50th Ontario Ecology, Ethology, and Evolution Colloquium 2024

Dismantling Biophobia

Programme and Schedule

May 02 to 04, 2024

UNIVERSITY OF WATERLOO

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Opening Remarks

Dear Attendees,

Welcome to the 2024 Ontario Ecology, Ethology, and Evolution Colloquium (OE3C) hosted by the University of Waterloo! OE3C has become a staple conference among Ontario biologists over the last 50 years. Recently, it has become known as a conference "for students, by students". Without the backing of an academic society, OE3C is only made possible through the imagination, commitment, and tenacity of self-assembling organizing committees, consisting of voluntary graduate students and postdoctoral researchers, as the conference bounces between Ontario institutes annually. Despite its tumbleweed-esque nature, OE3C has occurred every year since its inception in 1974 at York University (then referred to as the Ontario Ecological Colloquium – OEC), with the exception of 1975. In continuing with this tradition, the University of Waterloo is proud to host the 50th gathering of OE3C, while also marking the 40th anniversary of the last Colloquium held in Waterloo.

OE3C has served as the first conference experience for hundreds of students, including those who have continued in academia and are now professors themselves with students that attend this event. It is a conference valued by many as a friendly and supportive environment for emerging scholars to present their research, discuss ideas and issues at the forefront of their fields, and network with scientists outside their home institutions. This year is no exception. With **64 Oral and 41 Poster Presentations** by students from across **12 Ontario Universities**, the next generation of scholars are well represented and eagerly exploring a wide range of research topics. Such topics include Community Ecology, Environmental Change, Habitat Selection, Physiological Ecology, and Symbioses, to name a few. We look forward to diving into the diversity of research in ecology, ethology, and evolution taking place across the province!

This year, we are excited to welcome you as we build awareness on current issues and work towards **Dismantling Biophobia**. Consumed by technological advancements, humans today are more disconnected from the natural world than ever before; so much so that we have become the leading contributor to global environmental change. Across biology, a discipline rooted in life, there exists a lack of connectivity to the very world we aim to understand. For

today's students, biology happens in the classroom as opposed to in nature. Community aesthetics idealize manicured lawns and gardens of ornamental, non-native species. Societies prioritize highways, and industrial, commercial, and residential developments with little consideration for integrating or preserving natural landscapes. Why do we rebuke what nature surrounds us with as opposed to embracing it? When did we excise ourselves from the environment within which we exist? Where does this biophobia stem from?

Join us as our **Keynotes** guide us through the evolution of plant-bacteria mutualism, explore the pollination preferences of solitary bees, and untangle the mysteries of acoustic variation in bats and insects. Discussions with our **Sustainability Panel** will build on this theme as our experts provide insight into how we can re-integrate nature into our personal and professional communities.

This year's committee is excited to welcome you OE3C 2024 and uphold its reputation as an accessible, inclusive, educational, and exciting event!

Cheers to a great conference!

Michela Contursi & Lucas Greville

Co-Chairs, OE3C 2024

OE3C 2024 Organizing Committee

Lucas Greville
Co-Chair

Michela Contursi
Co-Chair

Lily Hou
Programme Coordinator

Ryan Leys
Programme Coordinator
Catering Organizer

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Mathumy Sivatheesan
Website Developer
Undergraduate
Representative

Harry Kumbhani
Undergraduate
Representative

Liam McGuire
Faculty Advisor

Land Acknowledgement

We would like to acknowledge that the land on which we are gathered here today, and over the next few days, is the traditional land of the Haudenosaunee, Anishinaabeg, and Attawondaron (or Neutral) peoples. The Haudenosaunee peoples are also known as the "People of the longhouse". Anishinaabeg has multiple meanings, one of which is "Beings Made Out of Nothing" and another is "Spontaneous Beings". Attawandaron comes from the Huron-Wendat people and means "People of a slightly different language".

The University of Waterloo is located on the Haldimand Tract, which includes 10 kilometers of land, on each side of the Grand River, as granted to the Six Nations under the Treaty of Haldimand. The Six Nations of the Grand River is currently the only First Nation community that includes all six Haudenosaunee nations and unifies these peoples under what is known as the Great Tree of Peace. Although the entirety of this land was promised, extending from the source of the river to Lake Erie, only a 5% of this land is currently owned by the Six Nations.

We express the utmost awe and respect for the longstanding, strong relationship these Nations have with the land, as they are the original caretakers. We acknowledge the deep and meaningful traditions of knowledge, law, society, nature, and philosophy of the Indigenous peoples of this land. We recognize the historic and ongoing injustices that Indigenous people endure across Canada and affirm our commitment to honour Indigenous voices, traditions, and cultures for the future of reconciliation.

Statement of Equity, Diversity, and Inclusion

The OE3C 2024 Organizing Committee acknowledges the continual systemic barriers that affect the equitable development of members of our communities. Factors including age, sex, sexual orientation, gender identity, nationality, ethnicity, religion, socioeconomic status, physical and neurological differences, marital status, parental status, and others all continue to contribute to privileges and/or prejudices. These privileges and prejudices often determine who has the power to make decisions.

We are diverse by nature and inclusive by choice. Diversity is at the core of our vision, mission, and values in putting together and facilitating this conference. We are committed to the inclusion of people from all walks of life representing diverse cultures, backgrounds, and viewpoints. Representativeness is an aspect to be tackled head-on and embraced fully. We strive to foster a welcoming environment for all. While we know we cannot change the world in one conference, we recognize our capacity to promote and inspire change wherever possible.

We hope that the environment and the discussions fostered during the OE3C 2024 will create a welcoming and safe space for all, and we encourage participants to reflect on our (collective and individual) positionality. The OE3C 2024 Organizing Committee looks forward to promoting Equity, Diversity, and Inclusion with you!

Code of Conduct

The OE3C 2024 Organizing Committee is committed to making this conference a productive and enjoyable experience for all. We expect cooperation from all participants to ensure a safe and welcoming environment for everybody. All conference attendees, speakers, and volunteers are required to agree with and uphold the following code of conduct:

Behave in a professional manner and be kind to others. Harassment and sexist, racist, or exclusionary comments or jokes will not be tolerated. 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 ethnicity, gender, gender identity and expression, age, sexual orientation, disability, physical appearance, body size, race, or religion. Sexual language and imagery, deliberate intimidation, stalking, following, harassing photography or recording, inappropriate physical contact, and unwelcome sexual attention, among others, are not appropriate.

All communication should be appropriate for a professional audience including people of many different backgrounds. 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 discretion of the organizers without a refund.

If you are being harassed, notice that someone else is being harassed, or have any other concerns, please contact a member of conference staff immediately. Conference staff can be identified as they will be wearing OE3C branded clothing and/or badges. Conference staff will be happy to help participants contact hotel or venue security or local law enforcement, provide escorts, or otherwise assist those experiencing harassment to feel safe for the duration of the conference.

We expect participants to follow these rules at conference and workshop venues and all conference-related events. For more information, please see the University of Waterloo policies and procedures on ethical behaviour: https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-33.

Statement of Sustainability

The 2024 OE3C Organizing Committee is committed to promoting environmental stewardship and sustainability where possible in all aspects of our event. We recognize the significant impact that conferences and gatherings of this nature can have on the environment, and we strive to minimize our ecological footprint, while delivering a fantastic conference experience for our attendees. Here, we have outlined some initiatives we have implemented throughout the planning and hosting of this conference in alignment with our sustainability goals:

- **Sustainable Practices:** We prioritized sustainable practices in event planning and execution, including venue selection, energy usage, water conservation, local sourcing of materials, and relying on local vendors.
- **Plant-Based Menu:** We have opted for an entirely plant-based food menu provided by local bakeries and caterers, reflecting our dedication to sustainable and eco-friendly food choices that minimize greenhouse gas emissions and water usage.
- **Waste Reduction:** We have implemented comprehensive waste reduction strategies by leveraging reusable options, relying on digital materials while minimizing print, and providing numerous recycling and composting stations throughout.
- **Compostable Materials:** Other than reusable chinaware, we have chosen to exclusively use compostable plates, utensils, and other food service items to reduce our output of non-biodegradable waste.
- **Bring-Your-Own:** We have made a call for all attendees to bring their own water bottle, coffee tumbler, pen, notebook, and tote/shoulder bag to carry everything while running between conference rooms, conversations, and activities.
- **Conference Badges:** Though a critical component for any successful conference where new connections are made and conversations flow, these badges are destined for the landfill after the closing ceremonies. With some creative thought, we have co-opted a wood sticker into a conference badge that doubles as swag! The conference logo (without your name and affiliation) can be stuck onto a notebook, laptop, coaster, magnetic backing, etc. and serve as a memento.
- **Carbon Offset:** To help offset the carbon footprint of our conference, we have partnered with the Sustainability Office at the University of Waterloo to plant 100 native trees, promoting campus biodiversity.

By embracing these sustainability initiatives, we aim to not only reduce our environmental impact but also inspire and empower others to adopt sustainable practices in their own lives, organizations, and future endeavours. Together, we can make a meaningful difference for our planet and future generations.

Thank you for joining us in our commitment to sustainability at OE3C 2024.

Acknowledgements

The saying “it takes a village” could not be truer when it came to putting together this conference. We are incredibly lucky to have so many folks assist us in every step of this process.

First, a massive thank you to the rest of our wonderful OE3C 2024 Organizing Committee. You have supported us throughout this entire process; from our initial whisperings in November 2023 when we teased the idea of hosting this conference, to entertaining innumerable brainstorming sessions, navigating logistical nightmares, facilitating all the scheduling and events, and putting up with us during many stress-filled days. You have all contributed so much to make this a great experience. For that, we are forever grateful. Your time and dedication to this endeavour is immensely appreciated. Thank you to our faculty advisor, Dr. Liam McGuire, for incepting the idea of hosting this conference among our committee members three-years ago, nudging us along, providing invaluable advice, and guiding us throughout this process.

A huge thank you to the University of Waterloo Dean of Science, Dr. Chris Houser, for your immense belief in the value of this colloquium. We could not have hosted this event at this caliber without the faculty's unmatched support.

Thank you to Dr. Kirsten Müller, and the entire team in the Department of Biology at Waterloo, for their assistance in making our vision for OE3C a reality. We would like to thank Jennifer Lehman, Jennifer Nowack, Kitty Chan, and Lucy Satora for their administrative support and for being ever so patient with our constant emails!

We also express our greatest thanks to our incredible keynote speakers, Dr. Jessica Forrest, Dr. Hannah Ter Hofstede, and Dr. Rebecca Doyle for their kindness, responsiveness, and willingness to work with us in making this event so special. Thank you to Patricia Huynh, Brendon Samuels, and Jean-Marc Daigle for taking the time to come and speak on their expertise and perspectives in the world of sustainability, an important issue that impacts us all. A special thank you to Patricia for also assisting us in the organization of our tree-planting event with the Sustainability Office to help offset the carbon footprint of hosting this conference.

Thank you to Jessica Miller, Stephanie Horsburgh, and Savannah Sloat for their support and making this process run as smooth as possible. We would also like to thank our OE3C 2024 volunteers for their willingness to lend a hand on the fly. We appreciate you all so much!

We also would like to thank our generous sponsors who believe in OE3C and have trusted us in this endeavour. A full list of our sponsors can be found on the following page.

Last but not least, we would like to thank every OE3C 2024 participant. OE3C would not exist without the enthusiasm, dedication, and willingness of each and every one of you to learn and share your knowledge on the three E's (Ecology, Ethology, and Evolution)!

With many thanks,

Michela Contursi & Lucas Greville

Co-Chairs, OE3C 2024

Sponsors


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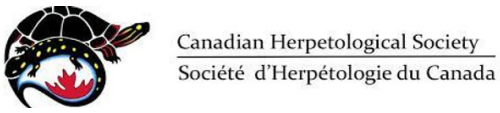
Canadian Herpetological Society
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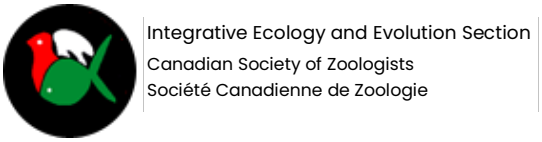
Integrative Ecology and Evolution Section
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VORTEX

OE3C 2024 Artwork

Logo for the 50th Ontario Ecology, Ethology, and Evolution Colloquium

This year's logo was designed by Beatriz Nogueira e Figueira of the 2024 OE3C Organizing Committee. The intention of the image is to highlight the Colloquium's theme, "Dismantling Biophobia", with one of the most iconic images in art, "The Scream" by Edvard Munch. Composed in 1893, this piece was first exhibited with its German title "Der Schrei der Natur" which translates to "The Scream of Nature". Although widely seen today as an expression of the existential anxiety and despair experienced by humans, this work has also been interpreted as a message from the natural world.

Munch wrote about the event that inspired The Scream, where he was out walking with two friends. "The sun was setting. Suddenly, the sky turned blood red and I felt a huge unending scream course through nature." This has led to interpretations that the man depicted in the image is not Munch himself, but a personification of nature.

This idea of nature screaming has never been more relevant than it is today, as we are all being called to be stewards of the environment. The climate crisis has led to an increase in natural disasters, loss of biodiversity, environmental destruction, and much more as the fear of irreversible change looms over us.

"The Scream" by Edvard Munch

A scream is very loudly coursing through nature, and we must respond to it. With this Colloquium, we aim to unite the world of ecology, ethology, evolution in a conversation about our role in the natural world.

The logo for this year's OE3C depicts the main character screaming, with a scarlet kingsnake (*Lampropeltis elapsoides*), Mexican redknee tarantula (*Brachypelma smithi*), and the silhouette of a bat (Order: Chiroptera) pictured over a paved road through a grassy terrain. The irrational fear of the natural world has led to a divide between humankind and nature, with fear of the unknown facilitating this separation. Our fear should be instead centred on losing the beauty and uniqueness of nature to the paved roads and development of nature-excluding environments, often described as "futuristic". United in thoughtful discussion and events that connect humans and nature, OE3C 2024 strives to call us all to rewrite our relationship with the natural world.

History of OE3C

With the everchanging nature of the Ontario Ecology, Ethology, and Evolution Colloquium (OE3C), it has been an absolute treat to dive into the history of this event and how it came to be what it is today. Please enjoy some of the highlights of the past 50 years of OE3C:

Prior to its inception, the OE3C was preceded by 'Ontario Technical sessions' that was also focused on student presentations. The fist colloquium was held in 1974 at York University and at that time was called the Ontario Ecology (or Ecological) Colloquium (OEC). It was organized by Assistant Professors Don McQueen and Larry Dill and included around 100 attendees and 30 talks (plus some invited talks). For many years, the Colloquium was organized by a Steering Committee made up of professors. For example, David Noakes (University of Guelph) was a committee member from 1974-2005 and Gray Merriam (Carleton University) was on the Committee 1983-93. Other members included Paul Hebert (University of Guelph) and Bill Taylor (University of Waterloo). The Committee selected the host university each year and therefore the local host professor. Most professors involved in the early years of the Colloquium also founded and ran the Ontario Universities Program in Field Biology.

In 1977, the third Colloquium (it was not held in 1975) was hosted at the University of Western Ontario. The second 'E' was added at this time at the request of behavioural ecologists, Miles Keenleyside and Ben Seghers in the Collip building at Western, and Patrick Colgan at Queens. From then on it was known as the Ontario Ecology and Ethology Colloquium (OEEC). The third 'E', for evolution, was added in 2011 after a discussion amongst previous hosts that focused on broadening the scope of the Colloquium. Given that the research of many attendees overlaps with evolution, the name was made more inclusive for evolutionary biologists.

Ascertaining the founding year and details on where, when, and if the Colloquium was held each year (Table 1) required extensive research. Uncertainty about the founding year, and possibly arithmetic errors, compounded over time. For example, the 1990 OEEC at Brock University was advertised as the 15th Colloquium when it was the 16th. By 2016, the Colloquium was advertised as the 46th event when it was the 42nd.

The Colloquium is now primarily organized by graduate students and postdoctoral researchers who voluntarily take on the responsibilities for venue arrangements, inviting keynote and plenary speakers, presentations scheduling, catering, organizing local excursions, event promotion, and securing sponsors. Previous sponsors include each host university, Canadian Botanical Association, Canadian Society of Zoologists (Zoological Education Trust), American Genetic Association, Ontario Federation of Anglers and Hunters, Canadian Herpetological Society, Canadian Society for Ecology and Evolution, Esri Canada, Dillon Consulting, Facets, Qiagen, The Company of Biologists, American Ornithological Society, American Fisheries

Society (Ontario Chapter), American Society of Naturalists, New England Biolabs, Cell Signaling Technology, Sugarbomb, Mountain Equipment Co-op, Coca-Cola, and the Comparative Cognition Society.

With that, we thank Don McQueen, Larry Dill, Robert Montgomerie, Brock Fenton, Gray Merriam, Ron Brooks, Laurence Packer, Tom Nudds, Paul Hebert, Robert McLaughlin, Raleigh Robertson, Ted Armstrong, Jim Bogart, and Norman Yan for sifting through their memories, computers, and files to help in assembling the early years of the colloquium.

For more information on the incredible history of this Colloquium, please see our website.

Table 1: The number of times and the years each university (and one government ministry) has hosted the Colloquium since its inception in 1974 at York University.

Location	n	Year
University of Waterloo	2	**2024**, 1984
Western University	7	2023, 2018, 2013, 2007, 1997, 1988, 1977
Queen's University	7	2022, 2017, 2009, 2002, 1998, 1989, 1978
University of Guelph	8	2021, 2020, 2014, 2008, 2001, 1999, 1991, 1982
McMaster University	4	2019, 2012, 2003, 1993
University of Toronto	4	2016, 2011, 2004, 1995
York University	4	2015, 1986, 1976, 1974
Laurentian University	1	2010
Brock University	3	2006, 1990, 1980
Carleton University	3	2005, 1996, 1981
Trent University	2	2000, 1983
University of Windsor	2	1992, 1979
University of Ottawa	1	1987
Ministry of Environment, Dorset	1	1985

Registration, Check-In, and Conference Locations

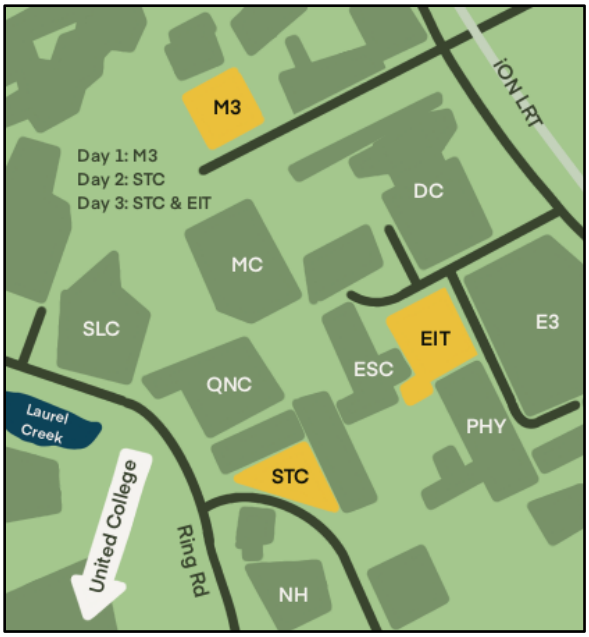
Upon arrival at OE3C 2024, please stop by the registration desk in Mathematics 3 (M3) to sign-in and pick up your conference name badge. If you arrive outside of the registration hours, please find a committee member to ensure you receive your conference name badge. Your registration to OE3C 2023 includes access to all keynote talks, panel discussion, concurrent talks and poster sessions, meals, social events, and all excursions.

Day 1 – Thursday 02 May 2024
Location: Mathematics 3 (M3), Main Atrium (1st Floor)
Registration Hours: 12:00 pm to 5:00 pm

Day 2 – Friday 03 May 2024
***Location*:** Science Teaching Complex (STC), Lower Commons and Main Atrium
***Registration Hours*:** 8:00 am to 9:00 am

Day 3 - Saturday 04 May 2024
Location: Science Teaching Complex (STC), Lower Commons and Main Atrium;
Center for Environmental and Information Technology (EIT),
Earth Science Museum (Main Atrium)
***Registration Hours*:** 8:00 am to 9:00 am
For a full campus map, please visit: https://uwaterloo.ca/map/

Visitor Parking
Parking is available for $7/day in University of Waterloo visitor lots. Parking lots N and X are closest to the event locations.
For a full list of parking lots please visit: https://uwaterloo.ca/parking/about/our-parking-lots

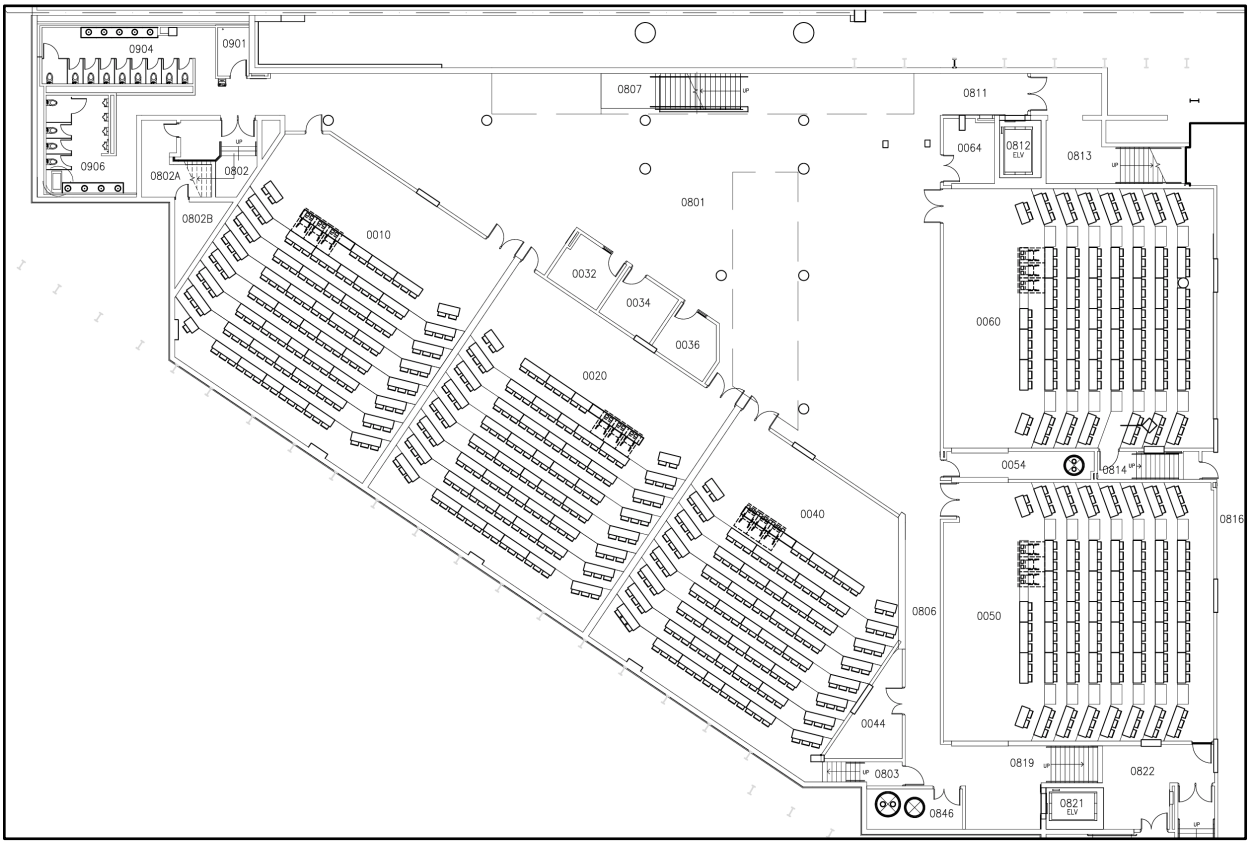


Presentation Information

Oral Presentations: Presenters are asked to submit their presentations as PowerPoint presentations to this Dropbox folder (linked here) by **5:30pm the evening before their presentation**. Please submit using the following format: TimeDay_FirstName_LastName (e.g., 230Friday_Lucas_Greville.pptx).

Poster Presentations: Presenters should bring their printed posters to the conference. Posters can be put up the morning of their presentation during breakfast and remain up as directed.

Location: Oral and poster presentations will be held in Science Teaching Complex, Lower Commons (rooms: STC-0010, STC-0040, STC-0060).



Conference Schedule at a Glance

Thursday 02 May

10:00 am	RARE Nature Reserve Tour (sign-up required)
12:30 pm	Registration (open all afternoon)
	Excursions and Activities: rare Charitable Reserve, WATER facility tour, Earth Science Museum, zoological collections, bird banding, tree planting, nature walk
4:00 pm	Coffee Break (M3–Atrium)
4:30 pm	Opening Ceremonies (M3–1006)
5:00 pm	Keynote: Dr. Jessica Forrest (M3–1006)
6:00 pm	Trivia & Catered Dinner (M3–Atrium)

Friday 03 May

8:00 am	Breakfast & Registration (STC-Lower Commons)
9:00 am	Keynote: Dr. Hannah Ter Hofstede (STC-1012)
10:00 am	Poster Session (STC-Lower Commons)
11:30 am	Concurrent Talks (STC-0010, STC-0040)
1:00 pm	Lunch (STC-Lower Commons)
2:00 pm	Concurrent Talks (STC-0010, STC-0040)
3:30 pm	Coffee Break (STC-Upper Commons)
4:00 pm	Sustainability Panel (STC-1012)
6:00 pm	Uptown Waterloo Dinner

Saturday 04 May

6:00 am	Bird Banding (rain date)
8:00 am	Breakfast & Registration (STC-Lower Commons)
9:00 am	Keynote: Dr. Rebecca Doyle (STC-1012)
10:00 am	Poster Session (STC-Lower Commons)
11:30 am	Concurrent Talks (STC-0010, STC-0040, STC-0060)
1:00 pm	Lunch (STC-Lower Commons)
2:00 pm	Concurrent Talks (STC-0010, STC-0040)
3:30 pm	Coffee Break (STC-Lower Commons)
4:00 pm	Concurrent Talks (STC-0010, STC-0040)
5:15 pm	Break
5:30 pm	Closing ceremonies & Catered Dinner (Earth Science Museum – EIT Main Lobby)

Conference Excursions and Activities

All excursions and activities are scheduled between 12:30 and 4:00 pm on Thursday 02 May 2024.

rare Charitable Research Reserve

rare Charitable Research Reserve is a community-based, 1200+ acre urban land trust located in Cambridge, Ontario with goals in conservation, research, and education in and around the Waterloo Region. *rare* protects highly sensitive lands across eight properties in the area and has been a field site for over 80 projects for researchers across a variety of disciplines. For OE3C 2024, we have partnered with *rare* to offer our attendees a guided walk, tour, and activity (gardening, pollinator surveys, etc.) at the land trust.

Two sessions to travel to *rare* are available: one morning (10:00am–12:00pm) and one afternoon (12:00pm–2:00pm) session. Those attending rare are asked to meet outside the Quantum Nano Centre (QNC) on the University of Waterloo Campus **30 minutes** before the scheduled session, as a bus will be taking folks to the land trust site. An OE3C volunteer will accompany groups to both sessions, so be on the lookout for OE3C official t-shirts.

The trips to rare are weather dependent. Folks registered for the rare excursions will be informed ahead of time, should the excursion be rained-out. In non-ideal weather, the bus will travel to the Cambridge Butterfly Conservatory in Cambridge, Ontario. The Cambridge Butterfly Conservatory is a tropical indoor garden hosting thousands of free-flying butterflies. The Conservatory works to promote butterfly conservation and education, displaying these creatures at all stages of life through their live insect galleries. Tickets to tour rare or visit the Butterfly Conservatory are free of charge for attendees.

Bird Banding

We are super excited to be able to offer a unique bird banding education experience through the newly established Columbia Lake Bird Observatory. Bird banding will occur at the University of Waterloo North Campus Community Garden (at Columbia Lake), Waterloo, Ontario. Attendees are asked to make their way to Columbia Lake before the start of their selected bird banding session.

WATER Facility Tours

The Waterloo Aquatic Threats in Environmental Research (WATER) Facility is a newly renovated aquatics facility within the Biology Department at the University of Waterloo. The facility supports research initiatives by using aquaculture industry style systems to monitor and control water parameters in several types of aquatic housing systems. The facility can house many different aquatic species, aquatic and terrestrial amphibians, and more!

There are several guided tours of the WATER Facility scheduled. Folks attending tours are asked to meet in the Biology 1 (B1) – room 178 before the start of their scheduled session.

Tree Planting

To offset the carbon footprint of hosting OE3C, we have partnered with the University of Waterloo Sustainability Office for a tree planting event. Attendees will have the opportunity to plant native Ontario trees at this location on campus and are encouraged to drop by to dig some holes and plant some trees between 1:30-3:30 p.m.

Zoological Collections

The Department of Biology at the University of Waterloo houses a multitude of museum specimens that will be on special, limited-time display for OE3C attendees. Folks can drop by Biology 2, rooms 149/150 to view the biological collections and can participate in a skull identification educational activity from 1:30-4:00pm.

UWaterloo Art Gallery

The University of Waterloo Art Gallery displays exhibitions of Canadian and international artists. Open to OE3C attendees, the gallery on campus provides a thoughtful, dynamic, and engaging program of exhibitions, artist presentations, and events featuring multimedia interdisciplinary work.

Two exhibits are currently open, the first showcasing work from Behnaz Fatemi. Entitled "*We will lose our beloveds – ما عزیزانمان را از دست خواهیم داد*", Fatemi's body of work highlights the complexities of migration. The artist will be doing a dance and performance on Thursday 02 May between 12:00-2:00pm in East Campus Hall, Gallery One.

The second exhibit is titled "*kupferschmidt / kupferschmid / kupferschmidte*" by Jill Smith. It is a sculpture and installation-based exhibition which uses materiality and autobiography to question the role and success of self-preservation amid a disruption to identity. The exhibit will be on display in East Campus Hall, Gallery Two until Saturday 04 May.

More information about the gallery and exhibits can be found on the University of Waterloo Art Gallery (UWag) website.

Earth Science Museum

The Earth Science Museum at the University of Waterloo houses an incredible gallery of geological and archaeological collections. OE3C attendees are encouraged to explore the open gallery at any time in the Centre for Environmental & Information Technology (EIT) building on the afternoon of 02 May from 1:30-4:00pm. However, should time be insufficient to see and do all the things, you will have a second opportunity to peruse the displays 04 May, as our closing ceremonies will be held in EIT. More information about the museum can be found on their website.

Nature Walk

Columbia Lake Environmental Reserve is a wildlife hotspot that is a part of the University of Waterloo's North Campus. Columbia Lake is a fantastic location for waterfowl, gulls, shorebirds, migrating raptors and passerines, as well as small mammals, amphibians, and a diverse array of native flora. At any time, attendees are welcome to walk the trails and enjoy what the environmental reserve has to offer.

Ecology Keynote

Dr. Jessica Forrest
(she/her/hers)

Dr. Forrest studies the evolutionary ecology of plant–pollinator interactions. She is interested in the causes and consequences of variation in species' life histories and seasonal phenologies, particularly as these traits relate to species interactions. She explores how pollinators and animal-pollinated plants are coping in a world that is getting warmer and more densely populated by humans. A primary application of Dr. Forrest's research is in understanding ways that climate change and other forms of global change affect pollinators (especially native solitary bees) and pollination. Her work has primarily focused on bees and plants in natural habitats, but she is also interested in how better knowledge of native bee ecology can benefit agriculture.

Dr. Forrest is currently an Associate Professor in the Department of Biology at the University of Ottawa. She completed her B.Sc. at McGill University, M.Sc. at Queen's University, her Ph.D. at the University of Toronto in the department of Ecology and Evolutionary Biology, and a Postdoctoral Fellowship at the University of California, Davis.

Making Sense of Speciation in Solitary Bees

Animals range in diet breadth from super-generalists to narrow specialists. Despite its evident disadvantages, dietary specialization has evolved frequently – likely because specialists are more efficient than generalists, or because specialization on low-quality or toxic food allows consumers to avoid competitors, predators, or parasites. In bees, specialization on particular host plants for pollen appears distinctly non-random: while specialists make up approximately 25% of the eastern North American bee fauna, these insects use pollen from only ~6% of plant genera and 3% of families.

In this talk, I ask: why do some plant taxa appear to be popular hosts for specialist bees, while others are ignored? Specifically, I will present work from my lab testing two distinct hypotheses to explain patterns of host–plant use in specialist solitary bees. The first (the pollen quality hypothesis) proposes that specialists associate preferentially with plants whose pollen is undesirable or even noxious to generalist competitors and natural enemies; the second (the "predictable plethora", or pollen quantity, hypothesis) proposes that specialists primarily exploit plant taxa that reliably provide large quantities of floral resources. Using laboratory rearing experiments, field surveys, and analysis of community-science data, we find limited support for the pollen quality hypothesis, but strong evidence for the pollen quantity hypothesis. While some plant taxa with low-quality pollen are avoided by generalists and favoured by specialists, not all host plants of specialists have low-quality pollen. In contrast, plant taxa with high regional abundance, as measured by community science observations, are far more likely than rare plants to host specialist bees. It remains to be seen whether host abundance predicts patterns of dietary specialization in taxa other than bees.

Ethology Keynote

Dr. Hannah ter Hofstede
(she/her/hers)

Dr. ter Hofstede conducts her research in the field of sensory ecology, specifically investigating how sensory systems encode environmental cues that are crucial for an animal's survival and reproduction. She has always been fascinated by animals and their behaviour, particularly by the ways in which sensory system evolution interacts with the behaviour and ecology of animals. Her research investigates how animal sensory systems filter the information they obtain about their environment and how sensory systems coevolve with behaviour. Much of her work to date explores the acoustic world of bats and their insect prey.

Dr. ter Hofstede is currently an Assistant Professor at the University of Windsor in the Department of integrative Biology and the Chair of the Behaviour, Cognition and Neuroscience program. She also acts as an affiliate faculty member in the Ecology, Evolution, Environment and Society Graduate Program at Dartmouth College in the U.S. Dr. ter Hofstede completed her M.Sc. at York University, her PhD at the University of Toronto Mississauga, and postdoctoral positions in the U.K. at the University of Bristol, and Cambridge University.

The Acoustic World of Bats and Insects

As nocturnal animals, bats and their insect prey rely heavily on acoustic cues and signals to orient, communicate, find food, and avoid predators in the dark. Bats use echolocation to avoid obstacles and locate flying insects, and many insects have ears that allow them to detect the ultrasonic calls of bats. Differences between species in the production and responses to sounds are well-documented, but individual differences within species are less known. In this talk, I will describe three studies investigating individual variation and variation over time in the acoustic ecology of bats and insects.

We investigated individual variation in the acoustic properties of big brown bat echolocation calls and found that repeatable differences in call duration across individuals is correlated with the ratio of time spent in open or cluttered areas. We also used an acoustic camera to assign communication calls to bats in flight and document the variation seen in these types of calls. Finally, we looked at changes in anti-predator behaviour in katydids over their adult lives, finding that they become less cautious and spend more time singing as they age, but they continue to pause or cease singing in response to bat calls throughout the season.

Evolution Keynote

Dr. Rebecca Doyle
(she/her/hers)

Dr. Doyle is fascinated by the concept that we, as humans, host many folds more microbial cells than human cells, and that DNA in microbes can have profound impacts on their hosts. In the Doyle lab, experimental approaches in combination with sequencing and genomic analyses are often used to capture evolution occurring in real time. She works to quantify how microbial genomes within a population change in response to environmental change, and in turn, how such microbial evolution impacts their host's ability to survive and reproduce.

Dr. Doyle is an Assistant Professor in the Department of Biology at McMaster University. She completed her B.Sc. and M.Sc. at Memorial University of Newfoundland, her PhD in Ecology and Evolutionary Biology at the University of Toronto, and a Postdoctoral Fellowship through the Institute for Genomic Biology at the University of Illinois.

Disentangling the Selective Drivers of Mutualism Decline of a Keystone Nutritional Symbiosis

Nutritional mutualisms, whereby unrelated species trade resources such as carbon (C) and nitrogen (N) to one another's mutual benefit, form keystone interactions in many ecosystems and play critical roles in Earth's nutrient cycles. Yet, the evolutionary persistence of these vital interactions is threatened by a rapidly changing environment. Previous work on the model legume-rhizobium mutualism, wherein N fixed by rhizobia is traded for C fixed by legumes, found that long-term N-supplementation in the form of mineral fertilizer caused an evolutionary decline in the benefits rhizobia provide to their legume hosts. However, the selective agents driving this evolutionary shift remained unclear.

To disentangle the drivers of mutualism decline, I experimentally evolved multiple populations of rhizobia (28 strains each) with or without legume hosts (plant+, plant-) under both N-supplementation (N+) or N-free (N-) conditions across four plant growing seasons, representing hundreds of rhizobium generations. At the end of the evolution experiment, I assessed how past exposure to N or plants impacted the rhizobia population's ability to confer plant growth benefits. When plants had been present during experimental evolution, my results recapitulated what was observed in the field: plants grew smaller when they were inoculated with rhizobia that evolved under N+ compared to N- conditions. However, when plants had been absent during experimental evolution, the growth benefits rhizobia conferred were similar regardless of whether they were exposed to N or not. I explore the various mechanisms underlying the observed shift in quality, including changes in rhizobia population size and composition. Overall, these results suggest that the evolutionary shift towards less beneficial rhizobia under N-supplementation is mediated by the indirect effects of hosts rather than the direct effects of N itself.

Sustainability Panelists

Patricia Huynh
(she/her/hers)

Patricia Huynh is the Sustainability Projects Manager, a PhD candidate, and a sessional instructor at the University of Waterloo. Patricia leads the coordination, development and implementation of projects that advance campus sustainability within the context of the Environmental Sustainability Strategy and Campus Climate Action Plan at the university. Patricia actively works to link academic research and learning opportunities with tangible, on-campus pilot, demonstration, and deployment projects with a focus on sustainability and climate action. Patricia has worked as a biologist, nature interpreter, and conservation engagement intern and is passionate about conservation, restoration, community building, and sustainable living.

Jean-Marc Daigle is a licensed landscape architect with over 40 years industry experience as both a landscape architect and builder in a wide range of commercial, industrial, institutional, and residential settings. He is a creative and versatile designer with an in-depth knowledge of landscape construction processes, with extensive experience in field construction, project management and construction supervision. Jean-Marc specializes in ecological landscaping, ecological restoration and naturalization, “xeriscaping”, natural habitat creation, natural swimming pool design and construction, low impact development, and shoreline stabilization and enhancement. He has a keen interest in the creation of ecologically sustainable landscapes and greenspaces that foster positive experiences of, and interaction with, the natural world. Jean-Marc was a co-author of Restoring Nature’s Place: A Guide to Naturalizing Ontario Parks and Greenspace, recognized as a preeminent guide on ecological restoration in Ontario.

Jean-Marc Daigle
(he/him/his)

Brendon Samuels
(he/him/his)

Brendon Samuels is a PhD candidate in the Department of Biology at Western University where he studies solutions for preventing bird-window collisions. Brendon is active in London's environmental sector, advocating for public education programs and policies that conserve biodiversity and advance climate change adaptation. He also maintains a naturalized yard and organizes regular litter cleanups in the community. Brendon is interested in strategies for shifting public perception of urban habitats as undesirably messy or disposable, mitigating conflicts with wildlife, and cultivating intercultural awareness of humans as agents in ecosystems.

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A6	Daisy (Shiying) Zhang	Has Mating Behaviour Diverged Across an Invasion Front of the Noble False Widow Spider?	32
A7	Emmanuelle Roy	Population Dynamics and Distribution of Methanotrophs in Landfill Cover Soils	33
A8	Hannah Li	Expression of the Protein Assembly Associated with Excitation-Contraction Coupling in Different Life Stages of the Unicellular Choanoflagellate, *Salpingoeca rosetta*	33
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A12	Lauren Weeks	The Good, the Bad, and the Low-abundant: A Review of eDNA Metabarcoding Data Analysis and Curation	35
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A14	Michelle Pham	Classification of Red Raspberry Fruit Development via Spectral Imaging & AI Learning	36
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A16	Rachel Regier	Investigating Freshwater Cyanophage Thermal Stability Within the Context of Climate Change	37
A17	Samuel Druif	Nutrient-Rich Solutions: Characterizing Compost and Compost Tea for Applications in Vertical Farming	38
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Dania Daanish	Candidate Sociability Genes	41	**11:45 AM**	Beatriz Nogueira e Figueira	No Place like Home: Characterizing the Roost Selection of the Migratory Silver-Haired Bat (*Lasionycteris noctivagans*) during Fall Stopover	44
Judy Kurbaj	Change in Expression of the Autism-Related Gene Neuroligin-3 Affect Social Spacing and Longevity in *Drosophila melanogaster*	42	**12:00 PM**	Kelly McLean	Wandering Wings: Exploring the Migration Routes and Habitat Selection of Eastern Population Sandhill Cranes	45
Elias Latchem	The Influence of Social Rank on Learning in Group Living Fish	42	**12:15 PM**	Kiaunna Lee	Breeding Territory Selection of Sandhill Cranes in Eastern Canada's Boreal Forest	45
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Ryan Conklin	Annual Survivorship Varies Between the Sexes, But Not With Overwinter Latitude, in Song Sparrows	48	**2:30 PM**	Harshina Brijlall	The Dark Side of Cyanobacteria: Expanding Our Understanding of Non-photosynthetic Cyanobacteria in Freshwater Systems	51
Ryan Leys	Nocturnal Heterothermy Use in North American Songbirds During Migration	48	**2:45 PM**	Matheus Sanita Limaa	Exploring Noncoding Transcriptomes from Organelle Genomes by Using Long-Read Data	51
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B4	Binjal Pradhan	Creating a Reporter to Measure *Sinorhizobium meliloti nodD1* Promoter Activity in Response to *Medicago truncatula* Root Exudates	54
B5	Candace Ma	Local Adaptation to Daylength in the Invasive Plant Species *Mimulus guttatus* of New Zealand	55
B6	Emily Dodsworth	Validating Thermal Refugia-Seeking Behaviour in Fish During Thermal Agitation	55
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B8	Bryant Serre	Development of an In-lab, Vertical Column Bioassay for Examining Chloride Exposure Modulation Among Endemic Zooplankton to Toronto's Inner Harbour	32
B9	Jezreel Dalmieda	Dissecting Genetic Architecture for Phenotypic Variations in *Aspergillus fumigatus*	57
B10	Kelsey Hazel	Investigating the Yield and Light Penetration Impacts of Novel Pot and Trellis Designs in Above-and Below-Ground Competition in Raspberry (*Rubus idaeus*).	57
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B13	Melanie Kuntze	Can Duckweed Remain a Viable Superfood Despite Climate Change?	59
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B20	Karen Vanderwolf	History of the Ontario Ecology, Ethology, and Evolution Colloquium	62

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Mathumy Sivatheesan	The Influence of Energetic Status on Risk-Taking Behaviour in Wintering Birds	64	**12:00 PM**	Brendan McEwen	Body Posture and Viewing Angle Modulate Detectability in a Poison Frog and Batesian Mimic	67	**12:00 PM**	Kendra Gardner	Insights into Lumpfish (*Cyclopterus lumpus*) Diets: Combatting Salmon Lice (*Lepeophtheirus salmonis*) in Aquaculture	70
Dominic Wood	Understanding Low-Arctic Tundra Community Plant Responses to Anticipated Climate Warming Using Long-Term Climatically Realistic Soil Nutrient Availability Enhancements	64	**12:15 PM**	Karl Loeffler-Henry	Evolutionary Transitions from Camouflage to Aposematism: Hidden Signals Play a Pivotal Role	67	**12:15 PM**	Timothy Smith	Avoidance of Fungal and Nematode Parasitic Threats by Red Flour Beetles (*Tribolium castaneum*)	70
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Sabina Henry	Assessing Which Traits Determine the Performance of Canadian Black Spruce (*Picea mariana*) in the Face of Climate Change	65	**12:45 PM**	Tom Sherratt	The Optimal Time to Approach an Unfamiliar Object: A Bayesian Model	68	**12:45 PM**	Alexandra Sauk	Host-Parasite Dynamics and Population Genetics Provide Insight into the Movement Ecology of an Endangered Bat Species	71

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Evan Gillis	Germination Differences Between Forage Crop and Non-Forage Crop Plant Species and the Potential for Their Overuse in Ecological Experiments	73	**2:45 PM**	Jack Rosenbaum & Dan Yang	Optimal Polyandry: The Effects of Multiple Mating on Female Fitness	77
Hannah Brazeau	The Effects of Pollinator Decline on the Evolution of Floral Traits	74	**3:00 PM**	Maggie Dobbin	The Adaptive Significance of Polyandry: A Meta-Analysis	78
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Julie Messier	Disentangling the Relative Contribution of Needle Age and Climate on Foliar Trait Variation in Black Spruce (*Picea mariana*)	75	**3:20 PM**	Thomas Pianta	The Great Bat Stress Physiology Project: Creating a Global Bat Stress Atlas	79

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Rachel Beaver	Microbial Analysis of Miocene-Era Bentonite Clay	80	**4:15 PM**	Reyad Malakh	Exploring Mating Behaviours in an Invasive Fish: The Role of Alternative Reproductive Tactics	83
Owen Tapia Daly	Does Community Composition Affect How Plants Respond to Mycorrhizal Networks	81	**4:30 PM**	Ainsley Harrison-Weiss	Sneaker Male Nest Preferences: Do Females Know Best?	84
Jessica Mero	Are Forage Crops Over-Represented in Biodiversity-Productivity Studies?	81	**4:45 PM**	Susheen Mahmood	Effect of Female Mating Status on Male Willingness to Fight in the Noble False Widow Spider	84
Jersey Allyson Fontz	Tracking Wetland Regeneration: A Long-term Assessment of Vegetation Dynamics Post-*Phragmites australis* Suppression	82	**5:00 PM**	Lyllian Corbin	Alternative Reproductive Strategies in Male Eastern Carpenter Bees	85

The Influence of Habitat and Prey Availability on Female Bat Foraging Behaviour During Reproduction

Alexandria E. Cosby[1] and Quinn M. Webber[1]
[1]*Department of Integrative Biology, University of Guelph, Guelph, Ontario*

Understanding predator foraging patterns in relation to prey and environmental features is crucial for unravelling links between species and the habitat they live in. A significant knowledge gap exists regarding the foraging behaviour of cryptic and endangered species such as little brown bats (*Myotis lucifugus*). Once abundant in the Great Lakes region of Ontario, little brown bats were listed provincially as endangered in 2014. The key question I will answer is how bat foraging behaviour varies over time and space as a function of habitat and prey availability throughout the reproductive season. My research has two primary objectives: 1) evaluate how spatiotemporal variables influence prey species assemblages and nutritional quality of nocturnal flying insects; 2) quantify shifts in little brown bat diet and foraging behaviour over the reproductive season. By using a suite of methods including DNA Bar Coding of guano and insect trapping, I will identify little brown bat critical foraging habitat and measure prey selection, helping to identify what insect species are essential for population recovery and long-term health. My research will provide a holistic view of how environmental variation, predator-prey dynamics, and reproduction influences the foraging behaviour of an endangered species.

Lighting Environment and Body Size Influence Activity and Risk Behaviour in a Poison Frog Mimic

Ana Veneat[1], Brendan McEwen[1], and Reuvan Dukas[1]
[1]*Department of Psychology, Neuroscience & Behaviour, McMaster University, Hamilton, Ontario*

Antipredator colour strategies are often thought of as fixed traits, but ontogenetic shifts in colouration are common. A transition in colour strategy may be met with a complementary shift in behavioural phenotypes, but this remains under-explored. Similarly under-explored is how light environment perturbations affect behaviour in diurnal animals. To address these questions, we conducted a field experiment using the non-toxic Amazonian frog *Allobates zaparo* which mimics a sympatric poison frog species. *Allobates zaparo* metamorphoses into a cryptic phenotype, becoming aposematic and improving mimetic resemblance across development. Human activity exposes *Al. zaparo* to elevated light intensity through canopy disruption. We used a field arena assay and calibrated photography to evaluate the effects that colour development and elevated light intensity have on exploration and boldness. We find that *Al. zaparo* improves its mimetic resemblance across development, but that colouration alone does not impact behavioural phenotypes. We find that larger frogs exhibit less-bold behaviour, and that high light intensity reduces frog activity. These results suggest the presence of reproductive-stage based behaviour, and that human activity may impose a novel selection pressure in the species.

How Can Thermal Image-Detection and Reflectance Determine the Moisture Content in Rockwool Cubes?

Anna S. Bazangeya[1], Michelle Pham[2], Parham Jafary[2], Lesley G. Campbell[1], and Habiba Bougherara[2]

[1]Department of Chemistry and Biology, Toronto Metropolitan University, Toronto, Ontario; [2]Department of Mechanical and Industrial Engineering, Toronto Metropolitan University, Toronto, Ontario

Rockwool is a widely used medium in soilless protected cultivation, where water deficit stress can pose a challenge to plant health and productivity. Substrate moisture content influences various factors including crop nutrient absorption, and plant stress responses. Due to rockwool's limited water retention capacity, precise moisture management is crucial for optimal crop growth. We hope to develop an imaging moisture monitoring tool that can estimate how much moisture is contained in a rockwool block at any given time. We aimed to determine the spectral reflectance signatures of rockwool cubes at varying levels of moisture for the development of a spectral library. In turn, drought conditions can be detected before visible signs manifest in plants, allowing for proactive irrigation management. A CARY 5000 UV/Vis-NIR spectrophotometer was used to capture spectral readings of rockwool cubes at varying moisture levels by incrementally adding known volumes of water. Additionally, we plan to use infrared thermal detection via an IR camera to monitor water flow characteristics within rockwool cubes under different watering conditions. The results of the study will be presented, providing insights into the physical properties of rockwool as a medium and elucidating water movement dynamics within it.

Investigating the Evolution and Genetic correlates of Sleep Consolidation across Cichlid Fish

Ayasha Abdalla-Wyse[1] and Maxwell E.R. Shafer[1]

[1]Department of Cell and Systems Biology, The University of Toronto, Toronto, Ontario

Sleep is essential to every animal studied; but sleep structure varies extensively across the animal kingdom. Sleep may be consolidated all at once (monophasic) or split into multiple bouts throughout the day (polyphasic). Interpreting behavioural diversity of sleep behaviours is difficult due to confounding variation between taxa. As such, I used the model clade of cichlids to understand the evolution of differences in consolidation and identify the genetic signatures associated. I took a comparative approach, integrating behavioural variability, evolutionary histories, and genomic analyses. Our previous work on cichlids has identified that they display high inter-species variation in sleep behaviours, including total duration and circadian timing (during the day or night). My project defined variation in sleep consolidation across cichlids by re-analyzing their activity patterns using 150,000 hours of video from 60 species and calculating metrics I have devised to quantify consolidation. Our analysis suggests that cichlids vary from highly fragmented sleep patterns to very consolidated patterns, and display differences across the circadian cycle. I will use this information to perform genome-wide association studies (GWAS) to identify genetic correlates of sleep consolidation. This will lay the foundation for future research that can investigate how consolidation affects sleep functions.

Sounds of the Water: Studying the Influence of Macrophyte Removal on the Underwater Soundscape in Lake Scugog, Ontario

Husnah Azmi[1] and Stephanie J. Melles[1]

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Freshwater lakes provide an array of ecosystem services like fishing, drinking, and swimming opportunities, and lakes can support highly diverse aquatic communities that are surprisingly rich in *sound* producing organisms. Passive acoustic monitoring (PAM), a technology using hydrophones, provides a non-invasive approach to studying underwater ecosystems, and there are many unanswered questions about aquatic bioacoustics – particularly in the ultrasonic frequency range. In the face of declining aquatic biodiversity, it is imperative to thoroughly document and comprehend biotic sound sources and assess any anthropogenic induced alterations. In this ongoing study, I utilize a wide range of sound data (2Hz – 250 kHz) collected from Lake Scugog, a lake in Southern Ontario with abundant macrophyte growth, to investigate the influence of macrophyte removal on the abundance of sounds produced by soniferous aquatic organisms. Biweekly measurements were taken 3 times before and after an aquatic macrophyte removal event using a hydrophone (SM4 Song Meter from Wildlife Acoustics) for acoustic recordings and an EXO2 Multiparameter Sonde for water quality measurements. Preliminary spectral analyses showing the abundance of varying sound frequencies across recordings before and after macrophyte removal indicate a slight decrease in sounds produced, but these results are inconclusive and require further data analysis.

Has Mating Behaviour Diverged Across an Invasion Front of the Noble False Widow Spider?

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Understanding how invasive species establish and spread is a key goal of invasion biology. As invasive populations mature, a range of shifts in demography are expected to affect sexual selection, and thus mating behaviours. In this project we compared mating behaviours across an invasion front of the noble false widow spider, *Steatoda nobilis*. Using lab reared offspring of mated spiders collected in England, we characterized mating behaviours within and across two populations. One population is from the northern invasion front in England (Nottingham, England), first reported in 2016. The other population is older (Portsmouth, England) and was first reported in 1978. Recent studies suggest divergence, however, mating behaviour, has not been examined yet. Here, we pair males and females within and across populations in standard lab mating trials to test the hypothesis of mating behaviour divergence. We predict lower courtship rates, mating rates, but increased reproductive output (arising from increased genetic diversity of offspring) in inter-population pairings compared to intra-population pairings. We discuss our findings in the context of population divergence and invasiveness.

Population Dynamics and Distribution of Methanotrophs in Landfill Cover Soils

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Landfills are large contributors to global methane emissions. Methanotrophs living in landfill cover soils can reduce these methane emissions. The objectives of this work are to investigate the microbial diversity and community interactions with varying environmental conditions in landfill cover soils to further our knowledge towards mitigating methane emissions. To evaluate the community composition and correlations with specific environmental conditions, we sampled the cover soils of landfills and took measurements of methane flux, and other environmental variables. Sampling sites were distinguished based on the levels of methane flux. The results indicated high relative abundances of methanotrophs at sites with high methane flux values, dominated by the genus *Methylomicrobium*. Sites were also distinguishable based on several environmental conditions measured, with differing pH values and soil chemistry. The distribution of methanotrophs in samples across landfills and sites differed significantly when considering community evenness. Microbial community diversity correlated most strongly to methane flux and to nitrate and nitrite concentrations, of the environmental factors examined. The present results strengthen our understanding of methanotroph dynamics across different methane exposures and geochemical conditions within landfill cover soils. This will inform the use of designer cover soils and/or methanotroph amendments in efforts toward mitigating methane emissions.

Expression of the Protein Assembly Associated with Excitation-Contraction Coupling in Different Life Stages of the Unicellular Choanoflagellate, *Salpingoeca rosetta*

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This project aimed to investigate the protein assembly associated with excitation-contraction coupling in different life stages of the unicellular choanoflagellate, Salpingoeca rosetta, a unicellular eukaryote closely related to animals. Custom polyclonal antibodies targeted against choanoflagellate homologs of key animal excitation-contraction coupling proteins, including SroCav1, SroRYR (Ryanodine Receptor), SroJPH (Junctophilin), SroSTAC (cysteine-rich domain-containing protein), SroMHC11 (major histocompatibility complex), SroBIN (bridging Integrator), and SroSERCA (Sarco(endo)plasmic Calcium ATPase), were employed to investigate their expression patterns. Preliminary data from immunolabelling indicates specific localization and co-localization patterns of these proteins, suggesting a complex and highly specific interaction network that parallels excitation-contraction coupling mechanism found in animals. Through Western blot analysis, it was found that SroSERCA, an essential gene involved in maintaining calcium homeostasis, was only detectable in thecates but not in rosettes, while SroSTAC was present in the cell membrane of starved chains. The protein density of SroMHC11 was found to be within less than a micron of SERCA of the sarcoplasmic reticulum. Additionally, JPH was found to be expressed only in the cell membrane of chains, while RyR was not. Future directions include carrying out Western blotting of SroVAMPa, SroCava2d, and SroRIMbp (Rab3-interacting molecule (RIM)-binding protein) in transfected HEK-293T cells, as well as focusing on triple co-immunolabelling of key proteins.

Climate and Commerce Convergence for Optimal Strawberry Farming Decisions

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Ever wonder why the price of strawberries fluctuates at the grocery store? We predict the answer is a complex mix of factors including the cost of fuel and fertilizers, the annual variation in seasonal availability of locally produced vs imported fruits that may be grown either conventionally or organically, indoors or outside, as well as more recent challenges. Mounting evidence indicates large-scale climatic phenomena such as El Niño Southern Oscillation (ENSO) can overwhelm endogenous factors that govern the population (and thus price) dynamics of wild species - we wondered if this would also influence cropped species. We contribute to the evidence by documenting an ENSO-related impact on strawberry wholesale prices at 3 food terminals across Canada. Time series of daily prices (2017-2023) were evaluated for common patterns of response to dramatic ENSO related events. We will share our preliminary results that describe the relative impact of ENSO relative to endogenous factors. Our findings may prove to be symptomatic of geographically broad impacts of large-scale climate on the dynamics of food security, even in global markets. Our findings reinforce the growing recognition that we should not overlook global-scale causal agents on food security practices.

Are Shorter Species in Herbaceous Vegetation More Shade-Tolerant?

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Competitive advantages are attributed to taller plants, especially regarding their ability to intercept more sunlight while also shading shorter plants. However, evidence has not clearly linked this "size-advantage" to light competition. Shorter plants are often the most shaded individuals within natural vegetation yet remain abundant and ubiquitous across community datasets and reach reproduction under high shade. Within forests, herbaceous plant survival is attributed to shade tolerance, but this adaptation has not been investigated within natural herbaceous vegetation, like old-fields, where shade conditions are comparable to some forests. We evaluated the incidence of shade tolerance adaptation, and 17 relevant functional traits (e.g., large leaf area, low chlorophyll a:b ratio), for 81 herbaceous species in a non-experimental old-field. We tested the hypothesis that short maximum height is predictive of trait values consistent with shade tolerance and found that 11 of 17 trait regressions were consistent. By assessing a broad scope of plant physiological performance, we provide a novel account of shade tolerance adaptation at the community-level, while also addressing two generalized assumptions in existing literature (i.e., a size-advantage in light competition, and the absence of shade tolerance within herbaceous vegetation), which have lacked robust supporting or opposing evidence.

Attentional Character Displacement: How Search Images Limit Competition

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Numerous studies in cognitive psychology and behavioural ecology have examined visual search and how foraging animals form search images, almost all focused-on individuals. Here, we present an agent-based model simulating collective foraging on cryptic prey in agents that either do or do not form search images. Agents focused on one prey type reduce its local density, biasing other agents to form search images for other prey types, which may reduce competition. We report agents' success rates as well as their positions and movements across attention-space. We also varied prey crypticity and the proportion of a population that could modulate their attention. We find that the ability to modulate attention increases distance in attention-space and reduces competition, improving success rates. Agents that cannot modulate their attention also benefit from foraging with those that can. These effects are sensitive to prey crypticity. By incorporating the cognition of visual search into a model of collective foraging, our data suggest that competition is a critical driver of the evolution of search images.

The Good, the Bad, and the Low-abundant: A Review of eDNA Metabarcoding Data Analysis and Curation

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Environmental DNA (eDNA) metabarcoding is a valuable tool for assessing fish communities and informing environmental management strategies. Given this, well-defined and informed methodologies are necessary to increase repeatability and accuracy of results. This review evaluates 87 eDNA metabarcoding studies with a focus on controls, replicates, and low abundance-read filtration methods. A rubric of 29 criteria was developed to standardize the evaluation process and assess the studies under review. While negative controls were common, their implementation and reporting varied, with limited use of positive controls and replicates throughout studies. Additionally, diverse approaches to low abundance sequence filtration underscore a lack of standardization and justification for threshold selection. Recommendations include the adoption of numerous practices: (1) increasing the application of controls and replicates, (2) providing the rationale behind low-abundance filtering criteria, (3) implementing benchmark studies, (4) improving communication of methods and results, (5) making raw sequence data publicly available, and (6) unifying terminology across the field. Refined methodologies in eDNA metabarcoding research are imperative to ensure the reproducibility and accuracy of fish community assessment and environmental management practices as this tool continues to integrate into conservation and management efforts.

Exploring the Role of Frequency-Modulated Bout (FMB) Calls in Big Brown Bat Mate Attraction

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The male big brown bat (*Eptesicus fuscus*) emits a unique call consisting of 3-4 frequency-modulated sweeps – the frequency-modulated bout (FMB). The FMB has a demonstrated role in food competition, but its exclusivity to males suggests a further function in mate attraction. This is congruent with the 'songflight' or 'social call' of two other male Vespertilionids, which has a role in both mate attraction and food competition and shares spectro-temporal characteristics with the FMB. In my presentation, I delve into these similarities across the family and outline my proposed procedure for investigating the role of FMBs in mate attraction, a two-alternative forced choice paradigm to test female big brown bats' responses to a synthetic FMB call during mating and non-mating seasons.

Classification of Red Raspberry Fruit Development via Spectral Imaging & AI Learning

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Scheduled deliveries of fresh fruits and vegetables requires communication between farmers and grocery retailers. Raspberry plants undergo multiple growth stages before their final fruit form, with each developmental stage occurring on a predictable schedule. The use of an AI-trained mechanical eye capable of predicting raspberry harvest dates and quantities requires additional research. We aimed to create a hyperspectral signature database of raspberry developmental stages. With phenology data and machine learning, this database can be used to create an automated system capable of distinguishing raspberry stages within the complex agricultural setting. Individual buds were marked on plants from 2 raspberry cultivars and tracked through developmental stages. Development was classified into 7 phenologies to create a reference standard (bud, flower, green fruit, yellow fruit, transition-stage fruit, ripe fruit, and overripe fruit). The spectral reflectance of each stage was measured using a CARY 5000 UV/Vis-NIR spectrophotometer. Of the 7 phenological stages, the average spectral signatures of 4 stages have been observed: yellow fruit, transition-stage fruit, ripe fruit, and overripe fruit. Data showed each stage with distinct reflectance value readings, with unique peaks along the measured wavelength range. The AI annotation suite has also been able to recognize several phenologies.

Mathematical Approaches for Simulating Epidemic Progression: Addressing Limitations of the Linear Chain Trick in ODE Models

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Simple dynamical models based on Ordinary Differential Equations (ODE) are widely used to forecast infectious disease spread. One issue with this framework is that it implicitly assumes that the residence time in any given state (e.g., the infectious state) is exponentially distributed. This assumption is often unrealistic. A common solution is the application of the Linear Chain Trick (LCT), where the infectious stage is divided into several substages, each following an identical exponential distribution, resulting in a more realistic Erlang-distributed duration. However, the LCT introduces challenges; it limits parametric flexibility and may require comparisons between models with different structures (i.e., different numbers of substages). Here, we propose using a fixed number of substages, but with varying substage transition rates in a geometric sequence. This approach keeps the key advantages of the LCT, while offering greater flexibility and easier fitting to data. We focus here on discussing the SIR (susceptible-infectious-recovered) model, but the potential applications of this approach extend to a wide range of dynamical models, of infectious diseases and other biological systems, offering advantages in terms of computational efficiency, ease of parameter estimation, and flexible time distributions.

Investigating Freshwater Cyanophage Thermal Stability Within the Context of Climate Change

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Viruses infecting primary producers such as cyanobacteria play a critical role in shaping aquatic ecosystems. Cyanobacteria thrive in warm surface waters, however, the impact that rising surface water temperatures due to climate change plays specifically on cyanophages, and within host-virus dynamics, remains unclear. This project investigated the thermal stability of two freshwater cyanophages (CrV and Ma-LMM01), which infect two species of invasive cyanobacteria (*Raphidiopsis raciborskii* and *Microcystis aeruginosa* respectively). Cyanophages were subjected to 4-hour temperature exposures ranging from 31°C to 45°C before triplicate MPN (most probable number) infection experiments were conducted, to determine infectious viral particle titer. Both cyanophages remained highly infectious up to 45°C, since there was no significant difference in the CrV viral titer between the control (25°C exposure) compared to any of the increased temperatures in the CrV experiments, and only a significant decrease in the Ma-LMM01 titer at 45°C. This indicates that like their hosts, cyanophages may have adapted to be stable at warm temperatures, avoiding viral decay. It is likely that these cyanophages will remain stable and infectious for the foreseeable future, since surface water temperatures on average are not predicted to surpass 45°C for over a century.

Nutrient-Rich Solutions: Characterizing Compost and Compost Tea for Applications in Vertical Farming

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Compost is organic waste that has been converted through digestion by various organisms into a nutrient rich soil that is often used in the agricultural industry as a fertilizer. The organic matter in compost can come from a variety of sources. Including fecal waste, spoiled food, industrial waste, and agricultural wastes. Compost tea is water that has had compost soaked and fermented and separated into a nutrient rich liquid. This experiment aims to determine and compare the nutrient makeup of compost and compost tea produced from four readily available organic waste sources: chicken manure, coffee grounds, spent grain from beer brewing, and raspberry leaves. Each source was processed in compost bins containing *Eisenia fetida*, commonly known as red wigglers. A portion of the compost was used to produce compost tea. Samples from each treatment were analyzed for their nutrient content as well as for the presence of common pathogens like *E. coli* and fecal coliforms. The study seeks to identify whether compost sources have distinct nutrient profiles and to produce sustainable organic fertilizer with ideal nutrient profiles. Preliminary results will be presented at the conference.

Signal and Quality: Individual Variation in Mountain Chickadee (*Peocile gambeli*) Songs and Spatial Cognitive Abilities

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This study explores the relationship between song and spatial cognitive abilities in male mountain chickadees (*Poecile gambeli*). Chickadees are nonmigratory, food-caching birds that rely on specialized spatial memory abilities to recover food stores and survive winter. Variation in male song has previously been linked with female mate preference in chickadees. While previous work found associations between song variation and spatial cognitive ability at the elevation level, direct evidence showing that variation in birdsong reflects spatial cognitive abilities is lacking. Using data collected over five years (2016-2017, 2020-2022), we directly tested the prediction that variation in male songs serves as an indicator of their cognitive abilities. We did not find a strong association between individual variation in song structure and spatial cognitive performance. However, differences in cognitive abilities and song between elevations were consistent with previous work. This study contributes to a deeper understanding of the role of birdsong in mate selection and the potential link between acoustic signals and cognitive performance in the context of natural selection.

Examining the Impact of Polyadenylation Factors PABPN1, PABPC1, and CPSF5 on the Epithelial-to-Mesenchymal Transition in Mammalian Cells

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Epithelial-to-mesenchymal transition (EMT) is the process in which epithelial cells lose their adhesive properties and convert into migratory mesenchymal cells. Alternative polyadenylation (APA) is a regulating mechanism of EMT in mammalian organisms. APA refers to variance in the polyadenylation sites (PAS) targeted during the polyadenylation process. This variance can generate different mRNA isoforms of the same gene that differ in terms of stability, activity, localization, and protein interactions. This study examines 3 different polyadenylation factors (PABPN1, PABPC1, and CPSF5), and their impact on EMT regulation. It is hypothesized that dysfunction in these genes will upregulate EMT in mammalian cells. In this study, murine mammary cancer cell line Py2T was used to model the effects of gene knockdowns of PABPN1, PABPC1, and CPSF5 on EMT regulation using short-interfering RNAs (siRNAs). EMT for each cell sample was quantified using Fluorescein Isothiocyanate (FITC)-Dextran and Transepithelial/Transendothelial Electrical Resistance (TEER) assays. Results for both TEER and FITC-Dextran assays indicate upregulation of EMT in all three of the knockdown samples relative to controls. While results are insufficient to establish statistical significance, they do support the initial hypothesis and indicate that EMT appears to be upregulated upon downregulation of the PABPN1, PABPC1, and CPSF5 genes.

Ecological Niche Contributes to the Persistence of the Western x Glaucous-winged Gull Hybrid Zone

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Hybrid zones occur in nature when populations with limited reproductive barriers overlap in space. Many hybrid zones persist over time, and different models have been proposed to explain how selection can maintain hybrid zone stability. More empirical studies are needed to elucidate the role of ecological adaptation in maintaining stable hybrid zones. Here, we investigated the role of exogenous factors in maintaining a hybrid zone between western gulls (*Larus occidentalis*) and glaucous-winged gulls (*L. glaucescens*). We used ecological niche models (ENMs) and niche similarity tests to quantify and examine the ecological niches of western gulls, glaucous-winged gulls, and their hybrids. We found evidence of niche divergence between all three groups. Our results best support the bounded superiority model, providing further evidence that exogenous selection favoring hybrids may be an important factor in maintaining this stable hybrid zone.

Beyond the Signal: Using Digitally-Coded Radiotransmitter Frequency to Predict Temperature

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Digitally-coded raditransmitters allow for the simultaneous tracking of multiple animals but don't explicitly report temperature data. The precise frequency of individual pulses deviates from their nominal frequency, recorded as frequency offset. I hypothesized that frequency offset of digitally-coded transmitters is correlated with temperature and could be used to document temperatures in free-living animals. I first conducted calibration experiments exposing transmitters to controlled temperatures resulting in a strong relationship between frequency offset and temperature. Next these transmitters were attached to free-living Silver-haired Bats (*Lasionycteris noctivagans*). Using only inferred temperature from frequency offset, torpor and homeothermy were observed under environmental conditions known to induce these strategies. However, predicted temperatures were inconsistent suggesting limitations for inferring exact temperature. Data from American Tree Sparrows (*Spizelloides arborea*) tagged with the same model of transmitter was explored with no evidence of heterothermy detected. Furthermore, the predicted temperatures were far below normal bird temperatures. My research indicates that digitally-coded transmitters can detect changes in temperature of free-living animals but is best used to document temperature patterns rather than measuring precise temperatures. Further studies should be conducted on known heterothermic birds to know if this method works for birds and can be used to detect heterothermy in new species.

A Case of the Zoomies? Unraveling the Intricacies of Dawn Swarming Behaviour in Temperate Bats

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Similar to many other bat species, little brown bats (*Myotis lucifugus*) live in complex and highly social maternity groups where bats form long-term social bonds with each other. Bats use visual and behavioural cues to communicate and maintain cohesion of their maternity groups over time. Individuals gather around roost sites before dawn and conduct unique behavioural displays. Collectively known as "dawn swarming", this phenomenon is thought to be investigative in nature. Some of these behavioural displays include circling around a roost, and swooping up at the entrance, all before entering the roost itself or visiting an entirely different site. Using thermal video recordings and a network of passive integrated transponder (PIT) tagged bats, we observed the dawn swarming behaviour of a *M. lucifugus* maternity group roosting in bat boxes in Pinery Provincial Park, Ontario, Canada. In 2023, we found activity peaked 30–75 minutes before sunrise. Activity formed a clustered, wave-like pattern, where individuals interacted with roost sites at variable, but discrete, time intervals. With this study, we aim to quantitatively characterize the behaviours conducted during dawn swarming to better understand bat social dynamics, and ultimately, aspects of how social animals communicate.

Candidate Sociability Genes

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Sociability is defined as individuals' tendencies to engage in friendly activities, such as feeding, traveling, and resting with conspecifics. It is prevalent among animal species and impacts fitness. Despite the clear importance of sociability for many animals including humans, we still have limited information of its natural genetic and neurobiological architecture. To address this knowledge gap, we generated low- and high-sociability lineages in fruit flies by artificially selecting them for sociability. Using a "multi-genomics" approach, combining genome scans, genome-wide differential gene expression and differential transcript usage analyses, we have identified several relevant candidate sociability genes. So far, we have conducted verification tests on 17 of these sociability candidate genes using RNA interference. We will discuss the functions of the verified sociability genes and plans for future work investigating the genetics of natural variation in sociability.

Change in Expression of the Autism-Related Gene Neuroligin-3 Affect Social Spacing and Longevity in *Drosophila melanogaster*

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Drosophila melanogaster is a fundamental model for genetic studies of behaviour and longevity. My research explores the autism-related *neuroligin 3* (*nlg3*) gene's potential effects on lifespan and behaviour in Drosophila by employing overexpression techniques. Utilizing the Gal4-UAS system, I manipulated *nlg3* expression in flies carrying a Trojan genetic construct for *nlg3* (*nlg3-Gal4*), facilitating precise gene expression mimicry. The *nlg3-Gal4* line itself displays a reduction in *nlg3* expression and crossing it with a line carrying a uas-*nlg3*cDNA construct allows for gene overexpression. Survival analysis and social spacing assays were conducted to evaluate the impact of altered *nlg3* expression on longevity and social behaviour. My findings indicate that overexpression of the cDNA in that mutant background restores normal longevity and social spacing. These discoveries not only advance our understanding of the genetic determinants of aging and social behaviour in Drosophila, but also hint at broader implications for aging research in more complex organisms.

The Influence of Social Rank on Learning in Group Living Fish

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Animals can learn through their own experiences (asocial learning) or through observing others (social learning). Asocial learning is costly but reliable, while social learning is less costly but unreliable. The low cost of social learning may make it seem like the obvious choice; however, the associated unreliability prevents animals from using it exclusively. Switching between asocial and social learning is expected as an animal will use whichever learning is most beneficial. However, theory predicts that dominants should prefer to learn socially while subordinates should prefer to use asocial learning. These preferences are the result of dominants prioritizing low-cost learning, while subordinates prioritize reliable information. However, these predictions are rarely tested. We used a foraging assay to test how social rank influences asocial and social learning in the group living cichlid fish *Neolamprologus pulcher*. We found that subordinate fish were faster in an asocial learning task but there was no difference between the social ranks when it came to learning from others. It also appears that subordinates are more likely to ignore social information when it contradicts with their individually learned information. Understanding how social ranks influence learning can help us better understand how social groups function.

Sentinel Behaviour in Mammal and Avian Species

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Sentinel behaviour is a form of coordinated vigilance where individuals take turns ensuring constant vigilance over the group from exposed prominent positions. Foragers benefit from this behaviour by maximizing their foraging efficiency while maintaining vigilance for threats, seemingly at the expense of the sentinel. Initially thought to be an altruistic behaviour, recent studies have supported a selfish, state-dependent model for sentinel decision-making where individual energetic states and perceived risk play key roles. Studies across multiple taxa have revealed several intrinsic and extrinsic factors that can affect sentinel behaviour. The objective of our scoping review was to identify and compile these factors in mammal and avian species. We show that individual energetic states and perceived risk could be behind the effects of intrinsic and extrinsic factors, further supporting the selfish state-dependent model for sentinel behaviour. Our findings also show how these factors can interact and highlight the complex relationship between individual motivators and the environment. Understanding these relationships can help us better understand the underlying mechanisms behind social behavioural decision-making and predict how social behaviours could change in different environments. This is especially important in the ever-urbanizing world, where the effects of human-altered habitats can greatly affect a species' success.

To be Touched or Not: A Comparative Study on Dogs and Horses

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The importance of choice in human-animal interactions is often disregarded. We examined the impact of consensual and non-consensual touch on stress-related behaviours and approach/avoidance tendencies in therapy dogs (n=18) and horses (n=10). Volunteers (n=44 and 49 respectively) interacted individually with dogs and horses in both non-consensual (on leash/tethered) and consensual (loose in the pen) touch. During the non-consensual treatment, the participant touched the dog/horse continuously. In consensual treatment, they touched the animal only if they came within arm's reach. Sessions were videoed for retrospective behavioural coding and analyzed using a GLMM for repeated measures. Stress-related behaviours in dogs (Lip-licking, panting and yawning, all $p>.40$) did not differ between treatments, while in horses, oral behaviours (1.25±0.13), restlessness (4.25±0.41) and tail swishing (4.68±0.18) were higher during non-consensual than consensual treatments (0.55±0.07, 1.75±0.18 and 4.20±0.19 behaviours/min; all $p<.0017$ respectively). In dogs, avoidance behaviours (moving/leaning away from the participant) were more frequent during consensual (3.0±0.31/3min) than non-consensual (0.4±0.33/3min) sessions ($P<.0001$). Conversely, dogs displayed more approach behaviours (actively engaged with the participant) during non-consensual (17.6±0.04/3min) compared to consensual sessions (14.5±0.04/3min; $P<.0001$). The results demonstrate subtle behavioural differences in therapy animals during consensual and non-consensual touch interactions emphasizing the importance of choice to ensure animal well-being.

Habitat Area and Environmental Filters Determine Avian Richness Along an Elevation Gradient in Mountain Peatlands

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Globally, relationships between avian richness and elevation in mountain ecosystems typically reflect one of four well-documented patterns, but the mechanisms responsible for these patterns are poorly understood. We investigated which pattern best described bird species richness in mountain peatlands of Alberta and used an AIC framework to investigate possible mechanisms. Avian richness displayed a plateauing (cubic) relationship in response to increasing elevation. Once we accounted for the richness–area relationship, the richness–elevation relationship was best described by a negative linear model rather than a cubic model. Consequently, we reject the neutral model and conclude that peatland area and one or more environmental filters are simultaneously driving relationships between avian richness and elevation in Rocky Mountain peatlands. Multicausality likely explains why researchers in different geographies observe inconsistent patterns between richness and elevation: drivers and interactions among drivers may vary spatially. Importantly, Natural Subregion was a stronger predictor of avian species richness than elevation per se (AICc weight = 0.96), suggesting that the responsible environmental filter(s) is relatively homogenous within ecological land classes (e.g., primary productivity) rather than directly variable with elevation (e.g., temperature). The results also lend insight into priorities for future research on richness–elevation patterns in mountain birds.

No Place like Home: Characterizing the Roost Selection of the Migratory Silver-Haired Bat (*Lasionycteris noctivagans*) during Fall Stopover

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Many species of bats take part in latitudinal migration, where they travel great distances while remaining exclusively nocturnal. At sunrise, bats must stopover to roost for the day. There are very few accounts of the types of roosts bats use during stopover, due to their elusive nature. During the fall migratory period, we caught silver-haired bats (*Lasionycteris noctivagans*) to characterize their roost selection and whether a roost was chosen opportunistically or due to specific characteristics. We used mist nets to capture bats at Long Point, Ontario, Canada, and dorsally affixed a radio-transmitter before release. During the day, we conducted radio telemetry to the roost, and measured various characteristics (height, decay status, species, etc.) of the roost tree and surrounding trees, as well as random trees at Long Point for comparison. In 2023, bats were found to select trees that are much larger than those in its surrounding environment as well as generally found at Long Point. The silver-haired bat, along with all other migratory bat species in Canada, was assessed as endangered as of May 2023 by COSEWIC. This research is crucial as understanding roost selection will inform and support population recovery efforts and habitat protection regulations.

Wandering Wings: Exploring the Migration Routes and Habitat Selection of Eastern Population Sandhill Cranes

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Stopover areas are crucial for migrating waterbirds to rest and refuel, yet quantitative descriptions are often lacking, hindering conservation efforts. Recent telemetry advancements that record frequent locations for long timespans allow for detailed stopover delineation and species management. Little is known about stopover distribution, chronology, and habitat selection of the Eastern Population of Sandhill cranes, despite their recovery from near extirpation. To address this information gap, we deployed GPS-GSM transmitters on 84 adult Eastern Population cranes in Ontario and Quebec from 2019-2022. Using kernel density estimates, we delineated spring and fall stopover locations. Fall stopovers averaged 895 ± 320 km2, with cranes spending 45 ± 13 days, while spring stopovers averaged 981 ± 317 km2, with 24 ± 8 days spent. Preliminary findings suggest cranes prefer stopover areas with higher proportions of agricultural and wetland habitat availability. Our study provides critical quantitative data on crane stopovers, offering insights into migration dynamics that can be used to provide insight into crane management.

Breeding Territory Selection of Sandhill Cranes in Eastern Canada's Boreal Forest

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Breeding habitat constitutes key resources for sandhill cranes and is important for regulating population persistence. Given the recent range expansion of Eastern Population (EP) cranes, our knowledge of crane breeding ecology remains limited, and research is required to understand spatiotemporal drivers of breeding territory selection for conservation planning. To address knowledge gaps, we monitored GPS-locations of 42 adult cranes from 2020-2022 across Eastern Canada's boreal forest to estimate the size and distribution of breeding territories and identify patterns of home-range selection using resource selection functions. We also developed spatially predictive models identifying potential breeding habitats across the landscape. Cranes established breeding territories throughout the boreal forest in Ontario and Quebec. Mean breeding territory arrival and departure were April 21±8.3d and August 28±13.9d, respectively, with the median home-range size being 8.06±26.4 km^2. Cranes selected home-ranges containing greater proportions of wetland, cropland, and recently disturbed areas, while avoiding forests and open habitats. By developing spatially predictive maps, we can understand patterns of habitat selection which allows for fine-scale analysis of factors impacting breeding ranges of cranes and advances our knowledge of conservation in increasingly human-modified landscapes.

Muskoxen Below Treeline: Ecological Implications of Range Expansion for Large Northern Ungulates

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Rapid changes in species geographic ranges have become increasingly common, driven by species introductions, habitat loss, and climate change. Understanding how range expansions influences a species' ecology is important for biodiversity conservation, food security, and the protection of critical habitats. This is particularly important for northern regions, where biodiversity is low and the effects of climate change are disproportionate compared to more southern parts of the continent. Muskox (ʔəjɪre; *Ovibos moschatus*) provide a unique opportunity to investigate range expansions in a northern context; since recovering from overexploitation, the species is extending the leading edge of their mainland distribution south, into the treeline. We use data from 10 muskoxen collared below treeline to investigate the species home range size and movement associations and compare to published estimates from tundra environments. Preliminary results suggest strong seasonality to muskox movements within the treeline, and low-site fidelity. This research will enhance our understanding of how species re-establish in old environments and will enhance conservation and management strategies in dynamic northern ecosystems.

Assessing Ecological Similarities, Threats, and Potential for Co-Management of Woodland Caribou and Wolverine in Canada's Boreal Forests

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Canadian boreal forests are undergoing some of the most rapid rates of change globally, driven by the impacts of forestry, industrial development, and climate change. As a result, boreal woodland caribou (*Rangifer tarandus caribou*) populations have declined significantly and are listed nationally as 'Threatened'. Federal conservation strategies such as the Pan-Canadian Approach aim to conserve this species and also bring co-benefits to other co-occurring 'Species at Risk' vulnerable to similar threats. Wolverines (*Gulo gulo*) share some ecological commonalities with woodland caribou, making them a candidate species for this co-management approach. To begin assessing the efficacy of a woodland caribou and wolverine co-management approach, I've conducted a review of existing woodland caribou and wolverine status assessments, recovery plans, and action plans at both a national and provincial/territorial level. Preliminary results show more extensive and detailed conservation planning in place for woodland caribou than wolverine, reflecting differences in some status listings. These documents indicate there is significant overlap in the reported drivers of woodland caribou and wolverine declines suggesting there is potential for co-management. This work will be built on by contrasting landscape-scale habitat associations for both species, and forecasting wolverine habitat availability under current caribou-focused forest management strategies.

Settling into the Groove: Decreases in Metabolic Rate with Increasing Flight Duration in *Eptesicus fuscus*

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Flight is the most energetically costly form of locomotion per unit time, yet bats are able to sustain flight over large distances and for many hours at a time. Studies to date have primarily focused on just the first couple minutes of flight, a period during which bats transition into steady state forward flight. We explore how the energetic cost of sustained flight changes with flight duration using big brown bats (*Eptesicus fuscus*). Using a within-subjects repeated measures design and the ^{13}C-labelled sodium bicarbonate isotope tracer method to estimate energetic expenditure, bats were flown from 2 – 11 minutes in an outdoor flight chamber with video recordings used to calculate the duration of each flight. Flight metabolic rate decreased with flight duration with bats reaching a sustained steady-state metabolic rate at ~6 mins of flight. These results indicate that bats undergo a change in metabolic processes as they transition between initial and sustained flight periods, suggesting past studies of short duration may overestimate the energetic cost of flight. Future studies should examine changes in the metabolic pathways and micronutrient fuel sources of bats during flight, with opportunities for comparative studies among species of bats that differ in foraging and flight strategies.

Why Study Skin pH of Wildlife?

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Skin is important in regulating water loss and is a key aspect of the immune system in pathogen defense. Several skin diseases pose conservation challenges to wildlife, such as white-nose syndrome in bats and chytridiomycosis in amphibians. Skin pH regulates the activity of enzymes produced both by hosts and by microbes on host skin, thus implicating pH in disease susceptibility and skin barrier function. Skin pH varies inter- and intra-specifically and is influenced by a variety of intrinsic and extrinsic variables. Increased skin pH is associated with a predisposition to cutaneous infections, and inter-specific and inter-individual variation in skin pH is implicated in differential susceptibility to some skin diseases. Despite extensive study in humans and domestic mammals, wildlife skin pH remains largely unexplored. The skin pH of wildlife may vary by species depending on the effects and requirements of seasonal conditions in native habitats. Human-induced alterations to native habitats, such as pollution, may impact wildlife skin health. Investigating skin pH's role in microbial pathogenesis and skin barrier function, as well as its interaction with environmental factors, may provide valuable insights on new therapeutic avenues.

Annual Survivorship Varies Between the Sexes, But Not With Overwinter Latitude, in Song Sparrows

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Many animals display differential migration, where members of a population breed at the same site but overwinter at different sites. Despite interest in how individual variation in migration affects fitness, the relationship between overwinter latitude and survival has been difficult to study because only surviving individuals that return to the breeding site can be sampled to assess winter latitude. We used stable isotope analysis of winter-grown claw tissue (δ^2H_c) as a proxy to examine the relationship between survival and overwinter latitude in differentially-migrating song sparrows (*Melospiza melodia*). We constructed encounter histories for 173 individuals from ten years of breeding-site capture records and fit a modified Cormack-Jolly-Seber model incorporating a hierarchical model of δ^2H_c. Analysis was conducted in the Bayesian framework via MCMC sampling, estimating distributions of missing δ^2H_c data based on the individual's previous values, to assess how survival varies with δ^2H_c. We found that both survival and capture probability varied by sex, but δ^2H_c did not differ by sex and δ^2H_c was not linked to survival. This finding may help to explain the maintenance of differential migration in this population of song sparrows.

Nocturnal Heterothermy Use in North American Songbirds During Migration

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Migratory flight is energetically demanding, but birds use twice as much energy during stopovers, largely driven by thermoregulatory costs. Birds have been assumed to be homeothermic, which would present an extreme challenge in maintaining fat stores, their primary migration energy source, on cold nights. I am examining the use of nocturnal heterothermy as a mechanism of energy conservation in small songbirds during migration. Nocturnal heterothermy allows individuals to reduce the amount of energy expended on thermoregulation during inactive periods, providing energy savings which could dramatically alter migratory strategies. My focal species are Brown Creeper (BRCR; *Certhia americana*), Golden-crowned Kinglet (GCKI; *Regulus satrapa*), Ruby-crowned Kinglet (RCKI; *Corthylio calendula*), and Yellow-rumped Warbler (YRWA; *Setophaga coronata*). I measured body temperature using temperature-sensitive PIT tags and measured metabolic rate using open-flow respirometry at 2, 7, 12, and 25/30°C. All focal species used nocturnal heterothermy with minimum body temperatures of 34.1°C (BRCR), 28.8°C (GCKI), 34.5°C (RCKI), and 33.4°C (YRWA). Metabolic rate increased at colder temperatures, but there is as much as a 42% difference in metabolic rate within a temperature treatment. Reduced thermoregulatory costs may result in an increased net refueling rate allowing individuals to reach their breeding territories and wintering grounds more rapidly.

Seasonal Temperature Induced Heart-Collagen Remodeling Response in the Rainbow Darter (*Etheostoma caeruleum*)

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Acclimation to temperature changes in fish has been shown to prompt a cardiac remodeling response, with collagen protein playing a key role, although the mechanism of this response remains unclear. Currently, it is believed to be a seasonal adaptation to shifting temperatures, with studies indicating that microRNA-29b, an epigenetic non-coding RNA, targets collagen mRNA in the heart. To further explore these questions, this study characterizes the remodeling response in a wild population of rainbow darters (*Etheostoma caeruleum*) to examine seasonal effects in a natural environment. Heart tissue was collected on-site at three season timepoints (Spring, Summer, Fall 2023) from the Grand River, Grand Valley, ON. Gene expression of microRNA-29b, and three collagen type I protein transcripts (*col1a1*, *col1a2*, & *col1a3*) was measured through qPCR. Histological analysis was used to visualize and quantify the collagen protein content through picrosirius red staining. Results from qPCR revealed seasonal and sex-specific differences in expression of microRNA-29b, *col1a1*, and *col1a2*, suggesting the presence of this remodeling response in a non-model species. Understanding the impacts of temperature fluctuations and extreme weather events on local fish populations is increasingly crucial. This study contributes to a more comprehensive understanding of seasonal effects in a natural environment.

The Impact of Two Road Salts on Aquatic Macroinvertebrates

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De-icing salts have been shown to damage vegetation, birds, and other wildlife. These salts often run off roads, accumulate in freshwater, and negatively impact organisms in these habitats that are not adapted to higher levels of salinity. While these salts are applied to mitigate winter ice conditions, Toronto waterways have been shown to exceed the federal chronic limit for chloride even in the summer. Our research contrasted how two common road salts (NaCl and $CaCl_2$) impact amphipod survival and their role as decomposers, as well as colonization of aquatic ecosystems. We compared mesocosms with no added salts, added NaCl, and added $CaCl_2$ (6 tanks each) that were left undisturbed for a month. We found that road salt significantly impacted amphipod survival across treatments. We also found extensive colonization by macroinvertebrates across all treatments. From this research, we are able to gain an understanding of how salinization impacts amphipods, and how it may influence colonization of aquatic ecosystems by Ontario macroinvertebrates.

Influence of Fish Load on Nitrifying Community Succession in Aquarium Biofilters

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Within freshwater aquarium systems, ammonia accumulation from metabolic waste or organic matter decay can become toxic for aquatic organisms. Ammonia is removed from aquaria through nitrification, a microbially mediated process that oxidizes ammonia (NH_3) to less-toxic nitrate (NO_3^-) via a nitrite (NO_2^-) intermediate, facilitated by ammonia-oxidizing bacteria (AOB), archaea (AOA), and comammox *Nitrospira* (CMX). Newly established aquaria that lack a nitrifying community are susceptible to ammonia toxicity and loss of aquatic life. However, nitrifier community succession and niche occupation within freshwater aquarium biofilters is poorly characterized. To investigate microbial community succession in response to fish loads, aquaria containing varying numbers of zebrafish (i.e., *Danio rerio*) were established and maintained for 240 days. Whole-community 16S rRNA gene sequencing and nitrifier-targeted *amoA* qPCR analyses were used to profile aquarium communities and abundances, respectively. Microbial community profiles from aquaria with high fish loads differentiated rapidly from low-fish-load aquaria, within the first two weeks of aquarium operation, and remained differentiated throughout the experiment. Nearly all aquaria were consistently dominated by *Nitrospira*-associated ASVs, regardless of fish load or aquarium operation time; AOB were less dominant, but present. In contrast to previous aquarium studies, AOA were nearly entirely absent.

Molecular Characterization of Cyanobacteria from a Wildfire Impacted Drinking Water Supply in Fort McMurray, Alberta, Canada

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Fort McMurray, Alberta, Canada, experienced a severe wildfire during the summer of 2016 that resulted in evacuation of ~90,000 people and loss of ~600,000 hectares of forest cover. As a result, the Regional Municipality of Wood Buffalo (RMWB) drinking water treatment plant has experienced ash and nutrient transport into the drinking water reservoirs, leading to annual toxic cyanobacterial proliferation. In the summer of 2023, systematic sampling of the RMWB water supply was conducted with the objective to characterize and monitor shifts in cyanobacterial community composition, identify potential toxin producers, and link communities to water quality parameters. The DNA from filtered water was extracted and 16S rRNA amplicon sequencing was conducted to characterize cyanobacteria in QIIME2 using a SILVA classifier and processed in RStudio. There were 1,232 cyanobacteria ASVs with a total frequency of 573,710 sequences, with the most dominant genus being *Cyanobium*. Potential bloom-forming and toxin producing genera observed were *Planktothrix*, *Microcystis*, and *Aphanizomenon*. An NMDS plot indicated cyanobacterial communities from the same location were generally similar in composition. An RDA analysis indicated that cyanobacterial communities were positively associated with temperature, total phosphorus, and total nitrogen. Results demonstrate that legacy impacts of the wildfire can potentially induce toxic cyanobacteria blooms.

The Dark Side of Cyanobacteria: Expanding Our Understanding of Non-photosynthetic Cyanobacteria in Freshwater Systems

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Genomic sequencing has expanded the phylum Cyanobacteria to include Non-photosynthetic Cyanobacteria (NCY). The NCY lack photosynthetic mechanisms and thrive in darker environments. This group is also hypothesized to be cyanotoxin producers of **β**-Methylamino-L-alanine (neurotoxin). The objective of this study is to explore the biogeography and seasonal distribution of NCY in freshwater systems. The Turkey Lakes Watershed (TLW), in Ontario, is a model site to observe the influence of autumnal and vernal shifts on cyanobacterial community dynamics in a changing climate. Using the 16S rRNA gene V4 region, amplicon sequencing was performed, and taxonomy was assigned with the SILVA v138 classifier. The NCY taxa observed for the summer months in TLW from 2018 to 2022 were Gastranaerophilales, Obscuribacterales, Vampirovibrionales, and Caenarcaniphilales. Samples collected in Summer 2022 and Fall 2023 reported 5 ASVs with a frequency of 160 reads (total) identified as NCY. Integrated water column samples from Winter 2023 reported a diversity of NCY, implying that ice cover may play a role in NCY community. In addition, NCY distribution were observed across five ecozones in Canada. The classification of NCY within Cyanobacteria is highly debated and therefore investigating NCY distribution is vital to microbial ecology.

Exploring Noncoding Transcriptomes from Organelle Genomes by Using Long-Read Data

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Mitochondria and chloroplasts are information processing hubs with genomes inherited from prokaryotic ancestors. Despite billions of years of reductive evolution (via Endosymbiotic Gene Transfer), organelle genomes exhibit a remarkable diversity in size, content, and structure. Just as convoluted, organelle transcriptomes can be seen as hybrid system - a prokaryotic relic entombed in a eukaryotic vessel. By using publicly available RNA-Seq data, I have demonstrated that organelle genomes are pervasively transcribed. The essence of these transcriptomes was hard to dissect because of the nature of short Illumina reads. As public repositories (such as NCBI SRA) are finally teeming with high-quality 3rd-generation RNA-Seq data (e.g., ONT and PacBio), I can investigate organelle transcriptomes in a detail not possible before. I have first (re)annotated the noncoding portion of ~ 36K organelle genomes and found hundreds of potential ncRNA genes of various sizes. I am now tapping onto long RNA data to identify these ncRNAs and sORFs with putative functions. Given the plethora of ncRNAS and micropeptides found elsewhere in the cell(s), I hypothesize that organelle genomes and transcriptomes are a treasure trove of regulatory elements.

Expanding Genomic Knowledge of Under-sequenced Organisms Using Petabase-scale Data Mining

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Seventy percent of previously sequenced species have only one representative genome available in the NCBI Genbank database. This limits our understanding of the pan-genome, evolution, and function of these organisms. Using species-specific *k*-mer signatures, we can predict which of the 26,847,286 datasets in the Sequence Read Archive might contain genomic information for any under-sequenced organism. Using this data we have found that it might be possible to add one or more draft genomes (at 1X coverage or greater) for 29,450 (30%) of species which have only one Genbank dataset. As a proof of principle, we used SRA datasets to expand the pan-genome for *Clostridium tarantellae*, which has only one representative genome available. Our analysis found several metagenomic datasets containing *C. tarantellae* which we used to assemble draft genomes for *C. tarantellae*, thus improving our understanding of its pan-genome and evolutionary history. Analysis of the associated metadata revealed an association with a fish host niche. This association was previously predicted but never demonstrated. This work demonstrates the potential of large-scale data mining for expanding the genomic knowledge of under-sequenced organisms and for revealing novel functional and environmental associations.

Uncovering the Role of an Enzymatically Active Flagellin in Surface Motility and Biofilm Regulation

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The bacterial flagellum, traditionally recognized for its role in bacterial swimming, has recently unveiled a novel enzymatic function through flagellinolysin, a metallopeptidase-containing flagellin. This enzymatic flagellin, identified in 74 bacterial species, has sparked interest in the flagellum's biological roles beyond swimming motility. This exploratory study aims to investigate the biological significance of flagellinolysin, particularly its involvement in surface motility, adhesion and biofilm development, using *Pseudoalteromonas tunicata* as a model organism. Simultaneously, this study examines a putative flagellinolysin substrate within *P. tunicata*'s proteome, a protein deemed "VCBS," which contains calcium-dependent adhesive domains. To explore differences in biological function, knockout and catalytic site point mutants of flagellinolysin, and knockout mutants of VCBS were constructed. These mutants, along with the wildtype strain, were cultivated on agar plates to assess differences in surface motility and grown in micro-centrifuge tubes to quantify biofilm development via a colorimetric assay. Findings from the surface motility and biofilm assays suggest antagonistic activities between VCBS and flagellinolysin in which the former promotes surface adhesion while the latter promotes surface motility and regulates biofilm-related adhesion. These results contribute new insights to the collective understanding of the role of flagella in surface motility and biofilm regulation.

Examining the Diversity of Cetacean Temporal Activity Patterns

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All animals partition their sleep and activity into distinct periods of the 24-hour day cycle. This daily timing of sleep and wakefulness defines a species' temporal activity pattern, an important aspect of fitness. Species must be well-adapted to their temporal niche, meaning transitioning between activity patterns is often difficult, requiring changes to a confluence of genes/traits. How constrained a species is in this regard appears to depend on life history traits and environment, as the aquatic osteichthyes (bony fish) have been found to have a much higher rate of transitions between temporal niches compared to mainly terrestrial groups like mammals. Using literature meta-analysis, we examine how differences evolved in the temporal activity patterns of cetaceans (whales, dolphins and porpoises), the largest group of fully aquatic mammals. We find that cetaceans have frequently transitioned between activity patterns over their evolutionary history, a stark contrast to other mammalian groups. By modelling the dynamics of cetacean activity pattern evolution and quantifying how it differs from comparable terrestrial groups in the wider order artiodactyla, we can elucidate mechanisms that facilitate frequent transitions, such as exaptation of aquatic adaptations or a stepwise progression through a more arrhythmic intermediate state (a cathemeral/crepuscular bridge).

What Does qPCR and Marker Sequencing Tell Us About Potential Cyanobacterial Blooms?

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Toxic cyanobacterial blooms pose a threat to the quality and safety of drinking water globally by forming dense surface blooms and producing toxins that are harmful to human health. The aim of this research was to quantify cyanobacterial abundance (16S rRNA gene V4 region) and a potential toxin producing gene (*mcy*E gene) in a northern Ontario forested watershed. Sampling was conducted from May to August 2022 with sequencing and quantitative PCR used for molecular analyses. Cyanobacteria and potential cyanotoxin producers appeared as early as May in this low nutrient, relatively undisturbed lake system. Abundances ranged from 3.597 – 6.299 DNA copies/µL for cyanobacteria and 0.030 – 7.437 DNA copies/µL for the *mcy*E gene. Peak abundances were observed in the months of July and August, without visible blooms during sampling. Abundances ranged from logged values of 4.892 – 5.996 DNA copies/µL for cyanobacteria and 0.300 – 2.786 DNA copies/µL for the *mcy*E gene. Cyanobacterial abundance had variability between the months, days, timepoints, and location in the water column, demonstrating the importance of consistent monitoring and sampling efforts. This highlights that monitoring drinking water sources require appropriate sampling protocols as each water system is unique and can be affected by various disturbances.

Characterizing Benthic Bacterial Communities in Areas Impacted by Wildfires in Fort McMurray

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The 2016 wildfire in Fort McMurray deposited nutrients, such as phosphorous and nitrogen, to water systems causing cyanobacterial proliferation not seen prior to this fire. Cyanobacterial proliferation has sustained over several summer seasons due to internal loading of nutrients. The objective of this study was to characterize the previously undescribed bacterial communities in the sediment and benthic water in Fort McMurray, using bioinformatic tools. Sediment and benthic water samples were processed monthly between June and September 2023. Samples were then sequenced for the 16S rRNA gene using Illumina MiSeq technology and analyzed using QIIME2 with the SILVA v.138 taxonomic classifier. Phyla in water throughout the seasonal period were consistently present in similar relative abundances. There was slightly higher relative abundance of Cyanobacteria in water samples in August, and lower relative abundance in September. In sediment, phyla were also consistently present in similar relative abundances, except for Cyanobacteria having a higher relative abundance in September. Cyanobacterial genera in benthic water and sediments shifted from benthic and planktonic genera present in higher relative abundances to entirely planktonic genera present in September. This result indicates the dying off a cyanobacterial proliferation in the water column and settling in the benthos.

Creating a Reporter to Measure *Sinorhizobium meliloti nodD1* Promoter Activity in Response to *Medicago truncatula* Root Exudates

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Exploring traits involved in legume-rhizobium co-evolutionary history and nitrogen-fixing ability, offers a probe into subsurface ecosystems and a means to develop sustainable agriculture. Legume-rhizobium symbiosis by root nodulation, is highly host-specific and is facilitated through chemical signaling via flavonoids. Unique flavonoid profiles induce the expression of *nod* genes and Nod factors in rhizobia to signal nodulation and intensifies rhizobia competition. Existing methods to investigate both nitrogen-fixation and rhizobia competitiveness are time-consuming and inefficient. A reporter construct using the promoter region of the *nodD1* gene of *Sinorhizobium meliloti* presents a convenient and modular molecular tool to facilitate investigations into legume-rhizobium symbiosis. A 12-hour growth curve of *S. meliloti* with variable exopolysaccharide secretion confirmed relative growth rates. Gibson assembly was used to create two plasmids containing different lengths of the uncharacterized promoter region of *nodD1*, 263bp and 500bp respectively. An experimental design for bi-parental conjugation using a diaminopimelic acid auxotroph, MFD*pir*, was developed to address the lack of competency and selectable traits in *S. meliloti*. Furthermore, previous characterization of flavonoid profiles of *Medicago truncatula* roots inoculated with co-evolved and high-quality nitrogen-fixing strains provided pragmatic flavonoid cocktails to measure variable promoter activity via GFP expression. Upon successful assembly of the reporter constructs, additional assays between co-evolved, novel, high or low-quality, specific, or broad-range legumes and rhizobia could revolutionize symbiosis investigations and optimize nitrogen uptake in legume agriculture.

Local Adaptation to Daylength in the Invasive Plant Species *Mimulus guttatus* of New Zealand

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Understanding how adaptation and phenotypic plasticity facilitate the rapid spread of invasive species remains a critical question in evolutionary biology. Clines in life-history traits along geographic gradients are a well-established phenomenon that demonstrate how plants synchronize their reproductive window with local conditions. Thus, we investigated whether there was evidence of local adaptation in the flowering and growth of an invasive plant. We used invasive populations of *Mimulus guttatus* from New Zealand, which is native to North America but has spread across other continents within the last 125 years, testing whether populations from across a wide geographic range showed evidence of differentiation or plasticity when grown under varying daylengths. Specifically, we selected nine populations and used seed from 12 maternal families from each population, grown in daylengths of 14, 16, and 18 hours. Given the rapid spread of the species, we expected extensive phenotypic plasticity for flowering and weak evidence of local adaptation. We found evidence of phenotypic plasticity across all populations under the different daylengths but also some evidence consistent with local adaptation to latitude in flowering. By examining how the combination of plasticity and genetic variation facilitates the spread of invasive species, we can better understand fundamental evolutionary processes.

Validating Thermal Refugia-Seeking Behaviour in Fish During Thermal Agitation

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Ectotherms, such as fish, are highly dependent on the stability of their environment to regulate body temperature, performance, and metabolism. Increasing temperatures cause behavioural changes in fish which can be observed and used as indices for determining upper thermal limits. The thermal agitation temperature (T_{ag}) is a recent, and ecologically significant, sublethal index for the upper thermal limit. Previous studies have described thermal agitation as the endpoint, occurring prior to the critical thermal maximum (CT_{max}), where fish start exhibiting apparent refugia-seeking and avoidance behaviour. It is an assumption that fish are in seek of colder-water refuge, but evidence for this is lacking. Therefore, this study attempts to validate the assumption that T_{ag} is refugia-seeking behaviour by using zebrafish (*Danio rerio*) and the Loligo shuttle box system. This system is set to provide a colder-water refuge (~27°C) while increasing the temperature of the fish's environment to the point of T_{ag} (~40°C). The behavioural responses of *D. rerio* will be observed and analyzed during T_{ag} to determine if refugia is sought out. Confirming the behavioural responses associated with T_{ag} will validate it as an additional sublethal endpoint prior to CT_{max} and help improve understanding of behavioural responses under thermal stress.

The Influence of Familiarity and Sex on Social Learning in Group Living Fish

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Social learning, learning via observation and imitation, is an ability that helps animals adapt to their environment. Current research indicates that factors, like one's sex and familiarity with the demonstrator influence an animal's likelihood of engaging in social learning. The aim of this study is to test how sex and familiarity affect social learning in the matrilineal, group-living cichlid species *Neolamprologus pulcher*. Such insights may reveal how information spreads within and between groups. A common foraging assay was used to test the learning frequency and speed of *N. pulcher* depending on the observer's sex and the familiarity status and sex of their demonstrator. We found that demonstrator sex and familiarity did not have a clear effect on *N. pulcher* learning. However, female *N. pulcher* learned faster than their male counterparts. As one of the first experimental studies to examine the factors influencing social learning in *N. pulcher*, we build upon the existing body of literature that examines how information spreads in groups. Such knowledge can shed light on the behaviours, dynamics, and transmission of cultural traits in cichlid communities. It can also help us further understand behaviour, decision-making, and cooperation in other taxa.

Development of an In-lab, Vertical Column Bioassay for Examining Chloride Exposure Modulation Among Endemic Zooplankton to Toronto's Inner Harbour

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Application of chloride-based deicers to many Great Lakes cities maintains safe travel conditions but leads to increasing chloride (Cl^-) concentrations in streams, lakes, and groundwater. Currently, environmental exposures of zooplankton to Cl^- across depth profiles are not well understood. Further, multi-lake mesocosm experiments (in-situ and ex-situ) demonstrated that Canadian Water Quality Guidelines for the protection of aquatic life (chronic: 120 ppm Cl^-) are too lenient, leading to reductions (>50% lethality) among various zooplankton. In the environment, water bodies that receive saline runoff may experience stratification. In response, zooplankton may modulate their exposure to contaminants through diel vertical migration (DVM), a predation avoidance response, with coincident benefits to ensure population persistence and regulation of phytoplankton communities. While past work has examined the impact of Cl^- on this behavior (e.g., downregulation of circadian genes, decreased DVM amplitude) initial testing used lethality test vessels do not adequately realize a zooplankton species' vertical niche. The proposed research is on the development of a novel, low-cost behavioral ecotoxicological method for zooplankton DVM testing, utilizing 8-12' column assays. These columns allow the simulation of thermohaline (salt and temperature-driven) stratification, where users can evaluate the impact of a contaminant on species vertical migration behaviors.

Dissecting Genetic Architecture for Phenotypic Variations in *Aspergillus fumigatus*

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Human fungal pathogens cause severe infectious diseases, especially in immunocompromised individuals. The rise in invasive fungal infections is linked to increased susceptibility, widespread presence of fungal pathogens, and evolving drug resistance. As a result of recent events, the WHO published the first-ever list of fungal priority pathogens in late 2022. Among them, the ubiquitous mold, *Aspergillus fumigatus,* causes numerous global aspergillosis cases. Research on *A. fumigatus* has primarily focused on single gene effects on virulence and drug resistance, lacking quantification of antifungal susceptibilities and related traits. We aim to fill this gap by analyzing 89 whole genome sequenced (WGS) *A. fumigatus* strains and phenotypic trait quantification. Divergent strains will be crossed, with progeny analyzed for growth at varying temperatures, response to antifungal drugs, and virulence factor production. Genotyping will involve WGS, genetic linkage mapping, quantitative trait loci (QTL) mapping, and genome wide association study (GWAS) to identify single nucleotide polymorphisms (SNPs) influencing phenotypic trait variation. We hypothesize that interactions between SNPs from different genes regulate virulence and susceptibility traits. Additionally, we'll explore correlations among virulence trait expressions to understand their interplay. The work done will provide valuable insights for better treatment strategies during the early stages of infection.

Investigating the Yield and Light Penetration Impacts of Novel Pot and Trellis Designs in Above-and Below-Ground Competition in Raspberry (*Rubus idaeus*).

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Rubus idaeus (commonly called red raspberries) contain many important micronutrients and dietary fibres for human health. With recent events of the Covid-19 pandemic, food insecurity levels have once again become a key concern for the Government of Canada. This study aims to identify the best possible above- and belowground conditions for raspberry growth in a vertical farming hydroponic platform to maximise yield. The objectives of this study are to measure the impact of below-ground competition in raspberries on yield while the volume of soil substrate remains constant or is reduced. Additionally, this study also aims to measure the impact of above-ground competition in raspberry plants on light interception and yield across multiple trellis designs. In doing so 298 raspberries of the 'Joan J' variety were placed in two novel trellis designs, and randomised to also have cut and uncut hemp fibre slabs to mimic competition and no competition respectively. This research is pertinent in exploring growing configurations of raspberries to increase yield while maximising vertical farm space. Configurations can then be applied to hydroponic farming techniques in Canada ultimately reducing transport, labour and pest limitations associated with high tunnel raspberry cultivation.

The Influence of Resource Quality on the Optimal Temperature for Population Growth in Flour Beetles

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As global environmental change continues to alter ecosystems, understanding its impact on population processes has become increasingly important. These global changes influence factors such as resource quality and temperature, and our study aimed to investigate the combined effects of these two factors on the population growth of flour beetles (*Tribolium castaneum*). We tested a novel prediction from recent theory (Thomas et al. 2017) that the optimal temperature for population growth (Topt) declines with decreasing resource quality. Specifically, we tested the hypothesis that increasing resource quality would increase Topt up to a plateau. We exposed flour beetles to a fully crossed experiment consisting of four levels of resource quality and five temperature levels (27.5, 30, 32.5, 35, 37.5°C), allowing us to examine the interactive effect of these two factors on population growth. We manipulated nutrient quality using varying ratios of whole wheat and rice flour, and we counted population sizes every two weeks to track growth rates across treatment conditions. Our results revealed a saturating relationship between nutrient quality and Topt, with Topt decreased under low-nutrient and low-temperature conditions. These findings highlight the importance of considering resource quality alongside temperature when predicting population responses to environmental change.

Dietary Composition and Partitioning in Ecuadorian Hummingbird Communities

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Hummingbirds (Trochilidae) are a highly diverse and primarily nectivorous group of birds. However, they also feed on small invertebrates to supplement their diet with protein and other nutrients. Despite this, invertebrate consumption and how invertebrates fit into the food network of hummingbirds is largely unknown. As such, our study aims to use DNA metabarcoding, a DNA-based identification method, to determine the diet of 29 hummingbird species from Ecuador. With this information, our goals are to 1) determine if beak morphology (length, width, shape) or habitat elevation impacts invertebrate composition in the diet, and 2) explore whether hummingbirds partition their invertebrate diet similar to their floral diet. It is expected that the results from this study will emphasize tropical hummingbird dietary networks and the factors which influence resource use between species. With this information, we hope to aid in combatting the population decline of at-risk hummingbird species and the plants which rely on them for pollination. In addition, this study will allow for further examination of tropical hummingbird community dynamics and add to the current set of primary literature concerning their ecology and evolution.

Can Duckweed Remain a Viable Superfood Despite Climate Change?

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Wolffia globosa is a tropical duckweed native to Southeast Asia, where it is used as a food source. This aquatic plant reproduces rapidly and contains important nutrients. With cultivation commonly occurring outdoors, *W. globosa's* reproduction is dependent on ambient temperatures. Thus, climate change could affect production and information regarding optimal temperatures for indoor production could be valuable. Reproduction, count of dead individuals and area coverage of *W. globosa* was measured at realistic increases to mean temperatures during its growing season (~1.5-2 °C in the next 40 years). As well, a thermal performance curve was created to understand the thermal tolerances of *W. globosa*, which can be beneficial in colder locations where indoor cultivation would occur. I found no significant effect of the predicted increase in mean temperature on the reproduction, count of dead individuals and area coverage of *W. globosa*. The frond count thermal performance curve indicates that the optimal temperature range is ~ 27-32 °C, while the area difference thermal performance curve indicates the optimal temperature range is ~ 23-27 °C. Therefore, in areas of Southeast Asia, like Laos and Myanmar, the mean temperature is expected to rise closer to optimal temperatures of *W. globosa*, which could increase production.

Effect of Population-Specific Mating Preferences in the Context of Male Competition and Female Mate Choice in the Noble False Widow Spider

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As an invasive species spreads through a region, the isolation of newly established populations may occur due to founder effects and local adaptation. Even when these populations have some geographic overlap, divergence can still occur due to premating isolation and mating preferences. However, if mating preferences are weak and hybridization costs are low, the populations may occasionally interbreed. In previous experiments using two populations of *Steatoda nobilis* from a northern and southern latitude of an invasive distribution in the United Kingdom, we observed that in one-on-one interactions, mating rates were the same whether males and females were from the same ('local') or different ('exotic') populations. While spiders from different populations may mate if they have no other choice, females may exhibit preferences if simultaneously exposed to local and exotic males, and males may be less likely to engage in fights with locally adapted competing males, compared to exotic males. To test whether population-specific mating preferences are intensified in competitive contexts, we matched two males from different populations in weight and age and introduced them to the web of a female from either population and observed the interactions. We discuss our findings in the context of perceived mate quality and competition.

Declining Ice Duration Alters Key Ecosystem Parameters in Lakes Worldwide

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Lake ice duration is declining worldwide, which will affect the structure and function of ice-covered lake ecosystems. However, lake ecosystem responses to ice loss remain poorly studied. A global analysis of changing under-ice ecology is necessary to understand how lakes will respond to declining ice duration. We examined 21 lakes in North America, Europe, and Antarctica. We find that shorter ice durations are weakly correlated with warmer under-ice water temperatures (R^2 = 0.35), reduced dissolved nitrogen (R^2 = 0.37) and phosphorus (R^2 = 0.35) concentrations, higher under-ice chlorophyll *a* concentration (R^2 = 0.34), and higher zooplankton abundances (R^2 = 0.07) in lakes worldwide. These parameters represent key ecosystem processes in lakes, and changes in these processes can alter lake ecosystem function over time, particularly under more severe climate warming. This global analysis improves our understanding of how lake ecosystem parameters change in response to ice loss and provides information that may help preserve lakes and the ecosystem services they provide under future climate warming.

Big Brown Bat (*Eptesicus fuscus*) Spatial Memory

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The study of bat movement focuses greatly on echolocation as the animal's method to orient, navigate, and forage. Interestingly, it has been shown that bats also rely on spatial memory for these tasks. Big brown bats, which produce frequency-modulated echolocation calls, also learn to rely on acoustic landmark locations to accurately navigate. Furthermore, after repeatedly flying through a cluttered environment, big brown bats learn the layout and where to orient their sonar beam while flying. This beam orientation persists even when the environment layout is changed. Finally, big brown bats can develop stereotyped flight paths in the wild and the laboratory. The proposed study aims to further our knowledge of big brown bat spatial memory by testing whether they can learn a food source's location, and whether changing its location has effects on feeding accuracy and echolocation call rate. The first attempt of this study was unsuccessful due to the inability/unwillingness of captive big brown bats to fly. However, we aim to complete a second attempt with newly-captured big brown bats.

Is Batman Bruce Wayne?: Using a Pattern Recognition Software to Identify Individual Big Brown Bats via Unique Collagen-Elastin Bundle Patterns

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Collagen-elastin (CE) bundle patterns in bat wing membrane have been used for identification (Amelon et al. 2017); however, the laborious nature of manually comparing images adversely affects this methods practicality. We tested the efficacy of a feature-based pattern recognition software —HotSpotter©— in automating this process by comparing wing membrane photos (n = 328) within a database of adult (n = 24) and juvenile (n = 34) big brown bats (*Eptesicus fuscus*). The ventral surface of the wing membrane was illuminated with ultraviolet light during imaging. Upon running a match comparison on a selected reference image, HotSpotter© ranks every other photo based on an assigned similarity score. Ranked images in HotSpotter© outputs were classified as either matches of (1) the same animal, (2) a related bat (mom/sibling), or (3) an unrelated individual and whether matches were of the same or opposite wing as the reference image. Higher similarity scores were afforded for same-individual, same-wing matches relative to other match types. The proportion of correct matches increased as the number of top-ranked images included when selecting a possible correct match increased. The results demonstrate that HotSpotter© has potential to accurately identify individual *E. fuscus* using photos of CE patterns in the wing.

The Early Bird's Advantage: Proactive Mitigation Strategies to Improve Habitat Quality for Avian Species at Risk

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In conservation biology, timing of conservation efforts can be as critical as the mitigation measures themselves. Utilizing advanced ecological tools, this study revealed the critical range of the Red-headed Woodpecker (*Melanerpes erythrocephalus*) and Eastern Whip-poor-will (*Antrostomus vociferus*) in Pinery Provincial Park, Ontario, Canada. This allowed for the implementation of proactive conservation strategies to improve habitat quality; embracing the expression that the early bird gets the worm. Combining the data collected from 14 autonomous recording units, breeding bird surveys, and community science data, we mapped these two species' presence within the grounds of the park. From there, we tailored resource management strategies to address the specific threats these species face, ensuring the preservation and enhancement of their habitat within the park. By deploying early conservation measures and integrating advanced monitoring techniques with traditional field surveys, this project offers a comprehensive approach to address the conservation requirements of avian Species at Risk in Pinery Provincial Park, and in Ontario. The data collected from this project not only contributes to the understanding of habitat preference for these avian species, but it also offers actionable insights for effective park management strategies aimed at mitigating threats and conserving the unique ecosystems that Pinery possesses.

Examining Links Between Copulatory Postures, Sexual Size Dimorphism and the Risk of Sexual Cannibalism Across Spider Species

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We tested hypotheses about the influence of the risk of cannibalism on mating behaviour and copulatory postures across species of spiders. Spider copulatory postures are species-specific, categorized into six positions that vary in whether the male is exposed to the female's fangs during copulation or protected. We hypothesized that males would be more likely to evolve protected postures in species where females are likely to be cannibalistic, or where females are much larger than males and able to kill them with little cost. We extracted data on mating for 51 species from 110 papers. In line with our predictions, spider species with more extreme female-biased size dimorphism were more likely to show invulnerable mating postures. However, no significant relationship was found between body size ratio and cannibalism occurrence or frequency. These findings suggest additional factors such as variation in female hunger or the timing of sexual cannibalism might be important. Limitations of this study include a lack of standardized body size measurements across papers, and the relatively narrow range of species that have been well-studied (primarily Theridiidae and Araneidae). Addition research will be necessary to gain a deeper understanding of the evolutionary forces shaping mating success and species diversity.

History of the Ontario Ecology, Ethology, and Evolution Colloquium

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The Ontario Ecology, Ethology, and Evolution Colloquium (OE3C) is a provincial conference organized by students for students that is hosted at a different Ontario university each year. The history of OE3C is undocumented with the founding year and location unknown. I searched the internet and emailed emeritus and current professors at universities across Ontario to assemble a history. My poster will summarize OE3C history and include historical documents and logos. The Colloquium was founded at York University in 1974 and was initially called the Ontario Ecology Colloquium. The name was changed to the Ontario Ecology and Ethology Colloquium in 1977, and finally to OE3C in 2011. The impetus for starting the Colloquium was to increase communication among professional ecologists at Ontario universities and government agencies. For many years OE3C was organized by a Steering Committee composed of professors but is now primarily organized by graduate students. The Colloquium has been hosted by thirteen different universities in Ontario, most commonly by the University of Guelph, Western University, and Queen's University. The Colloquium has been held every year since its founding except for 1975. The 2024 Colloquium at the University of Waterloo marks the 50th gathering of OE3C!

The Impact of Permafrost Thaw on Caribou Lichen Across the Northwest Territories

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The arctic is warming four times faster than the rest of the world and Canada's woodland caribou are facing the impacts. Caribou rely on caribou lichens, *Cladonia sp.*, as an important food source, however, caribou lichens are being affected by climate change through wildfire disturbances, northern shrub encroachment, and potentially, through increased rates of permafrost thaw. As permafrost thaws the active layer thickens, releasing nutrients and warming the soil, leading to an increase in plant productivity, potentially outcompeting established caribou lichen populations. Further, as ice rich permafrost thaws it releases water, increasing soil moisture, leading to lichen waterlogging and death. There is evidence that lichens at lower latitudes may recover from disturbances faster than at higher latitudes. Lichen biomass and richness will be quantified across a latitudinal gradient from 61°N to 69°N, adjacent to the Mackenzie River in the Northwest Territories. Permafrost thaw depths from the past decade will be used as a key predictor of lichen biomass. Territorial and community governments have identified caribou and caribou habitat as a research priority. This study will contribute to our understanding of climate related impacts on caribou lichen, furthering our knowledge of caribou habitat features in an environment of thawing permafrost.

Country Finch – City Finch: Does Urbanization Affect the Chemical Profiles of Darwin's Finch Preen Oil?

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The increase in urbanization can have a strong effect on ecological and evolutionary processes, which can be amplified on islands such as the Galapagos Islands due to their isolation. Many avian species are urban adapters by adjusting their behaviour and communication to account for urban anthropogenic stimuli. We know urbanization impacts avian species vocal communication due to urban factors such as anthropogenic noise. Much less work has focussed on olfactory communication and chemical signaling, yet recent research has shown chemical signaling such as through preen oil could play an important role in communication. Urban and non-urban finches on the Galapagos have adapted in a variety of ways which could affect their preen oil composition and therefore, potentially, their communication. We hypothesize that preen oil chemical composition will differ between urban and non-urban Darwin's finches. Using gas-chromatography mass-spectroscopy (GCMS) we analyze the chemical profiles of preen oil from urban and non-urban Darwin's finches. Our results will contribute to our understanding of chemical signaling, preen oil function, and how Darwin's finches are adapting to urbanization.

The Influence of Energetic Status on Risk-Taking Behaviour in Wintering Birds

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Birds must stay alert and vigilant to escape threats, but risks must be taken to survive in the wild. As temperatures decrease in the winter, metabolic rate increases to stay warm. Energetic stress caused by increased metabolic rate leaves birds eager to replenish energy stores in the morning. We predicted that cold overnight temperatures cause Black-capped Chickadees more energetic stress, and therefore be more risk-tolerant in the morning. To test this, we simulated a gradient of risk using five bird feeders equipped with motion-activated cameras, from a forest edge out to an open field on the University of Waterloo main campus. Only one feeder was filled daily to remove an option of a safer feeder. Visitation rate to feeders decreased with distance from the forest edge. Indicating farther feeders are perceived as riskier. We also found vigilance increased at farther feeders. However, we did not find any temperature effects on visitation rate. This may be the result of the mild winter we experienced this year. We suspect there may be a threshold effect and that risk-tolerance may only be affected below some cold temperature threshold. Repeating this study in a colder winter field site may be revealing.

Understanding Low-Arctic Tundra Community Plant Responses to Anticipated Climate Warming Using Long-Term Climatically Realistic Soil Nutrient Availability Enhancements

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Future tundra plant community composition and structure will be directly influenced by pronounced climate change already occurring in the Arctic. Furthermore, warming-induced increases in microbial activity enhance the supply of growth-limiting nutrients to plants and will indirectly influence plant community structure. Birch hummock tundra consists of evergreen and deciduous shrubs, sedges, forbs, mosses, and lichens; this widespread vegetation composition is already shifting in many locations across the Low Arctic as deciduous shrubs expand their cover and range. Warming will likely influence nitrogen (N) and phosphorus (P) differently due to their distinct biogeochemistry, so we must understand plant species' responses to climatically-realistic enhancements of these nutrients separately. Hence, a factorial annual low nitrogen and phosphorus addition experiment commenced in 2012 at the Daring Lake research site in the Northwest Territories to simulate anticipated increases in soil fertility due to climate warming. Preliminary harvest analyses evidenced NP growth colimitation of birch shoot extension with low level additions, but total aboveground biomass of the evergreen shrub *Rhododendron subarcticum* is not significantly affected by low-level additions of N, P, or the combination. These separate nutrient additions may inform on future plant community shifts in response to climate warming and reveal species' nutrient growth limitation.

Unravelling Plant-Soil Feedbacks in Arctic Permafrost Disturbances

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Arctic plant communities are experiencing accelerated temperature rises and increasing disturbance frequency. These environmental changes accelerate the expansion of tall, deciduous shrubs and influence their productivity, structure, and functional trait expression. Disturbances like rapid ice thaw or 'thermokarst' increase the amount of unfrozen soil available to plants and increase the accessibility of plant-available nutrients. This spurs shrubs to grow faster and produce greater quantities of litter than their counterparts in undisturbed tundra. However, it is unknown how disturbances alter shrub functional trait expression and plant-soil nutrient cycling dynamics. This research investigates how shrub traits are shaped by the unique conditions in disturbances and explores the potential impact on nutrient cycling. Shrubs were chosen from two thermokarst types north of Inuvik, NWT. Leaf, wood, and structural shrub traits related to productivity and leaf litter quality were measured in two focal shrub genera (Alnus and Betula). We expect shrubs in disturbed sites to exhibit increases in productivity-related trait expression and that litter decomposition in disturbances is therefore faster. Increased decomposition rates could alter tundra ecosystem function by boosting plant productivity, soil litter inputs, and nutrient cycling. These changes have implications for carbon cycling, soil microbial communities, and runoff to aquatic systems.

Assessing Which Traits Determine the Performance of Canadian Black Spruce (*Picea mariana*) in the Face of Climate Change

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Climate change is advancing rapidly, yet there is limited research on the adaptive potential of long-lived species under future climates. The ability of long-lived species to adapt hinges largely upon existing trait variation. Thus, assessing whether traits of a species positively or negatively influence performance is pivotal in understanding the adaptive capacity of a species in the face of climate change. In this study, we examine how *Picea mariana* traits, with a known response to warming and drought, impact individual performance. We conducted our investigation across three sites spanning a temperature and water availability gradient, mimicking the expected climate change in the North American Boreal Forest. The strength and direction of selection determine which traits or combinations of traits enhance or impede performance under different temperatures and water availabilities. Among the three study sites, we found that distinct trait combinations contribute to high performance, indicating varying selection pressures between the sites. We conclude that traits which exhibit directional variation along the gradient are correlated with the changing climate. Future research will explore how trait variation among different *P. mariana* populations aligns with the vector of selection in the warmest and driest site, which closely resembles future climates.

Power and Sample Size Calculation for Microbiome Differential Abundance Studies

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Determining an appropriate sample size for a study is a crucial step in planning scientific research. Appropriate sample sizes avoid both overinflated and inadequate sample sizes. Collecting too many samples wastes resources, time and effort of human subjects, and lives of experimental animals. Insufficient sample sizes, a much more common problem, waste even more resources through the inability to detect biologically meaningful differences. Microbiome studies are particularly challenged by sample size, particularly in studies of human subjects or expensive animal models. We analyzed seven real case-control microbiome datasets and developed a novel method for simulating microbiome data. We present a new approach for sample size and power calculation as a function of effect size (fold change) and mean abundance. We also quantify the expected total number of significant taxa within differential abundance studies. Differential abundance microbiome studies require larger sample sizes than currently prevalent in the literature to achieve adequate statistical power. Our framework will help researchers make informed decisions about appropriate sample sizes.

The Relative Size of Syrphid Mimics to Their Models and its Implications for the Evolution of Mimicry

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Many hoverfly (Syrphidae) species are Batesian mimics of stinging Hymenoptera, although their degree of similarity can vary considerably. Some species are considered excellent mimics, while others are considered very poor mimics. Previous research has shown that larger mimics are often better mimics, possibly because there is less selection for mimetic fidelity in smaller, less profitable prey (Penney et al., 2012). However, predators can also use body size to discriminate between mimics and their models. So, an alternative hypothesis is that mimetic fidelity varies with body size because larger mimics are less distinguishable in size from their hymenopteran models, which tend to be large. To compare these competing hypotheses, we tested whether colour pattern similarity was better explained by the absolute body size of the mimic or by the relative size of the mimic compared to the model. Mimetic fidelity was assessed by human ranking for 154 mimic-model pairs and the discriminability of these pairs was determined by measuring the intertegular distance of both the Syrphid mimic and Hymenopteran model. Body size is often overlooked as a discriminative trait, but if a mimic is distinguishable in size from a model, there may be little selection to further improve its fidelity.

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Body Posture and Viewing Angle Modulate Detectability in a Poison Frog and Batesian Mimic

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Aposematic signals warn predators that prey should be avoided due to dangerous secondary defences. However, as warning signals do not produce perfect avoidance, warning colours evolve as a trade-off balancing signal saliency against predator detection. For Batesian mimics, which display salient signals but lack secondary defences, the costs of predator encounters are greater, potentially increasing the benefit of crypsis. This raises the question of whether mimicked signals should evolve to be less salient than model signals, such that imperfect mimicry reduces detectability while retaining mimetic efficacy. Using simulated predator vision and screen-based human detection trials, we tested this "Cryptic Imperfection" hypothesis with the poisonous frog *Ameerega bilinguis* and Batesian mimic *Allobates zaparo*. We further test the effect of body posture and viewing angle on signal salience and detectability. We found that both species incorporate camouflage into their warning colours, but to different degrees depending on viewing angle and posture behaviour. We find differential detectability between model and mimic that does not perfectly adhere to a hypothesis of a cryptic mimetic phenotype. Our results suggest that imperfect mimicry can be an adaptive trait that balances defensive strategy with other signalling functions.

Evolutionary Transitions from Camouflage to Aposematism: Hidden Signals Play a Pivotal Role

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In nature, predation is ubiquitous, with nearly all animals being at risk of being preyed upon at some point in their lifecycle. The selection that this generates has led to the evolution of various adaptations that mitigate this risk. One of the most common of these is crypsis, in which animals have coloration that resembles the background, reducing the probability of detection by predators. However, some chemically defended animals employ an antithetical strategy, displaying conspicuous warning coloration that advertises their toxicity. The initial evolution of warning coloration, termed aposematism, is often seen as a paradox because any new conspicuous mutant would be easier to detect than its cryptic conspecifics and not readily recognized by naïve predators as defended. One possibility is that permanent aposematism first evolved through species that use hidden warning coloration, that is only exposed to would-be predators on encounter. Here, we performed large-scale phylogenetic analysis of evolutionary transitions in amphibian and elapid snake antipredation coloration and demonstrate that evolutionary transitions from camouflage to aposematism often involve an intermediary stage, namely cryptic species that facultatively reveal conspicuous coloration. Accounting for this intermediate step can resolve the paradox and thereby advance our understanding of the evolution of aposematism.

The Evolution of Bayesian Priors in Uncertain Environments

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Earlier research has cast the dilemma that predators face when deciding to sample unfamiliar prey as a two-armed bandit. If the predator chooses to reject the prey item, it incurs no cost, but gains no information about the profitability of the prey type. If the predator accepts the prey item, it gains an immediate payoff (a benefit or a cost) and information about the profitability of the prey type. Beginning with uniform priors and assuming Bayesian learning, it is possible to identify the optimal predator decision for any informational state (e.g., three of four prey items accepted are unprofitable). However, prior beliefs are rarely uniform and are subject to natural selection. We therefore extend the approach by identifying the optimal priors of predators for different foraging environments. For example, if red prey were on average costly to attack then one would expect predators to evolve a prior that would encourage it to quickly learn to avoid them. We derive the distributions of priors that are be selected in any given environment. We apply these insights to help understand why humans are more likely to learn to avoid unfamiliar unprofitable prey when they are conspicuous compared to when they are cryptic.

The Optimal Time to Approach an Unfamiliar Object: A Bayesian Model

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Many organisms hesitate before approaching unfamiliar objects. This caution forms the basis of some well-known assays in the fields of behavioral ecology, neuroscience and animal welfare. In this talk I present a mathematical model which identifies the optimal time an observer should wait before approaching an unfamiliar object. The model is Bayesian, and simply assumes that the longer the observer goes without being harmed, the lower will be the observer's estimated probability that the unfamiliar object is dangerous. Given the information gained, a time is reached at which the expected benefits from approaching the object exceed the expected costs. The model not only explains why latency to approach may vary with the object's appearance, but also why individuals habituate to any unfamiliar stimulus. I demonstrate the applicability of the model by fitting it to published data on the time taken by chicks to attack artificial caterpillars which share no, one, or two signaling traits with snakes. I use the example to show that while the optimal time to approach an unfamiliar object reflects the observer's expectation that the object is dangerous, the rate at which habituation arises is also a function of the observer's certainty in their underlying belief.

Spatiotemporal Characterization of Antagonistic Interactions Among Bacterial Population

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In natural environments, bacteria live in communities, that provide opportunities for defense against other bacteria, access to nutrients, and other avenues for cooperation. To synthesize or modify bacterial communities to suit our needs, we need to learn more about how bacteria in a community interact with each other. Our study focuses on antagonistic interactions and looks at how toxin producing and toxin-susceptible populations interact over time and space. To study these communities at single-cell level, we employ time-lapse microscopy to address questions traditionally explored at the population level. We model the bacterial populations using an agent-based approach. Current work involves calibration of these system models using representation learning. Our long-term goal is to develop predictive models for the engineering of the microbial communities. These models are designed to predict the effects of engineering antagonistic interactions among bacteria, including predator-prey dynamics in gut microbiomes and the biological control of plant diseases.

Snail Microhabitat Preference as a Potential Driver of Trematode Parasite Exposure Risk in the Bay of Fundy

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Microhabitat preferences of potential hosts are important to understanding their risk of encountering parasite infectious stages. We investigated this with two snail species (*Littorina littorea* and *Ilyanassa obsoleta*) known to host trematodes as snail movement could affect their potential exposure to trematode eggs or miracidia across intertidal mudflats. Field experiments were conducted in Kingsport Beach in the Bay of Fundy in June and August 2023 to assess snail movement over a 48-hour period in two distinct microhabitats: (A) a grassy region near the high tide zone and (B) a muddy region further from the high tide zone. A mark and recapture method was employed to record the movement of 795 and 206 snails among 10 $1m^2$ quadrats in zone A and B respectively. Results indicate differences in movement between the two snail species and sampling times. Further investigation is needed to see if these results are linked to patterns of trematode infection in these snails within the two zones but demonstrates the importance of considering host behaviour in microhabitats to better understand host-parasite dynamics.

Insights into Lumpfish (*Cyclopterus lumpus*) Diets: Combatting Salmon Lice (*Lepeophtheirus salmonis*) in Aquaculture

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Salmon aquaculture becomes less profitable when salmon reared in sea cages become infested with ectoparasitic copepods called "sea lice". The salmon louse (*Lepeophtheirus salmonis)* is the prominent species in Canadian Atlantic salmon farms in Newfoundland and can significantly reduce production and cause salmon welfare issues. Lumpfish (*Cyclopterus lumpus*) are commonly used as a biological control agent for sea lice in cold-water environments. However, lumpfish are highly opportunistic generalist feeders that will forage on non-target food items. Jessica Roy's research analyzing lumpfish diets from Newfoundland salmon farms revealed notable variances in diet composition between 2018 and 2020, confirmed by DNA metabarcoding. However, differences in farm locations and sampling methods necessitate further investigate to ascertain consistent trends. My study aims to assess the relationship between diet composition and lumpfish cleaning efficacy as a function of size within Atlantic salmon sea cages using morphological species identification and DNA metabarcoding. My hypothesis is that smaller lumpfish will eat more sea lice because their smaller mouth prevents them from eating large non-target prey items - such as krill and formulated pellets designed for salmon. My research will provide insight in the delousing efficacy of lumpfish of different sizes when used in Atlantic Canada.

Avoidance of Fungal and Nematode Parasitic Threats by Red Flour Beetles (*Tribolium castaneum*)

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Hosts have effective defences, both physiological and behavioural, to counter the ubiquitous threat of parasitism. Avoidance should be a common first-line defence given its reduced resource costs relative to most post-contact responses. However, avoidance requires that hosts can assess their environment for potential risk of infection based on cues involving sight, olfaction, or chemosensory perception. Various studies have established parasite avoidance in a range of animals, but this is poorly understood for insects. It is also unclear whether potential hosts exhibit avoidance behaviours that correspond to the level of threat. In this study, we investigated how red flour beetles (*Tribolium castaneum*) exhibited behavioural avoidance in response to a series of choices involving two different parasites, the fungal pathogen *Beauveria bassiana* (BB) and nematode *Steinernema carpocapsae* (SC). Beetles were placed in arenas with two chambers, allowing them to choose between two options represented by: 1) BB vs. no threat (NT), 2) SC vs. NT, 3) BB vs. SC, 4) BB vs. BB+SC, and 5) SC vs. BB+SC. The choices made by red flour beetles when facing these different parasite threat conditions will be discussed. This work has implications for understanding avoidance as an anti-parasite behaviour across different host taxa.

Contribution to Pollen Deposition in *Verbena hastata* (Verbenaceae) by Day and Night Active Pollinators

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Pollination by nocturnal insects is poorly studied due to the logistical challenges of traditional sampling methods. Although much is unknown about these pollinators, previous research has uncovered that nocturnal pollination is complementary and potentially as important to the reproductive success of plants as diurnal pollination efforts. Pollinators face threats such as higher temperatures due to anthropogenic activity and climate change. These vary in impact between day and night, potentially affecting species and pollination services differently. We completed a pollinator exclusion experiment using *Verbena hastata* (blue vervain) to measure differences in pollen deposition during the day and night. Temperature sensors were deployed to record variation experienced by individual plants. It was found that the average amount of pollen deposition during the day and night was not significantly different. Unbagged flowers had significantly higher pollen deposition, pointing to the potential importance of crepuscular pollinators active at dawn and dusk when we were exchanging pollinator exclusion bags, or that the bags themselves impacted pollinator visits. Temperature also did not impact pollen deposition, and future studies should consider conducting landscape level temperature assessments to better align with pollinator behaviour. We recommend that nocturnal pollinators are critical conservation targets for supporting native biodiversity.

Host-Parasite Dynamics and Population Genetics Provide Insight into the Movement Ecology of an Endangered Bat Species

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Host-parasite dynamics vary between species pairs and can have effects on the dispersal and transmission of parasites. *Myodopsylla insignis*, a bat flea, and *Spinturnix americanus*, a bat wing mite, are two common ectoparasites of the little brown myotis (*Myotis lucifugus*) that differ in life cycles and time spent on the host. Our aim is to characterize the genetic structure present in *S. americanus* and *M. insignis* relative to the known genetic structure of the host, *M. lucifugus*. We DNA barcoded 223 *S. americanus* and 87 *M. insignis* specimens from multiple sites in Atlantic Canada, and examined their genetic diversity, genetic structure, and biogeography. We found limited evidence of genetic structure with *M. insignis* exhibiting some isolation by distance in Labrador and *S. americanus* exhibiting regional differentiation between the island of Newfoundland and the mainland, similar to *M. lucifugus*. There is also evidence to support that *M. insignis* underwent historical population expansion and some evidence that *S. americanus* underwent historical population expansion or selection. Our study highlights the importance of considering host-parasite dynamics and parasite life history when investigating the genetic structure of parasites and illustrates how parasites can provide insight into the movement ecology and history of their hosts.

Investigating the Effects of Differing Far Red to Red Wavelengths and Increased Reflectivity on *Rubus ideaus L* Yield and Development Grown in a Vertical Farm

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Food security is improved when people have access to fresh fruits and vegetables. While Canada is the third largest importer of raspberries in the world, we have very limited means of growing raspberries ourselves, reducing our food security. To improve the production of raspberries in Canada, we are developing environmental recipes that increase yield of raspberries grown in indoor environments. To that end, we compared the effect of reflected light (white light vs high amounts of far red wavelengths) on the development and fruit production in raspberries (*Rubus ideaus L)*. The impact of differing far red to red ratios of reflected light as well as the effect of this reflected light on yield will be reported. Similar studies have suggested that by exposing other fruit crops to more far red wavelengths, crops such as tomatoes and strawberries produce more fruit. Preliminary results will be presented at the conference. We anticipate our results will increase the efficiency of indoor agriculture in Canada.

Sprouting Success: Investigating Seedbed Quality and Early Growth in High-Residue Corn and Soybean Fields across Eastern Ontario

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No-tillage and cover cropping are agricultural practices aimed at enhancing soil health, with long-term economic and environmental benefits. However, they present short-term challenges including reduced stand establishment and yield, partly due to heightened levels of surface residue. This residue can impede planting and influence underlying soil conditions. While previous studies have linked altered soil conditions under high residue with reduced stand establishment, the effects of these changes on early crop growth—a crucial period for later stand establishment—are less understood. To address these gaps, we will conduct on-farm research in high-residue corn and soybean fields. Fields will be stratified by topography and residue level to create sampling zones reflecting varying levels of expected stand establishment. Seedbed soil qualities will be assessed before and after planting. Success, and timing, of germination and emergence after planting will be measured then associated with seedbed quality, stand establishment, and yield. This research aims to provide insight into the relationship between high residue levels and stand establishment across diverse field environments, informing hypotheses for future research. Additionally, it may offer farmers insights to tackle stand establishment issues on their farms and promote the adoption of no-tillage and cover cropping across Ontario.

Impacts of Nonmycorrhizal Plant Abundance on the Growth Response of Arbuscular Mycorrhizal Plants to Mycorrhizal Networks

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Most plants form symbiotic relationships with arbuscular mycorrhizal (AM) fungi that improve the plant's ability to acquire soil nutrients, usually improving plant growth. It is uncertain if the abundance of neighbouring nonmycorrhizal plants within a community affects the growth response of mycorrhizal plants to these fungi. We tested whether increasing the proportion of neighbouring nonmycorrhizal plants could increase or decrease the growth response of mycorrhizal plants to AM fungi. To do so, we grew mycorrhizal focal plants *Bromus inermis*, *Plantago lanceolata*, and *Trifolium pratense* in ingrowth cores surrounded by communities consisting of conspecific mycorrhizal plants and varying proportions (20%, 50%, and 90%) of the nonmycorrhizal plant *Silene armeria*. Access to mycorrhizal networks in half of the focal plants was manipulated by rotating the ingrowth cores to sever hyphal connections. We found that biomass of *T. pratense* was significantly higher at nonmycorrhizal proportions of 90% compared to 20% or 50%, but plant growth responses to severing treatments did not vary with increasing nonmycorrhizal proportions in any mycorrhizal species. There was no evidence that increasing nonmycorrhizal plant abundance changed mycorrhizal plant responses to AM fungi, as the observed increases in mycorrhizal plant biomass were unrelated to AM fungal network status.

Germination Differences Between Forage Crop and Non-Forage Crop Plant Species and the Potential for Their Overuse in Ecological Experiments

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Forage crops, which are essential for livestock consumption, are widely distributed and naturalized in various plant communities. Due to their long history of cultivation and commercial seed sales, human selection may have led to improved germination traits in forage crops. Using greenhouse and field experiments, we investigated whether selection on forage crops has led to higher seed germination and lower dormancy in forages compared to non-forages. We also tested whether forages are overrepresented (relative to the background frequency in Ontario) in previously published pairwise competition experiments. We found that forage species exhibited significantly higher percent germination rates, lower seed dormancy, and faster germination than non-forage species. Additionally, in all but one competition experiment, forages were over-represented. Our results indicate that forage crops have favourable germination traits, which are known to be ecologically significant. High germination rates in this group have likely led to forages being overrepresented in ecological experiments where plants have been grown from seed. This overuse could lead to a biased understanding of ecological processes.

The Effects of Pollinator Decline on the Evolution of Floral Traits

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Recent declines in pollinator abundance could cause the evolution of floral traits associated with self-pollination (smaller flowers with reduced anther-stigma distance), or traits that both facilitate selfing and outcrossing (i.e., larger flowers with reduced anther-stigma distance). The evolution of selfing traits, by reducing the resources available to pollinators, could cause further declines in pollinator abundance (i.e., an eco-evolutionary feedback loop). To determine how floral traits will respond to pollinator decline, we evolved experimental populations of *Mimulus guttatus* under high vs. low abundances of bumblebee pollinators for three generations. We found that after two generations of experimental evolution, anther-stigma separation and flower size were ~0.2 SD lower in plants grown under low pollinator abundance. These preliminary results suggest that plants may respond to pollinator decline by evolving traits that facilitate self-pollination, which could initiate a feedback loop that further reduces pollinator abundance.

Analytical Flow Virocytometry Reveals Significant Differences and Correlations between Virus-Like Particles, Nutrients, and Taste and Odour Compounds in a Drinking Water Mesocosm Experiment

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Cyanobacteria are responsible for the production of taste & odour (T&O) compounds, such as Geosmin and 2-methylisoborneol (2-MIB), that cause recurring problems in certain drinking water reservoirs. T&O episodes often lead to considerable economic losses for the drinking water industry. Geosmin and 2-MIB are released from cells upon cyanobacterial death. The role lytic cyanophages play on the release of these metabolites, however, is obscure. To investigate this, a mesocosm experiment was conducted using water from a drinking water reservoir suffering T&O problems. Seven treatments with different concentrations of nitrogen and phosphorus were established, as high concentrations of nutrients promote cyanobacterial growth and consequently the production of T&O compounds. Virus-like particles (VLPs) were quantified using analytical flow virocytometry; cyanobacterial chlorophyll *a* (CyanoChl*a*), total nitrogen, total phosphorus, Geosmin and 2-MIB concentrations were measured. During the final day of the mesocosm experiment, significant differences in viral abundance, CyanoChl*a*, and the ratio of VLPs mL^{-1}/CyanoChl*a* $\mu g\ L^{-1}$ as a proxy for burst size were detected in the different treatments. Further, significant correlations were found between total phosphorus & VLPs, CyanoChl*a* & 2-MIB, and 2-MIB & VLPs. Altogether, these preliminary results hint towards an interplay between phosphorus and cyanophage-host systems on the concentration of 2-MIB.

Disentangling the Relative Contribution of Needle Age and Climate on Foliar Trait Variation in Black Spruce (*Picea mariana*)

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Trait variation matters because the phenotype determines fitness outcomes. Although intraspecific trait variation can be large, but much remains to be known about the factors causing it. For example, foliar traits change with leaf age and with climate during leaf emergence. In conifers where leaves last multiple years, these two factors covary and their relative roles are therefore difficult to separate. To address this gap in black spruce needles aged 1-4 years, we measured four traits associated with leaf carbon-use and morphology: leaf mass per area (LMA), leaf dry matter content (LDMC), chlorophyll concentration (CHL) and needle length (NL). Branches were collected from 282 individuals in two common garden sites with contrasting climates. For each year of emergence at each site, we extracted two growing-season climate variables (mean daily maximum temperature and total precipitation) and built mixed models predicting trait variation from needle age, climate, site, and provenance. We found that variation in LMA and LDMC was only driven by needle age, variation in NL was only driven by climate, and variation CHL variation was driven by both. Our results suggest that CHL may increase, and NL may decrease in response to a warming climate.

Among-Species Variation in the Parental Care and Following Responses of Juvenile Cichlids in the Genus *Apistogramma*

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Fishes of the family Cichlidae are well known for their diversity and repeated adaptive radiations. Many species of cichlid fish reproduce in pairs in which one or both parents provide intensive parental care for their offspring. For many species of neotropical dwarf cichlids (*Apistogramma*), only females care for their young and, when they do, they take on a characteristic, striking 'brooding' colouration and perform specific behaviours that appear to be directed to their offspring. I asked whether these behaviours (i) elicit specific responses in offspring and (ii) whether juvenile responsiveness to them changes over time. I observed the mother-juvenile interactions of fish raised in aquaria with a naturalistic environment including vegetation. Juveniles showed either defensive (e.g., freezing) or foraging responses to specific maternal behaviours. Maternal displays that trigger defensive responses could reduce risk of mortality to predation by acting as warning and then, when the threat is gone, the all-clear signal apparently indicates when the offspring can return to foraging. These responses to the female declined with age; this could be a result of a declining risk of predation and, also, increasing independence as they developed.

The Impact of Blue Light on *Drosophila melanogaster* Reproduction and Physiology

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Artificial blue light is ubiquitous thanks to its widespread use in light emitting diode (LED) devices. Prolonged blue light exposure has been linked to disrupted circadian rhythms and damage to human's eye retinal cells, and it is suspected to also have other long-term effects on health. To experimentally explore the consequences of blue light exposure many studies have used fruit flies, *Drosophila melanogaster* as a model. To date such studies have reported increased mortality, faster aging, and neurodegeneration in blue light exposed flies, and have speculated this damage is due to excess mitochondrial reactive oxygen species (ROS). In my study I exposed flies to blue light or white light for extended periods of time and placed them into reproductive assays where I could monitor their behaviour, reproductive success, and offspring production. I found that blue light flies and white light flies behaved differently from each other in these choice assays and these effects were different between the sexes. I discuss these results in the context of what they reveal about blue light, and concerns about its long-term effects on the behaviour and fitness of living organisms.

Beyond Simple vs Complex: Exploring the Nuanced and Unexpected Effects of Spatial Environmental Complexity on Mating Patterns and Female Fecundity

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The features of the physical environment define the space in which individuals interact, potentially influencing sexual selection. Several experimental studies have explored this idea using fruit flies *Drosophila melanogaster* and found that changing environmental spatial complexity influences the expression of male behaviour and is associated with changes in mating rates and female fecundity. However, these studies did not measure mating patterns, which can alter the genetic composition of the next generation, and furthermore only tested differences between a single simple and complex environment, thereby limiting our understanding of this phenomenon is. In our study we compared patterns of mating and offspring production between groups of large- and small-bodied males and females housed in a variety of different spatial environments. We found dramatically different mating patterns both between simple and complex environment, as well as between different complex environments, and that females in complex environments produced more offspring. We discuss these results in the context of sexual selection and sexual conflict, and the consequences for evolution in subsequent generations.

Optimal Polyandry: The Effects of Multiple Mating on Female Fitness

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In the past few decades, the study of polyandry has received increasing scientific attention with an emphasis on the fitness benefits and costs that females derive from mating with multiple males. The accumulation of studies on polyandry has demonstrated that a single mating typically does not maximize females' fitness. Our understanding of how polyandry affects female fitness, however, remains limited as existing studies mostly compared the fitness outcomes of mating with a single male vs. two or three other males. While informative, such studies likely do not capture realistic rates of female multiple mating in most species. To address this gap, we conducted controlled mating trials with female fruit flies (*Drosophila melanogaster*) either at low (every eight days), medium (every four days), or high (every other day) rates while controlling for exposure to harassment from males. We found that low mating rate females experienced sperm and/or seminal fluid limitations that constrained offspring production while high mating rate females produced the most lifetime offspring. We also found no evidence of differential mortality between treatments.

The Adaptive Significance of Polyandry: A Meta-Analysis

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The asymmetric investment in reproduction between males and females suggests that males should have higher optimal mating rates than females. However, polyandry, or females mating with multiple males, is ubiquitous among animals. In the past few decades, there has been much debate over the fitness consequences of polyandry for females. Three meta-analyses found that polyandry decreases female longevity while increasing fecundity, leading to a net fitness benefit. However, many studies in these meta-analyses either involved multiple matings with the same male, which is not polyandry, or only compared matings with one versus two males. Therefore, how higher, more realistic rates of polyandry influences female fitness remains unclear. To address this gap, we conducted an updated meta-analysis, which included a new decade of research and examined a wide range of levels of polyandry. We found that while polyandry in general increases female fitness, the intensity of polyandry that females experienced moderated its effects on fitness. Specifically, high rates of polyandry decreased both longevity and fecundity resulting in net fitness costs to females. Therefore, while our results support previous findings, they also highlight that high rates of polyandry are costly to females, thus suggesting that there may be an optimal intermediate rate.

The Impact of Post-Hibernation Energetic Constraints on Gestation Progress in the Little Brown Bat (*Myotis lucifugus*)

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Temperate bats face an energetic bottleneck in the early spring as low temperatures increase thermoregulatory costs and limit prey availability. Understanding how these bats maintain energy balance is especially salient for endangered species affected by white-nose syndrome (WNS). Within days of emerging from hibernation, bats with WNS must fight infection and begin healing damaged cutaneous tissues which can be energetically costly. This increase in energetic expenditure may delay or preclude female reproduction and can disrupt the synchrony of births within a colony, thereby reducing the energetic benefits of social thermoregulation. Phenological mismatch between births and peaks in seasonal food abundance may hinder juvenile development. Moreover, delayed births leave pups insufficient time to mature and fatten prior to hibernation, thus reducing the likelihood of first year survival. Remnant Myotis lucifugus colonies with few individuals persist despite WNS, however population growth is slow as females produce one pup annually. We collected blood samples from M. lucifugus at a maternity colony in southeastern Ontario weekly for four weeks beginning mid-May. We assessed plasma progesterone concentrations via ELISA to estimate gestation progress based on previously published data. This allows us to evaluate if WNS severity, as measured by wing damage, negatively impacts or precludes pregnancy. Weekly variance in progesterone concentration can also provide insight into the reproductive synchrony and health of the colony.

The Great Bat Stress Physiology Project: Creating a Global Bat Stress Atlas

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The Global Union of Bat Diversity Networks (GBatNet) is a network of networks which comprises 18 member networks from around the world with a focus on bat research, conservation, and education. Participants from across the member networks are currently collaborating on a series of interdisciplinary projects, including a structured literature review of bat stress physiology. The goal of the project is to provide a comprehensive assessment of the current state of knowledge, knowledge gaps, and future directions for the field. Initial screening used Rayyan artificial intelligence software to compile a list of candidate papers published in >100 journals. The list was further filtered by 13 participants from around the world who determined from the titles and content of each abstract which papers to include for further consideration. The project is now compiling the refined list for comprehensive content analysis. The structured literature review process will consolidate all major findings, techniques, and current knowledge gaps into a comprehensive review which can be used as a guide and resource for future bat stress physiology research.

Soil Moisture and Nutrient Manipulations in a Temperate Mesic Old-Field Meadow: Which Exerts the Stronger Decadal Length Influence on Plant Community Structure and Production?

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Soil nutrient and water availability determine plant community structure and productivity. Summer droughts will intensify soil water stress in temperate mesic grasslands, but water manipulation studies remain uncommon, and rarely consider nutrient interactions. Moreover, grassland recovery from long-term drought is an understudied metric of community resilience. My study tests the hypotheses that: 1) enhanced water and nutrient availabilities together will increase plant production only during a relatively dry summer; and 2) Plant community structure as a result of a long-term imposed drought will remain significantly altered, even after returning to ambient rainfall. Aboveground biomass was harvested to determine species richness and abundances from an Ontario grassland experiment set up in 2010, which applied factorial water (rain-out shelters, control, or water addition) and nutrient (control or NPK fertilizer addition) treatments to $1m^2$ plots (n=10). Drought recovery will be determined by assessing diversity in plots that were returned to ambient rainfall since a 2016 harvest. My preliminary results suggest that plant productivity is mainly dependent on soil nutrient availability, but that drought diminishes this effect by reducing plants' access to nutrients. Investigating the interactive effects of nutrient and water availability in grasslands is relevant for both agricultural applications and fundamental ecological science.

Microbial Analysis of Miocene-Era Bentonite Clay

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To help ensure the long-term integrity of a proposed deep geological repository (DGR) for storage of Canada's used nuclear fuel, it is essential to characterize microorganisms that may be associated with DGR design components, especially bentonite clay that will surround the used fuel containers (UFCs). Metabolisms of various microorganisms could influence the evolution of a DGR. For example, sulfate-reducing bacteria (SRB) could lead to the corrosion of metal components of UFCs and microorganisms that produce gases could create permeability fissures within the repository. In this study, the microbial communities within four bentonite clay cores from the Tsukinuno clay deposit (Japan), a naturally occurring Miocene-era bentonite deposit, were studied. The goal of this research was to investigate the abundance and composition of microbial communities in these ancient bentonite clay samples as an analogue to future bentonite within a DGR. Our results show low abundances of culturable microorganisms, including SRB. DNA sequencing results demonstrate relatively consistent microbial community compositions dominated primarily by sequences associated with phylum *Proteobacteria*. Low correlations were measured between microbial community composition and concentrations of various metals, non-metals, and clay varieties, suggesting that there may be other factors responsible for the core-dependent variations in microbial community composition observed.

Does Community Composition Affect How Plants Respond to Mycorrhizal Networks

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Plants and arbuscular mycorrhizal (AM) fungi have been posited as having a mutualistic relationship where plants exchange sugars for nutrient acquisition services by the hyphal network produced by AM fungi. The magnitude of plant response to AM fungi can depend on factors such as the species interacting in this relationship and the surrounding environment where the interaction takes place, but these effects are not well understood. We tested whether plant response to interactions with AM fungal hyphal networks is affected by the presence of conspecific or heterospecific plant species. We expected that plants would respond more positively to AM fungal networks when grown with conspecific individuals in the community due to the cultivation of AM fungi that were more likely to benefit the plant species. Contrary to the prediction, we found plant response to AM networks was negatively affected by conspecifics relative to heterospecific plant species. These results suggest that AM networks incur negative plant responses in conspecific communities via intraspecific competition. Our findings support that AM networks are one of many factors that impact the distribution of plant species. Specifically, these networks will accelerate the depletion of niche nutrients in the soil, thereby promoting greater spatial separation among conspecifics.

Are Forage Crops Over-Represented in Biodiversity-Productivity Studies?

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Biodiversity manipulation experiments are essential to our understanding of ecological theory and how plant communities are assembled in natural systems. Many forage species are present in ecosystems, and have become naturalized as a result of intense cultivation practices. These species are grown to feed livestock, and have undergone significant human selection for traits that increase productivity. We investigated the proportion of forage species used in biodiversity-productivity studies to determine if this differs from the background proportion found in natural communities. The proportion of forage crops used in the 21 biodiversity-productivity studies was obtained from a well-cited meta-analysis and compared to the background frequency in Ontario. We saw that forage crops were over-represented in the majority of studies, indicating that artificially selected upon species are being over-used in experiments meant to model natural systems. This finding may have implications for our understanding of ecological theory, and suggests there is a bias in the selection of species for ecological research.

Tracking Wetland Regeneration: A Long-term Assessment of Vegetation Dynamics Post-*Phragmites australis* Suppression

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The invasion and spread of invasive plants such as *Phragmites australis* ssp. *australis* greatly threatens wetland biodiversity. To suppress *P. australis* in Lake Erie coastal marshes, large areas were treated with herbicide and dead stems were mowed/rolled. The Waterloo Wetland Lab started a long-term monitoring program to track the efficacy of this suppression through the changes in vegetation community. Regrowth of vegetation in this area relied solely on the seedbank or nearby plant communities. Initially, plots were overrun with secondary invasions – other invasive species. Fortunately, vegetation in plots started to transition to an abundance of native plant species approximately 3-5 years post-herbicide suppression. Subsequently, we have shifted our focus to evaluating how closely treated plots are beginning to resemble plant communities in "reference plots" – areas never invaded by *P. australis*. Our objective is to determine whether the vegetation in our treated plots is mirroring reference conditions or is transitioning into a novel plant community type. We will continue to the monitor the vegetation community by performing a percent cover analysis. We hope that the results of this work will help us better understand plant community dynamics post-herbicide suppression and evaluate our goals of restoring a healthy native plant community.

Territoriality in *Odonata* and its Consequences on Behavioural Traits: A Phylogenetic Analysis

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Many, but not all, species of odonates (dragonflies and damselflies) exhibit territoriality. In species where it occurs, this territoriality is typically seen in males who defend oviposition sites from competitors and mate with females when they arrive. We describe the first systematic collation of the prevalence of territoriality in odonates. We follow it up with a phylogenetic analysis of its possible causes and consequences of territoriality. Our ancestral state reconstruction suggests that the common ancestor of all damselflies was non-territorial while the common ancestor of dragonflies was territorial. However, territoriality has been gained and lost several times throughout the phylogeny. Initial results indicate that, as expected, species with non-contact mate guarding tend to be territorial since this allows males to continue to defend their territories while ensuring paternity. However, contrary to our predictions, territoriality does not correlate with perching behaviour, which is energetically efficient and was predicted to have allowed more energy resources to be devoted to defending a territory. Additionally, territoriality does not correlate with exophytic oviposition, which is the faster oviposition method and was predicted to make territorial defence more cost-effective. Collectively, our results encourage a reassessment of our understanding of the ecological and evolutionary consequences of territoriality.

Exploring Mating Behaviours in an Invasive Fish: The Role of Alternative Reproductive Tactics

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The invasive round goby (*Neogobius melanostomus*) has alternative reproductive tactics (ARTs) with two male reproductive phenotypes: guarders and sneakers. Guarder males are larger, express secondary sexual characteristics, court females, and provide parental care. In contrast, sneaker males are smaller and obtain fertilizations by clandestinely entering the nest. We conducted an experiment to determine if and how reproductive behaviours of guarder males and females change in the presence of sneaker males. Guarder male aggression was 200% higher in the presence of a sneaker male, although no clear changes in parental care were observed immediately post-spawning. Female spawning was commonly disrupted by sneakers, leading to much shorter bouts of spawning, decreasing from 17 minutes long to only 3 minutes (82% reduction), although, the total spawning duration of individual females did not vary across treatments. Our findings suggest that guarder males and females detect and strongly respond to sneaker male threat either via increased aggression and/or altered spawning behaviours. Our study is the first to document round goby spawning behaviour in relation to sneaker behaviour and increases our understanding of how intrasexual competition influences aggression and reproduction in an ecologically relevant invasive species.

Sneaker Male Nest Preferences: Do Females Know Best?

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In the world of male alternative reproductive tactics, a major hurdle to a sneaker male's reproductive success is finding females. While guarders generally have the luxury of attracting females, sneaker males often must seek them out. One potential tactic to increase the likelihood of encountering females is to affiliate with female-preferred guarder males and nests. We investigated whether sneaker males share female preferences for particular male and nest characteristics in the plainfin midshipman (*Poricthys notatus*), a species of toadfish with two distinct male morphs—guarders and sneakers. We know female plainfin midshipman are attracted to guarder male humming and prefer larger males, and generally, female fish often prefer spawning alongside other females' eggs. In this study, we tested whether sneaker males share these female preferences and prefer to visit nests containing 1) guarder males, 2) large versus small guarder males, and 3) eggs. Preliminary results indicate that sneakers did not prefer to spend more time near these three types of nests; however, further analysis is necessary to disentangle sneaker preferences to better understand their decision-making.

Effect of Female Mating Status on Male Willingness to Fight in the Noble False Widow Spider

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Fighting in contests between males to secure mating opportunities is a costly endeavour, especially in polygynandrous species, thus males may alter the effort they invest into fighting for mates based on several factors. One of those factors is their motivation to mate with a female. Previously, we demonstrated that the mating status of a male could affect their motivation to fight with other males for mating opportunities, by showing that unmated males fight more than mated males in contests. Here, we tested if the mating status of a female could also affect a male's motivation to mate, and therefore their willingness to fight. This is because mating with recently mated females may be less valuable to males due to the risks of sperm competition. We placed two unmated *Steatoda nobilis* males, matched in age and mass, in either an unmated or mated female's web, and recorded the interactions. In trials with mated females, we observed less fighting between males and fewer male mating attempts, than with unmated females, thus indicating male choosiness. We conclude that a male's reduced willingness to fight for mated females may be a strategy to avoid injury and to preserve energy for other mating opportunities.

Alternative Reproductive Strategies in Male Eastern Carpenter Bees

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Males of the eastern carpenter bee (*Xylocopa virginica*), arrive to their nesting site before females (protandry) and hold territories to compete for access to mates. The persistence of these strategies is explained by sexual selection theory; however, males may use alternative tactics to avoid competitors, which is often associated with body size. Using 5 years of observations, we investigated patterns in the phenology and body size of *X. virginica* males to highlight selective pressures influencing their mating behaviour. Bees were individually measured and marked at several nest aggregations near Brock University, where we recorded daily flight activity. Most males were protandrous and remained at the same aggregation, while late-arriving males exhibited transient movement across aggregations. Large males were more likely to hover than small males, however, body size declines during the breeding season indicated replacement by smaller males. Thus, *X. virginica* males exhibit alternative reproductive strategies likely to maximise their access to mates. Our study further highlights the importance of multi-year studies to explain mechanisms underlying male reproductive strategies.