

19th Annual Graduate Student Symposium

Saturday, February 11th 2017



*Organized by the Graduate Students in
Ecology and Evolutionary Biology (GEEB)*

Sponsored by the Program in Ecology, Evolution and Conservation Biology (PEEC), and the Departments of Animal Biology, Entomology, Plant Biology, and Natural Resources and Environmental Sciences (NRES)

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19th Annual Graduate Student Symposium

The 19th Annual Graduate Student Symposium will take place on Saturday, February 11, 2017. Talks will begin at 8:15 a.m. in B102, Chemical and Life Sciences Laboratories (CLSL), at the University of Illinois at Urbana-Champaign. All of the talks will be given by graduate students at the University of Illinois whose research is related to ecology, evolutionary biology, or other closely aligned fields. The talks will end at 4:10 p.m., with a poster session and reception immediately following at 4:30 p.m. at the Concourse Café Space in IGB (maps provided on page 25). All participants, attendants, faculty, and staff are cordially invited to the reception.

Goals

The goals of the symposium are twofold:

1. The symposium is an opportunity for students and faculty to gain exposure to graduate student research in ecology, evolution, and related fields. Participation and attendance is encouraged from anyone working in ecology, evolutionary biology, behavior, conservation, environmental sciences, fisheries and wildlife biology, systematics, biogeography, modeling and other related fields.
2. The symposium is an opportunity for graduate students to gain experience presenting research ideas and results to peers in a formal setting and to receive constructive feedback on oral presentations.

Awards

Awards will be presented in five categories:

1. Best Overall Talk
2. Best Talk by a PhD Candidate (post-preliminary exams)
3. Best Talk by a PhD/MS Student (pre-preliminary exams)
4. Best Lightning Talk
5. Best Poster

Announcement of awards will be made at the reception following the symposium.

See page 24 for criteria used to evaluate oral presentations.

Graduate Students in Ecology and Evolutionary Biology

The symposium is organized by Graduate Students in Ecology and Evolutionary Biology (GEEB). GEEB is a registered student organization (RSO) at the University of Illinois consisting of graduate students conducting research related to the disciplines of ecology and evolutionary biology. The fundamental goal of this organization is to coordinate and unite graduate students from various departments through their interests in ecology and evolutionary biology. Members of GEEB include students from a wide diversity of campus units; we encourage and welcome students from any campus department to participate in GEEB social and academic activities.

In addition to organizing this annual symposium, other GEEB activities include:

1. Workshops and discussions with invited speakers on issues of interest to GEEB members (e.g. NSF/EPA grant writing skills, job preparation, mentoring)
2. Weekly research presentation and discussions (“Ecolunch”)
3. Archives of example grant applications to assist students in obtaining funding
4. Social activities such as happy hours, tailgating, field trips, charity events and a ‘new grad student welcome’ event in the fall to encourage inter-department camaraderie among students.

For more information and to receive email announcements about GEEB activities and news items, subscribe to our listserve at www.life.uiuc.edu/geeb.



Or follow us on twitter @GEEBatUIUC

GEEB officers for the 2016-17 academic year:

| | |
|---------------------------------|---|
| President | Rachel Moran (rmoran9@illinois.edu) |
| Vice-President/Treasurer | Miles Bensky (bensky2@illinois.edu) |
| Symposium Coordinator | Tara Stewart (tarastew@illinois.edu) |
| Ecolunch Coordinators | Selina Ruzi (ruzi2@illinois.edu) Lynette Strickland (lstric2@illinois.edu) |
| Outreach Coordinator | Ian Traniello (traniel2@illinois.edu) |
| Social Coordinator | Lisa Mitchem (ldmitch2@illinois.edu) |
| Webmaster | Beryl Jones (bmjones2@illinois.edu) |

Acknowledgments

Sponsorship

We thank the **Program in Ecology and Evolution and Conservation Biology (PEEC)** for their generosity in providing funding and resources for this event. PEEC is an interdisciplinary, campus-wide program designed to provide individualized training for graduate students for research and teaching careers in ecology and evolutionary biology and to produce scientists who are both technically competent and broadly educated in ecology, evolution and conservation biology. With approximately 78 faculty participants from 14 departments (in 6 colleges) and allied state agencies, there are many areas of concentration within the broad disciplines of ecology, conservation biology, evolution, and systematics. Students in PEEC can be found working at scales ranging from the molecular level to ecosystem responses to global change. PEEC is committed to supporting graduate education and research through summer research grants, travel grants, and an active seminar series.

We thank the **Department of Animal Biology** for their generous sponsorship of the GEEB symposium. There is a long tradition of departmental excellence stemming from Victor E. Shelford (faculty member from 1914 to 1947), who was instrumental in the development of the field of ecology in North America. His emphasis on empirical studies in both academic and research programs has continued to the present. The Department of Animal Biology's faculty teaches and conducts research in behavioral ecology, population & community biology, evolutionary ecology, evolution & development, molecular evolution, population genetics, conservation biology, phylogenetics, and physiology. Current research involves a wide range of organisms, from protozoans through mammals. The excellence of Animal Biology faculty is reflected in several recent awards including the Presidential Early Career Award for Scientists and Engineers (the highest honor bestowed by our Government on a young scientist), the Young Investigators Award from the American Society of Naturalists, the Helen Corley Petit Scholar award, and the Premio Internazionale 'Felice Ippolito' international prize for Antarctic research. Research facilities include laboratories well equipped for molecular biology, a modern avian behavior laboratory, greenhouses, and nearby research areas with mature forest, restored tall-grass prairies, and extensive areas for manipulative studies.

We appreciate the generous support of the **Department of Plant Biology**. The Department of Plant Biology at the University of Illinois has a long tradition of identifying, training, and graduating many of the world's top plant biologists. It is home department of three of the eight Clarivate Highly Cited Researchers on our campus and boasts world-class facilities for work in the areas of physiology & development, ecology & climate change, systematics & evolution, and biochemistry & genetics. Investigations in plant biology extend from studies of the systems biology of photosynthesis to the dynamics of paleo-ecosystems. Students in Plant Biology address many of society's most pressing challenges: managing and conserving our natural resources, assessing effects of climate change on crop yields and ecosystem function, and developing new sources of renewable energy.

We appreciate the generous support of the **Department of Natural Resources and Environmental Sciences (NRES)**. The Department of Natural Resources and Environmental Sciences (NRES) is an interdisciplinary unit in applied sciences that brings biological, physical, and social scientists together to understand, teach, and work towards

increasing the sustainability of urban, managed, and natural ecosystems from the local to global scale. All NRES educational and research programs center on science, applied ecology, and conservation in a variety of aquatic, terrestrial and human dominated ecosystems. Within that framework, our faculty, staff, and students study a wide variety of ecological systems with emphases on soil, water, people and social systems, forests, plants, animals, and microbes. Much of our research focuses on natural and social processes, such as habitat fragmentation, regulation, dispersal, disturbance, invasion, bioactivity, and decision-making.

We also appreciate the generous support of the **Department of Entomology**. The Department of Entomology was organized in 1909, beginning with S.A. Forbes as its first department head, establishing high standards for research and teaching that have characterized the department ever since. In 2005, the department was rated the top in the nation by the Faculty Scholarly Productivity Index and boasts two faculty members who belong to the National Academy of Sciences. Research is conducted as interdisciplinary collaborations with multiple departments and organizations. Additionally, the department participates in many outreach activities in the surrounding community.

Logistical Support

Many thanks to all the individuals who contributed to planning the GEEB Symposium and related activities, without whom this eventful weekend could not exist: Alice Doucet Beaupré, Miles Bensky, Todd Johnson, Janice Kelly, Lisa Mitchem, Rachel Moran, Amanda Owings, and Tara Stewart. Many thanks also to the many unlisted individuals in GEEB who donated their time, especially our moderators and speakers listed elsewhere in the program.

Thank you to James O'Dwyer (PEEC Admissions Committee Chair), Angela Kent (PEEC Director), Karen Sears (AB Admissions Committee Chair), Surangi Punyasena (Plant Biology Admissions Committee Chair), Penny Broga and Staci Sears (School of Integrative Biology), Tara Heiser (Animal Biology & PEEC), Jana Lenz (Plant Biology), Teresa Strang (NRES), and Letitia Cundiff (IGB) for taking on the massive task of arranging a stimulating weekend for all of the prospective students.

Judges

Finally, we thank the faculty, post docs, and graduate students (not listed to maintain anonymity) who generously volunteered their time to provide student-presenters with valuable feedback on their presentations and to help us in selecting the award-winning presentations.

Morning Schedule*

- 7:30 – 8:15 Morning Refreshments
- 8:15 – 8:30 Welcoming Remarks – Tara Stewart
- Moderator: Tara Stewart*
- 8:30 – 8:45 **Halie Rando:** Patterns of Y-chromosome diversity in the North American Red Fox
- 8:45 – 9:00 **Alida de Flamingh:** Origin and phylogeography of African savannah elephants (*Loxodonta africana*) in Kruger and nearby parks in southern Africa
- 9:00 – 9:15 **Nicholas Sutton:** A general framework for characterizing escape decisions
- 9:15 – 9:30 **Nicholas LaRacunte:** Predicting predictability with model-free forecasting
- 9:30 – 9:45 **Alice Doucet Beaupré:** Punctuated gradualism in the phylodynamics of the Earth microbiome
- 9:45 - 10:00 Break
- Moderator: Michael Rivera*
- 10:00 – 10:15 **Emily Reed:** Nearshore zooplankton community composition in Lake Michigan and implications for non-native introductions
- 10:15 – 10:30 **Brian Zalay:** Zooplankton response to Asian carp harvesting in Illinois river backwaters
- 10:30 – 10:45 **Dalon White:** Rapid adaptation to increased temperature regimes in largemouth bass (*Micropterus salmoides*)
- 10:45 – 11:00 **Elizabeth Golebie:** Angler satisfaction in the southern Lake Michigan fishery
- 11:00 – 11:15 **Michelle St. John:** Reinforcement and the role of sex on reproductive character displacement in killifish
- 11:15 – 12:15 Lunch

Afternoon Schedule*

- 12:15 – 12:30 Afternoon Remarks – Rachel Moran
Moderator: Andrew Sweet
- 12:30 – 12:45 **Joshua Gibson:** Kinematics, scaling and fatigue of mandible strike performance in a polymorphic trap-jaw ant *Daceton armigerum*
- 12:45 – 1:00 **Ophelia Bolmin:** Mimicking the jump of the click beetle (Coleoptera: Elateridae) using tribology and modeling
- 1:00 – 1:15 **Christina Feng:** A life table analysis of the Spotted Turtle (*Clemmys guttata*) in Illinois
- 1:15 – 1:30 **Bailey Morrison:** How spatial scale influences novel and disappeared climates in Alaska
- 1:30 – 1:45 **Cassandra Wilcoxon:** Cover crop usage in agricultural landscapes: a benefit for grassland birds?
- 1:45 – 2:00 Break
Moderator: Rachel Skinner
- 2:00 – 2:15 **Kelsey Witt:** Demographic history of ancient dogs in the Americas
- 2:15 – 2:30 **Will Wadlington** Genomic analysis of the sex determining region of the sex chromosomes in spinach
- 2:30 – 2:45 **Erin Allman Updyke:** Humans and chickens and kissing bugs, oh my! Exploring Chagas Disease eco-epidemiology in Central Panama
- 2:45 – 3:00 **Selina Ruzi:** Chemical cues associated with ant-mediated seed dispersal
- 3:00 – 3:15 **Rachel Moran:** Reinforcement drives behavioral isolation via reproductive and agonistic character displacement in darters
- 3:15 – 3:30 **Janice Kelly:** Who's in the neighborhood? Conspecific and heterospecific responses to perceived density for breeding habitat selection
- 3:30 – 3:45 Break

Afternoon Schedule (cont.)*

Lightning talks

Moderator: Jennifer Jones

- 3:45 – 3:50 **Rachel Paul:** Leaf-level hyperspectral reflectance as a tool for estimating drought response of specific leaf area and nitrogen content on an area basis in a C₄ grass
- 3:50 – 3:55 **Christian Millán-Hernández:** Determining host associations of an eluding parasitoid
- 3:55 – 4:00 **Michael Rivera:** The evolution of body size and body size variation in ant workers (Formicidae)
- 4:00 – 4:05 **Jaime Coon:** Grassland bird response to removal of the invasive grass tall fescue (*Schedonorus phoenix*) in a complex social-ecological system
- 4:05 – 4:10 **Timothy Swartz:** Amphibian communities of human-constructed ponds
- 4:30 – 6:30 **Reception and Poster Session:** Posters will be on display in the Concourse Café space on the first floor of IGB (see map on the last page).

*Note: All talks in B102 Chemical and Life Sciences Lab B. (See map on page 25.)

Abstracts for Oral Presentations

1. Halie Rando, Jeremy T. Stutchman, Estelle R. Bastounes, Jennifer L. Johnson, Carlos A. Driscoll, Lyudmila Trut, Benjamin N. Sacks, and Anna V. Kukekova

PhD student, Department of Animal Sciences, rando2@illinois.edu

PATTERNS OF Y-CHROMOSOME DIVERSITY IN THE NORTH AMERICAN RED FOX

A lack of Y-chromosome sequence for the red fox (*Vulpes vulpes*) has hindered the inclusion of male lineages in analyses of population diversity. Mitochondrial DNA has revealed that wild North American red foxes derive from at least three sources, though rates of introgression vary by geographic region. Now that the genome of a male red fox has been sequenced and assembled, Y-chromosome sequence was identified and scanned for repeated motifs. From these 194 putative male-specific microsatellites, eleven novel markers were developed to supplement the two known red fox Y-chromosome markers. Markers were genotyped in male red foxes from a farmed population as well as three wild populations: eastern Canada, Maryland, and Great Britain. The markers differentiated North American and European clades, but suggested introgression from feral and European foxes into the Maryland population. This high-resolution panel will allow future studies to analyze patrilineal contributions to diversity alongside matrilineal.

2. Alida de Flamingh, Alfred L. Roca, and Rudi J. van Aarde

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ORIGIN AND PHYLOGEOGRAPHY OF AFRICAN SAVANNAH ELEPHANTS (*LOXODONTA AFRICANA*) IN KRUGER AND NEARBY PARKS IN SOUTHERN AFRICA

African savannah elephants (*Loxodonta africana*) occur in fragmented and isolated populations across southern Africa. Transfrontier conservation efforts aim at preventing the negative effects of population fragmentation by maintaining and restoring linkages between protected areas. We sought to identify genetic linkages by comparing the elephants in Kruger National Park (South Africa) to populations in nearby countries (Botswana, Mozambique, Zambia and Zimbabwe). Mitochondrial DNA (mtDNA) and nuclear DNA (nDNA) phylogeographic patterns were incongruent, likely reflecting the effects of female philopatry and male-mediated dispersal, respectively. Kruger elephant heterozygosity and differentiation were not consistent with genetic isolation, a depleted gene pool or a strong founder effect. mtDNA geographic patterns suggested that the Kruger population was founded by elephants from areas north and south of Kruger, or has been augmented through migration from more than one geographic source. This study highlights the need for conservation initiatives that aim at maintaining or restoring connectivity among populations.

3. Nicholas M. Sutton and James P. O'Dwyer

MS student, Program in Ecology, Evolution, and Conservation Biology, nmsutto2@illinois.edu

A GENERAL FRAMEWORK FOR CHARACTERIZING ESCAPE DECISIONS

Animal behavior is notoriously difficult to model and predict. While many qualitative predictions of behavior exist, accurate quantitative models are lacking, mainly due to the presence of significant intraspecific behavioral variation within populations. We propose a new modeling framework for generating quantitative predictions of behavior in the presence of high individual behavioral variation. We present methods for analyzing the types of information necessary for accurate predictions, as well as for inferring the effects of prior personality or learning based biases within populations. Using these methods we analyzed white-tailed deer (*Odocoileus virginianus*) escape behavior in response to variable human approaches. We found that our model successfully predicted deer escape behavior, outperforming simpler models while using fewer free parameters in the process. The results of our model testing lay the groundwork for further development of models that allow for accurate quantitative predictions of behavior in the presence of high intraspecific behavioral variation.

4. Nicholas LaRacunte and James P. O'Dwyer

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PREDICTING PREDICTABILITY WITH MODEL-FREE FORECASTING

Ecological systems frequently involve so many interacting variables that there is no way to measure every potentially relevant aspect. The complexity of these systems often defies classical modeling, and we are left to wonder if the system is predictable or not. We combine and extend existing "model-free" forecasting methods Empirical Dynamic Modeling (EDM) and Sparse Identification of Non-linear Dynamics (SINDy) to address this question. Analyzing timeseries from a variety of systems, we quantify predictability and make short-term, model-free predictions from incomplete observations. We will discuss both the mathematical principles and broader applications of this work.

5. Alice Doucet Beaupré and James P. O'Dwyer

PhD student, Program in Ecology, Evolution, and Conservation Biology, doucetb2@illinois.edu

PUNCTUATED GRADUALISM IN THE PHYLODYNAMICS OF THE EARTH MICROBIOME

Recent efforts in large scale microbiome sampling and sequencing have documented microbial diversity with unprecedented global scope and resolution. The tools currently applied to these data allow us to quantify the amount and type of diversity found in microbial communities around the world, yet we know remarkably little about the underlying community dynamics and tempo of diversification that generated the biodiversity we observe. We introduce a new methodology together with two novel models to bridge the gap between biological process and observed microbial biodiversity, and apply it to data spanning 13,500 individual samples across 56 habitat types and 29 biomes. In doing so we identify a previously unidentified balance of fast and slow diversification processes in these microbial data, and a tendency towards universality in these patterns across the bulk of sampled habitats.

6. Emily M. Reed, Sara M. Thomas, John H. Chick, and Sergiusz J. Czesny

MS student, Department of Natural Resources and Environmental Sciences,
emreed@illinois.edu

NEARSHORE ZOOPLANKTON COMMUNITY COMPOSITION IN LAKE MICHIGAN AND IMPLICATIONS FOR NON-NATIVE INTRODUCTIONS

Nearshore areas in the Great Lakes provide an important transition zone between the watershed and offshore waters and serve as spawning and nursery habitat for many fish. Zooplankton communities are an integral component of nearshore systems, both as nutrient cyclers and food sources for higher trophic levels. However, recent anthropogenic alterations and invasive species introductions have dramatically changed species assemblages in the Great Lakes, including zooplankton communities. To better understand the role of zooplankton within critical nearshore areas, we compared zooplankton community composition around Lake Michigan, including harbors, drowned river mouth lakes, open-water locations, and Green Bay over two years. This nearshore zooplankton community assessment can help determine energy available to consumers within Lake Michigan's food web and provide insights to emerging community structures in this dynamic system. In particular, our findings highlight how zooplankton communities have the potential to hinder or facilitate Asian carp establishment in the Great Lakes.

7. Brian Zalay

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bzalay2@illinois.edu

ZOOPLANKTON RESPONSE TO ASIAN CARP HARVESTING IN ILLINOIS RIVER BACKWATERS

Asian carp (*Hypophthalmichthys nobilis* and *Hypophthalmichthys molitrix*) pose a major threat to the Great Lakes because they can have negative impacts on the zooplankton that support the ecosystem. In an effort to reduce the likelihood of an Asian carp invasion into the Great Lakes, the Illinois DNR contracted commercial fishing crews to conduct regular Asian carp removals. Although zooplankton have recovered from declining planktivory in other closed systems like lakes, it is not known if the same will be true from removals of an invasive planktivore in an open river system. The response of rotifer, nauplii, copepod, and cladoceran densities were compared in ten backwaters receiving various harvesting levels (kg removed/month) for four months in 2015. Zooplankton densities increased only in the high harvested backwaters. Therefore, harvesting may only be effective at the highest intensity (11,000 kg/month).

8. Dalon White and David Wahl

PhD student, Program in Ecology, Evolution, and Conservation Biology, dpwhite4@illinois.edu

RAPID ADAPTATION TO INCREASED TEMPERATURE REGIMES IN LARGEMOUTH BASS (*MICROPTERUS SALMOIDES*)

Recent evidence suggests that rapid adaptation of organisms to climate change will play a role in the overall impacts. However, large-scale, replicated model systems are logistically difficult to establish. To this end, we used artificially heated power plant cooling (PP) reservoirs that have been established for 4-5 decades as a model system. Temperature increases are similar to those predicted by global climate change models by the year 2100 (IPCC 2014). Adult largemouth bass (*Micropterus salmoides*) from multiple PP reservoirs and ambient reservoirs were bred in a

common pond environment and growth, metabolism, and temperature tolerance were assessed in a laboratory setting. Altered growth and metabolic rate, as well as conversion efficiency and consumption, especially at temperatures higher than those seen in ambient reservoirs, suggest that largemouth bass can rapidly adapt to persistent temperature increases. Importantly, however, there was not an effect on maximum temperature tolerance, though minimum tolerance was different.

9. Elizabeth Golebie and Craig Miller

MS student, Department of Natural Resources and Environmental Sciences,
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ANGLER SATISFACTION IN THE SOUTHERN LAKE MICHIGAN FISHERY

This study surveyed 422 anglers in the southern Lake Michigan fishery and compared satisfaction between three angler groups: those targeting salmonid species, those targeting yellow perch, and those targeting other species. Several differences were found between the three groups; salmonid anglers had the highest overall harvest rate and yellow perch anglers had the highest target species harvest rate. All three target species-specific regression models included number of fish biting, but they differed in the other variables that remained in the model produced by stepwise linear regression. Although satisfaction with harvest was highly correlated with overall satisfaction for all angler groups, there were few relationships between actual harvest and satisfaction, which suggests that angler perceptions may be more important than objective catch rates in this study site. This study demonstrates the differences in anglers targeting different species and reflects the importance of accounting for angler heterogeneity when designing management plans.

10. Michelle E. St. John and Becky Fuller

MS student, Department of Animal Biology, stjoh3@illinois.edu

REINFORCEMENT AND THE ROLE OF SEX ON REPRODUCTIVE CHARACTER DISPLACEMENT IN KILLIFISH

The presence of reproductive isolation between groups is the cornerstone of speciation. Reproductive isolation, however, is often not directly selected for, only arising as a by-product of selection in other contexts. Diverging groups often come back into secondary contact before the formation of reproductive isolation is complete, leading to the production of unfit hybrid offspring. If selection acts against these hybrids it can lead to increased species recognition, a process termed Reinforcement. Reinforcement's ability to *directly* increase reproductive isolation between groups may be critical to the process of speciation. One barrier in determining its importance, however, is that we do not know how frequently reinforcement occurs in nature. Here, we seek to document the presence of reinforcement in Florida populations of the bluefin killifish (*Lucania goodei*), determine if it acts equally in both sexes, and determine if it has cascading effects throughout the species.

11. Joshua C. Gibson, Dajia Ye, and Andrew V. Suarez

MS student, Department of Entomology, jcgibso2@illinois.edu

KINEMATICS, SCALING AND FATIGUE OF MANDIBLE STRIKE PERFORMANCE IN A POLYMORPHIC TRAP-JAW ANT *DACETON ARMIGERUM*

Power-amplifying "trap-jaw" mandibles have independently evolved multiple times within ants (Hymenoptera: Formicidae). Teasing apart the interaction between body size and strike performance in these groups is an important step in understanding how trap-jaw mechanisms function, but can be difficult as the vast majority of trap-jaw ant species are monomorphic, requiring interspecific comparisons which may be confounded by phylogeny. In this study we describe scaling and fatigue in mandible strike kinematics of the arboreal trap-jaw ant *Daceton armigerum*, an understudied continuously polymorphic species that exhibits a threefold difference in body size between the smallest and largest workers. Strike duration and maximum rotational velocity are shown to scale positively and negatively with body size, respectively. Maximum rotational kinetic energy is shown to scale positively with body size, suggesting that mandible mass and not maximum velocity drives energetic performance of strikes. The time between strikes, but not strike performance itself, was found to increase with continuous stimulation of strikes, suggesting that the loading mechanism of the mandibles fatigues with continuous stimulation but the energetic output of the strike is conserved.

12. Ophelia Bolmin, Alexander M. Hazel, Aimy Wissa, Marianne Alleyne, and Alison Dunn

MS student, Aerospace Engineering Department, obolmin2@illinois.edu

MIMICKING THE JUMP OF THE CLICK BEETLE (COLEOPTERA: ELATERIDAE) USING TRIBOLOGY AND MODELING

Click beetles (Coleoptera: Elateridae) are known for their novel self-righting mechanism to jump from an inverted position without using their legs. This ongoing research takes inspiration from click beetles' unique biological design with the aim of creating an autonomous self-righting robot. A suite of morphological modifications have enabled click beetles to propel themselves vertically in a somersaulting motion. The prosternal spine and mesosternal peghold represent a friction-induced hinge. A tribology experiment and a mechanical snap-fit model were designed to approximate the hinge's stiffness. This, and other biometrics, were combined with accurate take-off and airborne models derived from high-speed footage of jumps from *Ampedus linteus* (Say), *A. nigricollis* (Herbst), and *Melanotus communis*-complex. The models provide an experimental induced torque, which mimics the function of the actuation provided by the muscles of a click beetle. The results of this preliminary study will be scaled up to create a biomimetic jumping robot.

13. Christina Y. Feng and Michael J. Dreslik

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A LIFE TABLE ANALYSIS OF THE SPOTTED TURTLE (*CLEMMYS GUTTATA*) IN ILLINOIS

A deterministic life table facilitates visualization of the survival and reproduction rates of a population and is thus a valuable tool for demographic analysis. However, few have been compiled for long-lived species, especially chelonians, due to the extensive long-term data

requirements. At the Spotted Turtle species' western limit in Illinois, an ongoing mark-recapture study has focused on the state's larger extant population since 1988. We compiled the capture histories for 154 individuals of female or unknown sex and determined age-specific survival rates using Package RMark and calculated fecundity by palpating and radiographing females captured between late May and June. We then built a female-only life table with these vital rates to calculate reproductive output, generation time, and the population intrinsic growth rate. Our results show that given solely deterministic factors, the population exhibits a neutral growth rate, indicating that the population is stable around its carrying capacity.

14. Bailey D. Morrison, Joseph Napier, Guillaume de Lafontaine, Barbara Hug, Bo Li, Katy Heath, Feng-Sheng Hu, and Jonathan A. Greenberg

PhD student, Program in Ecology, Evolution, and Conservation Biology, bdmorri2@illinois.edu

HOW SPATIAL SCALE INFLUENCES NOVEL AND DISAPPEARED CLIMATES IN ALASKA

Climate projections suggest that by the end of the 21st century Earth may experience climates not found at present, and some present-day climates may disappear. Thus, quantifying novel and disappeared climates can provide insight into changes in ecological communities. The spatial resolution of climate used to predict novel and disappeared climate is an essential property to consider when conducting ecological analyses. In this study, we assessed how the spatial scale of climate influences novel and disappeared climates from the Last Glacial Maximum to present day in Alaska. To accomplish this, we produced downscaled climate surfaces ranging from 60m to 100km resolution for the LGM and present day. From this, we quantified the distribution of disappeared and novel climates across all scales. We found spatial aggregation affected novel and disappeared climate by: 1) increasing fractional area, 2) decreasing fractional area, and 3) has little to no effect on fractional area.

15. Cassandra A. Wilcoxon, Michael P. Ward, and Jeff W. Walk

MS student, Department of Natural Resources and Environmental Sciences, wilcoxe2@illinois.edu

COVER CROP USAGE IN AGRICULTURAL LANDSCAPES: A BENEFIT FOR GRASSLAND BIRDS?

Once an ancient practice, cover crops fell out of use during the agricultural intensification of the past century. Water quality and nutrient management issues have brought cover crops back into use recently. Use of cover crops in the Midwest Corn Belt region corresponds to spring avian migration. With large scale habitat loss across the landscape, cover crops have the potential to provide temporary habitat for birds in the spring. Bird surveys were conducted on corn + cover crop, soybean + cover crop, corn, and soybean fields in 2015 and 2016 throughout central Illinois. More species and more birds of conservation concern utilize cover crop fields. Birds of conservation concern include Eastern Meadowlark, Grasshopper Sparrow, and American Golden-Plover. As cover crop adoption rates increase, temporary habitat available to migrating birds also increases.

16. Kelsey Witt

PhD candidate, Program in Ecology, Evolution, and Conservation Biology, kewitt2@illinois.edu

DEMOGRAPHIC HISTORY OF ANCIENT DOGS IN THE AMERICAS

The domestic dog was an important part of human history in the Americas, and yet little is known about them. By studying their demographic history, dogs can be used as a proxy to examine human movements and interactions in the Americas. We sequenced the mitochondrial genomes of over 65 ancient dogs from different regions and time periods across North America, and examined genetic diversity estimates and haplotype sharing across time and space. Some groups show lower genetic diversity than others, which is indicative of population bottlenecks. Some haplotype clusters show regional specificity, while others are distributed more broadly across North America. These clusters suggest population continuity and gene flow, as well as evidence for migration routes. With this study, we find similarities between human and dog population movements and interactions and have developed a new and complementary way to investigate human history in the Americas.

17. Will Wadlington and Ray Ming

PhD candidate, Plant Biology Department, wadling2@illinois.edu

GENOMIC ANALYSIS OF THE SEX DETERMINING REGION OF THE SEX CHROMOSOMES IN SPINACH

Spinacia oleracea (spinach) has been studied for sex determination since the 1950's. However, research of the spinach sex chromosomes has been hampered due to the repressed recombination between X and Y chromosomes and also the difficulty of separating X and Y sequence in genome assembly. By using YY individuals for sequencing and also for generating recombined Y chromosomes, we can work around both problems. We were able to generate inbred YY plants for whole genome sequencing with PacBio. Sex chromosome sequence was identified from both XX and YY assemblies. For the genetic map of the Y, a hybrid YY parent was backcrossed to 5 females. The XY progeny will show recombination in the Y-linked traits that are variant between the two Y haplotypes. Together these experiments have the potential to uncover the molecular basis of sex chromosome differentiation in spinach.

18. Erin Allmann Updyke

PhD candidate, Department of Entomology, eallma2@illinois.edu

HUMANS AND CHICKENS AND KISSING BUGS, OH MY! EXPLORING CHAGAS DISEASE ECO-EPIDEMIOLOGY IN CENTRAL PANAMA

Chagas disease, a neglected tropical disease affecting millions of people throughout the world, is transmitted by multiple species of “kissing bug” (Hemiptera: Reduviidae). In Panama, species that transmit the disease are sylvatic (ie: wild-living), and the risk factors that govern human transmission are not well characterized. This study investigates the factors potentially contributing to Chagas disease exposure risk across land-use gradients in central Panama. Household surveys explored social and behavioral factors, such as living conditions, education level, socioeconomic status, and knowledge of both kissing bugs and Chagas disease. Presence

of domestic and wild animals around the home was positively correlated with having seen kissing bugs around the home. Entomological surveys captured multiple species of kissing bug across the gradients, but significantly more were captured in semi-urban and rural areas as compared to urban areas. Better understanding of these risk factors is integral to successful control efforts.

19. Selina A. Ruzi and Andrew V. Suarez

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CHEMICAL CUES ASSOCIATED WITH ANT-MEDIATED SEED DISPERSAL

Ant-mediated seed dispersal (AMSD) has evolved repeatedly in many regions around the world. Most research on AMSD focuses on plants with elaiosomes (food bodies). Elaiosomes contain chemicals that ants cue in on, however, seeds without elaiosomes can also be attractive to ants. This may be a form of chemically mediated manipulation by the plant to get ants to disperse seeds without providing a reward. To examine the chemical cues that play a role in seed dispersal, we field-tested hexane and methanol extracts from seeds of six neotropical pioneer tree species on Barro Colorado Island, Panama that lack elaiosomes. We measured attempted removal rates of each seed and beads treated with their chemical extract by a generalist ant species, *Ectatomma ruidum*. *E. ruidum* attempted to remove both seeds and hexane extracts of *Z. ekmanii* at similar rates (33.6% and 37.4% of time periods respectively) while ignoring other experimental and control extracts.

20. Rachel Moran and Becky Fuller

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REINFORCEMENT DRIVES BEHAVIORAL ISOLATION VIA REPRODUCTIVE AND AGONISTIC CHARACTER DISPLACEMENT IN DARTERS

Reinforcement can play a critical role in completing the speciation process after secondary contact by directly selecting for an increase in prezygotic isolation in response to maladaptive hybridization. The classic signature of reinforcement is heightened prezygotic isolation in sympatry compared to allopatry. We examined prezygotic and postzygotic isolation between orangethroat darters (clade *Ceasia*) and the rainbow darter (*Etheostoma caeruleum*). We measured prezygotic isolation in both in sympatric and allopatric populations in the form of (1) male preference for conspecific versus heterospecific females as mates, and (2) male recognition of conspecific versus heterospecific males as rivals. We found a pattern consistent with reproductive character displacement and agonistic character displacement in sympatry. Furthermore, we found that postzygotic isolation is present between *Ceasia* and *E. caeruleum* in the form of hybrid male behavioral sterility and backcross inviability. Together, this data provides strong evidence that reinforcement is driving speciation between *Ceasia* and *E. caeruleum*.

21. Janice Kelly and Mike Ward

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WHO'S IN THE NEIGHBORHOOD? CONSPECIFIC AND HETEROSPECIFIC RESPONSES TO PERCEIVED DENSITY FOR BREEDING HABITAT SELECTION

Social cue use for habitat selection is particularly common among songbirds, but few studies investigate if songbirds use social cues to assess conspecific or heterospecific density when making settlement decisions. We conducted a playback experiment to evaluate if Yellow Warblers and Willow Flycatchers, two potential competitors for breeding habitat, use social cues to assess density of their competition when making settlement decisions. We manipulated apparent warbler density (high or low) at treatment plots and evaluated settlement decisions by comparing warbler and flycatcher abundances across plots, as well as within-plot individual space use. Apparent warbler density did not affect warbler abundances, but caused individuals to cluster territories where playbacks simulated high apparent warbler density. In contrast, flycatchers were most abundant at plots with high apparent warbler density, but did not influence territory locations based on apparent warbler density. Apparent density from social cues can have species-specific effects on habitat selection.

22. Rachel E. Paul, Darshi Banan, Patrick Elsworth, Maximillian Feldman, Ivan Baxter, Asaph Cousins, and Andrew DB Leakey

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LEAF-LEVEL HYPERSPECTRAL REFLECTANCE AS A TOOL FOR ESTIMATING DROUGHT RESPONSE OF SPECIFIC LEAF AREA AND NITROGEN CONTENT ON AN AREA BASIS IN A C₄ GRASS

Intraspecific variation in changes to resource acquisition and use in response to drought stress may be controlled by genetic variation in drought tolerance and resource use efficiency (RUE). Leveraging genomic tools to understand crop response to stress requires the development of reliable high-throughput phenotyping methods for physiologically relevant traits. Leaf-level hyperspectral reflectance was tested as a tool for predicting specific leaf area (SLA) and nitrogen content on an area basis (N_{area}) for a *Setaria viridis* × *S.italica* RIL mapping population field grown in well-watered and drought treatments. Reflectance-predicted values were strongly correlated with measured values for SLA and N_{area} ($r^2=0.83$, $r^2=0.85$, respectively). Quantitative trait loci (QTL) for reflectance predicted values of SLA and N_{area} overlapped with QTL for their traditionally measured equivalent. This work demonstrates that leaf-level hyperspectral reflectance is a tool capable of accurately predicting physiologically relevant traits and detecting genotype-by-environment interactions.

23. Christian A. Millán-Hernández and Christopher Dietrich

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DETERMINING HOST ASSOCIATIONS OF AN ELUDING PARASITOID

The study of the associations between the parasitoid family Dryinidae and its auchenorrhynchan hosts has mostly relied in laboratory rearing of parasitized individuals resulting in a limited host

record. Several constraints of this methodology include control of environment, long waiting periods and large mortality rates. Field collection of larvae in parasitized Auchenorrhyncha provides an alternative to expanding dryinid host breadth, especially in biodiversity hot spots. Recent molecular phylogenetic studies have provided a framework upon which dryinid larvae can be identified using DNA or at least be placed within the existent phylogeny. I propose a novel technique: use DNA sequencing methods to identify these late-stage larvae attached to field-collected hosts. Analysis of the genomic information of these larvae coupled with previous data obtained from identified adults and GenBank records will greatly expand available dryinid host records and categorize the parasitoid nature of this family.

24. Michael Rivera and Andrew Suarez

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THE EVOLUTION OF BODY SIZE AND BODY SIZE VARIATION IN ANT WORKERS
(FORMICIDAE)

Body size is perhaps one of the most fundamental ecological traits affecting diet, locomotion, species interactions, etc. However much of the research on body size has been focused on obligatory solitary individuals, which are inherently constrained by tradeoffs on size. However, eusocial organism may have overcome some of these constraints by dividing up their somatic tissue into physiologically independent units. Ants provide a great model to study the evolution of body size in eusocial organisms as they are ecologically and morphologically diverse and have a solid background of phylogenetic information. Here we study the evolution of body size (and variation in body size) across Formicidae using a phylogenetic comparative framework, estimating ancestral trait values and finding clades with elevated rates of evolution.

25. Jaime J. Coon and James R. Miller

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GRASSLAND BIRD RESPONSE TO REMOVAL OF THE INVASIVE GRASS TALL FESCUE
(*SCHEDONORUS PHOENIX*) IN A COMPLEX SOCIAL-ECOLOGICAL SYSTEM

Invasions by non-native plants are especially salient in grasslands of the Midwest, a threatened ecosystem dominated by private lands. Not only do grasslands serve as habitat for numerous declining wildlife species, but they also provide services to humans. Yet, humans are responsible for much of the introduction and maintenance of non-native species in the region. To this end, I am studying a non-native plant (tall fescue, *Schedonorus phoenix*) in Midwestern grasslands. For my research I have collected ecological and social data to assess the impacts of tall fescue and its removal on grassland birds and arthropods, and evaluate landowner willingness to initiate this removal. Using this approach, I will contribute to a better understanding of the functional links between the human and natural systems in terms of ecosystem services, and provide guidance to conservation professionals as they navigate conservation in complex social-ecological systems.

26. Timothy M. Swartz and James R. Miller

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AMPHIBIAN COMMUNITIES OF HUMAN-CONSTRUCTED PONDS

Worldwide, nearly one-third of amphibian species are threatened with extinction, with habitat loss and fragmentation exacerbating declines caused by disease and pollution. These problems are exemplified in the Central US, where more than 85% of native wetlands have been destroyed. In this region, many of the remaining wetlands are ponds constructed for recreational fishing or as water sources for cattle. In this context, we examined the conservation value of constructed ponds of south-central Iowa by exploring how introduced predatory fishes, cattle-driven disturbance, and the surrounding landscape affect amphibian communities. Although ponds that were used by cattle or contained fish supported lower species richness overall, some ponds hosted diverse amphibian communities, including species of conservation concern. The results of this work suggest that pond construction may partially mitigate the loss of native wetlands, but that steps should be taken to minimize the impact of human activities on these habitats.

Abstracts for Poster Presentations

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MUD CRICKETS AND PYGMY MOLE CRICKETS (ORTHOPTERA: CAELIFERA: TRIDACTYLOIDEA) FROM BELIZE

Mud crickets and pygmy mole crickets are small insects that belong to the superfamily Tridactyloidea (Orthoptera: Caelifera). These crickets are mostly associated with freshwater ecosystems; they display a great potential for research in climatic change because of their association with these aquatic environments that are currently threat. However, very little is known about their biology and ecology. We reviewed samples of orthopterans collected from caves expeditions in Belize during the years 2011, 2012 and 2014. We found a first record of genus for the country, female specimens that could correspond to the species *R. mopana* where female description is still unknown and specimens from different genera and families in the samples that are presumed to live in sympatry. This revision contributes to the taxonomic knowledge of the superfamily Tridactyloidea as well as to the distribution and ecology of this group.

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THREE TAYASSUIDS FROM THE LATEST MIOCENE TO EARLIEST PLIOCENE (HEMPHILLIAN) GRAY FOSSIL SITE, TN

Outside of Florida, the Gray Fossil Site (GFS) is one of the few latest Hemphillian, approximately 7 to 4.5 Ma, localities known within the eastern United States. Lacustrine sediments of the GFS paleosinkhole contain a diverse biota that suggests an oak-hickory forest environment; believed to have acted as a refugium for a variety of browsing taxa that were otherwise diminishing with the spread of grasslands elsewhere. Within this fauna, tayassuids are represented by partial cranial and mandibular elements, isolated teeth, and disarticulated postcrania. In total, three tayassuid taxa—*Mylohyus elmorei*, *Prosthennops* cf. *P. serus*, and cf. *Catagonus* sp. (MNI 2 for each taxon)—are recognized within the GFS fauna; an expansion in the distribution for each taxon into the Appalachian region. This expansion is most substantial for *M. elmorei*, previously only been known from the Bone Valley Formation of Florida.

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SEX DIFFERENTIATION IN THE GROWTH OF SPOTTED TURTLES (*CLEMMYS GUTTATA*)

Understanding an organism's growth pattern is essential for studies of a species' ecology, life history, and demography. For many chelonians, size correlates strongly with the onset of sexual maturity and can be used to estimate the age at sexual maturity. We investigated organismal growth in an Illinois population of Spotted Turtles using long-term mark-recapture data

collected from 1988-2015. We compiled growth histories for 134 individuals with 1-27 year capture histories and conducted a nonlinear regression analysis of shell measurements to determine the best-fit growth functions. For both carapace (CL) and plastron length (PL), the data best fit the Weibull growth function, which showed females had a slightly larger asymptotic adult CL (112.42mm) and PL (103.05mm) than did males (106.99mm and 92.30mm, respectively). We estimate the minimum age at sexual maturity for females to be 9.7-10.4 years based on minimum shell measurements in gravid females captured during the study.

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**HOST DIVERSITY AND POPULATION DYNAMICS OF *IXODES SCAPULARIS* POPULATIONS:
A META-ANALYSIS**

Many factors influence *Ixodes scapularis* tick populations, including the presence of the hosts. Hosts, in turn, vary in their permissiveness (i.e. the ability for ticks to successfully feed). This results in heterogeneity in tick infestation and adds further complexity in understanding the mechanisms that influence *I. scapularis* abundance throughout the North America. We aimed to understand tick population dynamics by examining the prevalence and intensity of tick infestation in relation to species diversity via meta-analysis. We used general linear regression to determine the relationships between measures of species diversity and host specific *I. scapularis* prevalence and intensity. Overall, we found that with more hosts in a community, there is a larger proportion of hosts that have ticks, but fewer ticks per host. These results provide moderate support for the dilution effect mechanism: Encounter Reduction where added hosts lower the probability that ticks encounter reservoir hosts.

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**THE INFLUENCE OF BARK ON WOOD DECAY AND FUNGAL AND BACTERIAL
COMMUNITIES IN TERRESTRIAL AND AQUATIC ENVIRONMENTS IN A WET TROPICAL
FOREST**

Wood characteristics are known to influence decay rate. However, most decomposition studies do not differentiate between bark and wood, even though these tissues differ in structural compounds, nutrient concentrations, and function. I explored how bark influences decay rate and fungal and bacterial communities. I conducted a decay experiment in which I removed or retained bark from replicate branches of three tree species placed either in freshwater streams or on land. In addition to calculating wood decay rate, I also characterized fungal and bacterial communities using environmental sequencing. I found that bark increased decay rate of bark and wood in both terrestrial and freshwater environments. Decay rate was also faster in streams than on land. Fungal and bacterial communities differed between bark and wood and between terrestrial and freshwater sites.

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THE EVOLUTION OF PLUMAGE SEXUAL DICHROMATISM IN A GLOBALLY-DISTRIBUTED AVIAN GENUS, THE TRUE THRUSHES

Many species of birds exhibit striking feather colors and patterns which are used for both species-recognition by the animals themselves, and taxonomic delineation by researchers. The genus of the well-known American robin (*Turdus migratorius*), the true thrushes (*Turdus*), are an exceptionally diverse passerine genus with ~65 species distributed worldwide and exhibit striking diversity in melanin-based plumage coloration. Importantly, differences in plumage coloration between the sexes (i.e., sexual dichromatism) have yet to be investigated in this globally-distributed genus. Here, we examine the evolution of plumage coloration and sexual dichromatism in the diverse *Turdus* genus by mapping reflectance spectrophotometry measurements of five separate body regions onto a previously published molecular phylogeny.

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DEVELOPMENT OF MICROSATELLITE MARKERS FOR THE CHARACTERIZATION OF Y-HAPLOTYPES IN THE RED FOX

The red fox (*Vulpes vulpes*) is one of the world's most widespread carnivorous mammals, inhabiting regions of Europe, Asia, Africa, Australia, and North America. Previous research primarily used mitochondrial DNA in order to examine the red fox's population history through its maternal lineage. The Y lineage, however, has not been studied as extensively due to the lack of markers for the fox's Y-chromosome. The development of markers for the Y-chromosome would allow for new insights into the population history and phylogeography of the red fox. In this study, microsatellite markers located on the fox Y-chromosome were identified, screened for variation among individuals, and tested in a panel of foxes from several populations, including farm-bred foxes from a domesticated population maintained in Novosibirsk, Russia and wild British and Canadian red foxes. Y-haplotypes were identified for each fox, and the respective haplotype frequencies among the fox populations were examined. These haplotypes offer insight into the population history of the fox species through the paternal lineage, including the relatedness of these populations, and will facilitate the inclusion of the Y-chromosome in future studies of the phylogeography of the fox.

Sample Evaluation Form for Oral Presentations

Presenter: _____

****This form will be returned to the student presenter after judging. Please make your comments as constructive and supportive as possible.****

Presentations are to be judged in six categories. Each category should be evaluated as on a 5 pt scale where a 5 is excellent and a 1 is poor.

Evaluation of presentation

Significance and broad context..... _____

Defined research question/hypothesis..... _____

Quality of methodology _____

Results clearly described..... _____

Validity of conclusions drawn from results..... _____

Presentation (poise, clarity, coherence, competence with A/V)..... _____

| |
|---------------------------|
| TOTAL SCORE: _____ |
|---------------------------|

Comments on scientific content (effectiveness of putting project in general theoretical framework, creativity of ideas, focused research question, quality of methodology, validity of conclusions etc.).

Comments on presentation style (effectiveness at communicating ideas, poise, clarity, competence with A/V, creativity, etc.)

Judge's estimate of own ability to evaluate talk. High _____ Medium _____ Low _____

Symposium presentations will be held in B102, Chemical and Life Sciences Laboratories at 602 S. Goodwin, indicated by the black oval below. The reception will be held on the bottom floor of IGB in the Concourse Café Space (i.e. Array Café) indicated by a star below. Entrance to the Café Space will be through the gatehouse outside of the IGB (marked with a star on the map below). Once inside the gatehouse, proceed downstairs and the reception will be straight ahead.

