

Ecology and Evolutionary Biology

2018 Undergraduate Research Symposium



April 23, 2018

Storrs Hall WW01

Program

- 1:00-1:15 **Welcome and Opening Comments.** Eric Schultz, Symposium Chair; Carl Schlichting, EEB Head
- 1:15-1:30 **Global distribution of agriculturally important lacewing *Chrysoperla zastrowi sillemi*.** Mandese, Zoe¹, Katherine L. Taylor², Charles S. Henry², ¹*Ecology and Evolutionary Biology B.S. (expected May 2018)*, ²*Department of Ecology and Evolutionary Biology*
- 1:30-1:45 **Species specific odor recognition in green lacewings of the genus *Chrysoperla*.** Squillace, Miranda R.¹, Katherine L. Taylor², Charles S. Henry², ¹*Ecology and Evolutionary Biology B.S. (expected May 2018)*, ²*Department of Ecology and Evolutionary Biology*
- 1:45-2:00 **Juvenile Amphibian Growth and Survival in Response to Forest Leaf Litter Composition.** Breslau, Ben¹, Tracy Rittenhouse², ¹*Ecology and Evolutionary Biology B.S. (expected May 2018)*, ²*Department of Natural Resources and the Environment*
- 2:00-2:15 **Break**
- 2:15-2:30 **Avian spring migration as a dispersal mechanism for a forest insect invasion.** Russo, Nicholas¹, Morgan Tingley², ¹*Ecology and Evolutionary Biology B.S. (expected May 2018)*, ²*Department of Ecology and Evolutionary Biology*
- 2:30-2:45 **A/Ci Temperature Response Curves of *Leucadendron laureolum* and *Protea magnifica* across an Elevational Gradient.** Hossain, Sarah¹, Kristen Nolting², Kent Holsinger², ¹*Environmental Sciences B.S. (expected May 2018)*, ²*Department of Ecology and Evolutionary Biology*
- 2:45-3:00 **How *Phytophthora* stole Christmas: Transcriptomics to Decode Xmas Tree Resistance.** Trouern-Trend, Alexander¹, Jill Wegrzyn², ¹*Molecular and Cell Biology B.S. (expected May 2018)*, ²*Department of Ecology and Evolutionary Biology*
- 3:00-3:15 **Break**
- 3:15-3:30 **Comparison of Skull Size in Sympatric and Allopatric Fishers and American Martens.** Brandt, Matt¹, Miranda Davis², Tom Harrington², ¹*Biodiversity and Conservation Biology B.S.-M.S. (expected May 2019)*, ²*Department of Ecology and Evolutionary Biology*

- 3:30-3:45 **Mine the pine: Genotyping assay design for loblolly pine populations.** Caballero, Madison¹, Fikret Isik², Juan Acosta², Trevor Walker², Richard Sniezko³, Andrew Eckert⁴, and Jill Wegrzyn⁵, ¹*Molecular and Cell Biology B.S. (expected May 2018)*, ²*North Carolina State University*, ³*US Forest Service*, ⁴*Virginia Commonwealth University*, ⁵*Ecology and Evolutionary Biology*
- 3:45-4:00 **The feeding ecology of Lionfish (*Pterois volitans*) inside and outside of Marine Protected Areas.** Zhao, Evin¹, Adam Stewart², ¹*Biodiversity and Conservation Biology B.S.-M.S. (expected August 2018)*, ²*Simpson College*
- 4:00-4:15 **Are Zebra Mussels Disrupting River Herring Feeding Ecology?** Perfetto, Jake¹, Tim Pullen¹, Eric Schultz², ¹*Biodiversity and Conservation Biology B.S.-M.S. (expected May 2018)*, ²*Department of Ecology and Evolutionary Biology*
- 4:15-4:30 **Examining the Effect of the Novel Dopamine Transport Blocker CE-123 on Effort-Related Motivational Behaviors in Rats.** Schwartz, Rebecca¹, Renee Rotolo², Jen-Hau Yang², Rose Presby², Gert Lubec², Mercedes Correa², John D. Salamone², ¹*Biological Sciences/Psychology B.S. (expected May 2018)*, ²*Department of Psychological Sciences*

Abstracts

Comparison of Skull Size in Sympatric and Allopatric Fishers and American Martens.

Brandt, Matt¹, Miranda Davis², Tom Harrington², ¹*Biodiversity and Conservation Biology B.S.-M.S. (expected May 2019)*, ² *Department of Ecology and Evolutionary Biology*

My research examined if there is a trend between average body size and range overlap in American martens and fishers. Both Mustelid species have similar diets and past research indicates that they will compete for resources when they share a range. Because martens are the smaller of the two species, I hypothesized that fishers will outcompete martens for their shared resources and therefore, martens in sympatric populations will be smaller on average than martens in allopatric populations. I measured the condylobasal length of marten and fisher skulls as a proxy for body size and determined from the location written on the specimen tags whether the specimen was from an allopatric or sympatric range. My results indicated that both martens and fishers were smaller in sympatry than in allopatry. This result suggests that this difference in body size could be evidence of interspecific competition between martens and fishers that cause both species to have a reduction in body size.

Juvenile Amphibian Growth and Survival in Response to Forest Leaf Litter

Composition. **Breslau, Ben**¹, Tracy Rittenhouse², ¹*Ecology and Evolutionary Biology B.S. (expected May 2018)*, ² *Department of Natural Resources and the Environment*

In New England forests, maple (*Acer spp.*) abundance has significantly increased and oak (*Quercus spp.*) abundance has significantly decreased. To better understand how changes to forest composition alters amphibian habitat quality, we measured the growth and survival of 27 juvenile wood frogs (*Lithobates sylvaticus* or *Rana sylvatica*) and 27 juvenile American toads (*Anaxyrus americanus*) in response to leaf litter type. Between August and October 2017, half of the individuals in each species were raised in terrestrial enclosures with maple litter, and the other half were raised in oak litter. Using Kaplan-Meier survival estimates, we found that frogs and toads raised in maple leaf litter had higher survival rates than those raised in oak leaf litter. Additionally, we created a mixed-effects model with individual as the random effect to quantify the effect of leaf litter type on growth. In both amphibian species, mass was greater in maple litter than in oak litter ($t=-3.23$, $df=192.74$, $p=1.25e-3$). Increased survival and mass in maple litter suggests that juvenile amphibians benefit from the changing forest composition. Our results contrast with aquatic systems research, which found negative effects of maple litter on tadpoles. Our research can help inform future soil quality and leaf litter community studies.

Mine the pine: Genotyping assay design for loblolly pine populations. Caballero, Madison¹, Fikret Isik², Juan Acosta², Trevor Walker², Richard Sniezko³, Andrew Eckert⁴, and Jill Wegrzyn⁵, ¹*Molecular and Cell Biology B.S. (expected May 2018)*, ²*North Carolina State University*, ³*US Forest Service*, ⁴*Virginia Commonwealth University*, ⁵*Ecology and Evolutionary Biology*

Loblolly pine (*Pinus taeda*) is extensively cultivated for timber and pulp production in the Southeastern United States. It is among the longest living sexually reproducing organisms and one of the largest genomes assembled to date at 22Gbp. As a strictly out-crossing species with a 20-year maturation time and a large and fragmented genome, genotyping arrays provide a cost effective and accurate platform to generate SNP resources needed for genomic selection in both production and climate initiatives. This USDA-funded PineSNP project is leveraging resources (RAD-Seq and exome capture) of 2,688 individuals from the previous PineMAP project. For the identification of variants, short reads from the exomes and GBS studies were aligned to the 2.01 version of the genome and bi-allelic SNPs were identified. Probes were designed from these variants considering overall quality, depth of coverage, and polymorphic flanking sequence. Annotations of the high-quality SNPs were assigned using a custom SNPeff database and the latest v2.01 annotation. The extensive filtering pipeline reduced the initial number of detected variants from 35,196,703 SNPs to 200,000 final probes. These SNP annotations will be further evaluated for population metrics before inclusion in a final array that can be applied to genomic selection goals in loblolly pine.

A/Ci Temperature Response Curves of *Leucadendron laureolum* and *Protea magnifica* across an Elevational Gradient. Hossain, Sarah¹, Kristen Nolting², Kent Holsinger², ¹*Environmental Sciences B.S. (expected May 2018)*, ²*Department of Ecology and Evolutionary Biology*

I spent my summer in the field in the Cape Floristic Region of South Africa collecting data for my honors thesis on *Leucadendron laureolum* and *Protea magnifica*. My primary focus was to gain insight into how these plants might respond to increases in atmospheric CO₂. To do so I analyzed the relationship between CO₂ assimilation rates and sub-stomatal CO₂ concentrations (A/Ci) at low, medium, and high temperatures. I used a LI-COR 6800 portable photosynthesis system to measure CO₂ assimilation rates in the field at CO₂ ranging from current concentrations at 400 ppm to concentrations much more extreme at 1500 ppm. In addition to analyzing temperature response curves, differences in leaf trait characteristics across high and low elevations were examined to provide insight into whether differences in photosynthetic rates occurred among the same species at different elevations. With this data I ultimately aim to address the impact of possible climatic changes for this area and their implications for *Protea magnifica* and *Leucadendron laureolum*.

Global distribution of agriculturally important lacewing *Chrysoperla zastrowi sillemi*. Mandese, Zoe¹, Katherine L. Taylor², Charles S. Henry², ¹*Ecology and Evolutionary Biology B.S. (expected May 2018)*, ²*Department of Ecology and Evolutionary Biology*

The green lacewing genus *Chrysoperla* houses a cryptic species complex called the *Chrysoperla carnea* species group. These species are morphologically indistinguishable and were historically classified as the species *Chrysoperla carnea*. However, they are reproductively isolated by their vibrational courtship songs. Extensive work has been done to elucidate these cryptic species by using DNA data and examining their songs. Past phylogenetic analyses suggest that species-level divergence in *Chrysoperla* is extremely recent, and that new species have proliferated at a very quick rate. *Chrysoperla zastrowi sillemi* is an agriculturally important species of green lacewing, commonly used to control agricultural pests. In the past, this species has only been described with an old world distribution but populations of lacewings with the same song as *C. z. sillemi* have been found in California and Guatemala. It is possible that *C. z. sillemi* was purposefully introduced to these areas to control pests on crops. This project uses mitochondrial gene sequences, song data, and morphological characters to examine whether these populations are *C. z. sillemi* or one of the other cryptic species in the *Chrysoperla carnea* species group.

Are Zebra Mussels Disrupting River Herring Feeding Ecology? Peretto, Jake¹, Tim Pullen¹, Eric Schultz², ¹*Biodiversity and Conservation Biology B.S.-M.S. (expected May 2018)*, *Department of Ecology and Evolutionary Biology*

Invasive species pose problems to ecosystems by introducing novel stressors and interactions. This study examines the effects of the invasive Zebra Mussel (*Dreissena polymorpha*) on juvenile blueback herring (*Alosa aestivalis*) feeding ecology in the Hudson River. Since introduction in 1991, *D. polymorpha* spread quickly and outcompeted native filter feeders. This established population of *D. polymorpha* cumulatively filters large quantities of water daily and decreases both phytoplankton and zooplankton abundances. Since Blueback herring feed primarily on macroinvertebrates, we hypothesized these declines in prey abundance would have adverse effects on river herring feeding success and body condition. Using historical samples, we quantified *A. aestivalis* condition factor, feeding success, and diet composition for 1991, 1994, 1999, 2007, and 2011. We observed variation of all three response variables between years, yet in contrast to other studies *D. polymorpha* filtration rate did not account for a significant portion of the variation in *A. aestivalis* condition factor.

Avian spring migration as a dispersal mechanism for a forest insect invasion. Russo, Nicholas¹, Morgan Tingley², ¹*Ecology and Evolutionary Biology B.S. (expected May 2018)*, ²*Department of Ecology and Evolutionary Biology*

Birds act as long-distance dispersal agents for plants, animals, and other organisms during migration, and can contribute to the range expansion of invasive species. The hemlock woolly adelgid (*Adelges tsugae*) is an invasive insect that decimates eastern hemlock forests and relies on vectors to continue spreading northward. Since dispersing adelgid nymphs (“crawlers”) are most abundant from late April to late May in the Northeast U.S., we investigated the potential for birds to disperse this invasive insect over long distances during spring migration. We experimentally tested factors that influence the transfer of crawlers between hemlock branches and mounted passerine specimens. Crawler transfer peaked in May, coinciding with the peak emergence of adelgid crawlers. We also sampled the plumage of wild birds captured in Connecticut hemlock forests over two years of crawler activity and found significantly more crawlers on birds during spring migration than during the subsequent breeding seasons. The crawler load of sampled birds was also influenced by abundance of crawlers in the forest of capture. Finally, we confirmed experimentally that crawlers move off bird plumage and settle on uninfested hemlock foliage. Our results implicate an influence of avian ecology and life history in the dispersal of this destructive, invasive insect.

Examining the Effect of the Novel Dopamine Transport Blocker CE-123 on Effort-Related Motivational Behaviors in Rats. Schwartz, Rebecca¹, Renee Rotolo², Jen-Hau Yang², Rose Presby², Gert Lubec², Mercedes Correa², John D. Salamone², ¹*Biological Sciences/Psychology B.S. (expected May 2018)*, ²*Department of Psychological Sciences*

Although depression is commonly labeled as an affective disorder, some of its most debilitating symptoms are psychomotor/motivational dysfunctions such as anergia, fatigue, and psychomotor slowing. These motivational impairments can be modeled using animal tests of effort-based decision-making in operant behavioral tasks. The present study used the FR5/chow feeding choice test, in which an animal is allowed to select between a high effort/high reward option and a low effort/low reward option. CE-123, a novel atypical Dopamine (DA) transport inhibitor, was assessed on its ability to reverse motivational impairments induced by the DA depleting agent, tetrabenazine (TBZ). The impairments induced by tetrabenazine can be measured in both chow consumption and lever presses. It was found that while the 6.0 mg/kg and 12.0 mg/kg doses of CE-123 didn't result in any significant reversal, the highest dose of CE-123, 24.0 mg/kg, resulted in a significant partial reversal in both lever presses and chow consumption. These results can be used as a foundation for further drug development research that will lead to treatments for depression and other related disorders in humans that are characterized by symptoms such as anergia, fatigue, and a low-effort bias.

Species specific odor recognition in green lacewings of the genus *Chrysoperla*. Squillace, Miranda R.¹, Katherine L. Taylor², Charles S. Henry², ¹*Ecology and Evolutionary Biology B.S. (expected May 2018)*, ² *Department of Ecology and Evolutionary Biology*

Previous behavioral work reveals that lacewings of the genus *Chrysoperla* react to plant volatiles, showing that these insects are able distinguish between and respond to certain scents. The present behavioral study was conducted to help us understand the degree in which green lacewings recognize scents, specifically pheromones. Its immediate goal was to look for the presence of sex pheromones and determine their role in identification of potential mates by sexually receptive individuals. It was hypothesized that *Chrysoperla* females and/or males produce pheromones and are able to discriminate between pheromones produced by their own species and those produced by different closely-related species. The behavioral experiments were conducted using a Y-tube olfactometer and two cryptic species of green lacewing insects, *Chrysoperla agilis* (Neuroptera: Chrysopidae) and *Chrysoperla zastrowi*. Initial results of these experiments reveal that *C. agilis* male individuals are more successful at recognizing their own species, choosing conspecific females 87.0% of the time. *C. zastrowi* males were not successful at recognizing their own species, choosing conspecific females only 58.1% of the time. The results from the *C. agilis* behavioral tests suggest that these insects might be responding to species-specific sex pheromones, indicating the need for further investigation.

How *Phytophthora* stole Christmas: Transcriptomics to Decode Xmas Tree Resistance. Trouern-Trend, Alexander¹, Jill Wegrzyn², ¹*Molecular and Cell Biology B.S. (expected May 2018)*, ² *Department of Ecology and Evolutionary Biology*

Phytophthora cinnamomi, a soil-dwelling oomycete phytopathogen is responsible for \$6-7million in annual losses to North Carolina's Christmas Tree industry. The fir species that are farmed there exhibit no natural resistance. Infections lead to root and stem rot followed by foliar discoloration. Even more damaging is that the pathogen persists in infested soils and prevents successful replanting. Some individuals of Trojan fir (*Abies nordmanniana* ssp. *equi-trojani*), an endangered and closely related species native to Turkey, demonstrate partial resistance, making them valuable assets to resistance breeding programs. To investigate the genetic basis of this differential susceptibility, we set up an RNA seq experiment to measure gene expression of trees from across the post-infection morbidity gradient. 10 pooled libraries, each composed of root samples from 10 individuals were sequenced on an Illumina HiSeq 2500. Assembled transcripts in susceptible, resistant and uninoculated control libraries were clustered to generate a single reference with 39,538 sequences. Differentially expressed transcripts between susceptible, resistant and uninoculated trees were detected and functionally annotated to evaluate biological significance. Findings included significant upregulation of apoptosis related genes in resistant plants across comparisons, including XCP1, a cysteine peptidase which is involved in tracheary element autolysis.

The feeding ecology of Lionfish (*Pterois volitans*) inside and outside of Marine Protected Areas. Zhao, Evin¹, Adam Stewart², ¹*Biodiversity and Conservation Biology B.S.-M.S. (expected August 2018),* ²*Simpson College*

Lionfish (*Pterois volitans*) are a problematic invasive species in the Caribbean known to drive the decline and reduce the recruitment of Atlantic coral reef. With their impact on the local ecologies of coral reefs in the Caribbean, persistent and vigilant monitoring of the lionfish is required. Marine protected areas have been demonstrated to increase the biodiversity and ecosystem services of local reefs. However, the presence of lionfish threatens the stability of these areas. Local lionfish control programs have been demonstrated to be effective in minimizing the effects of lionfish at a local scale. More studies are required however, on the effects of lionfish that do persist within marine protected areas. In particular, there appears to be a dearth of studies on lionfish feeding ecology within the Roatan Bay Islands. By comparing the volume of stomach contents of lionfish caught inside and outside of marine protected areas, this study hopes to offer insight on the feeding behavior of lionfish in Roatan. This study will also serve as an opportunity to use management practices typical of NGOs within the Caribbean.

