

53RD ONTARIO ECOLOGY, ETHOLOGY & EVOLUTION COLLOQUIUM



OE3C 2023

- Surviving thE AnthropOC3nE -

Program and schedule

Thursday, May 25th – Saturday, May 27th



Western
UNIVERSITY • CANADA

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Opening remarks

Dear OE3C 2023 participant,

Thank you for choosing to attend the **53rd Ontario Ecology, Ethology, and Evolution Colloquium – OE3C 2023** (<https://oe3c2023.com/>). The OE3C is a conference organized by students for students, and we are honoured to have you with us. For the past 52 years, this colloquium has been bringing together ecologists, ethologists, evolutionary biologists, and related professionals from across Ontario to discuss the most pressing issues of our fields. Given the diversity of disciplines, it has always been difficult to come up with an overarching theme. Although Evolution is seen as the unifying thread of all Life Sciences, an annual event cannot choose Evolution as its theme every year. When pondering as to what are the most urgent challenges biologists now face, the current organizing committee readily embraced the climate crisis we live in.

However, the term “climate crisis” can be misleading. We are not experiencing “only a climate crisis”. We are experiencing a series of related crises (i.e., the biodiversity crisis, the ocean level crisis, the human displacement crisis, the chemical pollution crisis, and so on). These crises are all interconnected, and their compounding effects will serve as a landmark to the current geological epoch – the **Anthropocene**. Such a **multifaceted challenge with a planetary scale certainly will demand a multifaceted and planetary solution**. A single technology (e.g., carbon capture and storage, geo-engineering, and EVs) will undoubtedly not save us, and biologists will be pivotal in determining what steps humanity should take if we want to survive. Therefore, the current organizing committee has chosen the following theme: **“Surviving the Anthropocene: the 3 E’s under pressing planetary issues”**.

We know one conference alone will not save the planet, but we also know that biologists should be in the forefront of climate-related actions. We are confident that the OE3C 2023 will bring together inventive minds capable of spurring collaborations across the 3 E’s that can inform our next steps. With **70 talks and 50 poster presentations**, the OE3C 2023 spans studies from *“The community structure of Trichoptera across the Credit River watershed in the 1950’s”* to the *“Automation of green roof vegetation cover using machine learning”*. We have no doubt that students, postdocs, and faculty will leave the conference with a robust overview of what Ontarian biologists are studying and with the reassuring feeling that we are continuing to expand the 3 E’s.

One novelty of this year’s colloquium is the “Surviving the Anthropocene panel discussion” (on Saturday, May 27th). This panel brings together four Western researchers whose work relates to climate change in one way or another. The panel will provide attendees with a solid foundation in the **“Anthropocene challenges and solutions”**. But the OE3C 2023 is an ambitious project and the current organizing committee worked relentlessly to cover other

important aspects of our future disciplines. We believe that the future must be diverse and boundless, so we have chosen our keynotes accordingly. From the study of *rare purple-green photosymbiosis* to the investigation of *gender bias in genital evolution* to *a queer perspective on the diversity of life*, the OE3C 2023 keynotes bring to us what is the most thought-provoking and action-inducing in Biology.

Again, we would like to thank you for having chosen to be with us in this year's OE3C. We are honoured for having the opportunity to be part of the OE3C family and for helping to build a legacy of more than half a century. Let it not be forgotten that the OE3C survived the difficult years of the coronavirus pandemic, so we are truly grateful of being able to host this event fully in person this year.

We wish you a wonderful event packed with laughter, thoughtful discussions, enriching networking opportunities, and energizing inspiration for a brighter future.

Warmly,

On behalf of the OE3C 2023 Organizing Committee



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OE3C 2023 Organizing Committee



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Stefane Sahurashi
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Curtis Lubbe
Artwork
Postdoc @ Institute of Botany,
Czech Academy of Sciences



Kiana Lee
Fundraising
MSc student @ Way Lab



Sarah dos Santos
Fundraising
PhD student @ Coltman Lab



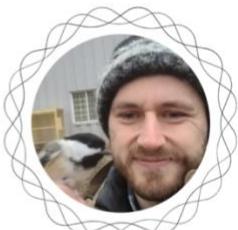
Joseane do Nascimento
Abstract/Programme
Postdoc @ Grbic Lab



Jorden Maglov
Abstract/Programme/Social Media
PhD student @ Grbic Lab



Libesha Anparasan
Abstract/Programme
PhD candidate
@ Hobson/McNeil Lab



Soren Coulson
Abstract/Programme
PhD candidate
@ Staples/Guglielmo Lab



Dr. Nusha Keyghobadi
Faculty partner
Professor & Associate Chair (Research)



Dr. David Smith
Faculty partner
Professor

Land Acknowledgement

"We acknowledge that Western University is located on the traditional lands of the Anishinaabek (Ah-nish-in-a-bek), Haudenosaunee (Ho-den-no-show-nee), Lūnaapéewak (Len-ahpay-wuk) and Attawandaron (Add-a-won-da-run) peoples, on lands connected with the London Township and Sombra Treaties of 1796 and the Dish with One Spoon Covenant Wampum.

With this, we respect the longstanding relationships that Indigenous Nations have to this land, as they are the original caretakers. We acknowledge historical and ongoing injustices that Indigenous Peoples (e.g., First Nations, Métis and Inuit) endure in Canada, and we accept responsibility as a public institution to contribute toward revealing and correcting miseducation as well as renewing respectful relationships with Indigenous communities through our teaching, research and community service."

More information about what steps Western University is taking towards decolonization can be found at: <https://indigenous.uwo.ca/>

Statement on Equity, Diversity, and Inclusion

We are fully aware of the (implicit and explicit) systemic barriers that prevent the equitable development of all members of our society. Therefore, the OE3C 2023 Organizing Committee wants to make a clear statement on Equity, Diversity, and Inclusion. We will welcome students and professionals from all walks of life. We know we cannot change the world in one conference, but we can take the necessary steps to promote the change that is needed.

We know that factors such as age, nationality, ethnicity, religion, gender identity, sex, sexual orientation, socioeconomic status, physical and neurological differences, marital status, parental status, and others all contribute to privileges and/or prejudices. These privileges and prejudices often determine who has the power to make decisions. Accordingly, representativeness is an aspect to be tackled and embraced fully.

We hope that the environment and the discussions fostered during the conference will create not only a welcoming/safe space for all but will also impart change in the way participants think about our (collective and individual) positionality.

The OE3C 2023 Organizing Committee looks forward to welcoming you and to promoting Equity, Diversity, and Inclusion with you!

Code of conduct

The organizers are committed to making this meeting productive and enjoyable for everyone, regardless of gender, sexual orientation, disability, physical appearance, body size, race, nationality, or religion. We will not tolerate harassment of participants in any form. Please follow these guidelines:

- Behave professionally. Harassment and sexist, racist, or exclusionary comments or jokes are not appropriate. Harassment includes sustained disruption of talks or other events, inappropriate physical contact, sexual attention or innuendo, deliberate intimidation, stalking, and photography or recording of an individual without consent. It also includes offensive comments related to gender, sexual orientation, disability, physical appearance, body size, race, or religion.
- All communication should be appropriate for a professional audience including people of many different backgrounds. Sexual language and imagery are not appropriate.
- Be kind to others. Do not insult or put down other attendees.

Participants asked to stop any inappropriate behaviour are expected to comply immediately. Attendees violating these rules may be asked to leave the event at the sole discretion of the organizers without a refund of any charge.

The complete “Legal Information & Terms of Use for Attendance and Participation” which are applicable to the OE3C 2023 can be found at: <https://conferences.uwo.ca/pdfs/Legal-Information-and-Terms-of-Use-for-Attendance-and-Participation.pdf>.

Acknowledgements

It is very difficult to acknowledge everyone who has helped us organize this year's colloquium. Although we inevitably fail to mention in here every single person who deserves an acknowledgement, please rest assured your help and support were (and still are) very much appreciated. When we took on the challenge to organize the traditional OE3C, we could not have anticipated how much work we were signing up for. Yes, there were times in which we wondered whether we did the right thing. There were (many) times in which we wondered whether our graduate degree had been derailed because of this event. Yet, as we approach the end, it has become clear to us that all the hard work and countless (extra) hours have been worth it.

Organizing the OE3C 2023 has connected us with people who we would not have connected otherwise. The event has taught us all the valuable "soft skills" one can think of: project management, grant application, conflict resolution, teamwork, budget estimation, and so on. Perhaps even more importantly, organizing the OE3C 2023 has given us a unique view of what Biology programs across Ontario are studying. It is as though we have taken a snapshot of the types of research being done by hundreds of students.

Just for those facts, we are already grateful. But we are also very grateful for the help provided to us by: i) the entire OE3C 2023 Organizing Committee, who was always eager to brainstorm ideas and solutions; ii) Dr. David Smith and Dr. Nusha Keyghobadi, who encouraged us to organize the event and guided us in grant applications; iii) Dr. David Coltman and the whole staff from the Biology Office at Western University, who helped us with administrative tasks at all times; iv) Dr. Bryan Neff and Dr. Elizabeth Webb, who guided us through internal grant applications; v) Dr. Karen Warkentin, Dr. Dara Orbach, and Dr. Sergio Muñoz-Gómez, our keynotes who have always been kind, responsive and attentive to us; vi) the OE3C 2023 volunteers, who have readily agreed to dedicate their time to this project; vii) our entire Biology department at Western University, which has always been supportive in different fronts along the way; and viii) Michael Zaigh and Patty Scheerer from Conference Services, who have always been ready to help with no matter what, no matter when. We also would like to thank our generous sponsors who have trusted their money in this endeavour and in our management. A full list of our sponsors can be found at the end of this detailed programme.

Last but not least, we would like to thank each and every OE3C 2023 participant. Without students, postdocs and faculty members willing to come together year after year, the OE3C would not exist. We thank you all for your dedication, enthusiasm, and willingness to share the wealth of knowledge that the three E's (Ecology, Ethology, and Evolution) have to offer.

With the warmest regards,

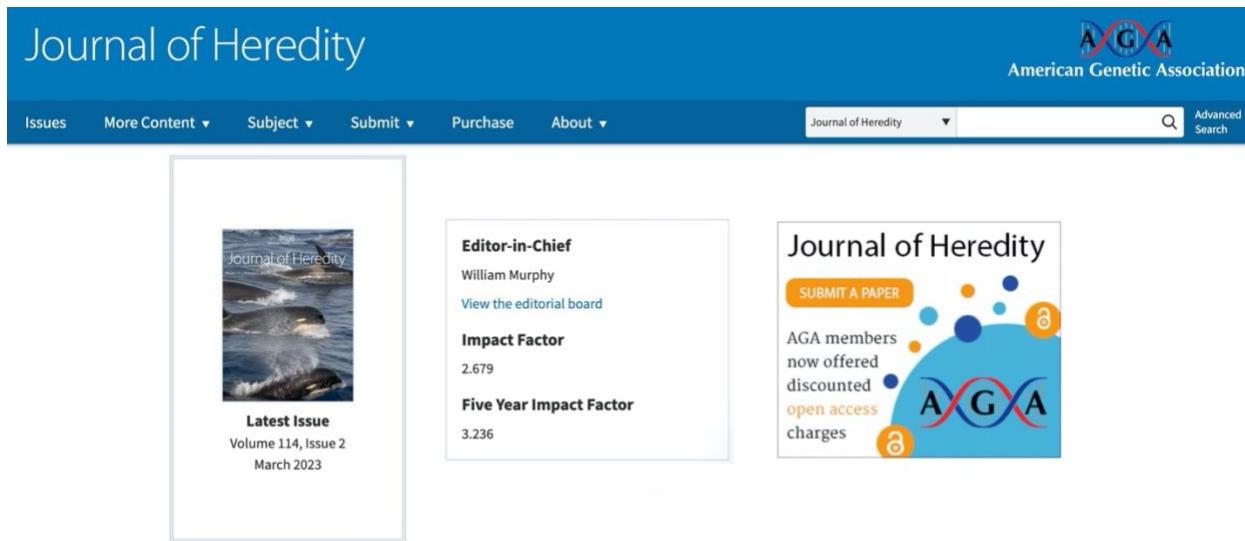
Matheus Sanita Lima & Stefane Saruhashi

OE3C 2023 Co-Chairs

OE3C 2023 Publishing opportunities

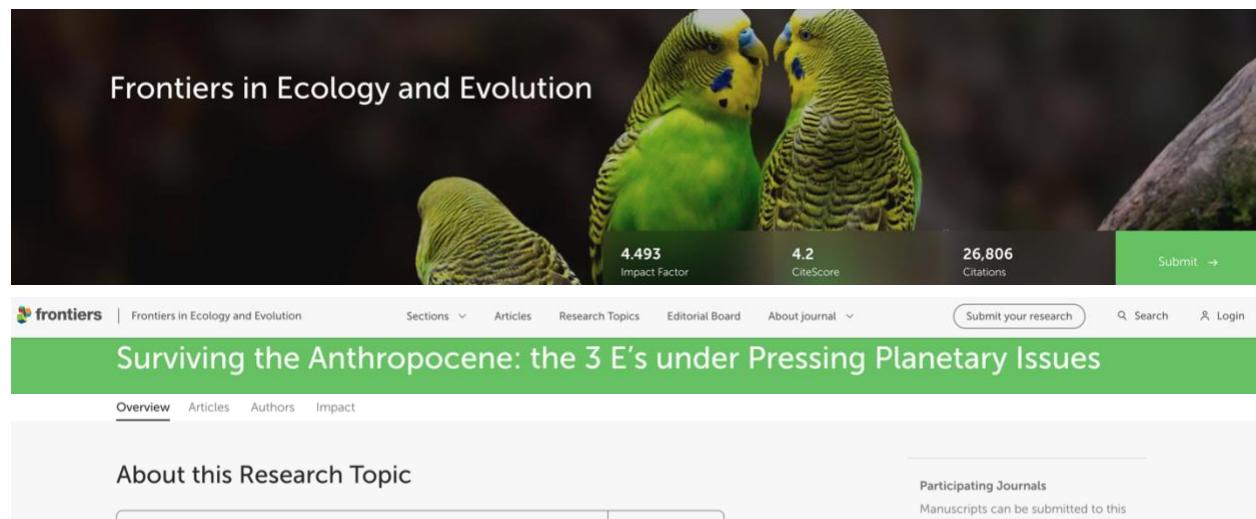
The OE3C 2023 has two publishing opportunities for its attendees:

Journal of Heredity from the American Genetic Association (AGA)



The screenshot shows the homepage of the Journal of Heredity. At the top right is the AGA logo and text "American Genetic Association". The main title "Journal of Heredity" is on the left. A navigation bar includes "Issues", "More Content ▾", "Subject ▾", "Submit ▾", "Purchase", and "About ▾". A search bar at the top right has "Journal of Heredity" in it and "Advanced Search" below it. The left sidebar features a thumbnail of the latest issue cover (whales) with the text "Latest Issue Volume 114, Issue 2 March 2023". The center column displays the "Editor-in-Chief" (William Murphy), "View the editorial board", "Impact Factor" (2.679), and "Five Year Impact Factor" (3.236). The right sidebar highlights "Journal of Heredity", "SUBMIT A PAPER", and mentions "AGA members now offered discounted open access charges".

Research topic “Surviving the Anthropocene: the 3 E’s under pressing planetary issues in Frontiers in Ecology & Evolution



The screenshot shows the "Surviving the Anthropocene: the 3 E's under Pressing Planetary Issues" research topic page. It features a large image of two green parakeets. Key metrics displayed are an Impact Factor of 4.493, a CiteScore of 4.2, and 26,806 Citations. A "Submit" button is visible. The top navigation bar includes the "frontiers" logo, the journal name, and links for "Sections ▾", "Articles", "Research Topics", "Editorial Board", "About journal ▾", "Submit your research", "Search", and "Login". The topic page itself has tabs for "Overview", "Articles", "Authors", and "Impact".

If you are interested in publishing in one of these journals, contact us at oe3cofficial@gmail.com. Please note that publishing fees will not be covered by the OE3C 2023.

General Information

OE3C 2023 Artwork and mascots



The OE3C 2023 Artwork and mascots have been designed and drawn by Dr. Frederick Curtis Lubbe.

F.C. Lubbe is a researcher at the Institute of Botany of the Czech Academy of Sciences, studying plant ecology with a focus on the belowground storage organs of plants and their relationship to plant growth strategy, carbohydrate storage, seasonal dormancy, and belowground movement. He originally began his higher education with a degree in fine arts and has a continuing personal art practice in both two- and three-dimensional media, primarily ink and paper or ceramics. More information about his work on imagery in Science Communication can be found here: <https://ecoevocommunity.nature.com/users/curtis-lubbe>.

A full display of all OE3C 2023 mascots along with the storyline that connects them can be found here: [OE3C 2023 Mascots&Artwork](#). Please note that the OE3C 2023 artwork can be shared, but Curtis Lubbe must be referenced.

Registration/check-in

When: Thursday, May 25th from 11:00 am to 1:30pm.

Location: University College, outside Conron Hall (UC 3110).

Your registration to OE3C 2023 includes:

- access to all talks and Lunch & Learn sessions,
- all meals and social events
- excursions
- panel discussion
- keynotes
- conference swag

Information for presenters

Oral Presentations

Talks will be 12 minutes with 3 minutes for Q&A. The classrooms are equipped with a Windows platform and support presentations formatted in standard and widescreen. We encourage presenters to save a copy of the presentation in a **USB drive OR send us their slideshow before their session at oe3cofficial@gmail.com.**

Poster Presentations

Please ensure your poster meets the recommended dimension of **90 x 100 cm**. We will provide pins and tape to secure posters to the boards. Presenters can hang the posters on Friday (May 26th) and Saturday (May 27th) from 8:00 – 9:30 am and remove the poster in the end of the day. Judges are expected to visit their designated posters at any time during the two-hour Lunch & Learn session. There will be an indigenous art exhibit by Amanda Myers (<https://www.amandamyersart.com/>) and Laney Beaulieu (<https://dreamweaverart.ca/>) during the Lunch & Learn sessions as well. More information about the indigenous artists can be found further below in the programme.

Panel

The “surviving the Anthropocene” panel brings together four Western-based experts on climate change and related disciplines. The panel happens on Saturday, May 27th from 2 to 4pm at Conron Hall (UC 3110). The panel will be transmitted live and recorded, and the link to the live transmission will be provided over email.

More information about each panelist can be found further below in this conference programme.

Here is the guiding synopsis of the panel:

*Starting with the Industrial Revolution in the 18th century, the Anthropocene is our current geological epoch. Marked by unprecedented human-made global disruption, the Anthropocene presents existential threats that might have never been encountered before. Global warming, biodiversity loss, rising sea levels, and climate-change-induced human displacement are just some of the many challenges we will continue to face. Guidelines for a sustainable future have been repeatedly proposed and the planetary boundaries for our safe existence have been established. Yet, more than 80% of the current global energy consumption still relies on unsustainable fossil fuels and the COP26 negotiations have not delivered. To make things worse, the demand for oil and gas is expected to peak in the next two decades. Amidst this uncertain and tumultuous background, what are the future steps for Ecology, Ethology and Evolution? How can biologists contribute to the future of their discipline while implementing best-practices that guarantee the long-term survival of our planet? These are some of the questions that will guide this panel discussion on “**Surviving the Anthropocene: future steps for the 3 E’s under pressing planetary issues**”.*

Emergency numbers

- Medical emergency: call 911 from a campus landline
- Campus Police: (519) 661-3300

Conference excursions

Your registration includes two tours of 50 minutes each on May 25th from 2:30 to 4:30 pm. We will meet at 2h30 pm just outside Conron Hall (UC 3110 - https://wts.uwo.ca/ctg/classrooms/university_college/uc_3110.html) and then head to the excursions. All excursions will convene at the FOGS Pollinator Garden (<http://fogsuwo.ca/pollinator/>) at 4:30 pm for a final activity. We will head to the Grad Club (<https://www.uwogradclub.ca/>) at 6:00 pm for Trivia Night and Mexican Dinner Buffet.

Advanced Facility for Avian Research (AFAR)



AFAR is home to the world's first hypobaric climatic wind tunnel for bird flight - allowing research into the physiology and fluid dynamics of bird flight in high altitude conditions. In combination with specialized indoor and outdoor holding rooms and innovative experimental and analytical facilities. AFAR is a leading centre for the study of avian neurobiology, physiology, and behaviour. More information at: <https://birds.uwo.ca/>

Advanced Facility for Avian Research



BIOTRON

Biotron

Biotron Experimental Climate Change Research Centre at Western University in London, Ontario, Canada houses specialized environmental chambers, laboratories and equipment dedicated to research in the fields of environmental sciences, biotechnologies, materials and biomaterials, and engineering. The Biotron supports the research on biotic and abiotic processes in the environment and specializes in the simulation of natural environments at a range of scales. More information at: <https://www.uwo.ca/sci/research/biotron/index.html>



Biodiversity Gallery

The Zoological Collections contain thousands of animal specimens of many major taxa including Arthropoda (representing nearly all the insect orders, with an emphasis on Lepidoptera; Arachnida; Crustacea), Mollusca (shells of mostly marine species, some freshwater and terrestrial), Echinodermata, and Vertebrata (e.g., whole, mounted skeletons of various taxa; parts of skeletons, e.g., skulls; taxidermy of Aves, Mammalia).

More information at:

<https://www.uwo.ca/biology/research/biology-facilities/zoological-collections.html> and
https://atwestern.typepad.com/zooological_collections/

Biodiversity Gallery



Friends of the Gardens (FOGS) pollinator garden

FOGS is a group of volunteer gardeners at Western University. The group was founded by Frances Howey (BA'60) 27 years ago. Since then, countless staff members, alumni, graduate students, post-docs, faculty, and community allies have contributed to the cause. Over these years, FOGS has amassed more than \$70K in student bursaries, and the group keeps on thriving. More recently, FOGS started working on the Pollinator Garden project. This is a grassroots initiative (led by Blanca Alvarez) that aims to provide nourishing grounds to our local pollinators. More information at: <http://fogsuwo.ca/>

FOGS Pollinator Garden



Medway Valley Heritage Forest

Medway Park

Medway Valley Heritage Forest Environmentally Significant Area (ESA) is a publicly owned lands cover 133 hectares, between the Elsie Perrin Williams Estate and Sunningdale Road. The Valley provides habitat and food for many species of wildlife and is a migration route of many birds. More information at: <https://thamesriver.on.ca/wp-content/uploads/2022-MedwayESA-brochure.pdf>



ESW Field Station

Environmental Sciences Western Field Station

Environmental Sciences Western is a Faculty of Science field station is located approximately 14 km north of the main Western campus. It is used for inter- and multidisciplinary research by faculty in the Departments of Biology, Physics and Astronomy and Geology, along with researchers from the Faculty of Engineering and Agriculture and Agri-Food Canada. More information at: <https://www.uwo.ca/esw/>

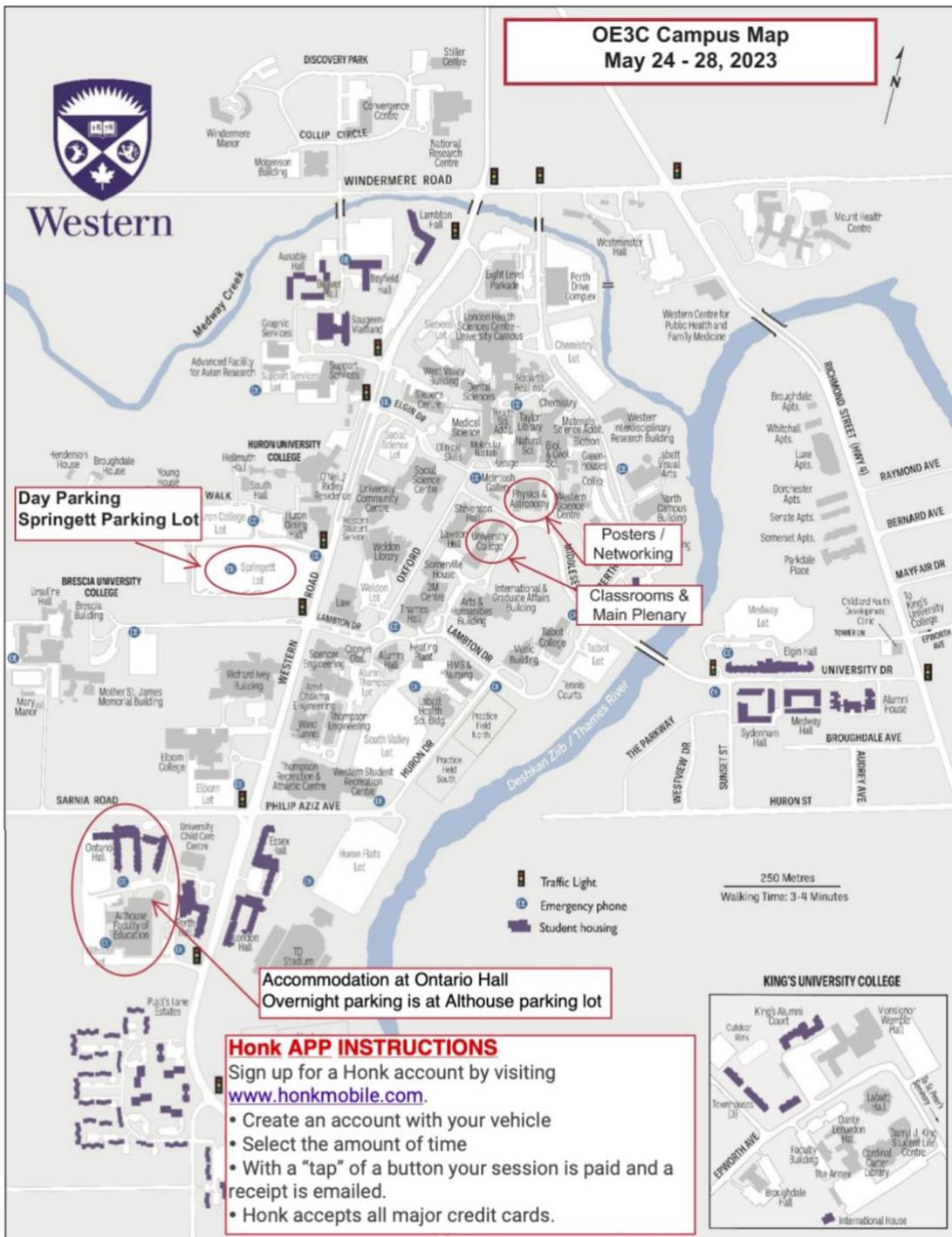


Wampum Learning Lodge

The Lodge is an intercultural teaching, learning, and gathering space at Western University, designed with Indigenous epistemologies and pedagogies at its heart. The Lodge facilitates and coordinates services and programming offered by Western's Office of Indigenous Initiatives (OII). It does so in collaboration with University stakeholders and Indigenous organizations and communities in Deshkan Zibiing territory, with the aim of advancing Reconciliation, Indigenization, and decolonization. More information at:

<https://indigenouslearningspace.uwo.ca/>

Campus Map and On-Campus Venues



For information about visitor parking (parking lots, payment methods and the HonkTAP App) visit: <https://www.uwo.ca/parking/find/visitor/index.html>. Accessibility on Campus and Western's Covid-19 policies can be found at: <https://oe3c2023.com/#venue>.

Indigenous Artists

Amanda Myers

Friday, May 26th, Lunch & Learn I: 12 – 2pm at the Physics & Astronomy Atrium



Boozhoo Kitaay Bizhikikwe ndizhinikaaz, waabizhesi ndodem. Anishinaabe miinwa Métis ndow, bezho Mide kwe ndow. Amanda Myers is my English name, I have worked with the Indigenous Student Centre at Western University over the past seven years, focusing both my educational studies and visual arts practice on identity. I choose to focus on identity, as someone whose ancestors chose not to register in a community, who chose to live their life as they always had, off the land. I draw on my family lineage which connects me to many communities in Ontario, northern Wisconsin, and Michigan through my Cadotte/Cadeau and Myers/Maillette ancestors. I have now called London home for ten years, where, as a professional artist and goldsmith, I work with acrylic paint, stained glass, beads, leather, natural elements,

precious metals, and stones. I have always loved to share my skills with others which led me to a path in education. Through workshop facilitation in southern Ontario schools and in working with the Centre for Addictions and Mental Health in the Fourth R program here in the Thames Valley District School Board, I have come to realize that my place is in helping our youth to feel confident in their identity and move forward in a positive direction. Bio retrieved from <https://www.amandamyersart.com/w>

Laney Beaulieu

Saturday, May 27th, Lunch & Learn II: 12 – 2pm at the Physics & Astronomy Atrium

Laney “Dream Weaver” Beaulieu is a second-year medical student at the Schulich School of Medicine and Dentistry in London, ON. Laney grew up in Deninu K’ue, NT and is Dene and Metis. Currently, Laney is the Student Director of the Indigenous Physicians of Canada, a Director of the Arctic Indigenous Wellness Foundation, and a member of the Indigenous Medical Students Association of Canada’s Leadership Circle. After graduating medical school, Laney plans to complete her residency in Psychiatry and return home to the Northwest Territories to serve the small community she grew up in and the other Indigenous communities in the region. Laney is also an artist who specializes in acrylic and digital mediums to convey scenes of her homeland and tell her peoples’ stories. Laney’s art has been featured on the cover of the Turtle Island Journal of Indigenous Health, the Royal Society’s Commission on the Health of Indigenous People during COVID-19, the promotional material of Thaidene Nene National Park, a mural at King’s College, and in homes across Turtle Island. To contact Laney and see more of her work you can find her on Instagram @dream.weaver.art or Facebook @Dream Weaver Art or take a look at her website <https://dreamweaverart.ca/>.

Keynote Speakers

Dr. Karen Warkentin – Boston University
Thursday, May 25th



Dr. Warkentin (they/them/theirs) are a professor of Biology and of Women's, Gender & Sexuality Studies at Boston University, and a Research Associate at the Smithsonian Tropical Research Institute (STRI). Their empirical work examines the integrative biology and behavior of terrestrial frog embryos, with research focused on red-eyed treefrog embryos in Costa Rica (Corcovado National Park, 1991–1995) and Panama (Gamboa, since 1998). They also apply a plasticity perspective to thinking about diversity in sex and sex-associated traits. They did their BSc at the University of Guelph, CA; MSc with Richard Wassersug at Dalhousie University in Halifax, Nova Scotia, CA; PhD with Mike Ryan at the University of Texas, USA; and postdocs

with Stan Rand and Mary Jane West-Eberhard at STRI and Andy Sih at the University of Kentucky, Lexington.

Crossing Boundaries, Disrupting Binaries: A Queer Perspective on the Diversity of Life

To understand diversity, we must look beyond normative expectations, but who we are shapes the questions we ask. Observations of unexpected variation can generate new research directions and overturn established knowledge, as exemplified in our work with tropical frogs. My queer perspective shaped the work that revealed predator-induced hatching, opening new avenues of research on embryo behavior, and unexpected observations led to my students' discoveries that changed understandings of reproductive mode and sex role evolution. Yet such observations are often ignored or devalued, as was long the case for same-sex sexual behavior in animals. We now know same-sex and other non-reproductive sexual behaviors are widespread, suggesting diverse functions of animal sexuality. Sex determination and development, sexed phenotypes, and reproductive modes are likewise highly diverse. Nonetheless, heteronormative practices and assumptions still impact the safety and academic freedom of LGBTQ+ biologists and bias research agendas. The self-reinforcing cycle of gender-binary thinking and focus on categorical differences also constrains and impoverishes our study of natural variation. Pro-active inclusion of gender and sexual minority scientists and support systems that enable minority researchers to pursue our own sometimes non-normative research agendas can help correct biases, increase innovation, and improve our understanding of diversity in nature.

Dr. Dara N. Orbach – Texas A&M University – Corpus Christi
Friday, May 26th



Dr. Orbach is a professor of Marine Biology at Texas A&M University- Corpus Christi. The Research in the Orbach (FABEMM!) lab explores evolutionary biology with a focus on the coevolution of anatomy and behavior, reproductive morphology, functional morphology, sexual selection, behavioral ecology, sociobiology, and decision-making processes. Her comparative approach allows her to work with multiple organisms including mammals, birds, bats, and fish. Dr. Orbach did her BSc in Biology at the University of British Columbia, CA; M.Sc at Western University; Phd at Texas A&M University at Galveston, USA; and post-doctoral fellow at Dalhousie University, CA.

Follow my lead:

Gender bias in genital evolution and insights from marine mammal reproductive anatomy

As copulation is the most direct mechanical interaction between the sexes, sexual selection pressures likely act on the genitals of both females and males. Yet most research on reproductive morphological evolution has focused on male intromittent organs with female genitalia receiving less attention across all clades. I review historic and contemporary patterns of gender bias and imbalance within the field of genital evolution to highlight research needs. I use cetaceans (whales, dolphins, and porpoises) to demonstrate what is known (and unknown) about the evolution of female reproductive morphology as there is an unparalleled level of vaginal diversity within this vertebrate clade. I discuss several collaborative research endeavors that investigate the relationship between form and function of the genitalia of female marine mammals and of genital co-evolution using a variety of innovative techniques applied at the micro-through macro-organism scales.

Dr. Sergio Muñoz-Gómez – Purdue University
Saturday, May 27th



Dr. Muñoz-Gómez is a professor of Biology (origins-of-life) at Purdue University. Dr. Muñoz-Gómez is the PI of the ECSO lab, he is evolutionary microbiologist and cell biologist whose main interests revolve around understanding the origin and diversification of eukaryotic cells and their symbiotic organelles. He did his B.Sc. at Universidad de Antioquia, Colombia; Ph.D. in Biochemistry and Molecular Biology (2013-2018), Dalhousie University, Canada; and EMBO Postdoctoral Fellow at Université Paris-Saclay, France.

The evolutionary origin of an extraordinarily uncommon purple-green photosymbiosis

*Symbioses are common and widespread in nature. Some of them, such as those between heterotrophs and photosynthesizers (photosymbioses), or heterotrophs and chemosynthesizers (chemosymbioses), have evolved convergently numerous times. Symbioses between eukaryotes and anoxygenic photosynthesizers such as purple bacteria, however, are exceedingly rare in nature—only two examples have ever been reported. One of these, the ciliate *Pseudoblepharisma tenue*, provides an intracellular niche to two contrasting photosynthesizers: anaerobic purple bacteria and oxygenic green algae. To gain further insights into the evolutionary origin of the *P. tenue* symbiosis, we focused on its closest relatives. Alongside the purple-green *P. tenue* in Simmelried pond samples, we found a purely green ciliate similar to *P. tenue*. The green ciliate has its cytoplasm packed with green algae and, in contrast to *P. tenue*, also harbors two different kinds of colorless intracellular bacteria. Phylogenetic analyses reveal that the purely green ciliate is a new species (*P. chlorelligera*) that is most closely related to *P. tenue*—together, they are sister to all known *Spirostomum* species. Moreover, they both share the same green algal symbiont related to *Chlorella sp. K10*, which suggests that this symbiosis predates their evolutionary divergence. By contrast, the bacterial symbionts of *P. chlorelligera* are distantly related to the purple bacterial symbiont of *P. tenue* and belong to the sister genera *Ca. Accumulibacter* and *Propionivibrio* (*Gammaproteobacteria*). We also discovered two new symbiont-free *Pseudoblepharisma* species that shed light on the early evolution of its symbiont-bearing relatives. Together, they suggest that the ancestor of *P. tenue* was a facultatively anaerobic phagotroph that, possibly, fed on purple bacteria. We argue that a facultatively anaerobic lifestyle predisposed the ancestor of *P. tenue* to acquire sediment-dwelling green algae and purple bacteria. Because the green algal symbionts were acquired first, they may have paved the way for the acquisition of purple bacteria by providing fermentation end-products that served as electron donors for anoxygenic photosynthesis. Such a series of events may help explain why purple symbioses are so rare in nature.*

Panelists

**Dr. Bipasha Baruah – Western University
Saturday, May 27th**



Bipasha Baruah is Professor and Canada Research Chair in Global Women's Issues at Western University's Department of Gender, Sexuality and Women's Studies. Her current research aims to understand how to ensure that a global low-carbon economy will be more gender-equitable and socially just than its fossil-fuel-based predecessor. Author of a book and more than 100 peer-reviewed articles, book chapters, and other works, Dr. Baruah serves frequently as an expert reviewer and advisor to Canadian and intergovernmental environmental protection and international development organizations. The Royal Society of Canada named her to The College of New Scholars, Artists, and Scientists in 2015. "The College" is Canada's only national system of multidisciplinary recognition for the emerging generation of Canadian intellectual leadership. Every year, it names individuals who have made exceptional professional contributions to Canada and the world within 15 years of completing their doctorates.

**Dr. Eric Dusenge – Western University
Saturday, May 27th**



Eric conducted his BSc at the University of Rwanda (2006-2010) and MSc at the University of Gothenburg in Sweden (2012-2015). The research projects for both BSc and MSc thesis focused on tropical tree physiology and were both done within the University of Rwanda and the University of Gothenburg collaboration. He defended his PhD thesis on boreal climate change ecophysiology at the University of Western Ontario, Canada, in 2019. After having worked on a couple of postdoc projects in Sweden (Marie Curie Fellowship) and the UK (postdoctoral fellow at the University of Exeter), he is now a postdoctoral associate in the Centre for Climate Change, Sustainable Livelihoods and Health at the Western University, Canada. Mirindi Eric's main research interests are to understand and predict how tropical and boreal trees will respond to climate change.

Dr. Katrina Moser – Western University
Saturday, May 27th



Dr. Katrina Moser is a paleolimnologist and climate scientist. The majority of my research is focussed on showing how climates have changed over thousands of years and reporting on the response of lake ecosystems to these changes. This knowledge provides a context for the profound changes underway today and helps us to plan for the future. My research has mainly been in remote alpine and northern regions where anthropogenic climate change is occurring most rapidly but is also ongoing here in southwestern Ontario. In my 30 years of research, I have observed dramatic changes in lake ecosystems and have become increasingly frustrated by the lack of action being taken to address climate change. To help remedy this situation, I put together a team to co-develop a course called Connecting for Climate Change Action that braids together eurowestern science and Indigenous Knowledge to inspire students to take action to address climate change and make the right choices for make a better future.

Dr. Hugh Henry – Western University
Saturday, May 27th



I am a terrestrial plant ecologist with interests in biogeochemistry, community ecology, physiological plant ecology and global change ecology. I use field experimentation, laboratory methods and theoretical modeling to explore questions ranging from resource acquisition by individual plants to species responses at the community level and nutrient cycling at the ecosystem level. I am particularly interested in exploring how plants and microorganisms interact to regulate nutrient cycling in natural systems.

Conference schedule at a glance

Day 1 Thursday May 25th	11am - 12pm Registration and check-in at University College Building 12 - 1:30pm Welcome lunch and reception at University College Building 1:30 - 2:30pm Keynote Ethology: Dr. Karen Warkentin at University College Building 2:30 - 4:30pm Conference excursions at various locations 4:30 - 5:30pm FOGS Pollinator Garden - Planting Day at Middlesex College parking lot 6 - 9 pm Trivia Night & Mexican Buffet Dinner Social at the Grad Club
Day 2 Friday May 26th	8 - 9am Breakfast and poster set-up at the Physics & Astronomy Atrium 9 - 10am Keynote Ecology : Dr. Dara Orbach at the University College Building 10am - 12pm Concurrent talk sessions at the University College Building 10:45am - 11am Coffee Break at the University College Building 12 - 2pm Lunch & Learn I at the Physics & Astronomy Atrium 2 - 4 pm Concurrent talk sessions at the University College Building 3:00 - 3:15pm Coffee Break at the University College Building 4:00 - 4:15pm Group photo at the University College Building 6 - 10:30 pm Buffet Dinner & Dance at the Thames Hall Atrium
Day 3 Saturday May 27th	8 - 9am Breakfast and poster set-up at the Physics & Astronomy Atrium 9 - 10am Keynote Evolution: Dr. Sergio Muñoz-Gómez at the University College Building 10am - 12pm Concurrent talk sessions at the University College Building 10:45am - 11am Coffee Break at the University College Building 12 - 2pm Lunch & Learn II at the Physics & Astronomy Atrium 2 - 4 pm Panel "Surviving the Anthropocene" at the University College Building 3:00 - 3:15pm Coffee Break at the University College Building 5 - 8 pm Closing Ceremony & Awards at the Grad Club

Talk sessions

AGA ROOM

FRIDAY, MAY 26th, 10 am – 12pm: SESSION - AGA, UNIVERSITY COLLEGE BUILDING 3110

10:00 – 10:15 am: Temporal analysis of genetic diversity in an isolated population of the Bog Copper butterfly, *Tharsalea epixanthe*

10:15 – 10:30 am : Out of thin air: surveying tropical bat roosts through air sampling of eDNA

10:30 – 10:45 am: Unraveling the impacts of the Mid-Pleistocene Transition on diversification of *Gazella subgutturosa*: insights from phylogeography and species distribution modeling

BREAK

11:00 – 11:15 am: The effects of species reintroduction on genetics: a proposed monitoring program for the reintroduction of the mottled duskywing butterfly (*Erynnis martialis*)

11:15 – 11:30 am: Mating complications: Exploring patterns of mating in fruit flies, *Drosophila melanogaster* in environments differing in their structural complexity

11:30 - 11:45 am: Linking morphology and genetics to explore ant population diversification across the Galapagos Islands

11:45 – 12 pm: fruitless transcripts and neurons that influence mate choice in female *Drosophila melanogaster*

PLANT EVOLUTION

FRIDAY, MAY 26th, 10 am – 12 pm: SESSION – PLANT EVOLUTION, UNIVERSITY COLLEGE BUILDING 3225

10:00 – 10:15 am: Investigating the range expansion of *Amaranthus palmeri*: variation in phenology and trade-offs

10:15 – 10:30 am: The rapid evolution of resistance gene copy number variation

10:30 – 10:45 am: An evolutionary perspective of plant receptor kinase signalling

BREAK

11:00 – 11:15 am: A look into the past: Investigate the origin(s) of glyphosate resistance in *Amaranthus palmeri* using herbarium samples

11:15 – 11:30 am: Pollinator decline alters selection on floral traits of *Mimulus guttatus*

11:30 – 11:45 am: Is extended floral longevity in response to pollinator decline adaptive?: A test with *Lobelia siphilitica*

11:45 – 12 pm: Random and non-random variation in flower colour along an urban-rural gradient

EVOLUTION

FRIDAY, MAY 26th, 10 am – 12 pm: SESSION - **EVOLUTION**, UNIVERSITY COLLEGE BUILDING 2105

10:00 – 10:15 am: Novel climates and competitive ability: a test for adaptive trade-offs between closely related species

10:15 – 10:30 am: Scales, plates, and toe pads: investigating evolutionary modularity and rates in *Anolis* scales

10:30 – 10:45 am: Assessment of cryptic Azure butterfly (*Celastrina*) species in southern Ontario using whole genome sequencing

BREAK

11:00 – 11:15 am: The relationship between dispersal and diversification in birds

11:15 – 11:30 am: Sexual dimorphism in *Steatoda nobilis*: how do the sexes differ in phenotypic and life history investment strategies?

11:30 – 11:45 am: Kin recognition in an invasive perennial plant influences the success of subsequent generations

11:45 – 12 pm: On the improbability of detecting phenotypic trade-offs and a partial solution

URBAN & AGRO ECOLOGY

FRIDAY, MAY 26th, 2 – 4pm: SESSION - **URBAN & AGROECOLOGY**, UNIVERSITY COLLEGE BUILDING 3110

2:00 – 2:15 pm: Ecological engineering for stormwater treatment: a case study in the Idlewood subdivision, Kitchener, Ontario, Canada (July-October 2022)

2:15 – 2:30 pm: Leveraging community science and sustainability to advocate for bird-friendly building design

2:30 – 2:45 pm: Using a One Welfare lens to see a new perspective of agroecology and its potential in the laying hen industry

2:45 – 3:00 pm: The role of restoration management and within-year variation on seed bank diversity and composition of designed urban meadows

BREAK

3:15 – 3:30 pm: Automation of green roof vegetation cover using machine learning and a comparison of digital and thermal imaging

3:30 – 3:45 pm: Canadian Bat Box Project

3:45 – 4:00 pm: Assessing the Spatiotemporal Abundance of Soybean Gall Midge in Soil from Infested Fields

HABITAT & DISPERSAL

FRIDAY, MAY 26th, 2 – 4 pm: SESSION – HABITAT & DISPERSAL, UNIVERSITY COLLEGE BUILDING 3225

2:00 – 2:15 pm: Heat stress experienced during metamorphosis: Impacts on subsequent pheromone mediated mating in the true armyworm (*Mythimna unipuncta*) (Lepidoptera: Noctuidae)

2:15 – 2:30 pm: The sweet smell of success: Habitat specific foraging challenges may shape olfactory traits in pumpkinseed sunfish

2:30 – 2:45 pm: Could the use of different species of milkweed as larval hostplants influence the fall migration of Monarchs?

2:45 – 3:00 pm: Influence of prey density on spatial and temporal patterns of kills by Canada lynx

BREAK

3:15 – 3:30 pm: Allocation of stored fatty acids during flight in Monarch Butterflies (*Danaus plexippus*): Implications for the importance of en route migratory nectaring sites

3:30 – 3:45 pm: Daily movement and habitat-use of lake sturgeon (*Acipenser fulvenscens*) in south-eastern Lake Superior

3:45– 4:00 pm: Androgens and movement: effect of experimental testosterone on migration behaviour of song sparrows

ECOLOGY I

FRIDAY, MAY 26th, 2 – 4 pm: SESSION ECOLOGY I, UNIVERSITY COLLEGE BUILDING 2105

2:00 – 2:15 pm: Long-term effects of silviculture on below ground carbon stocks in boreal forest sites varying in soil texture in Ontario, Canada

2:15 – 2:30 pm: Testing a core assumption of trait-based ecology: Are plant traits good predictors of individual performance?

2:30 – 2:45 pm: Do controlled environments provide ecologically relevant estimates of symbiotic interactions? A case study with plants and arbuscular mycorrhizal fungi

2:45 – 3:00 pm: Are high elevation habitats a refuge from biological control for invasive spotted knapweed (*Centaurea stoebe*)?

BREAK

3:15 – 3:30 pm: Using paleolimnology to assess long-term environmental change in lakes from Killarney Provincial Park and Sudbury, Ontario, Canada

3:30 – 3:45 pm: Evidence of deterministic community assembly from fossil diatoms in ancient Lake Towuti, Indonesia

3:45 – 4:00 pm: The effect of vegetation maintenance on avian species richness in public parks

ETHOLOGY I

SATURDAY, MAY 27TH, 10 am – 12pm: SESSION - ETHOLOGY I, UNIVERSITY COLLEGE BUILDING 2105

10:00 – 10:15 am: Costly traumatic insemination in bed bugs and the factors influencing female avoidance

10:15 – 10:30 am: Fear of predators has enduring effects on the brain and behaviour in wild animals

10:30 – 10:45am: Heads up! Social vigilance behavior in American crows

BREAK

11:00 – 11:15 am: Vibratory signalling patterns in male *Steatoda nobilis* during courtship displays

11:15 – 11:30 am: A baffling conundrum: why don't more crickets make acoustic tools?

11:30 – 11:45 am: Correlates of fitness in male *Steatoda nobilis*: this-over-that or has-it-all?

11:45 am – 12 pm: Variation in the kinematics of black widow spider legs during locomotion

ECOLOGY & ETHOLOGY II

SATURDAY, MAY 27TH, 10 am – 12pm: SESSION – ECOLOGY & ETHOLOGY II, UNIVERSITY COLLEGE BUILDING 3225

10:00 – 10:15 am: Increasing access to field work for BIPOC undergraduate students

10:15 – 10:30 am: How do mowing regimes affect tree cricket egg hatching success?

10:30 – 10:45 am: Metapopulation dynamics change toward and maybe contribute to a species range limit

BREAK

11:00 – 11:15 am: Effect of Artificial Light on the Development of Juvenile *Steatoda nobilis*

11:15 – 11:30 am: Tale of two fishes: How personality and species affect group behaviour

11:30 – 11:45 am: Can Misunderstanding Lead to Demise? Evaluating Motion Signal Performance of Toad-Headed Lizard *Phrynocephalus putjatai* x *P. guinanensis* Hybrids

11:45 am – 12:00 pm: The effect of mating status on male motivation to mate and willingness to fight in competitions in false widow spiders (*Steatoda nobilis*)

MOLECULAR TOOLS & ECOLOGY

SATURDAY, MAY 27TH, 10 am – 12 pm: SESSION - MOLECULAR TOOLS & ECOLOGY, UNIVERSITY COLLEGE BUILDING 3105

10:00 – 10:15 am: The role of phenylpropanoids in *Arabidopsis thaliana* defense against *Tetranychus urticae* herbivory

10:15 – 10:30 am: Assessing the potential of *Caenorhabditis elegans* in the bioremediation of *Microcystis aeruginosa*

10:30 – 10:45 am: Host-adaptation and specialization in *Tetranychus urticae* and *Tetranychus evansi*

10:45 – 11:00 am: Candidate Gene Validation of Sociability in *Drosophila Melanogaster*

BREAK

11:15 – 11:30 am: The Role of V-ATPase in Regulating pH in the Digestive Tract of *Tetranychus urticae* Koch

11:30 – 11:45 am: A hair out of place: Understanding the maintenance of a trichome polymorphism in *Camissoniopsis cheiranthifolia*

11:45 am – 12 pm: Viral-induced flower colour change reveals that turnip mosaic virus increases with stand size and human disturbance in *Hesperis matronalis*

12:00 – 12:15 pm: Plant-pest interaction: dissection of detoxification patterns associated with metabolic resistance in *Tetranychus urticae* adapted to *Arabidopsis thaliana*

CLIMATE CHANGE

SATURDAY, MAY 27TH, 10 am – 12 pm: SESSION CLIMATE CHANGE, UNIVERSITY COLLEGE BUILDING 3110

10:00 – 10:15 am: How will photosynthesis and growth in boreal forests respond to climate change?

10:15 – 10:30 am: Investigating variation in herbivore-and-climate-mediated selection on flowering time in an invasive wetland plant

10:30 – 10:45 am: Changes in peatland soil fauna biomass alter food web structure and function under warming and hydrological changes

BREAK

11:00 – 11:15 am: Complex Effects of Mycorrhizae on Poplars Under Elevated Temperature and CO₂

11:15 – 11:30 am: Responses of Soil Predatory Mites to Climate Warming and Elevated CO₂ in Boreal Peatlands

11:30 – 11:45 am: The effects of global change on soil and plant ¹⁵N retention in a grass-dominated old field over both the short and longer term

11:45 am – 12:00 pm: The effects of warming on floral traits

Lunch & Learn sessions

LUNCH & LEARN I

FRIDAY, MAY 26th, 12 – 2pm at PHYSICS & ASTRONOMY ATRIUM

POSTER 1, POSTER BOARD 1: How do frozen crickets maintain mitochondrial function?

POSTER 2, POSTER BOARD 1: Investigating the influence of parasitism on dispersal and cannibalism behaviors of backswimmers (*Notonecta undulata*)

POSTER 3, POSTER BOARD 2: Recovery Mechanisms of Grassland Plant Diversity after the Cessation of Nutrient Addition

POSTER 4, POSTER BOARD 2: The microplastic exposure landscape: a mass balance of microplastics in a large in-lake pelagic mesocosm experiment at the IISD Experimental Lakes Area (IISD-ELA)

POSTER 5, POSTER BOARD 3: Does climate influence scale size among populations of Anolis lizards?

POSTER 6, POSTER BOARD 3: Investigating mosquito abundance and species richness in the Georgian Bay Islands

POSTER 7, POSTER BOARD 4: A range-wide migratory network for Blackpoll Warblers (*Setophaga striata*)

POSTER 8, POSTER BOARD 4: WITHDRAWN

POSTER 9, POSTER BOARD 5: Investigating microplastics in muscle tissue of cold-adapted salmonids

POSTER 10, POSTER BOARD 5: Road salt pollution alters sex-bias in emerging mosquito populations

POSTER 11, POSTER BOARD 6: Expression of Co-Operative Behaviour Under Different Lighting Environments on *Drosophila melanogaster* Larvae

POSTER 12, POSTER BOARD 6: Quantifying the Presence of Trace Element Metals in Yellow Perch (*Perca flavescens*) Tissue After Microplastic Exposure in In-Lake Mesocosms

POSTER 13, POSTER BOARD 7: Sleeping sites of the white-eared opossum (*Didelphis albiventris*) in a Brazilian tropical forest: insights into sex differences

POSTER 14, POSTER BOARD 7: The role of intradiol ring-cleavage dioxygenases in *Tetranychus urticae* adaptation to *Arabidopsis thaliana*

POSTER 15, POSTER BOARD 8: Both microplastic concentration and food availability affect *Daphnia magna* survival.

POSTER 16, POSTER BOARD 8: Dynamics of stored lipids in fall migratory Monarch Butterflies (*Danaus plexippus*): Nectaring in Mexico allows recovery from the southwestern US drought?

POSTER 17, POSTER BOARD 1: Wingtip shape influences take-off speed within and among migratory songbirds

POSTER 18, POSTER BOARD 1: Ecological Drivers of Autumn Refuelling and Stopover Behaviour in Songbirds Migrating Through Eastern New Brunswick

POSTER 19, POSTER BOARD 2: Arthropod Diversity in Regrown Urban Grass Environments

POSTER 20, POSTER BOARD 2: Genetic diversity and fitness variation among populations of clonal invasive plants

POSTER 21, POSTER BOARD 3: The influence of flight capacity of Neotropical birds in the Ecuadorian Andes on the proportion of *Polyolepis* patches occupied

POSTER 22, POSTER BOARD 3: Evaluation of prey correlation with lice cleaning efficiency of lumpfish (*Cyclopterus lumpus*) in Canadian Atlantic salmon (*Salmo salar*) aquaculture in Newfoundland, Canada using morphological identification and DNA metabarcoding techniques

POSTER 23, POSTER BOARD 4: Tail morphologies strengthen the relationship between flight efficiency and natal dispersal distances in birds

POSTER 24, POSTER BOARD 4: WITHDRAWN

POSTER 25, POSTER BOARD 5: WITHDRAWN

POSTER 26, POSTER BOARD 5: Community structure of *Trichoptera* across the credit river watershed in the 1950s

POSTER 27, POSTER BOARD 6: White-footed mouse (*Peromyscus leucopus*) response to restoration of grassland alvar

POSTER 28, POSTER BOARD 6: Latitudinal variation in mutualism: a case study using castor plant - ant interactions

POSTER 29, POSTER BOARD 7: Pesticide resistance levels in field and greenhouse populations of *Tetranychus urticae*

POSTER 30, POSTER BOARD 7: The effects of N-heterocyclic carbene-enhanced coats on microbial corrosion of mild steel

LUNCH & LEARN II

SATURDAY, MAY 27th, 12 – 2pm at PHYSICS & ASTRONOMY ATRIUM

POSTER 1, POSTER BOARD 1: Microbial community response to experimental warming in boreal peatlands

POSTER 2, POSTER BOARD 1: WITHDRAWN

POSTER 3, POSTER BOARD 2: Potential probiotic bacteria isolated from water kefir and their inhibitory effect against the contagious bee pathogen *Paenibacillus larvae*

POSTER 4, POSTER BOARD 2: Effects of migratory strategy on flight muscle mitochondrial physiology in songbirds

POSTER 5, POSTER BOARD 3: Effects of site and migratory season on the consumption of biofilm and essential fatty acids composition in Western Sandpipers

POSTER 6, POSTER BOARD 3: Drosophila social spacing: elucidating the neural circuitry

POSTER 7, POSTER BOARD 4: The potential for gut microbes to affect honeybee hygienic behaviour

POSTER 8, POSTER BOARD 4: Seeing & speeding: the effects of reduced visibility on fish activity

POSTER 9, POSTER BOARD 5: Juvenile corn snakes do not prefer familiar conspecifics in a 3-chamber task

POSTER 10, POSTER BOARD 5: Effects of Moonlight on Diel Vertical Migration in Juvenile Round Goby

POSTER 11, POSTER BOARD 6: Mating Pool Return Rates and Direction of Mating Competition in a Role Reversed Dance Fly

POSTER 12, POSTER BOARD 6: WITHDRAWN

POSTER 13, POSTER BOARD 7: The effect of nutrient deposition on the costs and benefits of extended floral longevity in response to pollinator decline

POSTER 14, POSTER BOARD 7: WITHDRAWN

POSTER 15, POSTER BOARD 8: Plasticity, protandry, and pollination: the interplay between sex phase transition & flower colour change in an invasive weed

POSTER 16, POSTER BOARD 8: Selection on snake visual developmental genes is associated with shifts in visual ecology

POSTER 17, POSTER BOARD 1: Assessing Alignment Quality of New Reference Genome

POSTER 18, POSTER BOARD 1: Decoding the Fitness Landscape of Acute Myeloid Leukemia: Insights into Clonal Evolution and Gene-Environment Interactions

POSTER 19, POSTER BOARD 2: Unearthing the Miners: A Phylogenetic and Biogeographic Analysis of the Genus *Geositta* (Passeriformes: Furnariidae)

POSTER 20, POSTER BOARD 2: A pilot mutagenesis experiment to identify new, viable, X-linked mutations in *Drosophila prolongata*, a species with male biased sexual dimorphism

POSTER 21, POSTER BOARD 3: Investigating the origins, evolution, and function of a reverse transcriptase-like gene (*rtl*) in the mitochondrial genomes of volvocalean green algae

POSTER 22, POSTER BOARD 3: Microbial genome sequence compositions associated with life in extreme environments

POSTER 23, POSTER BOARD 4: WITHDRAWN

POSTER 24, POSTER BOARD 4: Modeling space structure impacts in redirected breeding species

POSTER 25, POSTER BOARD 5: The hidden influence of wins and losses: Evidence for human winner and loser effects from randomized trials

POSTER 26, POSTER BOARD 5: Ontogenetic shift from cryptic to aposematic colouration in an Amazonian frog

POSTER 27, POSTER BOARD 6: Pre- and post-zygotic reproductive barriers to inter-species hybrid sterility in *Caenorhabditis* nematodes

POSTER 28, POSTER BOARD 6: WITHDRAWN

POSTER 29, POSTER BOARD 7: WITHDRAWN

Abstracts - Talks

AMERICAN GENETIC ASSOCIATION (AGA) ROOM, UC 3110, Friday, May 26th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

Temporal analysis of genetic diversity in an isolated population of the Bog Copper butterfly, *Tharsalea epixanthe*

Contursi, M, and Keyghobadi, N.

University of Western Ontario, Department of Biology, London ON, CANADA

Restricted to Nearctic peatlands, Bog Copper butterflies (*Tharsalea epixanthe*) naturally live in highly fragmented acidic bog ecosystems. Existing in isolated and small populations, the Bog Copper may be experiencing changes in the amount of genetic variation present due to genetic drift and may be at increased risk of extinction due to stochastic events. Using butterfly wing clip samples, I investigated the genetic status of a population of Bog Coppers located in Sifton Bog, London, Ontario, Canada, through estimates of genetic drift and effective population size. Ten microsatellite loci were genotyped and amplified through PCR assay from wing clips taken in 2022. This, in conjunction with historic data from the same population collected in 2009 and 2014, was used to reveal changes in genetic diversity over time in this population of Bog Coppers. Overall heterozygosity (He), at all loci tested, was low with an average value of 0.255 across sampling years, indicating reduced genetic variation present. By generating estimates of effective population size (Ne), it was found that the population had a low Ne of 23.4 individuals between 2009 - 2022, suggesting a high rate of genetic diversity loss due to genetic drift. This study investigated the degree at which this Bog Copper population is vulnerable to stochastic events, informing potential need for translocation, genetic rescue, and/or regular monitoring efforts for this population in the future. It also provides genetic perspective on how small populations change temporally and helps enable conservation efforts in fragmented habitats that house unique and vulnerable wildlife.

Keywords: Bog Copper, butterfly, PCR, microsatellite, urban ecology

AGA ROOM, UC 3110, Friday, May 26th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Out of thin air: surveying tropical bat roosts through air sampling of eDNA

Nina R. Garrett¹, Jonathan Watkins², Charles M. Francis³, Nancy B. Simmons⁴, Natalia Ivanova⁵, Amanda Naum⁵, Andrew Briscoe⁶, Rosie Drinkwater⁷ and Elizabeth L. Clare¹

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Understanding roosting behaviour is essential to bat conservation and biomonitoring, often providing the most accurate methods of assessing bat population size and health. However, roosts can be challenging to survey, e.g., physically impossible to access or presenting risks for researchers. Disturbance during monitoring can also disrupt natural bat behaviour and present material risks to the population such as disrupting hibernation cycles. One solution to this is the use of non-invasive monitoring approaches. Environmental (e)DNA has proven especially effective at detecting rare and elusive species particularly in hard-to-reach locations. It has recently been demonstrated that eDNA from vertebrates is carried in air. When collected in semi-confined spaces, this airborne eDNA can provide remarkably accurate profiles of biodiversity, even in complex tropical communities. In this study we deploy novel airborne eDNA collection for the first time in a natural setting and use this approach to survey difficult to access potential roosts in the neotropics. Using airborne eDNA, we confirmed the presence of bats in nine out of 12 roosts. The identified species matched previous records of roost use obtained from photographic and live capture methods, thus demonstrating the utility of this approach. We also detected the presence of the white-winged vampire bat (*Diaemus youngi*) which had never been confirmed in the area but was long suspected based on range maps. In addition to the bats, we detected several non-bat vertebrates, including the big-eared climbing rat (*Ototylomys phyllotis*), which has previously been observed in and around bat roosts in our study area. We also detected eDNA from other local species known to be in the vicinity. Using airborne eDNA to detect new roosts and monitor known populations, particularly when species turnover is rapid, could maximize efficiency for surveyors while minimizing disturbance to the animals. This study presents the first applied use of airborne eDNA collection for ecological analysis moving beyond proof of concept to demonstrates a clear utility for this technology in the wild.

Keywords: Airborne eDNA, Roosting ecology, Chiroptera, Neotropical, Environmental DNA

AGA ROOM, UC 3110, Friday, May 26th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

Unraveling the impacts of the Mid-Pleistocene Transition on diversification of *Gazella subgutturosa*: insights from phylogeography and species distribution modeling

Asadollahi M¹, Ahmadzadeh F¹, Keyghobadi N²

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²University of Western Ontario, Department of Biology, London ON, CANADA

In this study aimed to investigate the impact of climate fluctuations on the genetic diversity and distribution of *Gazella subgutturosa*, a species of large mammals at risk of extinction. The research employed 109 mtDNA sequences (cyt b) and species distribution modeling to analyze the genetic status of populations, their evolutionary relationships, and the current and future state of population dispersion of the species. The results showed evidence of divergence of two main clades (*G. subgutturosa subgutturosa*, and *G. subgutturosa yarkandensis*) with a split between two clades of *G. s. subgutturosa* (Middle Eastern and Central Iranian) during the middle Pleistocene. The species' range has remained relatively stable from the past to the present but has shown a decreasing trend. However, future climate projections predict a contraction of suitable habitat at the northern and southern edges of the species' current distribution, shifting the range to the center of the study area. The study found that Pleistocene climatic fluctuations and refuges (Alborz, Zagros, and Kope Dagh Mountains) during cold periods may have shaped the current genetic structure of the species. Biogeographic analyses suggest that vicariance and dispersal events have also influenced the genetic structure of *G. subgutturosa*. Our study highlights the importance of understanding the genetic status of populations and their evolutionary relationships to prevent further declines of species at risk of extinction. The findings provide insight into the potential impact of future climate change on the genetic diversity and distribution of large mammals, particularly *Gazella subgutturosa*.

Keywords: *Gazella subgutturosa*, goitered gazelle, Species Distribution Models (SDMs), mtDNA, Phylogeography

AGA ROOM, UC 3110, Friday, May 26th 10am – 12pm

Graduate work, People's Choice Awards

The effects of species reintroduction on genetics: a proposed monitoring program for the reintroduction of the mottled duskywing butterfly (*Erynnis martialis*)

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When conserving a species, consideration should be given to protecting the genetics of the populations involved, and not only the number of individuals. In species reintroduction projects, members of a species are taken to a location in the species' native range where it was once extirpated in order to re-establish the locally extinct population. This translocation affects both the new population in the release site and the source population that the released individuals are drawn from: the new population must, as a subset of the source, attempt to persist as a relatively smaller and less diverse population, while the source itself faces the effects of the removal of its members. A project to reintroduce the endangered mottled duskywing butterfly (*Erynnis martialis*) to a reconstruction of its previously destroyed habitat is underway in southern Ontario and involves the release of the captively reared offspring of captured mated females into not only the reintroduction site, but also the source location that the females were drawn from. This keeps census numbers higher in both locations, but as the project progresses, this approach can potentially affect the allele frequencies of both populations depending on the success of the released individuals. I propose a project to monitor the reintroduction program to view differences in genetic diversity between the source population and the reintroduction site, and to see trends in each population over time. I intend to use microsatellites to characterize genetic diversity in order to see the effects of the translocation of individuals on both of the populations involved.

Keywords: species reintroduction, conservation genetics, mottled duskywing

AGA ROOM, UC 3110, Friday, May 26th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Mating complications: Exploring patterns of mating in fruit flies, *Drosophila melanogaster* in environments differing in their structural complexity

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While it is widely recognized that the effects of natural selection are often contingent on the specific nature of an organism's environment, the operation of sexual selection may also differ under different abiotic conditions. One way in which this can be manifested is in comparing the fitness of individuals living in environments differing in their structural complexity, which may alter the intra- and inter-sexual interaction dynamics. For instance, in fruit flies, *Drosophila melanogaster*, females living in simple vials experience greater harm from conspecific males than they do in more complicated environments (presumably because it is harder for males to persistently harass females) but is unknown if this environmental heterogeneity also influences mating patterns. In this study we measured the interactions and reproductive success of large and small-bodied males & females placed in to simple or complex environments. We also explore whether different types of environmental complexity would have the same or different effects on mating patterns. We found different male-female interactions in all 3 of the environments showing that slight variations in the environment can play a huge role in the outcome of evolution via sexual selection.

Keywords: Environmental complexity, sexual selection, mate-choice, reproductive success, *Drosophila melanogaster*

AGA ROOM, UC 3110, Friday, May 26th 10am – 12pm

Graduate work, People's Choice Awards

Linking morphology and genetics to explore ant population diversification across the Galápagos Islands

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Phenotypic and genotypic traits reflect the ecology and evolution of a species and exploring how the environment influences those traits is essential for understanding species adaptation. Patterns of trait diversity are known to be more affected by vicariance, or the geographic isolation of populations. Although extensive research has explored how isolation drives insect diversification, whether this pattern is occurring among the insects in the Galápagos Archipelago has yet to be explored. Here, we combine genetic sequencing and linear morphometrics to examine trait variation within the endemic ant species *Camponotus planus*. Specifically, this study tests whether the trait variation present across *C. planus* subspecies, which are differentially distributed and restricted to the Galápagos islands, is correlated to the geographic isolation of their populations. For genetic characterization, we used DNA barcoding by analyzing the cytochrome c oxidase subunit I (COI) gene. We analyzed COI sequences for population structure and phylogenetic inferences. Conversely, morphometric sampling included linear measurements of 19 morphological traits typically used in ant systematics and with demonstrated ecological significance. To assess the comparative morphospace across populations, we used a dimension reduction technique, principal components analysis (PCA). Phylogenetic analysis confirmed that geographically close populations clustered together, while still preserving intra-island variation. On the other hand, the morphospace of both minor and major castes of *C. planus* converged regardless of their distribution, with the only difference being the ranges of the morphological variances across islands. Although we provide preliminary evidence for genetic structure among populations, this is uncoupled from the morphological variation. This study encompasses a pioneer effort in studying evolutionary dynamics of insects in the Galapagos islands. These baseline results will be taken into consideration for further research integrating a genomic framework.

Keywords: Galápagos, COI, morphology, endemism, vicariance

AGA ROOM, UC 3110, Friday, May 26th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

fruitless transcripts and neurons that influence mate choice in female *Drosophila melanogaster*

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Speciation is the process by which individual populations diverge into separate species. Under the “Biological species concept” sexually reproducing organisms are no longer considered the same species once they cannot mate to form viable, fertile offspring. There are many barriers that may arise in populations to prevent mating, including prezygotic behavioural barriers. The *Drosophila melanogaster* subgroup is an excellent model organism for the study of behavioural barriers because these nine species of closely related fruit fly are all behaviourally isolated from each other to different extents. In *Drosophila melanogaster*, the genetic origins of this isolation have been studied for decades, and a gene called fruitless has been heavily implicated. The fruitless gene is alternatively spliced into many mRNA transcripts with different functions. One class of transcript is male specific and has been shown to regulate the courtship rituals of male *Drosophila*, but until recently, no fruitless transcripts were thought to influence female receptivity. Prior work in our lab shows that non-sex-specific transcripts called P2 transcripts, influence female receptivity to heterospecific courtship. A later grad student followed this work by characterizing which neurons express P2 transcripts in the whole central nervous system of female *Drosophila* and identified that when these neurons are hyperactivated or constitutively silenced, female *Drosophila melanogaster* reject male courtship attempts almost entirely. Through the use of the inducible Gal4/UAS system to isolate activation and silencing to the brain alone, I then localized the critical neurons for receptivity behaviours to the ventral nerve cord, and am currently exploring whether these neurons truly act through the mechanisms of fruitless, or other genes that are known to influence *Drosophila melanogaster* mating behaviours, such as: doublesex, pickpocket, spinster, and spr. The intention of my work is to provide a foundation for elucidating some of the innate mechanisms that may reinforce mating barriers and underlie complex behaviours in all organisms.

Keywords: *Drosophila*, fruitless, Gal4/UAS, Neural Modification, Female Rejection Behaviour

PLANT EVOLUTION, UC 3225, Friday, May 26th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

Investigating the range expansion of *Amaranthus palmeri*: variation in phenology and trade-offs

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Investigating latitudinal clines in phenological traits can provide insight on the range expansion of invasive species. Palmer's Amaranth (*Amaranthus palmeri*) is an invasive agricultural weed that is spreading northwards from the southwestern United States. Given that *A. palmeri* is an increasing threat to food production in the United States, it is critical to examine whether variation in phenology allows this species to adapt to shorter, northern growing seasons. To investigate genetically based variation in phenology across latitudes and the potential trade-offs related to reproductive timing, I set up a common garden experiment with 19 populations of *A. palmeri* from a latitudinal gradient across the United States. I grew two batches of plants from these populations and estimated phenological timing (days to bud, days to flower, weeks to senescence), vegetative growth and reproductive output across both batches. Population mean days to bud and flower decreased with latitude for both batches, consistent with evolution of phenology in response to the length of growing season. Batch effects were detected in all phenological traits examined, showing that phenotypic plasticity in the phenology of *A. palmeri* may also contribute to variation in phenology and the plant's rapid expansion. Moreover, earlier budding plants displayed reduced size at first bud, but did not show reduced fecundity as expected. Rather, earlier flowering had a higher estimated reproductive output and were also taller, suggesting potential for greater and more effective dispersal. Thus, given the latitudinal clines in reproductive timing and the reproductive advantage of earlier flowering, *A. palmeri* may have the potential to spread farther north. These results emphasize the need for investigation into whether phenological evolution will be constrained by genetic factors. Ongoing work is also being conducted to investigate whether glyphosate resistance conferred by high gene copy number of EPSPS (5-enolpyruvylshikimate 3-phosphate synthase) may influence phenological evolution.

Keywords: local adaptation, invasive weeds, phenology, range expansion, latitudinal clines

PLANT EVOLUTION, UC 3225, Friday, May 26th 10am – 12pm

Graduate work, People's Choice Awards

The rapid evolution of resistance gene copy number variation

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Queen's University

University of Guelph

Gene copy number variation (CNV) has been increasingly associated with the evolution of traits that confer adaptation to environmental stress. Here, we quantify the relation between variation in glyphosate resistance gene EPSPS (5-enolpyruvylshikimate-3-phosphate synthase) copy number and variation in phenotypic glyphosate resistance for 22 populations of *Amaranthus palmeri* from Georgia, North Carolina and Illinois, USA. We used digital drop PCR to estimate copy number, and detected a significant positive relation between population mean copy number and resistance. The majority of populations exhibited high mean phenotypic glyphosate resistance, yet maintained low-resistance individuals. We investigated threshold models for the relation between copy number and resistance, and detected a threshold of ~15 EPSPS copies: there was a steep increase in resistance below the threshold, followed by a much shallower increase in phenotypic resistance as copy number increases to ~160 copies. Across 924 individuals, as copy number increased the range of variation in resistance decreased, yielding an increasing frequency of high phenotypic resistance individuals. Among populations we detected a decline in variation (s.d.) as mean phenotypic resistance increased from moderate to high, consistent with the prediction that as phenotypic resistance increases in populations, stabilizing selection decreases trait variation. We also investigated the inheritance of EPSPS copies using 30 parental pairs from glyphosate-resistant populations and 900 F1 progeny. We detected a substantial decline in heritability after a threshold point of 48.8 mean parental EPSPS CNV. The weaker heritability of gene copy number variation at high CNV suggests there may be little evolutionary potential for EPSPS copy number to further increase. Declining heritability is also consistent with our finding that copy number variation within an individual is more variable as mean copy number increases, and with our finding that high copy number individuals are only found at very low frequency in agricultural populations.

Keywords: resistance, gene copy number variation, plant, evolution, *Amaranthus palmeri*

PLANT EVOLUTION, UC 3225, Friday, May 26th 10am – 12pm

Graduate work, People's Choice Awards

An evolutionary perspective of plant receptor kinase signalling

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Plants must constantly survey their environment to respond to environmental perturbations. Toward this end, plants deploy hundreds of receptor kinases (RKs) at the cell surface, which allow for the perception and response to external ligands. Diverse RKs and their cognate ligands have been characterized in plants to date, including many that act as pattern recognition receptors (PRRs) to activate pattern-triggered immunity (PTI) upon perception of non- or altered-self elicitor molecules. Intensive study of model PRRs and PTI has led to an emerging paradigm wherein ligand-bound RK complexes phosphorylate and activate associated receptor-like cytoplasmic kinases (RLCKs). These RLCKs in turn function to execute downstream signalling through the direct phosphorylation and regulation of diverse substrate proteins. I will discuss emerging insights into the evolutionary basis of RK/RLCK signalling, including the of kinases and their substrates, as well as the implications for how specificity is encoded in signalling pathways.

Keywords: plant immunity, receptor kinases, phosphorylation, signalling

PLANT EVOLUTION, UC 3225, Friday, May 26th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

A look into the past: Investigate the origin(s) of glyphosate resistance in *Amaranthus palmeri* using herbarium samples

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The selective pressure exerted by the increased usage of herbicides has led to the prevalence of herbicide resistance in weeds. *Amaranthus palmeri* is a major agricultural weed originating from southwestern United States and Mexico but has been expanding further north towards Canada. Several *A. palmeri* populations have been developing resistance to a common herbicide called glyphosate, primarily through EPSPS gene copy number variation. This project aims to answer an evolutionary question regarding glyphosate resistance in *A. palmeri* - did the copy number variation of EPSPS exist as standing genetic variation, or did it evolve rapidly once glyphosate use imposed selection on mutations that increase EPSPS copy number? With no apparent fitness cost associated with maintaining a low copy number of EPSPS, I further hypothesize that variation in EPSPS copy number was maintained at a low frequency prior to the commercialization of glyphosate in 1974, and then spread rapidly as glyphosate use intensified in the United States. To investigate the origins of glyphosate resistance, I collected historic samples from the United States and Mexico from herbaria across the United States and selected samples across three different time periods (pre-1974, between 1974 and 1995, and post-1995), representing a broad geographic distribution. I procure 5mg of leaf tissue from each sample for extraction via a modified CTAB protocol. Once extracted, I will use ddPCR to quantify the copy number of the EPSPS gene. The DNA extracted from these samples will be used for genomic analyses. Glyphosate-resistant *A. palmeri* is one of the most troublesome weeds in the United States, posing a significant threat to the agricultural landscape. With its recent emergence in Canada, understanding the evolutionary mechanisms that drive the rapid evolution of glyphosate resistance in *A. palmeri* will help us effectively manage the spread of *A. palmeri* in Canada.

Keywords: herbicide resistance, rapid evolution, weed management, copy number variation, herbarium samples

PLANT EVOLUTION, UC 3225, Friday, May 26th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Pollinator decline alters selection on floral traits of *Mimulus guttatus*

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Plants experiencing declines in pollinator abundance are expected to follow one of three adaptive pathways to ensure seed set: 1) encouraging visitation from remaining pollinators by increasing the attractiveness of flowers (i.e., outcrossing), 2) relaxing reliance on pollinators by increasing self-pollination (i.e., selfing), or 3) encouraging visitation while simultaneously investing in mechanisms for delayed self-pollination (i.e., mixed mating). To determine whether declines in pollinator abundance select for outcrossing, selfing, or mixed mating, we experimentally reduced pollinator access to arrays of *Mimulus guttatus* in a field experiment. We measured selection on floral traits associated with pollinator attraction (flower size) and propensity for self-pollination (anther-stigma distance). We found that, when compared to plants receiving ambient levels of pollination, experimental plants experienced stronger selection for mixed mating phenotypes (larger flower size, decreased anther-stigma distance). Our results suggest that as pollinators decline, selection may favour plants that can produce highly attractively flowers that can readily self-pollinate if outcrossing attempts fail.

Keywords: pollinator decline, floral traits, selection, *Mimulus guttatus*, pollination

PLANT EVOLUTION, UC 3225, Friday, May 26th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

Is extended floral longevity in response to pollinator decline adaptive? A test with *Lobelia siphilitica*

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Pollinator decline can reduce the quantity and quality of pollination services to plants, resulting in less pollen deposited on flowers and lower seed production by plants. In response to these reductions in pollination services, plants could plastically increase the amount of time that individual flowers are open and functional (i.e., extended floral longevity). To test whether plastically extending floral longevity in response to pollinator decline is adaptive, we manipulated pollinator access to the native wildflower *Lobelia siphilitica*. We used a crossover design to serially expose individual *L. siphilitica* plants to an ambient pollination treatment and a reduced pollinator access treatment that simulated pollinator decline. For flowers exposed to each treatment we measured floral longevity and seeds per fruit and used these data to test whether longevity is plastic and if so whether plasticity increased seed production. We found that *L. siphilitica* flowers exposed to reduced pollination stayed open longer than flowers exposed to ambient pollination, as expected if plants respond to pollinator decline by plastically extending floral longevity. Plants with greater plasticity in longevity produced significantly more seeds per fruit across pollination treatments, indicating that plasticity is adaptive. However, within both pollination treatments flowers that stayed open longer produced fewer seeds, suggesting that plasticity in longevity was adaptive not because extended longevity increased seed production in the reduced pollination treatment, but instead because shorter longevity increased seed production in the ambient pollination treatment. Our results indicate that extended floral longevity in response to pollinator decline is not adaptive, and thus that plasticity in floral traits is unlikely to be an important mechanism of adaptation to declines in pollinator populations.

Keywords: Evolutionary Ecology; Floral trait; Natural selection; Phenotypic Plasticity; Pollination

PLANT EVOLUTION, UC 3225, Friday, May 26th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Random and non-random variation in flower colour along an urban-rural gradient

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Human activity is altering evolutionary dynamics and it is critical that we investigate fundamental evolutionary questions within the contemporary context of urbanization. A longstanding question in evolutionary biology concerns the relative influence of adaptive and stochastic processes on evolutionary change. Selection often underlies variation within species, but stochastic processes can interact with and alter the effects of selection. Spatial patterns in the frequency of heritable traits can inform us about how adaptive and stochastic processes affect the evolution of populations. We investigated patterns in flower colour variation along an urban-rural gradient in the invasive plant *Hesperis matronalis* to investigate the relative influence of adaptive and stochastic processes, as well as human activity. Over two years we performed population surveys across eastern Ontario and analysed the relationship between flower colour diversity, population size, and the amount of human activity around each population. We found that flower colour morph frequency was non-randomly related to human activity levels. The frequency of pigmented flowers increased towards rural populations. This finding suggests that selection may play an important role in this system. We found little evidence of fitness differences between colour morphs but did find that pigmented morphs received more damage from seed predation. Future studies should investigate the agents responsible for this identified urban-rural cline in flower colour variation.

Keywords: natural selection, genetic drift, spatial variation, invasive species, urbanization

EVOLUTION, UC 2105, Friday, May 26th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

Novel climates and competitive ability: a test for adaptive trade-offs between closely related species

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Understanding the causes of species distributions will improve our understanding of how biodiversity is generated and maintained. One limit on species distributions is the cost of adaptation to challenge, which appears to compromise competitive ability. Closely-related dominant and subordinate species share the same preferred conditions, but competition forces subordinates into harsher conditions which dominants can't tolerate. We don't know 1) whether this pattern is broadly generalizable across taxa and 2) whether these costs to competitive ability are the result of a trade-off mechanism. Here, we use the challenge of climate to test across 200 species-pairs of closely-related birds for signatures of a widespread trade-off between adaptation to climate challenge and competitive ability. Climate is a general challenge with direct and indirect consequences for the physiology and behaviour of most species. If adaptation to climate challenge compromises competitive ability, then subordinate species should live in climates which are more divergent from their ancestral climate. Using phylogenetics and ancestral state reconstruction, we estimate the climate (temperature & precipitation) of each species-pair's common ancestor. We assess the severity of climate challenge for the dominant and the subordinate by measuring the percentage-overlap between their modern and ancestral climates. In our preliminary results, we find no support for adaptation to climate challenge compromising competitive ability. Most species appear to live in ancestral-like climates; species that have diverged significantly from ancestral-like climate, however, may show evidence for a trade-off between climate adaptation and competitive ability, but we await larger samples. Climate adaptations appear to be strongly conserved, and other challenges (rather than novel climate) may more significantly affect patterns of competitive ability. Identifying the sources of challenge to which species are most likely to adapt will help us to understand the impacts of anthropogenic challenges on biodiversity.

Keywords: costs of adaptation, competition, climate tolerance, range limits, birds

EVOLUTION, UC 2105, Friday, May 26th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

Scales, plates, and toepads: investigating evolutionary modularity and rates in Anolis scales *Su M and Mahler*
DL

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Biologists have long sought to understand what processes shape morphological diversity. The evolution of modularity, wherein sets of traits are more evolutionarily integrated with each other than with other traits, has been proposed to influence morphological diversification. Modularity can allow subsets of traits to evolve in semi-independent directions and at different rates. Here, I examine whether functional and/or developmental modularity have shaped the patterns of scale variation in Anolis lizards. Anoles are an adaptive radiation exhibiting repeated convergent evolution of morphologically distinct microhabitat specialists (ecomorphs), making them an interesting system for studying evolution. In squamate reptiles such as anoles, scales have many functions, including mechanical protection, crypsis, hydrophobicity, and photoprotection, and are very morphologically diverse. Systematists have recognized the incredible diversity of scale appearance among species, and frequently use scale traits to distinguish between species. However, the evolutionary mechanisms underpinning this diversity are not well-understood. To investigate whether modularity plays a role in shaping scale evolution in anoles, I tested several hypotheses of modularity based on regional differences in scale function and development, and compared evolutionary rates between modules. Using high-resolution photographs of ethanol-preserved specimens, I counted scales from several key body regions, including toepads (modified scales). My analyses found that all modularity hypotheses described the data better than the null hypothesis of no modular structure, though they could not be distinguished from each other. This suggests that developmental and/or functional modularity could indeed be influencing scale evolution, though more inquiry is needed. I also found that modules containing dorsal scales evolved at the highest rate while modules containing toepads evolved at the slowest rate. This is consistent with microhabitat specialization and concomitant toepad evolution occurring early in the anole radiation, and further divergence occurring later within ecomorph categories, involving traits related to macrohabitat differences, such as scales.

Keywords: Adaptive radiation, scales, modularity, reptiles, morphology

EVOLUTION, UC 2105, Friday, May 26th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

Assessment of cryptic Azure butterfly (*Celastrina*) species in southern Ontario using whole genome sequencing

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The species boundaries between cryptic species that differ little in morphology can be assessed using molecular delimitation tools. The taxonomy of *Celastrina* in North America has long been a debate as it contains a series of cryptic species that lack examination in their genomic differentiation. Here I used whole genome sequencing to assess the status of three *Celastrina* species that are proposed to occur in sympatric regions in southern Ontario: *C. lucia*, *C. neglecta* and *C. serotina*. Population structure analyses suggested two putative taxa within my sampled individuals, and fixation index analyses revealed several highly differentiated regions in their genome with other regions being largely homogenized. By relating the emergence dates of sampled individuals to proposed *Celastrina* phenology, I tentatively assigned these two taxa as *C. lucia* and *C. neglecta*. Late generation hybrids were found between the two putative species, suggesting that they do not exhibit complete reproductive isolation. However, I infer that these two putative species remain distinct in sympatric regions in southern Ontario due to the presence of genomic islands under strong selection despite ongoing gene flow. These highly differentiated regions may play a role in the phenological differences observed between the two taxa, potentially contributing to a temporal reproductive barrier.

Keywords: Species delimitation, butterfly, molecular evolution, genomics

EVOLUTION, UC 2105, Friday, May 26th 10am – 12pm

Graduate work & People's Choice Awards

The relationship between dispersal and diversification in birds

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Dispersal may have two opposing effects on diversification: it may inhibit speciation by facilitating gene flow and population genetic connectivity, but it may also stimulate diversification through the process of colonization of new areas. Few empirical studies have investigated these processes at macroevolutionary scales. We investigated the relationship between diversification rates and dispersal ability across all birds. We estimated diversification rates from a newly calibrated phylogeny of birds and dispersal ability from predictors of flight efficiency based on wing morphology. We found a pattern consistent with the intermediate dispersal model in which diversification rates peak at intermediate to low dispersal abilities and lineages with very low dispersal abilities experienced lower diversification rates. However, some lineages with high dispersal ability have experienced relatively high diversification rates. We discuss the potential mechanisms behind these patterns and provide directions for further research on this important process.

Keywords: birds, macroevolution, speciation, flight, wings

EVOLUTION, UC 2105, Friday, May 26th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Sexual dimorphism in *Steatoda nobilis*: how do the sexes differ in phenotypic and life history investment strategies?

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Sexual size dimorphism is an evolutionary puzzle thought to arise because of sex differences in selection on development and phenotype. Many studies focus on how sexual selection is particularly strong on males, though females of species where the sexes mate multiply will undoubtedly experience selection on traits that signal reproductive potential. We examined sex differences in development and mobility in the noble false widow spider *Steatoda nobilis*, a species with female-biased sexual size dimorphism. Reproductive potential in females, including traits such as egg production, correlates positively with mass in most spiders, so females should be under selection to be large. In contrast, males may trade off body size against investment in mobility since they are the mate-searching sex. In our laboratory population, we reared spiderlings on a common diet, and recorded development time across multiple instars. We tested spiderling mobility using a standardized sprint assay that simulates a predatory attack to motivate spiders to run. Although spiderlings are monomorphic at hatching, we predicted that female *S. nobilis* would have more prolonged instars than would males, as females must delay maturity to acquire greater resources between molts. In addition, whereas we expected male speed to be inversely related to size, we expected that females would all have similar, relatively poor running performance as female *S. nobilis* are mainly stationary and typically reside on a single home web. We tested these predictions within and across family lines, and discuss our results in terms of overall patterns, as well as possible heritable variation in sex-specific life history trade-offs.

Keywords: Sexual dimorphism, *S. nobilis*, phenotypes

EVOLUTION, UC 2105, Friday, May 26th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Kin recognition in an invasive perennial plant influences the success of subsequent generations

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The monospecific stand is a prominent feature of plant invasions composed of dense clusters of closely related conspecifics. These stands are highly persistent and considerably contributes to the ecological impacts of plant invasions. Due to the high degree of relatedness, Monospecific stands inherently promote interactions with kin. Thus, kin recognition in plants could potentially contribute to the persistence of these stands. For instance, groups of plants can avoid the tragedy of the commons and improve collective fitness by decreasing competition with kin. While plant kin recognition can influence group fitness, the ability of kin recognition responses to affect plants from future generations remains critically underexplored. In this experiment, I conditioned soil by growing sulphur cinquefoil (*Potentilla recta* L.) in groups of kin or non-kin under two different watering regimes. I then harvested the plants and collected the soil. To measure the effects of soil conditioning, I grew a second cohort of sulphur cinquefoil in conditioned soil. This second cohort was grown varying whether the soil was sterilized and whether the individual was related to the conditioning plants. Soil conditioning by groups of kin significantly increased the survival rate of the response plants. However, relatedness to the conditioning plants negatively impacted size. Overall, both results were dependent on water availability in the soil conditioning phase, and soil sterilization. Collectively, these results show kin recognition responses in sulphur cinquefoil produce long-lasting effects that can impact the success of plants from future generations. This may explain why some plants become invasive while others do not.

Keywords: Kin recognition, plant behavior, plant invasions, monospecific stand, transgenerational effects

EVOLUTION, UC 2105, Friday, May 26th 10am – 12pm

Graduate work, People's Choice Awards

On the improbability of detecting phenotypic trade-offs and a partial solution

Marc T. J. Johnson, Nassrullah Z.

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Trade-offs can explain a broad range of evolutionary patterns and processes in nature, from local adaptation to the evolution of specialization, to why some organisms live fast and die while others live long and prosper. In essence, evolutionary trade-offs help to explain why there is such an amazing diversity of traits and species in nature. Despite their importance in evolution, empirically detecting trade-offs has proven challenging. In this talk we will explore one general question: Why are phenotypic trade-offs so hard to detect? We do this using simulations to explore how variation in the flux of metabolites and branching complexity of pathways influences the strength and direction of trade-offs between metabolites. When we consider the simplest pathway with two metabolites produced from a single precursor – a case where there is a trade-off by definition – genetic variation among individuals in the amount of flux down a metabolic pathway obscures the ability to detect trade-offs. The relationship between the amount of the two metabolites produced from a common substrate can range from strongly negative (i.e., classic trade-off), to moderately positive (i.e., classic synergy), and this variation in outcome depends on whether genetic variation in the total flux of the precursor is left or right skewed, respectively. When we increase the number of metabolites that can be produced from a single precursor, the strength of the relationship between the concentration of any two metabolites decreases with an increase in the number of branches. The strength of trade-offs also decreases with an increase as the number of nested hierarchies within a pathway increases. We propose that increasing complexity to metabolic pathways, which is inherent to all metabolic systems is likely responsible for the difficulty in detecting trade-offs empirically. Importantly, this phenomenon applies far beyond metabolic pathways to include any type of branching pathway, including developmental, neurological and behavioural phenomena. A partial solution to this problem is the implementation of quantile regression, although this statistical method is not a silver bullet. Trade-offs are inherent to many evolutionary processes and patterns, but the complexity of pathways will make most of them difficult to detect.

Keywords: trade-off, evolution, metabolic pathway

URBAN & AGROECOLOGY, UC 3110, Friday, May 26th 2 - 4pm

Ecological engineering for stormwater treatment: a case study in the Idlewood subdivision, Kitchener, Ontario, Canada (July-October 2022)

Kuntz, B.

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Urbanization negatively affects stream ecology, despite the presence of treatment infrastructure. Properly functioning streams maintain their structures, functions, and water quality through the presence of appropriate vegetation, geomorphology, and large woody debris. This case study examined water quality indicators within an integrated stormwater treatment system in the Idlewood Estates subdivision in Kitchener, Ontario that includes both wet and dry stormwater management facilities and an engineered central creek system. The study aimed to determine whether (1) there were differences in water quality (measured as water temperature, the absolute difference between air and water temperature, and dissolved oxygen concentration) after being discharged from wet ponds, dry ponds, underground piping from catch basins, and streams; (2) there were differences in benthic invertebrate (BioMAP) water quality scores in locations under the influence of discharge from different types of stormwater management ponds; and (3) there was a correlation between BioMAP water quality scores and the length of the creek with vegetated banks and floodplain occurring upstream of each sample site. The results suggest that at least in the study areas and during the study period: (1) the type of stormwater management facility has little impact on water temperature in general; but (2) temperature may be buffered by increased shade and/or input from the water table; (3) dissolved oxygen may be higher in areas with more canopy cover; (4) linear distance of creek occurring before the site is positively correlated with WQId score; and that (5) WQId may be predicted as a function of upstream creek distance but that more research is needed. The results suggest that streams should be included in stormwater management designs, should include properly functioning floodplains and riparian vegetation, and that improved water quality is associated with increased stream length.

Keywords: stormwater, water quality, riparian proper functioning condition, benthic ecology, urban stream syndrome

URBAN & AGROECOLOGY, UC 3110, Friday, May 26th 2 - 4pm

Graduate work, Best talk, and People's Choice Awards

Leveraging community science and sustainability to advocate for bird-friendly building design

Brendon Samuels

University of Western Ontario, Department of Biology, London, ON, CANADA

Collisions with building windows, particularly with windows on low-rise buildings, result in tens of millions of bird deaths in Canada each year. Collisions at existing buildings and new building construction can be reduced by applying a bird-friendly design standard (e.g., CSA A460:19) to limit artificial light pollution and incorporate bird friendly design elements such as patterned window films and glass. Given ongoing declines in bird populations, growing awareness of collisions, Canada's renewed focus on conserving biodiversity and recent updates to Canada's Migratory Bird Regulations that outline stricter prohibitions on buildings killing birds, there is great interest in retrofitting building windows to reduce collisions. This presentation will provide an overview of field research completed on campus at Western University and in London, Ontario to document the extent of bird-window collisions occurring locally. I will discuss how data collected through a combination of controlled-effort surveys and community science methods have been useful for a) advocating to campus administration to invest in retrofits of high-risk buildings, b) supporting the municipal government to require bird friendly design in new building construction in applicable by-law, and c) engaging the community to retrofit windows at home. I will review potential barriers to change for individual building retrofits and policy initiatives and suggest ways to frame stronger arguments and alleviate concerns about cost and aesthetics. These case studies and shared resources may be useful for informing strategies to pursue bird collision mitigation with stakeholders such as post-secondary campuses and commercial building operators.

Keywords: birds, urban ecology, conservation, advocacy, sustainability

URBAN & AGROECOLOGY, UC 3110, Friday, May 26th 2 - 4pm

Graduate work, Best talk, and People's Choice Awards

Using a One Welfare lens to see a new perspective of agroecology and its potential in the laying hen industry

Nicholson S, Pearson W.

University of Guelph

Sustainability and animal welfare are often at odds with each other in our conventional egg farms. However, the pressure of the climate crisis as well as the consumer demand for better livestock welfare makes it critical to develop an egg farming system that is sustainable without sacrificing animal welfare. Established literature has argued that embracing food sovereignty through agroecology is a movement that can improve the sustainability of our farm systems as well as improve the wellbeing of the farmers and their community. By using a One Welfare lens, we predict that agroecology with food sovereignty can also improve laying hen welfare as well to create an egg farming system that benefits all three realms. There is a lack of literature that investigates this perspective, so our research uses several global examples of agroecosystems that produce eggs as well as established welfare research to show the potential agroecology has for benefitting laying hen welfare. Agroecosystems could greatly reduce some of the biggest impacts egg farming has on the environment, such as land use and waste management, while also providing several welfare benefits of free-range systems for the laying hens. Utilizing self-governing communities consisting of actors throughout the food systems, including animal welfare researchers, can promote good hen and human welfare by efficiently addressing problems through a bottom-up approach and participatory action methods. Although future research is needed to fill the gaps in our knowledge regarding laying hen welfare in agroecosystems, agroecology and food sovereignty can be a valuable direction to explore to ensure a net-positive gain in laying hen welfare, human wellbeing, and sustainability.

Keywords: Agroecology, Food Sovereignty, One Welfare, Laying Hens, Animal Welfare

URBAN & AGROECOLOGY, UC 3110, Friday, May 26th 2 - 4pm

Honor's thesis work, Best talk, and People's Choice Awards

The role of restoration management and within-year variation on seed bank diversity and composition of designed urban meadows

Grewal D, Xie G, Cormack C, MacIvor J.S

University of Toronto

Urban meadow restoration can rehabilitate wildlife habitat and increase floral biodiversity in formerly degraded spaces such as those beneath electrical power lines where trees are not permitted, and mowing is frequent. Monitoring seed banks can help to evaluate the efficacy of restoration efforts, such as the proliferation of native seed mixes or the reduction in spontaneous, non-native, or invasive species, through the emergence of species lying dormant in soil. Using soil seed banks, we investigate how above-ground restoration management throughout an extensive hydro-corridor in Toronto, Canada impacts seedling recruitment of native seed mixes, as well as spontaneous and non-native (including invasives) plant seedlings. Soil cores were taken in spring and in fall from 81 plots across nine urban meadow locations undergoing three different restoration stages. The soil samples were transplanted into greenhouse trays and surveyed for 100 days using the seed bank emergence method. A total of 11,373 seedlings representing 93 species of forbs, grasses and woody plants were surveyed. The native *Solidago* spp. (n=984) and *Rudbeckia hirta* (n=944), and the non-native, *Verbascum thapsus* (n=988) and *Chenopodium album* (n=873), were the most abundant species across all three regimes and locations. Across restoration stages and sampling periods, we found that restored meadow habitats (including unmown and mown regimes) had at least 30% more species, 3 times more seeds, and were 9 times more likely to contain a majority of seed mix species compared to tilled habitats. We found that twice as many species germinated in fall with 1.5 times more seedlings emerging compared to spring. There were also an increased odds of having a higher proportion of invasive species by a factor of 1.5. Our findings demonstrate the practical implications of seed bank dynamics across relevant restoration stages used by urban restoration practitioners, and the optimal time to evaluate potential recruitment of native and non-native seedlings is in the fall season.

Keywords: Urban Meadow, Seedbank

URBAN & AGROECOLOGY, UC 3110, Friday, May 26th 2 - 4pm

Honor's thesis work, People's Choice Awards

Automation of green roof vegetation cover using machine learning and a comparison of digital and thermal imaging

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Post-analyses of field photographs using digital and thermal cameras have become increasingly popular as the modern non-invasive approach for vegetation cover analysis. Field photographs could be modified through image processing software for object-based image analysis (OBIA) that differentiates pixels representing vegetation from the backgrounds. ImageJ is an open-sourced image processing software that incorporates features and machine learning plugins with the potential to conduct automation and semi-automation workflow for OBIA. In this study, we surveyed the vegetation cover of an extensive green roof using digital and thermal imagery. The vegetation cover values were evaluated using three methods: traditional manual segmentation based on a visual examination (MS), ImageJ Colour Threshold (CT) and Trainable Weka segmentation (TWS), which is a supervised machine-learning classification plugin available in FIJI (a distribution of ImageJ). Traditional manual segmentation based on visual examination was used as a reference standard. A significant correlation was found between the cover estimation from CT and TWS methods relative to MS and between the cover estimation on the thermal image to the visual image. TWS showed an overestimated vegetation cover on thermal images but underestimated values on visual images. The performance of CT was closer to manual segmentation due to the manual input of threshold values. The species diversity, stress response, and vegetation physiology could influence the performance of supervised machine-learning tools. Both digital and thermal imaging techniques may provide complementary results and reveal unique information regarding the functioning of the green roof. This short talk will offer some recommendations for obtaining field images and guides on using ImageJ and FIJI features to conduct OBIA on digital and thermal images of green roof modules.

Keywords: Green roof, ImageJ, Vegetation Cover, Machine Learning, Thermal Imaging

URBAN & AGROECOLOGY, UC 3110, Friday, May 26th 2 - 4pm

Graduate work, People's Choice Awards

Canadian Bat Box Project

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University of Waterloo

Canadian Wildlife Federation

Wildlife Conservation Society Canada

ACAP Saint John

Bat boxes are used to create habitat and mitigate habitat loss for bats, but few data are available on the success of these structures, particularly in Canada. The Canadian Bat Box Project is a 3-year national community science project we started in 2021. The overarching goal of our study is to understand bat box use at regional scales in relation to design, microclimate, and mounting conditions. We investigate whether bat boxes overheat in Canada (> 40°C) and if so, what box designs overheat under what mounting conditions in which regions. Willing participants install temperature loggers in their bat box and monitor occupancy. Bat box owners who have occupied boxes collect guano for genetic identification of bat species and swab the interior roosting chambers for *Pseudogymnoascus destructans*, the fungus that causes white-nose syndrome. Almost 1400 participants signed up for the project, with 807 providing useable data on 1312 boxes across all provinces and two territories. Of those boxes, 36.6% were used by bats at time of monitoring or had records of past use; most occupied bat boxes had < 10 bats. Our preliminary results indicate that larger, older boxes attached to buildings are most successful, and black boxes on poles with no vents are most likely to overheat. Several boxes reached temperatures over 50°C. Some bat boxes sampled in spring tested positive for *P. destructans*, and work is ongoing to determine if the fungus is viable in these structures. Summer 2023 is the final field season for the project. Our results can help improve recommendations for use of bat boxes as compensation habitat.

Keywords: citizen science, bat boxes, artificial roosts, bat conservation, microclimate

URBAN & AGROECOLOGY, UC 3110, Friday, May 26th 2 - 4pm

Graduate work, Best talk, and People's Choice Awards

Assessing the Spatiotemporal Abundance of Soybean Gall Midge in Soil from Infested Fields

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University of Nebraska-Lincoln, Department of Entomology, Lincoln NE, US

Soybean gall midge (SGM), *Resseliella maxima* Gagné (Diptera: Cecidomyiidae), was identified in 2019 as a new species injuring soybean in four midwestern U.S. states. Heavy infestations can result in the total yield loss in the first 30 meters near the field edge. Larval feeding under the plant epidermis causes dark discolorations and necrosis of the affected areas. After feeding period, larvae leave the plant to form a cocoon and pupate in the soil. Despite the severity of SGM attacks, there are limited management tactics due to knowledge gaps. To address knowledge gaps in SGM biology, a three-year field study was conducted to investigate the spatiotemporal abundance of SGM in soil from infested fields. Undisturbed soil cores (12 cm deep) were collected from four infested fields in 2019, 2021, and 2022 to access the distribution of SGM in the soil profile. Cores were divided into two cm layers and processed individually to separate cocoons from the soil prior to counting. Moreover, deformed soil samples were collected weekly to access the temporal dynamics of SGM in the soil in 2021 and 2022. A brine flotation technique was used to separate SGM from the soil in both samples. Results showed the greatest abundance of immatures (96.2%) was in the first six cm of soil depth. The majority (75.5%) of those were in the top two centimeters. The temporal access results showed that SGM population in the soil varied between fields and collection dates during each growing season. The findings here are crucial for understanding the spatiotemporal dynamics of SGM in the soil. This knowledge enables future studies and guides development of management practices like tillage to disturb its biology, mitigating its damage to soybean.

Keywords: Overwintering, cocoons, pupae, larvae, brine

HABITAT & DISPERSAL, UC 3225, Friday, May 26th, 2 – 4pm

Honor's thesis work, Best talk, and People's Choice Awards

Heat stress experienced during metamorphosis: Impacts on subsequent pheromone mediated mating in the true armyworm (*Mythimna unipuncta*) (Lepidoptera: Noctuidae)

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It is no doubt that insects will be affected by long-term effects of climate change, as well as by the increase in the short-term extreme weather events, such as heatwaves. Behavioural changes may reduce the impact of extreme weather events but in holometabolous insects there are immobile developmental stages – such as eggs and pupae – where this is not possible. In a previous experiment examining the effects of exposing several different developmental ages of true armyworm (*Mythimna unipuncta*) pupae to 30°C for 48 hours, I found negative effects on reproductive success of populations, with both sexes being affected. Earlier stages of metamorphosis also proved to be more susceptible to heat stress. Furthermore, there was a decline in incidence of mating when either sex had been exposed, suggesting effects on the pheromone-mediated mating system. This study looks at the effects of heat stress on i) the female calling behaviours accompanying pheromone release, ii) male and female sex pheromone titers via gas chromatography, iii) male fluctuating asymmetry and iv) the responsivity of male and female antennae to sex pheromone of the opposite sex via electroantennography. If results show that short-term heat stress experienced during metamorphosis alters pheromone-mediated communication in the true armyworm, this could be of considerable importance within the context of climate change as pheromones are used in many pest management programs and other species may experience similar outcomes. This talk will present on the preliminary results of female calling behaviours, and male fluctuating asymmetry and their impacts on mating following pupal heat stress.

Keywords: true armyworm, sex pheromones, calling behaviour, fluctuating asymmetry

HABITAT & DISPERSAL, UC 3225, Friday, May 26th 2 – 4pm

Honor's thesis work, Best talk, and People's Choice Awards

The sweet smell of success: Habitat specific foraging challenges may shape olfactory traits in pumpkinseed sunfish

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Our understanding of the sensory ecology of visual organisms often overlooks other sensory functions, such as olfaction. However, the taxonomically widespread presence and diversity of olfactory organs across animals suggests that olfaction is likely important to most animals. We explored how olfaction may vary between littoral and pelagic lake ecotypes of pumpkinseed sunfish (*Lepomis gibbosus*) by testing for olfactory trait differences between ecotypes. The littoral habitat is physically complex compared to the simple open water column of the pelagic habitat. Littoral pumpkinseed feed on spatially dispersed and cryptic benthic macroinvertebrates pumpkinseed, while pelagic pumpkinseed feed on smaller and more abundant, floating zooplankton. We hypothesized that ecological conditions in the littoral habitat favours olfactory traits that assist fish predators in locating dispersed cryptic prey. Olfactory traits were analyzed at the organ and tissue scale by the number of lamellae, the surface area of the peripheral olfactory organ and neural cell density in layers of the olfactory epithelium that correspond to the locations of crypt, microvillous and ciliated olfactory sensory cells. Littoral pumpkinseed had significantly more lamellae than pelagic pumpkinseed and a higher crypt olfactory sensory neuron density. Combined, these differences should increase the total number of olfactory receptors over the entire olfactory epithelium in littoral fish and suggest that functional olfaction may be habitat-specific in these pumpkinseed. It remains unknown how these differences affect olfactory performance and the specific ecological contexts in which olfaction is used.

Keywords: Olfaction, ecological influences, pumpkinseed sunfish, sensory epithelium, sensory neurons

HABITAT & DISPERSAL, UC 3225, Friday, May 26th 2 – 4pm

Graduate work, Best talk, and People's Choice Awards

Could the use of different species of milkweed as larval hostplants influence the fall migration of Monarchs?

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In insects, the quality of the larval diet can significantly affect adult parameters, including mass, morphology, and fecundity. In addition, it can influence development time, shifting adult flight periods. For migratory species, this is particularly important, as earlier emerging fall adults may experience environmental cues that stimulate reproduction instead of migratory behaviour, resulting in an evolutionary dead end. The monarch butterfly (*Danaus plexippus*) exclusively exploits milkweeds (*Asclepias* spp.) as their larval host plant. While studies have examined the effects of different species of larval host plants on summer generations, little attention has been given to the migratory fall generation. To study how larval host plant species may affect traits which can influence a timely departure and the capacity to undertake a long-distance migratory flight, I reared monarch butterflies in 2022 on three species of milkweed: common milkweed (*A. syriaca*), swamp milkweed (*A. incarnata*), and butterfly milkweed (*A. tuberosa*), using both measured leaf cuttings and whole plants outdoors under summer and fall conditions. I compared the effect of larval host plant on food consumption and assimilation, as well as on development time, adult body mass, wing surface area, and wing loading. While initial results indicate that larval host plant species may influence important traits such as development time and wing size, small sample sizes due to a smaller than usual immigrant population and high mortality in the field prevent me from drawing any strong conclusions. I will be repeating the experiment in 2023, increasing the number of individuals used.

Keywords: Ecology, monarch butterflies, milkweed, migration, larval diet

HABITAT & DISPERSAL, UC 3225, Friday, May 26th 2 – 4pm

Graduate work, Best talk, and People's Choice Awards

Influence of prey density on spatial and temporal patterns of kills by Canada lynx

R. Derbyshire, E. Studd, A. Menzies, Y. Majchrzak, M. Peers, S. Shiratsuru, M. Humphries, S. Boutin, D. Murray

Trent University

Thompson Rivers University

University of Guelph

University of Alberta

Memorial University of Newfoundland

University of Wisconsin Madison

McGill University

University of Alberta

Trent University

A re-occurring question in ecology relates to the balance between how and where predators hunt and kill prey and whether these patterns are driven simply by prey abundance versus other factors in the environment, like predator foraging behaviour or prey vulnerability. Although foraging theory predicts that predators should select habitats with the highest prey densities, other factors such as the absolute abundance of prey across the landscape, prey behavioural responses to predators, and how these variables change over space time can profoundly impact predator behaviour. We investigated the drivers of snowshoe hare (*Lepus americanus*) kills by Canada lynx (*Lynx canadensis*) during a drastic cyclic decline in hare abundance to test how prey abundance interacts with other environmental variables to predict lynx hunting behaviour. Based on >1000 hare kills by 50 lynx during an 8-fold decline in hare density over four years, we find that a suite of spatial and temporal covariates, including lynx space use, habitat-specific measures of hare relative abundance, vegetation characteristics, and year/season, are the best predictors of lynx kill site selection. In particular, our results suggest that lynx space use, not prey relative abundance or vegetation characteristics, is the strongest predictor of kill site location, but this effect was diminished in later years of the study when hare populations were low. Our work highlights that predator responses to prey may not be strictly driven by either prey density or catchability, which is an important consideration when attempting to understand and predict the effects of global environmental change.

Keywords: Predator-prey, behaviour, spatial dynamics, population cycles, Canada lynx

HABITAT & DISPERSAL, UC 3225, Friday, May 26th 2 – 4pm

Graduate work, People's Choice Awards

Allocation of stored fatty acids during flight in Monarch Butterflies (*Danaus plexippus*): Implications for the importance of en route migratory nectaring sites

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Many insect species are migratory, but migration is energetically costly, leading to a trade-off between migration and subsequent reproduction. This trade-off can be managed by differentially allocating resources to these two life-history processes, thereby reducing overlapping nutritional requirements for each. Of particular importance to allocation of resources to both migration and reproduction are essential and non-essential fatty acids. How different ecological conditions experienced by individuals affect differential allocation of nutrients has not been well explored, especially in insects. Our goal was to evaluate how reproductive and migratory rearing conditions affect the source and allocation patterns of fatty acids used during flight in the monarch butterflies (*Danaus plexippus*). We used diets manipulated isotopically to trace origins and use of stored lipids and used chromatographic analyses to determine fatty acid composition. Five-day old monarchs that had been reared in summer or fall (migratory) conditions were force flown for different periods (0-6h) after which samples of the fat body were analysed. Rearing conditions did not affect fatty acid accumulation, however patterns of use during flight differed with essential fatty acids being used less (and hence conserved) under fall compared to summer conditions but larval and adult derived lipids were used indiscriminately. We determined that frequent stopovers for nectar will limit the capacity of monarchs to conserve EFAs. Anthropogenic landscape changes causing a decrease in nectar availability will play a significant role in the migratory success of monarchs in the Anthropocene. In addition, nectar quality changes due to climate change may also play a role in successful refuelling of the monarch butterfly.

Keywords: fatty acids, nectar availability, migration, trade-off, carbon-13

HABITAT & DISPERSAL, UC 3225, Friday, May 26th 2 – 4pm

Honor's thesis work, Best talk, and People's Choice Awards

Daily movement and habitat-use of lake sturgeon (*Acipenser fulvenscens*) in south-eastern Lake Superior

Raegan Davis¹, Timothy Hain¹, Thomas Pratt², and Lisa O'Connor²

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²Department of Fisheries and Oceans Canada, Sault Ste. Marie ON, Canada

Lake sturgeon (*Acipenser fulvenscens*) are a large and long-lived species of freshwater fish native to the Laurentian Great Lakes - St. Lawrence River, Hudson Bay, and Mississippi River watersheds that reach sexual maturity later in life and spawn intermittently. The Great Lakes- Upper St. Lawrence populations were listed as Endangered in 2017 by the Committee on the Status of Species at Risk in Ontario, which has increased the urgency to better understand lake sturgeon movement ecology. In this study, I used acoustic telemetry to quantify movement and habitat use of 17 adult and 16 juvenile lake sturgeon in south-eastern Lake Superior from July 1st, 2016 to August 20th, 2017 using 40 acoustic receivers. A mean daily location was determined for each fish to calculate mean daily distance travelled, mean variance of daily distance travelled, and to assign fish to a specific waterbody location. In general, larger lake sturgeon moved greater distances than smaller lake sturgeon and had more variance in their mean daily movement. Adult lake sturgeon travelled more than juvenile lake sturgeon in the spring, summer, and fall. Adults also used areas with depths less than 15.5 m significantly more than juveniles who used areas with depths greater than 20.5 m more often. This study directly compares the difference in movement and habitat use of adult and juvenile lake sturgeon in a large aquatic system across different seasons. This research highlights the importance of studying individual lake sturgeon populations to create conservation management plans that are catered to the unique movement behaviour of different lake sturgeon populations. I recommend increasing the size of the acoustic array in south-eastern Lake Superior to better capture their large-scale movements between embayments'

Keywords: Lake sturgeon, movement, acoustic telemetry, GLATOS, conservation

HABITAT & DISPERSAL, UC 3225, Friday, May 26th 2 – 4pm

Graduate work, Best talk, and People's Choice Awards

Androgens and movement: effect of experimental testosterone on migration behaviour of song sparrows

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Testosterone levels are correlated with latitudinal migration distance in song sparrows (*Melospiza melodia*). However, it is unclear whether testosterone plays any direct causal role in shaping seasonal migration behaviour, or if instead both testosterone and migration distance are related to other aspects of individual phenotype. We ran a combined captive and field study to test for direct effects of elevated testosterone on autumn migratory behaviour in adult male song sparrows. Initially bringing the sparrows into captivity, we housed them in individual holding cages and adjusted the light-dark cycle once a week to match natural daylength. During the natural period of autumn migration for the species, subcutaneous beeswax testosterone implants elevated levels of circulating testosterone for a period of one month in experimental birds, to a level comparable to breeding males in spring. Blank beeswax implants were used for controls. We video-recorded birds nightly under infrared illumination for one week following the implant surgery and used movement tracking software to measure migratory restlessness and assess the effect of testosterone on autumn migratory behaviour. Preliminary analyses of the video footage do not support an effect of testosterone on migratory restlessness. One-week post-surgery, the sparrows were fitted with radio tags and released at the Long Point Bird Observatory on the Lake Erie shoreline. Through a combination of hand tracking and monitoring with the Motus network, all birds were tracked until departure on migration. Survival analysis shows that testosterone-treated birds delayed autumn departure from the site. This correlation between testosterone levels and migration timing provides evidence for an additional axis along which testosterone may play an important role in shaping migratory behaviour.

Keywords: Testosterone, migratory restlessness, departure timing, hormone implant, *Melospiza melodia*

ECOLOGY I, UC 2105, Friday, May 26th 2 – 4pm

Graduate work, Best talk, and People's Choice Awards

Long-term effects of silviculture on below ground carbon stocks in boreal forest sites varying in soil texture in Ontario, Canada

Deighton H

University of Western Ontario

The boreal forest has historically been regarded as one of the largest terrestrial carbon (C) sinks. However, increased soil organic matter (SOM) decomposition by microbes due to silviculture practices such as clear-cut harvesting and site preparation may exacerbate the effects of climate warming and shift boreal forests from being C sinks to C sources. The strength of the protection of soil C from SOM decomposition is driven mainly by soil texture, with clay soils expected to be more resistant to decomposition and have a higher C storage potential than sandy soils. We used an established stand-scale, full-replicated experimental study to identify how silviculture influences C dynamics at three boreal forest sites varying in soil texture in Ontario, Canada. Each site was surveyed for forest floor and mineral soils pre-harvest and 5-, and 14-years post-harvest. We found that C stocks did not significantly differ between silvicultural treatments over time; however, C sequestration differed across soil textures in the long-term. At the sand-dominated site, C stocks were lower in all treatments at year 14 compared with year 5 values, and at the clay- and silt-dominated sites, C stocks were higher at year 14 compared with year 5 values. This work improves upon our understanding of how silviculture practices affect belowground C stocks in the long-term and demonstrates that soil texture influences the magnitude of these effects.

Keywords: soil carbon sequestration, soil organic matter decomposition, silviculture, harvesting, boreal forest

ECOLOGY I, UC 2105, Friday, May 26th 2 – 4pm

Graduate work, People's Choice Awards

Testing a core assumption of trait-based ecology: Are plant traits good predictors of individual performance?

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Background, Questions & Methods: While the trait-based approach has taken an increasingly central role in plant ecology, some of its fundamental assumptions remain poorly tested. At its very core, functional ecology is based on the assumption that the plants traits commonly measured are important in determining the fitness of organisms in their environment. Yet, the rare studies relating traits to performance find weak evidence for this. Testing this core assumption, we ask: ‘Are functional traits are strong predictors of the performance of individual plants?’ We also explore the importance of intraspecific trait variation by asking ‘Do individual trait values outperform species mean trait values?’ On each of 360 saplings from 24 co-occurring temperate tree species, we measured plant performance as the relative growth rate of basal area, 18 commonly-measured functional traits affecting five vital physiological function, and 19 environmental variables collapsed into five principal components. Using gradient boosted models, we predicted individual performance from functional traits, environmental variables and covariates (age and species identity). **Results & Conclusions:** Preliminary analyses find that the 18 most commonly measured traits are mild determinants of relative growth rate in this system; the GBM explained 36% of the variance in the training dataset and 5% in the test dataset. The low explanatory power suggests that commonly measured traits are missing important aspects of ecology. The discrepancy among training and testing data indicates that the model has some explanatory power, but little predictive power. This suggests that trait-environment-performance relationships are highly variable among individual trees and that the relationships found here are unlikely to hold in other systems. The model retained all traits and contained a very large number of interactions, indicating that the effect of individual traits on performance depend on other traits and on the environment. Further, using species mean trait values instead of individual trait values decreased the predictive power of the model to 15%, indicating that capturing intraspecific trait variation is essential to predict individual performance. In summary, we find that the most commonly measured traits are mild predictors of growth rate in this system, that considering many traits and their interactions is necessary to predict individual performance, and that individual-level measurements cannot be substituted with species mean values.

Keywords: plant traits; temperate saplings; gradient boosted models; relative growth rate

ECOLOGY I, UC 2105, Friday, May 26th 2- 4pm

Graduate work, Best talk, and People's Choice Awards

Do controlled environments provide ecologically relevant estimates of symbiotic interactions? A case study with plants and arbuscular mycorrhizal fungi

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Symbioses involve the exchange of services between distinct organisms, often enabling partners to overcome many environmental challenges. The arbuscular mycorrhizal (AM) symbiosis occurs in ~70% of all plants and across many environmental conditions. In this symbiotic relationship, AM fungi provide many essential resources and services to plants in exchange for plant sugars. However, depending on the plant's environmental context, plant benefits may not outweigh the costs of the AM symbiosis. The evidence suggesting that AM fungi alter plant growth, typically in a beneficial way, has been derived predominantly from experiments in controlled greenhouse environments. Consequently, it is not known whether AM fungi produce the same plant responses in the field, where plant communities exist in more variable and stressful environments. We tested whether plant responses to AM fungi differ between greenhouse and multiple field environments using the same experimental design for several common grassland species. We found that while AM fungi benefited plant growth in a greenhouse environment, AM fungi reduced plant growth in the field. We also found that among plant species, the growth responses in the greenhouse were still positively correlated to one of the field environments but not the other. These results suggest that mutualistic effects of AM fungi on plant growth may be exaggerated by constructed greenhouse environments, and that parasitic effects may be more common in field environments. Overall, assessment of symbiotic interactions made in controlled environments should be treated with caution if responses differ in magnitude and direction in more ecologically realistic environments.

Keywords: symbiosis, mycorrhizal fungi, context dependence, plants, field

ECOLOGY I, UC 2105, Friday, May 26th 2 – 4pm

Honor's thesis work, Best talk, and People's Choice Awards

Are high elevation habitats a refuge from biological control for invasive spotted knapweed (*Centaurea stoebe*)?

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Species interactions vary in space, and what controls this variation is a central problem in ecology. Biological control aims to reduce population growth of invasive species (hosts) by engineering their interactions with specialist natural enemies (agents), yet biocontrol is often inconsistent: the host is controlled in some habitats or regions but not others. We evaluated the mechanisms underlying inconsistent biocontrol using spotted knapweed (*Centaurea stoebe*) and its capitula feeding weevil control agents (*Larinus* spp.). Existing survey data suggests that weevil seed predation decreases with elevation, possibly because the abundance and/or activity of weevils declines towards the high elevation distribution of its host. We quantified knapweed abundance and seed production as well as weevil occurrence and seed predation at 28 sites along three elevation transects in southern British Columbia, Canada. Weevil occurrence and seed predation declined with increasing elevation. Accordingly, knapweed seed production increased with elevation, most likely due to a lack of specialist seed predators at higher elevations. However, knapweed density did not increase with elevation, and was not significantly correlated with seed predation or weevil occurrence. These results suggest that knapweed is partially released from weevil control at high elevations but other historical or contemporary abiotic or biotic factors primarily influence knapweed abundance.

Keywords: invasive species, species interactions, biological control, geographic distribution, plant-herbivore interactions

ECOLOGY I, UC 2105, Friday, May 26th, 2 – 4pm

Honor's thesis work, Best talk, and People's Choice Awards

Using paleolimnology to assess long-term environmental change in lakes from Killarney Provincial Park and Sudbury, Ontario, Canada

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For over a century, Sudbury was a major source of sulphur dioxide, degrading terrestrial and aquatic ecosystems in the surrounding region. In the 1970s, emissions were drastically reduced due to concerns over widespread environmental damage from smelting operations. Killarney Provincial Park (KPP) is located 60 km southwest of Sudbury in northeastern Ontario, Canada. Previous studies have demonstrated that KPP lakes were also impacted by Sudbury smelting emissions, but little is known about how present-day conditions relate to pre-industrial conditions or the effects of climate. Here, I used a multi-proxy paleolimnological approach to examine ecological change in five lakes over the past ~200 years in Sudbury (Baby, Tillie and Crooked lakes) and KPP (Ruth-Roy and Johnnie lakes). My overall goals were to: (1) infer past ecological conditions from diatom assemblages, whole-lake chlorophyll-a (chl-a) and lake water dissolved organic carbon (DOC) concentrations; (2) explore patterns of potential acidification recovery over the past several decades; and (3) compare my changes to recent monitoring and meteorological data in my focal lakes. Distance from smelting operations, in combination with physical lake characteristics (i.e., water residence time, local geology), likely contributed to differences in the magnitude of change observed in paleolimnological indicators. In general, the acidification period was characterized by declines in small circumneutral taxa (i.e., *Discotella* spp., *Achnanthidium* spp., and *Aulacoseira* spp.), inferred chl-a and inferred DOC, concurrent with increased abundances of acidophilic diatoms (i.e., *Fragilariforma acidobiontica*, *Eunotia* spp., *Tabellaria flocculosa* and *Asterionella ralfsii*). After ~1970, only limited recovery in diatom assemblages was recorded, although inferred DOC and chl-a levels increased, indicating biological recovery is lagging behind chemical recovery and/or that the ecological trajectory has been influenced by other large-scale environmental changes. Given the impacted nature of all my study lakes, a clear climate signal in the recent diatom assemblages was not as evident as often noted in pristine Boreal lakes. This study demonstrates the importance of understanding the past to better assess ecosystem recovery and future ecological trajectories.

Keywords: Paleolimnology, diatoms, aquatic ecology, acidification

ECOLOGY I, UC 2105, Friday, May 26th 2 – 4pm

Graduate work, Best talk, and People's Choice Awards

Evidence of deterministic community assembly from fossil diatoms in ancient Lake Towuti, Indonesia

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Ecologists have tried to ascertain whether there are rules of assembly which determine community composition and relative abundance. Despite the fact that many classical studies viewed diatoms as being opportunistic and stochastically-distributed, more recent studies have demonstrated that diatoms are in fact tracking changes in their environment, and are therefore deterministic in their distribution. To resolve whether the drivers in diatom community composition and abundance over extensive periods of time were stochastic or deterministic, we analyzed the diatom fossil records from deep drilling cores from ancient Lake Towuti (>1 My old). The fossil record of Lake Towuti contains two separate growths of a planktonic diatom community which persisted for ~50 kyr each. These growths were separated by ~100 kyr-period of being mostly absent. Each growth was dominated by the same five provisional taxa of *Aulacoseira*. The aim of this study was to investigate whether the taxa of *Aulacoseira* were deterministically or stochastically distributed within these two historic growth periods. We used stratigraphically constrained hierarchical clustering analysis (CONISS) to identify stratigraphic zones with similar diatom assemblages and nonmetric multidimensional scaling (NMDS) to determine changes in *Aulacoseira* species composition through time. Our results show that the upper sections of both layers were dominated by *A. towutiensis* (provisional name) (67.9%–±16.9). The lower sections of both layers were dominated by either *A. sumatrensis* var. *rectangularis* (provisional name) (64.5%–±26.7%) or *A. sumatrensis* var. *elongata* (provisional name) (56.0%–±14.7). The CONISS and NMDS analyses demonstrate similar successional patterns in species composition in both upper and lower planktonic layers. The repeated pattern in community composition after extensive periods of time (~100 kyr) provides evidence that the diatom communities in the planktonic layers were regulated primarily by deterministic processes, likely related to lake mixing patterns.

Keywords: Diatoms, primary production, community ecology, fossil

ECOLOGY I, UC 2105, Friday, May 26th 2- 4pm

Honor's thesis work, Best talk, and People's Choice Awards

The effect of vegetation maintenance on avian species richness in public parks

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Globally, urbanization is increasing and the availability of suitable natural habitat for wildlife is decreasing. Greenspaces in urban environments can provide habitat for wildlife as well as essential services that ecosystems provide to the overall well-being of human populations. However, the habitat suitability of urban parks for wildlife may depend on their vegetative structure and maintenance. One way to assess the overall health of an ecosystem is to observe the diversity of the bird communities within them. In this study, I used presence and absence data from a citizen science database, eBird, to test the relationship between avian species richness and the grassland maintenance regime, as well as total area, in public parks in London, Ontario during the Ontario breeding season. Vegetation maintenance was designated as 'maintained' for mowed grasses, and 'naturalized' for un-mowed wild grasses. The maintenance status of the grassland area had no significant correlation with the avian species richness, but park area did have a significant, positive correlation with species richness for each study site. However, many of the species observed prefer forest habitat over grassland, which could contribute to the lack of a significant relationship between grassland maintenance regime and species richness. I suggest that if city planners wish to maximize biodiversity, they should prioritize conserving greenspaces that are large and protected from negative urbanization impacts.

Keywords: Avian species richness, biodiversity, vegetation maintenance, urban ecosystems, ecosystem health

ETHOLOGY I, UC 2105, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Costly traumatic insemination in bed bugs and the factors influencing female avoidance

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Bed bugs are among the most infamous examples of sexual conflict as they exhibit obligate traumatic insemination. To understand how females behaviourally respond to traumatic insemination, we conducted a series of three experiments. First, we tested whether traumatic insemination negatively impacts female fitness by comparing the lifetime reproductive output of females inseminated at high, natural rates vs. low, but sufficient rates. We found that daily insemination drastically reduced female fitness. Next, to examine if sexual history altered female tendency to avoid males, we quantified avoidance behaviour of females receiving six successive daily inseminations. We found that female evasion rates increased with their number of prior inseminations. Lastly, to further examine the factors that influence female avoidance behaviour, we used network analysis to compare the sexual and social behaviours of previously isolated vs. socialized females in a complex, naturalistic setting. Preliminary analyses show that social experience does not improve female social and sexual competency as socialized females did not show a greater tendency or ability to avoid costly traumatic insemination.

Keywords: Sexual conflict, bed bugs, traumatic insemination, social network analysis

ETHOLOGY I, UC 2105, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Fear of predators has enduring effects on the brain and behaviour in wild animals

Lauren Witterick, Matthew Chung, Kate Robinson, Scott MacDougall-Shackleton, Michael Clinchy, Liana Zanette

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Predators affect prey by killing them, but the fear of being killed also can have profound effects. Responding to predation risk is critical for prey to survive, however trade-offs from anti-predator behaviour can carry costs. Our research integrates biomedical research examining the enduring effects of fear on the brain with fear-induced behavioural changes documented by ecologists in the field, to understand the mechanisms leading to the demonstrated population and community level responses to fear. To experimentally test the enduring effects of fear on the brain and behaviour we manipulated perceived predation risk using auditory playbacks of predators or non-predators in wildlife. We conducted a series of manipulations through increasingly natural conditions, starting with acoustic isolation on birds in the lab, to semi-natural conditions on birds outdoors, to free-living meadow voles. We found that fear had enduring effects on behaviour and brain regions associated with fear processing, but that the responses varied between laboratory, semi-natural conditions, and free-living wildlife. In the lab, we found that predator exposure led to enduring anti-predator behavioural responses, and signatures of enduring brain activation signalling a continued sense of heightened alert in black-capped chickadees. In semi-natural conditions we found immediate, but not enduring, effects of fear on anti-predator behaviour, and enduring neuronal changes in brown-headed cowbirds in the spring, but no enduring effects on brain activation in an experiment on black-capped chickadees in the fall. When we removed captivity from the equation, we found enduring effects on activation and neurogenesis in free living meadow voles.

Keywords: fear, perceived predation risk, PTSD, neurogenesis

ETHOLOGY I, UC 2105, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Heads up! Social vigilance behavior in American crows

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Binghamton University, Department of Biological Sciences, Binghamton NY, USA

American crows are the black-clad rulers of a city's skies and can be spotted in most North American cities. Their abundance in cities has increased in the last decades, suggesting they benefit from living near humans. Recent literature shows that these urbanized species can have behavioral adaptations to better exploit anthropogenic resources and maximize their benefits and fitness in urban areas. While individual-level behavioral adaptations are an active area of research, adaptations of social behaviors and their contribution to the success of urbanized species are underexplored. Last summer, we performed observational trials in green and commercial areas selected from a Brock community science initiative (<https://crowkemon.weebly.com/>) and found that American crows have modified social vigilance behavior in urban settings. We found that the presence of a sentinel, a prominently perched individual that exhibits constant vigilance, and the type of environment in which they forage had a significant effect on the duration of behaviors performed by foragers, but not their pecking rate or the proportion of time allocated to each behavior. A significant interaction effect was also observed on bout duration. Our results demonstrate that, in the presence of a sentinel, American crows in commercial areas increase the duration of bouts of alert and foraging behaviors but decrease them in green areas. This suggests that their reliance on sentinels differs and reflects the individual's perception of their foraging environment. A riskier, more unpredictable environment could trigger a need for increased vigilance. Our findings could be insightful in understanding how social species respond to urbanization, and how these responses can benefit synurbanic species.

Keywords: Social behavior, Urbanization, Foraging, Vigilance, synanthropic

ETHOLOGY I, UC 2105, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Vibratory signalling patterns in male *Steatoda nobilis* during courtship displays

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In web-dwelling spiders, web-borne vibrations are thought to be the primary form of communication during mating interactions. As part of a comparative study of vibrational communication in cobweb spiders, we have examined the structure of male vibrational courtship signals in the Noble False Widow (*Steatoda nobilis*) and their relationship with female receptivity and male mating success. We conducted mating trials in which females were paired, independently and in sequential order, with two males. Male courtship, female acceptance and copulation behaviour was recorded on video. Male web-borne vibrational courtship signals were recorded using two laser Doppler vibrometers (LDV), and signalling was analyzed using synchronous video and vibrometry recordings. Similar to some previous studies on theridiid spiders, males produced multiple vibrational signals during courtship interactions. We recognized three distinct signal components. Abdominal vibrations are produced by rapid oscillations of the abdomen. Web plucking signals are produced when males grasp and release individual strands of the web using their second pair of legs. Jerk signals are the result of rapid dorsoventral movements of the male's entire body. The stereotypical signal sequence started with jerking, followed by abdominal vibrations, and lastly, the plucking. The timing, sequence, and duration of individual components was highly variable among males during courtship, as well as their mating success. We discuss which signal components are more important for female mating receptivity and male mating success, as well as their relationship with male size and condition.

Keywords: *Steatoda nobilis*, web-borne vibrations, communication signalling, vibrational courtship signals

ETHOLOGY I, UC 2105, Saturday, May 27th 10am – 12pm

Graduate work, People's Choice Awards

A baffling conundrum: why don't more crickets make acoustic tools?

Brandt Erin E, Duke S, Wang, H, and Mhatre N.

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The experience of the cacophonous summer cricket chorus is a nearly ubiquitous experience. Indeed, the call's loudness is key to its function. Males produce calls by rubbing forewings together to attract females. Louder calls travel further and are clearer against background noise and thus loudness has clear fitness implications. Unfortunately, the small size of crickets means their calls are produced inefficiently. Tree crickets make tools known as acoustic baffles to overcome this acoustic inefficiency, but no other crickets do. Given that baffling is rare and has implications for fitness, it makes an ideal test case for hypotheses about the rarity of animal tool use. Specifically, the "lack of utility" hypothesis suggests tools lack sufficient utility in most scenarios to drive their evolution. To test this, we quantified the utility of cricket baffles by investigating the increase in efficiency available to a range of cricket species if they used a baffle. We measured wing sizes and calling frequencies for 113 cricket species, across 7 clades. Next, we used finite element analysis to model sound fields generated by cricket wings within their natural wing size and call frequency ranges. In addition to idealized free-field models, we also modelled realistic scenarios incorporating the effect of reflective and scattering surfaces like the ground and vegetation. We plotted data from real crickets onto landscapes of predicted calling efficiency across parameters and scenarios. From these, we determined the maximum efficiency achievable with a baffle for each species. We found that calling from the ground could dramatically increase calling efficiency, sometimes even equaling baffling efficiency. Baffled and ground calling may thus represent alternate strategies to maximize calling efficiency. Our data supports the "lack of utility" hypothesis and brings new insight into how crickets can exploit the environment to increase call loudness and therefore fitness outcomes.

Keywords: animal sound production, acoustic efficiency, acoustic tool use, alternative acoustic strategies, sound radiation efficiency

ETHOLOGY I, UC 2105, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Correlates of fitness in male *Steatoda nobilis*: this-over-that or has-it-all?

Cruz Das, Erynne Sutanto, Marie Toukam, Veronica Palma, Laini Taylor, and Maydianne Andrade

University of Toronto Scarborough, Department of Biological Sciences, CANADA

Many invasive populations are predisposed to success in a new ecological context due to the presence of individual phenotypic and life history traits. Traits such as mass and maturity time typically vary across individuals, and the relationship between these may inform trade-offs that affect mating opportunities in adulthood. For instance, delayed maturation may mean acquisition of greater resources as a juvenile, while sacrificing early access to mates as an adult. In species where males must search for females to secure matings, many males may trade off body size against investment in mobility. This can be seen in species where females are dispersed and/or mate multiply, with the dynamics of sperm competition and courtship ability driving differential investment strategies in males. While some high-quality males may be “globally good” across all traits, others can attain reproductive success by exhibiting these trade-offs. Using males of the noble false widow, *Steatoda nobilis*, from an invasive population in southern California, we measured development time and physical performance across family lines. This involved tracking instars to adulthood and assessing sprint performance on a standardized track with simulated predator attacks. Since many phenotypic and life history traits have a genetic basis, we expect to see significant variation in these traits across family lines with a potential trade-off in development against physical quality. Specifically, we predict males that exhibit longer development times will be heavier, and that running performance will be inversely related to mass. These results highlight whether there exists a trade-off in males of *S. nobilis* regarding phenotypic and life history traits and have important implications regarding whether male investment strategies could adapt to novel selective pressures.

Keywords: Development, Trade-offs, Life History, Performance, Invasive Species

ETHOLOGY I, UC 2105, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Variation in the kinematics of black widow spider legs during locomotion

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Black widow spider's legs are multifunctional and serve locomotory, as well as sensory functions. Highly sensitive strain sensors at the joints enable the spider to sense a variety of vibrational stimuli. Typically, spiders are thought to use their front legs mainly for sensory function, and hind legs are thought to be primarily locomotor in nature. However, leg kinematics – which would be indicators of these differences – have not yet been described for most species. In this study, adult female black widow spiders were tracked in 3D as they walked across their webs. The kinematics and movement patterns of defined points along the leg and body were captured. I will use these data to investigate whether the front and hind legs show differences in ranges and periodicity of movement, indicating differences in their function.

Keywords: Biomechanics, locomotion, spider behavior

ECOLOGY & ETHOLOGY II, UC 3225, Saturday, May 27th 10am – 12pm

Graduate work, People's Choice Awards

Increasing access to field work for BIPOC undergraduate students

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There is a clear underrepresentation of Indigenous, Black and/or Racialized (BIPOC) individuals in ecology and evolutionary biology that only intensifies higher up the academic ladder. An essential part of understanding and connecting to nature is having the opportunity to observe alongside learning how to observe the changing landscapes through different lenses in a way that is both incredibly fun and deepens our entanglement with the natural world. Economic and social barriers among others disproportionately affect BIPOC students and preclude their participation from field work. Providing access to these field experiences in a safe and inclusive space created and maintained by mentors with similar lived experiences can help advance the next generation of student researchers by fostering scientific interest, building a community and helping connect to the land through a relational lens. Field Research in Ecology and Evolution Diversified (FREED) is an organization whose mandate is to address barriers to field work, experiential learning and research opportunities through cost coverage and subsidies for BIPOC students. FREED's curriculum is also led, designed and executed by majority BIPOC students and professionals for BIPOC students. FREED had its first excursion in August 2022 which was a paid, weeklong event full of curated workshops at Algonquin Provincial Park for 14 BIPOC students led by 11 BIPOC instructors and allies. This presentation will cover what we learned and how we are changing our organization structure and curriculum for the three events that FREED is running in 2023. Understanding how organizations like FREED can be made modular, sustainable, and transferable across different institutions is important for effective advocacy that aims to increase access to ecology and evolutionary biology for BIPOC undergraduate students.

Keywords: equity diversity and inclusion, decolonizing research, field work, natural history, education

ECOLOGY & ETHOLOGY II, UC 3225, Saturday, May 27th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

How do mowing regimes affect tree cricket egg hatching success?

Sehgal J, Murray R, Gwynne D.**

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Raspberry canes serve as important habitats for numerous insects, including hollow stems being used a retreat for spiders and nesting sites for larvae of some solitary bees, and stems being used as egg-laying (oviposition) sites for tree crickets (*Oecanthus*: family *Gryllidae*). To determine the impact of human activities/disturbances on egg hatching success in tree crickets, I examined the effects of mowing. Female tree crickets reproduce in select woody or herbaceous plant stems by drilling holes with their needle-like ovipositor; females drill a series of holes with their ovipositor into the pith of the cane and insert an egg into each hole, leaving a zipper-like scar on the substrate. As the fleshy area at the side of the bud in the axil of the leaf or on each side of the bud of raspberry canes are preferred sites for oviposition, I examined the effects of mowing on egg hatching success using 3 treatments: canes rooted in soil (the natural state), cut canes hanging upright against a fence simulating cut (mowed) stems in a natural orientation, and cut canes lying on the ground that simulated mowing where canes become covered with soil, leaves, and debris. I expected egg hatching success to be lowest in the mowing treatment due to the dampness/moldiness of the canes potentially promoting bacterial/fungal growth and thus, preventing the eggs from surviving. While I observed no significant difference between the egg hatching success between the natural state treatment and the mowed state treatments, it is important to understand different approaches and measures we can take to achieve a sustainable environment in conjunction of maintaining our own lawns.

Keywords: Tree crickets, oviposition, mowing, hatching success, raspberry canes

ECOLOGY & ETHOLOGY II, UC 3225, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Metapopulation dynamics change toward and maybe contribute to a species range limit

Gillies GJ, Dungey M, and Eckert CG.

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Theoretical work has suggested that changes in metapopulation dynamics across species ranges could cause metapopulation collapse and generate abrupt range limits, but this idea has not yet been empirically tested across a large geographical scale. A metapopulation will persist if (1) habitat availability remains high, (2) colonization rates remain high, and (3) extinctions rates remain low. It is possible that these parameters of habitat availability, colonization, and extinction change across spatial gradients towards a species' range limit. If metapopulation collapse enforces species range limits, we expect to observe decreasing habitat availability, decreasing patch colonization rates, and increasing patch extinction rates towards the range edge. To properly assess these parameters in a natural system, we performed a multi-year survey of *Camissoniopsis cheiranthifolia*'s northern range, assessing over 7,000 georeferenced plots both within and beyond the range, spanning 900 km between San Francisco, CA and Lincoln City, OR. We found that, towards the northern range edge, patches of suitable habitat become less frequent and smaller, occupancy of suitable habitat decreases, and patch colonization decreases. There were no significant changes in habitat patch turnover or patch extinction towards the range edge. These results indicate that metapopulation dynamics may play a role in the maintenance of *C. cheiranthifolia*'s northern range limit, but this metapopulation collapse is primarily driven by changes in habitat structure and colonization rates rather than extinction rates. This work has important implications regarding the role of population dynamics as a factor limiting geographic distributions and acts as one of the first large-scale empirical tests of the metapopulation theory for range limits.

Keywords: Range limits, metapopulation, population dynamics, biogeography, species distribution

ECOLOGY & ETHOLOGY II, UC 3225, Saturday, May. 27th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

Effect of Artificial Light on the Development of Juvenile *Steatoda nobilis*

Phutadol Boontem, Maydianne C.B. Andrade and Luciana Baruffaldi

University of Toronto - Scarborough

Due to technological advances, animals are more exposed to artificial light, which could affect their developmental rate. In this study, we investigated the effect of artificial light exposure on the development of juvenile *Steatoda nobilis* in a laboratory setting. Egg sacs from four different family lines were split into three treatments: Fluorescent (FL), LED (LL) and Low light (LW). We recorded how many juveniles reached the 1st to the 4th moulting instar outside the egg sac and how many days it took to reach each instar. We also recorded the mean development time for each family line. Lower numbers of juveniles exposed to low light reached the 4th instar and took significantly longer to develop when compared to the two light treatments. No significant differences were found between Fluorescent and LED light in regard to the number of spiders that reached the 4th instar and mean development time. The spiders could perceive low light as an indication of winter, causing them to slow down their developing rate, while the two light treatments could represent summer, where juveniles mature faster to prepare for mating season in fall. Each family line responded differently to the light conditions. As *S. nobilis* is an invasive species, different families with different genetic variation could allow for certain populations to thrive under new environments, by taking advantage of the unique resources (i.e., artificial light) to mature faster and surpass native species.

Keywords: Artificial light, development, *Steatoda nobilis*, genetic variation

ECOLOGY & ETHOLOGY II, UC 3225, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Tale of two fishes: How personality and species affect group behaviour

Shoot, Tanya T, and Miller, Noam.

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Many animals live in groups whose members vary in personality. Although personality traits have been studied at the individual level, how group personality composition and variation affect collective behavior has yet to be addressed. We assessed both zebrafish (*Danio rerio*) and guppies (*Poecilia reticulata*) individually for boldness, sociability, and aggression. We constructed groups of known personality compositions and ran them through both group and individual tasks. Individual innovation was first assessed using a barrier task, where each fish had to navigate around a barrier to reach a social reward. Each fish had 4 trials to complete the barrier task with a transparent barrier that had entrances on either side and then 2 trials with an opaque barrier with a center entrance. If the fish failed to navigate around the barrier or reach the social reward in 5 minutes, the trial ended. Groups of 4 fish were created with known personality distributions, and each completed a novel barrier task to assess innovation, a maze foraging task to assess collective decision-making, and a predator inspection paradigm to assess cooperation. We found that guppies increased the latency to navigate around the barrier across trials, whereas zebrafish decreased latency on the individual innovation task. When barriers were changed, there were no differences between trials or species, though both species were faster through the initial barrier than the second barrier. When in groups, zebrafish that were faster through the barriers alone were also faster when in a group, whereas guppies were slower through the barrier when in a group as compared to when alone. This experiment highlights how a group's personality composition affects collective behaviour and the advantages of being in a heterogeneous group. Differences across species demonstrate that the effects of personality depend crucially on ecology.

Keywords: animal personality, collective behaviour, guppy, zebrafish, individual differences

ECOLOGY & ETHOLOGY II, UC 3225, Saturday, May 27th 10am – 12pm.

Honor's thesis work, Best talk, and People's Choice Awards

**Can Misunderstanding Lead to Demise? Evaluating Motion Signal Performance of Toad-Headed Lizard
Phrynocephalus putjatai x *P. guinanensis* Hybrids**

Dupuis, M.

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When two species have not fully diverged but are reunited at a zone of secondary contact, they may hybridize. The expression patterns of traits that influence fitness may provide clues that predict the probability of their evolutionary fate. *Phrynocephalus guinanensis* and *P. putjatai*, two species endemic to the Qinghai-Tibetan Plateau hybridize at a zone of secondary contact. I hypothesized that either (a) reinforcement or stability is at play or, alternatively, (b) species reversal is occurring. Using tail displays, a fundamental social signal which characterizes this group, behavioural videos of *P. guinanensis*, *P. putjatai*, and their hybrids were recorded and digitized. Communication efficiencies were compared across groups using the variances of their tail display variables. After performing a principal component analysis for each sex, Levene's tests revealed no significant differences in variances for females whereas, for males, *P. guinanensis* expressed significantly greater variance than *P. putjatai*. However, the variance of hybrids did not significantly differ from either parent species. General linear models indicated that means of display variables did not significantly differ between sampling sites for either sex. After accounting for the effects of orientation and snout-vent length, right angle orientations and body size in males affected display variables. These results reveal that hybrids have a similar communication efficiency as their parent species, suggesting that communication performance is not strongly influenced by genetic incompatibilities. This evidence supports the species reversal hypothesis. Although fusion is a likely outcome, it is contingent upon the strength of selection that may keep the species apart. Future studies are needed to assess these potential divergences and to determine whether *P. putjatai* and *P. guinanensis* are undergoing despeciation.

Keywords: Communication performance, hybrid fate, tail display, speciation reversal, *Phrynocephalus* lizards

ECOLOGY & ETHOLOGY II, UC 3225, Saturday, May 27th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

The effect of mating status on male motivation to mate and willingness to fight in competitions in false widow spiders (*Steatoda nobilis*)

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Males competing to mate with a female can either fight until one wins and mates, or one of the males can walk away from the competition to search for a different female to mate with to avoid the costs of fighting. Two factors that may influence a male's willingness to fight with a competitor for mating opportunities are the perceived risks of fighting the competitor, and the motivation to mate with a female. We investigated the differences in motivation to mate between males who had mated in the past and unmated males. We hypothesized that unmated males would be more motivated to mate as they had not had any reproductive success in their lifetime, so they would be more willing to fight if it ensured an opportunity to mate. We placed either two unmated males (U-U) or one mated and one unmated male (M-U) from the spider species *Steatoda nobilis*, who were matched in age and mass, in the web of an unmated female. We examined how willing each male was to fight, and which one mated with the female. We observed less fighting in M-U trials than in U-U trials, and the males who initiated more fights usually got to mate with females. We also found that unmated males initiated more fights and mated more frequently than mated males did. These findings suggest that unmated males are more willing to accept the costs of fighting and are highly motivated to mate with females, while mated males are less motivated to mate and less willing to fight. This reduced willingness to fight in mated males may be due to the desire to protect their energy and physical health, by avoiding fights, to maintain a high future reproductive potential.

Keywords: *Steatoda nobilis*, Evolutionary Game Theory, Male-Male Competition, Mating Behaviours, Lifetime Reproductive Success

MOLECULAR TOOLS & ECOLOGY, UC 3105, Saturday, May 27th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

The role of phenylpropanoids in *Arabidopsis thaliana* defense against *Tetranychus urticae* herbivory

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The two-spotted spider mite (TSSM), *Tetranychus urticae*, is a polyphagous herbivore that feeds on over 1100 plant species. They have the unique ability to adapt quickly to new hosts in part through detoxification of plant defense compounds, a mechanism that is not well understood. The phenylpropanoid pathway, found in all plants, is known to produce metabolites involved in plant development and defense. This study aimed to determine the role of phenylpropanoids in the defense system of *Arabidopsis thaliana* (a challenging host to TSSM) against *T. urticae* herbivory. This was done through the genetic characterization of a ferulic acid 5-hydroxylase 1 (FAH1) mutant of *A. thaliana*, initially described in Chapple et al. (1992) and fecundity assays on the ‘London’ population of mites exposed to fah1 mutant and wildtype Columbia-0 *Arabidopsis* leaves. Completion of genetic characterization showed that the fah1 mutant plant contains a C>T transition mutation in exon one of fah1 that results in a premature stop codon and no functional protein is predicted in the mutant plant. London mite fecundity was significantly greater on fah1 mutant leaves relative to Col-0 leaves providing evidence that phenylpropanoids absent in the fah1 mutant plant likely contribute to *Arabidopsis* defense against TSSM herbivory. This study provides insight into the mite-*Arabidopsis* interaction, and the ability of mites to gain resistance to novel host plants.

Keywords: *Tetranychus urticae*, phenylpropanoid pathway, detoxification, ferulic acid 5-hydroxylase 1, fecundity

MOLECULAR TOOLS & ECOLOGY, UC 3105, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Assessing the potential of *Caenorhabditis elegans* in the bioremediation of *Microcystis aeruginosa*

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Reported incidences of cyanobacterial harmful algal blooms, or CHABs, are increasing across the world due to climate change and nutrient loading. CHABs can produce dangerous cyanotoxins and dominate freshwater ecosystems, causing damage. *Microcystis aeruginosa* is one of the most common species of cyanobacteria and can produce hepatotoxic and neurotoxic microcystins. The ecological and human impact of algal blooms are immense, and traditional CHAB remediation methods are not always adequate in eutrophic regions. A proactive, targeted approach is needed to bioremediate CHABs. Bioremediation of CHABs with *Viviparus georgianus* (the banded mystery snail) is somewhat effective, as the snail filter feeds and ingests intact cyanobacteria cells, which are then translocated to the benthos in pseudofeces or feces. Although this keeps cyanobacteria from entering its disruptive colonial phase, this is temporary, as currents eventually liberate live cyanobacteria cells. Nematodes, such as *Caenorhabditis elegans*, are potential candidates for bioremediating this pseudofeces and feces. *C. elegans* have detoxification pathways which may break down microcystin. We analyzed *C. elegans* health and fat accumulation on a diet of toxic *M. aeruginosa* and found that *C. elegans* are able to ingest, digest and metabolize the diet. It is unclear if a diet of toxic *M. aeruginosa* has some health impacts, however overall, it was able to sustain *C. elegans* development and *C. elegans* were tolerant of it. SKN-1 (a central iii regulatory protein to the phase II detoxification system) expression was not significantly greater on a diet of toxic *M. aeruginosa*, suggesting that this diet doesn't induce a stress response. Finally, *C. elegans* populations were observed, and several generations of nematodes demonstrated their ability to digest pseudofeces and feces containing toxic *M. aeruginosa*. Overall, these results suggest that *C. elegans* could be a viable CHABs bioremediation candidate in combination with *V. georgianus*.

Keywords: Bioremediation, cyanobacteria, nematodes, metabolism, *V. georgianus*.

MOLECULAR TOOLS & ECOLOGY, UC 3105, Saturday, May 27th 10am – 12pm

Graduate work, People's Choice Awards

Host-adaptation and specialization in *Tetranychus urticae* and *Tetranychus evansi*

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Generalist and specialist herbivores can both overcome plant defences at the molecular level; however, the degree and overlap of the mechanisms employed by these classes of herbivores remains largely unknown. Questions regarding how composite generalist herbivores can adapt to a new host in relatively few generations and still retain the ability to host shift, whereas specialist are much more restricted in their host range is of great interest. Tetranychidae mite species are well suited to address the relationship between host-adaptation and specialization because this family harbours closely related species with vastly differing host ranges - an extreme generalist *Tetranychus urticae* Koch and the Solanaceous specialist *Tetranychus evansi*. In this study, tomato-adapted *T. urticae* and *T. evansi* populations were used to compare mechanisms of host-adaptation and specialization respectively. Results indicate both species can attenuate induced tomato defenses, including protease inhibitors (PIs) that target mite cathepsin L digestive proteases. Additionally, to overcome tomato PIs, *T. evansi* relies solely on transcriptional attenuation of PI induction, whereas *T. urticae* has evolved constitutively higher activity of cathepsin L proteases targeted by PIs. Detoxification of toxic plant compounds was also observed to be important in both *T. urticae* and *T. evansi*, to different extents. *Tetranychus evansi* utilizes esterase and P450 activities to a large extent, while *T. urticae* relies on glutathione-S-transferase activity in addition and therefore relies on all three classes of detoxification enzyme to a moderate degree. Taken together, results suggest that both *T. urticae* and *T. evansi* use similar mechanisms to overcome tomato defences, with the specialist *T. evansi* having a greater ability to cope with them. Results are congruent with evolutionary times required for adaptation and specialization statuses respectively.

Keywords: *Tetranychidae*, adaptation, specialization, defence attenuation, detoxification

MOLECULAR TOOLS & ECOLOGY, UC 3105, Saturday, May 27th 10am – 12pm

Honor's thesis work, People's Choice Awards

Candidate Gene Validation of Sociability in *Drosophila melanogaster*

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Fruit flies (*Drosophila melanogaster*) are an ideal model system to study sociability because of their rich social lives. Scott et al., (2021) artificially selected for fruit flies with either high or low sociability to examine the mechanistic bases of sociability. Extraction, sequencing, and follow up analyses of DNA and RNA of the high, low, and control lineages using the methods described in Scott et al (2022) allowed us to identify candidate sociability genes. This study aims to functionally validate the expression of these genes on sociability by measuring the effects of knocking down gene expression using RNA interference (RNAi) lines. To quantify sociability, we will use circular 3D printed sociability arenas similar to the ones in Scott et al., (2022). Differential expression analyses of genes CG13197, sec5, thoc5, and CG8329, showed significant differences in the low sociability lineages compared to control and high lineages. Specifically, these genes had a lower magnitude of expression (based on log2CMP estimates) in low sociability lineages compared to control and high lineages. We predict that knocking down the expression of these candidate genes will lower sociability. In addition, FBgn0032436, Est-P, FBgn003353, and ppk28 also had significant differences in the lineages selected for low sociability compared to the controls. In contrast, these genes had a higher magnitude of expression (based on log2CMP estimates) in low sociability lineages compared to the control and high sociability lineages. As such, we predict that reducing expression in these candidate genes will increase sociability scores. Currently, two genes (thoc5 and Est-P) have been tested. As predicted, knocking down the expression of Est-P resulted in flies with significantly lower sociability scores compared to controls. However, flies with knocked down thoc5 did not have any significant differences in sociability compared to controls.

Keywords: *Drosophila melanogaster*, Sociability, Candidate genes, GAL4/UAS System.

MOLECULAR TOOLS & ECOLOGY, UC 3105, Saturday, May 27th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

The Role of V-ATPase in Regulating pH in the Digestive Tract of *Tetranychus urticae* Koch

Zoran Culo

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Spider mites are phytophagous organisms and resilient pests that pose an economic burden on plant-growing industries, prompting the use of synthetic chemical pesticides for their control. One of the key aspects of spider mite biology allowing for their successful herbivory on plant hosts is their ability to detoxify defensive allelochemicals and pesticides present in the liquified leaf cell contents they ingest. The mechanisms for retrieving dietary compounds and neutralizing harmful xenobiotic compounds in the spider mite digestive system remains largely unknown. The purpose of this study was to a) establish pH in intercellular and intracellular compartments of the spider mite midgut and b) to examine the effects of silencing the expression of a gene coding for the pH-regulating protein complex, V-ATPase. Indicator dyes were applied in adult female two-spotted spider mites (*Tetranychus urticae*) to establish the pH environment present in the midgut ventriculus, gastric caeca and posterior midgut in both fed and unfed states. A slightly alkaline pH range of 7.3 to 7.5 was observed in intercellular midgut compartments of unfed mites whereas the vesicles in free-floating digestive cells (where digestive activity is predicted to occur) were more acidic at 5.2. There were no significant changes in pH in any compartment when mites were fed. The expression of the gene tetur09g004140 (coding for subunit A of V-ATPase) was subsequently silenced by RNA interference in fed mites. The pH in the intercellular midgut compartments of knockdown mites showed significant increase in pH whereas no significant increase was observed in the digestive cell vesicles. This study reports for the first time the pH environment in the midgut of spider mites. Future studies can use this study as a guide for determining where proteases associated with digestive and/or detoxification activities may operate in the spider mite midgut based on their pH optima.

Keywords: spider mites, digestion, pH, RNA interference, indicator dyes

MOLECULAR TOOLS & ECOLOGY, UC 3105, Saturday, May 27th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

A hair out of place: Understanding the maintenance of a trichome polymorphism in *Camissoniopsis cheiranthifolia*

Williamson K.W., and Eckert C.G.

Queen's University

Phenotypic variation in adaptive traits is a compelling area of interest for biologists, particularly when it exists within the same population. Discrete polymorphisms can be readily quantified to inform the maintenance of variation. Polymorphisms can be maintained through the balance of genetic drift and gene flow, mutation and purifying selection, or through various selective pressures. *Camissoniopsis cheiranthifolia* exhibits a polymorphism in trichomes, which can be adaptive for resistance to herbivory, water stress, and UV-B protection. Trichomes can be costly to make in the absence of selective pressures. Although generally pubescent (having trichomes) throughout its range on the Pacific Coast, glabrous (lacking trichome) individuals of *C. cheiranthifolia* can occur and are frequently observed in Manchester Beach, CA. In this study, I investigate the mechanism that maintains the polymorphism by studying the phenotype frequencies in the species range, and within the population at Manchester. I also study the fitness of the phenotypes within Manchester. With these data I distinguish the following three hypotheses: (1) the glabrous phenotype is selectively neutral, (2) the glabrous phenotype is deleterious, (3) the glabrous phenotype is maintained by spatial heterogeneity in selection. Within the range of *C. cheiranthifolia*, the frequency of glabrous individuals is extremely low (0.81%) and is not associated with variation in precipitation, which would be the most likely selective pressure maintaining the polymorphism. At Manchester, the frequency of glabrous is high (65%) and glabrous individuals experience a small fitness disadvantage. Taken together, my data suggest the glabrous phenotype is a deleterious mutation. However, the high frequency of the glabrous phenotype within population is unlike any deleterious mutation. The discrepancy in my study highlights the necessity of comprehensive range analyses paired with within population surveys to expand the understanding of polymorphism maintenance.

Keywords: Polymorphism maintenance, trichomes, phenotypic variation

MOLECULAR TOOLS & ECOLOGY, UC 3105, Saturday, May 27th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

Viral-induced flower colour change reveals that turnip mosaic virus increases with stand size and human disturbance in *Hesperis matronalis*

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Little is known about the widespread distribution of pathogen prevalence in nature because many diseases cannot be easily detected. Diagnostic pathogen testing is expensive and time-consuming, which limits the number of individuals and populations that can be assayed. The goal of this research is to improve our fundamental understanding of infection dynamics across a broad spatial scale in nature by examining the infection of the invasive mustard, *Hesperis matronalis* (Dame's rocket), by turnip mosaic virus. This system provides a unique opportunity to study widespread pathogen prevalence because turnip mosaic virus induces a striking flower colour change in *H. matronalis*, allowing infection to be quickly and reliably diagnosed for a large number of individuals. I reported the occurrence of turnip mosaic virus across 108 stands of *H. matronalis* in eastern Ontario, Canada over two years. I found that the probability of turnip mosaic virus infection increases with stand size, local density, and level of human disturbance. The results of this study will help identify factors that influence the temporal and spatial distribution of a pathogen in nature. This knowledge will help mitigate the negative outcomes that disease can have on populations. Moreover, turnip mosaic virus has caused severe losses of rutabaga, a mustard crop, in Ontario. This epidemic is thought to have been caused by spillover infections from wild to cultivated plants. Examining the prevalence of turnip mosaic virus in *H. matronalis* and other wild mustard species may be important for protecting economically important crops.

Keywords: virus, invasive species, human disturbance

MOLECULAR TOOLS & ECOLOGY, UC 3105, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Plant-pest interaction: dissection of detoxification patterns associated with metabolic resistance in *Tetranychus urticae* adapted to *Arabidopsis thaliana*

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Alarming trends such as climate change and the growing world population are challenging the agricultural sector nowadays, which must guarantee food security, safety, and sustainability at the same time. The depletion of natural resources and biodiversity in agroecosystems determine significant yield losses and the onset of invasive plant-related pests. Among these, *Tetranychus urticae*, also known as Two-Spotted Spider Mite (TSSM), represents a major agricultural pest worldwide. TSSM has remarkable polyphagy documented on over 1,100 plant species. The resistance to a wide array of plant defense compounds is mainly attributed to their detoxification enzymatic activity, known as metabolic resistance. However, TSSM adapts to new host plants in an extraordinarily short evolutionary time than other arthropods. To elucidate the adaptation mechanism, the project investigates the differences in detoxification strategies of TSSM-adapted and non-adapted populations when on *Arabidopsis thaliana* plants. The plant-pest interaction study starts by investigating the toxicity of indole glucosinolate (IG) breakdown products, which provide a chemical barrier for *Arabidopsis* plants against TSSM herbivory. Using a metabolomic approach, I select candidate IG breakdown products accumulating in *Arabidopsis* upon TSSM feeding. Screening these candidates on adapted and non-adapted mites can confirm the greater detoxification ability due to the adapted state. Further analysis of the chemical modifications that occur to the toxic metabolite upon ingestion by the mites will unveil the specific enzymatic family or families involved in the mechanism of metabolic resistance. The role of detoxification enzymatic families will be tested at the gene level. Candidate detoxification genes, differentially expressed between non- and adapted mites, will be silenced in their function using environmental RNA interference. The resistance traits derived from this plant-pest interaction study can improve crop germplasm in plant breeding or serve as a target for a new category of plant protection products, i.e., RNAi-based pesticides.

Keywords: *Tetranychus urticae*, *Arabidopsis thaliana*, plant-pest interaction, metabolic resistance, adaptation

CLIMATE CHANGE, UCC 3110, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

How will photosynthesis and growth in boreal forests respond to climate change?

Hammer JM, Bither N, Cook A, Duarte AG, Dusenge ME, Murphy BK, Pastore M, Lee K, Schmieg S, Swartman R, Bermudez Villaneuva R, Hüner NPA, Reich PB, Way DA

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Anthropogenic activities are increasing atmospheric CO₂ concentrations ([CO₂]), leading to global warming. Northern latitude regions, including the Canadian boreal forest, are more vulnerable to warming than many other areas. This is concerning, given that boreal forests absorb and store large amounts of CO₂ through photosynthesis and growth. Despite this, we have relatively little data on the photosynthetic and growth responses of boreal trees to sustained elevated [CO₂] (EC) and warming. I grew seedlings of five widespread Canadian boreal trees for one growing season under various [CO₂] (400 and 750 ppm) and temperature (ambient +0, +4, and +8 °C) treatments. I then measured net photosynthesis at the growth [CO₂] (A_{growth}), photosynthetic capacity (V_{cmax} and J_{max}), and total biomass. In all species, V_{cmax} and J_{max} were unaffected by EC but were strongly reduced by warming, with few interactions. Associated with this, A_{growth} and biomass were generally enhanced by EC and suppressed by warming. Warming also increased the thermal optimum of A_{growth} , though this was not related to adjustments in the short-term temperature responses of V_{cmax} , J_{max} , or stomatal conductance. My results imply that photosynthetic CO₂ uptake and growth in Canadian boreal tree seedlings will be similar under current and future climates (provided that soil water and nutrients are non-limiting). These findings will help improve our models of global CO₂ cycling as the climate changes.

Keywords: Photosynthesis, growth, climate change, boreal forest, trees

CLIMATE CHANGE, UCC 3110, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Investigating variation in herbivore-and-climate-mediated selection on flowering time in an invasive wetland plant

Mia Akbar and Robert I Colautti

Queen's University

A common method to manage invasive species is the introduction of natural enemies (i.e., herbivores, pathogens, and parasites) as biological control agents. For example, *Galerucella pusilla* and *G. calmariensis* are two specialist herbivore beetles that were introduced to control invasive populations of the perennial herb purple loosestrife (*Lythrum salicaria*) in North American wetlands. However, the response to this biological control program has been highly variable with some populations exhibiting drastic population shrinkage over time while others seem unaffected indicating possible genetic variation in defence or tolerance to herbivory. Recent studies in *L. salicaria*, have demonstrated that growth and timing of reproduction vary across the introduced range and that this variation is heritable, resulting in flowering time clines that are locally adapted to variation in season length. We investigated how genetic constraints imposed by climate adaptation may limit the ability of *L. salicaria* to evolve in response to herbivore pressure. To this end, we conducted a multi-year common garden experiment at the Queen's University Biological Station (QUBS) in Ontario, Canada. The garden includes 12 experimental blocks, each with 200 individuals representing 20 genetic populations and 10 seed families per population. Half of the blocks were exposed to *Galerucella* beetles and other herbivores while the other half were protected by insecticide application. These seed families were sampled along a 100 ° latitudinal gradient in northeastern North America where northern plants have evolved early flowering to reproduce in shorter growing seasons relative to southern plants. We estimated the strength of phenotypic selection on flowering time and computed the relationship between strength of selection in the presence and absence of herbivory. Over multiple years of data, early-flowering families experience a greater decline in fitness in the presence of herbivory relative to late-flowering families ($p < 0.001$), indicating that northern populations are less tolerant to herbivory relative to southern populations of *L. salicaria*. This research demonstrates that adaptation to the abiotic stressor of climate limits the ability of populations to respond to the biotic stressor of insect herbivory.

Keywords: Genetic constraint, flowering time, plant invasion, biological control, climate adaptation

CLIMATE CHANGE, UCC 3110, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Changes in peatland soil fauna biomass alter food web structure and function under warming and hydrological changes

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Boreal peatlands play an important role in terrestrial carbon storage. Soil fauna and their trophic interactions play a key role in regulating microbial communities and the flux of carbon (C) and nitrogen (N) belowground, thus controlling the storage/release of C and N in soil systems. At northern latitudes, soil temperature and moisture conditions under climate change are predicted to become more extreme and more variable, and these factors will play an important role in regulating decomposition and ecosystem functioning, like C and N dynamics, in boreal peatlands. The objective of this research is to quantify and model the effects of experimentally imposed temperature and moisture conditions that simulate potential future climate, on peatland soil fauna food webs and soil C and N fluxes. Results suggest that increases in temperature and soil saturation will alter total faunal biomasses with warming increasing and soil saturation decreasing biomasses. Shifts in fauna biomass drove the changes in C flux, C mineralization, and N mineralization. However, under warming, increased population turnover rate alongside decreased feeding efficiencies increased the proportion of total C flux that is lost as respiration (i.e., C mineralization). Future research is needed to better resolve the opposing changes in potential future boreal peatland C and N dynamics threatened by potential future warming and climate-mediated changes in peatland hydrology.

Keywords: carbon flux, climate change, soil biodiversity, boreal peatlands, energetic food web models,

CLIMATE CHANGE, UCC 3110, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Complex Effects of Mycorrhizae on Poplars Under Elevated Temperature and CO₂

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The growth of *Populus* spp., an ecologically and economically important group of tree species, has declined due to elevated temperatures and droughts associated with climate change. Symbiotic microbes, such as mycorrhizae, may increase plant growth under climate change conditions by increasing tree access to water and nutrients. To address this hypothesis, three mycorrhizae (*Paxillus involutus*, *Cenococcum geophilum*, and *Cadophora finlandica* strain C) were isolated from *Populus tremuloides* roots in the field. We then determined the effects of mycorrhizal inoculation on hybrid poplar (*Populus x canadensis*) growth under a range of future climate scenarios: ambient (400 ppm) or elevated CO₂ (750 ppm) with either ambient temperatures or a +4 °C or +8 °C warming treatment. Non-inoculated poplars had reduced biomass and leaf health when grown under extreme warming, although moderate warming stimulated growth. Colonization of poplar roots by mycorrhizae increased with elevated temperature and CO₂. Inoculation with mycorrhizae did not increase tree height or total mass, except for trees grown under moderate (+4 °C) warming, where biomass increased ~15% compared to trees from current climate conditions. Our results suggest that mycorrhizae increase tree growth under moderate warming, which may enhance resilience to future climatic stresses.

Keywords: Poplars, Climate change, Symbiotic microbes, Mycorrhizae, growth and resilience

CLIMATE CHANGE, UCC 3110, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

Responses of Soil Predatory Mites to Climate Warming and Elevated CO₂ in Boreal Peatlands

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Boreal peatlands are critical ecosystems for global carbon cycling, and soil faunal communities are responsible for secondary decomposition of organic matter and nutrient cycling in this environment. While warming-induced changes to plant and microbial communities can potentially shift peatlands from carbon sinks to sources, little is known about the impact on specific soil microarthropod communities that are indirectly affected. Here, we present results from a large-scale, field-based experiment conducted over 4 years in the Spruce and Peatland Responses Under Changing Environments (SPRUCE) experiment, which tested how soil predatory mites respond to a range of experimental warming temperatures (0°C to +9°C) crossed with elevated CO₂ conditions. Predatory mites (Acari: *Mesostigmata*), contribute indirectly to decomposition and nutrient cycling processes through top-down control (predation) on other organism populations. We found that warming significantly decreased surface peat moisture, which in turn decreased predatory mites' species richness and abundance significantly. Additionally, higher moisture levels increased the abundance of predatory mites. While elevated CO₂ had no significant effect, the richness of mesostigmatids increased significantly under warming. At the community level, species composition varied significantly over time, with moisture being an important driver. Our results suggest that the cumulative and interactive effects of the SPRUCE experimental treatments on soil faunal biodiversity will continue to emerge and have implications for the carbon and nitrogen cycles.

Keywords: climate change, predatory mites, community ecology, peatland, bog

CLIMATE CHANGE, UCC 3110, Saturday, May 27th 10am – 12pm

Honor's thesis work, Best talk, and People's Choice Awards

The effects of global change on soil and plant ^{15}N retention in a grass-dominated old field over both the short and longer term

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Increased nitrogen (N) deposition and climate warming are two global change factors likely to have substantial impacts on soil and plants in northern temperate ecosystems over the next century. Although both N addition and warming can increase plant productivity, chronic N addition can lead to soil N saturation, which can decrease soil N retention over the long term. Likewise, warming can impact soil N retention by reducing snow cover and increasing the frequency of soil freeze-thaw cycles. We added new N addition and warming plots to a pre-existing field experiment established in a grass-dominated old field to study the effects of N addition and warming on plant and soil N retention over both the short term (3 years) and the longer term (16 years). For the plants, we targeted the responses of *Poa pratensis* and *Bromus inermis*, the two dominant grasses at the field site. *Bromus inermis* responded significantly to the warming treatment with greater biomass production and greater retention of the ^{15}N tracer compared to in the control plots. In contrast, *Poa pratensis* only responded significantly to the N addition treatment, with greater biomass production and higher percent tissue nitrogen compared to in the ambient N plots. The soils responded significantly to both treatments, with increased ^{15}N retention in the warmed plots and increased ^{15}N retention in the N addition plots. Notably, plot age did not play an important role in modulating the plant and soil ^{15}N retention responses, which possibly could be explained the two grass species remaining dominant in all of the treatment plots after 16 years (i.e., a lack of a shift in community composition or the relative abundance of plant species). These results demonstrate that in the absence of a shift in plant species composition, the effects of increased N deposition and warming on N deposition may not change substantially over the longer term.

Keywords: N cycle, N deposition, Warming, Retention, N15

CLIMATE CHANGE, UCC 3110, Saturday, May 27th 10am – 12pm

Graduate work, Best talk, and People's Choice Awards

The effects of warming on floral traits

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Introduction and Methods: Climate warming can affect the timing of flower development and plant growth, but few studies address how warming affects floral traits that are important for attracting pollinators. My objective was to investigate how floral traits that are important for pollinator attraction change when *Cucumis sativus* plants were grown at ambient or ambient +4 °C warmed temperatures. I tested how warming affects plant development (date of anthesis, floral display size), ultraviolet (UV) floral guides (signals to pollinators that are only visible under UV wavelengths of light), and the composition and concentration of floral flavonoids (compounds that absorb UV light). **Results:** Warming accelerated the rate of plant development by advancing the date of anthesis by ~14 days and increasing floral display size 44%. I found that total flower area decreased but the UV-absorbing proportion of flowers increased, so UV-absorbing area stayed constant with warming. Floral flavonoids are currently being identified and quantified. **Conclusions:** In response to warming, there is a developmental trade-off with decreased floral area and increased flower number. Additionally, maintaining a specific UV-absorbing area could be more important for pollinator attraction than floral temperature regulation.

Keywords: Climate change, warming, floral traits, plant-pollinator interactions

Abstracts – Posters
Lunch & Learn I
Friday, May 26th 12 – 2pm, Physics & Astronomy Atrium

POSTER 1, POSTER BOARD 1, FRIDAY, MAY 26th

Graduate work, People's Choice Awards

How do frozen crickets maintain mitochondrial function?

Saruhashi, S. and Sinclair, B.J.

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Frozen cells are rarely viable, likely because organelles such as mitochondria are susceptible to freeze-injury. However, the freeze-tolerant spring field cricket, *Gryllus veletis*, has normal - or even increased - whole organism metabolic rate after freezing. Do freeze-tolerant crickets protect their cellular metabolic machinery from freeze-injury? We measured mitochondrial function from Malpighian tubules, a highly metabolically active tissue, and evaluated changes in mitochondrial ultrastructure after freezing with EM. We compared acclimated (i.e., freeze-tolerant) and unacclimated (i.e., freeze-intolerant) crickets to identify changes associated with freeze tolerance acquisition. We found that acclimated crickets had lower state 3 respiration than their unacclimated counterparts, indicating that freeze-tolerant crickets have lower mitochondrial activity. We compared frozen freeze-intolerant crickets with frozen freeze-tolerant crickets to identify potential mechanisms that permit survival from freezing. We also compared unfrozen cold-exposed crickets with frozen crickets to disentangle the effects of cold and ice formation per se. Freezing does not appear to damage the outer mitochondrial membrane, but frozen freeze-intolerant crickets had evidence of damage to the inner mitochondrial membrane. These damaged crickets had increased proton leak and decreased state 3 respiration, and the inner membrane was permeable to NADH. TEM showed swollen mitochondria with fewer cristae in freeze-intolerant frozen crickets. Thus, freeze-tolerant crickets appear to protect their inner mitochondrial membrane from freeze-injury, allowing them to fuel the metabolic demands of recovery, whereas insects that cannot survive freezing incur mitochondrial damage.

Keywords: Insect physiology, low temperature, Malpighian tubules

POSTER 2, POSTER BOARD 1, May 26th

Graduate work, Best poster, and People's Choice Awards

Investigating the influence of parasitism on dispersal and cannibalism behaviors of backswimmers (*Notonecta undulata*)

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Parasites alter their hosts' behaviors in a variety of ways, including their ability and motivation to disperse. While there are apparent impacts of parasitism on infected hosts, less attention has been given to the indirect effects on uninfected hosts. Identifying how the presence of infected hosts alters the cost-benefits of dispersal for healthy individuals has important implications on host-parasite abundance and community stability. We explore this dynamic in backswimmers (*Notonecta undulata*), semi-aquatic flight-capable insects, that are commonly parasitized by *Hydrachnidia* mites. Mite parasitism can impede the swimming and flight ability of backswimmers. We investigated whether (1) this impeded mobility influences cannibalism and (2) if altered cannibalism changes dispersal behaviors. To test this, we manipulated the proportion of infected backswimmers in experimental mesocosms and recorded cannibalism and dispersal. Overall, infected backswimmers, who have impeded mobility, were significantly more likely to be cannibalized than healthy backswimmers. When more infected backswimmers were present, their probability of being eaten or dispersing was significantly reduced. Yet this also resulted in more infected backswimmers being eaten per healthy backswimmer and increased dispersal of healthy individuals. We expected that healthy individuals would stay rather than disperse when there was a lot of vulnerable infected backswimmers present to cannibalize, increasing the resources available to them. While infected backswimmers were cannibalized more, it appears that this was used as an energy boost for increased dispersal rather than as a motivator to stay. These results strengthened our understanding of how changes to resource-availability through cannibalism affects the cost-benefits of dispersal in parasitized populations.

Keywords: dispersal, parasitism, cannibalism, backswimmer, mite

POSTER 3, POSTER BOARD 2, May 26th

Graduate work, Best poster, and People's Choice Awards

Recovery Mechanisms of Grassland Plant Diversity after the Cessation of Nutrient Addition

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Plant species diversity has declined in response to elevated atmospheric nitrogen deposition in many regions due to increased industrialization. However, at present, some forms of nitrogen pollution that contribute to atmospheric N deposition have been more effectively controlled, and atmospheric N deposition is even declining in some areas. Recent research has shown that plant diversity does not recover quickly after N deposition is reduced. However, the factors that prevent the recovery of plant diversity remain to be further studied. We conducted a two-year multi-factor recovery experiment in an Inner Mongolia grassland, with 9 years of N addition (low and high rates) followed by 8 years of recovery. Bundling plants, lime addition, litter removal, seed addition, and their partial interactive treatments were used to respectively test the effects of light competition, soil acidification, litter accumulation, and seed restriction on the recovery of plant diversity. After low-rate N addition ceased, soil acidification and the effects of litter accumulation on the light penetration and seedling growth primarily hindered the recovery of species evenness, and the canopy shading of the upper plants limited the recovery of species richness to some extent. After high-rate N addition ceased, litter accumulation and its effect on light penetration primarily inhibited the recovery of species richness, further limiting the recovery of plant diversity. Overall, this study clarified the recovery mechanisms of plant diversity after N deposition is reduced. The finding that the dominant factors limiting recovery appear to vary based on the prior rate of N addition is of important theoretical value for biodiversity conservation in the context of global change.

Keywords: Biodiversity, Nitrogen deposition, Ecological restoration

POSTER 4, POSTER BOARD 2, FRIDAY, MAY 26th

Honor's thesis work, Best poster, and People's Choice Awards

The microplastic exposure landscape: a mass balance of microplastics in a large in-lake pelagic mesocosm experiment at the IISD Experimental Lakes Area (IISD-ELA)

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Microplastics (plastic particles sized <5 mm) are ubiquitous and persistent contaminants of growing concern, plaguing all ecosystems, and causing various effects on organisms of all trophic levels. There is increasing attention being paid to microplastic fate in physical matrices, uptake in organisms, and interactions within ecosystem processes, particularly in previously neglected freshwater ecosystems such as lacustrine habitats. Microplastic transport and fate in a lake can affect the exposure landscape (i.e., the amount of plastic each organism may be exposed to relevant to its habitat and life-history strategy). Microplastic uptake in aquatic organisms is not only determined by their feeding behaviour and other life history characteristics, but also particle characteristics such as size, shape, and density. However, distribution of microplastics in pelagic zones of lakes over time are not yet well-understood. Thus, we aimed to elucidate temporal and spatial variations in distributions of microplastics across a lacustrine habitat. This experiment included nine in-lake mesocosms - 10m in diameter and 2m deep. We added 4.4 billion particles to each mesocosm to achieve a nominal concentration of 29,234 particles/L. The experiment ran for 9 weeks, and we sampled water column, surface water, and periphyton wall strips at 24 hours, 72 hours, 1 week, 5 weeks and 9 weeks after addition. We aim to calculate a mass balance of specially manufactured polyethylene (positively buoyant), polystyrene (neutrally buoyant) and polyethylene terephthalate (negatively buoyant), 10 - 750µm in size. Results to date will be presented.

Keywords: Microplastic, transport, fate, exposure landscape, mass balance

POSTER 5, POSTER BOARD 3, FRIDAY, MAY 26th

Honor's thesis work, Best poster, and People's Choice Awards

Does climate influence scale size among populations of *Anolis* lizards?

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The scales of reptiles have been hypothesized to play roles in thermoregulation and hydroregulation, but the impact of climate on scale size remains unclear. Two primary mechanisms have been proposed to explain observed variation in scale size across climatic gradients. First, if scales facilitate heat exchange, and larger scales have relatively greater surface area, then populations of lizards in environments requiring thermoregulation should evolve larger dorsal scales to aid in thermoregulatory heat exchange (via heat gain in the sun and heat loss in the shade). Second, if more moisture is lost through interstitial skin than through scale surfaces, the evolution of larger scales (which reduce interstitial skin area) may mitigate moisture loss, and populations in drier environments should evolve larger scales. To test these hypotheses, we measured dorsal scale size in populations of four widespread species of *Anolis* lizard (*A. cristatellus*, *A. cybotes*, *A. semilineatus*, and *A. stratulus*) and tested for correlations between environmental variables and scale size. Populations of these species inhabit a wide range of environmental conditions, enabling us to examine the effect of climatic variables on intraspecific variation in scale morphology. Our results indicate that temperature has likely shaped the evolution of scale morphology in anoles, as populations in warmer regions consistently had larger dorsal scales, although the effect of temperature on scale area depended on moisture in some species. Our results suggest that scale size evolves as a thermoregulatory structure in some anole species, as predicted if dorsal scales facilitate heat exchange.

Keywords: evolution, temperature, precipitation, thermoregulation

POSTER 6, POSTER BOARD 3, May 26th

Graduate work, People's Choice Awards

Investigating mosquito abundance and species richness in the Georgian Bay Islands

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Mosquitoes are pests that act as vectors for many tropical diseases but can also carry these pathogens to temperate latitudes. With climate change, mosquito species are expanding their geographic ranges further north. Understanding where and how mosquitoes colonize new habitats will be important for predicting future disease outbreaks in temperate regions. We examined 140 samples of aquatic invertebrates collected from the world's largest freshwater archipelago: the Georgian Bay Islands. From these samples, we identified mosquito larvae and pupae. We established 5 morphotypes of larvae and then determined abundance along with species richness across 29 islands. We related our findings for abundance and species richness to distance from the mainland, island area, and water quality (specifically pH, temperature, and conductivity) to understand the distribution of mosquitoes across the temperate landscape. Our initial analyses revealed an uneven distribution of mosquito larvae; only 6 islands had a high abundance of mosquitoes (42-126), while most islands had less than 10 mosquitoes. Negative binomial models revealed that island area had a significant negative effect and pH had a significant positive effect on mosquito abundance. Our models also illustrated that distance from the mainland, island area, and water chemistry parameters had no significant effect on species richness. Thus, our results indicate that more mosquitoes are found on smaller islands and in alkaline water. Our findings also call for further investigation as they suggest that factors other than the ones examined, such as predator presence, competitor presence, or both, likely influence mosquito colonization patterns in the Georgian Bay Islands.

Keywords: Aquatic invertebrates, island biogeography theory, mosquitoes

POSTER 7, POSTER BOARD 4, May 26th

Graduate work, Best poster, and People's Choice Awards

A range-wide migratory network for Blackpoll Warblers (*Setophaga striata*)

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Understanding when and to what degree individuals from different populations mix or remain spatially segregated during the annual cycle (i.e., migratory connectivity) is critical for developing effective conservation measures for migratory birds. One approach for describing and analyzing migratory dynamics is to use network theory in which populations are represented by sets of seasonal nodes (breeding, stopover, nonbreeding) that are connected by edges (migratory routes). In this study, we will build and analyze a network to describe patterns of migratory connectivity in the rapidly declining Blackpoll Warbler (*Setophaga striata*). Blackpoll Warblers breed across North America's boreal forest, overwinter in northern South America, and are famous for undertaking a non-stop flight over the Atlantic Ocean during fall migration. We are currently analyzing tracking data from 44 light-level geolocators deployed and recovered on Blackpoll Warblers between 2013 and 2020 at 10 locations across the species' breeding grounds. This will allow us to identify the key stopover and nonbreeding areas used by individuals from different breeding populations and cluster these locations to form the nodes of a migratory network. We will then combine our movement data with relative abundance records from eBird to estimate the flow of individuals along edges and use network metrics, including betweenness and degree centrality, to identify key nodes for maintaining network connectivity. Finally, we will assess the network's modularity to quantify the degree to which different breeding populations mix during the annual cycle. Our results represent a key step towards understanding how environmental change in one part of the Blackpoll Warbler's range could affect population trends in other areas.

Keywords: Migratory connectivity, network theory, Blackpoll Warbler, annual cycle, light-level geolocator

POSTER 8, POSTER BOARD 4, May 26th – Withdrawn

POSTER 9, POSTER BOARD 5, May 26th

Graduate work, People's Choice Awards

Investigating microplastics in muscle tissue of cold-adapted salmonids

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Plastic pollution is a global environmental threat in marine and freshwater ecosystems—even in remote areas such as the Arctic. Microplastics (<5mm) are a diverse environmental contaminant which range greatly in morphology, size, material type, chemical ingredients, and effects. The presence of contaminants within seafood such as mussels and shellfish are widely studied, yet information regarding consumption of plastic within fish is limited. Past research has identified plastic within the gut content of fish, yet research on plastic within muscle tissue is limited. We aimed to understand the presence and abundance of microplastics in traditional Inuit foods in the Cambridge Bay area of Nunavut using the muscle tissue of Arctic char (*Salvelinus alpinus*) and Lake Trout (*Salvelinus namaycush*), which are important food sources in Northern communities. Microplastics were extracted using chemical digestions, Microwave-Assisted Extraction, and quantified using Pyrolysis/Gas Chromatography-Mass Spectrometry. We identified six polymers in the fillets from three sample years. Twelve Arctic char samples and six Lake Trout samples were processed. Plastics were identified within the muscle tissue. Polyethylene and polyvinyl chloride were the most common polymer across both species. We did not find a relationship between the mass of the entire fish with microplastic concentration within the fillets. Since presence and abundance in the fillet has now been identified, more research is warranted to evaluate exposure risks.

Keywords: Microplastics, salmonids, Arctic ecology, contaminants

POSTER 10, POSTER BOARD 5, May 26th

Graduate work, Best poster, and People's Choice Awards

Road salt pollution alters sex ratios in emerging mosquito populations

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With high road densities, temperate cities can experience high de-icing salt use during the winter. When road salts runoff into freshwater environments, they can decimate ecological communities by wiping out salt-intolerant taxa and promoting salt-tolerant taxa. One salt-tolerant taxa of concern are mosquitoes, which are potential zoonotic disease vectors. An increase in mosquito abundance can lead to higher disease transmission risk for urban residents, but only female mosquitoes are able to transmit zoonotic diseases like West Nile Virus (WNV) as they are the only sex that requires bloodmeals. Interestingly, many mosquito species display male-biased sex ratios. Yet, little is known about how common urban stressors, like road salt, affect the sex ratios of emergent mosquitoes across a season. We hypothesized that stressful conditions (salinity) would result in a more male-biased sex ratio by disproportionately harming the larger sex (females) as they are foraging in a polluted environment with less food availability. To test this, we manipulated road salt concentrations (0 g/L or 4.5 g/L) in 10 mesocosms during the WNV season (May to October). We measured the emergence sex ratio of mosquitoes by collecting adults in emergence traps from mesocosms every week. Despite observing female-biased ratios across both treatments, we found that mosquitoes significantly shift their sex ratios towards parity (50:50) in response to salt. By showing a shift toward more male mosquitoes emerging in high salinity compared to control treatments, our results suggest that road salts may have the potential to decrease female mosquito success and indirectly reduce disease transmission in cities.

Keywords: salinity, urban ecology, aquatic pollution, sex ratio bias, disease vector

POSTER 11, POSTER BOARD 6, FRIDAY, MAY 26th

Honor's thesis work, Best poster, and People's Choice Awards

Expression of Co-Operative Behaviour Under Different Lighting Environments on *Drosophila melanogaster* Larvae

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Successful growth and development in many different species are strongly tied to the presence, timing, intensity and/or type of light present in their environment. In this study we were interested in seeing whether the patterns of clustering behaviour exhibited by groups of 3rd-instar *Drosophila melanogaster* (fruit fly) larvae was influenced by their early-life lighting environment. Larval clustering of *D. melanogaster* is a complex social behaviour that permits groups to feed on resources that are otherwise inaccessible to the individual. It is a complex social behaviour, whose expression is frequently context-dependent, and reportedly has a light-dependent learning phase associated with it. We were especially interested in examining if cluster production differed under blue light conditions, as this is a common type of light produced by the LED bulbs present in screens that has been implicated as having disruptive effects on physiology. Vials of larvae developed in complete darkness, or in 12L:12L diurnal cycles, where the light was either white, or of one of two different intensities of blue light, and the number, size, and membership in clusters was measured. We confirmed that clustering behaviour does require light, as larvae in the dark treatment were less likely to successfully engage in clustering. Larvae exposed to different light types/intensities expressed different patterns of clustering, which may have important consequences for their subsequent growth and development.

Keywords: Social behaviour, developmental environment, blue light, feeding, drosophila melanogaster

POSTER 12, POSTER BOARD 6, MAY 26th

Honor's thesis work, Best poster, and People's Choice Awards

Quantifying the Presence of Trace Element Metals in Yellow Perch (*Perca flavescens*) Tissue After Microplastic Exposure in In-Lake Mesocosms

Zaidi S, Hermabessiere L, Cable R, Coverton G, Helm P, Hoffman M, Langenfeld D, Orihel D, Patterson M, Provencher J, Rennie M, Veneruzzo C, Rochman C

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Plastic pollution is becoming an increasingly prominent environmental issue as plastic waste degrades into microplastics and accumulates in ecosystems. In aquatic ecosystems in particular, they can easily be consumed by zooplankton, fish, or mammals due to their small size, buoyancy, and visual attractiveness. Because plastics are generally treated with additional chemical additives, microplastics are prone to leaching additives into the water, which have previously been found to have toxic outcomes for organisms. We aim to quantify the presence of plastic additives in yellow perch (*Perca flavescens*) tissue using large-scale pelagic in-lake mesocosms. Here, we are investigating how metal trace elements (aluminum, titanium, and bismuth) used in pigment additives in common types of plastic might leach and contaminate fish tissue outside the gut. We exposed yellow perch in mesocosms at the International Institute for Sustainable Development's Experimental Lakes Area (IISD-ELA; Northwestern Ontario, Canada). Our experimental design included two plastic treatments with 29,240 microplastics/L of polyethylene, polyethylene terephthalate, and polystyrene microplastics (one with additives and one without) and a negative control ($n = 3$). The experiment lasted 9 weeks, then we sampled the fish (2 - 5 per replicate mesocosm) and removed the gut tissue from each. The remainder of the fish were homogenized, followed by a microwave digestion to extract metals. Once digested, extracts were filtered, diluted, and analyzed via inductively coupled plasma - optical emission spectrometry to determine the concentrations of aluminum, titanium, and bismuth in the tissues. We discovered that bismuth and titanium concentrations were insignificant between treatments, however, the concentration of aluminum was significantly higher in the tissues of fish that were exposed to microplastics with additives. This indicates that aluminum bioaccumulated from microplastic additives leaching into the tissues. These results improve our understanding of the fate of additives in organisms and inform future studies examining additives in freshwater ecosystems.

Keywords: Microplastics, ecotoxicity, additives, yellow perch, freshwater ecosystems

POSTER 13, POSTER BOARD 7, May 26th

Graduate work, Best poster, and People's Choice Awards

Sleeping sites of the white-eared opossum (*Didelphis albiventris*) in a Brazilian tropical forest: insights into sex differences

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Universidade Federal da Paraíba

Sleeping site choice by animals is usually a balance between predation risk, minimizing ectoparasites infection and remaining close to feeding sites. In this study we documented sleeping sites of the two males and one female white-eared opossums (*Didelphis albiventris*) in a remnant of northeastern Atlantic Forest in Brazil, using radio-telemetry techniques. The points were georeferenced and plotted on the home range map of the animals. In general, this species preferred sleeping in tree-holes in tall, large-bodied trees and the female seemed to have selected higher quality sites. This is the first study of sleeping sites of this species and a contribution to its wider behavioral ecology.

Keywords: Neotropical marsupials; opossums; sleeping area; Atlantic Forest

POSTER 14, POSTER BOARD 7, May 26th

Graduate work, People's Choice Awards

The role of intradiol ring-cleavage dioxygenases in *Tetranychus urticae* adaptation to *Arabidopsis thaliana*

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Tetranychus urticae (two-spotted spider mite) is an extreme generalist herbivore with the ability to feed on over 1100 plant species, including 150 of agricultural importance. The two-spotted spider mite's polyphagous nature is driven by rapid adaptation to plant defenses. However, the specific plant defense compounds mites must overcome to achieve a host-adapted state are largely unknown. *Arabidopsis thaliana* is a challenging and non-preferred host for *T. urticae*, making it an excellent model to study mite-host adaptation. It has previously been shown that a class of tryptophan-derived compounds specific to the Brassicaceae family, indole glucosinolates, contribute partially to the *A. thaliana* defense response. The remaining phytochemicals that protect the plant against mite herbivory are unknown. We used combined metabolomic and transcriptomic approaches to identify classes of plant compounds that are induced upon mite feeding. HPLC-MS and RNA-seq revealed that both phenylpropanoids and flavonoids increase in abundance in planta upon mite feeding. Next, we measured mite fecundity on mutant *A. thaliana* plants defective in overall phenylpropanoid and flavonoid biosynthesis to assess mite performance. We found that mite fecundity significantly increases on phenylpropanoid and flavonoid mutants relative to wild-type plants, suggesting that compounds within these pathways are toxic to spider mites. We will next feed mites with these plant compounds and screen for resulting mite mortality levels to confirm the toxicity of these compounds *in vivo*. This study may identify phenylpropanoids and flavonoids as novel defense compounds protecting *A. thaliana* against spider mite herbivory. Because many phenylpropanoids and flavonoids are ubiquitous among plants, this study may shed light on mite adaptation mechanisms to not only *A. thaliana*, but economically important plants as well. Additionally, these findings may enable the development of novel pest control strategies through the identification of toxic phytochemicals.

Keywords: intradiol dioxygenase, host-herbivore interactions, metabolic resistance, *Arabidopsis thaliana*, two-spotted spider mite

POSTER 15, POSTER BOARD 8, May 26th

Honor's thesis work, Best poster, and People's Choice Awards

Both microplastic concentration and food availability affect *Daphnia magna* survival

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Microplastics (MPs) are found in freshwater ecosystems, yet how they affect organisms remains poorly understood. One observed mechanism relevant to adverse effects of MPs is food dilution. These effects may vary with food availability, which has implications for the outcomes of experiments using different food availability, as well as how MPs might affect organisms and food webs under various environmental conditions. In this study, we investigated the relationship between MP effects and food availability through a fully factorial experiment exposing *Daphnia magna* to three levels of environmentally relevant MP concentrations including a negative control, and three levels of food availability using virgin polyethylene (PE), polyethylene terephthalate (PET), and polystyrene (PS) microplastic fragments. We exposed 10 *Daphnia magna* individuals per treatment (1 per experimental unit, n = 10) which resulted in 90 total parent individuals. We monitored daily for mortalities and neonates as well as measured growth at the end of the experiment. We found effects of both microplastic concentration and food availability on *Daphnia* survival, but no significant interactive effects. Reproduction was affected by food availability but not microplastic concentration. Growth was different depending on food level with no effects of microplastics exposure. Here our results indicated that food availability does not necessarily affect the toxicity of microplastics to *Daphnia magna*. Still, we saw a pattern whereby daphnia exposed to higher microplastics had lower survival with medium food. Thus, we recommend considering food availability in toxicity tests, and we suggest future experiments use finer grain plastic and food treatments to detect an interaction.

Keywords: Microplastics, *Daphnia magna*, Food dilution, Interactive effects, Toxicity

POSTER 16, POSTER BOARD 8, May 26th

Graduate work, People's Choice Awards

Dynamics of stored lipids in fall migratory Monarch Butterflies (*Danaus plexippus*): Nectaring in Mexico allows recovery from the southwestern US drought?

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The eastern population of the North American monarch butterfly (*Danaus plexippus*) overwinters from November through March in the high-altitude (3000m+) forests of central Mexico. During this 5-month interval, individuals rely largely on stored lipids to last them through the winter and possibly through the return migration in the spring. Lipids are acquired during larval development and the conversion of sugars from flowers rich in nectar by adults. The dynamics of acquisition and utilization of lipids through the fall migration into spring are not well understood. The average lipid levels of monarchs collected at overwintering sites however, indicated that most had high levels of lipids prior to winter. This result suggested that the acquisition and depletion of lipids was a dynamic process that occurred throughout the migration and that a significant portion of the lipids were acquired in Mexico during the last portion of the migration. To test this hypothesis, we sampled fall migrant monarchs from southern Canada through the migratory route to two overwintering sites in 2019 (n=10 locations), 2020 (n=8 locations) and 2021 (n=7 locations). The influence of drought conditions in Oklahoma, Texas and northern Mexico in 2019 resulted in the lowest levels of lipid mass and wing loading occurring in that year but with higher levels at locations in Mexico southward to the overwinter sites. Lipid levels increased considerably during the 2020 and 2021 fall migrations but were higher during the Mexican portion of the migration than for Oklahoma and Texas samples, again suggesting a recovery as monarchs advanced toward the overwintering locations. In all three years, body water was highest during the Canada - USA phase of migration but then declined during the nectar foraging phase in Mexico before recovering again at the overwinter sites. Nectar availability and refueling by migrant monarchs is complex and depends on several proximate weather conditions and longer-term soil moisture that determines plant growth and floral nectar secretion which can change from year to year. The increase in mass and lipids from those in Texas to the overwintering sites in Mexico indicates that nectar availability in Mexico can compensate for poor conditions experienced further north. Our work emphasizes the need to maintain the floral and therefore nectar resources that fuel both the migration and storage of lipids throughout the entire migratory route.

Keywords: Lipid stores, nectar availability, fuel, wing loading, habitat conservation

POSTER 17, POSTER BOARD 1, May 26th

Graduate work, Best poster, and People's Choice Awards

Wingtip shape influences take-off speed within and among migratory songbirds

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Wings play a critical role in determining flight performance. Longer, more pointed wings are believed to increase energy efficiency during level flight, which could increase overall migration rate. Shorter, more rounded wings are believed to increase maneuverability, which could result in increased predator avoidance. Many migratory songbirds exhibit protandry, meaning males arrive earlier than females to the breeding grounds, and older birds typically arrive before younger ones. As a result, sex and age-related differences in wing morphology should represent trade-offs between flight efficiency and predator avoidance. To evaluate this, we analyzed the wing morphology and take-off speed of 1929 songbirds across 18 families captured during migration in Long Point, Ontario. Feather lengths were measured and used to determine wingtip size, pointedness, and convexity. We used Quantitative Magnetic Resonance to determine fat mass. The birds were then flown in a vertical flight chamber equipped with quad-level infrared light sensors and detectors, which allowed us to measure take-off speed at varying distances from the ground. We found that males and older birds had wingtips that were larger and more convex compared to females and younger birds. Older birds had more pointed wingtips than younger birds. Size and convexity were positively related to take-off speed while fat mass reduced speed, but only near the ground. Males were faster than females, birds were faster in the fall, and the ages had similar speeds. Given the strong relationship between wingtip convexity and take-off speed, future work should focus on the impact of wingtip convexity on level flight efficiency.

Keywords: Wing shape, flight performance, songbirds, take-off speed, migration

POSTER 18, POSTER BOARD 1, May 26th

Graduate work, Best poster, and People's Choice Awards

Ecological Drivers of Autumn Refuelling and Stopover Behaviour in Songbirds Migrating Through Eastern New Brunswick

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Songbirds acquire the energy to power migratory flight during inter-flight stopover bouts, yet our understanding of the linkages between habitat characteristics, energy deposition, and movement behaviour has been limited by the challenge of measuring these aspects in free living birds. Understanding these aspects is key to effective and scientifically informed conservation and management planning aimed to mitigate the anthropogenic impact on migratory bird species. We combined physiological assessment of refuelling with automated radio telemetry and invertebrate sampling to test how key individual characteristics together with aspects of stopover habitat shape the refuelling and movement of common songbird species at inland and coastal stopover sites in eastern New Brunswick during autumn migration. Local migrant abundance and invertebrate abundance did not differ systematically between inland and coastal stopover sites but varied between sites and across the migratory period. Capture refuelling rate differed between species and was greater in individuals with greater body mass, while resource abundance had an inconsistent effect on refuelling among species. Stopover departure hazard was increased by greater nocturnal tailwind assistance and greater capture date. Lower refuelling rate increased departure probability when the analysis was restricted to the first day of stopover. Together these results suggest that departure is governed by an initial assessment of local refuelling conditions, followed predominantly by the availability of energetically favourable tailwinds. Species level differences in refuelling may be partly explained by differences observed in the onset of daily activity.

Keywords: Metabolites, radio telemetry, movement behaviour, physiology, landscape

POSTER 19, POSTER BOARD 2, May 26th

Honor's thesis work, Best poster, and People's Choice Awards

Arthropod Diversity in Regrown Urban Grass Environments

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The impacts of climate change are especially pronounced in urban environments, where global warming temperatures heat the urban environment more than its impact would be in forested areas. The drastic environmental changes resulting from global warming alter arthropod communities, which are highly sensitive to climate change. Disruption to the arthropod community threatens the entire urban environment food web and the already diminishing number of pollinator species inhabiting urban environments. The clear threat that global warming poses on urban arthropod communities has motivated studies addressing the impact of climate change on arthropods by tracking shifts in arthropod biodiversity when their native urban grassland is regrown. However, key factors including regrown grass height, time since mowing ceased, and plot size have not been considered in the current, narrow focused research. We are predicting to find that as the grassland plots regrow, arthropod diversity will increase with plot size and duration since mowing ceased. Generalist and specialist arthropod populations are predicted to have varying responses to the naturalization of the grassland, with generalist arthropod populations increasing dramatically and specialist populations experiencing a slow increase in diversity throughout grassland regrowth. Our results will demonstrate how arthropod communities respond to grassland naturalization, specifically building on parameters such as plot size and plant height, which enhances existing knowledge of how arthropod communities respond to grassland naturalization. Understanding which grassland parameters are optimal to support an urban arthropod community will help city planners choose which sites have the greatest biodiversity potential and outline how human management strategies can be used to support urban arthropod communities.

Keywords: Urban, genomics, arthropods, climate change

POSTER 20, POSTER BOARD 2, May 26th

Graduate work, Best poster, and People's Choice Awards

Genetic diversity and fitness variation among populations of clonal invasive plants

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Over the last century, the aquatic plant flowering rush (*Butomus umbellatus*) has escaped its native European range and invaded parts of North America. Two cytotypes are currently invading North America: diploids, which are fertile and produce abundant seed and bulbil as well as triploids, which are sterile and produce little to no seed or bulbil. Even though diploids invest heavily in seed production, there is little evidence of sexual recruitment in invading populations. Environmental niche modelling predicts that flowering rush will continue to expand its range in North America. Because of the economic, environmental, and ecological impacts of its invasion, there are many biological control projects against flowering rush. The extent to which the diploid genotype can reproduce sexually, and the consequences of sexual reproduction are crucial for management for at least three reasons. (1) Biocontrol is more successful against plants that reproduce clonally compared to sexually reproducing species. (2) Seeds are more important vehicles for long-distance dispersal than clonal propagules. (3) Sexual recombination likely facilitates local adaptation, which can play a key role in the success of invasive species. My long-term goal is to understand the constraints on sexual reproduction in North American *Butomus*. I will progress towards my goal by addressing three short term objectives. Objective 1: Is sexual reproduction occurring in North American diploid populations of *Butomus*? Objective 2: What is the germination and recruitment niche of *Butomus* seed? Objective 3: What are the consequences of sexual recruitment in North American *Butomus*? Addressing these objectives will directly contribute to management efforts.

Keywords: *Butomus umbellatus*, Invasive Species, Clonal Reproduction, Sexual Reproduction, Germination Niche

POSTER 21, POSTER BOARD 3, May 26th

Honor's thesis work, Best poster, and People's Choice Awards

The influence of flight capacity of Neotropical birds in the Ecuadorian Andes on the proportion of *Polylepis* patches occupied

Erdem I, and Claramunt S.

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Habitat fragmentation and habitat loss are major threats to biodiversity and can affect the persistence and survival of species. The páramo landscapes of the northern tropical Andes are regions that are facing habitat alterations and are considered to be hotspots for avian biodiversity. These landscapes house *Polylepis* woodland patches that have also been highly impacted by increased fragmentation and decreased patch quality. Avian species are important indicators of habitat qualities in fragmented landscapes, due to their dispersal abilities. Given the dispersal abilities of birds and morphological predictors of flight capacity, it is predicted that flight capabilities could influence the proportion of patches the birds in the Ecuadorian Andes would occupy. We tested this prediction by examining the relationship between flight capacity and patch occupancy in the *Polylepis* patches of Cajas National Park, Ecuador. We analyzed patch occupancy in this páramo landscape. We quantified the flight capacity of 16 Neotropical birds using the aspect ratio, calculated based on measurements of specimens from the Royal Ontario Museum. Upon investigating different models using a phylogenetic binomial multi-predictor regression model, it was found that aspect ratio and total abundance were the two most important predictors for the proportion of patches occupied in the region. These findings indicate that morphological indices that influence flight capacity and the abundance of species should be taken into consideration when analyzing patch movements and the dispersal of species in fragmented landscapes. Other predictors such as mass, diet, tail length, and stratum could also be investigated to create a more comprehensive model which could help assess species persistence in regions that are threatened by habitat fragmentation.

Keywords: avian ecology, dispersal, wing morphology, flight efficiency

POSTER 22, POSTER BOARD 3, May 26th

Graduate work, Best poster, and People's Choice Awards

Evaluation of prey correlation with lice cleaning efficiency of lumpfish (*Cyclopterus lumpus*) in Canadian Atlantic salmon (*Salmo salar*) aquaculture in Newfoundland, Canada using morphological identification and DNA metabarcoding techniques

Gardner K, and Boulding EG.

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Aquaculture is a rapidly expanding industry worldwide, although it faces a significant challenge from parasitic copepods known as “sea lice”. A commonly encountered species in Newfoundland Atlantic salmon farms is the salmon louse (*Lepeophtheirus salmonis*), which only infects salmonid species and causes fish welfare issues. The use of lumpfish (*Cyclopterus lumpus*) as a biological control is a common sea lice infestation management method in Canadian aquaculture, as these fish are opportunistic generalist feeders and consume sea lice. Dietary analysis of lumpfish collected from Atlantic salmon farms in Newfoundland by Jessica Roy, a recent M.Sc. student from the Boulding lab, revealed significant differences in the morphological analysis of diet composition between samples collected in 2018 and 2020, which was substantiated by DNA metabarcoding. However, the samples from different years were obtained from different farm locations and using different sampling methods. Thus, more research is necessary to determine whether there are significant differences in dietary analysis among farm locations and years while maintaining a constant sampling method. My primary objective of this study is to evaluate the relationship between diet composition and lumpfish cleaning efficiency in Atlantic salmon cages. My secondary objective is to identify slower-digesting, wild prey items that may serve as indicators of more effective delousing of the salmon by the lumpfish. My hypothesis is lumpfish consume high energy prey items over low energy prey items when available within their sea-cage environments to maximize their daily energy intake. My study predicts the diet composition will vary between aquaculture farm locations relative to local prey, and *Lepeophtheirus salmonis* will be more abundant in sites where krill are absent. The results of this study will assist aquaculture companies in reducing Atlantic salmon losses caused by sea lice infestations and provide further insight into lumpfish diet relative to farm location.

Keywords: Lumpfish, cleaning efficacy, sea cage, morphospecies, DNA metabarcoding

POSTER 23, POSTER BOARD 4, May 26th

Honor's thesis work, Best poster, and People's Choice Awards

Tail morphologies strengthen the relationship between flight efficiency and natal dispersal distances in birds

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Natal dispersal is the process of organisms moving from where they are born to where they first breed, and this distance has many important ecological implications. Previous studies have found a positive relationship between flight efficiency and natal dispersal distance in birds. These papers have estimated flight efficiency by focusing primarily on wing characteristics, although tails have implications for flight efficiency as well, including the generation of lift and drag. In this paper we hypothesized that supplementing the flight efficiency proxy of wing aspect ratio with tail morphologies will strengthen the positive correlation between flight efficiency and natal dispersal distances in birds. This hypothesis was evaluated by measuring the tail sizes of 35 species of North American birds and incorporating this data in wing aspect ratio calculations. Phylogenetic generalized least squares (PGLS) models were then used to analyze the relationships between species average natal dispersal distances and species average wing aspect ratio and relative tail size (Method 1) and wing aspect ratio including tail area (Method 2). These models were then compared to a PGLS model of species average natal dispersal distances and wing aspect ratio's excluding tail data. We found that both adding relative tail size and including tail area in the wing aspect ratio calculations of these North American birds better predicts their natal dispersal distances. This suggests that avian flight efficiency and dispersal ability may be better estimated by models that include tail morphologies. This has importance in studying conservation, since dispersal is a principal method that birds may use to combat habitat fragmentation and climate change.

Keywords: birds, dispersal, ecomorphology, flight performance, tail morphology

POSTER 24, POSTER BOARD 4, May 26th – Withdrawn

POSTER 25, POSTER BOARD 5, May 26th – Withdrawn

POSTER 26, POSTER BOARD 5, May 26th

Honor's thesis work, Best poster, and People's Choice Awards

Community structure of trichoptera across the credit river watershed in the 1950s

Dede Kueviakoe K, and Murray-Stoker K.

University of Toronto Mississauga

This study demonstrates how the sex ratios and diversity of the primarily aquatic insect order of *Trichoptera* (Caddisfly) varies across the Credit River Watershed in the 1950s. Diversity will be assessed using raw species richness, as well as the Shannon-Wiener index for species richness and evenness. Due to the varying levels of urbanization that exist between sites, it will be possible to determine how caddisfly communities have changed: whether they show resilience or are negatively affected by these changes. Caddisflies are an ideal study organism because they have been shown to have varying sensitivities to pollution. The ethanol-preserved caddisfly samples for this study were taken from the Royal Ontario Museum Entomology collection, collected by Glen B. Wiggins in the 1950s. This paper will help characterize the past Credit River Caddisfly community which can be used to develop the knowledge we have about long-term community change in *Trichoptera* of the same community in the present.

Keywords: *Trichoptera*, urbanization, urban gradient, aquatic insect, sex-ratios, diversity, species richness

POSTER 27, POSTER BOARD 6, May 26th

Graduate work, Best poster, and People's Choice Awards

White-footed mouse (*Peromyscus leucopus*) response to restoration of grassland alvar

Burgess T¹, Sukumar S², Thomas M², and Bowman J^{1,3}

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Grassland alvar is a rare plant community in Ontario that does not occur elsewhere in Canada. Alvar habitats can be degraded by encroaching vegetation due to a lack of fire, and therefore methods of controlling vegetation might be required to maintain or restore alvars. The restoration and maintenance of alvar habitats is important for endemic species occurring on alvars, such as the eastern foxsnake (*Pantherophis gloydi*) and the blue racer (*Coluber constrictor foxii*), two endangered snake species. We evaluated the hypothesis that the control of encroaching vegetation could lead to the restoration of the alvar ecosystem. More specifically, we tested whether small mammals in alvar habitats would respond to two methods of control, prescribed burns and mechanical removal. A prescribed burn and mechanical removal of shrubs and forbs was conducted beginning in late 2019 on Pelee Island, Ontario, Canada. Live trapping of small mammals and associated vegetation monitoring was conducted before and after treatments. The only small mammal species to be caught was the white-footed mouse (*Peromyscus leucopus*), which had an observed decrease across all treatment sites and the control site. Generalized linear mixed effects models were used to determine that the effects of treatment plus variation by year best explained mouse abundance. We found variables describing coarse woody debris at a site were positively associated with capture success of mice, and that coarse woody debris variables decreased in all sites over the monitoring period. We suggest that as mouse abundance was related to coarse woody debris present in habitats, the decline in the debris at all locations explained the decrease in mice capture success across all sites.

Keywords: Grassland alvar, *Peromyscus leucopus*, prescribed burn, Pelee Island, endangered snakes.

POSTER 28, POSTER BOARD 6, May 26th

Graduate work, Best poster, and People's Choice Awards

Latitudinal variation in mutualism: a case study using castor plant - ant interactions

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The Biotic Interactions Hypothesis posits that interactions with other species, rather than environmental variables, and the primary agents of selection on living organisms as we move closer to the equator. Mutualism has recently begun to gain traction as an important factor in structuring and maintaining biodiversity, but there is mixed evidence in the literature on how the degree of generalization, intensity and diversity of partners in mutualism vary across latitude. In this study, we surveyed the mutualistic interactions of the castor plant (*Ricinus communis*) with ants across a 20–∞ latitudinal range across the Indian subcontinent to understand how mutualism with ants varies with latitude. In addition to being cultivated extensively for oil in India, castor plants are widespread close to human settlements. These plants produce different kinds of extrafloral nectaries (EFNs) and their seeds have fat-rich structures called elaiosomes, both of which are consumed by ants which may in turn protect the plant from herbivores and disperse its seeds. We measured mutualistic traits (EFN volume, size and number, elaiosome size) and interactions in castor populations in ten sites across India. We found that investment in mutualism by castor plants and the species richness of ant partners increases from temperate to tropical latitudes. We also found that herbivory decreased from temperate to tropical latitudes suggesting that recruiting ants as bodyguards is an effective anti-herbivore strategy. Taken together, our results lend support to the Biotic Interactions Hypothesis and contribute to a deeper understanding of the biogeography of species interactions.

Keywords: Mutualism, ant, castor, latitudinal gradient, EFN, elaiosome

POSTER 29, POSTER BOARD 7, May 26th

Graduate work, People's Choice Awards

Pesticide resistance levels in field and greenhouse populations of *Tetranychus urticae*

Moreira do Nascimento J, Zhurov V, Varonina H, Spenler J, fÜulo Z, Rahn A, Surman E, Gallo J, Scott I, Lizotte D, Baute T, MacDonald T, Bennett N, Grbić M and Grbić V

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The University of Western Ontario, Department of Computer Sciences, London ON, CANADA Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), Ridgetown ON, CANADA Plant Products Inc, Leamington ON, CANADA and Ontario Greenhouse Vegetable Growers (OGVG), Leamington ON, CANADA

Two-spotted spider mite, *Tetranychus urticae* (Koch), is a chelicerate herbivore with an exceptionally wide host range. It is a frequent pest of a wide variety of economically important crops. While low-level infestations are controlled by biological agents such as beneficial predatory mites, midges, and bugs, chemical controls are frequently implemented for persistent pest populations. However, pesticide resistance is frequently reported in *T. urticae* populations across the globe. Here we present a 2021 assessment of pesticide resistance of *T. urticae* populations coming from Southwestern Ontario. Our study covered a variety of crops (cucumber, pepper, strawberry, tomato, and soybean), and production systems (greenhouse and field). The assessed active compounds were abamectin, bifenazate, cyflumetofen, dimethoate, etoxazole, pyridaben, and spiromesifen. Our results indicate that resistance to multiple pesticides was present in the majority of the sampled populations with the greenhouse-collected populations being the most resistant. These results may be used to prioritize and plan pesticide usage on crops where multiple products are registered. Our assessment may also inform a choice of additional pesticide registration for spider mite control on soybean, which is currently performed exclusively with dimethoate that was demonstrated to have limited effectiveness.

Keywords: Spider mite, Phytophagous, Pest control, Acaricides

POSTER 30, POSTER BOARD 7, May 26th

Honor's thesis work, Best poster, and People's Choice Awards

The effects of N-heterocyclic carbene-enhanced coats on microbial corrosion of mild steel

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Microbial-influenced corrosion is the electrochemical mechanism whereby microorganisms can cause, contribute to, or accelerate the chemical degradation of materials by interacting with the substrate, surrounding solution, and other microorganisms. Microbial corrosion often occurs in the presence of biofilms and has been reported to cause structural damage in various environments, including nuclear waste storage facilities, medical devices, and pipelines. Overall, corrosion-related expenses are estimated to cost the global economy 2.5 trillion USD annually, with microbial corrosion potentially accounting for over 20% of total costs. While corrosion-resistant coats are an inexpensive and effective method of mitigating corrosion, they are susceptible to the formation and propagation of cracks. These defects can serve as entryways for oxygen, water, and microorganisms resulting in coating disbondment and localized corrosion. In the past 30 years, N-heterocyclic carbenes have gained significant recognition as attractive ligands for metal catalysis due to their ability to form strong, stable bonds with transition metals. Consequently, newly synthesized N-heterocyclic carbenes demonstrate the potential to reduce corrosion and increase adhesion between corrosion-resistant coats and the metal surface. This research will investigate whether carbene-enhanced metal can protect against microbial-influenced corrosion by exposing metals to pure cultures of corrosion-causing *Pseudomonas fluorescens* and *Desulfovibrio vulgaris*. Changes in the metal surface will be examined using scanning electron microscopy and Raman spectroscopy. RNA will also be extracted and sequenced from the biofilm to examine changes in corrosion-related gene expression in the bacteria. This research will help assess the efficacy of N-heterocyclic carbenes in reducing corrosion and contribute to the development of corrosion-preventative techniques.

Keywords: Bacteria, corrosion, N-heterocyclic carbenes, oil pipelines

Lunch & Learn II

Saturday, May 27th 12 – 2pm, Physics & Astronomy Atrium

POSTER 1, POSTER BOARD 1, May 27th

Graduate work, Best poster, and People's Choice Awards

Microbial community response to experimental warming in boreal peatlands

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Boreal peatlands are essential in global carbon cycles and storage as waterlogged, anoxic, acidic and low temperatures decrease rates of decomposition of organic substrates by microbial communities. However, this balance is at risk due to predicted effects of climate change on these conditions that is expected to disproportionately affect boreal peatlands and could potentially alter carbon storage and decomposition processes such that peatlands become carbon sources. As microbial communities play a vital role in decomposition, shifts in microbial community abundance and composition responding to climate change are undoubtedly changing, making them essential indicators of how carbon cycles will change. Experimentally warmed plots in boreal peatlands have previously shown shifts in plant and soil mesofauna towards more heterogeneous communities, however, less is known about how microbes will respond. In addition, previous methods of measuring microbial biomass using PLFA analysis gives vague functional and taxonomic details and are not optimized for organic-rich soils. Thus, I will be using ambient and experimentally warmed plots, to quantify differences in microbial biomass and community composition, using quantitative PCR (qPCR) and metabarcoding sequencing respectively, and in doing so provide an indicator for changes in microbial biomass in peatlands. I will also compare biomass estimates obtained from qPCR and PLFA and test if they are analogous. By quantifying shifts in microbial community composition and abundance, my research will provide baseline estimates on changes in microbial responses to experimental warming and validate the use of qPCR as a measure of microbial biomass in peatlands. Overall, my work will contribute to microbial carbon cycling models under the pressures of climate change.

Keywords: Peatlands, microbes, climate change, biodiversity, biomass

POSTER 2, POSTER BOARD 1, May 27th – Withdrawn

POSTER 3, POSTER BOARD 2, May 27th

Graduate work, Best poster, and People's Choice Awards

Potential probiotic bacteria isolated from water kefir and their inhibitory effect against the contagious bee pathogen *Paenibacillus* larvae

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United States Department of Agriculture. Bee Research Laboratory. Beltsville MD, USA

CONICET; Centro de Microbiología Básica y Aplicada (CEMIBA). Facultad de Ciencias Veterinarias. Universidad Nacional de La Plata (UNLP). La Plata, Buenos Aires, Argentina

Managed populations of honeybees (*Apis mellifera*) are exposed to several infectious diseases like American Foulbrood caused by the bacteria *Paenibacillus* larvae. In beekeeping, the controlled application of beneficial microorganisms is a potential alternative to the routine use of antibiotics. In this study, we use 16S rRNA gene amplicon sequencing to explore bacterial communities found in water kefir, a type of fermented drink that is popular in South America. From this source, we test the potential of any isolated strains to inhibit pathogen growth in vitro and, if successful, consider the future use of these strains as deliberately applied probiotics that can potentially help medicate bees against the worst symptoms of foulbrood. Our initial sequencing screen revealed a total of 30 different bacterial isolates, including an abundance of *Liquorilactobacillus*, *Leuconostoc* and *Oenococcus*. These lactic acid bacteria have species that are well represented in kefir and two of them, *Lentilactobacillus hilgardii* and *Lentilactobacillus buchneri*, are active against bacteria pathogenic to bee larvae. We therefore regard water kefir as a rich source of living bacterial cultures that are of potential relevance to beekeeping. For each candidate, we used agar-well diffusion method to test the soluble substances in cell-free supernatants against the measured growth of *P. larvae*. We found that most isolated strains (26 of 30) did inhibit the growth of the bee pathogen, being the strongest antagonism effect an inhibition zone of 10 mm. These strains thus show promise as future probiotic supplements that can potentially be applied to hives in an apiary. Currently, we are studying the nature of the antibacterial metabolites, including organic acids and bacteriocins. Once we identify them, we will incorporate the bacteria supernatants into bee food as a probiotic supplement to control honeybee diseases.

Keywords: *Apis mellifera*, *Paenibacillus* larvae, probiotics, water kefir, microbial ecology

POSTER 4, POSTER BOARD 2, May 27th

Graduate work, People's Choice Awards

Effects of migratory strategy on flight muscle mitochondrial physiology in songbirds

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Migration is an energetically challenging life-history strategy for birds, so variation in migratory strategy may translate to variation in energetic requirements. Mitochondria supply a large proportion of the energy used for migration, yet how mitochondrial function varies with migratory strategy is unclear. We hypothesized that mitochondrial function varies with migratory strategy in birds and predicted greatest capacities for oxidative phosphorylation and lowest for reactive oxygen species emission in long-distance migrant species compared to short-distance migrants. We tested this hypothesis by comparing mitochondrial physiology between a short-distance migrant and a long-distance migrant species in six Nearctic passerine families. We classified species overwintering in North America as short-distance migrants, and species overwintering in South America as long-distance migrants. We captured birds during spring or autumn migration at Long Point, Ontario, Canada and transferred birds to short-term captivity at Western University prior to sampling. We then assayed mitochondrial function using mitochondria isolated from the flight muscle. We found similar capacities for oxidative phosphorylation between short- and long-distance migrants within five families. Similarly, we found little variation reactive oxygen species emission rates between short- and long-distance migrants in five families. Together, our data do not support our hypothesis and suggest limited variation in mitochondrial physiology with overall distance of migration. This lack of variation may reflect similarities in energetic requirements that are independent of migratory distance or suggest that migratory songbirds converge in mitochondrial function.

Keywords: mitochondria, migration, evolution, birds, metabolism

POSTER 5, POSTER BOARD 3, May 27th

Graduate work, Best poster, and People's Choice Awards

Effects of site and migratory season on the consumption of biofilm and essential fatty acids composition in Western Sandpipers

Walters, S. H., Guglielmo, C. G., Hobson, K. A.

University of Western Ontario

Western Sandpipers (*Calidris mauri*) stop at mudflats along the Pacific Flyway where surface biofilm is thought to be a major component of their diet. Omega-3 (n3) long-chain polyunsaturated fatty acids (LC-PUFAs) within biofilm diatoms have been hypothesized to improve the physiological condition and migration performance of marine-associated birds. These LC-PUFAs are abundant in aquatic environments, with longer forms such as eicosapentaenoic acid (EPA; 20:5n3) and docosahexaenoic acid (DHA; 22:6n3) being strongly tied to marine sources. The fatty acid composition of biofilm diatoms may vary among mudflats due to different environmental conditions tied to location and season. For example, at Robert's Bank in the Fraser River Delta (FRD) of British Columbia, Canada, the spring snowmelt freshet is suspected to induce n3 LC-PUFA proliferation in biofilm diatoms. We investigated whether consumption of biofilm by refueling sandpipers varied depending on mudflat location and season, and whether it affected the fatty acid composition of plasma lipids. In 2020 and 2021, we sampled Western Sandpipers at Robert's Bank and two other FRD mudflats farther from the river outflow, as well as at marine-dominated mudflats on the west coast of Vancouver Island (Tofino, B.C.). Mudflat invertebrates and biofilm were also collected from these sites during both seasons. Bayesian isotopic ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$) mixing models were created to determine the probabilistic proportions of biofilm and invertebrate functional groups in the diet. Gas chromatographic analysis of plasma revealed significant differences in LC-PUFAs by site and season, with a particularly strong seasonal shift occurring at Robert's Bank.

Keywords: migration, nutritional ecology, stable isotopes, gas chromatography

POSTER 6, POSTER BOARD 3, May 27th

Graduate work, Best poster, and People's Choice Awards

***Drosophila* social spacing: elucidating the neural circuitry**

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Social behaviour can be defined as a response of individuals to conspecifics and is required for organisms to survive and reproduce. As such, social behaviour relies on the perception, integration, and response to stimuli, arising from interactions or communication from other individuals. The integration of and response to these cues from others require signalling throughout neural circuitry, which at the cellular level takes place between neurons via the synapse. The focus of our lab is to better understand the neurogenetic underpinnings of *Drosophila melanogaster* social space determination. We and others have shown that social spacing in *D. melanogaster* can be influenced by a variety of intrinsic and extrinsic factors, such as mating status, social enrichment, genes, and environmental conditions. Many genetic factors that play a part in pre- and post-synaptic regulation and signalling are important in this social behaviour. We have shown that dopaminergic signalling is important for modulating social space, while others have also implicated acetylcholine in the mushroom bodies. Recent research has also begun to connect neuropils or specific neural circuits to their associated social behaviours. Here, we show that genetic control of these circuits, and silencing specific neurotransmitter transmission, can in turn modify fly behaviour and provide insight into the neural circuitry controlling social space. I will present the culmination of progress our lab has made in elucidating the basis underlying the decision-making process for group formation and distancing, as represented by the number of flies within four body lengths in the social space assay. Our findings identify specific neuropil involvement in social space and the causal neural circuits for the sex-specific determination of social spacing. We also highlight novel synaptic molecular players and neurotransmitter types that influence social space.

Keywords: Behavioural genetics, neurons, synapse, sexual dimorphism

POSTER 7, POSTER BOARD 4, May 27th

Graduate work, Best poster, and People's Choice Awards

The potential for gut microbes to affect honeybee hygienic behaviour

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Honeybees live in densely populated colonies of closely related individuals and, as such, are vulnerable to the spread of contagion. One mechanism that bees have evolved to reduce this threat is hygiene: a characteristic behaviour performed by nurse-age worker bees, which consists of uncapping and removing dead or diseased brood from the hive. Despite the potential to artificially select for this trait through queen breeding, it is difficult to breed for hygiene, and there is no short-term solution that beekeepers might use to stimulate a hygienic response within their apiaries. In my project, I will supplement bee diet with a probiotic strain of *Lactobacillus* that may alter brain neurochemistry in a way that increases nurse perception of disease and, as such, could effectively bolster the hygienic response upon consumption. *Lactobacillus* is a gram-positive, lactic-acid-producing bacteria that can affect immune-associated gene expression and neurotransmitter concentration in the honeybee brain, suggesting that this genus may influence sensitivity to environmental cues. To test for potential effects on hygienic behaviour, I am using a 12-colony field assay to measure how effectively nurse bees remove freeze-killed brood from their hives. In addition to studying possible behavioural changes, I will verify cause and effect by examining concomitant changes in the abundance of the gut microbiota (via 16S rRNA gene amplicon sequencing) and the concentration of neurotransmitters in the brain (via histochemical staining and chromatography). The results of this experiment will contribute to the development of antibiotic-free approaches in disease control of managed honeybee colonies.

Keywords: honeybees, microbiome, neurotransmitters, hygiene, probiotics

POSTER 8, POSTER BOARD 4, May 27th

Honor's thesis work, Best poster, and People's Choice Awards

Seeing & speeding: the effects of reduced visibility on fish activity

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Although aquatic visibility varies naturally, anthropogenic influences like runoff from agriculture, deforestation, and factories have drastically decreased visibility in aquatic habitats worldwide. This decrease in visibility can create challenges for aquatic organisms that rely on visual cues to forage, avoid predators, and perform courtship. Two common forms of anthropogenically reduced visibility include turbidity, caused when suspended particulates in water scatter light, and low-light conditions, caused when pigments in water absorb light. However, we still do not know if turbidity vs. low-light conditions impact fish and other aquatic organisms differently. Furthermore, most studies on this topic expose fish to stable low-visibility conditions. As such, my thesis examines how turbidity vs. low-light conditions and stable vs. fluctuating visibility affect fish activity. To investigate these issues, I ran several experiments exposing zebrafish (*Danio rerio*) to either clay-based turbidity or dye-based low-visibility conditions, and fish were assigned to one of three treatment conditions (control, stable, and fluctuating visibility). Fish behaviour was videotaped and processed through TRex, an automated AI movement-tracking program. For dye experiments (low-light exposure), results suggest that fish exposed to fluctuating visibility experienced greater mean swimming speeds compared to control fish, and this was especially apparent during low-visibility fluctuations. However, we did not find similar results in clay experiments (turbidity exposure). Overall, our results show that low-light conditions may impact zebrafish more strongly than turbidity, and the degree of decreased visibility affects fish activity more than fluctuations themselves. These findings suggest that clay and dye should not be treated interchangeably in future turbidity experiments and provides insight on how human activity impacts aquatic life.

Keywords: fish, turbidity, low-light, behaviour, fluctuations

POSTER 9, POSTER BOARD 5, May 27th

Graduate work, Best poster, and People's Choice Awards

Juvenile corn snakes do not prefer familiar conspecifics in a 3-chamber task

Maggie-Rose Johnston, Morgan Skinner, & Noam Mille

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The social and cognitive abilities of reptiles have long been overlooked, in part due to historically being exposed to behavioral assays adapted for endothermic species. Recently, this picture has begun to change, in part by evaluating which experimental protocols are suited to their metabolisms and sensory perception and adapting those which are not. Snakes in particular have historically been assumed to have little interest in social interaction. As a result, most pet-trade species remain housed in isolation. Research has only recently begun to dismantle this perception, identifying complex group behaviors in snakes, such as biased social networks and a preference for associating with related conspecifics. In addition to association preferences in some species of snake, recent work has shown that Corn snakes (*Pantherophis guttatus*) can recognize the scent of familiar handlers, pointing to individual recognition even beyond their species. It is therefore reasonable to expect corn snakes to be capable of identifying conspecifics and, when presented with a choice between two snakes, to differentiate between the novel and familiar individual, especially if one is related to the subject. We adapted a 3-chamber assay to the subjects and ran n = 40 juveniles through a similar battery as in rodents. Despite prior research suggesting this to be within snakes' capabilities, juvenile *P. guttatus* failed to show a preference for either a related cage mate or a novel conspecific, and displayed only a weak, non-significant bias for being near a snake vs. an empty container. Including variables such as weight, sex and personality did not reveal significant effects either. These curious results suggest these snakes are either too young to discriminate conspecific scents, or that an experimental setup better tailored to their perception is necessary.

Keywords: Reptile, social behavior, 3-chamber task, pet trade, corn snake

POSTER 10, POSTER BOARD 5, May 27th

Honor's thesis work, Best poster, and People's Choice Awards

Effects of Moonlight on Diel Vertical Migration in Juvenile Round Goby

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The round goby (*Neogobius melanostomus*) is an invasive benthic fish species that is thought to have been introduced to the Great Lakes via the ballast water of transoceanic vessels. How a benthic fish was trapped in ballast water is puzzling. However, recent reports suggest that juvenile round goby undergo diel vertical migration to the water surface at night, but little is known about why juveniles of this typically benthic species make this energetically expensive journey. In this study, we investigated whether juvenile round goby undergo diel vertical migration in Lake Ontario. We also investigated whether, like in other species, moonlight might play a role in their nocturnal vertical migration. We sampled for juvenile round goby by towing a plankton net at the water surface and a seine net along the substrate in Lake Ontario both during the day and at night across different moon phases. We caught juvenile round goby on the bottom substrate during both day and night sampling but captured juveniles at the water surface only at night. We also caught more juveniles at the water surface during the full moon compared to other moon phases. Using long cylindrical tubes we ran a laboratory experiment with simulated daylight, full moon, and new moon light conditions to investigate juvenile round goby movement up into the water column. Juveniles moved higher up in the water column during the night condition compared to the day condition, but there was no statistically clear difference between the full moon and new moon conditions. Our findings suggest that juvenile round goby do undergo diel vertical migration in Lake Ontario. Taken together our results may inform regulations regarding the timing of ballast water uptake in shipping vessels.

Keywords: fish, invasive species, moonlight, vertical movement

POSTER 11, POSTER BOARD 6, May 27th

Graduate work, Best poster, and People's Choice Awards

Mating Pool Return Rates and Direction of Mating Competition in a Role Reversed Dance Fly

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Operational sex ratios (OSR; the number of males and females available to mate at a given time) have often been used as a predictor of the direction of mating competition. In gonochoric species the amount of time males and females spend as active participants in the mating pool (i.e., time spent waiting to mate) can be used as a proxy for competition for mates. Past work theorizes that the sex that spends less time waiting to mate in the mating pool, should be the sex with lower competition for access to mates; also experiencing less pre-copulatory sexual selection. *Rhamphomyia longicauda* is a dance fly that displays multiple sexually selected female ornaments in a lek-like mating pool with a female-biased OSR. Females of this species, having lost the ability to hunt, rely on proteinaceous nuptial gifts given by males during copulation for the nutrients necessary to mature their eggs. We performed a capture - mark- recapture experiment to measure how quickly males and females of *R. longicauda* return to the mating pool. We found that females are spending ~38% less time away from the mating swarm, returning every 3.31 days, to males' 4.58 days. While *R. longicauda* displays a sex role reversed mating system, our results are nonetheless consistent with mating pool theory; the sex under stronger selection to mate more often (*R. longicauda* females) return to the mating pool sooner and experience stronger competition for access to mates. Our results reveal how theoretical predictions developed to describe conventional mating systems can hold for species with uncommon mating systems. The results of this study can be utilized in estimating differences reproductive investment and time spent in the mating swarm using existing records of operational sex ratios.

Keywords: mating behaviour, sexual selection, *Empididae*, *Diptera*, female ornamentation

POSTER 12, POSTER BOARD 6, May 27th – Withdrawn

POSTER 13, POSTER BOARD 7, May 27th

Honor's thesis work, Best poster, and People's Choice Awards

The effect of nutrient deposition on the costs and benefits of extended floral longevity in response to pollinator decline

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Premise: In response to pollinator declines, plants could delay floral senescence and therefore increase their floral longevity. While extended floral longevity could benefit plants by increasing seed production through an increased likelihood of pollinator visitation, there is an associated cost of producing fewer seeds because resources are used for corolla maintenance rather than to mature seeds. However, whether these costs outweigh the benefits of extended floral longevity may depend on another human-mediated environmental change factor: nutrient deposition. If nutrient deposition provides plants with additional resources that can be invested into reproduction, then the benefits of extended floral longevity should be more likely to exceed the costs. Methods: To test whether nutrient deposition impacts the costs and benefits of extended floral longevity in response to pollinator declines, I will study the bumblebee-pollinated wildflower *Lobelia siphilitica*. I will simulate nutrient deposition by adding soil nitrogen and simulate pollinator decline by experimentally reducing pollinator access to *L. siphilitica* plants. I will measure seed production as seeds per fruit and floral longevity as the time from anthesis to corolla wilt. I will compare selection on floral longevity between treatments to determine if nutrient deposition increases the benefits and decreases the costs of extended floral longevity in response to pollinator decline. Conclusions: My study is the first of its kind to explore the effect of nutrient deposition on the costs and benefits of extended floral longevity in response to pollinator decline. This is critical as levels of nutrient deposition continue to increase and pollinator populations continue to decrease across the globe. Results from my research will be able to better predict how pollinator dependant plant species will respond to global pollinator declines under nutrient deposition conditions.

Keywords:

POSTER 14, POSTER BOARD 7, May 27th – Withdrawn

POSTER 15, POSTER BOARD 8, May 27th

Honor's thesis work, Best poster, and People's Choice Awards

Plasticity, protandry, and pollination: the interplay between sex phase transition & flower colour change in an invasive weed

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For hermaphroditic, animal-pollinated plants, reproductive success must mediate investment in male function, female function, and floral attractiveness. In *Saponaria officinalis*, a protandrous weed, the transition from male to female phase is associated with a change in flower colour from white to pink. Pollinators prefer white, male-phase flowers, which may allow *S. officinalis* to manipulate pollinator movement in favour of flowers where increased visitation will accrue greater reproductive success. However, variation in the pollination environment can shift the benefits to investing in each function. Plasticity in the timing or expression of floral advertisement and sex allocation may allow plants to respond to this variation. Do flowers adjust petal colour and sex phase transition in response to the pollination environment? In this thesis, I used a manipulative field experiment to investigate the plasticity of sex and colour change of *S. officinalis* flowers in response to variation in pollen removal. I manipulated the level of pollen removal for male-phase flowers (no removal, open-pollinated, and complete removal) and recorded responses in sex phase and flower colour across three days. I found that flowers with no pollen removal remained whiter over time, whereas those with complete pollen removal more greatly increased pinkness relative to open-pollinated flowers. While there were no differences in the pinkness of manipulated flowers at each sex phase, I found that flowers with no pollen removal delayed the transition to female phase, whereas flowers with complete pollen removal accelerated it. These findings further our understanding of the interaction between sex allocation, reproductive capacity, and floral advertisement, giving insight into plant-pollinator interactions in dynamic environments.

Keywords: plasticity, flower colour, sex allocation, plant-pollinator interactions

POSTER 16, POSTER BOARD 8, May 27th

Honor's thesis work, Best poster, and People's Choice Awards

Selection on snake visual developmental genes is associated with shifts in visual ecology

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Due to their unusual fossorial origins, snakes possess visual systems that are thought to have degenerated, followed by the re-evolution of many aspects of vision upon their emergence. Snakes are notable for the presence of diverse retina types, which is postulated to be achieved via photoreceptor transmutation—an evolutionary process that converts one photoreceptor type to the other type. Previous studies demonstrated shifts in selection in the largest clade of snakes known to have experienced photoreceptor transmutation. This suggests a potential association between shifts in selection in visual genes, and photoreceptor transmutation. However, this has not been investigated in visual developmental genes, and the relationship with photoreceptor transmutation remains unknown. In this research, evolutionary analyses of selection of visual developmental genes suggest that any shifts in selection are likely not associated with photoreceptor transmutation. Alternatively, there may be a potential association with visual ecology.

Keywords: Snake, photoreceptor development, photoreceptor evolution, photoreceptor transmutation, visual ecology

POSTER 17, POSTER BOARD 1, May 27th

Graduate work, Best poster, and People's Choice Awards

Assessing Alignment Quality of New Reference Genome

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Alignment of next generation sequences to a reference genome is among the most common bioinformatic tasks in modern genomics. All downstream analyses rely on this alignment and thus, this reference must be comprehensive, accurate and annotated. One of the ways in which the reference genome can be evaluated is its quality of alignment for different experimental sequences when compared to pre-existing references. Here, we evaluated our newly sequenced and assembled reference genome (referred to as new reference) of white clover (*Trifolium repens*) versus the pre-existing reference genome (referred to as pre-existing reference) by assessing alignment quality metrics. White clover is a perennial plant, and its allopolyploid genome is 956 Mbp across two subgenomes with 16 chromosomes. The pre-existing white clover genome presents some challenges in genomic analyses, such as gaps and misassemblies, the new reference aims to address these issues. We used fastp, fastQC, BWA mem and SAMtools to align four experimental sequences to each of the two reference genomes available (i.e., pre-existing and new reference). The quality of alignment was then evaluated through Qualimap and results were integrated using MultiQC for ease of comparison. The percentage of mapped reads was similar across the two references for all four datasets (new: $97.97 \pm 1.86\%$; pre-existing: $97.87 \pm 1.83\%$). It was found that the average median coverage across the four sequences was higher in the new reference ($58.25 \pm 14.69X$) as compared to the pre-existing reference ($20.5 \pm 4.38X$). Lastly, the mean mapping quality across the four sequences was greater for new reference for all four datasets (new: 36.93 ± 4.06 ; pre-existing: 14.45 ± 0.98). In conclusion, alignment to the new reference genome was of a higher quality overall as compared to alignment to the pre-existing reference genome.

Keywords: Genomics, evolution, genome assembly, quality assessment, sequencing quality

POSTER 18, POSTER BOARD 1, May 27th

Honor's thesis work, Best poster, and People's Choice Awards

Decoding the Fitness Landscape of Acute Myeloid Leukemia: Insights into Clonal Evolution and Gene-Environment Interactions

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Cancer emerges when cellular fitness outweighs organismal fitness. Underpinning every malignant cancer is a series of iterative and dynamic selective events that shape the evolutionary trajectory and clinical features of the malignancy. Acute myeloid leukemia (AML) is an aggressive blood cancer of the hematopoietic system resulting in the aberrant production of primitive myeloid precursors. Unlike other human malignancies, AML often consists of only a few distinct genetic clones that harbour mutations in recurrently implicated genes, establishing the disease as an amenable paradigm for the clonal evolution of cancer. Only a handful of studies have sought to elucidate the emergent functional properties of AML mutants that underlie their fitness in different microenvironments. Of the few that have attempted to do so, none have been able to achieve precise phenotypic characterization of recurrent AML mutants, owing to small study sizes. As such, this study aimed to deconvolute the clonal fitness landscapes within a genetically diverse cohort of consenting AML patients ($n=19$) using *in vivo* and *in vitro* functional assays to interrogate emergent gene-environment interactions. Leukemic stem cell (LSC) capacity was further assessed through xenotransplantation assays in either standard NOD/SCID-GAMMA (NSG) mice or growth-factor producing NSG (NSG-3GF) mice to determine the effect of human cytokine expression on the *in vivo* clonal phylogeny. The preliminary results point to an influential effect of the mutant genotype on the success and proliferation of AML clones in *in vitro* ($n=19$) and *in vivo* ($n=14$) environments. These findings illuminate the fitness consequences of recurrent mutations in AML, further phenotypic characterization of which has the potential to reveal prognostic biomarkers for residual disease monitoring or targeted therapeutic development.

Keywords: clonal evolution, acute myeloid leukemia, ddPCR, clonal fitness

POSTER 19, POSTER BOARD 2, May 27th

Honor's thesis work, Best poster, and People's Choice Awards

**Unearthing the Miners: A Phylogenetic and Biogeographic Analysis of the Genus *Geositta* (Passeriformes:
Furnariidae)**

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Accurate time calibrations are essential to the study of historical biogeography. Previous phylogenetic studies of the bird genus *Geositta* (miners, Passeriformes: *Furnariidae*) have relied on gene trees, genetic divergence or biogeographic events. These methods may lead to inaccurate divergence times, especially ancient biogeographic events with timing that is now outdated. This may result in a poor understanding of the clade's evolutionary history, such as mismatch between speciation events and environmental changes. Thus, we used Bayesian species tree methods, relaxed clocks, and a new fossil calibration to improve the divergence time estimates in this group. Furthermore, we estimated the ancestral geographic ranges of miners using BioGeoBEARS to test for a south-to-north colonization pattern. Our results agree with previous phylogenies in terms of topology and relationships. However, they show that the diversification of miners occurred more recently than previous estimates and originated in the Miocene. We found that the genus diversified only after the middle-Miocene climatic deterioration, which is a climatic event that led to the expansion of deserts and steppes, along with the shrinkage of subtropical and tropical biomes. This corresponds well with macroevolutionary studies that find an upward surge in diversification rate after this event. We also found that most speciation events in *Geositta* occurred during the Pliocene. Pliocene glaciations in the central Andean plateaus may have played a role in vicariant speciation in the subclade adapted to grassy steppes and deserts. On the other hand, ancestors of the other subclade, adapted to rocky substrates, were more widespread along the Andes. Our study does not support a major role of orogenic changes in diversification. This study provides an improved perspective of the miners' evolutionary history and reinforces the importance of accurate divergence time estimation in historical biogeography.

Keywords: phylogenetics, biogeography, time calibration, South America

POSTER 20, POSTER BOARD 2, May 27th

Graduate work, Best poster, and People's Choice Awards

A pilot mutagenesis experiment to identify new, viable, X-linked mutations in *Drosophila prolongata*, a species with male biased sexual dimorphism

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Drosophila prolongata is a species of fly that seen to have male-biased sexual dimorphism. The males of this species show extreme reversed sexual dimorphism in body size and foreleg morphology. The conspicuous sexual dimorphism of this species offers itself as an excellent model organism to study the effects of sexual selection and dimorphism within a population. There is uncertainty in the role of body size and exaggerated forelegs in *D. prolongata*. Some studies find that the forelegs aid in male-male competition, aid in copulation via leg vibration resulting in higher fertilization success, or act as an ornamental display influencing female choice in sexual selection. There are currently no genetic tools to further investigate the development, role, or use of these dimorphic characteristics in *D. prolongata*. Henceforth, this pilot mutagenesis experiment aims to identify new, viable, X-linked mutations that yield morphological changes to *D. prolongata*, using Ethyl methansulfonate as mutagen. Following protocol commonly used in the model organism *Drosophila melanogaster*, progeny of mutagenized male flies were single pair mated with sibings to yeild the F3 generation. Phenotype screening of F2 and F3 indicated possible mutation in the morphology of the progeny including but not limited to the wings (size, shape, veining, pigmentation), legs, body colour, bristles, and eyes. Confirmation of heritable X-linked mutation, flies possessing an extreme or unique morphological change will be kept and crossed to yeild F4 and F5 progeny for screening/confirmation. Upon identification of a mutation or phenotype caused by EMS mutagenesis in *D. prolongata*, a new strain will be kept and subsequently sequenced and analyzed for genotype isolation. Submissions to FlyBase and/or other public databases/mutation libraries will allow for genetic tool development to aid in investigations in evolution, dimorphism, development, gene interactions, population genetics, phylogeny and more.

Keywords: *Drosophila prolongata*, sexual dimorphism, Ethyl methansulfonate mutagenesis, morphological changes

POSTER 21, POSTER BOARD 3, May 27th

Graduate work, Best poster, and People's Choice Awards

Investigating the origins, evolution, and function of a reverse transcriptase-like gene (rtl) in the mitochondrial genomes of volvocalean green algae

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Volvocines are a fascinating group of algae, which includes the model organism *Chlamydomonas reinhardtii*. The mitochondrial genome of *C. reinhardtii* is an intriguing 16 kb linear molecule with few protein-coding genes, overhanging telomeres, and a free-standing ORF that codes for a protein that is similar to reverse transcriptase (the rtl gene). The function of rtl is unclear, however, replication of the linear mtgenome is thought to be one of its functions. My research focuses on the diversity of rtl within the Volvocales group as well as the relationship between rtl and mtgenome conformation (i.e., circular vs. linear). My key dataset includes newly assembled transcriptomes from 55 diverse species/strains of volvocalean algae. They were assessed using a BLAST-based approach. Each transcriptome was converted into a custom BLAST database and was queried using known rtl sequences using nucleotide-to-nucleotide (blastn) and amino-acid-to-amino-acid (tblastx) searches. Extracted rtl sequences were used for furthermore phylogenetics analysis.

Keywords: Volvocales, Green algae, mitochondrial DNA

POSTER 22, POSTER BOARD 3, May 27th

Graduate work, Best poster, and People's Choice Awards

Microbial genome sequence compositions associated with life in extreme environments

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Within the primary sequence of a genome there are fingerprints of sequence composition shaped by mutagenesis, population dynamics and natural selection. Nowhere is natural selection more of a force in shaping genome sequence composition than in extreme environments. Extremophiles are unique groups of genetically diverse organisms that have adapted the ability to survive and reproduce in extreme environments, meaning environments that approach and surpass the known limits of temperature and pH, among other factors, that life can sustain. Different extremophile species share structural and physiological traits often involving specialized membranes, proteins, and gene expression that permit life within shared extreme environmental conditions. It is hypothesized that the sequence composition of extremophile microbes bears signature marks of association with extreme environmental conditions. Here, 693 genomes of 253 archaea and 440 bacteria were included in a curated dataset, based on published empirical research identifying 229 archaeal and 369 bacterial temperature-adapted extremophiles (psychrophiles, mesophiles, thermophiles, and hyperthermophiles), and 69 archaeal and 117 bacterial pH-adapted extremophiles (acidophiles and alkaliphiles). The complete genome sequences were acquired from Genome Taxonomy Database (GTDB; release R07 April 8, 2022), from which 500 kb contigs were constructed as the representative assembly for each genome. Short sequence (k-mer) compositions were compared across cohorts using machine learning to classify by taxonomy and environment. K-mers important for classifying by environment, and their relative abundances, were compared against published reports of sequence compositional biases related to phenotypic adaptations of microbes found in similar extreme environments. As a case study, over- and under-represented relevant 3-mers for environmental classification were similar to prior reports of sequence compositional biases particular to the extreme environmental condition. Thus, alignment-free sequence analyses offer compelling evidence for a higher-level examination of environmental signatures within “extreme genomes”.

Keywords: extremophile, microbial genomes, genomic signature, machine learning, kmer

POSTER 23, POSTER BOARD 4, May 27th – Withdrawn

POSTER 24, POSTER BOARD 4, May 27th

Honor's thesis work, Best poster, and People's Choice Awards

Modeling space structure impacts in redirected breeding species

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Cooperative breeding is a form of cooperation where individuals postpone or even forgo their own reproduction to help others reproduce. In some species of birds, individuals failing to breed their own brood may help their related neighbours to succeed better in their brood. Modeling this remains a challenge due to the complex interplay between relatedness, space structure, and dispersal. Here we study a kin-selected model where space structures, whether infinite islands or stepping-stone structure, impact the emergence of cooperative breeding in the population. We use analytical and numerical methods to understand the role of space and relatedness in the emergence of cooperative breeding in the case of redirected breeding effort.

Keywords: Kin selection model, cooperative breeding, space structure

POSTER 25, POSTER BOARD 5, May 27th

Graduate work, Best poster, and People's Choice Awards

The hidden influence of wins and losses: Evidence for human winner and loser effects from randomized trials

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In many non-human animals, contest winners tend to win subsequent contests, while contest losers tend to lose subsequent contests. Regardless of skill or body size, winning experiences tend to generate more wins, while losing experiences generate more losses. Students of animal behaviour refer to these as the winner and loser effects, respectively. Winner and loser effects create long-lasting impacts on animal behaviour and fitness, and recent observational studies on judo and tennis players suggest the effects may also exist in humans. Despite the support these observations lend to human winner and loser effects, observations cannot isolate for the role of prior experience on subsequent performance. For example, the winner of a tennis set may keep winning because they are highly skilled, not because the experience of winning increases chances of future victory. To critically test whether human performance is affected by prior wins or losses, we designed two experiments, one involving videogames and the other involving reading comprehension. We randomly assigned human participants to either win or lose in phase 1 by manipulating their task difficulty. Then, we tested their performance in phase 2, which was moderately difficult for all participants. In both experiments, randomly assigned phase 1 winners performed significantly better in phase 2 than did randomly assigned phase 1 losers. The effect size was higher in the videogame experiment than in the reading comprehension experiment, perhaps because the videogame involved an overt contest with one winner and one loser. Finally, men and women exhibited similar magnitudes of winner and loser effects. As far as we know, this is the first critical experimental test of winner and loser effects in humans. Further experiments can help us better understand human winner and loser effects, and particularly their possibly important influence on human performance, cognition, and mood.

Keywords: winner and loser effects, physical contests, evolutionary psychology, human behaviour

POSTER 26, POSTER BOARD 5, May 27th

Graduate work, Best poster, and People's Choice Awards

Ontogenetic shift from cryptic to aposematic colouration in an Amazonian frog

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Batesian mimicry occurs when a non-toxic mimic species evolving the same colouration as a toxic model species, exploiting predator avoidance, and reducing predation. Most studies of Batesian mimicry to date have treated the model's warning signal and the mimic's approximated signal as fixed traits, modeling 'Mimic Fidelity' or how well adult mimics resemble adult models. We hypothesize that mimic fidelity is not a fixed trait, and that ontogenetic color change in both model and mimic should produce developmental windows where the mimic's fidelity is poor. We test this hypothesis using the toxic *Ameerega bilineata* and non-toxic *Allobates zaparo*, tropical frogs found in the Ecuadorian Amazon Rainforest who have evolved a strikingly similar visual signal. Using color-calibrated photographs and simulated predator visual models, we quantify shifts in colouration throughout both species' development and model how *Allobates zaparo*'s mimic fidelity shifts across time. Further, we test whether there is a maladaptive intermediate mimic phenotype where the juveniles are no longer well-suited for camouflage, while not yet approximating the toxic species they mimic as adults.

Keywords: Aposematism, Mimicry, Ontogeny, Poison Frog, Development

POSTER 27, POSTER BOARD 6, May 27th

Graduate work, Best poster, and People's Choice Awards

Pre- and post-zygotic reproductive barriers to inter-species hybrid sterility in *Caenorhabditis* nematodes

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Pre- and post-zygotic reproductive barriers that emerge through organismal development separate different species from one another, laying the foundation for the diversification of life on Earth. *Caenorhabditis* is an excellent tool for investigating the mechanisms of speciation due to its quick generation time and well-documented genetic makeup. *Caenorhabditis latens* and *Caenorhabditis remanei* are two closely related species that exhibit asymmetric hybrid sterility (Haldane's rule). Morphological defects in the reproductive structures of F1 males represent a potential barrier to mating and assortative mating trends between these two species could contribute to isolation. In this set of experiments, controlled mating assays and microscopy imaging were used to characterize defects in the male tails and gonads, as well as observe patterns in assortative mating. Hybrid crosses between female *C. remanei* and male *C. latens* produced males with significantly higher instances of reproductive structure defects, consistent with Haldane's rule. Documenting the nature of male reproductive structure defects improves our developmental understanding of hybrid dysfunction, and demystifying assortative mating trends clarifies the degree of pre-mating isolation in this system.

Keywords: Speciation, reproductive isolation, *Caenorhabditis*, hybridization, evolution

POSTER 28, POSTER BOARD 6, May 27th – Withdrawn

POSTER 29, POSTER BOARD 7, May 27th – Withdrawn

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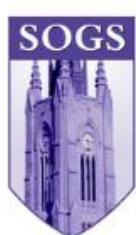
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