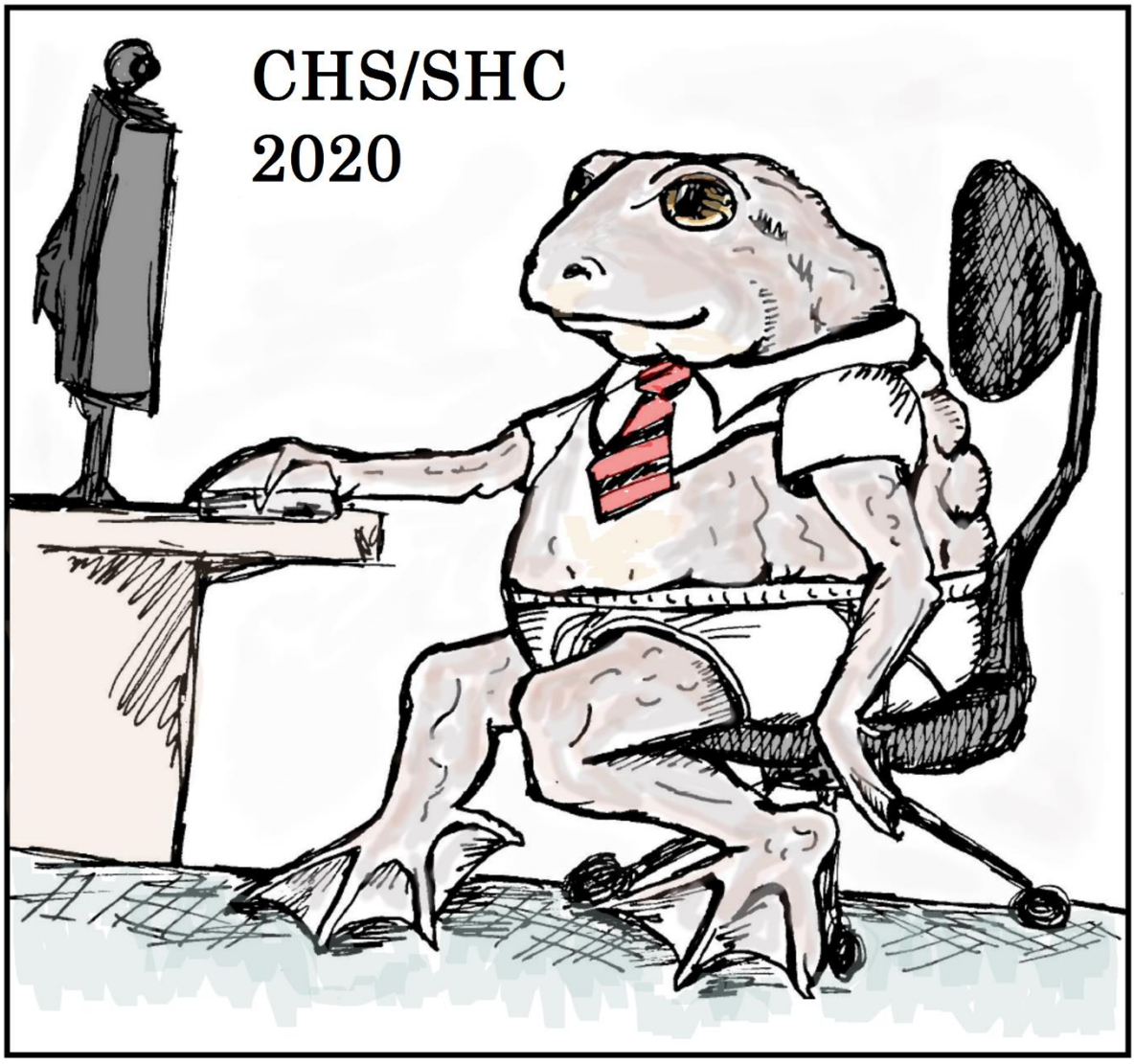
7th Annual Meeting of the
Canadian Herpetological Society

7ème Congrès Annual de la
Société d'Herpétologie du Canada



Virtual Meeting 2020

Canadian Herpetological Society 2020

Welcome

On behalf of the CHS Meeting and Workshop Committee, welcome to the virtual meeting for the 7th 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 the study of biology and conservation of amphibians and reptiles in Canada.

CHS Meeting and Workshop Committee

- Pamela Rutherford (Chair)
- Jack Arthur
- Amanda Bennett (Logo creator)
- Jonathan Choquette
- Joe Crowley
- Scott Gillingwater

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: Jacqueline Litzgus (Laurentian University, Sudbury, ON)
Vice President: Pamela Rutherford (Brandon University, Brandon, MB)
Past President: Joe Crowley (Ont. Ministry of Env., Conservation and Parks, Peterborough, ON)
Treasurer: John Urquhart (Blazing Star Environmental, Oshawa, ON)
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Directors at Large: Leslie Anthony, Christina Davy, Yohann Dubois, Scott Gillingwater, Stephen Hecnar, Patrick Moldowan
Webmaster: Drew Hoysak

Schedule Overview

Friday, September 11, 2020

8-10pm EDT	Social	YoTribe

Saturday, September 12, 2020

1:00pm EDT	Opening Remarks	Zoom
1:15pm	**Session 1**	All Things Ambystoma
1:35pm	Questions	
1:45pm	**Session 2**	Climate, Rocks and Peatlands
2:05pm	Questions	
2:15pm	**Session 3**	Fire, Trees and Grasslands
2:35pm	Questions	
2:45pm	**Break**	
3:00pm	**Session 4**	Here come the amphibians
3:20pm	Questions	
3:30pm	**Session 5**	Bringing it home with turtles
3:50pm	Questions	
4-6pm	Social	YoTribe

Sunday, September 13, 2020

1:00pm EDT	Opening Remarks	Zoom
	Travelogue Presentation Julia Riley and James Baxter-Gilbert	On the High Seas of Indonesia – Thar Be Dragons!
2:00pm	**Break**	
2:15pm	**Awards and Annual General Meeting**	

Saturday, September 12, 2020

Session 1 (Chair: James Paterson) All Things Ambystoma	
1315-1320	**HIGH DIVERSITY IN ISOLATED UNISEXUAL AMBYSTOMA COMMUNITIES** Evan A. Bare*, Jim P. Bogart, Dennis L. Murray, and Thomas J. Hossie
1320-1325	**ABNORMALITIES IN SPOTTED SALAMANDERS (*Ambystoma maculatum*) FROM UNCONTAMINATED ECOSYSTEM IN SOUTHEASTERN ONTARIO** Gloria H.Y. Gao*, Njal Rollinson, and Patrick D. Moldowan
1325-1330	**IDENTIFYING SUITABLE HABITAT AND MOVEMENT CORRIDORS FOR ENDANGERED SALAMANDERS ON PELEE ISLAND** Graeme N. Smith*, Evan A. Bare, Thomas J. Hossie, and Dennis L. Murray

Session 2 (Chair: Jolene Laverty) Climate, Rocks and Peatlands	
1345-1350	**ASSESSING HOW CLIMATE FREQUENCY DRIVES THE STRUCTURE OF ANURAN COMMUNITIES** Gabrielle L. Rimok* and Pedro R. Peres-Neto
1350-1355	**SPATIAL HETEROGENEITY OF SURFACE TOPOGRAPHY IN PEATLANDS: ASSESSING OVERWINTERING HABITAT AVAILABILITY FOR THE EASTERN MASSASAUGA RATTLESNAKE** Taylor D. North*, Chantel E. Markle, Lorna I. Harris, Paul A. Moore, and James M. Waddington
1355-1400	**UNDERSTANDING THE MOISTURE RESPONSE OF TURTLE NESTING HABITAT ON THE EASTERN GEORGIAN BAY ROCK BARRENS** Hope C. Freeman*, Chantel E. Markle, Nicole Sandler, and James M. Waddington

Session 3 (Chair: Nicholas Cairns) Trees, Grasslands and Fire	
1415-1420	**USING A LONG-TERM MONITORING DATASET TO ASSESS THE EFFECTS OF A SEVERE WILDFIRE ON THE SITE-LEVEL OCCUPANCY DYNNAMICS OF THE LONG-TOED SALAMANDER** Danial P. Hunter* and Elijus Slamas
1420-1425	**SENSITIVITY AND RESPONSE OF WOOD TURTLES (*Glyptemys insculpta*) TO COMMERCIAL FOREST HARVEST** Damien I. Mullin*, Graham J. Forbes, and Chris B. Edge
1425-1430	**IMPACT OF LIVESTOCK GRAZING ON GRASSLAND HERPETOFAUNA IN MIXED-GRASS PRAIRIE HABITATS** Candace J. Park* and Pamela L. Rutherford

Saturday, September 12, 2020

Session 4 (Chair: Donnell Gasbarrini) Here come the amphibians	
1500-1505	**INVASIVE CLAWED FROG, XENOPUS LAEVIS, CAN IDENTIFY LOCAL PREDATORS REGARDLESS OF COEXISTENCE TIME** Natasha Kruger*, Anthony Herrel, Jean Secondi, and John Measey
1505-1510	**INVESTIGATING ACUTE AND SUB-CHRONIC EFFECTS OF NEONICOTINOIDS ON NORTHWESTERN SALAMANDER LARVAE** Blake E.G. Danis* and Vicki L. Marlatt
1510-1515	**SHRINKING BEFORE OUR ISLES: THE RAPID EXPRESSION OF INSULAR DWARISM IN THE INVASIVE POPULATIONS OF GUTTURAL TOAD (*Sclerophrys gutturalis*) IN MAURITIUS AND RÉUNION** James Baxter-Gilbert*, Julia L. Riley, Carla Wagener, Nitya. P. Mohanty, and John Measey

Session 5 (Chair: Jackie Litzgus) Bringing it home with turtles	
1330-1335	**PARENTAL PROVISIONING AND FLUCTUATING THERMAL REGIMES ENHANCE IMMUNE RESPONSE IN A REPTILE WITH TEMPERATURE-DEPENDENT SEX DETERMINATION** Jessica A. Leivesley* and Njal Rollinson
1335-1340	**HOW SNAPPING TURTLE VOCALISATIONS ARE ASSOCIATED WITH ENERGETIC BENEFITS DURING NEST EMERGENCE** Claudia Lacroix*, Christina Davy, and Njal Rollinson
1340-1345	**ESTIMATING SEX BIASES IN COMMON TRAPPING METHODS USED FOR TURTLE POPULATION MONITORING** Remus J. James*, James E. Paterson, and Christina M. Davy

BARE

HIGH DIVERSITY IN ISOLATED UNISEXUAL *AMBYSTOMA* COMMUNITIES

Evan A. Bare[1]*, Jim P. Bogart[2], Dennis L. Murray[1, 3], Thomas J. Hossie[1, 3]

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Unisexual *Ambystoma* are a monophyletic lineage of all-female salamanders whose ability to reproduce depends on the availability of sperm deposited by one of 5 known congenerics. These animals range in ploidy from diploid to pentaploid, and their nuclear genome is composed of DNA from *A. laterale* and one (or more) of these congenerics. Across their range, unisexuals typically co-occur with only one potential sperm donor and are predominantly triploid (e.g., LLJ) with their genomotype being biased toward the local host populations (e.g. LL). On Pelee Island, Ontario unisexual *Ambystoma* are sympatric with both Small-mouthed Salamanders (*A. texanum*) and Blue-spotted Salamanders (*A. laterale*), both of which are viable host species for the complex. This island therefore presents a unique opportunity to examine the processes that shape unisexual communities. From 2015-2018 we genomotypes were identified from 1181 adults and 843 larvae from sites across Pelee Island. Genomotype composition varied significantly across sites. We found no evidence of spatial autocorrelation in community composition which may indicate limited flow of individuals among sites. Diploid unisexuals (LTs) made up the largest fraction of salamanders at all sites. Average ploidy was generally higher in larvae than adults at a given site. Overall, *A. texanum* made up ~4.3% of all samples, and *A. laterale* made up ~0.15% (i.e., 3 individuals). The relative abundance of diploid sperm donors at a given site ranged from 0.3%-12.5%. Comparison to samples collected 30 years ago indicates that these communities have shifted significantly in composition. *A. laterale* has been lost from some historic sites, and the relative abundance of L-biased unisexuals (e.g., LLTs) has declined. Our results highlight the role *A. laterale* plays in maintaining unisexual *Ambystoma* diversity and suggest that the loss of this host would lead to diminished genetic diversity of the complex on Pelee Island.

SHRINKING BEFORE OUR ISLES: THE RAPID EXPRESSION OF INSULAR DWARISM IN THE INVASIVE POPULATIONS OF GUTTURAL TOAD (*Sclerophrys gutturalis*) IN MAURITIUS AND RÉUNION

James Baxter-Gilbert [1]*, Julia L. Riley[2,3], Carla Wagener[1], Nitya. P. Mohanty[1], and John Measey[1]

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Island ecosystems have traditionally been hailed as natural laboratories for examining phenotypic change, including dramatic shifts in body size (e.g., island gigantism or insular dwarfism). Similarly, biological invasions can drive rapid localised adaptations within modern timeframes. Here we compare the morphology of two invasive guttural toad (*Sclerophrys gutturalis*) populations in Mauritius (est. 1922) and Réunion (est. 1927) to their genetic source population from Durban, South Africa. We found that female toads on both islands were significantly smaller than mainland counterparts (reduction in body size by 33.9% and 25.9%, respectively), as were males in Mauritius (22.4%). We also discovered a significant reduction in the relative hindlimb length of both sexes, on both islands, compared to mainland toads (ranging from 3.4 - 9.0%). Our findings suggest that the dramatic reshaping of an invasive amphibians' morphology, leading to insular dwarfism, can result in less than 100 years.

DANIS

INVESTIGATING ACUTE AND SUB-CHRONIC EFFECTS OF NEONICOTINOIDS ON NORTHWESTERN SALAMANDER LARVAE

Blake E.G. Danis* and Vicki L. Marlatt

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Environmental concentrations of neonicotinoids in surface waters have been detected at levels as high as 320 µg/L in Canada, and few studies have examined the toxicity of these pesticides in North American salamander species. This research investigated the adverse effects of neonicotinoids on the Northwestern salamander (*Ambystoma gracile*; NWS) after acute and sub-chronic exposures during early aquatic life stages via whole organism (i.e. growth, development) and molecular (i.e. gene expression) level endpoints. In an acute exposure NWSs were exposed to four imidacloprid concentrations (250, 750, 2250, 6750 µg/L) and a water control treatment for 96 hours. There was no evidence of adverse effects on survival, body weight, snout-vent length (SVL) and total body length. However, thyroid receptor β (TRβ) gene expression was reduced in larvae exposed to 750 and 2250 µg/L imidacloprid for 96-h compared to the control treatment. In subsequent experiments, NWS were exposed sub-chronically to imidacloprid alone and an equal part mixture of neonicotinoids (imidacloprid, clothianidin, and thiamethoxam (ICT)) at three concentrations (10, 100 and 1000 µg total neonicotinoids/L) and a water control. In all exposure experiments there was no evidence of an effect on larval survival, body weight, SVL, and total body length. However, advanced development of larvae in the 100 µg /L imidacloprid treatment was observed compared to the control in the 35-day imidacloprid exposure. Similarly, advancement of development in the 35-day ICT exposure was observed in the 100 µg/L ICT treatment compared to the control. These results demonstrate that imidacloprid is not acutely toxic up to 6750 µg/L, but may affect thyroid hormone signalling pathways based on decreased TRβ expression. Similarly, sub-chronic exposure to imidacloprid up to 1000 µg/L and a mixture of neonicotinods in equal parts up to 1000 µg/L did not impact survival and growth, but did cause sub-lethal impacts by advancing development.

UNDERSTANDING THE MOISTURE RESPONSE OF TURTLE NESTING HABITAT ON THE EASTERN GEORGIAN BAY ROCK BARRENS

Hope C. Freeman*, Chantel E. Markle, Nicole Sandler and James M. Waddington

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The Georgian Bay Biosphere Reserve is the world's largest freshwater archipelago, containing a mosaic of wetlands, peatlands, forests, and rock barrens, providing critical habitat for over 50 species-at-risk. The abundance of rock barrens on the landscape supports communities of lichen (*Cladonia* sp.) and moss (*Polytrichum* sp.), dominated by juniper (*Cupressaceae* sp.) and a mixture of shrubs such as blueberry (*Vaccinium* sp.). The shallow soil-filled depressions, covered with lichen and moss provide key nesting habitat for turtle species within Georgian Bay. Although rock barrens are the second most dominant land cover type within our study region, the availability of suitable nesting habitat with deeper soil deposits and an open canopy is limited to 11% of the rocky outcrops and < 3% of our study area. Our research aimed to identify a bedrock morphology and soil depth that allows potential freshwater turtle nests to drain most rapidly after large rain events. We found that deep (8–15 cm soil) crevices, which is a site with bedrock located on at least two sides of the soil deposit, responded most rapidly to large inputs of water over short periods. In addition, we found that the shallow rock barrens nesting habitat had unique moisture dynamics that were linked to soil properties to provide successful incubation conditions. Developing a more thorough understanding of the moisture dynamics of turtle nesting habitat can aid in the development of restoration techniques for the rock barrens landscape.

GAO

ABNORMALITIES IN SPOTTED SALAMANDERS (*Ambystoma maculatum*) FROM UNCONTAMINATED ECOSYSTEM IN SOUTHEASTERN ONTARIO

Gloria H.Y. Gao*, Njal Rollinson, and Patrick D. Moldowan

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The current literature on amphibian abnormalities have largely focused on abnormalities due to anthropogenic activity. Most of these causes have been determined through studies on anurans, but little of this baseline information has been established for other amphibians, particularly salamanders. This study determines the abnormality levels in wild populations of spotted salamanders (*Ambystoma maculatum*) in an uncontaminated ecosystem in Algonquin Provincial Park, Ontario. We predict that the baseline abnormality frequency will be around 5%, which is typical of such uncontaminated environments. Abnormalities were classified by body part, specifically forelimb, hindlimb, tail, and eye, and included examples such as polydactyly, syndactyly, and polymelia. A comprehensive sample was collected using both a drift fence during only one breeding season and long-term data using minnow traps. Baseline frequency of abnormalities was low (5.8%) in the drift fence data, but fluctuated throughout the long-term data. This baseline frequency can act as a potential guideline for future studies on salamander abnormalities, in both contaminated and uncontaminated environments.

HUNTER

USING A LONG-TERM MONITORING DATASET TO ASSESS THE EFFECTS OF A SEVERE WILDFIRE ON THE SITE-LEVEL OCCUPANCY DYNNAMICS OF THE LONG-TOED SALAMANDER

Danial P. Hunter* and Elijus Slamas

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The frequency of severe wildfires is expected to increase in the upcoming century. The long-toed salamander (*Ambystoma macrodactylum*) is listed as a "species of special concern" in Alberta, but the response of this species to severe wildfire has not been studied in Canada. The Kenow wildfire was a severe wildfire that occurred in Waterton Lakes National Park in southwest Alberta, Canada during the summer of 2017. Parks Canada has monitored several wetland sites throughout the park for the presence of amphibians including long-toed salamanders for many years, producing a long-term dataset that spans the occurrence of this wildfire. We will use occupancy modelling software to determine whether the Kenow wildfire affected the proportion of sites occupied by long-toed salamanders. We will also investigate how likely the 6 sites that do not have any detections since the wildfire represent true losses in occupancy, and are not an artifact of imperfect detection. Existing studies on the effects of wildfires on long-toed salamander occupancy dynamics in comparable environments suggest that the proportion of sites occupied does not immediately shift, but does after several years. However, these studies did not use such a severe wildfire in the study system. Our research will lend insight into how this species of special concern will respond to the expected increase in frequency of such severe wildfires.

JAMES

ESTIMATING SEX BIASES IN COMMON TRAPPING METHODS USED FOR TURTLE POPULATION MONITORING

Remus J. James*[1], James E. Paterson[1], and Christina M. Davy[2]

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Multiple survey methods are used to monitor turtle populations. Specific capture methods are typically chosen to maximize captures of target species, or to maximize the total number of captures per season, all while accounting for financial and logistical constraints. Ideally, population monitoring can track changes in sex ratios, as these relate to long-term population viability. However, if foraging or aggregation behaviours differ between female and male turtles, then some survey methods may suggest a skewed sex bias not reflective of the actual population. We compared apparent sex ratios from repeated surveys (2008 – 2019) for three species of turtles at two sites in Ontario, using three potentially unbiased methods (hoop trapping, minnow trapping, and visual surveys with canoes and boats, or by wading), and one clearly sex-biased method (nest site surveys). Capture data from nest site surveys for all species were (unsurprisingly) female-biased. Hoop trap captures were significantly sex-biased towards males for *Chrysemys picta*. In contrast, capture data from hoop traps for *Chelydra serpentina* were female biased, despite male-biased captures during visual surveys where we had expected equally detectability for both sexes. *Emydoidea blandingii* were male-biased based on visual and hoop trap surveys, while minnow trap captures were not biased towards either sex. These results indicate the importance of understanding behavioural aspects and interspecific variation in detection rates using different survey methods.
Understanding these relationships in behavioral differences and how these behaviors affect the detectability of one sex over another is important to recognize since it can result in inaccurate estimates of sex ratios, and possibly result in improper management decisions for species of management concern. This is chiefly important for turtle species since their functional populations are directly related to the number of females in a population.

INVASIVE CLAWED FROG, *XENOPUS LAEVIS,* CAN IDENTIFY LOCAL PREDATORS REGARDLESS OF COEXISTENCE TIME

Natasha Kruger[1,2]*, Anthony Herrel[3], Jean Secondi[2,4], and John Measey[1]

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Invasive species are exposed to novel predators after their establishment in a novel environment. Defences against novel predators may not be efficient at least at an initial stage. The presence of an anti-predator defence is an important parameter that may determine the ability of local communities to control the expansion of invasive populations. The African clawed frog, *Xenopus laevis,* is a globally invasive amphibian. In western France it faces predators functionally similar to predators found in its native range (South Africa), however, its invasive range has expanded to overlap the range of an invasive crayfish predator. We tested whether naïve *X. laevis* tadpoles from the invasive French population exhibit anti-predator response to local predators, and whether the response depends on the degree of relatedness with predators encountered in the native range of the frog. Alternatively, if naïve tadpoles may express generic neophobia to any cue they are not familiar with. We exposed naïve lab-reared tadpoles to a non-predator water snail, *Planorbarius corneus*, a native beetle, *Dytiscus dimidiatus*, and an invasive crayfish, *Procambarus clarkii*. Species of the Dytiscus genera are present across southern Africa while no related species to crayfish occur in *X. laevis'* native range. We found that *X. laevis* tadpoles innately reduce their activity when exposed to *D. dimidiatus* and *P. clarkii* stimulus cues. The innate response to *P. clarkii* indicates that *X. laevis* tadpoles are not naïve to the invasive crayfish. Thus, limiting the effects of these predators on the control of *X. laevis*, however, previous studies have found that *P. clarkii* mitigate the effects of other invaders. The complex interactions between co-invaders are essential to explore.

LACROIX

HOW SNAPPING TURTLE VOCALISATIONS ARE ASSOCIATED WITH ENERGETIC BENEFITS DURING NEST EMERGENCE

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Recent work suggests that freshwater turtles communicate by sound. Hatchling vocalizations among turtles, for instance, may be important for embryo-embryo communication, perhaps to encourage hatching synchrony and coordinate group emergence from subterranean nests (the 'Social Facilitation Hypothesis'). Here we explore whether the presence of siblings during hatching and nest emergence in hatchling turtles increases fitness – a basic pre-requisite of the Social Facilitation Hypothesis – using the broadly distributed snapping turtle (*Chelydra serpentina*) as a model organism. First, we demonstrate that *C. serpentina* hatchlings have a vocal repertoire: we detected vocalizations of 6 different types in a simulated nest environment; most vocalizations occurred in the 24 hrs following egg pipping and hatching. Next, we demonstrate that hatchlings benefit energetically from emerging with siblings vs emerging alone: we manipulated egg burial depth (shallow or deep) and sociality (presence or absence of siblings) in a 2 x 2 factorial design and found that eggs in the social treatment hatched earlier and lost less weight while emerging from the nest. Hatchlings in deep nest treatments also spent significantly more time in the nest, but no interactions were significant. Our data provide incremental support to the Social Facilitation Hypothesis, while contributing to a growing literature on the adaptive significance of sociality in reptiles. Future work should examine behavioural response of hatchlings to vocalization playback.

LEIVESLEY

PARENTAL PROVISIONING AND FLUCTUATING THERMAL REGIMES ENHANCE IMMUNE RESPONSE IN A REPTILE WITH TEMPERATURE-DEPENDENT SEX DETERMINATION.

Jessica A. Leivesley[1]* and Njal Rollinson[1,2]

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Neonate immune response is a key predictor of early-life fitness as it provides first-line defence against invading pathogens. Theory suggests that mothers may influence offspring immunity through provisioning offspring with greater energetic reserves, facilitating immune response; however, any effect of provisioning on immunity is unresolved, as post-hatching parental care has obscured relationships between provisioning *per se* and immunity. Here we test for an association between provisioning and immunity while manipulating neonate sex and incubation environment in a reptile with no parental care. We find that maternal provisioning is positively associated with bactericidal capacity of offspring blood. We also find that neonate sex has no influence on bactericidal capacity, but that fluctuating incubation temperature (i.e., a more naturalized incubation regime) was associated with a greater bactericidal capacity compared to constant temperature incubation. Our study clarifies that maternal provisioning *per se* is associated with immune response, while questioning the relevance of constant temperature incubation in experimental studies on ectotherm development. Our findings also suggest that the evolution of temperature-dependent sex determination in reptiles is unrelated to early-life immunity.

SENSITIVITY AND RESPONSE OF WOOD TURTLES (*Glyptemys insculpta*) TO COMMERCIAL FOREST HARVEST

Damien I. Mullin[1,2*], Graham J. Forbes[1], and Chris B. Edge[2]

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Sustainable forest management includes protecting species-at-risk, including the endangered Wood Turtle (*Glyptemys insculpta*). The Wood Turtle is a challenging species for forest management because they often travel 500+ meters perpendicular to rivers into forested habitats. Forestry occurs in approximately 40 % of the Wood Turtles Canadian range making it a widespread threat to the species, however the magnitude of the threat is unknown. Our research objective is to determine the indirect effects of commercial forestry on the thermal, spatial, and behavioural ecology of Wood Turtles. Our secondary objective is to determine the sensitivity and response of a long-lived philopatric species to habitat disturbance. We are using a BACI (before-after/control-impact) experimental design to study Wood Turtles for 2 years before and 2 years after forest harvest, in control sites (no harvest) and impact sites (clear cuts); our forest harvest is occurring Winter 2020-2021. Within the study site there will be 10 harvest blocks ranging from 3.4 – 13.5 ha (total harvest area = 73.3 ha). We outfitted 24 adult female Wood Turtles with VHF transmitters, GPS loggers, and Ibutton temperature loggers between 2019-2020. We collected a total of 7,341 active season spatial points from the GPS loggers between June 2019 and August 2020. We had 13 females encounter proposed harvest blocks, and 11 females that did not encounter proposed harvest blocks. All 10 turtles with 2 years of data collection showed a high degree of site fidelity to previously occupied sites. This research will provide important data to better delineate critical habitat which has range-wide implications for Wood Turtle conservation. Preliminary results will be presented.

NORTH

SPATIAL HETEROGENEITY OF SURFACE TOPOGRAPHY IN PEATLANDS: ASSESSING OVERWINTERING HABITAT AVAILABILITY FOR THE EASTERN MASSASAUGA RATTLESNAKE

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The eastern massasauga rattlesnake (*Sistrurus catenatus*) relies on small-scale differences in peatland surface elevation to survive harsh overwintering conditions at the northern limit of its range. We characterized the spatial heterogeneity of surface topography in peatlands within the Eastern Georgian Bay rock barrens landscape to assess potential snake overwintering habitat. At six peatlands, we used a differential global position system to collect surface elevation data. We created spatially-explicit surface models to map peatland surface topography, quantify habitat that was likely to remain unflooded during the overwintering period, and identify key characteristics associated with greater habitat availability. While all peatlands were spatially heterogeneous, larger peatlands were associated with greater surface spatial variability relative to the lowest elevation measured within each site. However, even peatlands with very little spatial heterogeneity (average of 0.24 m above lowest elevation), provided unflooded overwintering habitat. Inter-annual weather conditions and peatland and watershed characteristics likely control the availability and distribution of unflooded overwintering habitat. We found that trees, specifically white pine and maple, were spatially associated with higher surface elevations and could be used to identify areas of unflooded winter habitat. Our findings are useful for landscape-scale assessments of available overwintering habitat to prioritize conservation and management efforts.

PARK

IMPACT OF LIVESTOCK GRAZING ON GRASSLAND HERPETOFAUNA IN MIXED-GRASS PRAIRIE HABITATS

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Despite covering approximately one third of the Earth's surface, grasslands are among the most threatened and least protected habitats, with 45.8 % of global temperate grasslands converted for human-dominated uses such as agriculture. Prescribed livestock grazing is one management strategy to restore degraded grassland ecosystems; however, little is known about the effect of grazing on grassland herpetofauna. Herpetofauna may be particularly susceptible to impacts from grazing due to their low mobility and dependence on specific vegetative cover for food, protection and thermoregulation. The goal of this project is to understand how livestock grazing affects grassland herpetofauna species-at-risk in mixed-grass prairie habitats, which have been reduced to less than 20% of the historic range in Canada. We are surveying two types of mixed-grass prairies in southwestern Manitoba (undisturbed and grazed), using coverboard arrays to locate herpetofauna and quadrat surveys to characterize plant diversity. With this data, we will determine: 1) how grazing affects biotic (plant and herpetofauna species) and abiotic (thermal and moisture) environments, and 2) how biotic and abiotic environments change on a gradient from forest edge to the center of a mixed-grass prairie. Understanding the potential impacts of livestock grazing may improve management decisions regarding the conservation of grassland ecosystems, and in particular the management of mixed-grass prairie habitat throughout western Canada.

RIMOK

ASSESSING HOW CLIMATE FREQUENCY DRIVES THE STRUCTURE OF ANURAN COMMUNITIES

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Patterns of biodiversity are dependent on environmental heterogeneity (i.e., environmental spatial structure) and how it affects the diversity and distribution of species that vary in their niche breadths (i.e., specialists versus generalist species). In the case of amphibians, they are highly sensitive to environmental heterogeneity, especially when exacerbated by recent human-driven change. With amphibian populations declining world-wide, there is an immediate need to investigate the causes of these declines, some of which are associated to changes in climate. However, though community models consider climate as an important environmental predictor of species richness, diversity and distribution, its spatial frequency is still in the embryonic stage of study. Thus, I propose a framework in which the spatial frequency of climate will be used to account for the unexplained residual variation in current biodiversity and community models. Using a climate frequency index (CFI) previously developed in our lab, the heterogeneity of climate will be quantified and used to determine how common the climatic conditions are within any given geographic cell. Using broad-scale, long-term, multispecies data acquired by the North American Amphibian Monitoring Program (NAAMP) and the Wisconsin Frog and Toad Survey (WFTS), this study aims to understand how spatial frequency of climate affects patterns of amphibian species richness, diversity, and distribution of niche breadths. The goal of this study is to further scientific knowledge in amphibian community ecology and improve current approaches in their conservation.

IDENTIFYING SUITABLE HABITAT AND MOVEMENT CORRIDORS FOR ENDANGERED SALAMANDERS ON PELEE ISLAND

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Habitat loss has caused severe decline in amphibian populations globally. Pelee Island, Ontario is home to at-risk populations of small-mouthed Salamanders (*A. texanum*) and Unisexual *Ambystoma* (Small-mouthed Salamander dependent population), whose populations have declined following dramatic changes to the landscape since the late 1800s. Surviving populations on the island would be at greater risk if impermeable habitat between breeding sites results in low connectivity among remaining patches of suitable habitat. We therefore conducted intensive field surveys to document both breeding sites as well as terrestrial areas occupied by adult and newly-metamorphosed juvenile salamanders. This data was then used to assess salamander habitat suitability (MaxEnt) and connectivity (Circuitscape) across the island. Surveys identified 6 general areas where salamanders were present, as well as 33 confirmed breeding sites which included both natural wetlands and artificial ponds. Salamander habitat suitability models confirmed that terrestrial capture locations (n=469) were most strongly influenced by proximity to suitable breeding sites, but also found strong effects related to land cover type. Compared to sympatric unisexuals, Small-mouthed Salamanders had a narrower range of suitable habitat, were found closer to breeding sites, and were more closely tied to deciduous forest, wetland habitat, and clay soils (i.e., Brookston Clay). Our evaluation of potential connectivity among breeding sites found that there was low likelihood of salamanders successfully dispersing among sites. This indicates that salamander populations on Pelee Island are largely isolated from one another and have low probability of genetic exchange. These findings should prompt conservation groups to prioritize the protection and enhancement of habitat between isolated populations to create dispersal corridors. This could be achieved by restoring deciduous forest and forested wetland habitat, and by constructing new wetlands in strategic locations between existing breeding sites. These endeavors would also benefit other rare species on Pelee Island.