to its social status, there are greater chances that the policies adopted in a university setting will be adopted elsewhere. In this paper, I will talk about the zero-waste initiative adopted by the University of Florida

and ways the initiative works in the university to reach the zero-waste goal. I will be doing content analysis and thematic text analysis of the data and follow Hudson's framework for a successful policy implementation.

Jenicca Poongavanan

MS Student, SNRE

A glimpse into the reproducibility of scientific papers in movement ecology: How are we doing?

Reproducibility is the earmark of science and thus Movement Ecology as well. However, studies in disciplines such as biology and geosciences have shown that published work is rarely reproducible. Ensuring reproducibility is not a mandatory part of the research process and thus there are no clear procedures in place to assess the reproducibility of scientific articles. In this study we put forward a reproducibility workflow scoring sheet based on six criteria that lead to successful reproducible papers. The reproducibility workflow can be used by authors to evaluate the reproducibility of their studies before publication and reviewers to evaluate the reproducibility of scientific papers. To assess the state of reproducibility in Movement Ecology, we attempted to reproduce the results from Movement Ecology papers that use behavioral pattern identification methods. We selected 75 papers published in several journals from 2010-2020. According to our proposed reproducibility workflow, sixteen studies reflected at least some reproducibility (scores ≥ 4). In particular, we were only able to obtain the data for 16 out of 75 papers. Out of these, a minority of papers also provided code with the data (6 out of the 16 studies). Out of the 6 studies that made both data and code available, only four studies reflected a high level of reproducibility (scores ≥ 9) owing it to good code annotation and execution. Based on our findings, we proposed guidelines for authors, journals and academic institutions to enhance the state of reproducibility in Movement Ecology.

Robert Feder

Undergraduate Student, SNRE

Influence of Land Use on Plant Diversity and Fire Frequency in Pine Rockland Fragments of Miami-Dade County Remains Unclear

The pine rockland ecosystem of Miami-Dade faces constant pressures from its surrounding environments. Whereas pine rockland once graced approximately 126,500 acres of southern Florida landscape, the rapid development of Miami-Dade County has reduced these forests to fragmented habitat islands that span only 2% of their historic range, excluding Everglades National Park. The goal of this research is to determine the landscape context within which 18 fragments exist and analyze how this landscape context influences the biodiversity and management of these fragments. Land use composition was quantified for a 500-meter buffer surrounding each fragment. Principal component analysis was then performed to elucidate major gradients of land use surrounding pine rockland fragments. Lastly, multiple regression was used to determine how plant species richness and fire frequency respond to gradients of land use and other abiotic covariates across the pine rockland fragments. The results indicate that buffers primarily vary along an urban-to-agriculture gradient;

however, this gradient does not significantly predict plant diversity nor fire frequency. Until the impacts of land use on pine rockland function are better understood, it is important to account for landscape context of each fragment when developing conservation strategies and goals for this globally, critically imperiled habitat.

Lacey Lingelbach

Undergraduate Student, SNRE

Beyond Rising Seas: Understanding Climate Planning Challenges in Rural Inland Florida

Despite being farther away from direct impacts of sea-level rise, Florida's rural inland localities, like those across the nation and world, can be as vulnerable to a changing climate as coastal ones. However, unlike their urban coastal peers, many have not addressed or acknowledged climate change. Few existing research projects have explored the reasons why. To begin understanding the complexities of the rural Florida climate story, this research aims to answer the question: What challenges are preventing rural inland communities in Florida from addressing climate change and what do they need to overcome them? To characterize these obstacles and identify next steps, a combination of primary sources (i.e. surveys of local governments and rural voters) and secondary sources from the author, government agencies, scientists, universities, and other expert organizations were analyzed holistically. The four challenges identified include: community sentiment, investment capacity, gaps in climate literacy, and external connections and coordination. These challenges are linked to numerous underlying issues characteristic of rural communities, such as socioeconomic levels, physical and social isolation, the availability of human capital, and cultural values and perceptions. Based on this information, the implications section reviews how local governments, community members, and external supporting agents can actively curtail disparities in climate preparedness.

Session 3: Demography

Seth Farris

MS Student, Affiliate Dept: Wildlife Ecology and Conservation

Improving the use of alligator abundance as an ecological indicator using hierarchical modeling

Indicator species can be monitored as an index to measure the overall health of an ecosystem. Crocodylians are good indicators in the Florida Everglades as they respond to changes in hydrology, can be efficiently monitored, and are a key part of ecosystem trophic relationships. Eye shine surveys at night are a standard method used to sample alligators, but because some individuals that are present in a study area may go undetected and the proportion of individuals counted is not constant over time, appropriate modeling is required to convert counts to estimates of abundance. N-mixture models, a class of hierarchical models, allow researchers to estimate abundance from spatially replicated count data while simultaneously accounting for imperfect detection.

I utilized an N-mixture model to estimate American alligator (*Alligator mississippiensis*) abundance using survey count data from South Florida and assigned these estimates to quartiles that were represented as color coded categories of red, yellow, or green to provide a rating of Everglades restoration. I compared the results to a previously used method in which unadjusted counts of these same data were assigned to color coded quartile categories. Water depth played a major role in the detection probability of alligators and final stoplight colors between the two methods matched 76% of the time. This suggests that the original stoplight score method provided a good overall snapshot of the trends in alligator abundance in the Everglades; however, the hierarchical models estimate abundance and trends of abundance by incorporating detection probability thus providing unbiased abundance estimates.

Brandon Merriell

MS Student, Affiliate Dept: Wildlife Ecology and Conservation

Demography and population dynamics of the Florida panthers: an integrated population modeling approach

Estimating population parameters for rare and endangered species is often challenging due to small sample sizes, which often leads to low precision of estimated parameters. One way to improve precision of demographic parameter estimates is to integrate multiple data types within one analytical framework such that information is shared across parameters and data types, thereby improving precision of all estimated parameters. We analyzed multiple data types (live recapture, dead recoveries, radio-telemetry, den check data and population abundance indices) within an integrated population modeling (IPM) framework to estimate sex- and stage- specific survival rates, and stage-specific reproductive parameters, and to model population dynamics of the endangered Florida panther (*Puma concolor coryi*). We implemented the Florida panther IPM in a Bayesian analytical framework using NIMBLE in the R computing platform. We found that survival was strongly sex- and age-specific; females generally survive better. Old adult panthers of both sexes had lower survival than other stages, and old adult panthers had a lower probability of reproduction and produced smaller litters when they reproduced. Results will be presented, and their management implications discussed.

Celine Carneiro

MS Student, Affiliate Dept: Wildlife Ecology and Conservation

Genomic insight into the demographic history and structure of the grasshopper sparrow (*Ammodramus savannarum*)

Understanding the demographic history of a species can provide important insight into its adaptive potential in a rapidly changing Anthropocene. Specifically, changes in population size over time shapes a species' contemporary genetic diversity and population structure. The grasshopper sparrow is one such species that has experienced marked changes in its population size over the last 100 years. For my thesis, I produced an annotated reference genome for the grasshopper sparrow and used it to reconstruct the demographic history using a Markovian coalescent model. The reference genome was also used in conjunction with ~11,000 single nucleotide polymorphisms (SNPs) genotyped for 103

grasshopper sparrows representing four subspecies found in the United States. These SNPs were used to assess genome-wide diversity and population structure of the four subspecies and to reconstruct the more recent demographic history using a stairway plot analysis. Lastly, I tested alternative demographic scenarios that may explain the inferred historical changes in N_e as well as the observed estimates of diversity and structure. My results indicate a lack of genetic structure and low genome-wide heterozygosity across all four subspecies as well as a gradual reduction in N_e since the last glacial maximum. Coalescent modeling suggests that the eastern and Florida subspecies underwent recent (1000 ybp) population divergence with ongoing gene flow after split. Overall, this study introduces the first annotated reference genome for *Ammodramus* and produces a robust picture of the demographic history of the grasshopper sparrow since the late Pleistocene, shedding light on important management and conservation implications.

Daniel Catizone

MS Student, Affiliate Dept: Wildlife Ecology and Conservation

Ecology of the ornate diamondback terrapin (*Malaclemys terrapin macrospilota*) in St. Joseph Bay, FL

Diamondback terrapins (*Malaclemys terrapin*) in Northwest Florida have been understudied, which has resulted in a gap in our knowledge in the region. To help fill this gap I conducted a research study on the population of terrapins in St. Joseph Bay from 2017 to 2020. During this time, I captured 466 individuals in the bay. Using the data collected from these individuals I estimated a population size of 2,414 (1617-3691 95% CI) and a male biased sex ratio of 8.9:1. These data also allowed me to estimate survival and probability of entering the population for adult males, adult females, and juveniles. Documented changes in habitat use occurred during my survey season from April through November that was consistent across years. Utilizing the mark recapture data, I documented apparent high site fidelity about 111 of 120 terrapins that were recaptured. The remaining nine individuals moved from 0.25 km to 10 km from their original capture site. Examination of factors that may influence terrapin use of my study sites resulted in a strong indication that sites away from the mainland were preferred by terrapins.

Lightning Talks:

Emily Wheeler

PhD Student, SNRE

Assessing the Impacts of the COVID-19 Pandemic on Agriculture in the Galapagos Islands

The COVID-19 pandemic has produced a variety of impacts to farming and socio-economic systems around the world. The Galapagos Islands have experienced numerous changes as a socio-economic system due to the growing tourism industry and increasing anthropogenic pressures on natural resources. Historically, the Galapagos Island's economy has been heavily dependent on the area's booming tourism industry, causing residents to abandon their farmlands to pursue more economically profitable opportunities in the tourism sector. This land abandonment has thus increased invasive species distributions and limited the agricultural sector's ability to provide food security for the growing

human populations. Consequently, the island's food system has relied heavily on imported goods to compensate for the influx of tourists and a growing local economy. Due to the COVID-19 pandemic, the tourism industry collapsed, causing the most severe economic crisis in the archipelago's history. With limited imported goods from mainland Ecuador and work in the tourism industry, residents pursued other economic activities such as in the agricultural sector to sustain their livelihoods. By using a high-resolution land cover map from before the pandemic occurred as a baseline, we will compare current images from PlanetScope and Sentinel-2 to assess how COVID-19 has changed the land cover of each of the four populated islands' agricultural zones. We hypothesize that there has been an increase in the extension of the agricultural lands in each of the zones. This proposed research will assist in conservation efforts by evaluating how the agroecosystems of the islands have changed due to COVID-19.

Esteban Rodofili

PhD Student, Affiliate Dept: Fisheries and Aquatic Sciences

Object-based image analysis for ship detection in satellite imagery: a proof of concept for marine mammal studies and a tool to monitor illegal fishing

Under current increasing threats to marine mammals (e.g., climate change, collisions), there is need for abundance and distribution non-invasive data collection over larger and remote areas at lower costs than traditional surveys. Satellite images offer a solution but their manual processing is time-intensive. While automation attempts have been developed using pixel-based techniques for image analysis, they yielded high numbers of false positives. In this work, object-based image analysis (OBIA) was used to detect ships in a freely acquired satellite image as a proof of concept for the application to marine mammals in higher resolution imagery, and also as a potential tool for monitoring illegal, unreported and unregulated fishing, which threatens sustainable fisheries and the ecosystems they depend on. OBIA was applied to a Planet satellite image (3 m spatial resolution) off the Island of Capri, Italy. An OBIA workflow was implemented in Google Earth Engine, a free-access coding platform that allows sharing scripts with other users. OBIA regroups homogenous pixels and uses the resulting objects as units of analysis. A random forest classification algorithm was applied using area, perimeter, width, height, and spectral standard deviation of the objects. Ship and water sample points were used as training data. 15 of the 19 ships present in the image were detected: three boats close to each other were detected as one and two others were missed. These results make for a proof-of-concept of OBIA in detecting and counting marine mammals, and for a potential tool in illegal, unreported and unregulated fishing monitoring.

Justin Pitts

PhD Student, Affiliate Dept: Agronomy

Physiological Impacts of Primed Acclimation in Arabica Coffee

Drought is one of the most prevalent stressors afflicting agronomic crops, is considered ubiquitous globally, responsible for billions of dollars of loss and is expected to increase in both frequency and intensity in the near future. My research aims to address specific impacts associated with drought in a

globally important crop, coffee (*Coffea arabica*) through primed acclimation. Primed acclimation (PA) is a novel management strategy in which an irrigation deficit is induced in plants for a short period of time followed by rehydration to pre-deficit levels. PA has been shown to create a 'stress memory' in plants which prepares them for future drought events without continued investment towards the maintenance of an acclimated state. Coffee culture is heavily dependent on rainfall, with it being the primary source of irrigation for a majority of plants globally. The range of precipitation which coffee thrives under is narrow and future projections predict decreases in this range within our lifetimes. Drought stress in coffee can lead to reductions in yield, plant vigor and death. The use of PA as a management strategy could potentially address these issues, however it is understudied in coffee. A primary aim of my research is to examine the impacts that PA has on coffee physiology, water usage and yields in hopes of isolating mechanisms which can lead to improved drought resilience in the face of a changing climate. These questions will be addressed through a greenhouse study consisting of 40 mature coffee trees treated with varying levels of PA.

Lauren Bradley

Undergraduate Student, SNRE

Elucidating molecular mechanisms of harmful algal blooms on respiratory effects

The overgrowth of certain types of harmful algae in the ocean (harmful algal blooms, HAB) occurs worldwide in coastal regions, including Florida. Commonly, these HABs are known as "red tide" because they often cause the discoloration of ocean water to a rusty red and are notorious for degrading marine ecosystems. Neurotoxins produced by the algae are known to kill aquatic species (i.e. fish, shellfish) in significant numbers. Additionally, humans also report respiratory symptoms such as coughing, sneezing, and the interruption of breathing during active HABs, particularly in individuals with chronic respiratory conditions. Yet the mechanism by which HABs cause these respiratory effects is unknown. This research project will employ human lung epithelial and immune cells to determine how aerosolized components of HABs (algae and toxins) alter immune responses. The hypothesis is that components of algae induce the secretion of exosomes from lung cells that traffic signaling lipids to immune cells, causing upregulation of immune responses. The experimental design includes exposing cells to aerosol extract of toxins, algae and a combination of the two at various doses. Exosomes are then isolated and lipid analysis performed by mass spectrometry. Immune analysis will be performed using PCR and ELISA techniques. To date, results indicate that aerosol extracts of algae upregulate exosome production and alter lipid profiles. Next experiments will determine whether these lipid molecules alter immune markers in other cell types. Overall, these data are the first to shed light on mechanisms involved in respiratory effects associated with HAB exposures.

Maggie Jones

PhD Student, Affiliate Dept: Wildlife Ecology and Conservation

Consumers, climate, and canopies: Combined effects of megaherbivores and drought on tree loss in African savannas

African savannas provide a unique opportunity for assessing the relative roles of consumers compared to climate and resources in determining vegetation patterns because these systems are characterized by a discontinuous woody canopy that is maintained by both top-down processes like herbivory and bottom-up forces like climate. In the face of climate change and increasing drought frequency, the interaction between drought and herbivores is likely to have important consequences for limiting woody growth and canopy closure. Our goal was to understand how drought, herbivory by African elephants (*Loxodonta africana*), and density dependent factors interact to influence the density of large trees in southern African savannas. We compared differences in the change in the number of large trees before and after a severe drought in areas with high densities of elephants (Kruger National Park, South Africa) and no elephants (Hlane Royal National Park, Eswatini). We found that more trees were lost after the drought at both sites, and in general, more trees were lost in the savanna with elephants. However, the change in tree loss pre- to post-drought was greater in the savanna without elephants. We also found evidence of density-dependent effects, with more trees lost in areas of high densities. Our results suggest that while consumers like elephants play a large role in preventing canopy closure, in savannas without these megaherbivores, the synergistic effects of density-dependent processes and droughts can have a similar impact in limiting tree densities.

Melissa Moreno

MS Student, Wildlife Ecology and Conservation

Establishing a Modern Data Workflow

Advances in technology such as expanded remote sensing and animal tracking platforms have triggered rapid expansion of data available for ecologists and natural resource scientists. We have customized a modern data workflow for continuous and discrete long-term ecological data to assist in adaptive decision making. To promote reproducibility in our workflows and reduce data collection errors, we incorporated specific standards into our program including (1) standardizing field datasheets linked to an electronic data entry platform; (2) performing quality assurance and control (QA/QC); (3) creating scripts to analyze data and inform decision making; and (4) use a version control workflow to track changes to data, scripts and documents.

Vanessa Luna-Celino

PhD Student, Affiliate Dept: Wildlife Ecology and Conservation

Institutional arrangements for fire management in Quechua communities in the Peruvian Andes

The need for agricultural expansion has increased fire use throughout the tropics. Even though the Tropical Andes has a long history of anthropogenic fires shaping the natural landscape, fire use here has also increased, aggravating local people's vulnerability to the changing climate. Little is known regarding the local rules for fire management in this region and how these rules are adapted to fit changing socioenvironmental contexts. This is especially important for Quechua communities which have long-term local institutions for the governance of shared resources in a good portion of the Tropical Andes. Considering fire as both an agricultural tool and a problem -when uncontrolled-, this preliminary

doctoral research will study community-based fire management and evaluate how it fits Ostrom's (1990) design principles for self-governing institutions. I will also document the traditional ecological knowledge and the role of external institutions (multi-level government, protected areas officials, conservationist NGOs) on fire control and prevention on communal lands. I will use participant observation of agricultural burns, key informant interviews, and secondary data revision in at least two Quechua communities in Southern Peru. In later stages of this investigation, I aim for participatory action research that promotes individual and collective learning, as well as a reflection on fire management practices.

Session 4: Organism-Environment Interactions

Sam Zlotnik

PhD Student, Affiliate Dept: Entomology and Nematology

Morphological plasticity, not social behavior, may maintain diet breadth in leaf-footed bugs

Generalist-feeding animals must overcome a wide range of defenses in the species that they consume. In particular, structural feeding barriers in plants pose major challenges to generalist herbivores. Understanding the feeding strategies used by generalist herbivores, as well as their limitations, is important for predicting future range shifts of introduced species as well as other species of economic or ecological concern. We investigated how two strategies, developmental plasticity and social feeding behavior, may contribute to diet breadth in western leaf-footed bugs, *Leptoglossus zonatus* (Hemiptera: Coreidae). To test the role of plasticity in diet breadth, we raised bugs on a diet of sunflower seeds covered with a thin or a thick artificial coating and measured their mouthpart morphology at adulthood. We found that bugs raised on seeds with a thick coating had longer mouthparts, indicating likely diet-induced plasticity. To test how social behavior contributes to diet breadth, we raised bugs with an adult or a juvenile conspecific on a diet of pecans with or without shells. Juvenile bugs may reuse the feeding sites of larger conspecifics to facilitate feeding through barriers. We therefore predicted that bugs feeding on pecans with shells would have higher survival when housed with an adult than with another juvenile. We found that juvenile survival was severely limited by pecan shells, but the presence of adults did not ameliorate this effect. Our results suggest that morphological plasticity, but not social behavior, facilitates feeding and could function to maintain diet breadth in *L. zonatus*.

Renata Diaz

PhD Student, Affiliate Dept: Wildlife Ecology and Conservation

Declines in energetic compensation over time in a desert rodent community

Energetic compensation – when declines in energy use from some species in a community are offset by gains from others – can render community-level function resilient to species' fluctuations. When compensation is mediated by niche structure, it depends on the degree to which species are functionally substitutable. If species have different responses to changing conditions, shifting conditions may modulate the redundancy between species, rendering compensation variable over time. Experiments on

the rodent community near Portal, AZ have historically shown strong evidence of energetic compensation. After removal of kangaroo rats from experimental plots in 1977, smaller granivores displayed partial (~25%) compensation immediately, and near-complete compensation (~70%) following the establishment of the functionally analogous *Chaetodipus baileyi*. We explore whether compensation has persisted despite major transitions in the habitat and rodent community over the 40-year duration of the study. Driven by a precipitous decline in *C. baileyi* over the past decade, energy use on experimental plots declined to ~40% of total energy use on control plots. This is a smaller shortfall in energy use than was first observed, but this is due to a sitewide increase in small granivore abundance rather than an increase in compensation. Shifting conditions may have made *C. baileyi* unable to continue to substitute for kangaroo rats, while persistent niche differences may prevent smaller species from compensating further despite increases in their abundance sitewide. These results highlight that energetic compensation in natural communities is a dynamic, contingent phenomenon that plays out over extended temporal scales – in this case, spanning decades.

Connor Morang

Undergraduate Student, SNRE

Decomposition rates of leaf, palm, and turfgrass differ in a sub-tropical urban stream

Most headwater streams rely on allochthonous organic matter inputs to supplement energy produced internally from autochthonous sources. Allochthonous organic matter quality influences decomposition rates, subsequently affecting nutrient and food web dynamics within a stream. Land use change can influence the type and relative quality of allochthonous inputs. Lawns are prolific in urban and suburban landscapes, making turfgrass an increasingly common allochthonous organic matter source in streams. However, turfgrass decomposition in urban streams is poorly understood. This study assesses how organic matter quality, macroinvertebrate presence, and light availability affects decomposition rates in an urban stream. These factors were studied by deploying oak leaves, turfgrass clippings, and palm fronds in either coarse or fine mesh bags at two different sites in an urban stream (one open canopy, one closed canopy). Mass loss and percent organic matter change were calculated for these different treatments following a 4 month deployment. Preliminary results indicate that turfgrass, oak leaves, and palm fronds lost 80%, 28%, and 42% of their mass, respectively over 4 months. Understanding how shifts in organic matter affect decomposition rates is essential for furthering our knowledge of urbanization impacts on stream ecosystems.

Natalie Claunch

PhD Student, Affiliate Dept: Wildlife Ecology and Conservation

Thermal Influences on Invaders from Islands

Understanding a species' physiological tolerance is critical to predicting environments at risk of invasion by nonnative species. When physiological data are limited, climate-matching ecological niche models (ENMs) are used to predict areas at risk of invasion. These models may mis-calculate the spread of island-sourced invaders after initial establishment, because the restricted geography of islands may not

reflect evolutionary constraints on thermal limits. Additionally, rapid physiological adaptation or plasticity may occur in species introduced to new environments. We investigated the possibility of thermal plasticity in the Northern curly-tailed lizard, which has established across Florida. We evaluated the Thermal Matching hypothesis (distribution reflects thermal conditions of the native range) by comparing the results of an ENM incorporating only native populations (native model) and one including both native and invasive populations (full model). We found confirmed established populations outside predicted suitable areas of the native-only ENM, and rejected the Thermal Matching hypothesis. We tested the Thermal Potential (lizards tolerate environments with thermal extremes not observed in the native range) and Thermal Plasticity (thermal tolerance reflects local thermal extremes) hypotheses by comparing critical thermal limits (CT_{min} , CT_{max}) of individuals from two established populations: Key Largo, matching native range latitudes, and Cocoa Beach, 160 km north of the native range. In favor of the Thermal Plasticity Hypothesis, we found lizards from the northern population had 1°C lower CT_{min} compared with the population within the latitude of the native range, meaning that lizards are either acclimatized or adapted to the lower temperatures in Cocoa Beach.

Hannah Gottesman

PhD Student, Affiliate Dept: Fisheries and Aquatic Sciences

Larval Dispersal and Reproductive Resilience on Multiple Scales in a Sex-Changing Marine Fish, Gag Grouper (*Mycteroperca microlepis*)

A metapopulation is a network of populations or migratory contingents of conspecifics that exhibit self-recruitment and exchange in non-uniform, asynchronous amounts. Disturbance of movement patterns within a metapopulation disrupts this structure. Isolated populations or contingents are susceptible to decline due to reduced abundance and diversity. These impacts cannot be assessed through conventional measures which neglect the role of spatio-temporal variability in metapopulation structuring. An eco-evolutionary framework developed for primates and birds, reproductive resilience describes how movement influences reproductive success and connectivity within metapopulations. It allows us to identify which components of a species' spatial life cycle need to be protected to ensure long-term sustainability despite environmental or anthropogenic perturbations. My doctoral research evaluates the reproductive resilience of gag grouper (*Mycteroperca microlepis*) populations in the eastern Gulf of Mexico. Gag are protogynous hermaphrodites with a complex life history. Larvae settle in West Florida estuaries, before transitioning to nearshore habitat as juveniles. During wintertime, mature females migrate to spawning sites where males remain year-round. These spatially isolated groups are linked through migration and dispersal. Here, I will: 1) present the results of our updated multiple-year dispersal model that incorporates biological, behavioral, and environmental inputs to estimate gag larval trajectories and 2) compare estimates of larval settlement and survival with observed annual recruitment anomalies and oceanographic conditions. Our findings illustrate the role of larval dispersal as a driver of metapopulation structuring. A predictive index of population success, this model is applicable to natural resource management and spatial planning.œ