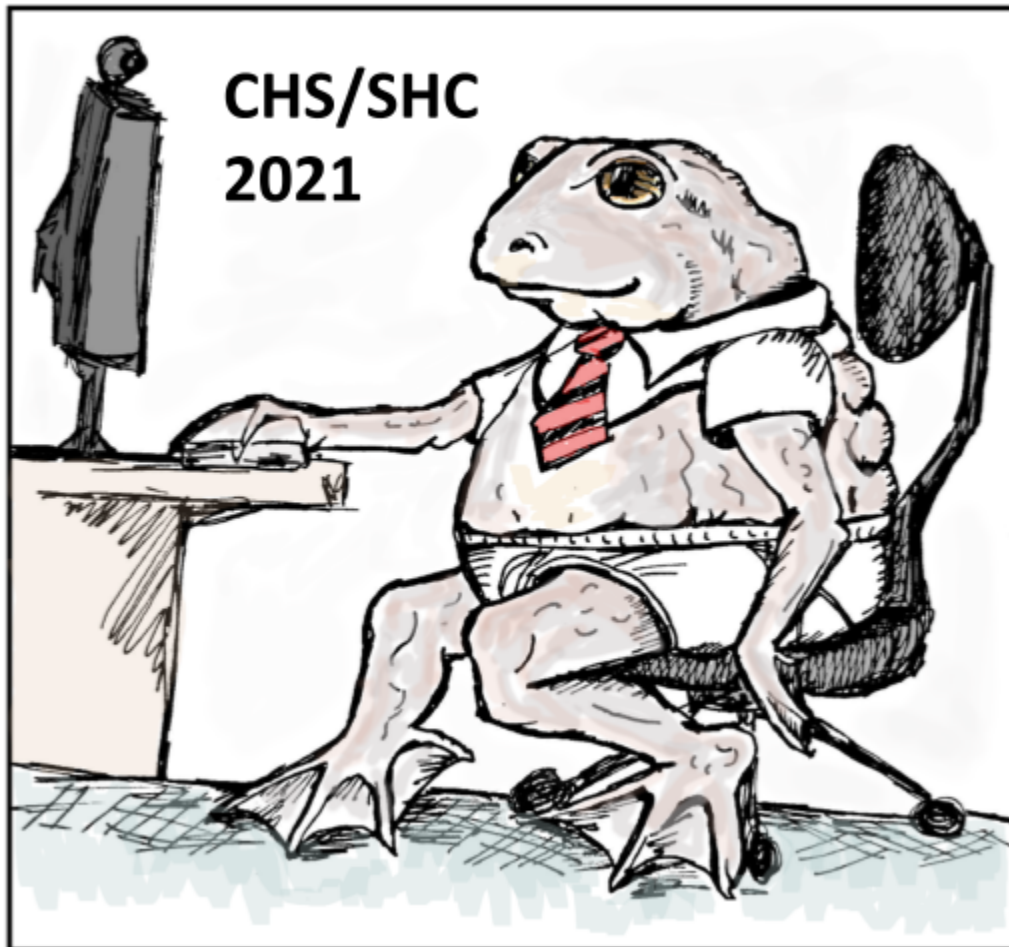


***8th Annual Meeting of the
Canadian Herpetological Society***

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



Virtual Meeting 2021

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ACOUSTICS

Canadian Herpetological Society 2021

Welcome

On behalf of the CHS Meetings and Workshops Committee, welcome to the virtual meeting for the 8th Annual Meeting of the Canadian Herpetological Society/Société d'Herpétologie du Canada. This year's meeting continues a long-standing tradition of annual meetings to promote research and conservation of amphibians and reptiles in Canada.

CHS Meetings and Workshops Committee

- Pamela Rutherford (Chair)
- Amanda Bennett (Logo creator)
- Jonathan Choquette
- Scott Gillingwater
- Hannah McCurdy-Adams
- Julia Riley

Canadian Herpetological Society

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

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

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

President: Pamela Rutherford (Brandon University, Brandon, MB)

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

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Webmaster: Drew Hoysak

Canadian Herpetological Society 2021

Schedule Overview

Friday, September 17, 2021

1200 EDT	Wildlife Acoustics Workshop	
1800	Social	

Saturday, September 18, 2021

1100 EDT	Opening Remarks	
1115-1215	Plenary Talk Katy Greenwald Eastern Michigan University	What <i>Ambystoma</i> salamanders can teach us about the evolution of sex (or, why make males when you can steal sperm?)
1215-1230	Break (15 min)	
1230-1335	Session 1: Snakes and Lizards	Chair: Hannah McCurdy-Adams
1335-1400	Break (25 min)	
1400-1440	Session 2: Frogs	Chair: Nicholas Cairns
1440-1500	Break (20 min)	
1500-1530	Session 3: Turtles	Chair: Jackie Litzgus
1530-1545	Break (15 min)	
1545-1640	Session 4: Herpetological Communities	Chair: James Paterson
1640-1730	Break (50 min)	
1730-1900	AGM and Awards	
1900-2100	Great Canadian Herp Quiz	

Sunday, September 19, 2021

1100 EDT	Opening Remarks	
1115-1215	Travelogue Ryan Wolfe, University of Toronto	The no-travel Travelogue ... What the herp?
1215-1230	Break (15 min)	
1230-1340	Session 5: Salamanders	Chair: Damien Mullin
1340-1400	Break (20 min)	
1400-1445	Session 6: Turtles	Chair: Briar Hunter/David Lesbarrères
1445-1500	Break (15 min)	
1500-1605	Session 7: Amphibians and Landscapes	Chair: David Lesbarrères
1605-1630	Break (25 min)	
1630-1710	Session 8: Applied Amphibian Conservation	Chair: Patrick Moldowan/David Lesbarrères
1710-1715	Closing Remarks	

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Session 1: Saturday, Sept 18

Snakes and Lizards	
1230-1245	<p><u>MITIGATING AN ECOLOGICAL TRAP ON AN ENDANGERED SNAKE SPECIES MASSASAUGA (<i>Sistrurus catenatus</i>) DURING A BOG RESTORATION PROJECT</u> <u>Anne R. Yagi*</u>, <u>Katharine T. Yagi</u>, and <u>Glenn J. Tattersall</u></p> <p>CANCELLED</p>
1245-1300	<p><u>POSSIBLE HIBERNACULAR LIMITATION OF SNAKE SPECIES ON THE EASTERN ONTARIO CHAMPLAIN SEA PLAIN</u> <u>Frederick W. Schueler</u></p>
1300-1305	<p><u>LET IT SNOW: MICROCLIMATE SELECTION IN OVERWINTERING GREATER SHORT-HORNED LIZARD (<i>Phrynosoma hernandesi</i>)</u> <u>Nicholas A. Cairns</u></p>
1305-1320	<p><u>IDENTIFYING POTENTIAL CONNECTIVITY FOR AN URBAN POPULATION OF RATTLESNAKES (<i>Sistrurus catenatus</i>) IN A CANADIAN PARK SYSTEM</u> <u>Jonathan D. Choquette*</u>, <u>Matthew R. Macpherson</u>, and <u>Robert C. Corry</u></p>
1320-1335	<p><u>MATERNAL EFFECTS, NEONATAL MASSASAUGA SURVIVAL AND HEADSTARTING: SOME FOOD FOR THOUGHT!</u> <u>Anne R. Yagi</u>, <u>Katharine T. Yagi</u>, and <u>Glenn J. Tattersall</u></p> <p>CANCELLED</p>

Canadian Herpetological Society 2021

Session 2: Saturday, Sept 18

Frogs	
1400-1415 student	<u>TRACKING CLIMATE CHANGE IN THE SPATIAL DISTRIBUTION PATTERN AND THE PHYLOGEOGRAPHIC STRUCTURE OF HYRCANIAN WOOD FROG, <i>Rana pseudodalmatina</i> (Anura: Ranidae)</u> <u>N. Amiri*, S. Vaissi, F. Aghamir, R. Saberi-Pirooz, D. Rödder, E. Ebrahimi, and F. Ahmadzadeh</u>
1415-1420 student	<u>ASSEMBLY OF A NORTH AMERICAN WOOD FROG (<i>Rana sylvatica</i>) SKIN TRANSCRIPTOME AND PREDICTION OF NOVEL ANTIMICROBIAL PEPTIDES</u> <u>Alexander J. Douglas* and Barbara A. Katzenback</u>
1420-1435 student	<u>BIOLOGICAL INVASION MEETS FROG FARMING: HEAD AND LIMB MORPHOLOGY OF AMERICAN BULLFROGS (<i>Rana [Lithobates] catesbeiana</i>) IN NORTH AMERICA, SOUTH AMERICA, AND ASIA</u> <u>Hollis A. Dahn*, Ming-Feng Chuang, Amaël Borzee, Jacob C. Lafond, Anna C. Savage, Jenny Urbina, Gabriel J. Cohen, Jing Che, Robert W. Murphy, and Njal Rollinson</u>
1435-1440 student	<u>EVALUATION OF ENVIRONMENTAL DNA (EDNA) FOR MONITORING A CRYPTIC AND THREATENED AMPHIBIAN - THE WESTERN CHORUS FROG (<i>Pseudacris triseriata</i>) GREAT LAKES ST. LAWRENCE - CANADIAN SHIELD POPULATION.</u> <u>John Urquhart, Chris C. Wilson, Thomas J. Hossie, Christopher J. Dennison*, Siobhan Galway, and Dennis L. Murray</u>

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Session 3: Saturday, Sept 18

Turtles	
1500-1515	<u>CHOOSING A MATE WHEN EVERYONE'S WATCHING: PUBLIC INFORMATION AND MALE MATE CHOICE IN THE NORTHERN MAP TURTLE</u> <u>Grégory Bulté*</u> , <u>Brooke Huneault</u> , and <u>Gabriel Blouin-Demers</u>
1515-1520 <i>student</i>	<u>EVALUATING NEW MITIGATION STRATEGIES TO DETER FEMALE TURTLES FROM NESTING IN UNSAFE ROAD-SIDE HABITATS</u> <u>Jenna Kentel*</u> , <u>Tianna Burke</u> , and <u>Jacqueline D. Litzgus</u>
1520-1525 <i>student</i>	<u>IMPACTS OF A WINDFARM AND SUBSEQUENT WILDFIRE ON THE SPATIAL ECOLOGY AND HABITAT SELECTION OF AN ENDANGERED FRESHWATER TURTLE</u> <u>Stephanie J. Delay*</u> , <u>John Urquhart</u> , and <u>Jacqueline D. Litzgus</u>
1525-1530 <i>student</i>	<u>MULTI-SCALE ASSESSMENT OF ROCK BARRENS TURTLE NESTING HABITAT: EFFECTS OF MOISTURE AND TEMPERATURE ON HATCH SUCCESS</u> <u>Hope C. Freeman*</u> , <u>Chantel E. Markle</u> , <u>Nicole Sandler</u> , and <u>James M. Waddington</u>

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Session 4: Saturday, Sept 18

Herpetological Communities	
1545-1600 <i>student</i>	<u>WEAVING INDIGENOUS KNOWLEDGE AND WESTERN SCIENCE TO INVESTIGATE THE IMPACTS OF RAILWAYS ON WILDLIFE</u> <u>Kyle D. Vincent*</u> , <u>Jacqueline D. Litzgus</u> , <u>Cory L. Kozmik</u> , <u>Steven J. Kell</u> , and <u>Jesse N. Popp</u>
1600-1605 <i>student</i>	<u>ARE PROTECTED AREAS AN EFFECTIVE MEASURE FOR THE CONSERVATION OF ONTARIO'S HERPETOFAUNA?</u> <u>Claudia Lacroix*</u> , <u>Katie Ziebarth</u> , <u>Njal Rollinson</u> , and <u>Marie-Josée Fortin</u>
1605-1620	<u>FRANCIS COOK'S HERPETOLOGICAL PAPERS: IS THERE A PLAN?</u> <u>Frederick W. Schueler*</u> and <u>Aleta Karstad</u>
1620-1625 <i>student</i>	<u>UNDERSTANDING THE IMPACTS OF WILDFIRE AND WINDFARM CONSTRUCTION ON THE HERPETOLOGICAL COMMUNITY OF EASTERN GEORGIAN BAY</u> <u>Aidan J. Maloney*</u> , <u>John Urquhart</u> , and <u>Jacqueline D. Litzgus</u>
1625-1640 <i>student</i>	<u>THE ELEMENTAL CONTENT OF REPTILES AND AMPHIBIANS: NUTRIENT RECYCLING CONSEQUENCES</u> <u>Emily M. May*</u> , and <u>Rana W. El-Sabaawi</u>

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Session 5: Sunday, Sept 19

Salamanders	
1230-1245 student	<u>CLIMATE-ASSOCIATED DECLINE OF BODY CONDITION IN A FOSSORIAL SALAMANDER</u> <u>Patrick D. Moldowan*</u> , <u>Glenn J. Tattersall</u> , and <u>Njal Rollinson</u>
1245-1300 student	<u>HABITAT PARTITIONING BASED ON LOCAL CLIMATIC VARIATION DOES NOT EXPLAIN WITHIN-POPULATION VARIATION IN MORPH FREQUENCIES OF A WELL-KNOWN POLYMORPHIC SALAMANDER, PLETHODON CINEREUS</u> <u>Teagan Netten*</u> and <u>Njal Rollinson</u>
1300-1305 student	<u>LARVAL GROWTH RATE AND PHENOLOGY OF EMERGENCE FROM NATURAL VS. CONSTRUCTED PONDS IN AN ENDANGERED SALAMANDER COMPLEX ON PELEE ISLAND, ON.</u> <u>Jordan C. McDonald*</u> , <u>Dennis L. Murray</u> , and <u>Thomas J. Hossie</u>
1305-1320 student	<u>IDENTIFYING MULTIPLE CLONAL LINEAGES IN ISOLATED UNISEXUAL <i>Ambystoma</i> COMMUNITIES</u> <u>Evan A. Bare*</u> , <u>Jim P. Bogart</u> , <u>Chris Wilson</u> , <u>Thomas J. Hossie</u> , and <u>Dennis L. Murray</u>
1320-1335 student	<u>ASSESSING THE EFFECTS OF PREVALENCE ON SPECIES DISTRIBUTION MODELS FOR LONG-TOED SALAMANDERS IN SOUTHWESTERN ALBERTA.</u> <u>Jayna C. Bergman*</u> and <u>Julie A. Lee-Yaw</u>
1335-1340 student	<u>IDENTIFYING SUITABLE AREAS FOR HABITAT CREATION FOR <i>Ambystoma</i> SALAMANDERS ON PELEE ISLAND</u> <u>Graeme N. Smith*</u> , <u>Evan A. Bare</u> , <u>Thomas J. Hossie</u> , and <u>Dennis L. Murray</u>

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Session 6: Sunday, Sept 19

Turtles	
1400-1415	<u>CONSERVATION GENETICS OF BLANDING'S TURTLE (<i>Emydoidea blandingii</i>) AT THE NORTHERN EDGE OF ITS DISTRIBUTION RANGE</u> <u>Yann Surget-Groba*</u> , <u>Caroline Gagné</u> , <u>Alexander Stone</u> , <u>Sylvain Giguère</u> , and <u>Yohann Dubois</u>
1415-1420 <i>student</i>	<u>USING SCIENCE TO INFORM SPECIES AT RISK MANAGEMENT: PREDICTING THE EFFECT OF FOREST HARVEST ON WOOD TURTLE HABITAT SUITABILITY</u> <u>Damien Mullin*</u> , <u>Graham Forbes</u> , <u>Deanna McCullum</u> , <u>Shane Hertz</u> , and <u>Chris Edge</u>
1420-1435 <i>student</i>	<u>A MODEL OF SEASONAL VARIATION IN SOMATIC GROWTH RATES APPLIED TO PAINTED TURTLES (<i>Chrysemys picta</i>) AND SNAPPING TURTLES (<i>Chelydra serpentina</i>)</u> <u>Matthew G. Keevil*</u> , <u>Doug P. Armstrong</u> , <u>Ronald J. Brooks</u> , and <u>Jacqueline D. Litzgus</u>
1435-1440 <i>étudiante</i>	<u>GÉNÉTIQUE DES POPULATIONS DE TORTUES MOUCHETÉES (<i>Emydoidea blandingii</i>)</u> <u>Daphnée J. Bernier*</u> et <u>Yann Surget-Groba</u>
1440-1445 <i>étudiante</i>	<u>ESTIMATION DE L'ABONDANCE DE LA POPULATION DE TORTUE MOUCHETÉE À PARTIR DE L'ADN ENVIRONNEMENTAL</u> <u>Laura Désilets*</u> , <u>Yann Surget-Groba</u> et <u>Yohann Dubois</u>

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Session 7: Sunday, Sept 19

Amphibians and Landscapes	
1500-1515 <i>étudiante</i>	<u>UTILISATION DES BASSINS DE RÉTENTION D'EAUX PLUVIALES PAR LES AMPHIBIENS</u> <u>Laura Milliard*</u> , <u>Louis Imbeau</u> et <u>Marc J. Mazerolle</u>
1515-1530 <i>student</i>	<u>EVOLUTIONARY RESPONSES OF AMPHIBIAN POPULATIONS INHABITING MINING-IMPACTED ENVIRONMENTS</u> <u>David Ryan Coady*</u> , <u>David Lesbarreres</u> , and <u>Darryl Edwards</u>
1530-1535	<u>THE EFFECTS OF CLIMATE AND LAND USE ON PRAIRIE AMPHIBIAN BIODIVERSITY</u> <u>James E Paterson*</u> , <u>Lauren E Bortolotti</u> , and <u>James H Devries</u>
1535-1550 <i>student</i>	<u>OCCUPANCY AND ABUNDANCE OF POND-BREEDING ANURANS IN BOREAL LANDSCAPES</u> <u>Mariano J. Feldman*</u> , <u>Louis Imbeau</u> , <u>Marc J. Mazerolle</u> and <u>Nicole J. Fenton</u>
1550-1605	<u>FOWLER'S TOADS (<i>Anaxyrus fowleri</i>) USE THE SUBSURFACE THERMAL GRADIENT FOR THERMOREGULATION UNDERGROUND.</u> <u>Émilie Forget-Klein</u> and <u>David M. Green*</u>

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Session 8: Sunday, Sept 19

Applied Amphibian Conservation	
1630-1645	<u>HOW WELL DO UNDERPASSES AND FENCING REDUCE ROAD MORTALITY AND CONNECT HABITATS OF NORTHERN RED-LEGGED FROGS (<i>Rana aurora</i>) AND OTHER AMPHIBIANS ON HIGHWAY 4 ON VANCOUVER ISLAND, BC?</u> <u>Barbara A. Beasley</u>
1645-1650 <i>student</i>	<u>INVESTIGATING GENETIC HEALTH IN CAPTIVE AND WILD OREGON SPOTTED FROGS (<i>Rana pretiosa</i>) IN CANADA.</u> <u>Briar T. Hunter*</u> , <u>David Lesbarrères</u> , and <u>Gabriela F. Mastromonaco</u>
1650-1705 <i>étudiante</i>	<u>MEILLEUR DÉVELOPPEMENT LARVAIRE À FAIBLE DENSITÉ CHEZ LA RAINETTE FAUX-GRILLON</u> <u>Aurore Fayard*</u> , <u>Jeffrey Ethier</u> , <u>Odile Colin</u> , <u>Emiko Wong</u> , <u>Linda Paetow</u> , <u>Sophie Tessier</u> , <u>Lyne Bouthillier</u> , <u>Vance L. Trudeau</u> et <u>Marc J. Mazerolle</u>
1705-1710 <i>student</i>	<u>USING A COLLABORATIVE APPROACH FOR THE CAPTIVE BREEDING AND REINTRODUCTION OF BOREAL CHORUS FROGS</u> <u>Jeffrey P. Ethier*</u> , <u>Aurore Fayard</u> , <u>Odile Colin</u> , <u>Emiko Wong</u> , <u>Linda Paetow</u> , <u>Sophie Tessier</u> , <u>Lyne Bouthillier</u> , <u>Marc J. Mazerolle</u> , and <u>Vance L. Trudeau</u>

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ABSTRACTS

AMIRI

TRACKING CLIMATE CHANGE IN THE SPATIAL DISTRIBUTION PATTERN AND THE PHYLOGEOGRAPHIC STRUCTURE OF HYRCANIAN WOOD FROG, *Rana pseudodalmatina* (Anura: Ranidae)

N. Amiri^{1*}, S. Vaissi², F. Aghamir³, R. Saberi-Pirooz¹, D. Rödder⁴, E. Ebrahimi¹, and F. Ahmadzadeh¹

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Climate change has major effects on population patterns, connectivity, and divergence. We used mtDNA sequences and species distribution modeling to assess the impact of climatic changes in the past (Last Glacial Maximum, and Mid-Holocene, recent (1970–2000), and future (2070) on the phylogeography and spatial distribution of populations of the Hyrcanian wood frog, *Rana pseudodalmatina*, in northern Iran. Based on two mitochondrial genes (*cytochrome b* and *16S* ribosomal RNA), we found evidence for two regional patterns that diverged in the Pleistocene (1.6 Mya) and are distributed in the eastern and western sections of the current species range. Biogeographic analyses support the hypothesis that both vicariance (an increase in the Caspian Sea water levels) and dispersal events have been involved in shaping the species' genetic structure. Reconstruction of the ancestral distribution of *R. pseudodalmatina* suggests the species' range contracted in two independent eastern and western glacial refugia during the LGM, expanding from the Mid-Holocene to the present to occupy Hyrcanian forests continuously. According to future climate projections, the species' range shows a tendency to shift to higher altitudes. Landscape connectivity analyses support higher population continuity in the central part of the current range, with isolated populations in the easternmost and westernmost extremes. Our integrative study of *R. pseudodalmatina* provides support for the “refugia-within-refugia” scenario in the Hyrcanian forests.

[Session 2](#)

IDENTIFYING MULTIPLE CLONAL LINEAGES IN ISOLATED UNISEXUAL *Ambystoma* COMMUNITIES

Evan A. Bare^{1*}, Jim P. Bogart³, Chris Wilson^{1,4}, Thomas J. Hossie^{1,2} and Dennis L. Murray^{1,2}

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Populations of clonal species are typically considered to be genetically non-diverse. This lack of diversity leads to weak adaptive capacity and high levels of intraspecific competition. In contrast, multiple distinct lineages occasionally do co-occur, broadening the capacity for niche specialization and rapid adaptation to new or changing environments in these populations. In heterogeneous landscapes with multiple congeneric species to compete with, having multiple clonal lineages may also lead to diversification of niche space and increased capacity for species packing. Likewise, variable local environments will impose different selective pressures that could result in populations that differ in clonal lineage composition. Unisexual *Ambystoma* comprise a monophyletic all-female lineage of salamanders with hybrid nuclear genetics with variable ploidy levels. This group has a unique and complex reproductive system that requires sperm from a host species to initiate egg development. While primarily clonal, they also occasionally incorporate allochthonous chromosomes from host sperm through ploidy elevation or genome replacement. On Pelee Island, unisexual *Ambystoma* are syntopic with two different compatible host species, *A. laterale* (LL) and *A. texanum* (TT), comprising an isolated *Ambystoma* complex. Between 2015 and 2018, tissue samples were collected from 1181 adults and 843 larvae across multiple sites which were genotyped using 7 microsatellite loci. At least 5 multilocus lineages were identified based on a 3 mutation-step Manhattan distance cut-off, which exhibit high correlation with Bruvo distance metrics. While each lineage is present across the island, population structures are highly variable and maintain regional similarities. Additionally, lineage diversity does not appear to correlate to local host species, suggesting that differences in host niche space are not the primary cause of such structure. This study is the first to use this novel genetic analysis strategy for the unisexual *Ambystoma* complex and could be more widely implemented in clonal systems in general.

[Session 5](#)

Canadian Herpetological Society 2021

BEASLEY

HOW WELL DO UNDERPASSES AND FENCING REDUCE ROAD MORTALITY AND CONNECT HABITATS OF NORTHERN RED-LEGGED FROGS (*Rana aurora*) AND OTHER AMPHIBIANS ON HIGHWAY 4 ON VANCOUVER ISLAND, BC?

Barbara A. Beasley

Association of Wetland Stewards for Clayoquot and Barkley Sounds, P.O. Box 927, Ucluelet, BC, V0R 3A0, beasley@island.net

Northern Red-legged Frogs (*Rana aurora*) and three other aquatic-breeding species of amphibians are frequently killed along Highway 4 on the west coast of Vancouver Island. At two stretches of highway with concentrated mortality, our non-profit organization promoted the installation of underpass structures and various types of fencing. These included dirt pathways created over rip-rap armour beneath a bridge, four new concrete box culverts (1.8 m x 0.5 m), improved access to three existing drainage culverts (0.6 m in diameter), and fencing made of concrete lock blocks, plastic sheeting, and pool-cover fabric to serve as barriers and guiding structures. Some sections of fencing were angled from the forest to the entranceways of underpasses and other sections were installed parallel to the road. Monitoring the effectiveness of some of these structures has been underway for several years, others were installed just within the last year. To-date we have found fewer individuals of all species on the highway along fenced than unfenced sections when fencing is properly installed and maintained. Using camera traps we observed Northern Red-legged Frogs and Northwestern Salamanders (*Ambystoma gracile*) regularly moving through both types of culverts. We found more Northern Red-legged Frogs per night moving under the bridge after we placed dirt over the rip-rap than before. We suspect but lack strong evidence that there is more movement along angled than parallel fences and question whether the latter may do more harm than good by restricting movements. We do not know how well the underpasses work for the Rough-skinned Newts (*Taricha granulosa*) and Pacific Treefrogs (*Pseudacris regilla*) abundant at both sites. We seek academic partners and more resources to help us better understand how well these structures function in sustaining populations and the ecological processes provided by dispersing and migrating amphibians.

[Session 8](#)

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BERGMAN

ASSESSING THE EFFECTS OF PREVALENCE ON SPECIES DISTRIBUTION MODELS FOR LONG-TOED SALAMANDERS IN SOUTHWESTERN ALBERTA.

Jayna C. Bergman* and Julie A. Lee-Yaw

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Amphibians are experiencing global declines, making it imperative to both inventory populations and to understand the factors that shape species' distributions. Species distribution models (SDMs) are a potentially useful tool in this regard, but model parameterization requires care as modeling decisions can impact results. This study tests the effects of assumptions about species prevalence when generating species' distribution models with the widely-used software, Maxent. We focus on the long-toed salamander (*Ambystoma macrodactylum*), a species of Special Concern in Alberta. Models were built using locality records from across the species' range and 21 bioclimatic variables. We varied the prevalence setting in Maxent from 0.4 to 0.7 and examined the impact on the predicted distribution of suitable habitat for long-toed salamanders at the edge of their range in south-western Alberta. In addition to internal validation, we used independent locality records from Waterton Lakes National Park (WLNP) to validate the models. Increasing prevalence resulted in both higher values of suitability and greater prediction of suitable habitat to the east of the species' current range. Independent AUC scores for WLNP ranged from 0.68 to 0.75, with a prevalence setting of 0.6 resulting in the best performing model. These results indicate that assumptions about prevalence can have dramatic impacts on modeled distributions and habitat suitability scores. For long-toed salamanders, setting prevalence to 0.6 results in models that do a reasonable job of predicting independent data, demonstrating the value of using independent datasets to help optimize model settings.

[Session 5](#)

GÉNÉTIQUE DES POPULATIONS DE TORTUES MOUCHETÉES (*Emydoidea blandingii*)

Daphnée J. Bernier* et Yann Surget-Groba

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La diversité génétique est un enjeu important dans les petites populations fragmentées, particulièrement dans le cas des espèces en péril, comme la tortue mouchetée. Le projet de recherche présenté aborde cet aspect de la conservation sous deux angles : évaluer l'état de la diversité génétique et la connectivité des populations de tortues mouchetées en Outaouais et en Ontario (ceinture de verdure d'Ottawa) et déterminer si cette évaluation peut être faite directement à partir d'échantillons d'ADN environnemental (ADNe). L'étude a pour but d'identifier les populations isolées génétiquement qui nécessiteraient une gestion en tant qu'unités indépendantes et de d'évaluer si l'utilisation de l'ADNe, méthode permettant d'économiser temps, personnel et ressources, est une méthode efficace pour arriver aux mêmes conclusions. Il est attendu qu'avec la topologie et la fragmentation de l'aire de répartition, la population de l'Outaouais soit composée de plusieurs sous-populations plus ou moins connectées, voire complètement isolées. En postulant que la rivière des Outaouais est un obstacle difficilement franchissable par cette espèce, il est aussi attendu que les populations de l'Outaouais et de l'Ontario soient isolées génétiquement. Finalement, avec le choix de marqueurs microsatellites disponibles pour l'ADN, il est attendu qu'une ou plusieurs combinaisons de ces marqueurs pourraient évaluer la diversité génétique des tortues mouchetées d'un milieu humide avec l'ADNe, tout en discriminant pour les autres espèces de tortues. La récolte de données de ce projet a débuté à l'été 2021, où la collecte d'ADNe et la capture-marquage-recapture avec prise de tissu biologique (bouts d'écailles) ont été faites en Outaouais. Les mêmes actions sont prévues pour l'été 2021 en Ontario.

[Session 6](#)

CHOOSING A MATE WHEN EVERYONE'S WATCHING: PUBLIC INFORMATION AND MALE MATE CHOICE IN THE NORTHERN MAP TURTLE

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Sperm competition is prevalent in animals and many adaptations have evolved to reduce its risk. Males can reduce the risk of sperm competition by integrating public information when interacting with potential mates. Specifically, males can reduce sperm competition by avoiding females already affiliated with rival males. We tested this hypothesis in a population of wild northern map turtles (*Graptemys geographica*), a gregarious species with seemingly prevalent sperm competition. We used 3D printed decoys and underwater videography to record the response of free ranging males to female decoys affiliated or not with rivals. More males visited female decoys when rivals were present, suggesting a form of eavesdropping during mate selection. Males were more likely to interact with the female decoy, however, when rivals were absent, suggesting that they behave to reduce sperm competition. Moreover, the types of interactions differed between the accompanied and the unaccompanied female decoys, indicating an audience effect during male-female interactions. Finally, males interacted more with the male decoys than with the female decoys in the treatment with rivals, indicating a yet unclear form of male-male interactions. Collectively, our results suggest that free ranging male northern map turtles use public information to both select mate and to reduce sperm competition.

[Session 3](#)

Canadian Herpetological Society 2021

CAIRNS

LET IT SNOW: MICROCLIMATE SELECTION IN OVERWINTERING GREATER SHORT-HORNED LIZARD (*Phrynosoma hernandesi*)

Nicholas A. Cairns

The availability of suitable overwintering sites is thought to be a major constraint on northern range limits in reptiles. Most temperate reptiles must overwinter below the frost line to survive brumation. Despite living in the one of the most extreme habitats of any lizard, ranging more than 80°C in a season, *Phrynosoma hernandesi* appear to overwinter in burrows as shallow as 7 cm below the surface. This is not deep enough to avoid freezing temperatures in the absence of insulation. In Canada, lizards appear to travel from summer ranges to specific overwintering sites, including “communal” (n>1) burrows. Anecdotally, these sites also tend to retain snow. By overwintering in areas with predictable, consistent snow cover, these lizards may be selecting a relatively stable microclimate for brumation in an area that fluctuates widely. However, this hypothesis remains untested and we know very little about the overwintering microclimate these lizards require. As an ephemeral habitat feature, the patterns of snow cover are expected to change with future climatic shifts and this may lead to more overwinter mortality. Over time, this can lead to local extirpation and range contraction. I propose a simple, non-invasive monitoring program to ascertain the conditions utilized by overwintering *P. hernandesi* at its northern range limits. These data can speak to local physiological adaptation, the importance of snow for this species and the risk climate change may pose for its persistence in Canada.

[Session 1](#)

IDENTIFYING POTENTIAL CONNECTIVITY FOR AN URBAN POPULATION OF RATTLESNAKES (*Sistrurus catenatus*) IN A CANADIAN PARK SYSTEM

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In the face of ongoing habitat loss and fragmentation, maintaining an adequate level of landscape connectivity is needed to both encourage dispersal between habitat patches and to reduce the extinction risk of fragmented wildlife populations. In a developing region of southwestern Ontario, Canada, a declining population of Eastern Massasauga rattlesnakes (*Sistrurus catenatus*) persists in fragmented remnants of tallgrass prairie in an urban park system. The goal of this study was to identify potential connectivity pathways between habitat patches for this species by using a GIS least-cost permeability swath model, and to evaluate the outputs with snake road mortality data. Results identified seven pathways between five core habitat blocks, a subset of which were validated with aerial imagery and mortality data. Four high ranking pathways intersected roads through or near road mortality hotspots. This research will guide conservation interventions aimed at recovering endangered reptiles in a globally rare ecosystem, and will inform the use of permeability swaths for the identification of locations most suitable for connectivity interventions in dynamic, urbanizing landscapes.

[Session 1](#)

Canadian Herpetological Society 2021

COADY

EVOLUTIONARY RESPONSES OF AMPHIBIAN POPULATIONS INHABITING MINING-IMPACTED ENVIRONMENTS

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Environments impacted by mining and mining-related activities can often be characterized by high levels of toxic trace metals. These pollutants present unique challenges for wildlife, often resulting in profound evolutionary changes. Despite this, investigations of evolutionary mechanisms such as local adaptation and maladaptation in response to these anthropogenic selection pressures are rare. We conducted a reciprocal transplant experiment with *Rana pipiens* tadpoles from 3 populations to test if adaptive or maladaptive evolution occurs in amphibians inhabiting mining-impacted environments. We added a temperature treatment to assess the potential role of global warming on the evolutionary outcome of these impacted tadpole groups. Our results showed evidence of growth and mortality rate variation largely consistent with life-history trade-offs associated with local adaptation to environments impacted by multiple chemical stressors. Specifically, the population from the environment with the highest amount of trace metals showed a reduced risk of mortality, but lower larval growth rate in its original environment relative to tadpoles from naïve populations. We also observed that as temperature increased, tadpoles from the most impacted environment had a lower mortality rate than tadpoles from the less impacted environments, when raised in the less impacted environments. Our study demonstrates the potential for amphibian populations to adapt to mining-impacted environments but confirms the effect of global warming in influencing mortality rate.

[Session 7](#)

Canadian Herpetological Society 2021

DAHN

BIOLOGICAL INVASION MEETS FROG FARMING: HEAD AND LIMB MORPHOLOGY OF AMERICAN BULLFROGS (*Rana [Lithobates] catesbeiana*) IN NORTH AMERICA, SOUTH AMERICA, AND ASIA

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The American bullfrog (*Rana [Lithobates] catesbeiana*) is a prolifically invasive species native to eastern North America, with established feral populations in western North America, South America, Europe, and Asia. These introduced populations threaten native species through competition, disease transmission, and direct predation. Many of these introductions were fueled by the widespread cultivation of frogs for meat. Thus, this species represents both a conservation concern and an economic resource for numerous countries. Bullfrog farms contribute escapees to feral populations, but are those escapees predisposed to being better or worse invaders? Increased dispersal ability and changes in response to dietary differences are frequently observed in invasion scenarios. However, conditions and breeding practices inside bullfrog farming facilities could be complementary or antagonistic to this effect. Here we collected linear morphometric data from 1205 American bullfrogs in Canada, the U.S.A., Brazil, China, and South Korea. These represent native, introduced, and captive populations. We use linear model selection and model averaging to investigate the effect of native, introduced, or captive origin on head and limb allometry. This information could be used to inform management decisions on invasive bullfrog control and the frog farming industry.

[Session 2](#)

IMPACTS OF A WINDFARM AND SUBSEQUENT WILDFIRE ON THE SPATIAL ECOLOGY AND HABITAT SELECTION OF AN ENDANGERED FRESHWATER TURTLE

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Wind energy is a rapidly increasing source of renewable energy and is projected to continue to increase as governments look for solutions to reduce carbon emissions. Although wind energy presents many advantages, windfarms can pose risks to wildlife including direct mortality, habitat alteration, and an increased risk of wildfire occurrence due to human, machinery, and turbine presence. Our study will quantify the impacts of a windfarm and a subsequent wildfire on the spatial ecology of an endangered freshwater turtle using a *post-hoc* design with three treatments: control, windfarm, and windfarm affected by wildfire (windburn). We will outfit 10 turtles in each treatment (n = 30 turtles total) with VHF radio transmitters and track them twice per week during the active season (May to September). At each radiolocation, we will record turtle location, habitat type, and environmental parameters at both the turtle location and a random paired location. We will then (1) quantify and compare home range size (HR) and daily distance moved (DDM) among treatments, and (2) determine and compare habitat selection at multiple scales. If landscape fragmentation by the windfarm infrastructure is affecting turtles, then we expect to see smaller HR in the wind and windburn sites compared to the control site. If the windfarm and the wildfire have affected critical habitats, then we expect to see altered habitat selection at all scales in the wind and windburn sites compared to the control site. Our study is important because wind energy initiatives are increasing at an unprecedented rate, but we don't yet know how turtles, one of the most at-risk taxa on the planet, are affected. Our study will generate results that can be used to create data-driven mitigation strategies at our study site and at other windfarm sites with at-risk turtles.

[Session 3](#)

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DENNISON

EVALUATION OF ENVIRONMENTAL DNA (EDNA) FOR MONITORING A CRYPTIC AND THREATENED AMPHIBIAN - THE WESTERN CHORUS FROG (*Pseudacris triseriata*) GREAT LAKES ST. LAWRENCE - CANADIAN SHIELD POPULATION.

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Effective monitoring and assessment of at-risk amphibians requires techniques that have high accuracy, precision, and efficiency. These criteria are particularly relevant when developing conservation and management strategies for cryptic species with imperfect detection, especially when compounded by seasonal variation in activity. The Western Chorus Frog (*Pseudacris triseriata*) Great Lakes/St. Lawrence – Canadian Shield population is listed as Threatened under Schedule 1 of the federal Species at Risk Act (SARA), highlighting the need for its robust assessment, and collection of data that can fully assess population distribution and trend. Traditional survey methods (e.g. calling activity point counts) can produce biased assessment owing to inconsistent vocalization patterns especially in relation to environmental conditions and time-of-year. However, DNA from environmental samples (eDNA) is an emerging tool that is well-suited for detecting and monitoring species that otherwise are difficult to study using traditional methods. Our team is investigating the reliability of eDNA for tracking Western Chorus Frog, either as a sole tool or as a complement to traditional surveys. During spring 2021, we collected eDNA from 16 sites where Western Chorus Frogs were confirmed present, and 2 sites where confirmed absent, and used a stratified sampling design to assess spatial and temporal variation in eDNA counts. Our final results are pending further laboratory work, with the expectation that eDNA could provide an important tool for monitoring spatio-temporal variation in Western Chorus Frog populations in Ontario and beyond.

[Session 2](#)

ESTIMATION DE L'ABONDANCE DE LA POPULATION DE TORTUE MOUCHETÉE À PARTIR DE L'ADN ENVIRONNEMENTAL

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La protection et l'établissement d'un plan de conservation d'une espèce en péril commence par savoir précisément l'abondance et la répartition de cette espèce. Les méthodes de suivi traditionnelles pour estimer la taille des populations (observation direct, piégeage, marquage), demandent un grand effort d'échantillonnage. Pour améliorer la détection et le suivi des populations menacées, il est nécessaire de développer une méthode plus rapide et plus sensible. De plus en plus, la méthode de l'ADN environnemental (ADNe) qui détecte l'ADN laissé par les espèces dans l'environnement est souvent utilisé. L'ADNe est une alternative efficace souvent citée dans des recherches pour son faible coût et sa rapidité à détecter une espèce. Cependant, l'ADNe est surtout utilisé pour détecter la présence d'espèce aquatique et non pour estimer son abondance, mais elle serait un atout considérable pour mettre en place rapidement un plan de rétablissement sur une espèce menacée. L'objectif de mon projet de maîtrise est donc d'évaluer s'il est possible d'estimer l'abondance de la population de tortue mouchetée, une espèce menacée au Québec, uniquement à partir de la méthode ADNe. Nous avons donc étudié 8 sites habités par la tortue mouchetée. Sur chacun des sites, nous avons collecté 30 échantillons d'ADNe et installé 30 verveux durant 9 nuits consécutives. Par la suite, nous allons calculer un indice d'abondance de l'espèce via l'ADN détecté sur chacun des sites et nous allons comparer cet indice à l'abondance réelle estimée à partir des données de capture. Si nous observons une bonne corrélation entre l'abondance estimée par l'ADNe et celle estimée par la méthode traditionnelle, nous pourrions confirmer que la méthode ADNe est capable d'estimer rapidement l'abondance de la tortue mouchetée.

[Session 6](#)

ASSEMBLY OF A NORTH AMERICAN WOOD FROG (*Rana sylvatica*) SKIN TRANSCRIPTOME AND PREDICTION OF NOVEL ANTIMICROBIAL PEPTIDES

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Antimicrobial peptides (AMPs) are a group of short, amphipathic peptides that inhibit the growth of a wide range of microbes and play an important role in the immune system. AMPs are a particularly important element of the innate immune defenses of amphibian skin, and correspondingly many diverse antimicrobial peptides have been isolated from amphibian skin secretions. The North American wood frog (*Rana sylvatica*) has only been observed to produce two AMPs (Brevinin-1SY in adults and Temporin-1SY in metamorphs), fewer than is typical for its genus. To provide a resource for the discovery of new AMPs we have assembled a transcriptome of *R. sylvatica* skin *de novo* from an existing sequencing read archive. The assembled transcripts were queried for homology to known AMPs from the Antimicrobial Peptide Database. In addition to transcripts encoding the previously described AMPs, several transcripts were found which appear to encode novel antimicrobial peptides, suggesting that the AMP repertoire of *R. sylvatica* is considerably more complex than was previously thought. Research is ongoing to confirm the expression of the assembled transcripts in *R. sylvatica* skin tissue and determine whether mature AMPs matching the predicted sequences are present in skin secretions. Examining the role of AMPs in the *R. sylvatica* will support conservation efforts by providing a better understanding of host-pathogen interactions in a species which is vulnerable to emerging pathogens that currently threaten amphibian populations. This research was funded by an NSERC Discovery Grant.

[Session 2](#)

Canadian Herpetological Society 2021

ETHIER

USING A COLLABORATIVE APPROACH FOR THE CAPTIVE BREEDING AND REINTRODUCTION OF BOREAL CHORUS FROGS

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Biodiversity of amphibians is declining in North America, with over 40% of amphibian species in Canada listed as Endangered, Threatened, or of Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Captive breeding and reintroduction programs combine several techniques to safeguard populations, mitigate declines, increase abundance, and acquire knowledge. The goal of our research program is to investigate new, innovated ways to improve the captive breeding and reintroduction of boreal chorus frogs (*Pseudacris maculata*) in the Montérégie region of Québec. The boreal chorus frog has been listed under the Quebec Threatened or Vulnerable Species Act (TVA) since 2001 and the federal Species at Risk Act (SARA) since 2010. However, the few remaining natural populations occur in fragmented habitat with a high risk of further destruction. Our project is highly collaborative, utilizing the expertise of several institutions including the University of Ottawa, Université Laval, Montréal Biodôme, Ministère des Forêts, de la Faune et des Parcs, and Sépaq. At the University of Ottawa, the Trudeau Lab is combining concepts from ecology, acoustic behaviour, and endocrinology to increase our knowledge of the role of acoustic communication in reproduction by determining if acoustic signals can be used to predict and enhance reproductive success in a captive setting. At Université Laval, the Mazerolle Lab is investigating reintroduction methods, such as the impact of tadpole density and the presence of forest litter on larval development. Captive breeding is being conducted at the Montréal Biodôme using assisted reproductive technologies, where offspring are reintroduced to artificial ponds in Parc National du Mont-Saint-Bruno. The results will benefit not only local populations, but can be extrapolated to captive breeding programs for the conservation of many other amphibian species in North America and further abroad.

[Session 8](#)

MEILLEUR DÉVELOPPEMENT LARVAIRE À FAIBLE DENSITÉ CHEZ LA RAINETTE FAUX-GRILLON

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La Rainette faux-grillon (*Pseudacris triseriata*) est inscrite dans la loi sur les espèces menacées ou vulnérables (LEMV, 2001) au Québec, et dans la loi fédérale des espèces en péril (LEP, 2010). Le futur des quelques populations naturelles restantes des Grands Lacs, du Saint-Laurent et du Bouclier canadien est incertain. L'établissement de nouvelles populations dans des milieux humides restaurés pourrait être un moyen de conserver cet anou. L'objectif de ce projet est de maximiser le succès de réintroduction de cette espèce dans plusieurs étangs aménagés au parc national du Mont-Saint-Bruno. Nous avons réalisé une expérience en mésocosmes sur des têtards élevés *ex-situ*, afin de tester simultanément l'effet de la litière forestière (avec vs sans litière) et de la densité larvaire (0,1 vs 1 têtards/L). Nous avons émis l'hypothèse que l'ajout de litière et la faible densité de têtards améliorent la survie et le développement larvaire. Le taux d'émergence, la taille (mm) et la masse (mg) à la métamorphose (stade Gosner 46) ont été mesurés. L'émergence des têtards a débuté 32 jours après introduction dans les mésocosmes, lorsque les larves avaient entre 33 et 44 jours. L'analyse n'a révélé aucune différence des taux de survie larvaire entre les différents traitements. Cependant, l'ajout de litière à faible densité augmenterait la masse ($t(6)=-5.16$, $p=0.0021$), ainsi que la taille des métamorphes ($t(6)=-2.93$, $p=0.0264$), ce qui valide notre hypothèse de départ. Les métamorphes provenant des traitements à faible densité étaient de plus grande taille ($t(6)=-9.96$, $p<0.0001$) et avaient une masse plus importante ($t(6)=-8.63$, $p=0.0001$) que ceux des traitements à haute densité, peu importe la présence de litière. Ces résultats montrent que le développement larvaire en mésocosmes à densité de 0,1 têtards/L avec litière forestière est une stratégie efficace pour l'élevage des individus en vue de la réintroduction.

[Session 8](#)

OCCUPANCY AND ABUNDANCE OF POND-BREEDING ANURANS IN BOREAL LANDSCAPES

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Wetland ecosystems in Northern Quebec are increasingly degraded due to their vulnerability to climate change and anthropic disturbances, including timber harvesting, hydroelectric development, and mining activities. These impacts may affect amphibian species that are particularly dependent on certain wetland types, such as peatland ponds and beaver ponds as these ponds are potentially an important source of juvenile recruits. However, the abundance and occupancy of species and the relative importance of ponds with different characteristics is unknown. Our objective was to assess the influence of pond and landscape level characteristics on amphibian use of ponds. We sampled 50 ponds in three mining sectors of Northern Quebec in 2018 and 2019. Using acoustic recorders and visual counts of adults and egg masses, we estimated the occupancy of calling males and the abundance of adults and egg masses of three amphibian species: wood frog (*Lithobates sylvaticus*), mink frog (*Lithobates septentrionalis*), and spring peeper (*Pseudacris crucifer*). We quantified the influence of pond variables such as habitat type, pond surface, fish presence, acidity, and landscape variables on occupancy and abundance. Our analyses revealed no effect of explanatory variables on the probability of occupancy of calling males of the three species. The abundance of mink frog adults decreased with increasing pond area and increased with pH. Wood frog reproductive effort, quantified as egg mass abundance, was exceptionally greater (more than four times higher) in beaver ponds than in peatland ponds. In a northern context, where few amphibian species are present, these results provide a reference to guide management decisions in these increasingly disturbed wetlands, which are important habitats for amphibian communities.

[Session 7](#)

MULTI-SCALE ASSESSMENT OF ROCK BARRENS TURTLE NESTING HABITAT: EFFECTS OF MOISTURE AND TEMPERATURE ON HATCH SUCCESS

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Understanding thermal and moisture regimes in nesting habitat is an important step in management and restoration of at-risk turtle habitat because anthropogenic stressors that affect these key properties impact hatch success. In rock barrens landscapes, freshwater turtles are known to nest in unique shallow-soil deposits in depressions in the bedrock. Our objective was to provide the first comprehensive multi-scale assessment of turtle nesting habitat in a rock barrens landscape. At the nest-site scale, we characterized nesting habitat, tested for evidence of nest-site selection by the Blanding's Turtle (*Emydoidea blandingii*), Spotted Turtle (*Clemmys guttata*), and Midland Painted Turtle (*Chrysemys picta marginata*), and examined the effects of nest temperature and moisture on egg hatching success. At the landscape-scale, we conducted a systematic survey across 660 ha to assess the availability of nesting habitat. Although rock barrens were the second most dominant land cover type, the availability of suitable nesting habitat with deeper soil and an open canopy was limited to 11% of the rocky outcrops and, 3% of the study area. We found that shallow rock barrens nesting habitat had unique soil temperature and moisture dynamics that were linked to soil properties and bedrock morphology to provide successful incubation conditions. In particular, mean daily temperature, variance of soil saturation during incubation, and their interaction had a significant effect on egg hatching success, regardless of egg mass. There was also evidence that turtles selected sites that were warmer and drained faster than paired haphazard sites despite having other similar characteristics. Given that the loss and degradation of nesting habitat is of conservation concern for the survival and recovery of at-risk turtle species, we recommend that key management strategies should include stronger protection of critical rock barrens nesting habitat and the development of landscape-appropriate strategies for restoration and creation of nesting habitat.

[Session 3](#)

FOWLER'S TOADS (*Anaxyrus fowleri*) USE THE SUBSURFACE THERMAL GRADIENT FOR THERMOREGULATION UNDERGROUND.

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As ectotherms with moist, permeable skins, amphibians continually seek a physiological balance between maintaining hydration and optimizing body temperature. Laboratory studies have suggested that dehydrated and starved amphibians should select cooler temperatures to slow the rate of water loss and reduce metabolism. However, much less is known about amphibian thermoregulatory behaviour in the wild, where environmental conditions and constraints may be more variable. In seasonally cold environments, where animals must maximize growth, gamete production and/or fat storage for winter dormancy over a short active season, maintaining a high metabolic rate may be primary. We investigated the thermoregulatory behaviour of the Fowler's Toads, *Anaxyrus fowleri*, in the wild at their northern range limit at Long Point, Ontario. We outfitted adult toads with small temperature loggers and radio-tracked them for periods of 24 hours. Simultaneously, we also recorded air and subsurface temperatures to a depth of 18.6 cm. When active at night, toads rapidly equilibrated with ambient air temperatures. However, during the day, resting toads selected and maintained body temperatures around 30°C during the heat of the day by adjusting the depth to which they were buried. This strongly suggests that they behaviourally thermoregulate during their resting hours to maintain a high metabolic rate without regard to the dryness of their immediate surroundings.

[Session 7](#)

Canadian Herpetological Society 2021

HUNTER

INVESTIGATING GENETIC HEALTH IN CAPTIVE AND WILD OREGON SPOTTED FROGS (*Rana pretiosa*) IN CANADA.

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The Oregon Spotted Frog (*Rana pretiosa*) is the most endangered amphibian in Canada and captive programs are in place to support its recovery. Unfortunately, all face challenges of poor reproductive performance, low egg fertility and high incidence of egg binding in females. While these issues are physiological in nature, they may have a genetic basis. Yet the level of genetic diversity in this species, whose populations have disappeared from up to 90% of its historical range, is currently unknown. In order to better understand its reproductive challenges and determine if differences exist between the remaining 6 wild populations and 3 captive populations, this study is investigating their genetic make-up. DNA has been collected by buccal swabbing both captive and wild frogs to measure genetic variability and inbreeding coefficients. We suspect inbreeding is already present in the small, fragmented wild populations and even more prevalent in the further restricted captive populations. Determining genetic variability holds implications not only for the adaptive potential of captive-bred frogs reintroduced to the wild, but also for the long-term sustainability of these programs. Results are still pending, but overall, my work will improve the cohesiveness of current Oregon Spotted Frog recovery efforts across Canada, ensuring all time, effort and resources make a lasting impact on our most endangered amphibian species.

[Session 8](#)

A MODEL OF SEASONAL VARIATION IN SOMATIC GROWTH RATES APPLIED TO PAINTED TURTLES (*Chrysemys picta*) AND SNAPPING TURTLES (*Chelydra serpentina*).

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Understanding patterns of somatic growth—lifetime change in body size—is important for estimating life-history parameters, such as age at maturity and schedules of survivorship, and for insight into the impacts of variation in habitat quality, competition, and abiotic factors. Therefore, quantification of somatic growth using models is integral to many studies of organismal ecology, especially for long-lived species whose lifetime growth cannot be directly measured. Modeling growth is challenging for animals, such as temperate herpetofauna, whose growth rates are seasonally variable and neglecting seasonal variation reduces model fit and precision, and may introduce bias. We reviewed common methods of handling seasonal variation among growth observations, including implicit approaches—such as rescaling dates prior to analysis—that often escape critical scrutiny. To develop an explicit model of seasonal growth, we observed growth across an active season for 11 juvenile Snapping Turtles (*Chelydra serpentina*) radio-tracked in Algonquin Provincial Park, Ontario. We integrated the seasonal component into a von Bertalanffy model of growth among years and applied the combined model to a long-term mark-recapture dataset of juvenile Midland Painted Turtles (*Chrysemys picta marginata*) in Algonquin Provincial Park. Although most Painted Turtles were only measured once per year, we were able to fit the seasonal model without targeted within-season sampling. We estimated that 90% of annual growth of Snapping Turtles accumulated in only 56 days, while Painted Turtles experienced a longer growing season (90% growth in 102 days). Interspecific differences in behaviour and thermal ecology may explain differences in growing season duration.

[Session 6](#)

EVALUATING NEW MITIGATION STRATEGIES TO DETER FEMALE TURTLES FROM NESTING IN UNSAFE ROAD-SIDE HABITATS

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Roads may create an ecological trap for female turtles during nesting forays. Exposed road shoulders are attractive as nesting habitats despite the risk to female fitness. The viability of turtle populations is dependent on the survivorship of reproductive females, but few cost-effective mitigation strategies directly address the vulnerability of females to roads. Here, we will evaluate a new mitigation strategy that aims to deter female turtles from nesting in unsafe road-side habitat and encourages their use of safer alternative sites. The mitigation design makes use of routine road maintenance to replace gravel road shoulders with rock rip-rap (large angular rocks) and paved road shoulders, coupled with artificial nesting mounds. We will evaluate the effectiveness of the mitigation based on road mortality and nesting survey data collected over three consecutive years, using a before-after-control-impact (BACI) experimental design. In addition, we will conduct mark-recapture surveys to estimate abundances in the wetlands adjacent to the road to evaluate the impacts of the mitigation in the context of the local turtle community. If the rip-rap and paved shoulders work to deter females, then we expect a reduction in the number of nests laid on road shoulders and the use of the artificial nesting mounds in the “after” period of the experimental design. Particular attention will be paid to how turtles interact with the rip-rap, quantified using wildlife cameras and behavioural assays. The mitigation strategy will be considered successful if it prevents females from nesting on the road and no secondary consequences are observed. Our study will contribute to the limited literature that quantifies the efficacy of road mortality mitigation strategies on a population-level. If the new mitigation strategy is successful, it could be applied to other conservation projects that have limited resources.

[Session 3](#)

ARE PROTECTED AREAS AN EFFECTIVE MEASURE FOR THE CONSERVATION OF ONTARIO'S HERPETOFAUNA?

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Biodiversity is being lost at an alarming rate, and evaluation of effective conservation practices is imperative. Protected areas are a common approach to biodiversity conservation, yet areas of high conservation concern often fail to overlap with protected regions. To assess this concern, we evaluated whether protected areas feature a greater diversity of herpetofauna (reptiles and amphibians) than unprotected areas within Southern Ontario. Specifically, we tested whether species richness (number of species) differed inside and outside parks by using national, provincial and regionally protected areas, and data from the Ontario Reptile and Amphibian Atlas (ORAA), a citizen science-based monitoring program. The ORAA comprises 397 478 observations of 50 herpetofauna species (26 classified at-risk) within spatially delimited grid cells (10×10 km raster cells). While accounting for environmental variation (e.g., road density, temperature, agriculture, sampling effort), we ran linear mixed-effects models at two different spatial scales (cell level: cells with a park present vs absent, park boundary level: observations inside vs outside protected areas) and three different species richness scales (all species, at-risk species, common species). Overall, we found that species richness was highest within protected areas at the cell level, whereas species richness was the highest outside of protected areas at the park boundary level. All results were similar among species richness scales; however, species richness of common species at the cell level did not differ inside and outside parks. Overall, our results suggest that species richness is highest in the vicinity of protected areas, where regions surrounding protected areas may be vital to the persistence of species at risk. Our results also suggest that protected areas are less effective at protecting species within park boundaries; however, this is likely an artifact of sampling biases from citizen science-based data.

[Session 4](#)

Canadian Herpetological Society 2021

MALONEY

UNDERSTANDING THE IMPACTS OF WILDFIRE AND WINDFARM CONSTRUCTION ON THE HERPETOLOGICAL COMMUNITY OF EASTERN GEORGIAN BAY

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Understanding the degree to which habitat disturbance affects fragile and biodiverse herpetological communities is critical to mitigating damage from future anthropogenic and natural environmental disturbances. Eastern Georgian Bay, Ontario is a recognized hotspot for common and at-risk species of reptiles and amphibians but is also a location under pressure for development. Henvey Inlet Wind (HIW), built in partnership with Henvey Inlet First Nation, is located in Eastern Georgian Bay and is the largest single-phase wind project in Ontario (87 turbines x 300 Mega Watts). Windfarm construction began in 2017 and turbines began operating in 2019. During HIW construction in summer 2018, a large wildfire affected areas of Georgian Bay adjacent to and within the footprint of HIW. Few studies have examined how such combined disturbances impact herpetological communities. Our study aims to quantify the abundance, diversity and health of anuran, snake, and turtle individuals and populations in the areas of the windfarm and wildfire. Surveys will consist of a combination of cover-board clusters, visual encounters with mark-recapture, anuran chorus recordings, as well as habitat selection and availability assessments in four replicated site treatments: control, wildfire, windfarm, wildfire + windfarm. These data will be analyzed using various diversity (e.g., Shannon-Weiner) and body condition indices (e.g., Snout-Vent Length (SVL), Body Mass (BM)) and compared among treatments to look for individual and community-level impacts. Our findings will inform implementation of mitigation strategies for future large-scale windfarm development projects, especially in areas prone to wildfires.

[Session 4](#)

THE ELEMENTAL CONTENT OF REPTILES AND AMPHIBIANS: NUTRIENT RECYCLING CONSEQUENCES

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Organismal elemental content provides valuable information about how organisms have taken up and stored nutrients and about how they will recycle or remove nutrients from the ecosystem in the future. Vertebrates are nutrient-rich and long-lived, making them potentially important nutrient stores or sinks in diverse ecosystems; removal of currently threatened vertebrate species from these ecosystems may, therefore, have drastic nutrient cycling consequences. However, the causes and consequences of elemental content variation in vertebrates are currently unknown. Here, we present some results from a systematic review that compiled whole-body measurements of percent phosphorus (%P) from diverse vertebrates, including 39 unique amphibian species and 17 unique reptile species. We analyzed the impact of taxonomy, life stage, habitat, diet, and size on %P using weighted general linear models. Class, order, and life stage best explained variation. Adult reptiles consistently had higher %P (3.76%; $s^2 = 3.05$) than adult amphibians (2.11%; $s^2 = 0.18$), who generally had the lowest %P of all studied vertebrates. Turtles drove most relationships based on order, as they had the highest %P of all vertebrate orders (6.16%; $s^2 = 0.055$); nevertheless, squamates also had higher %P (2.90%; $s^2 = 1.28$) than both urodelans (2.08%; $s^2 = 0.14$) and anurans (2.28%; $s^2 = 0.43$). Within amphibians, life stage drove much of the variation in %P, likely due to the rapid development and mineralization of bone during ontogeny. Overall, our data suggest that reptiles concentrate and store relatively more %P than other vertebrates. High %P reptiles like turtles may, therefore, be important long-term P stores. Amphibians concentrate less %P than reptiles, but their rapid changes in %P with metamorphosis may affect nutrient recycling in both aquatic and terrestrial ecosystems. The removal or extinction of reptiles and amphibians from ecosystems may greatly impact how nutrients are stored and recycled.

[Session 4](#)

LARVAL GROWTH RATE AND PHENOLOGY OF EMERGENCE FROM NATURAL VS. CONSTRUCTED PONDS IN AN ENDANGERED SALAMANDER COMPLEX ON PEELEE ISLAND, ON.

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Several organizations regularly construct ponds to mitigate the effects of wetland loss on amphibian populations by providing new areas for reproduction and larval development. It remains unclear whether constructed ponds adequately replicate the conditions needed for these sites to provide tangible conservation value. Many such sites have been constructed in Southern Ontario to aid federally-endangered *Ambystoma* salamanders, which exist as a mixed-ploidy 'complex' composed of sexual and unisexual individuals. To better understand the conservation value of constructed ponds, we monitored natural and constructed ponds across Pelee Island and selected 6 sites (2 natural + 4 constructed) where we collected detailed data to evaluate larval growth rate, timing of emergence, size at emergence, and the genetic composition at the larval vs. juvenile stage. Specifically, we conducted regular dip-netting of larvae and captured emerging metamorphs using a combination of pitfall traps and coverboard arrays. Preliminary observations include that most constructed ponds and some natural ponds on Pelee Island were too shallow to retain water long enough for salamander larvae to reach metamorphosis in 2021. Second, a newly constructed pond (<1 year old) created following evidence-based recommendations specific to this system was colonized, had the largest larvae, and metamorphs emerged nearly a month prior to those from natural ponds. Pond temperature played a key role in the accelerated larval growth rate. Third, metamorph dispersal from the ponds was not skewed towards forest cover, possibly limiting juvenile survival when ponds are not surrounded by forest. Genetic results are required before we can assess whether constructed ponds adequately support survival and recruitment of the sexual species (*A. texanum*) upon which this salamander complex depends. Our work is intended to help improve artificial pond construction for the benefit of at-risk salamanders, while also providing new insight into the competitive dynamics among members of the *Ambystoma* complex.

[Session 5](#)

UTILISATION DES BASSINS DE RÉTENTION D'EAUX PLUVIALES PAR LES AMPHIBIENS

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La restauration et la création de milieux humides sont des stratégies envisagées comme mesure de compensation à la perte de milieux humides naturels. Dans ce contexte, la création de bassins de rétentions d'eaux pluviales lors de la construction de routes figure parmi ces méthodes potentielles de compensation. Notre projet avait comme objectif de quantifier l'utilisation de bassins de rétention par les amphibiens. Nous avons émis l'hypothèse que les amphibiens utilisent davantage les milieux humides éloignés que les milieux près des routes et qu'à distance égale à la route, ils utilisent davantage les milieux humides naturels que les bassins de rétention. Nous avons évalué la présence d'adultes à l'aide de points d'écoute de chants d'anoures et le succès reproducteur à l'aide de décomptes de masses d'œufs et de têtards dans 20 bassins de rétention construits par le Ministère des Transports du Québec, 20 milieux humides naturels près des routes (< 50 m) et 20 milieux humides éloignés des routes (50 m – 500 m). La qualité des sites a été évaluée en mesurant des caractéristiques locales comme la taille de l'étang, la végétation, les propriétés physico-chimiques, l'hydropériode, ainsi que des variables à l'échelle du paysage. Nos résultats ont révélé que la conductivité et le pH étaient substantiellement plus élevées dans les bassins que dans les milieux humides naturels. Nos analyses n'ont dévoilé aucun effet des variables explicatives sur l'occupation des amphibiens aux stades de têtards et d'adultes d'anoures. Toutefois, l'abondance de masses d'œufs de salamandres fousseuses diminuaient avec l'augmentation de la conductivité et de l'hydropériode. Ces résultats suggèrent que plusieurs espèces d'amphibiens bénéficient des bassins de rétention en tant qu'habitat près de la route. La diminution d'application de sel de déglacage permettrait de bonifier les milieux humides en bordure de route pour les communautés d'amphibiens.

[Session 7](#)

CLIMATE-ASSOCIATED DECLINE OF BODY CONDITION IN A FOSSORIAL SALAMANDER

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Temperate ectotherms have responded to recent environmental change, likely due to the direct and indirect effects of temperature on key life-cycle events. Yet, a substantial number of ectotherms are fossorial, spending the vast majority of their lives in subterranean microhabitats that are assumed to be buffered against environmental change. Here we examine whether seasonal climatic conditions influence body condition (a measure of general health and vigor), reproductive output, and breeding phenology in a northern population of fossorial salamander (Spotted Salamander, *Ambystoma maculatum*). We found that breeding body condition declined over a 12 year monitoring period (2008–2019) with warmer summer and autumn temperatures at least partly responsible for the observed decline in body condition. Our findings are consistent with the hypothesis that elevated metabolism drives the negative association between temperature and condition. Population-level reproduction, assessed via egg mass counts, showed high interannual variation and was weakly influenced by autumn temperatures. Salamander breeding phenology was strongly correlated with lake ice-melt but showed no long-term temporal trend (1986–2019). Climatic warming in the region, which has been and is forecasted to be strongest in the summer and autumn, is predicted to lead to a 5 to 27% decline in salamander body condition under realistic near-future climate scenarios. Although the subterranean environment offers a thermal buffer, the observed decline in condition and relatively strong effect of summer temperature on body condition suggest that fossorial salamanders are sensitive to the effects of a warming climate. Given the diversity of fossorial taxa, heightened attention to the vulnerability of subterranean microhabitat refugia and their inhabitants is warranted amid global climatic change.

[Session 5](#)

Canadian Herpetological Society 2021

MULLIN

USING SCIENCE TO INFORM SPECIES AT RISK MANAGEMENT: PREDICTING THE EFFECT OF FOREST HARVEST ON WOOD TURTLE HABITAT SUITABILITY

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Sustainable forest management includes protecting and managing habitat for species-at-risk such as the endangered Wood Turtle (*Glyptemys insculpta*). Forestry occurs in approximately 40% of the Wood Turtles Canadian range making it a widespread threat to the species, however the magnitude of the threat is unknown. The Wood Turtle is a challenging species for forest management because females often travel 500+ meters perpendicular to the rivers into forested habitat creating large spatial extents of occupancy. Our research objective is to determine the effects of commercial forest harvest on Wood Turtle habitat suitability to better delineate critical habitat. We outfitted 20 female Wood Turtles with VHF transmitters and GPS loggers and are tracking them from 2019-2021 to collect multi-year fine resolution Wood Turtle spatial data. We will then combine this occurrence data with environmental predictor variables collected both on-site and via remote sensing (LiDAR) in a resource selection function to create a habitat suitability model. We will then apply our habitat suitability model to chronosequence forest harvest blocks aged 1, 5, 10, 15, and 25 years, and late successional forests, to predict the effects of forest harvest on Wood Turtle habitat suitability. Between June 2019 and September 2020 we collected a total of 7,341 locations during the active season from the GPS loggers. Preliminary analysis of habitat use data shows Wood Turtles select canopy openings within forested landscapes. Our study will provide important data to better delineate critical habitat which has range-wide implications for Wood Turtle conservation.

[Session 6](#)

HABITAT PARTITIONING BASED ON LOCAL CLIMATIC VARIATION DOES NOT EXPLAIN WITHIN-POPULATION VARIATION IN MORPH FREQUENCIES OF A WELL-KNOWN POLYMORPHIC SALAMANDER, *Plethodon cinereus*

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Polymorphic species have two or more distinct morphotypes with a genetic basis that occur together at a higher frequency than expected by recurring mutation. Differences between morphotypes can allow them to co-exist by occupying different niches, thus maintaining intraspecific variation through resource partitioning. The well-known striped/unstriped colour polymorphism in *Plethodon cinereus* is maintained by a combination of genetic drift, gene flow, and selection. The selective processes acting to maintain morph frequencies in *P. cinereus* are unclear, as the frequency of each morph varies both among and within populations. Temporal variation in observed morph frequencies occurs within populations due to individual salamanders retreating underground when conditions are unfavourable. Physiological differences between the striped and unstriped morphs, as well as correlations between morphotype and environmental factors over broad spatial scales, suggest that the unstriped morph prefers hotter temperatures and possibly wetter substrates. However, temperature and moisture are confounded with a variety of other factors at broad spatial scales and few studies have been performed at a local scale. The present study aims to elucidate whether the striped and unstriped morphotypes partition habitat according to temperature or moisture by examining temporal variation in morph frequency within populations across two years and 66 sites in Northern Ontario. We built six mixed-effects models to examine the relationship between morph frequency, temperature, and precipitation. Model selection showed that none of the models adequately explain variation in morph frequencies. Temperature and precipitation do not appear to drive variation in morph presence within sites over the early active season, and thus the present study fails to support a role for temperature and moisture in generating variation in morph frequencies. Future studies should explore other selective mechanisms at a local scale.

[Session 5](#)

THE EFFECTS OF CLIMATE AND LAND USE ON PRAIRIE AMPHIBIAN BIODIVERSITY

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Habitat change is one of the leading causes of global biodiversity loss. For many biological communities, we have a poor understanding of where species occur and how species respond to land use change. The prairie ecozone of Canada is a working landscape where most land is privately owned and used for agriculture, including cropland and pasture for cattle. Embedded within agricultural areas are small woodlots and shallow depressional wetlands (prairie potholes) that support biodiversity and provide other ecosystem services. Our objective was to test how land use within a farm (quarter sections of land) affects amphibian biodiversity and the presence of individual species. Using community science data, we built species distribution models for Canadian prairie amphibians with climate and land cover data at multiple scales to predict species' presence and biodiversity potential. We used detailed land use products, including the Canadian Wetland Inventory and estimates of native grassland cover using remote sensing to predict amphibian presence at the farm-scale. Even within a species' range, we found that climate variables explained the largest amount of variation in species' presence for 6 of 7 study species. Within a species' climate niche, we found evidence that the amount of habitat within a farm affected the probability of which amphibian species are present. Prairie amphibians were less likely to be present in areas with more cropland, as expected. Amphibian responses to other land cover types were species-dependent, including species responding positively to grassland cover (e.g. Plains Spadefoot Toad, Northern Leopard Frog) or tree cover (e.g. Boreal Chorus Frog and Wood Frog). Our results will form part of a suite of tools to model prairie biodiversity and predict how land-use change, including habitat restoration, will affect biodiversity.

[Session 7](#)

Canadian Herpetological Society 2021

SCHUELER

POSSIBLE HIBERNACULAR LIMITATION OF SNAKE SPECIES ON THE EASTERN ONTARIO CHAMPLAIN SEA PLAIN

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In Eastern Ontario the range limit of Milk Snakes (*Lampropeltis triangulum*) is a curved line, between Ottawa and Brockville, that corresponds to the eastern edge of the Frontenac Axis and the limestone escarpments along the Ottawa and St Lawrence Rivers. This pattern makes it plausible to think that northern Milk Snakes are limited to areas with small-scale topography, escarpments, and broken rock, because these provide a kind of hibernacula, which aren't available in most of easternmost Ontario. Ribbon Snakes (*Thamnophis sauritus*) show a similar pattern, as do Rat Snakes ("*Pantherophis spiloides*") and Brown Snakes (*Storeria dekayi*), though not extending as far north. I will discuss these patterns, and the possibility that if the construction of super-optimal hibernacula in eastern Ontario led to increased populations of various Snakes, this hypothesis would be supported.

[Session 1](#)

Canadian Herpetological Society 2021

SCHUELER

FRANCIS COOK'S HERPETOLOGICAL PAPERS: IS THERE A PLAN?

Frederick W. Schueler* & Aleta Karstad

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From 1960 until the last few years, Francis Cook, as curator at the National Museum, was the central figure of Canadian Herpetology. In last year's keynote address, after his death, we discussed the 13 bins of Francis' papers his widow Joyce had given us from his study. We've now received 12 more bins as a first instalment on the papers from the loft of their drive-shed. These documents include the files of the herpetology section of the museum that Francis brought home when the museum closed down herpetology in 1993. These include: 1) Manuscripts and background for Francis' Herps of Canada book, 2) long-term (1970-2015) herp observations at a series of sites and especially at their Maplestone Farm, 3) historic correspondence and papers, including Shelly Logier's files from the ROM, 4) Francis' correspondence with many of us, and 5) copies of historic publications. We're totally overwhelmed by the responsibility this entails, and hope the CHS can work with us to see that this material is appropriately worked up, published, or archived.

[Session 4](#)

IDENTIFYING SUITABLE AREAS FOR HABITAT CREATION FOR *Ambystoma* SALAMANDERS ON PELEE ISLAND

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Habitat loss and fragmentation have significantly contributed to amphibian population declines, globally. Pelee Island, Ontario is home to a complex of salamanders, Small-mouthed salamanders (*Ambystoma texanum*), Blue-spotted salamanders (*A. laterale*) and Unisexual *Ambystoma* (Small-mouthed salamander dependent population). These populations have declined as a result of intense landscape changes since the late 1800s, particularly the historical drainage of wetlands. Identifying core habitat areas is vital in determining disproportionately important habitat for imperiled species to ensure their long-term viability. We conducted intensive field surveys to document breeding sites and terrestrial areas occupied by these salamanders. This occurrence data was used to assess salamander habitat suitability across Pelee Island. Habitat suitability varied across salamander genotypes, with Small-mouthed salamanders having the least available habitat, which was mostly dependent on being close to breeding sites. Diploid Unisexuales had a broader range of suitable habitat and were primarily distributed based on proximity to breeding ponds and land cover type. Generally, there was a small amount of suitable terrestrial habitat available for this complex of salamanders. The long-term viability of this population of *Ambystoma* salamanders may rely on the enhancement of suitable habitat near current breeding sites. Although it can take many years for a constructed pond to become suitable for salamanders, these built ponds can help improve population persistence. Based on our recommendations, the Nature Conservancy of Canada is currently in the process of constructing several ponds in key habitat areas. Further habitat protection and enhancement will be essential to effectively conserve these at-risk salamanders.

[Session 5](#)

Canadian Herpetological Society 2021

SURGET-GROBA

CONSERVATION GENETICS OF BLANDING'S TURTLE (*Emydoidea blandingii*) AT THE NORTHERN EDGE OF ITS DISTRIBUTION RANGE

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The conservation of species at risk requires as a first step to have detailed information on the distribution and abundance of the different populations. It also needs information on population connectivity to be able to identify different management units. For many species, traditional inventory methods (direct observation, trapping, etc.) require a considerable investment in time. For instance, it was estimated that an average of 20 nights of trapping were needed to capture one Blanding's turtle in the Outaouais region (Quebec). It is thus essential to develop quicker and more sensitive methods to efficiently monitor species at risk populations. Environmental DNA (eDNA) is quickly becoming a method of choice for aquatic species inventories. However, this method is generally used for detecting the presence of a species, but not its abundance while this information is essential to determine population trends and measure success toward recovery. The first objective of this project will be to evaluate the cost and efficiency of eDNA methods to detect and estimate the size of Blanding's turtle populations, as compared with traditional inventory methods. Since it is also very important to estimate genetic diversity and population connectivity to design recovery plans, the second objective of this project will be to evaluate the possibility of estimating genetic diversity and gene flow directly from eDNA. The development of these techniques will facilitate and reduce the cost of Blanding's turtle monitoring and recovery actions.

[Session 6](#)

WEAVING INDIGENOUS KNOWLEDGE AND WESTERN SCIENCE TO INVESTIGATE THE IMPACTS OF RAILWAYS ON WILDLIFE

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Railways have been documented to cause mortalities for many different species, most commonly a result of wildlife-train collisions. Railway-related mortality can lead to population declines, but the ecological impacts of railways are understudied. Most research on wildlife-train collisions has focused on large mammals but understanding railway-specific risks for under-represented taxa, especially vulnerable species, is important for developing effective mitigation strategies. We aim to fill knowledge gaps using a two-eyed seeing approach that weaves Indigenous knowledge and Western science to investigate wildlife interactions with railways. We initiated this project based on concerns from First Nations communities about wildlife mortalities on railways, particularly species at risk. To inform study design, we invited community members to share knowledge concerning wildlife-railway impacts in individual interviews. We then conducted weekly visual surveys over three field seasons along two 3.5 km sections of railway in Eastern Georgian Bay, recording the locations of all wildlife observed alive or dead. In total we recorded 332 observations of individuals from 39 different species, of which 73% were found dead, and 27% were encountered alive, findings corroborated by shared Indigenous Knowledge. Reptiles and amphibians were the most severely impacted taxa, accounting for 87% of observed mortalities. We observed seven different at-risk species interacting with the railway, of which individuals from three at-risk turtle species and one at-risk snake species were found dead on the tracks. These preliminary results highlight the value of using multiple knowledge systems in ecological research and indicate some taxa such as reptiles and amphibians may be more susceptible to railway mortality. The next stage of our project aims to identify mortality hotspots and determine if landscape or habitat features contribute to the location or frequency of railway mortalities, information critical to developing effective railway impact mitigation.

[Session 4](#)

MITIGATING AN ECOLOGICAL TRAP ON AN ENDANGERED SNAKE SPECIES MASSASAUGA (*Sistrurus catenatus*) DURING A BOG RESTORATION PROJECT

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A bog community restoration project was successfully initiated following the termination of peat soil strip mining in a remnant ombrotrophic bog ecosystem in southern Ontario, Canada. However, a restored bog hydrology consisting of an elevated and stable groundwater table was not maintained for the long-term, and the restoration progress relapsed. Within ten years the site hydrology became stochastic with the annual removal of beaver dams and increased the peatland's vulnerability to frequent wildfires. An ecological trap was recognized for the resident reptile community. For example, the endangered Massasauga uses the peatland for hibernation and gestation, and this habitat is compromised in peat-mined areas. 'Assisted hibernation' is a mitigation technique and refers to the method of limiting neonatal dispersal into the trap area, by hibernating them in artificial burrows within ideal habitat for their first winter. This prime habitat must meet the criteria of maintaining a "Life Zone", which is a subterranean space that does not freeze or flood completely. This mitigation must continue until a long-term solution to the sites stochastic hydrology is implemented. From 2017-2020, the sites hydrology was monitored using data loggers across the ecosystem and one main control point was identified for an engineered structure. Peatland hydrology would be best resolved by abandoning a section of drain that currently cuts into the organic basin of the feature and realigning it back into clay soils in the farmlands, establishing a wetland buffer. Discussions with stakeholders are currently under way to determine the best long-term solution.

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YAGI

MATERNAL EFFECTS, NEONATAL MASSASAUGA SURVIVAL AND HEADSTARTING: SOME FOOD FOR THOUGHT!

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We examined survival results for assist hibernated Massasaugas following their first winter hibernation within optimal hibernation habitat, in conjunction with maternal factors (maternal size, age, year, clutch size, litter size, birth size) and head started neonatal snake factors (pre-hibernation mass, length, winter duration). We found that first winter survival improved with larger pre-hibernation weight despite initial small birth weight, suggesting headstarting is a suitable management tool to aid neonatal snake first winter survival. However, the minimum number of pre-hibernation feeding opportunities to reach the pre-hibernation mass goal of $14g \pm 1.5$ was estimated at 5 to 10 meaning the habitat the neonatal snakes are born into must also provide an abundance of small mammal litters. Impacted habitats where the water levels change frequently from year to year do not support a diverse and abundant small mammal population and may be the next limiting factor at our study site.

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