

**6<sup>th</sup> Annual Meeting of the  
Canadian Herpetological Society  
6<sup>ème</sup> congrès annuel de la  
Société d'Herpétologie du Canada**



**Montréal 2019**

**MUSÉE  
REDPATH  
MUSEUM**

**McGill University**





## The Canadian Herpetological Society

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The Canadian Herpetological Society is devoted to fostering scientific research on amphibians and reptiles and, in recognition of the inherent value of all native amphibians and reptiles, conserving Canada's native species of amphibians and reptiles and their ecological and evolutionary functions in perpetuity. The CHS is made up of researchers, conservation practitioners, naturalists, educators, and other individuals with an interest in Canada's reptiles and amphibians.

The CHS 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.

The CHS strives to foster a safe, friendly, and respectful environment for members and will not condone or tolerate harassment or discrimination in any form. CHS members will observe and uphold the highest standards of scientific integrity and professional behaviour.

The CHS is a registered Canadian charity.

**President:** Jacqueline Litzgus, Laurentian University

**Vice President:** Pamela Rutherford, Brandon University

**Past President:** Joe Crowley, Ontario Ministry of Natural Resources and Forestry

**Treasurer:** Jose Lefebvre, Acadia University

**Secretary:** Amanda Bennett, Council of Canadian Academies

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Leslie Anthony, Cascade Environmental, Whistler, BC

Christina Davy, Ontario Ministry of Natural Resources and Forestry

Yohann Dubois, Ministère des Forêts, de la Faune et des Parcs du Québec

Stephen Hecnar, Lakehead University

Patrick Moldowan, University of Toronto

Scott Gillingwater, Upper Thames River Conservation Authority

**Editors of The Canadian Herpetologist:** Jackie Litzgus and Joe Crowley

## The Redpath Museum

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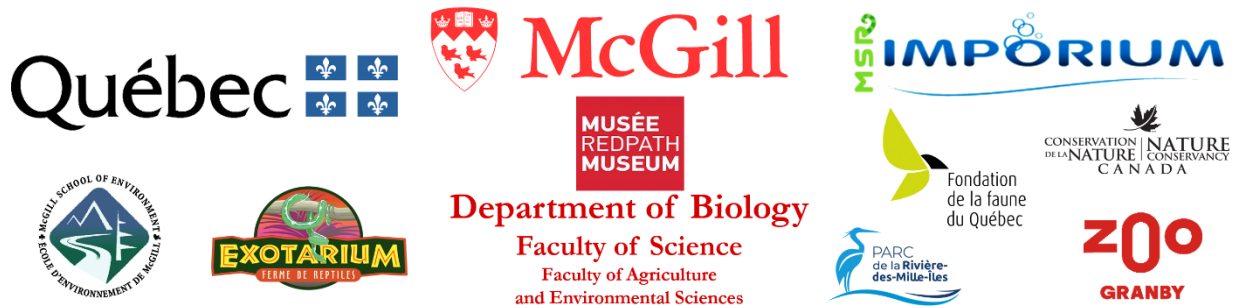
The Redpath Museum is the natural history museum of McGill University. Opened in 1882, it is both the oldest museum building and the oldest natural history museum in Canada. It is a small academic unit with seven academic faculty, plus curatorial, outreach and support staff. Although small, it is a full-service museum with strong collections of over 1.6 million catalogued specimens, primarily in zoology, paleontology, mineralogy and non-Canadian ethnology, with extensive research programs focused on evolution, ecology and conservation biology. It offers undergraduate courses and graduate training in these fields, has permanent exhibits open to the public, and maintains an extensive program of public engagement.

**Washrooms:** The Redpath Museum building, however, is conspicuously underserved with washroom facilities. Washrooms are located in the basement. They are inadequate for a large group of people. Additional washrooms are available next door in the Leacock Building basement.



## Sponsors

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### Platinum Sponsors:

Redpath Museum, McGill University  
Ministère des Forêts, de la Faune et des Parcs, Québec  
Department of Biology, McGill University

### Gold Sponsors:

MSR Imporium Canada Inc., Lasalle, Québec  
Exotarium, ferme de reptiles. St. Eustache, Québec  
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### Silver Sponsors:

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Faculty of Agriculture and Environmental Sciences, McGill University  
Parc de la Rivière-des-Mille-Îles, Laval, Québec

## Local Organizing Committee:

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**David M. Green** (Chair), Redpath Museum, McGill University  
**Jessica Ford**, Department of Biology, McGill University  
**Nathalie Jreidini**, Department of Biology, McGill University  
**Eric Guerra-Grenier**, Department of Biology, McGill University  
**Pablo Menendez**, Department of Biology, McGill University  
**Hans Larsson**, Redpath Museum, McGill University  
**Heather Gray**, Redpath Museum, McGill University  
**Hervé Maranda**, Exotarium, ferme de reptiles. St. Eustache, QC  
**Joël Bonin**, Nature Conservancy of Canada  
**Anaïs Boutin**, Biologiste, Laval, QC

### With thanks to:

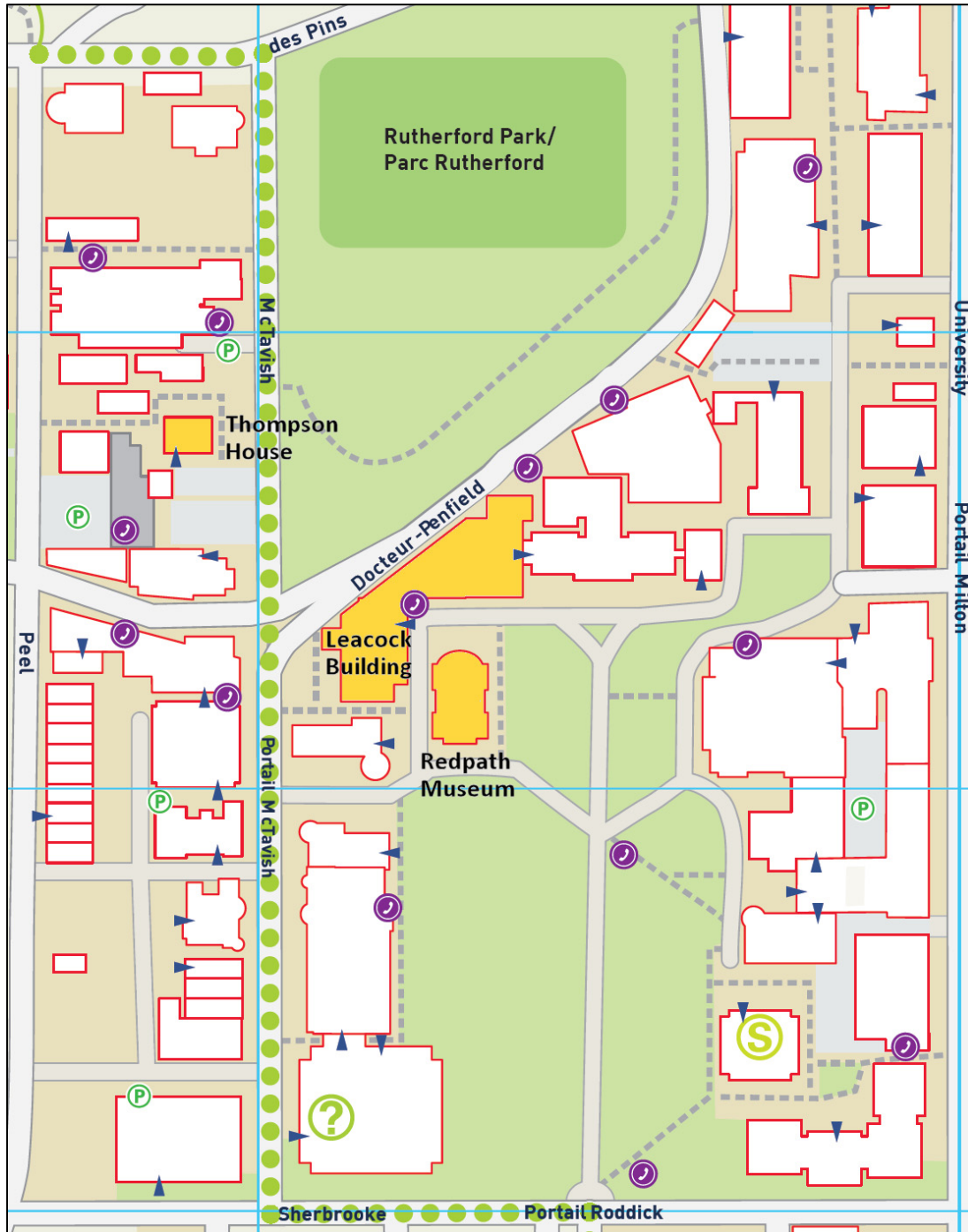
**Redpath Museum:** Ingrid Birker, Ginette Dessureault, Caroline Leblond, Andrew Hendry, Rowan Barrett, and the Redpath Museum Club

**CHS:** Jose Lefebvre, Amanda Bennett, Joe Crowley, Jacqueline Litzgus, Steve Marks, Drew Haysak, Jonathon Choquette, and all session chairs.

*This year's logo was created by Jessica Ford.*



# McGill University Lower Campus Map





## Presentation Guidelines

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### Oral Presentations

- Use PowerPoint for your presentation.
- Bring an electronic copy of the PowerPoint presentation on a USB memory device.
- Mac users must save their PowerPoint presentation in PC format with a .ppt or .pptx file extension.
- You may not use your own computer for your presentation. Check that your presentation works smoothly on a PC (Windows) computer before bringing it to the conference.
- Arrive at least 30 minutes prior to the beginning of your session and provide your presentation to the chairperson so that it can be loaded onto the session computer.
- Contributed oral (i.e. platform) presentations are scheduled in 15-minute time slots. Therefore, talks should be 12 minutes long to allow for up to 3 minutes of questions.
- Note that this conference will have two concurrent sessions at all times during the scientific program, except for the keynote plenary presentations on Saturday and Sunday mornings. To allow participants to move between rooms between talks, session chairs will not allow any speaker to go beyond his or her allotted 15 minutes.

### Poster presentations

- Posters should be formatted to a maximum of 36" on a side.
- Posters may be displayed all day Saturday and on Sunday morning.
- Poster boards will be available in the 2<sup>nd</sup> floor Dawson Gallery of the Redpath Museum. Presenters may mount their posters on any available poster board.
- The official poster session will be on Saturday afternoon at 4:00pm, prior to the Annual General Meeting of the Society. During the poster session, presenters are expected to attend their posters.
- Take-down of posters will be Sunday at noon.

***Presenters are solely responsible for the content of their presentations.  
Les présentateurs sont seuls responsables du contenu de leurs présentations.***





## Opening Reception

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### Friday, September 20<sup>th</sup>

**17:15 – 21:00 No-host general reception for all participants**

Redpath Museum, Dawson Gallery (2<sup>nd</sup> Floor)

Wine, beer and assorted delicacies will be on offer.

## Business Meetings

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### Saturday, September 21<sup>st</sup>

**12:00 Canadian Herpetological Society Board Meeting**

Redpath Museum, Dawson Gallery (2<sup>nd</sup> Floor)

### Sunday, September 22<sup>nd</sup>

**12:00 Captive Rearing and Introductions Working group**

Redpath Museum, Dawson Gallery (2<sup>nd</sup> Floor)

**16:45 Chorus Frog Conservation and Recovery Group discussion**

Redpath Museum, Room 106

## Silent Auction

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### Saturday September 21<sup>st</sup> and Sunday September 22<sup>nd</sup>

Redpath Museum Rm 200.

Books, paintings, illustrations, photographs, sculptures and assorted other unique and herpetologically themed items are for sale to the highest bidder. Cash or credit accepted.

Organized by Pablo Menendez.

**9:00 – 17:00 Saturday and 9:00 - 12:00 Sunday:** Items are on display and open for bids

**12:00 Sunday:** Bidding closes. Winners announced.

**Thank you to our donors:** Richard Ancheta, Ingrid Birker, Luis A. Coloma, Jonathan Davies, Ginette Dessureault, David M. Green, Andrew Hendry, Sheena Lee, Marion Pennell, Santiago Ron, Veronica Steiner, Susan Stromberg, Mary Intven Wallace, Anne Yagi, Montreal Botanical Garden, Rio Tinto Alcan Planetarium, and others.

## Group Picture

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### Saturday September 21<sup>st</sup>

**12:00 noon** Redpath Museum front steps



## Program at a Glance

### Friday, September 20th

17:15 **Opening No-host Reception** (Redpath Museum Dawson Galley (2<sup>nd</sup> floor))

### Saturday, September 21<sup>st</sup>

#### Plenary Keynote Address (Redpath Museum Auditorium)

9:00 **Hans Larsson** (Director of the Redpath Museum). Wranglin' crocs through the ages.

#### Session 1 (Redpath Museum Auditorium)

Chair: Jackie Litzgus

#### Session 2 (Redpath Museum Room 106)

Chair: Steven C. Loughheed

9:45	Leermakers*	Pollack*
10:00	Rouleau*	Ford*
10:15	Angoh*	Ziebarth*
10:30	<b>Break</b>	
11:00	Feng*	Choquette*
11:15	Connoy*	Dillon*
11:30	Leivesley*	Comsa*
11:45	Terebiznik*	Macpherson*

12:00 *Group Picture (Redpath Museum front steps)*

12:10 **Lunch Break**

*Meeting: CHS Board of Directors (Redpath Museum Dawson Gallery)*

#### Session 3 (Redpath Museum Auditorium)

Chair: James Paterson

#### Session 4 (Redpath Museum Room 106)

Chair: David M. Green

14:00	Van Den Diepstraten*	Guerra-Grenier*
14:15	Fenech*	Chen*
14:30	Wijewardena*	Trowbridge*
14:45	Wallace*	Jreidini*
15:00	Ellsworth*	Moldowan*
15:15	Vlcek*	Fieschi-Méric*
15:30	Paterson	Linton
15:45	Davy	Green

(\* student competition participant)

16:00 **Posters** (Redpath Museum Dawson Gallery)

Britt*	Browning	Camarasa
Čapkun-Huot	Fotherby	Gallon
Khalilzadeh	Oromi	Skinner*
Sukumar	Trowbridge*	Wijewardena*

(\* student poster competition participant)

17:00 **CHS Annual General Meeting** (Redpath Museum Auditorium)

19:00 **CHS Banquet** (Thompson House, McGill University)



## Program at a Glance

### Sunday, September 22<sup>nd</sup>

#### Plenary Keynote Address (Redpath Museum Auditorium)

**9:15 Mathieu Denoël** (Université de Liège, Belgique) Facultative paedomorphosis in newts: a fascinating polyphenism threatened by environmental change

#### Session 5 (Redpath Museum Auditorium)

Chair: Hannah McCurdy-Adams

#### Session 6 (Redpath Museum Room 106)

Chair: Lea Randall

10:00	Hughes	Dubois
10:15	Mazerolle	Randall
10:30	<b>Break</b>	
11:00	Galway	K. Yagi
11:15	Lougheed	Gallon
11:30	Trudeau	A. Yagi
11:45	McCurdy-Adams	Dionne
12:00	<b>Lunch Break</b>	

*Meeting: Captive Rearing and Introductions Working Group (Redpath Museum Dawson Gallery)*

#### Session 7 (Redpath Museum Auditorium)

Chair: Constance Browne

#### Session 8 (Redpath Museum Room 106)

Chair: Pamela Rutherford

14:00	Bonin	Andrews
14:15	Zagorski	Van Drunen
14:30	Browne	Lee-Yaw
14:45	<b>Break</b>	
15:15	Gunson	Gray
15:30	Seburn	Clemente-Carvalho
15:45	Bulté	Rutherford
16:00		
16:45	<i>Meeting: Chorus Frog Conservation and Recovery Group discussion (Redpath Museum Room 106)</i>	

### Monday, September 23<sup>rd</sup>

#### Field Trip to Parc de la Rivière-des-Mille-Îles

**8:30** Departure from McGill University (Sherbrooke St.)  
**15:30** Return (time approximate)



## Saturday Morning, September 21<sup>st</sup>

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### Plenary Keynote Address

#### Redpath Museum Auditorium

9:00 **Hans Larsson** (Director of the Redpath Museum). Wranglin' crocs through the ages

### Session 1

#### Redpath Museum Auditorium

Chair: Jackie Litzgus

9:45 **Leermakers\*** Mitigating road mortality of wildlife in Rouge National Urban Park

10:00 **Rouleau\*** Socioecology of the Midland Painted Turtle (*Chrysemys picta marginata*)

10:15 **Angoh\*** Effects of invasive wetland macrophytes on habitat selection by turtles

10:30

11:00 **Feng\*** Environmental DNA surveys help to identify winter hibernacula of a temperate freshwater turtle.

11:15 **Connoy\*** At what time will turtles nest? A comparative study across scales of nest time preferences of freshwater turtles in North America.

11:30 **Leivesley\*** The feminization of a Snapping Turtle (*Chelydra serpentina*) population and a reconstruction of historical hatchling sex ratios.

11:45 **Terebiznik\*** Phenotype-environment correlations in wild snapping turtle nests, and the maintenance of temperature-dependent sex determination.

12:00

**Group picture** (Redpath Museum front steps)

12:10

**Lunch Break**

### Session 2

#### Redpath Museum Room 106

Chair: Steven C. Lougheed

**Pollack\*** Determining trophic transfer of microplastics in the St. Lawrence River system

**Ford\*** The net effect of toad tadpoles on their environment

**Ziebarth\*** Local-scale drivers of amphibian and reptile beta diversity in Ontario's landscape

### Break

**Choquette\*** Occupancy modeling as an approach to evaluate effectiveness of conservation translocations in a temperate-zone rattlesnake

**Dillon\*** Does ophidiomycosis (snake fungal disease) affect the fitness of wild Eastern Foxsnakes (*Pantherophis gloydi*)?

**Comsa\*** Fingerprinting Foxsnakes: evaluating the accuracy of ventral markings as individual identification in Eastern Foxsnakes (*Pantherophis gloydi*)

**Macpherson\*** Testing efficacy of mitigation fencing designs at preventing road access by Gray Ratsnakes

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(\* student competition participant)



## Saturday Afternoon, September 21<sup>st</sup>

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### Session 3

#### Redpath Museum Auditorium

Chair: James Paterson

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- 14:00 Van Den Diepstraten\*** Behavioural response of an endangered freshwater turtle (*Clemmys guttata*) to dynamic coastal wetlands
- 14:15 Fenech\*** Communal nesting of Common Snapping Turtles (*Chelydra serpentina*) using visual cues
- 14:30 Vlcek\*** Do freshwater turtles preferentially nest in disturbed soil?
- 14:45 Wallace\*** Mortality risk to Wood Turtles in a landscape under active agriculture in New Brunswick
- 15:00 Ellsworth\*** Knowledge and opinions of turtle road mortality mitigation efforts on Hwy 69, Ontario
- 15:15 Wijewardena\*** Habitat protection, restoration, and head-starting: can these conservation strategies recover an urban population of endangered Blanding's Turtle (*Emydoidea blandingii*)?
- 15:30 Paterson** Modelling the effects of rehabilitation on turtle populations
- 15:45 Davy** Spatial genetics of Canadian Queensnakes (*Regina septemvittata*) reveal near-total isolation of population fragments on a heavily modified landscape

### Session 4

#### Redpath Museum Room 106

Chair: David M. Green

- 
- Guerra-Grenier\*** Hidden yellow markings in Pickerel Frogs (*Lithobates palustris*): testing for possible functions one picture at a time
- Chen\*** Understanding variation in male advertisement calls in Spring Peepers (*Pseudacris crucifer*)
- Trowbridge\*** Let the little guys speak! Anuran community ecology and calling acoustics in windfarms
- Jreidini\*** Using 8 years of capture-recapture data on the endangered Fowler's Toad (*Anaxyrus fowleri*) to explore dispersal theories
- Moldowan\*** Nature's pitfall trap: Salamanders as rich prey for carnivorous plants in a nutrient-poor northern bog ecosystem
- Fieschi-Méric\*** Adaptation to captivity within ex-situ collections of urodeles: a case study with Alpine (*Ichthyosaura alpestris*) and Palmate (*Lissotriton helveticus*) newts.
- Linton** Recovering endangered Jefferson Salamander (*Ambystoma jeffersonianum*) and Jefferson-dependent unisexuals (*Ambystoma laterale* - (2) *jeffersonianum*): a case study using egg translocation
- Green** Dispersal is stochastic but migration evolves.

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(\* student competition participant)



## Saturday Afternoon and Evening, September 21<sup>st</sup>

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16:00 **Posters** (and refreshments)

### Redpath Museum Dawson Gallery

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**Britt\*** The impact of temporal vegetation variation on Spring Peeper (*Pseudacris crucifer*) advertisement call propagation in their northern range

**Browning** Night moves: nocturnal movements of endangered Spotted Turtles (*Clemmys guttata*) and Blanding's Turtles (*Emydoidea blandingii*)

**Camarasa** Life history traits variation of *Calotriton asper* (Pyrenean brook newt) in populations of lake and mountain streams.

**Čapkun-Huot** The effects of sex, physical traits, and parasites on painted turtle (*Chrysemys picta*) behaviour

**Gallon** Potential variables influencing habitat suitability for Eastern Hog-Nosed Snakes (*Heterodon platirhinos*) at their northern range limit

**Fotherby** Habitat use by the Carolinian population of Gray Ratsnake (*Pantherophis spiloides*) in Ontario

**Khalilzadeh** Genetic monitoring of wild and reintroduced Northern Leopard Frog (*Lithobates pipiens*) populations: optimization of a slow recovery

**Oromi** Population dynamics of natterjack toad (*Epidalea calamita*) in the semiarid zone of Mas de Melons

**Skinner\*** Individual differences in sociability and boldness in Eastern Garter Snakes

**Sukumar** Developing a standardized long-term monitoring protocol for Ontario snakes

**Trowbridge\*** Herps in the wind: the community ecology of herpetofauna in windfarms

**Wijewardena\*** Drivers of communal overwintering behaviour of Blanding's Turtle (*Emydoidea blandingii*) in a restored wetland complex in the Rouge National Urban Park, Ontario, Canada

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(\* student poster competition participant)

17:00 **CHS Annual General Meeting**  
Redpath Museum Auditorium

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19:00 **CHS Banquet** (doors open at 19:00, seating for dinner at 19:30)  
Thompson House, McGill University

**After dinner program.** Jonathon Choquette, MC

**Travelogue:** Steve Marks "Australia: From Sydney to Uluru and back again!"

**Awards:** Silver Salamander and Blue Racer Awards, Student Awards

**Canadian Herpetology Quiz.** Joe Crowley, quizmaster

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## Sunday Morning, September 22<sup>nd</sup>

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### Plenary Keynote Address

#### Redpath Museum Auditorium

- 9:15 Mathieu Denoël** (Université de Liège, Belgique) Facultative paedomorphosis in newts: a fascinating polyphenism threatened by environmental change

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### Session 5

#### Redpath Museum Auditorium

Chair: Hannah McCurdy-Adams

- 10:00 Hughes** Monitoring of measures to maintain connectivity for anurans in an urbanizing landscape
- 10:15 Mazerolle** Landscape effects and temporal patterns in roadside anuran populations from a 21-year monitoring program
- 10:30**
- 11:00 Galway** Introducing the new long-term occurrence monitoring program for the great lakes – St. Lawrence – Canadian Shield population of the Western Chorus Frog (*Pseudacris triseriata*)
- 11:15 Loughheed** Conservation genomics of chorus frogs from across Canada
- 11:30 Trudeau** Captive breeding and reintroduction of Leopard and Chorus Frogs in Canada
- 11:45 McCurdy-Adams** Prioritizing species recovery projects: how do you choose your next project to have the greatest conservation benefit?
- 12:00**

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### Session 6

#### Redpath Museum Room 106

Chair: Lea Randall

- Dubois** Will eDNA improve amphibians and reptiles monitoring programs?
- Randall** How can mitigation guidelines be applied effectively?
- Break**
- K. Yagi** Immediate and long-term effects of public beach use on the movement and survival of the endangered Fowler's Toads (*Anaxyrus fowleri*) at Nickel Beach, Port Colborne Ontario
- Gallon** Cats aren't the only ones with nine lives... Spatial ecology of Eastern Hog-nosed Snakes (*Heterodon platirhinos*) in an anthropogenically-modified landscape
- A. Yagi** A long-term study on Massasaugas (*Sistrurus catenatus*) inhabiting a partially-mined peatland: presenting a novel approach to characterizing snake overwintering habitat
- Dionne** Les étangs vernaux – des Habitats indispensables à protéger

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### Lunch Break



## Sunday Afternoon, September 22<sup>nd</sup>

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### Session 7

#### Redpath Museum Auditorium

Chair: Constance Browne

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**14:00 Bonin** An overview of the Nature Conservancy of Canada's initiatives to save turtle species at risk in partnership with Quebec recovery teams.

**14:15 Zagorski** Pros and cons of using GPS tags for tracking semi-aquatic turtles

**14:30 Browne** Life history and ecology of a small urban population of Eastern Painted Turtles in New Brunswick

**14:45**

**15:15 Gunson** Results from four years of monitoring drainage culverts and designated crossing structures for turtles along 5 phases of construction on Highway 69 in Ontario

**15:30 Seburn** Do turtle warning signs reduce roadkill?

**15:45 Bulté** Adding insult to injury: impacts of recreational motor boating on a population of Northern Map Turtles.

### Session 8

#### Redpath Museum Room 106

Chair: Pamela Rutherford

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**Andrews** The Monkton Vermont amphibian underpasses

**Van Drunen** Estimating critical habitat for the endangered Jefferson salamander (*Ambystoma jeffersonianum*) and their unisexual dependents based on year-round movements

**Lee-Yaw** The evolutionary ecology of subspecies' boundaries in the Long-toed Salamander

### Break

**Gray** Amphibian biodiversity surveys in intact forests of the Darien, Panama: a collaborative project with local communities.

**Clemente-Carvalho** The pectoral girdle of *Brachycephalus* (Anura: Brachycephalidae) — does the microscopic organization resemble the macroscopic structure?

**Rutherford** Impacts of agriculture and roads on amphibians in the prairie potholes of Manitoba, Canada

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## Monday, September 23<sup>rd</sup>

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### Field Trip to Parc de la Rivière-des-Mille-Îles

**8:30** Pick up at McGill and departure to Parc de la Rivière-des-Mille-Îles for visits to the Centre d'exploration, Miller Marsh and riverside habitats

**15:30** Return to Montreal

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## ABSTRACTS

### Oral Presentations

(\* indicates speaker)

ANGOH

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#### EFFECTS OF INVASIVE WETLAND MACROPHYTES ON HABITAT SELECTION BY TURTLES

Siow Yan Jennifer Angoh<sup>1\*</sup>, Joanna Freeland<sup>1</sup>, James Paterson<sup>1</sup>, Prabha Amali Rupasinghe<sup>2</sup>, and Christina Davy<sup>1,3</sup>

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<sup>2</sup> Department of Biology, McMaster University, Hamilton, ON L8S 4K1, rupasinp@mcmaster.ca

<sup>3</sup> Ontario Ministry of Natural Resources and Forestry, Wildlife Research and Monitoring Section, Peterborough, ON, K9J 7B8, christina.davy@ontario.ca

Invasive species that alter habitats can have significant impacts on wildlife. The invasive graminoid *Phragmites australis*, hereafter *Phragmites*, is rapidly spreading into North American wetlands, replacing native vegetation. Invasive *Phragmites* is considered a potential threat to several species-at-risk (SAR), including some turtles. To explore the hypothesis that *Phragmites* does not provide suitable habitat for turtles, we tested the prediction that turtles avoid *Phragmites*. We used VHF-GPS transmitters to follow Blanding's turtles (*Emydoidea blandingii*, n = 14) and spotted turtles (*Clemmys guttata*, n = 12). Our study wetland contains large stands of *Phragmites*, as well as *Typha* spp. (including invasive *Typha × glauca*) that have similar structural traits to *Phragmites*. We found that both turtle species did not avoid habitats dominated by *Phragmites* or *Typha* when choosing a home range at the landscape scale, or while moving within their home range. We also tested whether Blanding's and spotted turtles' microhabitat selection is affected by shoot density of *Phragmites*, *Typha*, or both. We compared shoot densities of *Phragmites* and *Typha* in 4 m<sup>2</sup> plots, from locations used by tracked turtles with paired, random locations in these turtles' home ranges. For both turtle species, the densities of *Phragmites* and *Typha* shoots were comparable between used and random locations within the home ranges (generalized linear mixed models; p > 0.05). The use of *Phragmites* stands by Blanding's and spotted turtles suggests that *Phragmites* stands can provide habitats that are equally suitable to similar available habitats, including *Typha* marshes, and do not automatically constitute "unsuitable habitats". *Phragmites* can replace preferred habitats of some turtle species, and control of *Phragmites* can help to preserve habitat heterogeneity. However, the presence of SAR turtles in *Phragmites* stands should inform risk-assessments for *Phragmites* control methods that include mechanical rolling of stands, where heavy machinery might encounter turtles.  
(student award competition)



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## ANDREWS

### THE MONKTON VERMONT AMPHIBIAN UNDERPASSES

James S. Andrews

The Vermont Reptile and Amphibian Atlas, 642 Smead Road, Salisbury, VT 05769,  
jandrews@vtherpatlas.org

In 1993, an amphibian road-crossing area was discovered on a busy two-lane, paved, town road in Monkton, Vermont, USA. Monitoring of the site began in 1997 and it was determined to be a conservation-priority crossing area for amphibians and other wildlife. Priority for conservation action was based on a high number of amphibians crossing, high diversity of species, high-numbers of species of greatest conservation need present (*Ambystoma laterale*), and high mortality from traffic. The Monkton Vermont Conservation Commission working with the Lewis Creek Association began raising money in 2008 for two amphibian underpasses to be built. Funds were raised from Defenders of Wildlife, the Davis Conservation Foundation a Federal Transportation Enhancement Grant, a Vermont Fish and Wildlife Department State Wildlife Grant, direct mail fundraising, and an online Indiegogo fundraiser. Fundraising covered the total construction, design, and oversight costs of \$342,000. Construction took place during the summer of 2015 and the underpasses were functional during the spring amphibian migration of 2016. Cameras were installed in the culverts and programmed to take photos every minute from dusk through dawn between March 10 and May 3, 2016. These cameras recorded 2,208 amphibians crossing in one or both directions during this time period. Video is available at the Vermont Reptile and Amphibian Atlas Facebook page and through YouTube. Many other mammal and bird species are using the tunnels, ranging in size from *Peromyscus* sp. mice to porcupines and bobcat. Road-surface monitoring continues.

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## BONIN

### AN OVERVIEW OF THE NATURE CONSERVANCY OF CANADA'S INITIATIVES TO SAVE TURTLE SPECIES AT RISK IN PARTNERSHIP WITH QUEBEC RECOVERY TEAMS.

Joel Bonin<sup>\*1</sup>, Caroline Gagné<sup>2</sup> and Valérie René<sup>1</sup>

<sup>1</sup>The Nature Conservancy of Canada, Montréal, Qc, joel.bonin@natureconservancy.ca,  
valerie.rene@natureconservancy.ca,

<sup>2</sup> The Nature Conservancy of Canada, Gatineau, Qc, caroline.gagne@natureconservancy.ca

Among the turtle species facing the greatest risks, Spiny Softshell (*Apalone spinifera*), Wood (*Glyptemys insculpta*) and Blanding's (*Emydoidea blandingii*) benefit from the work undertaken by the Nature Conservancy of Canada (NCC) in collaboration with governmental and private organizations in Québec. Habitat protection and recovery actions are now facilitated by a five years partnership with the Granby Zoo. Thanks to that joined effort, a recent acquisition will add to the protection of the Spiny Softshell within the Lake Champlain area. Since the government of Canada adopted the Species at Risk Act in 2002, a third of the species' habitat within that area has been protected thanks to land acquisition. Over the last 15 years, the annual revenue of a \$100,000 stewardship endowment fund has been used there to support citizen science and



recovery team's priorities. Habitat enhancements include nesting ground and wetland restoration in partnership with the government of Québec and various other partners. This level of collaboration is taking place elsewhere for other species of turtle. Environmental DNA analysis has been used to search for the elusive Wood and Blanding's in several localities of the Ottawa valley thanks to a recent partnership with scientists. Over the last three years, the citizen science mobile phone application [Carapace.ca](http://Carapace.ca) has produced more than 3000 turtle sightings along roads across the province. Road kills frequency data help identify areas of special concerns where roadside mitigation infrastructures may be required. We are presenting several examples of drift fence and road crossing that have been erected on NCC protected properties in partnership with the ministry of transportation of Québec. Even if new technology are now at the service of conservation, the participation of volunteer observers is instrumental. This reminds us of the importance to support initiatives such as the Atlas of Amphibians and Reptiles of Québec.

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**BROWNE**

### **LIFE HISTORY AND ECOLOGY OF A SMALL URBAN POPULATION OF EASTERN PAINTED TURTLES IN NEW BRUNSWICK**

Constance L. Browne<sup>1\*</sup> and S. Andrew Sullivan<sup>1</sup>

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We examined the population demographics of a small, urban, population of Eastern Painted Turtles in New Brunswick near the northern limits of the species range. We captured turtles using hoop traps, dip-netting, and by hand, marking and measuring each turtle. Jolly-Seber population size estimates indicated that our population included 17 females (95% CI = 17-17), 9 males (95% CI = 9-9), and 29 juveniles (95% CI = 22-48) in late summer 2015. We captured a number of very large females at our study site; 5 of 17 females (29%) were larger than the largest previously recorded Eastern Painted Turtle. Growth rates for juveniles were greater than most populations of Eastern Painted Turtles reported elsewhere. Growth rates at our site were significantly greater for smaller (younger) turtles and also for females compared to males. Overall survivorship estimates were 100% from late summer 2014 to spring 2015 (overwinter). From spring 2015 to late summer 2015 survivorship was 100% for females, 89% for males, and 93% for juveniles. We speculate that the large body sizes found at our study site were achieved through good survivorship rates and higher growth rates compared to other areas reported previously. Our data supports previous findings that size of painted turtles increases with increasing latitude, and additionally, growth may have been enhanced by the increased nutrient levels common in human-modified landscapes.

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**BULTÉ**

### **ADDING INSULT TO INJURY: IMPACTS OF RECREATIONAL MOTOR BOATING ON A POPULATION OF NORTHERN MAP TURTLES.**

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Recreation is an important service provided by freshwater ecosystems. Recreational powerboating is particularly popular in Canada but this activity has been shown to have various negative consequences on aquatic wildlife including freshwater turtles. Since 2003, we have been gathering observational and experimental data on the effects of motor boats on a population of northern map turtles in Lake Opinicon, Ontario. The frequency of traumatic injuries attributed to propellers increased from 3.8% during the 2003-2007 period to 8.4% in 2019. Mortality rate from boat strikes is unknown but population viability analysis indicates that low levels of mortality would result in population decline. In addition to causing injuries, motor boats can disturb basking turtles. In lake Opinicon, rates of disturbance ranged from 0.15 disturbance/hour in May to 1.23 disturbance/hour in July and August. According energetic models, such levels of disturbance can negatively affect turtle's metabolism. Experimental disturbance of females in May also shows that most females basking at a site do not resume basking at that site in the two hours following the disturbance. We conclude by highlighting areas of future research on the interactions between boating and turtles.

## CHEN

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### UNDERSTANDING VARIATION IN MALE ADVERTISEMENT CALLS IN SPRING PEEPERS (*PSEUDACRIS CRUCIFER*)

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The mate recognition system is the foundation of biological speciation in anurans. Sexual selection has been suggested to cause males call evolution. It is generally assumed that a significant fraction of variation in male call has an underlying genetic basis and that there is some link between call attributes and fitness, yet there are largely unproved assertions with many other factors contributing to diversity of calls within a male chorus. Anurans advertisement calls are important in studies in sexual selection, speciation as well as phenological studies. In all of these understanding, heritability is prerequisite to understanding evolutionary patterns and potential responses to selection. However, very few studies have examined the heritability of advertisement calls in anurans. In general we know that key aspects of anuran calls, including both temporal and spatial attributes, vary with morphology such as body size, ontogeny such as age, abiotic factors such as temperature and habitat types, as well as biotic interactions like inter-male competition. In this study, I try to quantify the genetic-basis of anuran call variation within a calling assemblage of a temperate treefrog, *Pseudacris crucifer*, and disentangle the relative contributions of different factors: body size, age, calling temperature and genetics. I use skeletochronology to estimate age, single nucleotide polymorphisms (SNPs) markers to estimate the relatedness of calling males and animal model to incorporate influential factors. By investigating the genetic basis as well as environmental components of advertisement call attributes, we will gain a better understanding of call evolution and the potential for sexual selection to drive divergence.

(student award competition)



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## OCCUPANCY MODELING AS AN APPROACH TO EVALUATE EFFECTIVENESS OF CONSERVATION TRANSLOCATIONS IN A TEMPERATE-ZONE RATTLESNAKE

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Conservation translocations are used as a tool to augment or reintroduce populations of herpetofauna; however, biologists lack a thorough understanding of how to conduct and evaluate effective translocations, especially with temperate-zone snakes. Standardized estimates of a species' distribution pre- and post-translocation can inform whether or not a project was effective at long-term population establishment. Occupancy modelling has grown in popularity as a means to estimate the distribution of cryptic animals, including snakes, as it incorporates imperfect detection. Rate of detection can be strongly influenced by factors including survey technique and timing, therefore, a comparison of different survey methods would assist in developing the most efficient monitoring regime. We estimated occupancy and detection probability in an endangered population of cryptic North American pit-vipers (Eastern Massasauga, *Sistrurus catenatus*), prior to experimenting with conservation translocations as a recovery tool. Over 6 years, we conducted repeated standardized surveys at 40 sites (~2.0 ha each; 20-30 total surveys in majority of sites) using two methods and in two seasons, and analyzed detection histories using the program Presence. Preliminary analyses suggest that detection probabilities were higher using visual encounter surveys compared to artificial cover objects, and during spring as opposed to summer. Massasauga occupancy was limited to only 10% of survey sites (n=4/40). This study will generate robust baseline distribution data which will be used to inform and evaluate effectiveness of planned conservation translocations to recover an endangered rattlesnake population. It will also provide direction to other conservation practitioners working with small populations of cryptic herpetofauna.  
(student award competition)

CLEMENTE-CARVALHO

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## THE PECTORAL GIRDLE OF *BRACHYCEPHALUS* (ANURA: BRACHYCEPHALIDAE) — DOES THE MICROSCOPIC ORGANIZATION RESEMBLE THE MACROSCOPIC STRUCTURE?

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*Brachycephalus* is a genus of frog endemic to the Atlantic rainforest of southeastern and southern Brazil, with 36 species currently recognized. The species of *Brachycephalus* are well characterized and diagnosed based on skin color, osteological traits, and morphometric features. *Brachycephalus* is remarkably featured by miniaturization with extremely small adult body size (<1.8 cm) as well as its associated morphological features including the loss and/or fusion of some bones in skeleton. Despite some recognitions of skeleton diversification in *Brachycephalus*, the actual osteological diversity and patterns across species remain unclear, especially the pectoral girdle morphology. Amphibian pectoral girdle is a complex structure and exhibits marked variation across species. Diversification of this structure in *Brachycephalus* genus has been underestimated, with the evidence of the actual presence of omosternum in *Brachycephalus ephippium* examined by Kaplan (2004) (previously assumed to be absent). In fact, only 18 out of 36 *Brachycephalus* species have been scrutinized for osteological characteristics, and the pectoral girdle of all were simply classified as arciferal with fused elements, the absence of sternum, as well as the lack of omosternum in some species without actual histological examinations. Herein, we examine the pectoral girdle of *Brachycephalus* species at the microscopic and macroscopic levels of organizational complexity using histological sections and clearing and double staining techniques. We identify different patterns of bones and cartilages arrangement (i.e. epicoracoids, coracoids, clavicle and omosternum), which are only visible through histological sections. In addition, we find different degrees of omosternum development in *Brachycephalus*. Such characterizations can only be identified through histological sections in combination to the clearing and double staining techniques. Our results are critical in accurately defining the *Brachycephalus* pectoral girdle condition with implications for the taxonomy and description of new species of this group, as well as recognizing diversifying patterns of pectoral girdle in amphibians.

## COMSA

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### FINGERPRINTING FOXSNAKES: EVALUATING THE ACCURACY OF VENTRAL MARKINGS AS INDIVIDUAL IDENTIFICATION IN EASTERN FOXSNAKES (*PANTHEROPHIS GLOYDI*)

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When studying wild populations, marking individuals for identification allows researchers to differentiate new and recaptured individuals, and can assist with population monitoring. However, marking can come with its own costs and considerations such as equipment, specialized training, invasiveness, and stress caused to the study subject. We asked whether the ventral tail markings of Eastern Foxsnakes (*Pantherophis gloydi*) can be used to accurately identify individual snakes. We used over 200 photographs of Eastern Foxsnakes captured between 2015 and 2019 at Rondeau Provincial Park, Chatham-Kent, Ontario, Canada. Photos in which the snake was contorted were straightened using the program I3S Straighten, and then all photos were imported into I3S Spot for comparison. We marked reference points on each



photograph at the cloaca and the tail tip, and then compared photos to all others in the library using the I3S Spot algorithm. We found that the ventral tail markings of Eastern Foxsnakes were unique enough to be used for individual identification, even if some of the photographs had been taken at an angle, or image-processed to straighten the snake before analysis. This method provides an affordable, minimally stressful, and non-invasive way to identify individual Eastern Foxsnakes. It works for snakes of all sizes and allows re-identification between capture as a neonate and as a mature individual. This method can facilitate collaborations among researchers and citizen scientists who may not have access to other marking methods, and can improve data quality for long-term mark-recapture studies  
(*student award competition*)

CONNOY

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## AT WHAT TIME WILL TURTLES NEST? A COMPARATIVE STUDY ACROSS SCALES OF NEST TIME PREFERENCES OF FRESHWATER TURTLES IN NORTH AMERICA

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The timing of nesting season in many freshwater turtles is well studied, but the factors influencing nest time within a day is not. We used long-term data from the Algonquin Park turtle life-history study to establish which factors may be influencing within-day nest time for freshwater turtles. We used mixed models to relate body size to nest time, and nest time to air temperature, for Painted turtles, *Chrysemys picta*, and Snapping turtles, *Chelydra serpentina*. In order to determine if air temperature at the time of nesting for individual nests was non-random, we compared the distribution of nesting temperatures to the entire distribution of temperatures that occurs during the nesting season. We found a significant relationship between nesting temperature and body size as well as body size and nest time within a day for *C. picta*, and that both *C. picta* and *C. serpentina* nest at significantly higher temperatures than the mean nesting season temperature. Smaller *C. picta* were shown to nest earlier in the day and at higher temperatures, suggesting that larger body sizes limit the temperature at which a turtle can nest. Conversely, the distribution of nesting temperatures for *C. serpentina* was lower, suggesting a small-size constraint on nesting at lower temperatures. This research is the first comprehensive study to offer an understanding of factors affecting nest time within a day which apply to North American freshwater turtles. This research is important for understanding interactions of nest time and predation as well as for all researchers collecting data on nesting freshwater turtles.  
(*student award competition*)



DAVY

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## SPATIAL GENETICS OF CANADIAN QUEENSNAKES (*REGINA SEPTENVITTATA*) REVEAL NEAR-TOTAL ISOLATION OF POPULATION FRAGMENTS ON A HEAVILY MODIFIED LANDSCAPE

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Habitat loss and fragmentation can restrict the dispersal of wildlife across the landscape and limit gene flow among populations. In Canada, the endangered, semi-aquatic queensnake (*Regina septemvittata*) is restricted to seven extant locations in southern Ontario that overlap areas of intense landscape modification. The recent COSWEIC assessment suggested that recovery of Canadian populations may be limited by queensnakes' low dispersal ability, coupled with reduced habitat connectivity in southern Ontario. To understand connectivity among Canadian queensnake populations, we applied spatial and population genetic analyses to blood samples collected during a series of collaborative mark-recapture surveys in the Detroit, Ausable, Thames, Grand, and Maitland rivers. We performed restriction site-associated DNA sequencing (RADseq) on 87 snakes and identified single-nucleotide polymorphisms (SNPs) from the sequences. Analyses with two subsets of the data (4,657 and 2,819 SNPs) produced similar results. Queensnakes in the five rivers represent five genetically isolated populations, with little or no exchange of individuals despite the relative proximity of three of the five rivers. Queensnakes in the Maitland were the most differentiated from the other groups. Census population size estimates for Maitland queensnakes have been declining over the past 6 years, and our SNP-based estimates of effective population size in the Maitland were low (19.6 – 30.5). Our genetic results support field observations that queensnakes seldom move far from riverbanks and suggest that dispersal among watersheds is rare. From a recovery perspective, our results suggest that extirpation of queensnakes in one of these five rivers would probably not be mitigated by immigration from other rivers. Our results suggest that each group of queensnakes in Ontario represents an independent unit, requiring targeted, watershed-specific recovery actions. Queensnake recovery relies on protecting remaining, suitable habitat and restoring habitat at extirpated locations, to increase habitat connectivity and encourage dispersal of snakes.



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## FACULTATIVE PAEDOMORPHOSIS IN NEWTS: A FASCINATING POLYPHENISM THREATENED BY ENVIRONMENTAL CHANGE

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Paedomorphosis is a major developmental process that bypasses metamorphosis and allows reproduction in larvae. In newts and salamanders, it can be facultative with paedomorphs retaining gills and metamorphs dispersing on land. Although paedomorphs are often associated with deep alpine lakes, they can also be present in semi-permanent ponds where they can survive drying by metamorphosing on the basis of environmental cues. Being paedomorphs in such risky conditions remains advantageous as it allows an early reproduction (i.e. progenesis), yet at the price of low reproductive immediate pay-offs. Female biased sex-ratios are yet found in natural populations of paedomorphs due to the higher metamorphosis rate and lower sexual activity of paedomorphic males. The persistence of both phenotypes in coexistence in the same pond or lake is favored by resource partitioning. Indeed, the trophic specialisations of each morph explain their different diet patterns and their preferences for different micro-habitats. This shows that facultative paedomorphosis is a trophic polyphenism and that its selection is not only caused by the advantages of life in water versus on land, but also through an optimal use of aquatic resources. Sadly, the low number of populations of paedomorphs and their restriction to the aquatic habitat make them particularly vulnerable. There are indeed declining at a very high rate across all their distribution range. For instance, the most remarkable populations of paedomorphs, previously known as subspecies in the Balkans all vanished. The main driver of this decline is the introduction of alien species, extirpating first paedomorphs and then metamorphs. The only hope is that, being a polyphenism, paedomorphosis shows fast resilience but this is not likely in isolated areas where populations constitute evolutionary significant units. Conservation actions should therefore take place to remove threats and protect the main populations of paedomorphs as a highly valuable part of diversity.

DILLON

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## DOES OPHIDIOMYCOSIS (SNAKE FUNGAL DISEASE) AFFECT THE FITNESS OF WILD EASTERN FOXSNAKES (*PANTHEROPHIS GLOYDI*)?

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Ophidiomycosis (snake fungal disease) is caused by the pathogen *Ophidiomyces ophiodiicola*. Infected snakes exhibit dermal lesions, occasional systemic infections, and, in rare cases, mortality. To better understand the conservation implications of ophidiomycosis, we investigated its impacts on individual fitness in a population of endangered eastern foxsnakes (*Pantherophis gloydi*). We tracked 30 foxsnakes over 6 years and quantified three fitness proxies: body condition, movement patterns, and oviposition. Body condition (residuals of log mass/SVL) was similar between snakes with and without ophidiomycosis, though snakes with the disease often started and ended the active season at a lower body condition and had higher body condition during mid-active season. Snakes with ophidiomycosis moved similar distances per day to uninfected snakes. Interestingly, snakes with ophidiomycosis had larger home ranges (df = 20,  $W = 90$ ,  $P > 0.04$ ), suggesting that probability of infection may be associated with exposure to a larger number or diversity of habitats. We observed successful oviposition in 3 of 9 female snakes showing clinical signs of ophidiomycosis, and in 2 of 6 female snakes that did not show clinical signs of the disease (df = 14,  $X^2 = 0.31$ ,  $P > 0.05$ ). Thus, we found no evidence that ophidiomycosis reduced oviposition. Of 19 snakes tracked from 2017–2019, 14 tested positive for *O. ophiodiicola* at some point during tracking, but only one mortality was directly attributed to the disease. However, investigation of mortality not directly related to ophidiomycosis indicates that snakes with the disease may be at a higher risk of predation than snakes without the disease. Overall, our results suggest that ophidiomycosis has only indirect effects on the fitness of eastern foxsnakes. Given that foxsnakes are the most affected species at our study site, ophidiomycosis does not appear to pose an imminent threat to our study population under current conditions.

(student award competition)

## DIONNE

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### LES ÉTANGS VERNAUX – DES HABITATS INDISPENSABLES À PROTÉGER

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Les étangs vernaux sont des milieux humides temporaires de petites tailles, mais d'une grande importance pour plusieurs amphibiens, reptiles et invertébrés. Leur assèchement récurrent en fait des habitats de reproduction spécialisés, ou même uniques, pour certaines espèces. Pour jouer pleinement leur rôle écologique, les étangs vernaux ne peuvent être dissociés du milieu forestier qui les entoure. Ce dernier permet de maintenir les caractéristiques hydriques de l'étang et d'assurer aux espèces visées l'accès aux ressources nécessaires pour compléter leur cycle vital. Les lois et règlements du Québec offrent actuellement peu de protection pour les étangs vernaux. En raison de leurs caractéristiques physiques, notamment leur petite taille et



leur caractère isolé du réseau hydrographique, ils échappent souvent aux protections législatives relatives aux milieux humides. Le ministère des Forêts, de la Faune et des Parcs évalue présentement la possibilité d'accorder une protection légale à ces habitats. Cette présentation débutera avec une synthèse des projets réalisés au cours des 10 dernières années afin de reconnaître l'importance des étangs vernaux dans le maintien de la biodiversité, de développer des méthodologies pour les identifier ou de déterminer des modalités permettant de les protéger. Elle sera complétée par une présentation des travaux en cours au ministère afin de définir les critères de sélection des étangs vernaux d'importance pour l'herpétofaune et les modalités de protection de l'habitat essentiel autour des étangs en s'inspirant des statuts de protection dans le reste de l'Amérique du Nord. Cette présentation veut engendrer une discussion avec les experts en herpétologie pour valider ou améliorer l'approche du ministère afin de mieux encadrer la conservation de cet habitat faunique important pour l'herpétofaune. This presentation aims to generate a discussion with experts in herpetology to validate or improve our approach to protect vernal pools, an important herpetofauna habitat.

DUBOIS

## WILL eDNA IMPROVE AMPHIBIANS AND REPTILES MONITORING PROGRAMS?

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Effective monitoring tools are needed to properly assess the status of species, to locate populations for conservation efforts, and to describe population trends in relation to threat intensity and conservation actions. Traditional methods used to survey and monitor population trends yield in some cases poor estimates of the abundance. In other cases, traditional methods are time consuming or sometimes degrade habitat quality. The detection of environmental DNA (eDNA) in water samples is a promising method to increase the detection of aquatic amphibians and reptiles, decrease the survey effort, and reduce the impact on the habitat. Le ministère des Forêts, de la Faune et des Parcs (MFFP), in collaboration with many partners, initiated several eDNA research projects on amphibians and reptiles in the last 6 years. The expectation is that eDNA can be incorporated in population monitoring strategies to increase the sample size of amphibian and reptiles species at risk monitoring programs. In this presentation, we aim to discuss the overall perspective of the eDNA for amphibian and reptile monitoring. We present an overview of the objectives and the results obtained so far for each project conducted in Quebec on five species of turtles (wood, Blanding's, spiny softshell, musk, and map) and two species of amphibians (chorus frog and spring salamanders).



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## ELLSWORTH

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### KNOWLEDGE AND OPINIONS OF TURTLE ROAD MORTALITY MITIGATION EFFORTS ON HWY 69, ONTARIO

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Road mortality presents one of the greatest threats to turtles, but properly constructed and installed mitigation structures have been shown to reduce this threat. All eight of Ontario's turtle species are classified as 'Species At Risk' (SAR) and six of those species are found along Hwy 69 between Sudbury and Parry Sound, Ontario. A previous study showed that the mitigation structures on Hwy 69 were not effectively preventing turtle road mortality and that, specifically, the exclusion fencing needs improvements. Research has shown that public support can be instrumental in funding such projects, but it is unclear who is responsible for this funding. We investigated the current level of knowledge and support for road mortality mitigation among residents of the Greater City of Sudbury using an online survey distributed through Facebook. We collected 263 responses that included knowledge about road mortality mitigation and its importance for turtles at risk, as well as opinions about how funding for mitigation should be achieved (particularly using tax dollars). Questions were divided into 3 sections: 1) general information about species-at-risk, 2) turtle-specific information, and 3) road mortality mitigation. A final section collected respondent demographics. Questions collected a combination of quantitative and qualitative data to provide insight into respondents' reasoning for answers, allowing us to make connections among knowledge levels, opinions, and demographic groups. Preliminary analysis has revealed that over 85% of respondents know what mitigation structures are for (despite less than 33% knowing the phrase 'road mortality mitigation'), and the majority support increased road mortality mitigation along Hwy 69. Additionally, over 80% of respondents know that turtle populations are declining and give high priority to SAR conservation. Establishing a baseline of knowledge and opinions on the subject of turtle road mortality mitigation will help guide any future research, outreach, and campaigns around Sudbury. (*student award competition*)

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## FENECH

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### COMMUNAL NESTING OF COMMON SNAPPING TURTLES (*CHELYDRA SERPENTINA*) USING VISUAL CUES

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Social behaviour in turtles is being increasingly recognized as an important component of their ecology. Recent research on painted turtles (*Chrysemys picta*), for example, documented non-random spatial distribution of nests, suggesting that females selected nesting sites in proximity to other nesting females. We explored this potential for communal nesting behaviour in common snapping turtles in Rondeau Provincial Park, using 3D printed snapping turtle models. Three different nesting sites of 40m each were divided up into three equal sections within each site. Three different 3D model treatments were used: one with 2 models to a section, one with a single model and one section which did not feature a model (control section). Treatments were assigned randomly each day within the selected nesting sites to control for variation in nest-site quality. We found that the 2-model treatment had significantly more nests and attempted nests compared to the control sections. The increased nesting activity in treatment sections reveal that there was interest by the snapping turtles in the models via visual cues. We suggest that the turtles use conspecifics to help assess the suitability of the nest microenvironment: if a turtle has already invested in nest searching and site selection, then a second turtle can expedite its own nesting by using the first as an initial cue to nest-site suitability, which may be valuable when turtles are on land and are more vulnerable to predation and injury.  
(*student award competition*)

FENG

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## ENVIRONMENTAL DNA SURVEYS HELP TO IDENTIFY WINTER HIBERNACULA OF A TEMPERATE FRESHWATER TURTLE.

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Overwintering is a critical part of the annual cycle of animals at high latitude, and selection of hibernation sites is important to population persistence. Identifying the location of such hibernacula for aquatic species is challenging in areas where water bodies are frozen for significant parts of the year. We test whether winter environmental DNA surveys of a medium-sized freshwater lake could help us to locate underwater winter hibernacula of the northern map turtle, a species of conservation concern in Canada. Using under-ice winter water sampling across a mid-sized temperate lake and quantitative PCR with a species-specific probe, we find localized eDNA signals consistent with known or suspected hibernacula. Our approach can provide novel insights for aquatic species in winter, a part of the annual cycle for which we often know very little.

(*student award competition*)

FIESCHI-MÉRIC

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## ADAPTATION TO CAPTIVITY WITHIN *EX-SITU* COLLECTIONS OF URODELES: A CASE STUDY WITH ALPINE (*ICHTHYOSAURA ALPESTRIS*) AND PALMATE (*LISSOTRITON HELVETICUS*) NEWTS.



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Amphibians are currently the animal class facing the highest risk of extinction, notably because of disease outbreaks. Faced with the urgency and the complexity of the situation, conservation institutions prioritize the implementation of *ex-situ* collections to ensure the persistence of the most endangered species. Yet, little is known about the effect of captivity on their skin microbiome, an effective barrier against pathogens responsible for chytridiomycosis in the wild. Moreover, behavioural adaptations to captivity have been reported in several anurans. We hypothesize that captivity could restructure salamander skin microbiota, and could also modify their behaviour, thereby weakening their *in-situ* fitness during reintroduction efforts. Using two European urodeles, the alpine newt, *Ichthyosaura alpestris*, and the palmate newt, *Lissotriton helveticus*, we collected adults in the wild and kept them in captivity for a year, while monitoring the evolution of their behaviour and skin microbiome monthly. Differences in microbiome and behaviour were noted between sexes and species, and between phases (aquatic to terrestrial phase). As our results suggest, newts have different personalities and show differences in the evolution of the skin-microbiome. Taken together, we hope these results will provide general guidelines for *in-situ* conservation projects for urodeles.  
(*student award competition*)

## FORD

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### THE NET EFFECT OF TOAD TADPOLES ON THEIR ENVIRONMENT

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Amphibian larvae are present in abundance in nearly all sources of freshwater. Although ephemeral, larval amphibians often comprise the main vertebrate biomass in freshwater systems, especially in cases where fish are not present. However, while the effect of many external factors on amphibian larvae has been extensively studied, few studies have focused on how amphibian larvae affect their environment. Studies that have examined this effect of amphibian larvae on their environment have suggested that amphibian larvae may have profound effects on sedimentation rates, periphyton and phytoplankton abundance, macroinvertebrate abundance, and zooplankton community composition. An alteration in any or all of these factors would result in a dramatic shift in ecosystem function, but the influence of amphibian larvae on other aquatic communities is often overlooked. In my study I examined how the presence of toad tadpoles influences an ecosystem using experimental mesocosms. I measured nutrient concentration, phytoplankton and periphyton biomass, and zooplankton community composition in mesocosms where tadpoles were either present, or absent. Mesocosms with tadpoles present had a more consistent concentration of phosphorus through time, lower algal biomass, and more zooplankton diversity than mesocosms where tadpoles



were absent. These findings help us better understand the possible ecological consequences of amphibian loss, which is urgent information in the face of a global amphibian decline.  
(*student award competition*)

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GALLON

**CATS AREN'T THE ONLY ONES WITH NINE LIVES... SPATIAL ECOLOGY OF EASTERN HOG-NOSED SNAKES (*HETERODON PLATIRHINOS*) IN A ANTHROPOGENICALLY-MODIFIED LANDSCAPE**

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For vertebrate ectotherms living at their northern range limits, understanding their distribution, habitat preferences, and threats can be crucial to conserving at-risk populations. Populations at range peripheries are often sparse and experience ecological challenges that those at the core of the range do not face. Eastern hog-nosed snakes (*Heterodon platirhinos*) are listed as Threatened in Ontario. Their cryptic yet highly-mobile behaviours make them difficult to survey, so little is known about their ecology and life history, although such information is required to meet government-mandated recovery actions and conserve local critical habitat. In southwestern Ontario near the species' northern range limit, investigating their ecology is especially complex due to competing land uses, persecution, and other threats to snake survival, such as road mortality. Available habitat for the study population includes naturalized beaches, forested areas, and bluffs, but also includes potentially life-threatening habitats such as crop fields, roadways, human residences, and a marina. With a putatively higher likelihood of interacting with anthropogenic development, we are investigating the spatial ecology of snakes in our population using mark-recapture and visual encounter surveys, and radio telemetry. Snakes (n=11) are radio-located 3-4x/week and telemetry points are later used to undertake paired used-available habitat surveys to understand variables important to habitat selection. Preliminary analyses have shown similarities to other studies in some aspects like home range size ( $\bar{x} = 47.7$  ha) and daily movement distance ( $\bar{x} = 37$  m), while some novel findings that set our population apart include individuals crossing a large watercourse and using crop fields. We will further discuss the trials and tribulations experienced by individual snakes in our study population who appear to 'slither through', and the implications for population persistence in this human-impacted area.

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GALWAY

**INTRODUCING THE NEW LONG-TERM OCCURRENCE MONITORING PROGRAM FOR THE GREAT LAKES – ST. LAWRENCE – CANADIAN SHIELD POPULATION OF THE WESTERN CHORUS FROG (*PSEUDACRIS TRISERIATA*)**

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Blazing Star Environmental is working with Canada Wildlife Service and Trent University to develop a long-term, range-wide program to monitor changes in the spatial extent and distribution of the Great Lakes – St. Lawrence – Canadian Shield (GLSLCS) population of western chorus frog (*Pseudacris triseriata*) and the factors influencing any observed trends. The primary goal of the program is to establish the spatial extent and distribution of western chorus frog, and how it changes over time. The data will allow the conservation community to quickly detect, and respond to, range declines of this threatened species and will inform COSEWIC status assessments. This monitoring program will launch in spring 2020 and *the participation of scientists, practitioners, citizen scientists, naturalists, and other concerned citizens is needed* participation is needed! Changes in population size, extent and distribution of a species on the landscape are the clear measures of progress towards, or away from, recovery of a species or population. However, the challenges with accurately measuring these variables for a wide-ranging species, such as the western chorus frog, are important considerations when designing a long-term monitoring program. Pilot studies were conducted in 2017 and 2018 to investigate detection probability, occupancy and factors that impact detection (air temperature, background noise, distance from calling, proximity to roads, etc.). The results of these studies informed the protocol used for this monitoring program and some preliminary results will be shared. Citizen scientists, biologists, naturalists, researchers and other concerned citizens across the GLSLCS western chorus frog population range are encouraged to participate in breeding frog surveys for the first sampling period and beyond!

## GRAY

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### **AMPHIBIAN BIODIVERSITY SURVEYS IN INTACT FORESTS OF THE DARIEN, PANAMA: A COLLABORATIVE PROJECT WITH LOCAL COMMUNITIES.**

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The high biodiversity of the Parque Nacional Darién, Panama is one of the reasons it was designated as an UNESCO World Heritage site and a place of Outstanding Universal Value. However, the species that contribute to that biodiversity are not fully known due to the inaccessibility of many areas of the park. The conservation of the forests and the species of the park are of interest to scientists but also to the communities who live in the park. As part of an international scientific expedition, the biodiversity of the forests of the southern Rio Balsas was explored in January 2019. Local Emberá technicians were trained at that time to collect data on species of amphibians and birds encountered along 1-km transects. Six transects were established in intact forests and were to be surveyed twice per month for 6 months. I will present preliminary results from these amphibian surveys. This study is a first assessment of the amphibian species and their distribution within this southern region of the park.



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## DISPERSAL IS STOCHASTIC BUT MIGRATION EVOLVES.

David M. Green

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Despite a long history of study and much theorizing, animal dispersal remains enigmatic, especially in relation to animal migration, with which it is often confused. Because dispersal enables such things as gene flow, range expansion, metapopulation dynamics and out-breeding, all of which can enhance species survival, it has long been assumed that it is a trait that must necessarily evolve. Yet dispersal is not particularly conducive to the survival of individual dispersers because of the risks inherent in traveling to new sites, and the low probability of successful relocation. Efforts to reconcile this contradiction have achieved limited success, potentially because dispersal is generally defined in the context of particular evolutionary genetic models rather than ecological principles. The Fowler's Toads at Long Point, Ontario, are an attractive model system for study as they exhibit both migratory and dispersive movements at small temporal and spatial scales. Analysis of extensive capture/recapture data from these toads indicates that dispersive movements are fundamentally both stochastic and scale independent, providing a new window through which to view dispersal and the evolution of migratory behaviour.

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## GUERRA-GRENIER

### HIDDEN YELLOW MARKINGS IN PICKEREL FROGS (*LITHOBATES PALUSTRIS*): TESTING FOR POSSIBLE FUNCTIONS ONE PICTURE AT A TIME

Eric Guerra-Grenier\* and David M. Green

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Traditional studies on adaptive animal coloration used to characterize body color phenotypes in fixed categories – animals either used their color patterns for camouflage or to signal information (defenses against predators, quality as a mate, etc.). Recent advances in the field however suggest that adaptive color strategies are not mutually exclusive, but rather form a complex continuum of traits. Some animals are conspicuous at close range while cryptic at a distance, others vary in conspicuousness among populations. There are even species that globally match their background's colors while concealing conspicuous body parts. Such is the case with the Pickerel frog (*Lithobates palustris*), one of the most toxic anurans in Eastern Canada. These frogs possess bright yellow legs that seemingly contrast with the rest of their body and the substrate they are found on. The aim of our study is to quantify the color phenotypes of Pickerel frogs to test whether these hidden yellow markings have an adaptive function. To do so, we are taking digital pictures of frogs in the field and extracting spectral information to quantify the colors involved using metrics such as hues, saturation and luminance. Further analyses using visual modelling will also allow us to determine which



features are salient to ecologically relevant avian, mammalian and reptilian predators. While the data are still under analysis, preliminary results indicate that the legs of small individuals tend to blend in with the substrate given low levels of luminance and saturation. Larger frogs, on the other hand, seem to have brighter hind legs with more saturated yellows that further contrast with background features. Future steps of our project will involve 1- behavioral experiments to assess if and in which context hind leg coloration is displayed and 2- biochemical assays to test whether skin toxicity varies with body size.

(student award competition)

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## GUNSON

### **RESULTS FROM FOUR YEARS OF MONITORING DRAINAGE CULVERTS AND DESIGNATED CROSSING STRUCTURES FOR TURTLES ALONG 5 PHASES OF CONSTRUCTION ON HIGHWAY 69 IN ONTARIO**

Kari E. Gunson,

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Mitigation measures (reptile exclusion fencing, and or wildlife crossing structures) targeting the Blanding's Turtle (*Emydoidea blandingii*) and other freshwater turtles and snakes were installed along five phases of highway twinning and highway upgrade projects on Highway 69 between Parry Sound and Sudbury in Ontario from 2011 to 2016. Each phase of installation has its own unique circumstance and specification for mitigation measures. Some phases include only drainage structures with exclusion fence, others include both drainage structures and designated crossing structures, and last one phase includes three large 2.8 x 3.3 reptile tunnels, drainage structures, and combined large and small animal exclusion fencing. In total there are over 35 km of highway with exclusion fencing and approximately 55 potential crossing structures for reptiles. We selected a variety of crossing structures to monitor with time lapse cameras to assess use, and percent passage of turtles. Crossing structures were selected to evaluate whether wet versus dry or small versus large crossing structures are preferred. We also conducted on-road surveys to monitor what type of exclusion fencing implementation and design was most effective. Our database now contains 150 records of turtle use at tunnels. Preliminary results have shown that freshwater turtles prefer wet versus dry culverts to cross under the highway and other results on crossing structure preference are currently underway. Additionally, turtles are more likely to cross through structures than snakes. Road surveys showed that exclusion fencing with the most gaps was positively correlated to the highest road-kill rate. In addition, preferred crossing structure use by time of day was not as expected, and occurred mid-day when temperatures peaked. Collectively, our results have and are providing critical best management practices for designing, and implementing mitigation measures for reptiles on roads.

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## HUGHES

### **MONITORING OF MEASURES TO MAINTAIN CONNECTIVITY FOR ANURANS IN AN URBANIZING LANDSCAPE**



Samantha A. Hughes

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In an ever-urbanizing landscape the need for habitat connectivity, as well collaboration with planning authorities, is paramount. Measures such as wildlife corridors and wildlife crossing structures are increasingly used to achieve connectivity. I offer a presentation on results from two locations in Guelph, ON where these measures have been implemented to support amphibian movement between habitat that is divided by roads. These projects provide an excellent opportunity to document the impacts of urbanization on the existing amphibian populations and to assess the effectiveness of the mitigation measures in maintaining landscape connectivity. These projects also provide the opportunity to work with the municipality and engage the community in exploring avenues for habitat connectivity in the urban landscape.

**JREIDINI**

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### **USING 8 YEARS OF CAPTURE-RECAPTURE DATA ON THE ENDANGERED FOWLER'S TOAD (*ANAXYRUS FOWLERI*) TO EXPLORE DISPERSAL THEORIES**

Nathalie Jreidini

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Animal movement impacts the structure and dynamics of a population and is generally of two forms: one-way (dispersive), or round-trip (migratory). Several theories are proposed concerning the processes which potentially drive an animal to disperse. However, some suggested causes of dispersal are theoretical in nature and lack empirical evidence. Using 8 years of data collected on an endangered toad population, the Fowler's toad (*Anaxyrus fowleri*) found in Long Point, Ontario, I have explored some of these theories. These toads are found in marshes and ponds during their breeding season, which is typically from the beginning of May until mid-June and are then found on the sandy beach along the northern shore of Lake Erie until it is time to hibernate for the winter, and are thus easy to track during the spring and summer months. Nightly surveys of this population were carried out every year (2012-2019) from the beginning of May until mid-August. Pictures taken of the toads' backs were used to identify individuals by matching the wart pattern to previously taken pictures. The UTM coordinates collected for each toad were used to obtain their individual movement distances and trajectories. Filtering these occurrence points to only use data obtained on consecutive night surveys, night-to-night movements were calculated as the Euclidean distance between two points. A CJS model was used to estimate the yearly population abundance. Despite the fact that the population abundance has been relatively low during the last 8 years, analyzing the extent of those movement distances over the same surveyed area for each year has shown that the yearly population abundance seems to impact the distance moved by every individual toad from one night to the next on the beach shore. The overall goal of this study is to gain more insight into how and why populations disperse.  
(*student award competition*)



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## LARSSON

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### WRANGLIN' CROCS THROUGH THE AGES

Hans C. E. Larsson and José Avila Cervantes

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The dwindling ranks of crocodiles caps millions of years of successes. From their origins during the rapid evolutionary radiation of early archosaurs during the Triassic, through the reign of dinosaurs and then mammals (and birds and frogs), the crocodile lineage has survived countless environmental shifts and one mass extinction. Their Mesozoic radiations span from fully marine to terrestrial herbivores. This talk will explore features of crocodile evolution I've explored over the past three decades. Beginning with their evolution, ancestral crocodiles peaked in diversity during the Late Cretaceous. Most of this diversity was restricted to the southern continental landmass called Gondwana. Several endemic lineages radiated into terrestrial carnivores, herbivores, omnivores and amphibious niches. Discoveries from South America and Africa will be used to describe this phenomenal radiation and how it set the stage for crocodiles to survive the end Cretaceous mass extinction. A new alligatoroid from Eocene deposits in the Canadian High Arctic will also be introduced. The 250 million year long fossil record of crocodile ancestry can be used to explore relationships between the age-old question of how much ontogeny recapitulates phylogeny. Although this notion may seem outdated, data combining the evolutionary record of crocodiles with a high resolution embryonic series of the American Alligator will be used to demonstrate how phylogeny is partly embedded in current ontogenetic processes. Finally, current field studies with Neotropical *Crocodylus* will be discussed. Results from these efforts have shown the importance of sampling wild populations. A revised phylogeny of *Crocodylus* suggests multiple trans Atlantic dispersals of the genus to establish current Neotropical and African species. Results from throughout the Neotropics reveals a complex interplay between speciation and hybridization. Even land barriers, such as the Isthmus of Panama, seemed to have little effect on historic gene flow. One of the greatest drivers in their evolution may have been the last glacial maximum (LGM), which still resonates in Panamanian *Crocodylus acutus* populations on the Caribbean and Pacific coasts. One outcome of the LGM appears to also have been the isolation of a new pair of hybrid populations in the Caribbean atoll Banco Chinchorro. Mitochondrial and RADseq genomic data will be presented to support this finding and their critical role in moving forward with crocodile conservation in the region.

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## LEERMAKERS

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### MITIGATING ROAD MORTALITY OF WILDLIFE IN ROUGE NATIONAL URBAN PARK

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As urban development continues to expand, so do road networks and, consequently, this disrupts the movement of wildlife across the natural landscape. One method of mitigating road mortality is the use of an ecopassage to provide safe crossing. However, before determining placement of an ecopassage, it is important to consider how the threat of road mortality is spatially and temporally distributed, which can be related to factors such as neighbouring landscape features, traffic volume, distance to nearest train tracks, distance to nearest culvert, basking for thermoregulation, seasonal movement, and weather. Rouge National Urban Park (RNUP) was established in 2017 and is currently the largest urban park in North America, encompassing areas of Toronto that extend from Lake Ontario up to Uxbridge. To determine road mortality hotspots, road surveys were walked in RNUP recording live and dead on-road herpetofauna, mammals and birds. Road surveys were completed in 2010, 2011, 2017, 2018 and 2019, along three different commuter roads, each two-kilometres long that intersect forested habitat and wetland complexes. Road-mortality data were analyzed using Generalized Linear Mixed Models (GLMMs) to model the occurrence of wildlife road kill incorporating both random and fixed effects. Overall, this project is important to ensure safe wildlife passage across roads by providing guidance on placement of ecopassages.  
(student award competition)

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LEE-YAW

## THE EVOLUTIONARY ECOLOGY OF SUBSPECIES' BOUNDARIES IN THE LONG-TOED SALAMANDER

Julie A. Lee-Yaw  
University of Lethbridge

Understanding the outcome of contact between divergent groups is of increasing importance as species' ranges shift in response to climate change. Historical range changes following the last glacial maximum offer a window into the types of outcomes that may be expected when young taxa meet and hybridize. In many cases, genetic differences between such taxa are maintained despite hybridization, suggesting that barriers to gene flow have evolved. Determining the relative importance of ecological factors versus intrinsic reproductive barriers in these cases is a fundamental goal of evolutionary biology and informs our understanding of the processes that maintain biodiversity. Here, I present genetic data that have allowed for the identification of subspecies' boundaries and informed the extent of hybridization between subspecies of the long-toed salamander (*Ambystoma macrodactylum*) in the Pacific Northwest. I then overview evidence to suggest that intrinsic barriers to gene flow may be more important than ecological barriers in maintaining subspecies' boundaries in this system. I end by discussing the implications of these results for the status of different long-toed salamander populations in Canada.

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LEIVESLEY

## THE FEMINIZATION OF A SNAPPING TURTLE (*CHELYDRA SERPENTINA*) POPULATION AND A RECONSTRUCTION OF HISTORICAL HATCHLING SEX RATIOS.

Jessica A. Leivesley<sup>1\*</sup>, E. Graham Nancekivell<sup>2</sup>, Ronald J. Brooks<sup>2</sup>, and Njal Rollinson<sup>1,3</sup>



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Previous research suggests rapid climate change may cause female-biased sex ratios and lead to the extinction of turtles with temperature-dependent sex determination. However, these predictions typically focus on populations in species' core ranges, whereas populations at Northern-most range edges are adapted to cooler temperatures and may have different sensitivity to rapid warming. Here, we use long-term data to predict how primary sex ratios have changed over a 15-year period in a population of snapping turtles (*Chelydra serpentina*) near their Northern range limit in Algonquin Provincial Park. We also develop a model to predict primary sex ratios from air temperature data rather than nest thermal profiles. We find that since 1983, the primary sex ratio of nests has fallen from 42.86% males (36.00% - 49.72%) to 22.49% males (13.08% - 31.90%) in 1997. This is an average decrease in the percentage of males of 1.45% per year. Using historical air temperature data, our model is then used to reconstruct primary sex ratios back to the early 1900s. The ability to predict yearly primary sex ratios of turtles with temperature-dependent sex determination in pre-industrial times will enhance our knowledge of how local and global climate change are impacting these species.  
(student award competition)

## LINTON

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### RECOVERING ENDANGERED JEFFERSON SALMANDER (*AMBYSTOMA JEFFERSONIANUM*) AND JEFFERSON-DEPENDENT UNISEXUALS (*AMBYSTOMA LATERALE* - (2) *JEFFERSONIANUM*): A CASE STUDY USING EGG TRANSLOCATION

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Between 2008 and 2015, Natural Resource Solutions Inc. (NRSI) carried out extensive *Ambystoma* salamander surveys at a complex of ponds in southwest Kitchener. Through this work we identified a healthy population of Spotted Salamander (*Ambystoma maculatum*), and a small number of mature Jefferson-dependent Unisexual *Ambystoma* (*Ambystoma laterale* - (2) *jeffersonianum*). We also determined that bisexual Jefferson Salamander, although once present as demonstrated by the presence of co-occurring unisexuals, were no longer occupying the habitat. The absence of bisexual males in the population has apparently led to the extirpation of the Jefferson Salamander (*Ambystoma jeffersonianum*) population and will eventually lead to the extirpation of Unisexual *Ambystoma*, which require a bisexual sperm donating species. As part of an Overall Benefit Permit under the *Endangered Species Act*, NRSI, in collaboration with Dr. James Bogart (University of Guelph), was tasked with developing



a feasibility assessment on the potential to recover the extirpated population salamanders. We identified the first steps of the feasibility assessment to be: 1) confirm if viable egg masses could be translocated to the subject pond, 2) confirm if larvae would successfully develop in the subject pond, and 3) through controlled lab experiments, document differences in larval health and survival. To achieve these objectives, egg masses were collected from a source population located near Hamilton, ON. Eggs were translocated to the recovery study site in Kitchener and maintained in mesh enclosures until release of mature larvae. A subsample of eggs were also reared in the laboratory at NRSI's head office. This project has increased our understanding of the feasibility of using egg mass translocations as a recovery technique which is directly applicable to the recovery strategy objective: *Investigate future possible reintroduction of the species at historic or presently unoccupied areas with suitable habitat.*

LOUGHEED

## CONSERVATION GENOMICS OF CHORUS FROGS FROM ACROSS CANADA

Stephen C. Lougheed<sup>\*1</sup>, Mary Kathleen Hickox<sup>1</sup>, Nicholas A. Cairns<sup>1</sup>, Joe-Felix Bienentreu<sup>2</sup>, Ruben Boles<sup>3</sup>, John Brett<sup>4</sup>, Ying Chen<sup>1</sup>, Brigitte Collins<sup>5</sup>, Andrew Didiuk<sup>6</sup>, Briar Hunter<sup>4</sup>, Neil Gushulak<sup>7</sup>, Randall Mooi<sup>8</sup>, Hannah McCurdy-Adams<sup>9</sup>, Cynthia Paszkowski<sup>10</sup>, Pamela Rutherford<sup>11</sup>, Katrina Switzer<sup>12</sup>, Nathalie Tessier<sup>13</sup>, and Rute Clemente-Carvalho<sup>1</sup>

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Amphibians are the most threatened terrestrial vertebrate class in the world, with up to one third of extant species at risk of extinction, and many populations undergoing precipitous



declines. Among the species with declining populations are the trilling chorus frogs in Ontario and Quebec. The current status of chorus frogs in Canada remains problematic in terms of taxonomy, evolutionary affinities, and population structure, with obvious consequences for management decisions and conservation prioritization. They have been characterized based on morphology, call playback, and mitochondrial DNA sequences, but these varying approaches have led to somewhat disparate conclusions. Recent mtDNA work suggests two disjunct populations of boreal chorus frogs (*Pseudacris maculata*), one in western Canada and the other in southwestern Quebec and southern Ontario, with a putative (as yet uncharacterized) contact zone in SW Ontario between *P. maculata* and western chorus frogs (*P. triseriata*). We lack comprehensive data on evolutionary affinities and phylogeography across the entire Canadian range of *P. maculata*, as well as on the extent of hybridization (if any) and location of the contact zone between *triseriata* and *maculata*. We are addressing this data deficit by surveying a panel of 1000s of nuclear Single Nucleotide Polymorphisms (SNPs) and mitochondrial DNA sequences from both species with samples spanning the entire distribution from the Northwest Territories and Alberta through to Quebec, with particular focus on the contact zone. Our data to date show diagnostic differences between eastern and western populations of boreal chorus frogs, marked phylogeographic structure within each regional population, and deep evolutionary divergence in both genomes between western and boreal chorus frogs. These new data will help conservation managers make more informed decisions about conservation priorities and action.

## MACPHERSON

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### TESTING EFFICACY OF MITIGATION FENCING DESIGNS AT PREVENTING ROAD ACCESS BY GRAY RATSNAKES

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Populations of many snake species around the globe are in decline as a result of anthropogenic threats such as road mortality. To reduce road mortality, wildlife barrier fencing is often used, albeit with varying levels of success. Given how adept gray ratsnakes (*Pantherophis spiloides*) are at climbing and the relatively large size they reach, this Threatened species serves as a good system for testing mitigation fencing as they can act as an umbrella species for other, smaller Ontario snakes. In this experiment, the exclusion potential and behavioural response of gray ratsnakes to different types of barrier fencing were assessed. We expect fencing material, height, and/or shape to determine an individual's success in climbing over it. Gray ratsnakes were tested in circular testing arenas 2m in diameter, and constructed of eight different combinations of fencing materials, heights, and shapes based on the recommendations of the OMNRF's best management practices for reptiles and amphibians. The behavioural responses, such as success in climbing over the fencing, number of climbing attempts made, and time taken to escape were video-recorded for each snake. Morphometrics and ground temperature



were also recorded, as these factors can also affect a snake's climbing ability. For each of the fencing combinations 12 trials were performed (~100 trials in total). Preliminary results show that the snakes had the most success escaping from the 0.6 m tall vinyl sheet fencing with a lip (100% escaped), and the most difficulty escaping from the 1 m tall hardware cloth fencing with a lip (only 6.7% escaped). Our study will inform the use of barrier fencing to reduce snake road mortality, thus helping to conserve snake populations at risk and apportioning limited resources for conservation more effectively.

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MAZEROLLE

## LANDSCAPE EFFECTS AND TEMPORAL PATTERNS IN ROADSIDE ANURAN POPULATIONS FROM A 21-YEAR MONITORING PROGRAM

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Quantifying long-term patterns in the distribution of species is important to inform management decisions. To do so, certain agencies now rely on monitoring programs based on citizen-science. We used a 21 year data set collected by volunteers from 158 routes distributed across the province of Quebec to survey anuran populations. Our objectives were to 1) estimate population trends for three anuran species (spring peeper, *Pseudacris crucifer*; American toad, *Anaxyrus americanus*; wood frog, *Lithobates sylvaticus*), and 2) to quantify the effect of anthropic variables on amphibian extinction and colonization parameters with landscape data that we extracted for a subset of years. We hypothesized that occupancy levels increase with latitude, as a result of decreasing levels of urbanization moving northward. We also hypothesized that occupancy levels are negatively impacted by the amount of anthropic landscape cover variables. In both assessments, we modeled the detection probability with the number of days elapsed since snowmelt as a novel alternative to Julian date to correct for weather variations across large spatial scales. Results indicate that the occupancy of the three species was high and stable between 1993 and 2013, but varied among regions. In partial support of our predictions, the initial occupancy of spring peepers increased with latitude, whereas the extinction probability of wood frogs decreased with latitude. Contrary to our predictions, we found no effect of anthropic variables on amphibian occupancy dynamics. The number of days elapsed since snowmelt was a strong predictor of detection probability for all three species investigated. We strongly suggest to include this type of variable in future studies to model detection probability of various animal taxa across large spatial scales.

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M<sup>c</sup>CURDY-ADAMS

## PRIORITIZING SPECIES RECOVERY PROJECTS: HOW DO YOU CHOOSE YOUR NEXT PROJECT TO HAVE THE GREATEST CONSERVATION BENEFIT?



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Amphibians and reptiles are among the most vulnerable groups of species, experiencing declines worldwide. Approximately half of the 51 species (or population units) of amphibians and reptiles that the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has assessed as threatened, endangered, or extirpated call for some form of hands-on intervention in their published recovery strategies. Wildlife Preservation Canada's (WPC) mandate is to perform hands-on applied conservation of species at risk (SAR). Our Conservation Action Plan identifies all Canadian SAR for which direct human intervention/ex-situ management is recommended as a recovery approach; over one third of this list is herpetofauna. We developed a decision support system that provides a transparent and effective method for evaluating and prioritizing potential projects. Our weighted criteria consider the global and Canadian biological and cultural value of a species, recovery potential, and additional criteria which reflect WPC's hands-on mission. We piloted the system with the herpetofauna on our list to inform the strategic growth of WPC's Amphibian and Reptile Initiative; results are presented and discussed. Feedback is sought from conference attendees and other experts to improve the process before expanding to other taxa. WPC is currently working with partners to build a Canadian Species Initiative which will use established International Union for Conservation of Nature (IUCN) Conservation Planning Specialist Group tools to bring in-situ and ex-situ communities together to achieve species conservation objectives in a One Plan Approach. Our first Integrated Collection Assessment and Planning workshop will be held in early 2020, preceded by a 2-day training course on how to evaluate the conservation needs of species and recommended role(s) of ex situ management.

## MOLDOWAN

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### **NATURE'S PITFALL TRAP: SALAMANDERS AS RICH PREY FOR CARNIVOROUS PLANTS IN A NUTRIENT-POOR NORTHERN BOG ECOSYSTEM**

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Botanical carnivory is an evolutionary marvel of the plant kingdom that has long fascinated general onlookers and naturalists alike. The Northern Pitcher Plant (*Sarracenia purpurea purpurea* L.) is found across eastern North America and has been subject to a wealth of observational and experimental studies. The documented prey assemblage of *S. purpurea* is diverse and comprised almost exclusively of invertebrates. In this study, we use a collection of observations in *Sarracenia* to illustrate that vertebrate prey can occur with a striking frequency. Visual surveys of pitcher plants were conducted during the metamorphic Spotted Salamander



(*Ambystoma maculatum* Shaw) dispersal period at a fishless kettle lake-bog site in Algonquin Provincial Park, Ontario. In 2018, we recorded metamorphic Spotted Salamanders captured in nearly 20% of surveyed plants and estimated that plants are responsible for 4-5% of salamander early life stage mortality in our study population. This presentation will discuss our surprising observations from the investigation of two widely distributed and well-studied species, as well as salamanders as aquatic-terrestrial nutrient vectors, and future directions for research. The high frequency of salamander captures in pitcher plants suggests that these plants serve as a non-trivial source of mortality for salamanders and salamanders serve as an appreciable seasonal nutrient pulse for pitcher plants at our study site.  
(student award competition)

PATERSON

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## MODELLING THE EFFECTS OF REHABILITATION ON TURTLE POPULATIONS

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When wildlife rehabilitators treat injured wildlife, their attention is focused on the health of individual animals. Ecologists and wildlife managers rarely consider rehabilitation as a conservation tool, but releasing rehabilitated individuals can have population-level impacts. Turtle populations are especially sensitive to increases in adult mortality and many individuals are injured or killed on roads. Our study objective was to determine the rates of road mortality and wildlife rehabilitation under which population extinction risks for turtles could be mitigated. We modelled population viability under various vehicle strike rate and rehabilitation scenarios, using demographic estimates from studies on Blanding's Turtles (*Emydoidea blandingii*) and Snapping Turtles (*Chelydra serpentina*), and intake records from the turtle hospital at the Ontario Turtle Conservation Centre. At low rates of vehicle strikes (0.01/year), saving 10-25% of individuals struck by cars had little effect on population trajectory or extinction risk because mortality from vehicle strikes was not high enough to cause strong population declines. Rehabilitating 50% of adults struck on the road in this scenario led to an increasing population and negligible risk of extinction within 200 years, assuming no other major sources of additive mortality. At intermediate vehicle strike rates (0.02/year), probability of extinction within 200 years increased to 34%, but was reduced by half if 25% of injured turtles were rehabilitated. At higher vehicle strike rates (0.05/year), rehabilitation of injured adults slowed population declines, but extinction risk was still over 90%. Our models demonstrate that under some conditions, rehabilitation of injured turtles can slow turtle population declines when vehicle strike rates are high, or stabilize populations when strike rates are low. Recovering turtle populations requires us to address multiple sources of mortality. Veterinarian-guided rehabilitation of injured turtles may "buy time" for threatened populations, and could be integrated into multi-pronged efforts to reduce local extinction risks.



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## POLLACK

### DETERMINING TROPHIC TRANSFER OF MICROPLASTICS IN THE ST. LAWRENCE RIVER SYSTEM

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While plastic pollution in aquatic environments has been an environmental problem for more than half a century, only in recent years has it gained more public awareness. Microplastics (> 5mm) are a less well-known form of plastic pollution. Microplastics cause significant environmental harm due to abundance and ability to transfer through the trophic system. Ingested microplastics have the potential to be lethal to organisms by causing internal blockages, as well as exposure to toxins. To determine the presence of microplastics we assessed 6 sediment samples, 30 zebra mussels (*Dreissena polymorpha*), 10 round goby fish (*Neogobius melanostrumus*), and 5 anurans from 5 sites along the St. Lawrence River from North of Ogdensburg to Cape Vincent. Sediment samples were sieved through 500 µm, 250 µm, 100 µm, 50 µm, and 20 µm filters and residual material was separated by density in 0.897 g/ml ethanol and DI-water solution, 1g/ml DI water, as well as 1.1 g/ml 1.2 g/ml saline solutions. Floated particles were extracted from the mediums using a vacuum and 20 µm filter. Filters were then examined under a microscope (10X) and possible microplastics were extracted using a tungsten needle and adhesive. Microplastics and specific polymer type were then confirmed using Attenuated Fourier - *Infrared* (AF-IR) spectroscopy. The gastrointestinal tracts of organisms were removed from collected specimens and dried for > 24-hours at 60C. A proteinase enzyme protocol was applied to the sample and residual material was filtered through a 20 µm filter. Similarly, filters were examined under microscope and possible microplastics were collected and confirmed using AF-IR spectroscopy. Preliminary results from AF-IR spectroscopy have detected microplastics in one sediment and one tissue sample. AF-IR absorption spectras will be further analyzed to determine plastic polymer types and abundance in each sample. Research will be completed Fall 2019.  
(student award competition)

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## RANDALL

### HOW CAN MITIGATION GUIDELINES BE APPLIED EFFECTIVELY?

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Mitigation translocation involves moving animals that would otherwise be destroyed or negatively affected by development activities to an alternative release site. The use of translocation as a mitigation tool for threatened amphibians is increasing, but it is not without risk—the practice can result in injury, mortality, stress, exposure to pathogens and genetic risks



for the translocated animals or animals at the release site. Little is known about the success of these types of translocations, but success rates are presumed to be low, mainly due to dispersal from the release site or homing to the collection site, or because release sites lack suitable habitat to meet the needs of all life-stages. Many jurisdictions in Canada currently allow translocations without providing clear guidance on how to plan, implement, and monitor translocations. We developed amphibian mitigation guidelines in collaboration with government agencies in a 4-year process. We discuss the use of guidance documents and adoption of guidelines into policy in Canada's Prairie Provinces and in the wider context of Canada.

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ROULEAU

### **SOCIOECOLOGY OF THE MIDLAND PAINTED TURTLE (*CHRYSEMYS PICTA MARGINATA*)**

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Social systems are common across the animal kingdom. In many species, social systems involve associations between kin. Hamilton's Rule suggests that social associations between kin should provide greater inclusive fitness benefits to participants relative to those between non-kin. Kin-based social systems are present in a number of reptilian taxa, but reptile sociality research has focused primarily on squamates. The purpose of this study is to investigate the presence of kin-based sociality in basking aggregations and nesting behaviour of the Midland Painted Turtle (*Chrysemys picta marginata*). The turtle's biology suggests that it has the capacity to form and maintain social groups. A genotypic analysis will be conducted on our focal population to determine relatedness between individuals. The nesting and basking habits of the focal population will be monitored throughout three active seasons, with particular attention paid to interactions between individuals. Behavioural trials will be conducted to test for channels of social communication between turtles during nesting and basking. Correlations between social associations and relatedness data will be explored upon gathering of preliminary data. Reptiles are underrepresented in the animal sociality literature. This study will contribute a description of sociality in a novel reptilian taxon. Understanding the social grouping of turtles will contribute greatly to research on the evolution of turtle, and, more broadly, vertebrate sociality. Further, the present study's relatedness analysis will contribute to further behavioural and evolutionary research on a long-term life history study of Midland Painted Turtles in Algonquin Provincial Park, Canada.

*(student award competition)*

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RUTHERFORD

### **IMPACTS OF AGRICULTURE AND ROADS ON AMPHIBIANS IN THE PRAIRIE POTHoles OF MANITOBA, CANADA**



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Following the end of the last ice age, glacial melting across the Prairies of North America created a landscape dotted with depressional wetlands. Wetlands in the Prairie Pothole Region (PPR) typically contain water following snowmelt for some period of time, although they may be temporary, semi-permanent, or permanent. To date, more than 40% of the original wetlands in PPR have been drained (primarily for agriculture and road construction) and thousands of acres are lost every year. Wetlands in the PPR are important breeding grounds for waterfowl and migratory bird species, including many species of amphibians and reptiles. The objectives of our research are to investigate the impacts of agriculture and road construction on species inhabiting Prairie Pothole wetlands in southeastern and southwestern Manitoba, and to recommend mitigation measures for road construction and agricultural activities. We surveyed wetlands from spring to fall of 2016-18 and recorded the following: water chemistry, breeding activity, species richness and morphology, and physical characteristics of the wetland. We selected study wetlands that differed in two main parameters: 1) proximity to type of road (gravel versus paved) and 2) proximity to livestock (full access by livestock, restricted access by livestock or natural). We found that breeding activity and species richness varied from year to year, differed among the wetlands, and was negatively affected by water chemistry (particularly salinity and conductivity), presence of fish and access by livestock.

## SEBURN

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### DO TURTLE WARNING SIGNS REDUCE ROADKILL?

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Roadkill is a serious threat for many species of freshwater turtles. One of the most common road mitigation tools is wildlife warning signs to alert drivers. These warning signs have commonly been used for large mammals, although there is little evidence they are effective at reducing roadkill. We tested the effectiveness of turtle warning signs at four known roadkill hotspots along a provincial highway in eastern Ontario and compared the results with four control sites on a nearby major road for a before-after-control-impact (BACI) study. We found 30 dead turtles in the four hotspots in 2017 before the signs were installed, and 27 dead turtles in 2018 after the signs were installed and this difference was not statistically significant ( $\chi^2 = 0.158$ ,  $p > 0.6$ ). There was also no statistically significant difference in the number of dead turtles at the control sites between the two years. Although turtle warning signs may alert some drivers, they should not be considered a replacement for more effective road mitigation tools such as wildlife fencing and crossing structures.



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## PHENOTYPE-ENVIRONMENT CORRELATIONS IN WILD SNAPPING TURTLE NESTS, AND THE MAINTENANCE OF TEMPERATURE-DEPENDENT SEX DETERMINATION

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Approximately 80% of turtle species exhibit temperature-dependent sex determination (TSD), yet the mechanism behind the adaptive significance of TSD is still unknown. Theoretically, according to the Charnov-Bull hypothesis, TSD should develop when incubation temperature differentially influences male versus female fitness. Many of the investigations that have searched for support of this hypothesis rely on *ex situ* laboratory experiments which fail to account for within-nest microclimate variation and naturally fluctuating environmental conditions. This study addressed these gaps by allowing snapping turtle eggs to develop in their natural nest environment past the point of sex determination. Information on nest temperatures, oviposition order, egg depth, egg weight, hatch weight, hatchling sex, and development time were collected. Mixed linear models and a structural estimating equation were conducted to create a path analysis of correlations between these factors. At the bottom of the nest: heavier eggs gave rise to heavier male hatchlings that took longer to develop due to cooler temperatures. At the top of the nest: lighter eggs gave rise to lighter female hatchlings that developed quicker due to hotter temperatures. Matching larger sizes to males might provide a differential fitness advantage as male size is highly deterministic of their reproductive success. A possible adaptive mechanism for matching females to hatching sooner is still unclear, as hatching synchrony and limited variation in hatch date within a clutch might not be sufficient to confer an advantage.

*(student award competition)*

## LET THE LITTLE GUYS SPEAK! ANURAN COMMUNITY ECOLOGY AND CALLING ACOUSTICS IN WINDFARMS

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To combat climate change, alternative “green” energy sources are being introduced, like wind energy. Although green energy sources reduce reliance upon fossil fuels, they may introduce new sources of habitat alteration and noise pollution. Negative impacts of habitat destruction on wildlife are well-documented, while noise pollution is an emerging, less-studied threat to populations that rely on auditory communication for mating. Anurans exhibit altered song characteristics and calling behaviours in response to noisy environments, such as near roadways with traffic noise, yet few studies have considered wind energy as a source of



disruptive noise. In May 2018 we began studying anuran community ecology and call characteristics within Prince Wind, a Northern Ontario windfarm located close to relatively pristine wetlands. We are measuring anuran diversity in habitats adjacent to wetlands using transect surveys and anuran chorus characteristics (intensity, diversity, and dominant frequency) using nightly audio recordings with SM4 Song Meters in 4 turbine sites (<0.5 km from turbines) and 4 control sites (>1.5 km from turbines). If turbines present a new source of noise pollution to anurans, then we expect wetlands within the windfarm to have lower species diversity, lower chorus intensity, and altered call characteristics to compensate for the turbine noise. Preliminary analyses indicate similar diversity and number of species calling in both turbine and control wetlands, with 4 different species recorded in both treatments. Amphibian populations are declining globally, so understanding and discovering new possible threats and mitigation options are essential to their conservation. We will discuss our results and how they could influence amphibian fitness and population persistence under the demand for green energy alternatives.

(student award competition)

## TRUDEAU

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### CAPTIVE BREEDING AND REINTRODUCTION OF LEOPARD AND CHORUS FROGS IN CANADA

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Amphibian reproductive technologies offer effective approaches for captive breeding, genetic management and reducing the risk of species extinctions. However, there are relatively few examples of applications of these technologies in practice in conservation programs in Canada and around the world. We have developed the AMPHIPLEX (amphibian amplexus) method for spawning induction in captivity that has been successful for a dozen species thus far. Intraperitoneal injection of both sexes with a combination of a peptide hormone (gonadotropin-releasing hormone agonist) and a dopamine antagonist (metoclopramide) induces the full sequence of spawning and fertilization events in *Lithobates pipiens* and *Pseudacris triseriata* (Great Lakes, St. Lawrence and Canadian Shield Populations following current COSEWIC conventions and SARA listing) which otherwise do not breed at all in captivity. This has permitted the raising and distribution of eggs, tadpoles, metamorphs for further laboratory-based experiments in ecotoxicology and endocrine physiology (*L. pipiens*). In addition, despite low fertilization rates in the captive population of *L. pipiens* in B.C., reintroduction of thousands of



individuals has begun. For the case of the *P. triseriata* no reproduction had been recorded in a captive QC population maintained for several years until they received the hormonal treatments. Spawning, fertilization rates and subsequent metamorphosis have been highly successful, in that descendants of wild stock could also be bred under captive conditions. A pilot study for reintroduction of >1000 *P. triseriata* in a suburban park (St. Constant, QC) indicated moderate survival over 2 years. While promising, there are important aspects of these studies that require concerted research efforts of the various stakeholders. This must include assessment and major improvement of fertility outcomes, optimization of housing conditions and development of effective methods for site selection, reintroduction and population monitoring.

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VAN DEN DIEPSTRATEN

### BEHAVIOURAL RESPONSE OF AN ENDANGERED FRESHWATER TURTLE (*CLEMMYS GUTTATA*) TO DYNAMIC COASTAL WETLANDS

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Long-term data are essential to understanding the ecology and behaviour of long-lived species of conservation concern. The natural cycles in lake and coastal wetland water levels can dramatically alter habitat over a turtle's lifespan, so to persist, turtles must show a degree of adaptability to a dynamic environment. We have been studying a Lake Huron, Canada population of globally-endangered Spotted Turtles (*Clemmys guttata*) since 2007. Twelve years ago, during a period of low-lake levels, habitat selection of the Spotted Turtle population was studied. That study identified microhabitat preferences and movement patterns that differed seasonally, and found that nesting females showed fidelity to nest substrate rather than location. As high-water levels have returned, we now have the opportunity to compare the habitat use of the same female turtles between high water and low water years. Our current project aims to identify whether individual turtles retain these habitat preferences in high-water conditions. Using GPS data loggers, we estimated the location of five nests. Four of the five nesting females appear to have shifted their substrate preferences between low-water conditions and present high-water conditions. Nest location has also shifted inland by a mean of 305 m (n=4, SE=104). If turtles can behaviourally adapt to this natural change in environment, understanding which microhabitat preferences are retained over a range conditions can inform mitigation strategies. Evaluating the potential to construct nesting mounds out of the preferred nesting substrate is one of many possible applications of this research. Our project is especially relevant given that human activity tends to suppress natural variation in water levels; variation that is critical in maintaining the early-successional habitat preferred by Spotted Turtles.  
(student award competition)



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## VAN DRUNEN

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### ESTIMATING CRITICAL HABITAT FOR THE ENDANGERED JEFFERSON SALAMANDER (*AMBYSTOMA JEFFERSONIANUM*) AND THEIR UNISEXUAL DEPENDENTS BASED ON YEAR-ROUND MOVEMENTS

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Habitat protection is a key component of endangered species conservation, but critical habitat designations are often based on limited data or habitat use during a small portion of a species life cycle. In Canada, Jefferson salamander (*Ambystoma jeffersonianum*) and their unisexual dependants (*Ambystoma laterale* - (2) *jeffersonianum*) are designated as endangered federally and provincially. Protected habitat around breeding pools for these species is based on limited movement data primarily from spring and summer periods. Furthermore, differences in habitat use has not been directly compared in areas where these two species co-occur. In 2017 and 2018, we radio-tracked a total of 19 *A. jeffersonianum* (JJ) and 14 *A. laterale* – *jeffersonianum* (LJJ & LJJJ) to overwintering sites. We used these data and summarized available movement data from past studies tracking movements in other periods of the annual cycle to estimate year-round critical habitat. *A. jeffersonianum* travelled significantly longer distances to overwintering locations than unisexuals. Individuals were more likely to overwinter next to a similar genotypic individual than not. Critical habitat encompassing the entire annual cycle of *A. jeffersonianum* extends up to 400 – 450 m from breeding ponds indicating existing regulatory habitat protections in Canada do not currently protect sufficient habitat.

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## VICEK

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### DO FRESHWATER TURTLES PREFERENTIALLY NEST IN DISTURBED SOIL?

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Nest-site selection of freshwater turtles has significant consequences on maternal fitness, hatchling fitness, and population recruitment. A common but anecdotal observation is that turtles will frequently nest in human-disturbed soil, such as piles of clean fill near shorelines, and natural nest sites are known to include areas with uprooted trees near shorelines. Yet, disturbed



sites have not yet been shown to attract turtles, and the mechanisms through which turtles are able to find disturbed sites are unknown. At a long-term study site in Algonquin Park, we investigated (1) whether painted turtles are attracted to disturbed areas, and (2) if they are, whether painted turtles located these sites via olfactory cues from the soil. As part of a random block design, ten blocks were divided into four sections with three treatment plots, Rake (moderately disturbed), Daily Rake (severely disturbed), Organic Input (severely disturbed with added organic material) and an undisturbed control. Blocks were monitored for 27 days. We found that turtles exhibited no preference for disturbed or highly organic soil, compared to the undisturbed control blocks. The present study suggests that, contrary to popular belief, disturbed soil is not a preferred nest environment for turtles. This study may help in the development and management of planned nesting areas for species at risk.

*(student award competition)*

**WALLACE**

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## **MORTALITY RISK TO WOOD TURTLE IN A LANDSCAPE UNDER ACTIVE AGRICULTURE IN NEW BRUNSWICK**

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Agricultural land and improved agricultural machinery present an ecological trap for some species. The threatened wood turtle (*Glyptemys insculpta*) inhabits riparian buffers and forests but will use agricultural fields if close to nesting habitat, as these fields can provide adequate basking temperatures and feeding grounds. In actively farmed fields, agricultural machinery can present a mortality risk for the species. Mitigation of this risk is difficult, as there is limited information on the effects of agricultural practices on wood turtles. We sought to quantify how different agricultural practices affect wood turtles at levels ranging from individual movement behaviour to population demographics. From May to October of 2017 and 2018, we studied wood turtles in central New Brunswick along a second-order stream surrounded by hayfields and forest. We located 50 wood turtles along a 2-km section and radio-tagged 23 to monitor their habitat use and relative risk from agricultural practices. In July and August of 2017 and 2018, we monitored the movement response of wood turtles approached by agricultural machinery. Results varied, but none of the turtles successfully escaped the mower during harvest. We recorded a total of 993 relocations in 2017 and 2018, and from 15 June to 15 July, approximately 50% of relocations were within a hayfield. Females used the fields more often and for a longer period than males. In June, 86% of turtles in the field were within 30m from the field edge and 80% in July. Due to the high risk of mortality from agriculture practices, implementing grass buffer strips along field edges would help avoid mortality risk to wood turtles. This information will help fill several critical knowledge gaps for this species-at-risk and provide management recommendations to land managers attempting to mitigate agricultural impacts.

*(student award competition)*



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## WIJEWARDENA

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### **HABITAT PROTECTION, RESTORATION, AND HEAD-STARTING: CAN THESE CONSERVATION STRATEGIES RECOVER AN URBAN POPULATION OF ENDANGERED BLANDING'S TURTLE (*EMYDOIDEA BLANDINGII*)?**

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Habitat loss and fragmentation are major drivers of population decline for many freshwater turtles, especially in urban areas. Several conservation strategies, including habitat protection and restoration, and head-starting, have been used to improve population recovery, with varying success. However, few studies have investigated the success of these strategies when implemented simultaneously. Our study investigates individual and population health of head-started Blanding's Turtles (*Emydoidea blandingii*) released into a restored wetland complex in the Rouge National Urban Park (RNUP) in Ontario, Canada. We conducted a mark-recapture study to measure: 1) population size; 2) age distribution; 3) sex ratio; 4) somatic growth rate; 5) body condition (mass vs. body length); and, 6) survivorship of each head-started cohort. In the 2018 and 2019 field seasons, using baited hoop traps and walking transects, we captured 36 Blanding's Turtles (1 wild female, 1 wild male, 34 head-start juveniles; 20 recaptures). The sex ratio was 0.03 male: 0.03 female: 1 juvenile, and the age distribution confirmed that juveniles are the most common demographic class in the population. These results are not surprising given that only 5 adult wild Blanding's Turtles have been historically found at the study site. Preliminary results also indicated that at least 47% of head-started Blanding's Turtles display relatively poor body condition, and a growth rate of 7 mm/year, which is slower than that of wild Blanding's Turtles of similar age in southeastern Michigan, USA. Our study will indicate whether several conservation strategies implemented together can initiate recovery of an endangered turtle population in a highly disturbed habitat where multiple threats persist.  
(student award competition)

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## YAGI, A.

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### **A LONG-TERM STUDY ON MASSASAUGAS (*SISTRURUS CATENATUS*) INHABITING A PARTIALLY-MINED PEATLAND: PRESENTING A NOVEL APPROACH TO CHARACTERIZING SNAKE OVERWINTERING HABITAT**

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From the literature, we surmised that temperate snakes survive hibernation when a vertical subterranean space exists, called a "life zone" (LZ), that is aerobic, flood, and frost-free. Thus, the main concern was that areas of lethal subterranean habitat may exist, for an endangered isolated Massasauga (*Sistrurus catenatus*) population inhabiting a partially mined peatland,



creating an overwintering ecological trap. Radiotelemetry confirmed: (1) individuals moved between “Mined” and “Not-Mined” habitats during the active season, (2) individuals tracked over multiple years exhibited site fidelity to either Mined or Not-Mined hibernation sites, and (3) not all hibernacula were identified. A subterranean habitat investigation ensued using a grid of wells, and frost tubes installed in two sample areas, Mined, and Not-Mined. We measured frost depth, snow-height, groundwater (level, temperature, and dissolved oxygen) weekly for 11 consecutive winters. The LZ within the Mined study area was periodically reduced to zero during a flood-freeze cycle, while the LZ in the Not-Mined study area was maintained for the duration of the study. Model selection analysis revealed that soil-depth and flood status best predicted LZ size. Thermal buffering and groundwater dissolved oxygen increased with LZ size; and annual Massasauga encounters decreased with LZ depletion. This analysis suggests a population decline occurred when LZ size was reduced by flooding. Our data give support to the importance and maintenance of an LZ for successful snake hibernation. Our methods are applicable to other anthropogenically impacted sites where snake populations are at risk.

YAGI, K.

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### **IMMEDIATE AND LONG-TERM EFFECTS OF PUBLIC BEACH USE ON THE MOVEMENT AND SURVIVAL OF THE ENDANGERED FOWLER’S TOADS (*ANAXYRUS FOWLERI*) AT NICKEL BEACH, PORT COLBORNE ONTARIO**

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The Niagara region houses the highest density of Fowler’s toads along the shoreline of Lake Erie, which coincides with a high density of people living on and using the beaches. Nickel beach in Port Colborne continues to support Niagara’s largest subpopulation of Fowler’s toads, due to the presence of good overwintering, refuge and breeding habitat. One of the main human impacts to Fowler’s toads here is vehicular access onto the beach, and associated grading to create beach parking. The purpose of this study is to quantify the impact of human activity on the population of Fowler’s toads at Nickel Beach, to inform ongoing management practices to enhance long-term toad survival. We assessed human impact on Fowler’s toads by tallying the total number of vehicles and beach patrons on the beach, 2-3 times per week between May and September. The toad population was monitored using mark-recapture surveys once per week between May and September. Toadlet survival was assessed using a pool of identified toadlets, divided into three groups that were released into either “Control”, “High Impact”, or “Low Impact” areas of the beach. Toadlet surveys 3-4 times per week thereafter within these areas aim to determine toadlet survival and movement. Our results from 2018 show that human activity on the beach did affect toadlet survival and movement, however the results did not reveal significant trends, possibly due to small sample size per treatment group. This study is being repeated in 2019 and 2020 to acquire enough information on survival to inform a PVA model.



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## ZAGORSKI

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### PROS AND CONS OF USING GPS TAGS FOR TRACKING SEMI-AQUATIC TURTLES

Gabriella M. Zagorski<sup>1\*</sup>, Heather I. Van Den Deipstraten<sup>1</sup>, Douglas R. Boreham<sup>2</sup>, and Jaqueline D. Litzgus<sup>1</sup>

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Global Positioning System (GPS) transmitters have been used for several decades to observe large terrestrial mammal movements and behaviour. Recent advances in technology have resulted in GPS tags of smaller sizes that can be deployed on smaller animals such as birds and turtles. There are advantages and disadvantages of using GPS transmitters compared to other methods to collect movement data. For example, GPS tags can provide fine temporal location data with minimal human resources but with great financial investment, whereas VHF telemetry requires substantial field time by researchers but is less expensive. Lotek PinPoint GPS transmitters were used in two studies in Ontario to identify nesting sites for endangered Blanding's turtles (BLTU) and Spotted turtles (SPTU). Tags were deployed when females were confirmed gravid with shelled eggs and offloaded once turtles were no longer gravid. VHF radios were also affixed to turtles to preserve GPS battery life. GPS tags were deployed on 12 BLTU and 10 general nesting areas were identified with 2 tag failures. GPS tags were deployed on 6 SPTU and 5 general nesting areas were identified with 1 tag failure. Exact nesting locations were found only by ground-truthing GPS data or by conducting nesting surveys (8 BLTU, 0 SPTU). The greatest challenges to using GPS tags were lack of locational accuracy and limited battery life, and a user learning curve. We conclude that VHF radio telemetry paired with nightly visual nesting surveys (i.e., substantial investment into human resources) remains the best method for identifying exact locations of turtle nests. This is an important issue to consider because time and resources are limiting factors in collecting data to support the conservation of at-risk turtle species, especially in small populations or in areas threatened by human development.

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## ZIEBARTH

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### LOCAL-SCALE DRIVERS OF AMPHIBIAN AND REPTILE BETA DIVERSITY IN ONTARIO'S LANDSCAPE

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Globally, we are experiencing a biodiversity crisis in which species are going extinct 100 to 1000 times faster than background levels would predict. This acceleration in extinction is caused by many anthropogenic forces, which reptiles and amphibians are not immune to. In Ontario, there



are more than 50 species of reptiles and amphibians, of which 23 are listed as either Special Concern, Threatened, or Endangered by COSEWIC. This project therefore aims to determine the drivers affecting the beta diversity of reptiles and amphibians in Ontario. In determining the beta diversity of these species, the metric allows us to ask how variation in species assemblages are influenced by variation of local environmental factors (temperature, landcover, and road density). This will help to identify the drivers of herpetofauna decline; pinpoint areas of high conservation value or high connectivity; guide Ontario Nature in informing conservation, population management, and policy decisions; and demonstrate the abilities of citizen science data. The data for this project was supplied by Ontario Nature. The Ontario Reptile and Amphibian Atlas is one of numerous citizen science initiatives managed by Ontario Nature and contains more than 400,000 records regarding occurrence data for all species of reptiles and amphibian across Ontario. A corresponding fishnet layer was also supplied by Ontario Nature representing the province in 10 by 10 km grid cells. With each occurrence record being assigned to its respective grid cell, the beta diversity was calculated for the 3134 grid cells with species recorded in them. The factors we believe are affecting the beta diversity (temperature in the form of growing degree days, landcover, and road density) have been preprocessed and are ready for analysis. The analysis stage of this project is underway, and once completed we will be able to determine the factors affecting beta diversity and herpetofauna decline.  
*(student award competition)*





## Poster Presentations

**BRITT**

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### **THE IMPACT OF TEMPORAL VEGETATION VARIATION ON SPRING PEEPER (*PSEUDACRIS CRUCIFER*) ADVERTISEMENT CALL PROPOGATION IN THEIR NORTHERN RANGE**

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Organisms that use acoustic communication are greatly influenced by the physical structure of their habitats. Selection typically favours individuals with call properties and/or behaviours that decrease excess attenuation and sound distortion with distance. For many temperate frogs with prolonged breeding seasons the structure of vegetation can change markedly over the period during which they call, with potentially profound consequences for sound transmission. The spring peeper (*Pseudacris crucifer*), a small, nocturnal, North American treefrog, inhabits a diversity of habitats from Florida to Ontario. In their northern range, males call terrestrially, and breeding can begin as early as late March continuing through to late May/early June. During this time, aquatic habitats can transform from open to densely vegetated, with great variation in night time temperatures. Southern populations experience less microclimatic variation and higher temperatures during breeding, and males often call arboreally to maximize call propagation. Northern males tend not to call arboreally, possibly as a consequence of more open habitats, at least early in the season. To determine how changing habitat might affect sound transmission in northern spring peepers, we conducted a series of playback experiments in six marshlands that vary substantially in size and species composition using a playback loop of 18 male advertisement calls from across the species range. The loop was broadcasted at two heights and recorded at two distances for each height. To quantify effects of changing vegetation, all playback combinations were conducted four times throughout breeding season. Photographs of a gridded (10cm<sup>2</sup>) sheet were taken through the vegetation along the playback transect for all heights and distances to quantify habitat structure. These data allow us to assess how changes in habitat structure and density during breeding season might influence advertisement call transmission and calling behaviour of northern male spring peepers. (*student poster award competition*)



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**NIGHT MOVES: NOCTURNAL MOVEMENTS OF ENDANGERED SPOTTED TURTLES (*CLEMMYS GUTTATA*) AND BLANDING'S TURTLES (*EMYDOIDEA BLANDINGII*)**

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Most movement ecology research on temperate turtles focuses on tracking during daylight hours, with the exception of the nesting season when tracking hours are often extended into the evening to capture nesting migration. However, it is not clear whether temperate, non-nesting turtles actually reduce their activity during the night. GPS-tracking devices can collect and archive locations around the clock, provided the GPS antenna is above water. Thus, locations collected during the night indicate occurrences of turtles that are not underwater, and can be used to infer nocturnal movements. We collected GPS-tracking data for 12 spotted turtles (*Clemmys guttata*) and 14 Blanding's turtles (*Emydoidea blandingii*) from May - July 2018, and used these data to ask: Are turtles moving at night? We found that both spotted and Blanding's turtles exhibited some nocturnal movements, but the frequency of these movements differed between species. Nocturnal movements were more common in spotted turtles (10 of 12 tracked turtles) than in Blanding's turtles (3 of 14 tracked turtles). Night-time movements varied from 2 m to 269 m. Individual variation was high, with some spotted turtles displaying a higher proportion of nighttime points to daytime points in a 24-hour period. We also explored the thermal implications of nocturnal movements, as turtles are exposed to a different range of temperatures at night and may adjust the timing of their movements to access more optimal thermal resources.

ČAPKUN-HUOT

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**THE EFFECTS OF SEX, PHYSICAL TRAITS, AND PARASITES ON PAINTED TURTLE (*CHRYMESYS PICTA*) BEHAVIOUR**

Catherine Čapkun-Huot

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While the study of animal personality is gaining in popularity, no adequate tests had been proposed to investigate it in turtles prior to my field work. In this study, I designed two new tests to assess turtle aggressive and boldness behaviours. The first one uses three operational categories describing the degree to which an individual is aggressive and the second measures the time an individual takes to escape from a platform into the water. Additionally, I tested the hypothesis that the sex and physical traits of an individual are linked to specific behaviours in painted turtles (*Chrymesys picta*). I predicted that males and females would differ in terms of personality traits, as well as bigger and smaller individuals. I also hypothesized that a



relationship exists between the parasite load and an individual's behaviour, as parasites can have an effect on the host behaviour and as some behaviours might be more prone to parasite transmission. I predicted that bolder individuals would have more leeches than shyer individuals. The results of my behavioural tests showed that less aggressive individuals seemed to be shyer. However, I found no other significant correlations between the sex, physical traits, number of leeches, and behavioural measurements. My findings are a good starting point for future studies to extend knowledge on turtle personality.

## CAMARASA

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### LIFE HISTORY TRAITS VARIATION OF *CALOTRITON ASPER* (PYRENEAN BROOK NEWT) IN POPULATIONS OF LAKE AND MOUNTAIN STREAMS.

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Demographic life history traits were analysed in the Pyrenean brook newt (*Calotriton asper*) in order to evaluate its phenotypic variation at different habitats. In this study, life history traits of *C. asper* were estimated in 9 populations living in lake and mountain streams. Skeletochronology methods was used to determine age structure and different traits such as age at maturity and longevity. Age structure was different between populations and sex, and the lacustrine populations attained the maturity earlier. In Perramo and Acherito lakes, with the presence of facultative paedomorphosis, newts were less long-lived. The maximum sizes were found in lacustrine populations but exhibited high variation between localities. Local variability of age and size distributions of *C. asper* follow a complex pattern that depend on the habitat, sex and locality interaction.

## GALLON

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### POTENTIAL VARIABLES INFLUENCING HABITAT SUITABILITY FOR EASTERN HOG-NOSED SNAKES (*HETERODON PLATIRHINOS*) AT THEIR NORTHERN RANGE LIMIT

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Over three quarters of Canadian reptiles are listed as species at risk (SAR), where most occur at their northern range extent. Populations at range peripheries often face ecological challenges that exacerbate existing threats. For SAR populations inhabiting human-modified landscapes at range peripheries, understanding habitat selection is important for effective conservation management. Populations of the Threatened eastern hog-nosed snake (*Heterodon platirhinos*) inhabiting southwestern Ontario are one such example. This highly mobile species occupies



large home ranges, which can feature several competing land uses within anthropogenically-dominant landscapes. Our study population in Huron County, ON navigates such a landscape where naturalized habitats are interspersed amongst human-modified areas. We are investigating whether putatively higher chances of anthropogenic interaction influences the availability and suitability of potential thermoregulatory habitat. Furthermore, we are trying to determine how varying degrees of human activity and presence of invasive grasses, common reed grass (*Phragmites australis* ssp.) and reed canary grass (*Phalaris arundinacea*) influence habitat selection. To quantify available habitat we are using paired used-available habitat plots, as well as noting degree of disturbance and invasive grass presence. To measure thermoregulatory habitat impacts, we placed temperature data loggers in invasive grass stands and representative habitats around the study area. Preliminary results of the strongest models revealed by Akaike Information Criteria analyses show that snake presence is negatively associated to canopy cover, while vegetation density and forest edge distance are positively associated when all structural variables are considered at a landscape scale. At a finer scale (1-m<sup>2</sup>), potential cover objects are positively associated with snake occurrence. Our next step is to analyze temperatures of habitats, and compare them to observed snake locations and time of occurrence. Once complete, this project will provide insight into how anthropogenic development can impact the presence of critical eastern hog-nosed snake habitat in southwestern Ontario.

FOTHERBY

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## HABITAT USE BY THE CAROLINIAN POPULATION OF GRAY RATSNAKE (*PANTHEROPHIS SPILOIDES*) IN ONTARIO

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Knowledge of a species' habitat use plays a major role in the success of the recovery of a species through habitat protection, restoration, enhancement or creation activities. In Ontario, the provincially and federally Endangered Carolinian population of Gray Ratsnake (*Pantherophis spiloides*) has received little study to understand its habitat requirements. To improve our knowledge of the population's habitat requirements, we conducted a radio telemetry study in which we documented the habitat use by Gray Ratsnake individuals of the Carolinian population (Big Creek subpopulation). Microhabitat characterization noted a preference for edge habitats and greater vertical vegetation structure. An analysis of macrohabitats observed home ranges of radio tracked snakes to consist mainly of forested habitat with some open and edge habitat. Of particular interest, several habitat features were used by more than one individual throughout the three-year monitoring period. The results of this study provide a baseline for future recovery activities that involve the protection, restoration, enhancement or creation of habitat for the Carolinian population of Gray Ratsnake.



**KHALILZADEH**

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**GENETIC MONITORING OF WILD AND REINTRODUCED NORTHERN LEOPARD FROG (*LITHOBATES PIIPIENS*) POPULATIONS: OPTIMIZATION OF A SLOW RECOVERY**

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Northern leopard frog (*Lithobates pipiens*) was widely distributed throughout North America but has undergone dramatic population size decline over recent decades in Western Canada. To date, only a single population remains at the Creston Valley Wildlife Management Area in British Columbia as conservation efforts have successfully maintained this population. Yet, viability of the population is uncertain and in the event that sources for reintroduction must be found outside this physically isolated and unique population, information about its genetic health and origin is critical. We will test two alternate hypotheses regarding the origin of this population: (1) Colonization from the south via Washington (USA), or (2) colonization from a Western population via an over-mountain route, originating from Alberta or a closely related northern US population. In addition, genetic monitoring of reintroduced and managed population provides valuable information on changes of genetic diversity and effective population size over time. In recent years, translocations of Northern leopard frogs in Alberta proved reintroduction to be an effective approach in conservation of amphibian species; however, the number of published studies using genetic monitoring to understand genetic diversity of populations before, during and after reintroduction is limited. Using genetic markers such as microsatellites and mitochondrial DNA, this study will also assess genetic consequences of translocation for a few reintroduction sites in Alberta.

**OROMI**

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**POPULATION DYNAMICS OF NATTERJACK TOAD (*EPIDALEA CALAMITA*) IN THE SEMIARID ZONE OF MAS DE MELONS**

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The population dynamics of *Epidalea calamita* was studied in different localities of the semiarid zone of Mas de Melons (Lleida, Catalonia, Spain). Passive Integrated Transponder tags (PIT tags) were used in a capture-recapture method to analyse the population size and patterns of populations dynamics. The zone is characterized by the presence of semipermanent and temporal ponds where the natterjacks reproduced. The firsts results reveal that there is high



connectivity between ponds, with movements of individuals from four of the five ponds studied. The number of captured and recaptured males was higher than females and estimated population size varied among years. The results found support previous studies that show the high migratory capacity of this species in semi-arid areas. This movement capacity allows maintaining the connectivity between reproduction points that can change every year.

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**SKINNER**

## **INDIVIDUAL DIFFERENCES IN SOCIABILITY AND BOLDNESS IN EASTERN GARTER SNAKES**

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There is little research on individual differences, sometimes called 'personality', in snakes. We measured sociability and boldness of juvenile Eastern Garter Snakes in both an individual and a group environment. To individually test sociability, we measured a snake's attraction to a social shelter (scented with conspecific skin lipids), compared to a control shelter. To measure boldness, we examined the time to emerge from a shelter and the time spent exploring an arena. We then examined the consistency of these behaviors when the snakes were moved into a group environment, by placing groups of ten snakes in a square enclosure that had four hides. We recorded positions of all the snakes every 5 seconds for 8 days. We constructed social networks of the snakes' interactions and examined the effects of individual differences in sociability and boldness on their aggregation tendencies. We found that social preferences within the group context were consistent across days and between the individual and group scenarios. Additionally, we found significant changes in boldness across contexts. Not only is this the first study to demonstrate individual differences in sociability in snakes, it is also the first study to examine the effects of snake 'personality' in a group context.  
*(student poster award competition)*

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**SUKUMAR**

## **DEVELOPING A STANDARDIZED LONG-TERM MONITORING PROTOCOL FOR ONTARIO SNAKES**

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In Ontario, there is a lack of population trend data for many snake species, causing difficulties when assessing their conservation status, particularly for cryptic and lesser-studied species. Thus, there is a need for widespread, standardized, long-term monitoring to gather baseline information about Ontario's snake populations. Ontario Nature is developing a long-term monitoring protocol to assess population trends in Ontario snakes over time. In 2018, the



protocol was tested by conservation professionals and private landowners in areas with Eastern Foxsnakes in Norfolk and Haldimand counties. This year, the project has expanded to over 15 sites across Ontario targeting multiple snake species. Sites include provincial and national parks, private landowners, land trusts and conservation authorities. In addition to monitoring the snakes found under cover boards, the protocol includes the collection of habitat data to assist with the identification of areas with greatest stewardship need.

The goal of this project is to develop and implement a monitoring program for Ontario's snakes that will be capable of detecting population trends over a ten-year period. With the cooperation of partner conservation professionals, standardized data will be collected that will address knowledge gaps and help monitor Ontario's snakes.

## TROWBRIDGE

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### HERPS IN THE WIND: THE COMMUNITY ECOLOGY OF HERPETOFAUNA IN WINDFARMS

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Depleted fossil fuel resources and associated climate change have caused a demand for green energy alternatives that are low in harmful emissions, but that may present their own potential problems. Impacts of windfarms on birds and mammals are widely documented, and recent concerns about herpetofauna near windfarms have created a demand for new research. To fill this knowledge gap, in 2016 we conducted a pilot study examining herpetofauna community ecology in a Southern Ontario windfarm situated within an agricultural landscape. We found marginally significantly lower species diversity in wetlands near wind turbines compared to control sites, but post-hoc tests showed that one turbine site was driving the treatment difference. To reduce the influence of other anthropogenic impacts, in May 2018 we began studying herpetofauna community ecology within Prince Wind, a Northern Ontario windfarm located close to relatively pristine wetlands. We are measuring herpetofaunal biodiversity using survey transects, and spatial ecology of turtles using radio telemetry. If herpetofauna are negatively impacted by the presence of turbines, we expect lower diversity in wetlands and turbine avoidance behaviours by turtles. Preliminary data indicate that both treatments have similar diversities with 11 species of herpetofauna observed in both turbine and control sites, and that Painted Turtles (*Chrysemys picta*) in impact and control sites show similar movements patterns. We discuss the implications of our study with respect to conservation of herpetofauna, including possible impacts from windfarms and mitigation strategies. Understanding the interaction of herpetofauna ecology and windfarms is essential to minimizing negative impacts of green energy alternatives.

*(student poster award competition)*



**DRIVERS OF COMMUNAL OVERWINTERING BEHAVIOUR OF BLANDING'S TURTLE  
(*EMYDOIDEA BLANDINGII*) IN A RESTORED WETLAND COMPLEX IN THE ROUGE  
NATIONAL URBAN PARK, ONTARIO, CANADA**

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Freshwater turtles in northern temperate areas spend more than half their lives overwintering and must tolerate prolonged periods of submergence at cold temperatures under ice, and hypoxic conditions. For at-risk turtles, successful winter hibernation is crucial for their long-term conservation. Winter aggregations are common for northern populations of turtles, such as the Blanding's Turtle. Environmental factors identified to influence overwintering site selection include dissolved-oxygen content, pH, water temperature, water depth, substrate type, vegetation cover, and duration of ice cover. Interestingly, this species overwinters communally even when overwintering habitats are not limited, and the reason for communal overwintering behaviour has not been well studied. Our study focuses on four hypotheses that may explain communal overwintering behaviour in head-started Blanding's Turtles in the Rouge National Urban Park (RNUP): habitat limitation; predator avoidance; site fidelity to reduce energy costs; and non-random spatial affiliation by siblings. Given that the head-started Blanding's Turtles are juveniles, the mate-selection hypothesis will not be investigated. We will conduct this study from September 2019 to April 2020 using radio telemetry and visual surveys. Genetic relatedness of turtles will be estimated using known clutch histories: Blanding's Turtles hatched from the same clutch will be considered closely related (i.e. siblings). The findings from this study will identify the potential drivers of communal overwintering behaviour of juvenile Blanding's Turtles and provide a better understanding of which behaviours will maximize their chances of survival during winter.

*(student poster award competition)*





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## NOTES

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