

**9th Annual Meeting of the
Canadian Herpetological Society**

**9^{ème} Congrès Annuel de la
Société d'Herpétologie du Canada**

CHS

SHC



**FREDERICTON
2022**





LITTLE RAY'S NATURE CENTRES

What Makes Us Great



Rescue

Little Ray's Nature Centre is the largest exotic animal rescue in North America and has successfully rescued and relocated over 6000 animals in the past 25 years.



Conservation

On top of other programs, Little Ray's partially funded and managed the construction of the first captive breeding and release facility for big headed turtles in Myanmar.



Species Survival

Partnered with Wildlife Preservation Canada for the captive breeding and release of critically endangered loggerhead shrike.

About Us



Family owned and operated business of 25 years



First carbon neutral zoo in North America



Recipient of the Eleanor Oakes Award for traveling exhibits program & educational program design



Recipient of the Peter Karsten In Situ Conservation Award for Green Initiatives & Outstanding Achievement in Conservation.



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Welcome

On behalf of the CHS Meetings and Workshops Committee, welcome to city of Fredericton, New Brunswick for the 9th Annual Meeting of the Canadian Herpetological Society/Société d'Herpétologie du Canada. This year's meeting continues a long-standing tradition of annual meetings to promote research and conservation of amphibians and reptiles in Canada. We are excited to host everyone either virtually, or in-person in Fredericton.

Health and Safety

The COVID-19 pandemic is not over, thus masks are **mandatory** for attending this conference in-person. Medical, N95, and cloth masks are acceptable. Masks are mandatory indoors, including while presenting. Masks may only be removed to eat and/or drink, or when outdoors. The Wu Centre (University of New Brunswick)'s masking policy can be found here

<https://www.unb.ca/coronavirus/students/returning/community-masks.html>.

CHS Conference Organizing Committee

- Pamela Rutherford (Chair, Meetings and Workshop Committee)
- Chris Edge (Chair, Local Organizing Committee)
- Graham Forbes (Co-Chair, Local Organizing Committee)
- Amanda Bennett
- Hannah McCurdy-Adams
- Julia Riley
- James Baxter-Gilbert
- Shaylyn Wallace
- Connie Brown
- Damien Mullin

Fredericton Inn

Our conference hotel is the **Fredericton Inn** (1315 Regent Street, Fredericton, NB). The hotel is in uptown Fredericton, and is within walking distance of many shops, restaurants, and the Regent Mall. The hotel is also within walking distance of the University of New Brunswick Woodlot which has 10+ kms of walking and hiking trails; closest entrance is the Bishop Drive Woodlot Trail. **The banquet will take place at the Fredericton Inn.**

Wu Centre

Our conference is being hosted at the University of New Brunswick's **Wu Centre** (6 Duffie Drive, Fredericton, NB). The Wu Centre will be our main hub for the conference hosting every event excluding the Friday Social, Saturday Banquet, and the Monday Fieldtrip.

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The Wu Centre is a 20 minute walk from the conference hotel. Regent St. is quite steep between Preistman st and Montgomery st. so we suggest [the following route](#). Anyone needing assistance with transportation should contact the conference chair Chris Edge conference@canadianherpetology.ca

Silent Auction and Book Raffle

Funds raised from the silent auction and Book Raffle help CHS/SHC deliver student awards and student travel bursaries – so please bid. The silent auction opens on Saturday 17 September at the start of lunch (11:45) and closes on Sunday 18 September at the end of lunch (13:20). The silent auction will be held at the Wu Centre in the Chancellor's Room.

Meals

Lunches and light refreshments during breaks are provided at the Wu Centre.

Quiet Room

We are providing a quiet room with privacy for anyone who wants to use it during the conference. The room number will be announced at the conference.

Canadian Herpetological Society

The Canadian Herpetological Society (canadianherpetology.ca) is a registered Canadian charity that advances reptile and amphibian research and conservation in Canada by:

- promoting scientific research on reptiles and amphibians and disseminating the results;
- facilitating collaboration among amateur and professional herpetologists;
- advancing public understanding of our native reptile and amphibian species, the threats they face and the conservation solutions that exist; and
- promoting, supporting and leading conservation and stewardship projects.

CHS is made up of researchers, conservation practitioners, naturalists, educators, and other individuals with an interest in Canada's reptiles and amphibians.

President: Pamela Rutherford (Brandon University, MB)

Vice President: Jolene Laverty (Nova Scotia Department of Lands and Forestry, NS)

Past President: Jacqueline Litzgus (Laurentian University, ON)

Treasurer: John Urquhart (Blazing Star Environmental, ON)

Secretary: Amanda Bennett (Council of Canadian Academies, ON)

Directors at Large: Leslie Anthony, Christina Davy, Patrick Moldowan, James Paterson, Marc Dupuis-Desormeaux, Ryan Wolfe

Webmaster: Drew Hoysak

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Presentation Instructions

CHS 2022 is a fully hybrid event, with all talks streamed via Zoom. Please follow the below guidelines to ensure the conference runs smoothly.

All talks, in person or virtual, must be uploaded to the below dropbox link by **11:59pm AT on 14 September 2022**

<https://www.dropbox.com/request/5yMIDGhUIzwNRePfY92b>

All talks must be submitted as a PDF (.pdf), powerpoint 2016 (.pptx) or Power Point Show (.ppsx).

All presentation will be loaded from the local computer.

For those giving and in person talk stay at the podium and speak into the microphone so that your colleagues online can both see and hear you.

For those giving a virtual talk you will be given remote control of the local computer. You will be able to advance your slides, move the mouse, use the pointer, and see your slides on your computer. Your video feed will be displayed on a second screen adjacent to your presentation. You will not be able to see your speaker notes in powerpoint. We ask that you ensure you have a quality microphone, speakers, and test your audio equipment before the conference.

If you would like an explanation of how to use the remote settings and/or trial the set up please join Pam Rutherford online

Wednesday September 7 from 4-6pm AT (2-4 pm CT) or

Friday September 9 from 12-2pm AT (10am-12pm CT)

Join Zoom Meeting

<https://us06web.zoom.us/j/81263756623?pwd=OHFH2FWNHovTUIHdnhJNmo0MFQ5dz09>

Meeting ID: 812 6375 6623

Passcode: 497000

We are working really hard to have a fully hybrid conference. Online participants are encouraged to ask questions verbally or put them in the chat. There will be someone in person monitoring the chat and looking for “raised hands” online.

15 minute talks

Target 10-12 minutes for your presentation to leave a few minutes for questions

5 minute lightning talks

Please use your full allotted time. There are no questions at the end of 5 minute talks.

Posters

Posters must be smaller than 120cm long x 90cm high

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Schedule Overview

Friday 16 September 2022 (all times in ADT)

1300-1700	Community Science Workshop	Workshop Organizing Committee to facilitate (see Workshop section)	Wu Centre Chancellor's Room
1830-2300	Reception: Harvest Music Festival		See page 10 for details

Saturday 17 September 2022

730-830	Registration		Atrium
830-845	Opening Address	Pamela Rutherford, President CHS/SHC Chris Edge, Chair LOC	Auditorium
845-945	Plenary	Don McAlpine New Brunswick Museum	Auditorium
945-1000	Break (15 min)	Coffee/tea + light snacks	Atrium
1000-1145	Session 1: Behaviour	Chair: Jackie Litzgus	Auditorium
1145-1245	Lunch	Buffet style (provided)	Atrium
1145-1245	Equity, Diversity, and Inclusion Open Discussion	Briar Hunter	Chancellors Room
1245-1435	Session 2: Variation in Space and Time	Chair: Marc Mazerolle	Auditorium
1435-1450	Break (15 min)	Coffee/tea + light snacks	Atrium
1450-1650	Session 3: Ecology and Herpetology	Chair: Graham Forbes	Auditorium
1650-1700	Break (10 min)	Not catered	Atrium
1700-1800	Poster Session	Appetizers provided	Atrium
1830-2300	Banquet		Fredericton Inn Bi-Centennial Room
1830-1900	Reception (cash bar)	Keynote Georgia Ward-Fear Macquarie University	
1900-2000	Dinner is served		
1930-2000	Awards		
2000-2100	Keynote		
2100-2130	Great Canadian Herp Quiz		

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Sunday 18 September 2022

730-815	Registration		Atrium
815-830	Opening Address	Chris Edge	Auditorium
830-1015	Session 4: Conservation I - Turtles and Snakes	Chair: Tom Herman	Auditorium
1015-1035	Break (15 min)	Coffee/tea + light snacks	Atrium
1035-1210	Session 5: Conservation II - Snakes and Amphibians	Chair: Lesley Anthony	Auditorium
1210-1220	Group Photo (10 min)		Atrium
1220-1320	Lunch	buffet style (provided)	Atrium
1220-1320	CHS Board Meeting		Chancellors Room
1320-1440	Session 6: Conservation III – All the Herps!	Chair: Donnell Gasbarrini	Auditorium
1440-1445	Closing Remarks	Chris Edge Pamela Rutherford	Auditorium
1445-1500	Break (15 min)	Coffee/tea + light snacks	Atrium
1500-1630	Annual General Meeting	Pamela Rutherford, President CHS/SHC	Auditorium

Monday 19 September 2022

915-1500	Field Trip		
915	Pickup from Fredericton Inn	Led by Shaylyn Wallace, Nature Trust New Brunswick, and Greg Jongsma	Various
1000	Hyla Park Nature Preserve		
1200	Lunch at Happy Bakery (local bakery)		
1245	Odell Park (old growth forest)		
1500	Drop off at Fredericton Inn		

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Friday 16 September 2022

1300 – 1700 ADT: Community Science for Herps Workshop

Location: Wu Centre, Chancellor's Room + Virtual
Registration required!

In this interactive workshop, learn when and how to participate in many community science (sometimes referred to as citizen science) projects across Canada to contribute to conservation and research of herpetofauna. This workshop will be conducted in English, but with questions in English or French.

Agenda

1300-1330 (30 min)	Welcome and Introductions
1330-1410 (40 min)	Introduction and Community Science Overview Hannah McCurdy-Adams and James Baxter-Gilbert
1410-1420	Quick Break (no refreshments provided, 10 min)
1420-1530 (70 min)	Case Study Presentations of Individual Projects 1. Magnetawan First Nation Department of Lands, Resources and Environment Nadine Perron 2. Invasive Species & Herps in New Brunswick: Increasing Public Reporting to Improve Data Kristin Elton 3. Gray Treefrogs in Hyla Park Shaylyn Wallace 4. Ontario Turtle Conservation Centre Sue Carstairs 5. Ontario FrogWatch and Turtle Tally Donnell Gasbarrini 6. Community Science with Western Toads in Haida Gwaii and Squamish Roseanna Gamlen-Greene
1530-1550	Coffee Break (coffee/tea + light snacks provided, 20 min)
1550-1650 (60 min)	iNaturalist Tutorial and Discussions James Pagé
1650-1700 (10 min)	Closing business and remarks

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Friday Night Reception: Harvest Festival

1830, 2000, and 2130 ADT: Various locations

With the [Harvest](#) music festival on it wouldn't be right for us not to enjoy some of the free live music, buskers, street performers, and the rest of the festival experience. To take advantage of this event, our Friday night reception will include a walk, music, beer, water, wine, and conversation. Rather than try to get everyone into one venue we've arranged a few meeting times and locations throughout the Harvest Festival area. Someone from the LOC will be at each one of the meeting places to help people find each other. The event is open to everyone, whether you registered or not. We encourage you all to meet at one or more of the locations and then explore and enjoy the festival.

Designated meeting spots:

1830: In front of the Legislative Assembly of New Brunswick, 706 Queen St, Fredericton, NB, <https://goo.gl/maps/Y1BZVaKRkckAzWv49>

2000: Graystone Brewing. 221 King St, Fredericton, NB, <https://goo.gl/maps/2aK8LrkZWrwH7f6F6>

2130: Lunar Rogue, 625 King St, Fredericton, NB, <https://goo.gl/maps/iR3G1kEZsX4j2HkdA>

Other options:

There are quite a few free shows to take in <https://harvestmusicfest.ca/cbc-free-harvest-2022/>

Many of the watering holes will have live music as well <https://harvestmusicfest.ca/buskers-pubs-clubs-2022/>

Saturday 17 September 2022

845 – 9:45 ADT: Plenary Speaker

“Ever the humblest plodder”: Philip Cox and the rise of scientific herpetology in Maritime Canada 1898-1970



Dr. Don McAlpine

Head, Department of Natural History
Research Curator and Head, Zoology Section
New Brunswick Museum

Dr. Don McAlpine is a leading researcher and zoologist in Atlantic Canada. He has worked as the Zoologist (since 1981), and as Head of the Natural History Department of the New Brunswick Museum (since 2006). Don's knowledge of natural history is unmatched and spans several taxa including herps, whales, fish, molluscs, and soil invertebrates. There even is a beetle named after him, *Atheta mcAlpinei*! For over 10 years, Don has organized intensive week-long Bio-blitzes in different new protected areas in NB. Don is an associate editor at four journals, and is adjunct (or similar) at five Canadian and American universities. Don has made the time for over 800 media interviews, and is a well-known, and respected naturalist, curator, and researcher in Atlantic Canada, and nationally.

Abstract: Late 19th and early to mid-20th C Maritime herpetology, in spite of the few individuals involved, was more outward-looking and influential than we might imagine. The contributions of three Maritime herpetologists, Philip Cox (1847-1939), Stanley Gorham (1917-1984) and Sherman Bleakney (1928-2019) together set the stage for future herpetological study in Atlantic Canada. Cox's desire to produce a herpetological collection that was Canada-wide in scope, although unsuccessful, was perhaps the earliest recognition of the value of such a project to the country and his published research was some of the first in the region to move past the anecdotal and local. Bleakney's PhD thesis on the zoogeography of eastern Canadian amphibians and reptiles was the first doctoral thesis in herpetology in Canada and provided a solid foundation for those interested in studying the biogeographic history of the eastern Canadian herpetofauna. His work on the Leatherback Sea Turtle has been equally important, leading to an understanding that Atlantic Canadian marine waters are critical to the life history of this now endangered reptile. With a formal education that ended at age 15, no access to a herpetological collection when he started his work in New Brunswick, and no real herpetological library, Gorham, remarkably, produced the first checklist of world amphibians, complete with species synonymies, in nearly a century and moved the work of Maritime herpetology to the international stage.

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Saturday 17 September 2022

1145 – 1245 ADT :Equity, Diversity, and Inclusion Open Discussion

Location: Wu Centre, Chancellors Room + Virtual

Come join the EDI Committee for some unstructured conversation and connection. Whether you're interested in joining the committee, curious about what we do, have questions or experiences to share - everyone is welcome and wanted here! Drop in virtually or in person and stay for as little or long as you like. We look forward to connecting with you!

<https://laurentian.zoom.us/j/94794779399?pwd=aFAxbDlvVllxQ091MjV4MnBEaTBxUT09>

Meeting ID: 947 9477 9399

Passcode: 658931

Find your local number: <https://laurentian.zoom.us/u/abx2vvp611>

Join by SIP

94794779399@zoomcrc.com

Join by Skype for Business

<https://laurentian.zoom.us/skype/94794779399Description>

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1000 – 1145 ADT: Session 1: Behaviour

Session 1: Behaviour (Chair: Jacqueline Litzgus)	
1000-1015	Studying the secret social lives of reptiles Julia Riley
1015-1030	Why do freshwater turtles aggregate at basking sites? Malcolm Fenech*
1030-1045	Conspecific cues enhance egg viability in the captive breeding of boreal chorus frogs (<i>Pseudacris maculata</i>) Jeffrey Ethier*
1045-1100	Differences in vocalization patterns of female and male adult painted turtles (<i>Chrysemys picta</i>) in various social contexts Claire Voss*
1100-1115	Challenges and potential costs of overwintering for Snapping Turtles (<i>Chelydra serpentina</i>) Matt Keevil*
1115-1130	Testing the influence of predation on habitat selection of Northern Prairie Skinks (<i>Plestiodon septentrionalis</i>) using a lizard model. Candace Park*
1130-1145	Ontogenetic variation in Western Rattlesnake (<i>Crotalus oreganus</i>) migratory tactics in British Columbia Chloe Howarth*

*denotes student presentation

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1245 – 1435 ADT: Session 2: Variation in Space and Time

Session 2: Variation in Space and Time (Chair: Marc Mazerolle)	
1245-1300	Comparative phylogeography of five co-distributed frogs in Central Africa Gregory Jongsma
1300-1315	The spatial ecology of climate influences species distributions: the case of the Great Plains Toad (<i>Anaxyrus cognatus</i>) Gabrielle Rimok*
1315-1330	Using science to inform species at risk management: Predicting the effect of forest harvest on Wood Turtle habitat suitability Damien Mullin*
1330-1345	Temporal changes in age and size at maturity of male Painted Turtles (<i>Chrysemys picta</i>) in response to climate change Lilian Chan*
1345-1350	Tech Break (5 min)
1350-1405 (virtual)	Axanthism in Green Frogs (<i>Lithobates clamitans</i>) and its geographic distribution Stephen Hecnar
1405-1420 (virtual)	Using droplet digital PCR to assess breeding phenology in chorus frogs in Ontario Ying Chen*
1420-1425 (5 min virtual)	Acoustic signal variability of trilling chorus frogs in Ontario Haolun Tian**
1425-1430 (5 min virtual)	Using environmental DNA to map the contact zone of <i>Pseudacris maculata</i> and <i>Pseudacris triseriata</i> in Southern Ontario Madeleine Robitaille*
1430-1435 (5 min virtual)	Status of turtle populations in Point Pelee National Park: a 20-year update Ian Wick*

*denotes student presentation

**denotes student presentation from non-first author

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1450 – 1650 ADT: Session 3: Ecology and Herpetology

Session 3: Ecology & Herpetology (Chair: Graham Forbes)	
1450-1505	Newfoundland herpetology: History, emerging systems, and research potential James Baxter-Gilbert
1505-1520	The Canadian BioGenome Project Samantha Jones
1520-1535	Packed in: Exploring sympatry and niche space in <i>Ctenotus</i> skinks Nicholas Cairns
1535-1550	Invertebrate and vertebrate species sensitivity distribution for insecticides derived from insecticidal toxins of <i>Bacillus thuringiensis</i> Madelaine Empey*
1550-1555 (5 min)	Effects of moisture on the phenotype and development of oviparous reptiles Cameron Bell*
1555-1600 (5 min)	Testing for the effects of a freshwater barrier to dispersal on an island population of northern watersnake (<i>Nerodia sipedon</i>) Arjun Augustine*
1600-1605	Tech Break (5 min)
1605-1620 (Virtual)	Differing effects of competition across years between two closely related larval amphibians Jessica Ford*
1620-1635 (Virtual)	Varying effects of anthropogenic and natural disturbance regimes on amphibian populations in a dynamic wetland landscape Victoria Tawa*
1635-1650 (Virtual)	Artificial displacement alters movement behavior of a terrestrial amphibian Nathalie Jreidini*

*denotes student presentation

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1700 – 1800 ADT: Poster Session

Poster Session	
Introducing the Riley Integrative Ecology Lab	Julia Riley
Semen collection from Canadian snakes	Ginger Elliot
Sexual dichromatism of tomia in Blanding's Turtles (<i>Emydoidea blandingii</i>)	Kelsey Moxley
The effect of environment on the mating behaviour of the Eastern Red-backed Salamander (<i>Plethodon cinereus</i>)	Alexia McCormick*
Effects of handling on Wood Turtle (<i>Glyptemys insculpta</i>) movement: insights using GPS loggers	Anna Varty*
Does urbanization impact the prevalence of defensive behaviours in redbelly (<i>Storeria occipitomaculata</i>) and common garter snakes (<i>Thamnophis sirtalis</i>)?	Ella Eberhardt*
Survival of chorus frogs in natural and restored environments	Jeanne Dudemaine*
How do roads affect populations of northern snakes?	Andrea Gigeroff*

*denotes student presentation

2000 – 2100 ADT: Banquet Keynote Speaker

Dancing with Danger: using taste aversion to conserve reptilian predators in Northern Australia



Dr. Georgia Ward-Fear
Postdoctoral Research Fellow
Department of Biological Sciences
Macquarie University

Dr. Georgia Ward-Fear is an Australian conservation scientist and reptile ecologist. She asks counterintuitive questions: Can pest species be ecologically useful? Does indigenous traditional hunting increase prey resilience under environmental change? Instead of controlling harmful invasive species, can we ‘train’ the native animals they impact? Her research sits at the interface of invasion ecology, animal behaviour and sometimes, sociopolitical science. To tackle conservation issues, Georgia collaborates with indigenous land management networks and brings industry stakeholders together in new and exciting ways. For her PhD (2016), together with the Balangarra indigenous rangers, Georgia trialed a novel technique to mitigate the ecological impacts of toxic cane toads on wild Monitor lizards, (inducing ‘Taste Aversion’); it was successful, attracting international media attention and leading to further funding. Georgia then developed ‘The Cane Toad Coalition’ (2017), a strategic partnership between prominent conservation organisations, Indigenous NGOs and cultural groups, State governments and regional stakeholders (www.canetoadcoalition.com). Georgia leads the coalition, with the ambitious task of delivering the largest and most innovative strategy for cane toad mitigation to date. Together with her indigenous collaborators, she works with a range of apex reptilian predators in the wild. Excitingly, they are succeeding at mitigating the impacts of this devastating toad invasion.

Georgia is a University medallist (2009), a Val street Scholar (2013-16) and is part of the Homeward Bound initiative (2019) a global network of Women in STEM, collaborating to influence global environmental policy. She is one of Science and Technologies Australia ‘Superstars of STEM’ and an APIS ‘Tall poppy’. Recently, her biography was written for the 5-book series ‘Aussie STEM stars’, for kids aged 10-13. She hopes to apply the taste aversion results to other systems and challenge academic models of conservation research globally.

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Sunday 18 September 2022

830 – 1015 ADT: Session 4: Conservation I – Turtles & Snakes

Session 4: Conservation I – Turtles & Snakes (Tom Herman)	
830-845	The influence of landscape variables on turtle and frog railway interactions Kyle Vincent*
845-900	A soft release does not improve reintroduction outcomes for an endangered freshwater turtle in an urban landscape Tharusha Wijewardena*
900-915	The efficacy of two novel treatments (Ponazuril and Humatin) for <i>Cryptosporidium</i> sp. in Western Painted turtles (<i>Chrysemys picta bellii</i>) Andrea Gielens
915-920 (5 min)	Ecology of species at risk turtles within the footprint of a proposed highway expansion and transmission line Brooke Carroll*
920-925 (5 min)	A rocky solution: Evaluating the use of common construction materials as road effect mitigation for turtle communities in a rock barren landscape Jenna Kentel*
925-930 (5 min)	Evaluating the effectiveness of wildlife exclusion fencing in preventing wildlife-vehicle collisions of herpetiles in Toronto, Ontario Donnell Gasbarrini
930-935 (5 min)	Population demography and spatial ecology of Spotted Turtles (<i>Clemmys guttata</i>) in central Ontario Stephane Thibeault*
935-940 (5 min)	How's it going? Tracking land-based conservation of herpetofauna in B.C from 2010 to 2021 Purnima Govindarajulu*
940-945 (5 min)	Understanding the impacts of wildfire and windfarm construction on squamate community ecology in Central Ontario Aidan Maloney*
945-1000	Multi-species assessment and planning for Canadian snakes: Identifying and evaluating ex situ conservation activities as Part of a One Plan Approach Hannah McCurdy-Adams
1000-1015	A systematic review of snake translocations to identify potential tactics for reducing post-release effects Jonathan Choquette*

*denotes student presentation

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1035 – 1210: Session 5: Conservation II – Snakes & Amphibians

Session 5: Conservation II – Snakes & Amphibians (Chair: Lesley Anthony)	
1035-1050	Complicated conservation for a Canadian snake: BC's peripheral population of Western Rattlesnakes. Karl Larsen
1050-1105	Effectiveness of road mortality mitigation for Western Rattlesnakes (<i>Crotalus oreganus</i>) in British Columbia Jade Spruyt*
1105-1120	Defying expectations: Apparent long-term stability trends in a protected population of endangered Fowler's Toad Tyler Ambeau*
1120-1135	Egg binding in amphibians: insight from Canada's most endangered anuran, the Oregon Spotted Frog (<i>Rana pretiosa</i>) Briar Hunter*
1135-1150	Habitat suitability and reintroduction site selection criteria for the northern leopard frog (<i>Lithobates pipiens</i>) Rebecca Stanton
1150-1155 (5 mins)	Amphibian reproductive technologies: searching for new spawning induction methods Brianna Raven*
1155-1200 (5 mins)	Determining the presence of <i>Ophidiomyces ophiodiicola</i> in New Brunswick and Nova Scotia Issac Acker*
1200-1205 (5 mins)	Impact of forest harvesting and herbicide use on salamander population health Sara Leslie*
1205-1210 (5 mins)	There's something in the water: steps to understanding the cues for Oregon spotted frog (<i>Rana pretiosa</i>) breeding Andrea Gielens

*denotes student presentation

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1320 – 1440: Session 6: Conservation III – All the Herps!

Session 6: Conservation III – All the Herps! (Chair: Donnell Gasbarrini)	
1320-1335	Using decision analysis to assess the feasibility of recovery of northern leopard frogs (<i>Lithobates pipiens</i>) using conservation translocations in northern Idaho Lea Randall
1335-1350	Talking turtles! Investigating snapping turtle hatchling vocalizations and synchronized nest emergence in the wild Claudia Lacroix*
1350-1355	Tech Break (5 min)
1355-1410 (virtual)	Impacts of a windfarm and wildfire on the spatial ecology and habitat selection of an endangered freshwater turtle Stephanie Delay*
1410-1425 (virtual)	Creating landscape-appropriate habitat restoration strategies: Success of a turtle nest habitat design for rock barren landscapes. Chantel Markle
1425-1430 (5 min virtual)	Evaluating hormone therapy as a tool to support conservation breeding of the endangered Oregon Spotted Frog (<i>Rana pretiosa</i>): A pilot study Pourya Sardari*
1430-1435 (5 min virtual)	The great unknown: Understanding mitigation translocation of herpetofauna in BC Megan Winand
1435-1440 (5 min virtual)	Butler's gartersnake communities have female leaders Morgan Skinner*

*denotes student presentation

End of Contributed Talks

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1

Determining the presence of *Ophidiomyces ophiodiicola* in New Brunswick and Nova Scotia

Issac M. Acker, Julia L. Riley

Mount Allison University, Sackville, New Brunswick, Canada

Abstract

Ophidiomyces ophiodiicola is a fungus that infects the skin of a variety of North American snakes. This fungus causes Snake Fungal Disease (SFD), which can produce dermal lesions throughout a snake's body and be lethal. Current research shows SFD is prevalent around the Great Lakes within Ontario and the United States, but it is unknown if *O. ophiodiicola* occurs in Canada's Atlantic provinces. To start filling in this knowledge gap, we surveyed for wild individuals of five snakes residing in New Brunswick and Nova Scotia: *Diadophis punctatus edwardsi*, *Opheodrys vernalis*, *Storeria occipitomaculata*, *Thamnophis saurita*, and *Thamnophis sirtalis pallidulus*. We swabbed individuals to sample for *O. ophiodiicola*, visually checked for signs of SFD, and recorded sex, length, and weight. We will use the morphological measurement to calculate their body condition. To date, we have swabbed 50 snakes of three species (*O. vernalis*, *S. occipitomaculata*, and *T. sirtalis pallidulus*). No snakes with serious cases of SFD have been observed (i.e., large lesions). However, smaller lesions and minor scale crusting has been observed on a few *T. sirtalis pallidulus* that could indicate a mild infection. Currently, we are continuing our surveys to increase our sample size and geographic spread. In the fall, genetic testing will be performed on the skin swabs to identify the presence or absence of *O. ophiodiicola*. This research will provide vital information about the wildlife disease landscape in Atlantic Canada and expand our knowledge about SFD in wild snake populations.

5-minute

In-person

Student

2

Defying expectations: Apparent long-term stability trends in a protected population of endangered Fowler's Toad

Tyler R. Ambeau¹, Christina M. Davy², James E. Paterson³

¹Department of Biology, Trent University, Peterborough, Ontario, Canada. ²Department of Biology, Carleton University, Ottawa, Ontario, Canada. ³Institute for Wetland and Waterfowl Research, Ducks Unlimited Canada, Stonewall, Manitoba, Canada

Abstract

Monitoring population trends and identifying the factors underlying population growth and decline is critical for accurate assessment and effective recovery of species at risk. At Rondeau Provincial Park (Ontario, Canada), a previous PVA suggested a high probability of extinction of endangered Fowler's toads (*Anaxyrus fowleri*), and surveyors reported a perceived decline in abundance over 17 years of visual encounter surveys (2004-2021). However, population trends remained uncertain. We used the survey data to quantify trends in catch per unit effort (CPUE, a proxy for relative abundance among years), and to test factors affecting body size at maturity and the hybridization of *A. fowleri* with the American toad (*Anaxyrus americanus*). We hypothesized that if food availability was limiting toad abundance, we would observe compensatory, density-dependent shifts in toad body size. Additionally, we tested the hypothesis that hybridization rates are driven by changes in the abundance of *A. americanus*, predicting that the abundance of *A. americanus* observed on surveys would be positively related to the proportion of hybrid individuals encountered. We used linear models to assess the relationship between CPUE and toad body size, and the proportion of hybrids. On average, toad observations from 2004 to 2021 increased each year by 8 (± 2) toads caught per survey day. Average body size of toads fluctuated throughout the study but was not associated with CPUE, suggesting either a lack of density dependence in body size, or that the threshold abundance for this effect was not reached. Hybrid proportions in the survey data increased by 8% ($\pm 0.01\%$) over the study period but was not predicted by the abundance of *A. americanus* in the surveyed habitat. Overall, our results suggest that current habitat conditions are apparently supporting this endangered population of *A. fowleri*, and that prey availability does not appear to be a current concern

Platform

In-person

Student (not judged)

3

Testing for the effects of a freshwater barrier to dispersal on an island population of northern watersnake (*Nerodia sipedon*)

Arijun M. Augustine, Stephen C. Lougheed

Queen's University, Kingston, Ontario, Canada

Abstract

Island biota have long been a focus for researchers seeking to understand the origins of biodiversity and the distributions of species. Many studies have examined the role of marine islands in driving genetic differentiation among conspecific populations and ultimately species diversification, but far fewer have examined these evolutionary processes in freshwater island populations. A pilot study using microsatellite data to investigate population structure in northern watersnakes (*Nerodia sipedon sipedon*) found evidence that suggests that a watersnake population on Main Duck Island and nearby Yorkshire Island, small islands in Lake Ontario that are over 12 km from the nearest land, is genetically distinct from mainland counterparts. My study tests whether the Main Duck Island population is indeed genetically unique using a genome-wide panel of single-nucleotide polymorphism markers derived from reduced representation sequencing, which provides more statistical power to detect divergence than microsatellites and may provide insights on adaptive divergence. If found to be genetically distinct from mainland populations, the Main Duck Island population would be a compelling example of a freshwater island shaping evolutionary trajectories, and should the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) judge it to be a designatable unit, it would come under the management of Thousand Islands National Park.

5-minute

In-person

Student

4

Newfoundland herpetology: History, emerging systems, and research potential

James H. Baxter-Gilbert, Julia L. Riley

Mount Allison University, Sackville, NB, Canada

Abstract

The island of Newfoundland has no native, extant, terrestrial amphibians or reptiles. However, at least five Canadian species have been introduced, established self-sustaining populations, and have spread outward from their introduction sites. These include three species of frog, one toad, and a gartersnake, resulting in Newfoundland having one of the densest assemblages of domestic invasive herpetofauna in Canada. Recently, we have documented the presence of another, the Eastern Red-backed Salamander (*Plethodon cinereus*), which now adds another taxon to the growing list of invasives. We conducted surveys to determine presence/absence and engaged in discussions with local community members, which together generated some curious insights and theories on the history of this invasion, how these salamanders are surviving, and what may be limiting their spread. This 'recent' discovery, coupled with the previous invasions, represent excellent study systems for testing invasion biology hypotheses and understanding how in a time where many herps are in decline, some populations are able to expand and thrive.

5-minute

In-person

5

Effects of moisture on the phenotype and development of oviparous reptiles

Cameron T Bell¹, Rebecca Raynal², Daniel Noble³, Lisa Schwanz², Daniel Warner⁴, Julia Riley¹

¹Mount Allison University, Sackville, New Brunswick, Canada. ²University of New South Wales, Sydney, New South Wales, Australia. ³Australian National University, Canberra, Australian Capital Territory, Australia. ⁴Auburn University, Auburn, Alabama, USA

Abstract

The early environment is a key factor in the development of reptiles that affects many facets of their phenotype. The majority of reptiles do not exhibit parental care after laying their nest, which leaves the nesting environment as the main driver of early development. Much of the research about the impact of nest environment has focused on temperature, but many other factors have the capacity to impact development too, like soil type and moisture. To better understand the impact nest soil moisture has on the offspring phenotypes of oviparous reptiles, we are conducting a meta-analysis using data from the Reptile Development Database (<https://repdevo.com/>), which contains data from pertinent studies published from 1974 to 2016. We also conducted our own systematic review of the literature to include data until 2022 in our study. Data were included if embryos were incubated in a lab environment, and the study included at least 2 different soil moisture treatments. With these restrictions, the Web of Science search yielded data from 71 studies in addition to those already present in the RepDevo database (n = 300). Data were categorized based on defined trait types: incubation, morphology, performance, sex ratio, and survival. Effect sizes were calculated from our data based on these trait types and water potential treatments within each research article and are now being run through a meta-analytic model. Our preliminary results will provide an understanding of how multiple environmental factors impact reptile developmental plasticity. Environmental change is multifaceted and complex - impacting more than just temperature. Our study will help us understand how changes in soil moisture may affect reptile development and highlight potential consequences for populations impacted by environmental change.

5-minute

In-person

Student

6

Packed in: Exploring sympatry and niche space in *Ctenotus* skinks

Nicholas A. Cairns¹, Eric R. Pianka²

¹Val Marie, SK, Canada. ²University of Texas, Austin, TX, USA

Abstract

How species, in particular closely related species, persist together in sympatry, is at the core of our understanding of community ecology, biodiversity and evolution. In sympatry, the ecological conditions which species can be exposed to are roughly the same but increasing species richness shrinks the relative availability of resources or niche space. This may lead to niche partitioning, the process whereby selection drives differential patterns of resource use between competing species to minimize overlap. This is reflected in the physical and ecological traits of individual species. While universal in scope, these phenomena are likely best investigated using models with broad patterns of sympatry, known phylogenetic relationships and which can be investigated along a number of ecological dimensions. *Ctenotus* are a hyperdiverse genus of skinks in Australia, with more than 100 named species. In the Great Victoria Desert this genus can be particularly speciose and can reach extremely high rates of sympatry with more than 10 congeners co-occurring at the same site. Our aim is to describe how multiple species of *Ctenotus* coexist in sympatry. We use microhabitat, patterns of diel and thermal activity, reproductive biology, morphology, and diet data from thousands of lizards generated from 40 years of active capture and pitfall trapping. Combining this with phylogenetic relationships, we will generate an estimated niche for each species in community and compare them to better understand how this many congeners can persist together. Analysis is ongoing but to date we have interesting patterns partitioning along a number of axes. Among the species examined some appear to be more specialized and some more generalized. Some relatively phylogenetically distant species display convergence but often with notable partitioning along one or more axes. *Ctenotus* appears to present extensive ecological and evolutionary lability which likely allows for such remarkable levels of sympatry.

Platform

In-person

7

Ecology of species at risk turtles within the footprint of a proposed highway expansion and transmission line

Brooke Carroll¹, Samantha Noganosh², Jacqueline D. Litzgus¹

¹Laurentian University, Sudbury, Ontario, Canada. ²Department of Lands and Resources, Magnetawan First Nation, Britt, Ontario, Canada

Abstract

Habitat destruction and loss are the leading causes of declines for populations of many wildlife species. The traditional lands of Magnetawan First Nation (MFN) were recently bisected by development of a power transmission line and are threatened by a pending highway expansion that will further destroy and fragment wetlands, uplands and forests that until now, have remained relatively pristine. MFN lands are home to diverse species at risk reptiles that are already facing population declines due to road mortality and habitat destruction. The loss of critical habitats within the footprints of these developments may contribute to the ongoing decline of these vulnerable species. Our research will take a Two-Eyed Seeing approach, combining Indigenous ways of knowing with Western science to provide site-specific ecological data that can be used to inform decision making around protecting reptiles during and post development. Within proposed areas of destruction, we aim to quantify ecological attributes of at-risk turtles, such as abundance, home range, and daily movement patterns. Using visual encounter surveys and various trapping methods we will locate at-risk turtles within and nearby the developments, and outfit captured individuals with radio transmitters to collect habitat use data and to identify critical habitat features. During the 2022 pilot field season we tracked turtles ($n = 11$) twice per week and have collected over 150 location points across our study area. We aim to increase the number of turtles we are tracking ($n = 16$), and to locate more individuals directly within the development footprints, as so far all but one individual has been captured in adjacent habitats. The findings of our study will improve our understanding of the spatial ecology of these turtles, help to identify critical habitats, and will inform conservation and mitigation plans to protect them.

5-minute

In-person

Student

8

Temporal changes in age and size at maturity of male Painted Turtles (*Chrysemys picta*) in response to climate change

Lilian T.Y. Chan¹, Jessica A. Leivesley¹, Njal Rollinson^{1,2}

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²School of the Environment, University of Toronto, Toronto, ON, Canada

Abstract

In the past decades, rapid anthropogenic activities have rapidly intensified climate change, leading to a shift in the timing of life-history transitions. How climate change influences the age and size at sexual maturity of freshwater turtles, however, is not well studied. Here, we estimate the age and size at maturity of male painted turtles (*Chrysemys picta*) from Algonquin Provincial Park, Ontario, and test whether they have changed in recent years using long-term data from 1978 to 2021. As the current literature shows that a warmer climate will likely increase the growing season, we predict that the age at maturity will decrease while the size will increase, since theory suggests that favourable growth conditions may cause maturation to occur earlier and at a larger size. We assume maturation of a male turtle occurs when he reaches the claw length at which claws are experiencing maximum growth rate at the population level. We find that the age at maturity did not change significantly with time, but the size at maturity has increased from 8.98 cm in 1990 to 9.95 cm in 2021. Our findings suggest that the longer growing season has led to a higher juvenile growth rate. This study demonstrates that life history traits are plastic and can respond to climate change.

Platform

In-person

Student

9

Acoustic signal variability of trilling chorus frogs in Ontario

Ying Chen, Stephen C. Lougheed

Queen's University, Kingston, Ontario, Canada

Abstract

Male advertisement calls are the primary mating displays in many anurans. Recognizing conspecific calls is important for finding appropriate conspecific mates with which to mate. Divergence in mate recognition systems can be a powerful premating isolation mechanism contributing to speciation. However, some species lack call divergence altogether (and other factors may play a role in keeping gene pools separate), while others have marked intraspecific variation. Ecological and abiotic factors play an important role in shaping call variation. Trilling chorus frogs in Ontario possess one of two deeply-diverged mitochondrial genomes (*Pseudacris maculata* and *P. triseriata*), but much shallower divergence in nuclear genomes, implying a complex evolutionary history. Data on call variability are scarce which precludes using acoustic insights to clarify species status. Recognizing this deficit, we quantified dominant frequency, pulse number and call duration from passive automated acoustic recordings of chorus frogs and compared them with data of *P. maculata* from the literature.

5-minute

Virtual

Student

10

Using droplet digital PCR to assess breeding phenology in chorus frogs in Ontario

Ying Chen, Orienne Tournayre, [Haolun Tian](#), Stephen C. Lougheed

Queen's University, Kingston, Ontario, Canada

Abstract

Climate change has driven phenological shifts in many amphibians, leading to phenological mismatches and conservation concern in many taxa. Collecting data with high spatiotemporal sensitivity can help determine changes in emergence and breeding, which are important for conservation planning. Investigating phenology in rare or cryptic species can be challenging due to difficulties in detection. In this study, we tested eDNA as a non-invasive tool to investigate the breeding phenology of a breeding assemblage of trilling chorus frogs in Eastern Ontario. Based on automated acoustic recorder data, a single male calling began on March 31st 2022, when the focal marsh was largely frozen but when maximum daytime air temperatures reached above 5°C. Using droplet digital PCR (ddPCR), *Pseudacris maculata* eDNA signal was detected in water samples on April 6th, six days after the first male called. The strength of eDNA signal was positively related to number of males were calling, implying that eDNA is a reasonable proxy for calling assemblage size. There are some mitigating factors to consider. No eDNA signal was detected on April 8th despite evidence of males calling, likely due to precipitation. PCR inhibition was detected in some samples (probably the result of humic substances in some water samples), limiting eDNA detection and quantification using ddPCR. Our results suggest that ddPCR eDNA may be useful for early detection of some species with low biomass and low DNA shedding rate in lentic environments such as wetlands, but there remain technical challenges and repeated spatiotemporal sampling coverage is needed for reliable detection.

Platform

Virtual

Student

A systematic review of snake translocations to identify potential tactics for reducing post-release effects

Jonathan D. Choquette^{1,2}, Jacqueline D. Litzgus¹, Joanne X.Y. Gui², Trevor E. Pitcher³

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Abstract

Advancements in the field of reintroduction biology are needed, but an understanding of how to effectively conduct translocations, particularly with snakes, is lacking. We conducted a systematic review of snake translocation studies to identify potential tactics for reducing post-release effects. We included studies on intentional, human-mediated wild-wild, or captive-wild translocations to any location, regardless of motive or number of snakes translocated. Only studies that presented results for at least 1 of 4 outcomes (movement behaviour, site fidelity, survival, or population establishment) were included. We systematically searched 4 databases for published studies and used 5 methods to search the gray literature. Our search and screening criteria yielded 121 data sources, representing 130 translocation cases. We quantified the association between 15 translocation tactics and short-term translocation outcomes by calculating odds ratios and using forest plots. Snake translocations involved 47 species (from mainly 2 families), and most were motivated by research, were monitored for at least 6 months, occurred in North America, and took place from the 1990s onward. The odds of a positive snake translocation outcome were highest with release of captive-reared or juvenile snakes, release of social groups together, delayed release, provision of environmental enrichment or social housing before release, or minimization of distance translocated. The odds of a positive outcome were lowest when snakes were released early in their active season. Though our results do not demonstrate causation, outcomes of snake translocation were associated with 8 tactics (4 of which were strongly correlated); in addition to targeted comparative studies, we recommend practitioners consider the possible influence of these tactics when planning snake translocations.

Platform

In-person

Student

12

Impacts of a windfarm and wildfire on the spatial ecology and habitat selection of an endangered freshwater turtle

Stéphanie J. Delay¹, John Urquhart², Jacqueline D. Litzgus¹

¹Laurentian University, Sudbury, Ontario, Canada. ²Blazing Star Environmental, Oshawa, Ontario, Canada

Abstract

Wind is a source of renewable energy, and its use is projected to increase as governments look for solutions to reduce carbon emissions. Although wind energy presents many advantages, windfarms can pose risks to wildlife. We used a post-hoc design to investigate whether body condition, spatial ecology, and multiscale habitat selection by spotted turtles (*Clemmys guttata*) differed among three treatment sites in central Ontario: Control, windfarm (Wind), and combined post-wildfire and windfarm (Windburn). We outfitted 9-10 turtles per treatment with VHF radio transmitters and tracked them approximately twice per week throughout the active season. Body condition, home range size and minimum daily distances moved by turtles did not differ among treatments, but it is possible that we did not detect responses to the habitat modification because our study was conducted 2 years post-construction and 2.5 years post-wildfire, so habitat recovery had begun and turtles possibly had sufficient time to adapt their behaviours. Turtles did not avoid habitats near turbines or roads but also did not cross roads unless a semi-aquatic culvert was present, highlighting the need to maintain habitat connectivity. In Windburn, turtles used wet depressions on rock barrens while Control and Wind turtles did not, possibly because Windburn turtles were exploiting new early successional macrohabitat resulting from the wildfire; however, pre-wildfire movement data would be required to confirm cause. In all treatments, turtles selected microhabitat based on temperature, water depth, available cover, and hummock presence, suggesting that turtles were able to find suitable microsites in the modified landscapes of our study area. Our study is one of the first to assess impacts of windfarms on semi-aquatic turtles, an at-risk and understudied taxon on windfarms, but more research is required to understand the acute and long-term impacts of windfarms and wildfires on turtles to inform data-driven mitigation strategies.

Platform

Virtual

student

13

Survival of chorus frogs in natural and restored environments

Jeanne Dudemaine¹, Marc J. Mazerolle¹, Vance L. Trudeau², Aurore Fayard¹, Emiko Wong³, Odile Colin³, Lyne Bouthillier⁴, Catherine Doucet⁴, Sophie Tessier⁵

¹Université Laval, Québec, Québec, Canada. ²University of Ottawa, Ottawa, Ontario, Canada. ³Biodome de Montreal, Montreal, Québec, Canada. ⁴Ministère des Forêts, de la Faune et des Parcs, Québec, Québec, Canada. ⁵Société des établissements de plein air du Québec, Québec, Québec, Canada

Abstract

Several amphibian species have experienced population declines in recent decades. The Great Lakes, St-Lawrence, Canadian shield populations of the western chorus frog (*Pseudacris triseriata*) has suffered reductions in its distribution. Wetland habitat loss following urban expansion is one reason of the decline in the Montérégie area of southern Quebec. Different tools have been considered to promote the conservation of the species, including releasing individuals in restored environments. Our project aims to evaluate the persistence of chorus frog populations following reintroduction in restored habitat. The project has three objectives: (1) to assess the abundance and survival of individuals in reintroduced populations and compare them to natural populations, (2) to determine the impact of larval density in mesocosms on short term and long-term survival, (3) to evaluate the use of environmental DNA to estimate the abundance of individuals.

In 2021, we released 732 metamorphs in two constructed ponds in Parc national du Mont-Saint-Bruno. We conducted a capture-mark-recapture study in three natural ponds and three constructed ponds during the 2022 breeding season. One of the three natural populations became extinct, whereas the two other natural populations had a low number of adults captured (12-20 individuals). At the ponds constructed for chorus frog reintroduction, we captured adults released the year before as metamorphs, although captures were low (5-10 individuals). We reared a total of 1191 individuals in mesocosms during the summer 2022, distributed along six larval densities. A total of 583 individuals reached metamorphosis. Preliminary results show that individuals reached metamorphosis at a lower size and weight when reared at higher density. The metamorphs were marked with Visible Implant Elastomer and released in two constructed ponds. The results obtained from this project will allow us to better orient reintroduction efforts to promote the persistence of introduced populations.

Poster

In-person

Student (not judged)

14

Does urbanization impact the prevalence of defensive behaviours in redbelly (*Storeria occipitomaculata*) and common garter snakes (*Thamnophis sirtalis*)?

Ella Eberhardt, Gabriel Blouin-Demers

University of Ottawa, Ottawa, Ontario, Canada

Abstract

Urbanization is the expansion of human presence through the development of infrastructure such as roads and buildings and is a major threat to wildlife. Urbanization can disturb natural habitats and displace species, causing them to wither adapt or move elsewhere. Reptiles in Canada are faced with challenges due to their lifestyle and are increasingly affected by the expansion of urban regions. As such, there are major impact on snake biodiversity; however, the effects of urbanization on snake behaviour is less well studied. I tested the hypothesis that increasing urbanization will impact defensive behaviours of redbelly snakes (*Storeria occipitomaculata*) and common garter snakes (*Thamnophis sirtalis*) in the Ottawa-Gatineau region. I captured snakes between May and August 2021 under cover board arrays. During capture, all snakes were filmed continuously, and I used the recordings to tally defensive behaviours. There was no significant relationship between degree of urbanization based off land usage and degree of defense displayed by captured snakes; however, there may be other factors at play that were not accounted for in this study such as foot traffic or noise disturbance.

Poster

In-person

Student

CHS / SHC Fredericton 2022

15

Semen collection from Canadian snakes

Ginger C. Elliott¹, Sarah Jane Stanger-Guy²

¹African Lion Safari, Cambridge, ON, Canada. ²Scales Nature Park, Oro-medonte, ON, Canada

Abstract

Biodiversity is declining at an unprecedented rate, with reptiles and amphibians being the most at risk group of land vertebrates (IUCN RedList, 2021). Of the 61 reptiles with assessed by the Committee on the Status of Endangered Wildlife in Canada, only 5 were designated not at risk (COSEWIC, 2021). Yet, only one native Canadian snake, the Massasauga Rattlesnake, has a Species Survival Plan. Recovery efforts include the maintenance of an ex situ (in human care) population, which serves against extinction in the wild, and is the focus of conservation breeding for reintroduction. Assisted reproductive technologies (ART) have proven beneficial in conservation breeding programs for many species at risk (Young et al 2021). While ART has had limited use among reptiles, the simple structure of the female reproductive tract that is maintained throughout snake family groups, suggests that Artificial Insemination could be successfully implemented. The integration of ART to conservation breeding programs would help managers to meet goals to maintain genetic diversity, even enabling transfer of genetic material (i.e. gametes) between wild and captive populations (Oliveri et al 2018). However, there are technical challenges that must be addressed before the potential of ART can be realized among the zoological industry. These include developing suitable sperm collection and assessment protocols and protocols for the preservation of snake spermatozoa (Oliveri et al 2018). The goal of our preliminary work is to refine techniques for collection of snake semen as applied to snake species in Canada, including Gartersnake (*Thamnophis*), Western Hognose Snake (*Heterodon nasicus*), Northern Watersnake (*Nerodia sipedon sipedon*) Blue Racer (*Coluber constrictor foxii*), Eastern Foxsnake (*Pantherophis gloydi*), Eastern Milksnake (*Lampropeltis triangulum*) and Grey Ratsnake (*Pantherophis spiloides*).

Poster

In-person

16

Invertebrate and vertebrate species sensitivity distribution for insecticides derived from insecticidal toxins of *Bacillus thuringiensis*

Madelaine A. Empey, Monica Y. Reyes, Vance L. Trudeau

University of Ottawa, Ottawa, Ontario, Canada

Abstract

Information on how insecticides containing toxic proteins from *Bacillus thuringiensis* (Bt) affect non-target organisms is largely unknown. Effects on Canadian species have also been undetermined despite the wide application of Bt insecticides. Acute toxicity tests (96-h LC50 estimates) of Bt *israelensis* (VectoBac 200G®, potency of 200 ITU/L) on northern leopard frog (*Lithobates pipiens*) and chorus frog (*Pseudacris maculata*) tadpoles were conducted. The median lethal concentration of these species were 75 500 and 70 560 ITU/L, respectively. These LC50 values were compared to others using Species Sensitivity Distribution (SSD) curves constructed from median lethal concentrations of Bt insecticides (International Toxicity units for spp. *israelensis*, *kurstaki*, and *sphaericus*) obtained from published peer-reviewed literature. LC50 estimated for anurans is approximately 400 times higher than for certain target species such as the mosquito, *Aedes aegypti*. It was found that some non-target Dipterans and Lepidopterans may be at risk. Canadian anurans were found to be more tolerant than South American counterparts. There are large gaps in data regarding the susceptibility of fish, amphibians, and mammals. The use of SSDs is important to assess which organisms are most at risk, and how to mitigate possible ecological effects in habitats in which these agents are applied. Funding: City of Ottawa, University of Ottawa Research Chair in Neuroendocrinology (VLT).

Platform

In-person

Student

17

Conspecific cues enhance egg viability in the captive breeding of boreal chorus frogs (*Pseudacris maculata*)

Jeffrey P. Ethier¹, Megan Worth¹, Marc J. Mazerolle², Vance L. Trudeau^{1,2}

¹University of Ottawa, Ottawa, Ontario, Canada. ²Université Laval, Quebec City, Quebec, Canada

Abstract

Captive breeding of amphibians is progressively improving due to advancements in assisted reproductive technologies. Hormone injections can induce spawning in amphibian species that would otherwise not reproduce in captivity due to a lack of natural social and environmental cues. Nevertheless, spawning success and gamete viability under captive conditions remains low in many species. We hypothesized that social cues can be used to increase the number of eggs produced, improve egg viability, and increase the survival of offspring post-hatching. To test these, we broadcasted recordings of either conspecific calls or sounds recorded near natural ponds (*i.e.*, background sounds from wind, rain, insects) just prior to the breeding season to groups of captive pre-spawning male and female boreal chorus frogs (*Pseudacris maculata*). Both sexes were injected with a hormone mixture to induce spawning during the 2021 breeding season. We found that the number of spawning pairs, the number of eggs produced, and the number of eggs per spawning female did not differ between groups. Egg viability in groups exposed to conspecific calls was 18% higher (80%) compared to groups exposed to natural pond sounds (62%) ($F_{1,6} = 6.25$, $p = 0.047$). A larger percentage of offspring survived to 46 days post-hatching in groups exposed to conspecific calls (75%) compared to groups exposed to natural pond sounds (67%), but this difference was not statistically significant ($F_{1,13} = 1.51$, $p = 0.241$). Conspecific calls likely enhance effects hormone injections to activate the reproductive axis, resulting in higher quality gametes. These results indicate that social cues, such as conspecific calls, can improve the number of offspring that are produced in captivity, aiding amphibian conservation projects. Funding: NSERC, ECCC and MFFP.

Platform

In-person

student

18

Why do freshwater turtles aggregate at basking sites?

Malcolm Fenech¹, Grégory Bulté², Gabriel Blouin-Demers¹

¹University of Ottawa, Ottawa, Ontario, Canada. ²Carleton University, Ottawa, Ontario, Canada

Abstract

Aggregation occurs in many animals and is defined as the tendency for individuals to be spatially closer to one another than what would be expected by chance. Animals, including reptiles, aggregate for both asocial and social reasons. Freshwater turtles, in particular emydid turtles are well known to aggregate at basking sites but it remains unclear why they do so. Basking aggregations may occur because high-quality basking sites are limited, or because aggregation increases the detection of predators. We tested these two hypotheses with northern map turtles (*Graptemys geographica*) and painted turtles (*Chrysemys picta*), two locally abundant species that aggregate at basking sites. We conducted 75 days of basking surveys at Petrie Island, Ontario, Canada, documenting 1804 observations across 259 basking sites. At each basking site, we measured the available basking area, canopy coverage, and distance to the nearest shoreline. Larger aggregations of basking turtles occurred at sites with more available basking area, more open canopy, and a further distance from the shoreline. Additionally, we conducted controlled disturbance trials of basking turtles and measured flight initiation distance. Turtles in larger aggregations left basking sites from further away than in smaller aggregations or individual basking turtles. Our study highlights the importance of available basking sites with preferred habitat characteristics where freshwater turtles choose to aggregate and that aggregation at basking sites increases predator detection.

Platform

In-person

Student

19

Differing effects of competition across years between two closely related larval amphibians

Jessica Ford, David Green

Redpath Museum, McGill University, Montreal, Quebec, Canada

Abstract

In order to avoid extinction due to competitive exclusion, species will often resort to habitat partitioning, in which species use different habitats, or different parts of a habitat, in order to reduce interspecific competition. It can be difficult to determine if different habitat use is due to niche partitioning, or habitat selectivity, once species have established in different portions of their habitat. At the edge of ranges, species may naturally co-occur and compete strongly again. In Long Point, Ontario, the Fowler's toad (*Anaxyrus fowleri*) is at the northern edge of its range and overlaps with the more common American toad (*Anaxyrus americanus*). Amphibian species are expected to compete strongly at their tadpole stage, when they are in the highest densities. Thus, to determine if these species compete strongly in local pond environments, we reared both species together, and apart, in mesocosms mimicking natural habitats in 2018 and 2021. We measured survivorship to, weight at, and time to metamorphosis for both species. We determined that the presence of *A. americanus* always had a detrimental effect on *A. fowleri*. Notably, however, this effect presented itself differently across years. In 2018, the presence of *A. americanus* reduced survivorship of *A. fowleri*, whereas in 2021 the presence of *A. americanus* reduced the weight at metamorphosis of *A. fowleri*, but not affect the survivorship. Our study suggests that competitive exclusion is occurring at the edge of *A. fowleri* range, and demonstrates the importance of studying species interactions across multiple years.

Platform

Virtual

Student

Evaluating the effectiveness of wildlife exclusion fencing in preventing wildlife-vehicle collisions of herptiles in Toronto, Ontario.

Kari Gunson¹, [Donnell Gasbarrini](#)²

¹EcoKare International, Peterborough, ON, Canada. ²Adopt-A-Pond/Toronto Zoo, Toronto, ON, Canada

Abstract

Wildlife exclusion fence (WEF) is a common technique to reduce wildlife-vehicle collisions, however, WEF for herptiles has shown variable effectiveness in Ontario. Here we summarize the effectiveness of WEF after monitoring a 340 m section of fence installed on the east and west sides of the Scarborough-Pickering Townline Road in Rouge Urban National Park (Toronto, ON). We analyzed the road mortality by taxa for turtles, snakes, amphibians, and small mammals separately to assess sample size for analysis. We looked at road mortality along three spatial configurations:

Scenario 1) 150 m of WEF on both sides of the road.

Scenario 2) Scenario 1, plus 40 m WEF extension on the east side of the road only.

Scenario 3) Scenario 2, plus 30 m beyond furthest reach of WEF at each end.

Our findings showed that the WEF was effective for all taxa combined and for amphibians when there was WEF on both sides of the road but not for the other two scenarios where fence-end effect was taken into account. This is LIKELY because animals moved along the WEF to the fence ends and crossed the road instead of being directed into the ecopassage. Additionally, there were multiple animals that breached the fence by climbing, jumping, or moving through weak points such as gaps or holes. These findings show that studies monitoring only the extent of WEF without also monitoring fence-end buffers may incorrectly claim effectiveness without accounting for fence-end effects. Furthermore, this type of analysis is challenging because sample sizes are often too low for animals such as freshwater turtles to adequately assess taxa-specific before and after differences in road mortality. We recommend that future WEF installations commit to regular maintenance, including the entire habitat plus adequate fence-end buffers. Additionally, escape jump-outs should be incorporated for sections where WEF is present on only one side of the road.

5-minute

In-person

CHS / SHC Fredericton 2022

21

There's something in the water: steps to understanding the cues for Oregon spotted frog (*Rana pretiosa*) breeding

Andrea Gielens

Wildlife Preservation Canada, Aldergrove, BC, Canada

Abstract

Reduced to a handful of declining and fragmented populations in the wetlands of B.C., the Oregon spotted frog is Canada's most imperiled amphibian, and listed as Vulnerable in the IUCN Red List. Conservation breeding and reintroduction is a necessary step to bring this species back from the brink. Ex situ recovery efforts have been ongoing for this species in some capacity since 1999. Captive breeding efforts have included many different strategies which have had limited success; until recently the program experienced low egg production and egg viability. However in 2021, males and females overwintered in separate enclosures were introduced in the female overwintering enclosure at the onset of observed breeding congregation in the wild. The result was a dramatic increase in the number of females who laid as well as the fertility of those egg masses. These methods and results were replicated in 2022. The program has seen an increase of an average of under 2000 to over 20,000 fertile eggs a year. While the mechanism behind this phenomenon requires further study, this breakthrough has provided significantly more animals for release, benefitting reintroduction goals. We have also seen a decrease in the incidence of egg binding thus enhancing the long term survival of females in the ex situ breeding colony.

5-minute

In-person

22

The efficacy of two novel treatments (Ponazuril and Humatin) for *Cryptosporidium* sp. in Western Painted turtles (*Chrysemys picta bellii*)

Andrea Gielens¹, Adrian Walton²

¹Wildlife Preservation Canada, Langley, BC, Canada. ²Veterinarian, Maple Ridge, BC, Canada

Abstract

Since 2011, an ex situ hatching and rearing program for Western Painted Turtle (*Chrysemus picta bellii*) has occurred annually in British Columbia as part of recovery efforts for the endangered Pacific Coast subspecies. Guided by the provincial recovery team, the program has grown from 20 individuals to more than 200 releases per year, to support reintroduction and reinforcement efforts for populations from the Sunshine Coast to Metro Vancouver and the Fraser Valley. In recent years there have been observed occurrences of what has been colloquially called "soft shell" within the headstarted turtle cohorts while in captivity. While the shell appears externally normal, after several months the relatively soft shell of the young hatchling does not harden as expected, and instead becomes increasingly soft; affected individuals have increased mortality. When first observed in 2014, between 8% of the hatchlings were affected by soft-shell, but this rose to 28% in 2020. Initial pathology reports suggested a generalized diagnosis of Metabolic Bone Disease (MBD). However, further consultations with veterinarians and food science specialists and lab analyses resulted in a diagnosis of intestinal Cryptosporidiosis. These protozoan infections are not well characterized in reptiles, and there have been limited studies on infections in turtles. Treatment with anti-parasitic medication and disinfection of equipment with a non-chlorine based oxidizing agent can decrease or eliminate parasitic load in the individual and ex situ environment. We present the results of a hatchling treatment trial using Ponazuril and Humatin to decrease parasite load and increase survival in hatchling Western Painted Turtles. The aim of this study was to assess the effectiveness of two novel treatments for *Cryptosporidium* in chelonians, specifically Western Painted turtles.

Platform

In-person

23

How do roads affect populations of northern snakes?

Andrea E.S. Gigeroff, Gabriel Blouin-Demers

University of Ottawa, Ottawa, Ontario, Canada

Abstract

The greatest driver of the current global biodiversity crisis is habitat loss. Roads are a major contributor to habitat loss because they destroy and fragment habitat, in addition to causing direct mortality. Animals may respond to roads either by avoiding them, thus leading to population isolation, or by attempting to cross them, thus potentially leading to increased mortality and, if so, also to population isolation. We studied the impact of road density on the abundance of two northern snake species: the redbelly snake (*Storeria occipitomaculata*) and the garter snake (*Thamnophis sirtalis*). We hypothesized that roads are detrimental to snake populations due to road avoidance and road mortality. Therefore, we predicted that snakes should be less abundant at sites with higher road density in their surroundings. I also hypothesized that snakes in areas of high road density would be killed on roads before reaching full size. Therefore, we predicted that snakes should be smaller at sites with higher road density in their surroundings. We deployed cover boards at 28 old field sites along a gradient of road density in 2020-2021. We visited sites weekly, counted the number of unique individuals, and measured their snout-vent length.

We captured fewer garter snakes at sites surrounded by more roads, and fewer redbelly snakes at sites surrounded by more urban areas. We did not detect a statistically significant effect on size of either species. The effect of roads and urban area were not strong, suggesting that though roads do have an impact on populations of northern snakes, that effect may be small relative to other factors. Perhaps garter and redbelly snakes are more resilient to the effects of roads and urbanization than other northern reptile species given their small size, and thus restricted movements, and their extensive use of disturbed habitats such as old fields.

Poster

In-person

Student (not judged)

CHS / SHC Fredericton 2022

24

How's it going? Tracking land-based conservation of herpetofauna in B.C from 2010 to 2021

Matt Morrison¹, Lindsay Anderson², Leigh Anne Isaac³, Megan Winand³, [Purnima Govindarajulu³](#)

¹B.C. Ministry of Environment, Nelson, BC, Canada. ²B.C. Ministry of Land Water Resource Stewardship, Nelson, BC, Canada. ³B.C. Ministry of Land Water Resource Stewardship, Victoria, BC, Canada

Abstract

British Columbia (B.C.) has 32 native species of herpetofauna, of which over half are species of conservation concern. To understand patterns of investment in land-based herpetofauna conservation projects we compiled a database through report reviews and surveys. Collating data was challenging as tracking and reporting was inconsistent and uncoordinated. Nevertheless, we assembled a list of 214 projects (from 2010-2021) and categorized project activities using the Conservation Measures Partnership (CMP) classification. Highest investment effort was in Conservation Designation and Planning, focusing on private land conservation covenants (n=81 projects), followed by Land/Water management, focusing primarily on wetland restoration/creation (n=60 projects) and Research and Monitoring (n=47 projects). The projects were funded by diverse sources (n=29) and most projects were funded by multiple partners. Exact project costs were not available and therefore projects were classified in cost categories, with most projects falling within the \$20,000-\$100,000 cost range. Total investment was estimated at 5 million (cumulative sum of number of projects in each cost category) but is an underestimate as costs were not reported for 60% of projects (n=129). Approximately half of the projects (n=133) listed a primary species/ group as a target, with Western Painted Turtle (n=15), Red-Legged Frog (n=14) and Western Toad (n=13) listed as top target species. The projects were distributed across BC, with most in the southern regions. Post-completion, 18% of projects were monitored (n=40) and 11% were maintained (n=23) on an annual basis. This analysis shows our understanding of the patterns and the efficacy or sustainability of land-based conservation of herpetofauna in B.C. is limited. This pilot analysis reveals the need to 1) track conservation projects more thoroughly, 2) build in capacity to assess effectiveness of investments, and 3) adaptively improve strategic planning if we hope to implement effective conservation of herpetofauna in B.C.

5-minute

In-person

CHS / SHC Fredericton 2022

25

Axanthism in Green Frogs (*Lithobates clamitans*) and its geographic distribution

Stephen J. Hecnar, Darlene R. Hecnar, Daniel J. Brazeau

Lakehead University, Thunder Bay, ON, Canada

Abstract

Colouration in amphibians varies among species and can vary with environmental factors or show trends within species ranges. Colour and pattern are important for crypsis and advertisement, and natural selection may eliminate colours or patterns that deviate from the best survival strategy. Axanthism is a rare aberrant colour trait caused by disorders of chromatophores. Blue-coloured individuals have been found in over 20 amphibian species and most often in the Family: Ranidae. Our goal was to build a database of axanthism in Green Frogs and to examine its extent and geographic distribution. We compiled our records with those provided by colleagues, and with those found by searching the literature and online sources. We also solicited records by advertising on herpetological organizations websites. As of 2022, we have compiled records of over 300 individuals from over 200 locations across the species range. Colour ranged from dark to light blue or turquoise with extent varying from small patches to complete dorsal and lateral coverage on individuals. Significantly more blue females than blue males were found. To examine geographic distribution, we found the gravitational centre of the species range and divided the range into four quadrats (N,S,E,W). Next we plotted location coordinates and tested observed versus expected records based on area. This rare colour aberration (<0.124% prevalence) occurred nearly exclusively in the northern portion of the species range and increased eastward. Explanation for the cause of the distribution and how it affects populations and individuals remain unknown.

Platform

Virtual

26

Ontogenetic variation in Western Rattlesnake (*Crotalus oreganus*) migratory tactics in British Columbia

Chloe R. Howarth¹, Karl W. Larsen¹, Christine A. Bishop²

¹Thompson Rivers University, Kamloops, BC, Canada. ²Environment and Climate Change Canada, Delta, BC, Canada

Abstract

Migration is a phenomenon central to many animals' ecology, allowing individuals to respond to changes in resource availability and exploit habitats favourable for critical life-history processes. Yet, migratory behaviour is not always ubiquitous within populations: multiple tactics can exist, often related to age class, sex, or reproductive condition. For Western Rattlesnakes (*Crotalus oreganus*) at the northernmost extent of their range (British Columbia - BC), seasonal migrations between hibernacula and summer ranges provide access to essential food resources and mates. Multiple studies by our group has revealed immense variation in migratory behaviour and habitat use within and between populations. While several studies have investigated the movements of adult rattlesnakes and a handful have explored neonatal den location behaviour, little information exists regarding the ontogeny of rattlesnake migration behaviour; in general, juveniles are a grossly understudied rattlesnake demographic. We are considering whether ontogenetic shifts in migratory strategies (seen in many other species) occur in our study populations, and whether the variation seen in adult rattlesnake migration is present from a young age. We used radio-telemetry to assess juvenile outbound spring movements at a study site near Osoyoos, BC, and collected habitat data along their movement pathways. Our preliminary results, comparing our juvenile data to existing adult radio-telemetry data from the same hibernacula, indicate that the variation seen in adult rattlesnake migration also is present in juveniles to some degree, and that these younger animals select habitat with high rock and woody-debris cover at multiple spatial scales. This work is providing vital information for developing conservation strategies that recognize varying types of migratory behaviour in a threatened species.

Platform

In-person

Student

27

Egg binding in amphibians: insight from Canada's most endangered anuran, the Oregon Spotted Frog (*Rana pretiosa*)

Briar Hunter¹, David Lesbarrères^{1,2}, Gabriela Mastromonaco^{3,1}

¹Laurentian University, Sudbury, ON, Canada. ²Environment and Climate Change Canada, Sudbury, ON, Canada. ³Toronto Zoo, Toronto, ON, Canada

Abstract

Egg binding, otherwise known as post-ovulatory stasis or dystocia, has long plagued animal breeding programs. The secondary complications and consequences of this failure to lay mature eggs are well documented in managed amphibian populations but its causes remain poorly understood. We used the Oregon Spotted Frog (*Rana pretiosa*) to investigate this issue due to their well-established, multi-zoo breeding program and the high incidence of documented egg binding therein. While this species may have a natural tendency to retain eggs, we believe mortality resulting from said retention is only seen ex situ. Using morphometrics, we compared the body-mass index from egg bound frogs in zoos to a decade of data collected on wild populations. We also used ultrasound technology and video recordings to monitor female follicular development and amplexus behaviour over the 2022 breeding season to better understand cases of egg retention. We asked how initial egg development, amplexus frequency and duration, female age and genetic origins contributed to the number of egg binding cases seen this year. While this physiological condition remains complex, our study is shedding much needed light on this issue, with far-reaching implications for amphibian conservation breeding programs worldwide. Additionally, this research continues to inform and improve the cohesiveness of Oregon Spotted Frog recovery efforts, ensuring their persistence in our Canadian landscape.

Platform

In-person

Student

The Canadian BioGenome project

Samantha J Jones¹, Jackie Litzgus², Pamela Rutherford³, Maribeth Murray⁴, Steven J.M. Jones^{5,6}

¹Canada's Michael Smith Genome Sciences Centre, Vancouver, British Columbia, Canada. ²Laurentian University, Sudbury, Ontario, Canada. ³Brandon University, Brandon, Manitoba, Canada. ⁴University of Calgary, Calgary, Alberta, Canada. ⁵Canada's Michael Smith Genome Sciences Centre, Vancouver, British Columbia, Canada. ⁶University of British Columbia, Vancouver, British Columbia, Canada

Abstract

Canadian biodiversity is one of our greatest national treasures. From coast to coast to coast, Canada is home to approximately 80,000 plant and animal species, in environments ranging from desert to the arctic. Many of these species are under threat due to rapid changes in climate and other human-led impacts on our environment. The Canadian BioGenome Project seeks to better understand and conserve our natural heritage by sequencing the genomes of four hundred Canadian species. Working with scientists, conservation groups and other affiliated Earth BioGenome Projects, we will identify species where a genome will aid in their conservation and increase our understanding of their underlying biology and populations. The species we sequence are selected based on existing and established priorities of Indigenous peoples, federal (e.g., DFO, ECCC, Parks) and provincial (e.g., Alberta Environment and Parks, ROM, MNB) organizations, and conservation and wildlife groups (e.g., African Lion Safari, Wildlife Preservation Canada, Toronto Zoo). These organization have a history of (or a strong interest in) using genomic information to develop tools and solutions for the maintenance of biodiversity, monitoring, conservation, restoration and environmental management. The data generated will be easily accessible through a user-friendly geospatial platform of metadata and genomics data.

Canada has approximately 100 reptiles and amphibians, more than half of which have been listed as Endangered, Threatened, or Special Concern by COSEWIC. We're seeking input of which species should be sequenced first, as well as access to samples for sequencing.

Platform

In-person

29

Comparative phylogeography of five co-distributed frogs in central Africa

Gregory F.M. Jongsma

New Brunswick Museum, Saint John, NB, Canada. Florida Museum of Natural History, Gainesville, FL, USA

Abstract

Identifying the processes that drive and maintain diversity in the tropics is a major challenge. Using genome-wide sampling, we tested the role of well-established diversification mechanisms: 1) forest refugia, 2) riverine barriers, and 3) ecological gradients on five co-distributed frog species in the Lower Guinean Forest (LGF) in Central Africa. The complex of overlapping biogeographic features in the LGF makes disentangling mechanisms that initiate divergences difficult. Taking an integrative approach combined with strategic field sampling, we identified the primary mechanisms of diversification and characterized secondary mechanisms that shape population structure after the divergence event. Demographic models support that forest refugia are the primary mechanism of divergence in three of the species and ecological gradients for two species. There was little morphological or environmental differentiation between populations of *Amnirana albolabris*, running counter to the ecological gradient mechanism. We propose an alternative parapatric mechanism of divergence: the semipermeable barrier. Lastly, we demonstrate that rivers play an important role in reinforcing divergences initiated by forest fragmentation.

Platform

In-person

30

Artificial displacement alters movement behavior of a terrestrial amphibian

Nathalie Jreidini, David M. Green

McGill University, Montreal, QC, Canada

Abstract

Homing abilities have been widely documented in amphibians, but it remains unclear whether individuals have homing tendencies in the absence of motivational cues related to breeding and site fidelity. We tested whether artificial displacement would impact the movement behavior of a non-philopatric terrestrial amphibian, the Fowler's Toad (*Anaxyrus fowleri*), within its home range and after its breeding season had ended. We translocated 65 male and female Fowler's Toads from their initial points of capture a total of 104 times over one of three different distances (100 m, 250 m, and 500 m) and compared these toads' subsequent 24-h movements to those of a control group of 43 un-translocated toads. To shield the translocated toads from auditory, visual, and olfactory cues en route, we translocated them in opaque enclosed boxes and performed the experiment in the uniformly unobstructed landscape of the Lake Erie shoreline of Long Point, Ontario. We mainly investigated directionality bias as the orientation between control and translocated groups, homing tendency as the correlation between movements post-translocation and translocation distance, and homing accuracy as the variation in distance between final and initial capture points. Our results provide clear evidence that translocation changes the movement behavior of these toads and that they possess homing tendencies outside of their breeding season. Toads had a strong directional bias to move in the opposite direction to the one they were artificially displaced, in contrast with the control group which showed no directional bias among 61 recorded 24-h movements. This tendency for amphibians to home following artificial displacement might be a significant confounding factor in any procedure involving their relocation.

Platform

Virtual

Student

Challenges and potential costs of overwintering for Snapping Turtles (*Chelydra serpentina*)

Matthew G. Keevil¹, Patrick D. Moldowan², Ronald J. Brooks³, Jacqueline D. Litzgus¹

¹School of Natural Sciences, Laurentian University, Sudbury, Ontario, Canada. ²Department of Ecology and Evolutionary Biology, University of Toronto, Toronto, Ontario, Canada.

³Department of Integrative Biology, University of Guelph, Guelph, Ontario, Canada

Abstract

Snapping Turtles (*Chelydra serpentina*) have been studied for 50 years at their climatic range edge in Algonquin Provincial Park, Ontario, Canada. The cold climate at this latitude and elevation imposes major constraints on Snapping Turtle life history: slowed growth (90% of annual growth occurs during a 40 to 70-day window), delayed maturity (16–20 years to sexual maturity in females), and stochastic reproductive success. In addition, the cold climate imposes challenges and costs during the extended winter period. Despite climate constraints, individual Snapping Turtles can successfully overwinter in diverse microhabitats including large lakes, peatlands and seepages with little standing water. We discuss the biotic and abiotic challenges to overwintering through a series of case studies involving predation risk, environmental exposure, and habitat choice. Firstly, we revisit a turtle mass mortality event caused by River Otter (*Lontra canadensis*) predation during three winters (1986–1989). We show that patterns of abundance and survival reveal little evidence of turtle population recovery during the 23-years post-catastrophe. A recent resurgence in otter predation activity illustrates the importance of stochastic adult mortality events in repressing populations with slow life histories. We have observed apparent rodent gnawing on the shell of overwintered turtles and severe frostbite leading to necrotizing scute exfoliation from exposure to freezing temperatures, resulting in sublethal and lethal costs. Predation risk and environmental exposure may impose a trade-off between the selection of open water and shallow water or muddy overwintering habitat. Because these processes seem to be operating at different temporal scales, the trade-off is only revealed by long-term monitoring. The slow life histories and suite of both stable and stochastic biotic and abiotic challenges make northern turtle populations particularly sensitive to perturbation and vulnerable to decline.

Platform

In-person

Student

32

A rocky solution: Evaluating the use of common construction materials as road effect mitigation for turtle communities in a rock barren landscape

Jenna L. Kentel¹, Tianna Burke², Steven Kell³, Jacqueline D. Litzgus¹

¹Laurentian University, Sudbury, Ontario, Canada. ²Georgian Bay Biosphere, Parry Sound, Ontario, Canada. ³Shawanaga First Nation Lands and Resource Department, Nobel, Ontario, Canada

Abstract

Roads create an ecological trap for female turtles during nesting forays because exposed road shoulders are attractive nesting habitats despite the risk to female turtles' fitness. While the viability of turtle populations is dependent on the survivorship of reproductive females, few cost-effective mitigation strategies directly address their vulnerability to roads. Here, we evaluated a new mitigation strategy that aimed to deter female turtles from nesting in unsafe road-side habitat. This mitigation design made use of routine road maintenance to replace exposed gravel on road embankments with rock rip-rap and paved road shoulders. Nesting survey data collected over three consecutive years (2020-22) was used to determine if this mitigation strategy deters females from nesting on the road. We evaluated the effectiveness of this mitigation strategy in the context of the local turtle population, using a rigorous mark-recapture study to quantify abundance and a before-after comparison. Across all 3 study species, the number of nests on the road were similar in the before (n=133) and after (n=138) periods of the study. Turtles did not nest in road sections with rip-rap; however, turtles continued to gain road access to nest in the nearest available road-side habitat. Turtles may still be nesting on the road because naturally occurring nesting habitat is limited in the surrounding rock barren landscape; therefore, we assessed the availability of nesting habitat based on soil depth and canopy openness by conducting habitat transects around nesting hotspots on the road. Our study contributes to the limited literature that quantifies the efficacy of road-effect mitigation strategies at the population level.

5-minute

In-person

Student

33

Talking turtles! Investigating snapping turtle hatchling vocalizations and synchronized nest emergence in the wild

Claudia Lacroix¹, Christina M. Davy², Njal Rollinson¹

¹University of Toronto, Toronto, Ontario, Canada. ²Carleton University, Ottawa, Ontario, Canada

Abstract

Turtles are a clade where the study of social behaviour has been historically overlooked and where investigations regarding acoustic signalling behaviour are only recently being explored. Despite accumulating evidence for the role of acoustic signals and social behaviour in turtles, questions regarding intraspecific variation in acoustic signals and their associated social behaviours remain. Recent work suggests that snapping turtle (*Chelydra serpentina*) hatching vocalizations do not affect hatch date but that sociality remains an important factor in coordinating nest emergence. Here we directly explore whether acoustic signals play a role in facilitating nest emergence by using *in situ* field experiments and the broadly distributed snapping turtle as a model organism. Specifically, we use acoustic monitoring techniques to test whether vocalization behaviour (vocalisations/h) is correlated with subterranean movement in the nest (movement/h) after controlling for environmental covariates (e.g., temperature, clutch size). Preliminary results suggest that vocalization behaviour positively correlates with subterranean movement in the nest but that a more robust sampling of environmental covariates and above-ground emergence behaviour is needed.

Platform

In-person

Student

34

Complicated conservation for a Canadian snake: BC's peripheral population of Western Rattlesnakes.

Karl W. Larsen¹, Christine A. Bishop²

¹Thompson Rivers University, Kamloops, BC, Canada. ²Environment & Climate Change Canada, Delta, BC, Canada

Abstract

All Canadian snake species reach the northern limits of their distribution within the country, and many have limited ranges that invoke the 'peripheral population' concept. While the biological value of peripheral populations long has been used as an argument for the conservation of these populations (and peripheral populations in general), the limited ranges often seen within the Canada prompt fairly uniform assessments and management strategies, and a 'one size fits all' approach. However, in conducting detailed ecological study of the threatened Western Rattlesnake (*Crotalus oregonus*) over 25+ years, our combined research programs have revealed a striking diversity of life-history traits and behaviors within the limited Canadian range of the animal, including some that may have developed relatively recently. This variation includes migratory tactics, size at first reproduction, defensive behaviour, timing of denning, and significantly different habitat use even within the same subpopulations. We will provide a review of this variation, the research behind it, and the possible contributing factors (anthropogenic and natural) that may be at work. However, the striking differences witnessed over a 'pocket range' of the species are not altogether unexpected given our understanding of peripheral populations, and they suggest a blanket approach to management may be an oversimplification of a more complex problem.

Platform

In-person

35

Impact of forest harvesting and herbicide use on salamander population health

Sara Leslie¹, Christopher B. Edge², Julia Riley¹

¹Mount Allison University, Sackville, NB, Canada. ²Natural Resources Canada - Canadian Forest Service, Fredericton, NB, Canada

Abstract

Eastern Red-backed Salamanders (*Plethodon cinereus*) are excellent indicators of biodiversity and ecosystem integrity in forested habitats because of their sensitivity to environmental change. Salamander populations are widely known to decline after harvesting timber due to environmental changes associated with this activity. For example, clear-cutting reduces canopy cover, which raises soil temperature and lowers soil moisture. Salamander populations then recover as the forest regenerates and environmental conditions become more suitable. The application of herbicide reduces the herbaceous midstory during forest regeneration, potentially enhancing or extending the environmental effects of canopy removal on salamander populations. Though past observational and experimental studies have documented reduction and recovery in salamander abundance after clear-cutting, there is little research on the impact of herbicide application on salamander population recovery post-harvest. To assess the effects of harvest and herbicide application on salamander population health, I am performing a field study on Eastern Red-backed Salamanders within regenerating clear-cut forest plots of varying ages that have and have not been treated with a glyphosate-based herbicide, as well as control unharvested plots. In each plot, I am sampling for salamanders using area-constrained searches of 30 m² and then for each salamander found I am visually-assessing their health by documenting tail regeneration and cuts/lesions, identifying the species, and recording the individual's age class, weight, and length. During the conference, I will present a preliminary summary of this research. After the field season, I will statistically test whether there is an effect of time since harvest or herbicide application on salamander abundance and body condition. The results from this work will provide valuable insight into the health of harvested forest ecosystems and how the most widely used herbicides in the world, glyphosate, may impact them.

5-minute

In-person

Student

36

Understanding the impacts of wildfire and windfarm construction on squamate community ecology in central Ontario.

Aidan J. Maloney¹, John Urquhart², Jacqueline D. Litzgus¹

¹Laurentian University, Sudbury, Ontario, Canada. ²Blazing Star Environmental, Oshawa, Ontario, Canada

Abstract

Understanding the degree to which habitat disturbance affects fragile and biodiverse herpetological communities is critical to mitigating damage from anthropogenic and natural environmental disturbances. Given the global push to move away from use of fossil fuels, harnessing wind power has become a popular alternative energy resource; however, windfarm construction results in habitat disturbance. Climate change has the potential to cause habitat disturbance through increases in forest fire severity and frequency. Few studies have examined how the combined disturbances of windfarms and wildfire impact herpetological communities. Our ongoing study aims to quantify the abundance, diversity and health of snake individuals, populations and assemblages in areas impacted by a windfarm and wildfire. Surveys consisted of a combination of looking under deployed cover-boards and natural cover, and visual encounters in four replicated site treatments: control, wildfire, windfarm, wildfire + windfarm. These data will be analyzed using various diversity and abundance and body condition indices, and compared among treatments to look for individual and assemblage-level impacts. Preliminary data indicate patterns of lower abundance and diversity in sites affected by the wildfire and windfarm construction. A total of 30 surveys per treatment (n=120) were conducted in the 2022 field season with a total of 7 target snake species encountered across all treatments; 6 species in control, 6 in wildfire, 5 in windfarm, and 3 in wildfire + windfarm. Approximately 1.65 snakes were found per survey in control, 0.89 in windfarm, 0.68 in wildfire, and 0.28 in wildfire + windfarm. Incidental observations of Five-lined Skinks (*Plestidon fasciatus*) revealed over 40 skinks in each of control and windfarm treatments, fewer than 10 in wildfire + windfarm, and skinks were completely absent from wildfire treatment. These findings will inform implementation of mitigation strategies for future large-scale windfarm development projects, especially in areas prone to wildfires.

5-minute

In-person

Student

37

Creating landscape-appropriate habitat restoration strategies: Success of a turtle nest habitat design for rock barren landscapes.

Chantel E. Markle, Danielle T. Hudson, Hope C.A. Freeman, James M. Waddington

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Abstract

Turtle nesting habitat can be created or enhanced as a strategy to increase habitat availability or provide suitable habitat away from urban threats. The traditional approach to nest habitat construction is to create nesting mounds using a mix of sand and gravel. However, nesting mounds do not resemble natural turtle nesting habitat in a rock barren landscape where turtles nest in crevices and cracks in the bedrock which have filled with soil and are covered with lichen (*Cladonia* spp.) and/or moss (*Polytrichum* spp.). Furthermore, a sand nesting mound will easily erode and dissipate off an open, rocky landscape. Therefore, our objective was to design and evaluate the success of novel turtle nesting habitat for a rock barrens landscape. Based on detailed nest habitat assessments, we designed and constructed turtle nesting sites to better represent natural nesting habitat in the landscape. To evaluate success of the nest habitat design, we assessed the (1) survival of transplanted moss and lichen cover on created nest sites, (2) ecohydrological and physical conditions at created and natural sites, and (3) turtle egg hatching success at created and natural sites using a split-clutch experiment. Initial results indicate that hatch success was higher at the created nest sites compared to natural sites. In general, created habitat tended to have a more stable thermal and moisture regimes compared to natural sites. We also found no difference in productivity between lichen transplants and natural sites, indicating that in-tact lichen transplants were successful. Moss transplant success was more variable likely due to heat and/or moisture stress because transplants were conducted during nesting season. Overall, the initial success of our nest habitat design suggests that this landscape-appropriate strategy will be useful for creating and enhancing turtle nesting habitat in rock barren landscapes.

Platform

Virtual

38

The effect of environment on the mating behaviour of the Eastern Red-backed Salamander (*Plethodon cinereus*)

Alexia E. McCormick, Julia L. Riley

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Abstract

Non-random mating in a polymorphic system is regarded as an important factor contributing to ecological divergence, but its dynamics in natural populations are poorly understood. The Eastern Red backed Salamander (*Plethodon cinereus*) is a terrestrial salamander well-known for its striking colour and pattern dimorphism. These salamanders are known to exhibit weak assortative mating, but have potential to diverge along several niche dimensions. Our study aims to investigate why and how *P. cinereus* mating behaviour is maintained over spatiotemporal scales. Specifically, we examined the effect of environment on the assortative mating behaviour of the Eastern Red-backed Salamander by turning over natural cover objects to find male–female pairs during the spring and summer of 2022. We have recorded sex, color morphology, snout–vent length of 120 salamanders and environmental factors like soil moisture, temperature, and soil pH of the cover objects they are sheltering under. We are continuing our surveys during autumn 2022, and thus will present a preliminary summary of this work. Our research will provide essential data for understanding the maintenance of the Eastern Red backed Salamanders mating behaviour and its potential role in their ecological separation by color morphology. In addition, this work will provide valuable information on the distribution of *P. cinereus* color morphs and the seasonal timing of their mating behaviour in New Brunswick.

Poster

In-person

Student

Multi-species assessment and planning for Canadian snakes: Identifying and evaluating *ex situ* conservation activities as part of a One Plan Approach

Stephanie Winton^{1,2}, Jessica Steiner^{1,2}, Amy Chabot^{1,3}, Hannah McCurdy-Adams², Kathy Traylor-Holzer⁴

¹Canadian Species Initiative, Guelph, Ontario, Canada. ²Wildlife Preservation Canada, Guelph, Ontario, Canada. ³African Lion Safari, Cambridge, Ontario, Canada. ⁴IUCN SSC Conservation Planning Specialist Group, Apple Valley, Minnesota, USA

Abstract

While many *in situ* conservation efforts are underway to address threats to wild snake populations in Canada, conservation planning has generally not considered the full complement of potential conservation roles that the *ex situ* community might contribute to effectively achieve recovery goals. In March 2021, species experts and practitioners from *in situ* and *ex situ* communities across North America came together virtually to evaluate potential *ex situ* conservation roles for each of 39 Canadian snake taxa in an Integrated Collection and Assessment Planning (ICAP) workshop. Based on the IUCN SSC *Guidelines on the Use of Ex Situ Management for Species Conservation* decision process, multi-species ICAPs assist *ex situ* facilities with identifying conservation priorities for collection planning and conservation support. Participants identified priority recommendations for *ex situ* conservation roles, where appropriate, that will directly benefit wild snake populations and foster better integrated conservation efforts. At-risk species with established *ex situ* populations had the most recommendations, such as establishing breeding and release programs. Conservation-based research, training and education were recommended for most taxa, including two non-threatened taxa that can serve as models for more threatened snakes. Key recommendations and subsequent progress will be highlighted. The recommended actions broaden existing *ex situ* roles and published recommendations, identify regional priorities for Canadian snakes, and complement *in situ* conservation efforts, enabling the development of more detailed integrated conservation plans. The ICAP process also increased knowledge and understanding amongst all participants of the full spectrum of possible *ex situ* conservation roles as part of a One Plan Approach to conservation planning.

Platform

In-person

40

Sexual dichromatism of tomia in Blanding's Turtles (*Emydoidea blandingii*)

Kelsey E. Moxley¹, Scott Gillingwater², Madelaine J. Kellett¹

¹Scales Nature Park, Oro-Medonte, ON, Canada. ²Upper Thames River Conservation Authority, London, ON, Canada

Abstract

Blanding's Turtles (*Emydoidea blandingii*) have been observed to show variation in upper tomia (upper beak) colouration, however, there is very little reference to this phenomenon in the literature. To explore this further, we created a study to examine the colour variation by photographing hundreds of Blanding's Turtle faces in central Ontario. Our study suggests Blanding's Turtles exhibit sexual dichromatism through their upper tomia colouration. A guideline was created which suggests adult males have a solid, or mostly solid, dark upper tomia, while adult females present a cream to yellow tomia with black banding. Photos of Blanding's Turtle faces were presented to 13 observers to assess the accuracy of the guideline in determining the sex of a turtle. Observers were able to correctly identify the sex of 97% of Blanding's Turtles following the guideline. However, there were a few instances where males and females did not fit the guideline. This pattern of sexual dichromatism has also been anecdotally observed in other populations in southwestern Ontario with similar results. At this point there is no clear understanding as to why this dichromatism occurs in Blanding's Turtles, and further research is recommended. The implications of this study are wide ranging and can be useful for determining sex with a high degree of accuracy in adult turtles during visual surveys, utilizing citizen science data, and conducting demographic studies.

Poster

In-person

41

Using science to inform species at risk management: Predicting the effect of forest harvest on Wood Turtle (*Glyptemys insculpta*) habitat suitability

Damien Mullin^{1,2}, Graham Forbes¹, Deanna McCullum³, Shane Hartz², Christopher B. Edge²

¹University of New Brunswick, Fredericton, NB, Canada. ²Natural Resources Canada - Canadian Forest Service, Fredericton, NB, Canada. ³5th Canadian Division Support Base Gagetown, Oromocto, NB, Canada

Abstract

Sustainable forest management includes protecting species-at-risk such as the endangered Wood Turtle (*Glyptemys insculpta*). The Wood Turtle is a challenging species for forest management because females may travel 500+ meters perpendicular from rivers into forested habitats. Forestry occurs in approximately 40% of the Wood Turtles Canadian range making it a widespread threat to the species, however the magnitude of the threat is unknown. Our research objective is to determine the effects of commercial forest harvest on Wood Turtle habitat suitability to better delineate critical habitat. We outfitted 20 female Wood Turtles with VHF transmitters and GPS loggers and are tracking them from 2019-2022 to collect multi-year fine resolution Wood Turtle spatial data. We will then combine this occurrence data with environmental predictor variables collected both on-site and via remote sensing (LiDAR) in a step selection function to quantitatively inform a habitat suitability model. We will then apply our habitat suitability model to chronosequence forest harvest blocks aged 1-35 years, and late successional forests, to predict the effects of forest harvest on Wood Turtle habitat suitability. Preliminary results will be presented as the research is still on-going. This study will provide important data to better delineate critical habitat which has range-wide implications for Wood Turtle conservation.

Platform

In-person

Student

42

Testing the influence of predation on habitat selection of Northern Prairie Skinks (*Plestiodon septentrionalis*) using a lizard model.

Candace J. Park^{1,2}, Nicholas A. Cairns³, Stefanie E. LaZerte^{1,4}, Pamela L. Rutherford¹

¹Brandon University, Brandon, MB, Canada. ²Wildlife Preservation Canada, Guelph, ON, Canada. ³No affiliation, Val Marie, SK, Canada. ⁴Steffi LaZerte R Programming and Biological Consulting, Brandon, MB, Canada

Abstract

Predation pressure has a strong influence on the evolution of prey phenotypes, including morphology and behaviour. Under high predation pressures, prey species may alter behaviours that are critical for survival to avoid increased exposure, which has consequences for reproduction and growth in herpetofauna species. Predation also influences prey habitat selection, and in highly fragmented habitats, may exacerbate demographic impacts. Northern Prairie Skinks are an at-risk lizard species in Canada, only found within fragmented patches of mixed-grass prairie habitat in Manitoba. Adults are cryptically coloured, while juveniles have blue tails that are hypothesized to function as predator decoys. These distinct phenotypes suggest that juveniles and adults experience differences in predation pressure, and as a result, there may also be differences in habitat selection and use for each age class. To determine whether Northern Prairie Skinks experience varying predation pressures based on age and microhabitat, we constructed clay models mimicking adult and juvenile skinks through differences in colour and size, and deployed models across a successional gradient from aspen forest to open prairie in southwestern Manitoba. Predator attacks were quantified through marks left in the clay. Predation rates on clay models did not differ between adult and juvenile skink phenotypes; however, predation rates were significantly higher within forests microhabitats relative to intermediate prairie microhabitats. Our results help reveal where Northern Prairie Skinks are most vulnerable to predation in mixed-grass prairie habitats. This will allow grassland management practices to prioritize enhancing shelter at microhabitats where skinks experience high predation risks, helping to prevent further declines in Canada.

Platform

In-person

Student

Using decision analysis to assess the feasibility of recovery of northern leopard frogs (*Lithobates pipiens*) using conservation translocations in northern Idaho

Laura Keating¹, Lea A. Randall¹, Rebecca Stanton¹, Casey McCormack², Michael Lucid³, Travis Seaborn⁴, Sarah J. Converse⁵, Stefano Canessa⁶, Axel Moehrenschrager¹

¹Wilder Institute / Calgary Zoo, Calgary, Alberta, Canada. ²Idaho Department of Fish and Game, Coeur d'Alene, Idaho, USA. ³Selkirk Wildlife Science LLC, Sandpoint, Idaho, USA. ⁴University of Idaho, Moscow, Idaho, USA. ⁵U.S. Geological Survey, Seattle, Washington, USA. ⁶University of Bern, Bern, Erlachstrasse, Switzerland

Abstract

Conservation translocations, intentional movements of species to protect against extinction, have increased thirty-fold over the last three decades and are projected to increase further as biodiversity loss continues worldwide. The literature abounds with analyses to inform translocations and assess whether they are successful, but the fundamental question of whether they should be initiated at all is rarely addressed formally. We used decision analysis to assess northern leopard frog reintroduction in northern Idaho, USA, with success defined as a population that persists for at least 50 years. Along with other considerations, the Idaho Department of Fish and Game will use this assessment in the future to make a decision regarding reintroduction of northern leopard frogs. Stakeholders from government, indigenous groups, academia, land management agencies, and conservation organizations also participated. We built an age-structured population model to predict how management alternatives would affect probability of success. We accounted for both parametric uncertainty and stochasticity (environmental and demographic) in the model, which allowed us to explicitly represent uncertainty around the probability of success and to assess the sensitivity of predicted outcomes to uncertainty. For the leading alternative, results were bimodal, with most parameter combinations resulting in either very low (<5%) or relatively high (>95%) probabilities of success. Overall, the results of this feasibility assessment suggest that a successful reintroduction of northern leopard frogs is possible but far from certain, with the uncertainty primarily driven by uncertainty surrounding survival of early life stages. Conservation translocations would benefit greatly from more widespread use of decision analysis to counter the complexity and uncertainty inherent in these decisions.

Platform

In-person

44

Amphibian reproductive technologies: searching for new spawning induction methods

Brianna H. Raven, Chunyu Lu, Vance L. Trudeau

University of Ottawa, Ottawa, Ontario, Canada

Abstract

Since the 1970s, amphibian populations around the world have been declining rapidly more than any other vertebrate taxa. The global decline can be attributed to several factors including habitat disturbance/destruction, climate change, pollution, and endocrine disruptors. One method to aid declining amphibian populations is through captive breeding programs. Many species are unable to reproduce efficiently in captivity and must be injected with hormones that mimic natural changes in the activity of the hypothalamus-pituitary-gonad (HPG) axis to induce spawning. Human chorionic gonadotropin and the AMPHIPLEX mixture developed by the Trudeau lab have been commonly used for stimulating spawning in captive populations, but their effectiveness to induce spawning is varied and species-specific. There are a multitude of other potential captive breeding methods which have been researched in mammals and fish but have yet to be explored in amphibians. Kisspeptin and secretoneurin are two newly discovered peptide hormones that stimulate reproduction in mammals and teleosts, respectively, with limited research on amphibian models. It is essential to study these new hormones in amphibians as they may provide new and more efficient modes of captive breeding induction of declining populations. Preliminary in vivo experiments I have completed using these peptides in the western clawed frog, *Silurana tropicalis*, have been promising in showing that these hormones may be playing crucial roles within the HPG axis of this species, and more studies are currently being conducted. Given that little to nothing is known about the roles of kisspeptin and secretoneurin in frog reproduction, this research could provide fundamental knowledge about the hormonal control of spawning in amphibian species and provide new approaches for the conservation of endangered amphibian species through captive breeding programs.

5-minute

In-person

Student

45

Introducing the Riley Integrative Ecology Lab

Julia L Riley

Mount Allison University, Sackville, New Brunswick, Canada

Abstract

Are you looking for a lab to pursue herpetological research? Or, simply to further your career in herpetology? The Riley Integrative Ecology Lab (RIEL) has set down roots at Mount Allison University in Sackville, New Brunswick. Our research combines three major fields - behavioural ecology, evolutionary ecology, and conservation – with a focus on amphibian and reptile study systems. Current research topics in the lab include studying the mating behaviour and colouration of Eastern Red-backed Salamanders, investigating the invasion biology of herpetofauna in Newfoundland, testing the impact of forest management approaches on salamander populations, and monitoring wildlife disease in Atlantic Canada. In the coming years, there will be many opportunities to get involved as seasonal field technicians, Honours and graduate students, and postdocs. We are looking to work with kind, inquisitive, and hard-working individuals that are motivated to make positive waves in Canadian herpetology. If this interests you, either as a potential lab member or collaborator, feel free to come by the poster session to chat!

Poster

In-person

46

Studying the secret social lives of reptiles

Julia L. Riley¹, Michael Cherry², Martin Whiting³

¹Mount Allison University, Sackville, New Brunswick, Canada. ²Stellenbosch University, Stellenbosch, Western Cape, South Africa. ³Macquarie University, Sydney, New South Wales, Australia

Abstract

Animals exhibit tremendous diversity in sociality; from organisms that live their life almost exclusively alone to those that live in large groups. Our understanding of sociality, however, has a taxonomic bias. Research has mainly focused on birds, eusocial insects, and primates, which confines our understanding of the diversity, evolution, and importance of sociality. Yet recently, lizards have been shown to exhibit a range of social and mating systems. It is thought that specific ecological and life history characteristics act in concert to select for the evolution of family-living and parental care. For example, viviparity and longevity favour natal philopatry, and a species' reliance on limited resources can promote grouping. I will present research investigating the social systems of five lizard species that exhibit life history and ecological characteristics that can select for the evolution of family living. First, the Australian Tree Skink (*Egernia striolata*), which belongs to the social Egernia-group of lizards, as well as preliminary data on four species of cordylid lizards from South Africa that is a potentially novel lineage of family-living squamates. I will also present an expansion of this work to another taxonomic group, turtles, as well as a discussion of how and why we should apply this work to Canadian herpetofauna. This presentation will outline a framework for the study of sociality and discuss its importance for the conservation of reptiles and amphibians.

Platform

In-person

47

The spatial ecology of climate influences species distributions: the case of the Great Plains Toad (*Anaxyrus cognatus*)

Gabrielle L. Rimok, Pedro R Peres-Neto

Concordia University, Montreal, Quebec, Canada

Abstract

Species distributions are largely determined by three main drivers: abiotic environmental conditions, dispersal, and biotic interactions. However, it is specifically the variability in abiotic environmental conditions (i.e., environmental heterogeneity) and how they are spatially structured (i.e., environmental spatial autocorrelation - ESA) that determines whether or not a habitat, or even a landscape, is environmentally suitable for species establishment. Environmental heterogeneity itself is spatially structured; where environmental conditions/features that are closer together in space tend to be more similar than those farther apart. As such, the spatial structure of environmental features (i.e., ESA) mimics dispersal networks because spatial patterns in environmental heterogeneity affect the strategies and energetic costs (and their associated fitness consequences) involved in movement and dispersal among patches. At broad spatial scales, species distributions are shaped by environmental conditions, namely, those of climate. Climatic conditions thus also impose important physiological and life history constraints on species and in accordance with environmental features, are also often heterogeneous and spatially structured. Yet, how they affect and contribute to species distributions remains unknown. Here, we use species distribution models (SDMs) in a novel framework in which we demonstrate for the first time, the influence of climate heterogeneity (within and between patches) and climate spatial structure on species distributions through a case study of the Great Plains toad (*Anaxyrus cognatus*). Our results demonstrate that a model using climate spatial structure, within and between-patch heterogeneity as predictors explained this species' distribution better than the standard SDM. As such, we provide critical evidence that there is added value in considering climate spatial structure when fitting different SDMs for the same species. Most importantly, we demonstrate that climate spatial structure and heterogeneity are important mechanisms driving species distributions.

Platform

In-person

Student

48

Using environmental DNA to map the contact zone of *Pseudacris maculata* and *Pseudacris triseriata* in Southern Ontario

Madeleine C. Robitaille, Stephen C. Lougheed

Queen's University, Kingston, Ontario, Canada

Abstract

We will use environmental DNA (eDNA) to map a contact zone between two chorus frog lineages in Southwestern Ontario. Contact zones facilitate the study of dynamics between diverging lineages in primary (evolved *in situ*) or secondary (evolved in allopatry) contact and are of interest to evolutionary and conservation biologists; the outcomes of contact have implications for species boundaries and their range limits, and can clarify questions of species delineation and hybridization. *Pseudacris maculata* and *Pseudacris triseriata*, the latter of which is classified as threatened in Canada, comprise two diverging, non-sister mitochondrial lineages of trilling chorus frogs (family Hylidae) that are in secondary contact in Southwestern Ontario. Populations within Ontario and Quebec that possess these distinct mitochondrial haplotypes comprise two designatable taxonomic units in Canada. However, the location of the contact zone between the two lineages is unclear and debated, lying somewhere between Toronto and Georgian Bay (which spans approximately 150 km). Using eDNA in water samples rather than sampling frogs directly will facilitate a study with a wider geographical range, will better capture representative haplotypes within sampled wetlands, and will be less invasive than tissue sampling (e.g. toe clipping, buccal swabbing). We will collect eDNA from an array of wetlands in a north-south transect on the outskirts of Toronto and norward that encompasses the presumed contact zone. DNA will be amplified and quantified using droplet digital PCR with duplexed primer-probe sets that target the cytochrome *b* mitochondrial gene of each lineage (one primer-probe set for each lineage). This study will clarify the ranges of *P. maculata* and *P. triseriata*, with implications for their conservation and designation by COSEWIC.

5-minute

Virtual

Student

49

Evaluating hormone therapy as a tool to support conservation breeding of the endangered Oregon Spotted Frog (*Rana pretiosa*): A pilot study

Pourya Sardari¹, Andrea Gielens², Paula Mackie³, Gabriela Mastromonaco³

¹Simon Fraser University, Burnaby, BC, Canada. ²Wildlife Preservation Canada, Guelph, ON, Canada. ³Reproductive Science, Toronto Zoo, Toronto, ON, Canada

Abstract

Ex-situ conservation management of the endangered Oregon spotted frog (*Rana pretiosa*; OSF) includes captive breeding for reintroduction and, if necessary, storing sperm from different individuals to maintain genetic diversity. However, most frog species, including OSF, require the administration of exogenous hormones to facilitate sperm collection. In this pilot study, the impact of hormones GnRH and hCG on sperm concentration was evaluated in OSF. Thirty male frogs were selected from two captive breeding sites, Greater Vancouver Zoo and Vancouver Aquarium (15 individuals from each facility) and were divided into 5 treatment groups: 1 sham injection (n=6) and 4 hormone injection treatments, each involving different GnRH and hCG concentrations (n=6 per treatment). Spermic urine was collected using a 3.5 Fr tomcat catheter gently inserted into the cloaca, and sperm concentration was evaluated at times 0, 30, 60, 120, 180, 240, and 300 min post-hormone injection. A Linear mixed-effect (LME) model was used to analyze the repeated measures data and Tukey's HSD to determine significantly different means. As expected, sperm concentration increased immediately after all hormone treatments, then decreased significantly over time ($F_{7,138} = 29.88$, $p < .0001$), but remained elevated above baseline (time 0) for 240 minutes. However, there was no significant difference in recovered sperm concentration between treatment groups at any time. ($F_{3,21} = 0.93$, $p = 0.44$). The results of this pilot study show that hormone injection can facilitate sperm collection from OSF for up to 240 minutes. However, more research is needed to understand the individual response to hormone treatments and the impact on sperm quality.

5-minute

Virtual

Student

50

Butler's gartersnake communities have female leaders

Morgan Skinner¹, Megan Hazell^{2,3}, Joel Jameson², Stephen C. Lougheed³

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³Queen's University, Kingston, Ontario, Canada

Abstract

Animal social groups can often be divided into subgroups of individuals that tend to interact with each other. In the social science literature, these subgroups are often referred to as communities. In some animal groups, there are sex and age differences in community integration where individuals can emerge as highly central to their community. Most of what is known about differences in community centrality comes from research done on highly social mammals. Due to challenges in observation, and arguably the largely untested assumption that they are non-social, much less is known about community structure in snakes. To investigate the community structure of snake groups, we constructed social networks from the observed and inferred social interactions that occurred among Butler's gartersnakes (*Thamnophis butleri*) during an 11-year mark-and-recapture project. Based on recent laboratory work showing sex and size differences in gartersnake sociability, we hypothesized that large females might be central to their communities within the social networks. To test this hypothesis, we identified the smaller communities that existed within the larger networks and looked for sex and weight differences in the individuals that emerged as community 'leaders' (i.e., had high community centrality). We found that heavier-bodied individuals were more likely to be central to communities, and that females had higher community centrality than males. Understanding social interactions and intraspecific community structure can have important implications for conservation. For example, community leaders can provide valuable information about food and shelter locations to other group members, and the importance of such individuals should be considered when modifying, bolstering, or translocating populations.

5-minute

Virtual

Student

51

Effectiveness of road mortality mitigation for Western Rattlesnakes (*Crotalus oreganus*) in British Columbia

Jade A. Spruyt¹, Michelle Matson¹, Karl W. Larsen¹, Christine A. Bishop²

¹Thompson Rivers University, Kamloops, BC, Canada. ²Environment and Climate Change Canada, Delta, BC, Canada

Abstract

Reptiles, and especially species with life histories characterized by low reproductive rates and low adult mortality - like rattlesnakes - are extremely vulnerable to demographic consequences of road mortality. To combat road mortality and aid in habitat connectivity for vulnerable reptile species, mitigation measures are becoming increasingly common. However, in-depth analyses of their effectiveness on reptile species remain rare, both at the level of direct roadkill and the population persistence level. This study assesses the immediate impact of recently installed ecopassages and directional fencing on a Western Rattlesnake (*Crotalus oreganus*) population in British Columbia, Canada. Using road survey, traffic monitoring, and mark-recapture methods, we analyze trends in the roadkill rates and population size throughout the periods before, during, and after the mitigation was installed. Wildlife cameras in ecopassages allow us to quantify use by Western Rattlesnakes, and compare detection frequencies to other at-risk snake species in the area. Rattlesnake roadkill rates have decreased after mitigation installation, despite there being an increase in traffic. However, rattlesnakes were less likely to use ecopassages than colubrids in the same community, and population estimates do not indicate a clear trajectory of recovery. This study highlights the short-term effects of road mortality mitigation on this federally and provincially threatened species, and improves our understanding of how these animals adjust to the change in their environment. It also emphasizes that long-term monitoring is necessary in order to detect changes in ecopassage use and population size past the initial implementation phase.

Platform

In Person

Student

52

Habitat suitability and reintroduction site selection criteria for the northern leopard frog (*Lithobates pipiens*)

Rebecca Stanton, Lea Randall

Wilder Institute/Calgary Zoo, Calgary, Alberta, Canada

Abstract

There currently exists only a single extant population of northern leopard frogs in British Columbia (BC), and past reintroduction attempts have met with limited success. As a result, the BC Northern Leopard Frog Recovery Team initiated a search for a new reintroduction site in 2021 through the development of quantitative assessment tools. This involved establishment of a Habitat Suitability Index (HSI) model and a Site Selection Criteria table based upon the unique habitat requirements of the northern leopard frog in BC. The HSI model spatially filtered for suitable habitat within the historical range based on attributes such as elevation, number of waterbodies, solar exposure, road density, etc. Any potentially suitable locations detected by the HSI were further filtered during a preliminary desktop assessment whereby clearly unsuitable sites (e.g., located in heavily forested areas or with significant barriers between habitat types) were eliminated. Concurrently with the HSI, a Site Selection Criteria table was developed. Use of this table involves scoring each site for numerous habitat attributes important for the northern leopard frog in the overarching categories of breeding habitat, foraging habitat, overwintering habitat, connectivity, and land use/other. On-the-ground field visits were completed at all suitable sites in spring, summer, and fall in order to collect the relevant data to allow for scoring of each site in the Site Selection Criteria table. We found these methods to be an effective way to quantitatively compare and select a new reintroduction site.

Platform

In Person

53

Varying effects of anthropogenic and natural disturbance regimes on amphibian populations in a dynamic wetland landscape

Victoria Tawa, David M. Green

McGill University, Montreal, Quebec, Canada

Abstract

Environmental disturbance may have important consequences for the maintenance of biological diversity. Biodiversity may rise as a result of the increased landscape heterogeneity that disturbance can produce but if the intensity or magnitude of disturbance is beyond what may be tolerable, there may be severe negative consequences for biota. At Long Point, Ontario, Canada, anuran amphibians have experienced a chance overlap of major disturbance events, both anthropogenic and natural. Marshes have been treated with herbicide to control the spread of invasive *Phragmites australis* reeds while high water levels and storms on Lake Erie have eroded and washed out shoreline sand dunes. We studied how the resulting habitat modifications have affected the resident species of frogs and toads. Using a 3-replicate 2x2 factorial site design of disturbance regimes, we collected occurrence data using minnow traps, acoustic surveys, and visual surveys, following the disturbances. We found that the dune washouts, which resulted in the formation of open, sand-filled ponds, and the anti-*Phragmites* herbicide treatments both reduced the homogeneity of the landscape. Post-disturbance, ranid frogs (*Lithobates* spp.) were significantly less abundant in sites affected by dune washouts and significantly tended to inhabit both treated and control sites where vegetation was more abundant. The natural washouts, however, produced improved breeding habitat for Fowler's Toads (*Anaxyrus fowleri*), which successfully bred in any washout site, regardless of herbicide-treatment status. Our result indicates that disturbance, particularly the natural disturbance regime, is necessary for maintaining diversity in anuran communities at this, and similar, environments.

Platform

Virtual

Student

54

Population demography and spatial ecology of Spotted Turtles (*Clemmys guttata*) in central Ontario

Stephane D. Thibeault¹, Jeff Hathaway², Kelsey Moxley², Jacqueline D. Litzgus¹

¹School of Natural Sciences, Laurentian University, Sudbury, ON, Canada. ²Scales Nature Park, Oro-Medonte, ON, Canada

Abstract

Over half of the world's turtle species are considered to be at risk of extinction by the International Union for Conservation of Nature (IUCN), largely as a result of anthropogenic activities. One species in need of conservation action is the spotted turtle (*Clemmys guttata*), a small freshwater turtle endemic to eastern North America. The spotted turtle is listed as Endangered by the IUCN and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and populations continue to decline due to habitat destruction/fragmentation, illegal capture for the pet-trade, and road mortality. While research has been conducted on coastal populations in Eastern Georgian Bay, Ontario, little is known about inland populations of central Ontario. One objective of our study is to use visual encounter surveys and mark-recapture data to describe the demography of populations across central Ontario, also allowing us to map the extent of occurrence in this understudied area, thus filling government-identified knowledge gaps. In 2022, 21 wetlands were surveyed yielding a total of 68 spotted turtle observations. Our second objective is to describe the spatial ecology, using radio-telemetry, of a large, inland population of spotted turtles, allowing us to quantify movement patterns and habitat selection, including quantification of the variables that influence aestivation behaviour. Preliminary field data collection in 2022 included monitoring movements and habitat use of 16 turtles outfitted with transmitters; turtles were tracked and located approximately once per week. Spatial data collected in July and August showed that turtles were predominately under cover, tucked into mosses and narrow-leaved emergent grasses in shallow water areas; no turtles were found aestivating in terrestrial areas. Our study will provide information that has the potential to support mitigation efforts by better informing provincial and federal conservation actions for spotted turtles.

5-minute

In Person

Student (not judged)

55

Effects of handling on Wood Turtle (*Glyptemys insculpta*) movement: insights using GPS loggers

Anna C. Varty¹, Damien I. Mullin¹, Graham J. Forbes¹, Christopher B. Edge²

¹University of New Brunswick, Fredericton, NB, Canada. ²Canadian Forest Service, Natural Resources Canada, Fredericton, NB, Canada

Abstract

Radio telemetry and GPS tracking are common methods used to study turtle movement, habitat use, and home range. However, the application of radio transmitters and GPS loggers is an invasive procedure, requiring capture, handling, and transmitter application, and is often a repeat occurrence for individuals. Behavioural responses to handling stress in non-reptile taxa are well documented and can impact animal behaviour, thus affecting the validity of research results. Previous work on handling-induced stress of the at-risk Wood Turtle (*Glyptemys insculpta*) suggests a physiological response to handling, yet there is no information on how handling may impact the movement of this species to date. Our objective is to determine if movement of adult female Wood Turtles differs significantly before and after standard handling procedures. In order to determine pre- and post-handling movement patterns, we will use GPS loggers to monitor turtle movement over a 12, 24 and 48 hour period before handling and a 12, 24 and 48 hour period after handling, with a fix interval of 4 hours. This study will involve 20 adult female Wood Turtles in south-central New Brunswick and will take place from July to September 2022. Individuals will be located using radio telemetry once per month and will be handled for 10 minutes when replacing GPS loggers. This information will be an important methodological study to inform future handling procedures when studying the Wood Turtle.

Poster

In-person

Student

The influence of landscape variables on turtle and frog railway interactions

Kyle D. Vincent¹, Jesse N. Popp², Cory L. Kozmik³, Steven J. Kell⁴, Angela Belleau⁵, Jacqueline D. Litzgus¹

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Abstract

The impacts of railways on wildlife are poorly understood, particularly for less charismatic and more vulnerable taxa like reptiles and amphibians. Although some studies have examined wildlife-railway use and mortality rates, few have investigated how wildlife interact with railways spatially. Our aim was to improve our understanding of turtle and frog railway interactions by determining whether interaction hot spots exist on railways, then investigating how adjacent habitat and landscape features influence where mortalities and live observations occur along the tracks. This study was initiated in partnership with two First Nations based on community concerns for train-killed wildlife, particularly species at risk. We conducted weekly surveys along two 3.6 km sections of railway and documented all observations of live and dead wildlife. For hot spot and spatial analyses, we focused on turtle and frog observations (turtles, $n = 63$; frogs, $n = 292$), as these groups were the most frequently impacted by railways, already face global population declines, and First Nation community members highlighted concern about turtle railway mortalities in interviews. Preliminary analyses identified significant hot spots of turtle and frog railway interactions at both study sites. Locations of turtle interactions were best predicted by the presence of gaps under the rail, potentially leading to entrapment, and proximity to wetlands, while frog interactions were found to be influenced by proximity to habitats with diverse land cover. Understanding where to target mitigation structures is important for effective wildlife conservation, as these efforts are often costly, time consuming, and need to be taxon specific to be most effective. The findings of this study provide valuable insight that may be used to target mitigation at identified hotspots, but also identify habitat predictors that could be important for targeting turtle and frog railway mitigation strategies on a broader scale.

Platform

In Person

Student

57

Differences in vocalization patterns of female and male adult painted turtles (*Chrysemys picta*) in various social contexts

Claire Voss, Claudia Lacroix, Njal Rollinson

University of Toronto, Toronto, ON, Canada

Abstract

The topic of turtle vocalizations first emerged in scientific literature less than 10 years ago, making reptilian bioacoustics a discipline in its infancy. Little has since been done to explore the characteristics of acoustic communication within the genus *Chrysemys*. Here we explore the vocal repertoire of the adult painted turtle (*Chrysemys picta*), and whether these vocalizations differ between the sexually dimorphic adult male and female painted turtles. Specifically, we performed a field experiment in Algonquin Provincial Park and recorded 35 hours of adult painted turtle audio underwater. The experimental set-up comprised five different behavioural contexts (e.g., 1 male, 1 female, 2 males, 2 females, 1 male and 1 female) in which mature turtles were placed in cattle tanks filled with water. We then used hydrophones and acoustic monitoring techniques to record underwater vocalizations at 1-hour intervals. Vocalizations were then categorized based on their auditory and visual qualities using sound analysis software. Overall, we present the underwater vocal repertoire of adult painted turtles and introduce preliminary results highlighting differences in vocalization behaviours between males and females. We will then present ongoing work that is further exploring variation in vocalization behaviours among different social contexts (e.g., male and female vs. male and male) and whether vocalizations correlate with the number of social interactions observed. In sum, our study furthers our understanding of acoustic communication in non-avian reptiles, with the hope of elucidating the role of acoustic communication in social behaviour and sexual selection among turtles.

Platform

In Person

Student

CHS / SHC Fredericton 2022

58

Status of turtle populations in Point Pelee National Park: A 20-year update

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Testudines are one of the most at-risk vertebrate orders globally. All turtle species in Ontario are currently listed on the Species at Risk Act and Point Pelee National Park has historically offered the greatest freshwater turtle diversity in Canada. Our study is taking place in PPNP which is currently home to five species of turtles with a sixth having been recorded in the past using the beaches for nesting. The most extensive study of the turtle populations in PPNP conducted by Browne and Hecnar (2001-2002) indicated top heavy age-structure and high rates of nest predation. Our team has been studying the turtle community to provide a snapshot in time and examine their current status as well as the efficacy of the nest protection program started in 2001 by Browne and still practiced by Parks Canada. Methods of capture include hoop traps and basking traps and individuals are marked and released. In 2022 we have had more than 400 Snapping Turtle captures and 900 total captures. Although this study will be conducted over two field seasons and we have completed one field season, early results suggest a shift in community structure. Early results also suggest the nest protection program has been efficacious. Additional highlights of our research have included predator surveys, overwintering map turtle hatchlings, and a Blanding's individual that had two clutches in a single year.

5-minute

Virtual

Student

59

A soft release does not improve reintroduction outcomes for an endangered Freshwater turtle in an urban landscape

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Abstract

Headstarting is used as a conservation tool to recover endangered animal populations worldwide. Headstarted animals sometimes exhibit a behavioural acclimation period as they gain experience in the release environment. Soft release has reduced the acclimation period and improved reintroduction outcomes (e.g., survival) in some headstarted species, but has not been tested in freshwater turtles in terms of body condition and growth rate. Using data collected from headstarted Blanding's Turtles (*Emydoidea blandingii*) released into an urban wetland complex in Toronto, Ontario, we quantified body condition and growth rate to test for a post-release acclimation period. We further examined whether using a soft release improved acclimation period. Soft release involved confining headstarted turtles to an enclosure for seven days at the release site without food provisioning. We found that both soft- and hard-released turtles experienced reduced body conditions, indicating an acclimation period of up to 365 days, with soft-released turtles showing an initial steeper decline in body condition. The growth rate of hard-released turtles was slightly faster on average than that of soft-released turtles, but this difference was not statistically significant. We also compared the body condition of our headstarted turtles with conspecific wild populations and found that the body condition of the headstarted turtles was higher than those of wild turtles in Algonquin Park and Lake Erie populations. However, the habitat and environmental conditions of the study sites likely played a larger role in the observed differences than headstarting, given that we compared Blanding's Turtles of similar size. Based on our results, soft release did not improve the acclimation period of headstarted Blanding's Turtles at our study site. In the future, we plan to investigate whether soft release yields any benefits in terms of survival and movement patterns of headstarted turtles.

Platform

In Person

Student

The great unknown: Understanding mitigation translocation of herpetofauna in BC.

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Abstract

British Columbia (BC) is home to a diverse herpetofauna assemblage (32 native species) with diversity and abundance concentrated in the southern regions where human environmental impacts are high. During highway construction prior to the 2010 Winter Olympics in Vancouver, a highway was realigned impacting high value amphibian habitat. In response to public pressure during this highway construction, 1,037 amphibians of six species, including 683 Red-legged Frogs (SARA Species of Special Concern) were captured and translocated from the impacted wetlands to outside the highway project footprint. Since this high-profile translocation, the number of these mitigation translocations for herpetofauna have increased over the past decade. The capture and translocation of wildlife, including herpetofauna, is regulated under the B.C. Wildlife Act. To understand the extent of these translocations, B.C. Wildlife Act permit applications were tracked from 2019-2021. A total of 604 mitigation translocation permits for herpetofauna were submitted during this time, but 180 (30%) these applications were withdrawn due to project changes or delays. In total, these permits estimated that approximately 1.5 million animals would be translocated. However, actual number of animals translocated remains unknown due to lack of reporting and follow up. Less than half the mitigation translocation projects (181/409, 44%) submitted post-salvage reports. The total from these reports alone indicates that 1.2 million herpetofauna were translocated. Most of the translocated animals were amphibians, with reptiles forming a very small fraction of the translocated animals (162 individuals). The most commonly translocated species were: Western Toad (*Anaxyrus boreas*) (~1.1 million), followed by Northwestern Salamander (*Ambystoma gracile*) (n=61,687) and Long-toed Salamander (*Ambystoma macrodactylum*) (n=17,462). Based on this preliminary analysis, it is clear that large numbers of herpetofauna are being translocated at significant cost but the efficacy of these translocations in conserving herpetofauna populations during development projects is unknown.

5-minute

Virtual

CHS / SHC Fredericton 2022

Information about your host city of Fredericton, New Brunswick

1. Useful Links

- i. Wolastoqey History (what land are we gathering on?)
<https://wnnb.wolastoqey.ca/history/>
- ii. Fredericton Tourism
<https://www.tourismfredericton.ca/>
- iii. Fredericton Taproom Trail
<http://www.tourismfredericton.ca/en/beer/fredericton-taproom-trail>
- iv. Fredericton Harvest Festival
<https://harvestmusicfest.ca/>
- v. Wu Centre, University of New Brunswick
<https://www.unb.ca/fredericton/conference-services/meet/wu-centre.html>
- vi. Hyla Park Nature Preserve
<https://www.naturetrust.nb.ca/en/hyla-park-nature-preserve>
- vii. Odell Park
<http://www.tourismfredericton.ca/en/experience/odell-park-odell-arboretum>
- viii. UNB Woodlot
<https://www.unb.ca/fredericton/forestry/current-students/hands-on-learning/forest-lands.html>
- ix. Beaverbrook Art Gallery
<https://beaverbrookartgallery.org/>