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Cover photograph of Plains Hog-nosed Snake taken by Joe Crowley during the 2017 CHS conference field trip to Spirit Sands, Manitoba.

INSTRUCTIONS FOR AUTHORS

All submissions should be relevant to Canadian herpetofauna or other topics related to Canadian herpetology. Submissions by Canadian herpetologists about research or programs they have been involved with outside of Canada are also considered for publication. Please submit:

- Citations of recent (within the last 2 years) publications relevant to Canadian herpetology that have not already been listed in TCH. If the publication was "in press" in the previous issue, we will re-list it in the upcoming issue with the full citation information
- Abstracts of student theses (4th year, M.Sc., Ph.D.) that have not already been listed in a previous issue of TCH
- Feature articles on topics such as ecology, genetics, taxonomy, conservation issues, field techniques, recovery programs, etc.
- Field notes outlining the results of recent herpetological work
- News, announcements, job postings, collaboration opportunities or any other information that may be of interest to Canadian amphibian and reptile researchers and conservation practitioners
- Photographs and art
- Book reviews

Please e-mail your submissions as MS Word documents with photos attached separately as JPEGs to the Editors (jlitzgus@laurentian.ca or Joe.Crowley@ontario.ca).

EDITORIAL NOTES

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We're back! Did you miss us? We are excited to showcase the fall issue of TCH, full of awesome content. We missed producing the spring issue for several reasons, and have decided to produce the newsletter once/year for now, but have plans to discuss further at the Board level. One idea related to the future of TCH is highlighted by Dave Seburn in the Feature Articles section of this issue of TCH: Dave makes a call for submitting some of our herp research and natural history observations to the Canadian Field-Naturalist (CFN), as an alternate peer-reviewed venue that complements TCH. In fact, CFN is currently compiling a special herp issue in honour of one of the great fathers of Canadian herpetology, Dr Francis Cook. Please connect with Dave if you'd like to contribute to that special issue of CFN.

One of the greatest conservation successes in Ontario of the past year, in which CHS played a large part, was the ending the Snapping Turtle hunt. With a regular fishing license, it was previously possible to take Snapping Turtles (despite their at-risk status designation of Special Concern), with the minimal restriction of a daily bag limit. The MNRF proposed some changes to the hunting regulations, but the hunt would continue. A huge comment- and letter-writing campaign was instrumental in getting the attention of many stakeholders, and the arguments and data were respected, resulting in a complete ban on any harvesting of Snapping Turtles as of April 2017. Thanks to all of those in CHS that helped see this initiative through to a great conclusion.

CHS would not be what it is without the dedication and time invested by our Board members, who are all volunteers that hold "real jobs" on the side. Two of our Directors, Jean-François Desroches and Jonathan Choquette, stepped down from the Board this year. Jonathan has been our Secretary for the past few years, and has contributed to several important CHS initiatives and projects, and has also been instrumental in helping to keep the Board organized and on task. We are very happy to welcome Dr. Pamela Rutherford, this year's conference host and long-time CHS/CARCNET member, to the CHS Board. We'd also like to take this opportunity to give a shout-out to Dave Seburn who is the Chair of the Conservation Committee; although Dave is not technically a Board member, he has thrown himself fully into facilitating the activities of the Conservation Committee. For example, he has frequently sent out information emails calling for comments on herp recovery strategies, and he created an email list serve for those interested in participating on the committee.

In this issue, we are pleased to present a total of 3 Feature Articles, 3 Field Notes, plus the revitalization of our Book Review section with a contribution from Leslie Anthony about the newest edition of the Peterson Herp Field Guide. We are also excited to share with you the abstracts of our recently-graduated students, and publications by our colleagues from around the country. Some winter reading for you to enjoy while you hunker down by the fire dreaming of the first calls of Wood Frogs and Spring Peepers… sooner than later if Climate Change has its way.

MEETINGS

TCH will post announcements about upcoming herpetological meetings and provide reports of recently-held meetings.

Canadian Herpetological Society 2017 Conference and Annual General Meeting

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The 2017 Canadian Herpetological Society (CHS) conference and annual general meeting was held at Brandon University in Brandon, Manitoba from September 15-18. The conference started on the Friday with 55 people gathering for an opening reception at the Prairie Firehouse, a local pub and restaurant in downtown Brandon. In total, 75 people attended the conference with attendees from Vancouver Island to Nova Scotia, and all parts in between. There were even a few that attended from south of the border. It was a wonderful opportunity to reconnect with everyone, and share our research, conservation successes and conservation challenges.

The conference talks commenced on Saturday morning with a welcome from the Local Organizing Committee Chair (Pamela Rutherford), the CHS President (Joe Crowley) and the Brandon University Dean of Science (Dr. Austin Gulliver). The plenary sessions began with a stimulating presentation by our keynote speaker Dr. Christina Davy (Ontario Ministry of Natural Resources and Forestry, and Trent University), entitled "Collaboration, creativity and compromise - research around the 'rough edges' of reptile conservation". Dr. Davy challenged us all to reconsider some of our long-held paradigms and develop new strategies to improve our conservation effectiveness. Throughout Saturday and Sunday we enjoyed 26 contributed talks and 16 poster presentations. The poster session was held in the John E. Robbins Library at Brandon University.

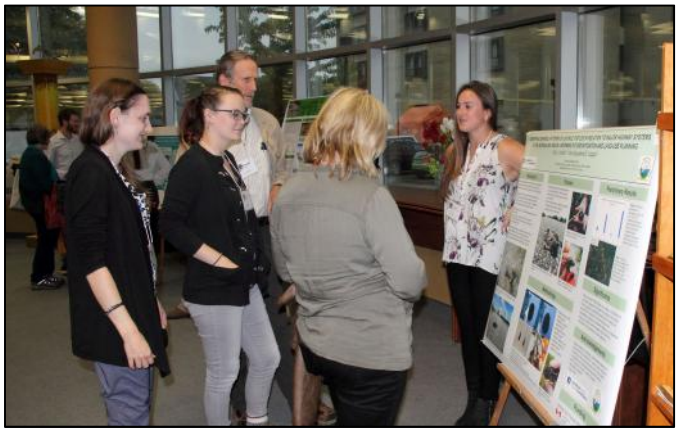
The CHS Annual General Meeting was held on the Saturday afternoon between the conclusion of the days' talks and the poster session. The AGM was kicked off by a short year-in-review presentation by CHS president, Joe Crowley. Joe also discussed the many ways that CHS members can become involved with the society, including participating on CHS committees, assisting with conference planning, nominating IMPARA sites, participating in CHS-led reviews of national recovery documents, and sharing information and resources with other members and the public through social media, e-mail and publishing in *The Canadian Herpetologist*. We heard updates from all of our CHS committees and learnt about a number of interesting projects that are underway. The Publications and Website Committee noted an unusually low number of submissions for recent issues of *The Canadian Herpetologist*, and initiated a discussion about potential future direction for the publication. Participants suggested a number of great ideas for the Board to consider, including the potential to create a CHS blog. Two members, Jean-François Desroches and Jonathan Choquette, stepped down from the CHS Board this year. An election was held for one new Board member, and Pamela Rutherford was elected to the CHS Board. Jose presented his annual financial report for 2016, and we were pleased to hear that the 2016 conference generated some proceeds and that the CHS's account was carrying a balance of $5,530 in December of 2016. The AGM

2017 CHS conference participants in Brandon, MB (Photo by Drew Hoysak)

wrapped up with a brief discussion about locations for the next few CHS meetings (see News and Announcements for details about future CHS meetings).

The conference banquet was held in Harvest Hall at Brandon University. Jonathan Choquette did a great job as our master of ceremonies (for the third year in a row - thank you Jonathan!), and kept the evening's activities on schedule. Our travelogue speaker was Dr. Sara Ashpole (St. Lawrence University), who entertained us with her many adventures in China in her talk entitled "When Walmart allows you to check off a species from your life-list." The World Congress of Herpetology was recently held in Hangzhou, China in August 2017. Sara spoke about the conference and other research activities that she had conducted throughout China. Sara's talk was followed by the annual awards ceremony, during which several individuals were recognized for outstanding research and conservation work in the field of herpetology (for details about the award recipients, see News and Announcements). A CHS banquette would not be complete without the CHS Quiz, during which Steve Marks put our knowledge of herpetology to the test with interesting and informative questions that inspired more than a few people to brush up on their Canadian species before next year's conference.

CHS Quiz, presented by Steve Marks (photo by Joe Crowley)



CHS poster session (photo by Joe Crowley)

The conference concluded on the Monday with a field trip during which 50 people visited Spruce Woods Provincial Park. This region is home to one of the few areas of sand dunes in Canada, and contains many unique plants and animals, including Northern Prairie Skinks and Plains (formerly Western) Hog-nosed Snakes. Our first stop was to a research site of Dr. Pamela Rutherford, and while the weather was cool we were able to see adult and newborn Northern Prairie Skinks, and Smooth Green Snakes. The benefit of the cool weather was that we had wonderful photographic opportunities. Normally, these animals are elusive so pictures in their natural habitat are challenging. We had lunch at the picnic area in the park, and were able to see a Canadian Toad and Red-sided Gartersnake in the nearby area. After lunch, we headed to the renowned Spirits Sands, where we first traveled to the dune face before breaking up into several smaller hiking groups. While all were aware that a Plains Hog-nosed Snake was possible, but not likely, the group was able to find a total of three Plains Hog-nosed Snakes throughout the afternoon! This species was a new one for many individuals and seeing several in one day was exceptional for all of us. The afternoon weather was

perfect, and participants were able to see the beauty of this region and appreciate all of the unique plants and animals that are in this habitat. Throughout the afternoon, folks were able to find most of the amphibians and reptiles in this region, including Red-bellied Snakes, baby Common Snapping Turtles, and Red-sided Garter Snakes. Everyone returned to the vehicles exhausted and thirsty but with many stories to tell. It was a treat to be part of this field trip and showcase this wonderful region in Canada. Many thanks to our tour guides and field trip organizers: Nick Cairns, Neil Gushulak, Allison Krause Danielsen and Pamela Rutherford.

A Prairie Skink that was observed during the CHS field trip (top); field trip participants exploring Spirit Sands (middle); field trip participants inspecting (admiring!) two Plains Hog-nosed Snakes (bottom) (photos by Joe Crowley)

A final thank you to Brandon University, the local organizing committee, CHS Board members, sponsors and participants. And, of course, big thanks go to all the presenters who took the time to share their work and experiences over the weekend. It was a successful conference, full of wonderful and inspiring people. Keep up the great work and we hope to see you next year in British Columbia!

FEATURE ARTICLES

Better Red than Dead?

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Even casual observations of the Common Gartersnake (*Thamnophis sirtalis*) reveal this species comes in a wide variety of appearances. Dark snakes with longitudinal, cream-coloured stripes may be considered the standard colouration (Fig. 1), but other individuals can be brown, tan, checkered, missing their dorsal stripe, or even all black. Several sub-species have prominent red bars above the lateral stripes; others have bright yellow-orange dorsal stripes; and the Puget-sound Gartersnake is often tinged with blue. Dashes of red, blue, or green hues may show on the membrane between the scales and become visible if the snake inflates in self-defense. One explanation for various colour morphs within a species is that different appearances offer different adaptive advantages. That is, one particular appearance may increase survival in one environment, while another appearance is more superior in a different environment. As a result, both colour morphs are maintained by positive selection for these appearances in the environments for which they are best suited. By contrast, the existence of different colour morphs may be driven by random genetic processes. In these cases, colour morphs may only represent the individual's random inheritance of a particular set of genes, and the resulting appearance coded by these genes confers no adaptive advantage to the individual. Are the forces maintaining this diversity of colour morphs within *T. sirtalis* rooted in adaptation (are certain appearances better in some situations?) or in random processes (do mutations coding for appearance simply get bounced around within the gene pool with no influence on survival)?

Studies designed to address exactly these questions have been carried out along the coast of Lake Erie,

where populations of Common Gartersnakes include a mix of "normal" looking individuals and a melanistic, or all-black, morph. The black phenotype is caused by a recessive mutation, but black individuals are more common in many of these coastal populations than would be expected for a recessive trait. As such, it is presumed that being black has unique benefits in this environment. One benefit might include being able to warm up faster in the spring when the cold lake creates an exaggeratedly cool environment compared to inland areas (see Rowell 2013, and references within, for a more thorough review). Many of the places these black garter snakes occur are on isolated islands or sand spits connected to the mainland by a narrow isthmus—a fact that may be important to the persistence of melanism. Because such narrow or non-existent connections to the mainland severely reduce access to mainland mates, the recessive melanistic trait may be less likely to be swamped by non-melanistic mainland genes. All this considered, this example elucidates that natural selection across different environments, and connectivity among these different environments, plays a strong role in dictating colour patterns in organisms.

Figure 1. “Standard” colouration of the Common Gartersnake.

A paper by Mooi et al. (2011) addresses the "remarkable variation and frequency of colour morphs" of the Common Gartersnake in central Canada; their work includes thorough coverage of the striking erythristic morph—a phenotype comprised of profoundly red individuals (Fig. 2). These red snakes are noted from the Abitibi region of northern Ontario, westward to south-central Manitoba, and the Montréal area (Bleakney 1959). These “flame” Gartersnakes typically sport crimson flanks, blackish upperparts, and a well-defined, cream-coloured vertebral stripe running the length of the body. Why such a conspicuous, intensely red morph of *T. sirtalis* persists in this region remains unknown. Presuming diet as an unlikely mechanism because neonates can be born intensely red, the authors suggest that gene flow, random genetic drift, and/or natural selection must explain the origin and persistence of the mutations(s) that produce these red individuals.

Figure 2. Erythristic Common Gartersnakes are striking animals. Their faces and flanks are crimson red, while the upper surface is charcoal-black with red interstitial dashes on the skin among the scales. The dorsal midline is delineated by a sharply-defined cream-coloured stripe.

Erythrism and random genetic drift

The gartersnakes at Mooi *et al.*'s study site and in the rest of Canada are relatively recent arrivals that expanded their range following the Wisconsin Glaciation episode (Barnett 1992). Is this red colour morph somehow associated with gene sorting during this northward range expansion? Mutations can "ride the wave" at the leading edge of a range expansion and such mutations may "reach a larger spatial distribution and a much higher frequency than would be expected in stationary populations" (Klopfstein et al. 2006; Hallatschek et al. 2007). Such a phenomenon can be considered "the founder effect in motion", whereby individuals at the edge of the frontier will produce offspring that will further the front of invasion, populating and establishing that frontier-genotype in new populations along the advancing wave. If a mutation coding for erythrism appeared in frontier-breaking garter snakes during their northward range expansion, these genes might have an exaggerated representation in populations that followed as the wave of colonization advanced. This perception might help to explain why erythristic individuals are noted in the north, but not the southern part of *T. sirtalis'* range. Although Placyk et al. (2007) considered *T. sirtalis* from

a phylogeographic perspective within the Great Lakes basin, their work did not sample from regions where the erythristic morph is known, and they did not measure signatures of genetic drift. That this erythristic morph is anecdotally described from the Montréal Island lends support that random genetic drift may play a role in its persistence because gene flow should be restricted in such an isolated place. However, the presence of erythrism in the Abitibi region of Ontario westward to central Manitoba may be more difficult to ascribe to this mechanism given the gene flow that would be expected to occur across the apparently-contiguous range of garter snakes in this region.

Erythrism and non-random natural selection

Because bright red hues are generally conspicuous to predators (Ruxton et al. 2004), it is surprising that these profoundly red garter snakes were not snubbed out of the gene pool given that predators should find them more often than cryptically-coloured morphs. This may suggest natural selection works to keep erythristic individuals in the gene pool. With the exception of anecdotal reports from the Montréal area, these intensely erythristic *T. sirtalis* appear limited to boreal climates. A reasonable presumption that follows this observation is that life in boreal environments might be what promotes the presence of erythrism (Fig. 3). Gartersnakes operating relatively farther north might be expected to face greater challenges with growth and reproduction given their thermally-limited environment. In their work on the plains garter snake (*T. radix*), Tuttle and Gregory (2012; 2014) demonstrated that northern snakes did not necessarily underperform southern snakes—a fact that they partially attributed to "effective thermoregulation". That is, these northern garter snakes may rearrange their time-energy budgets to permit more basking than would a more southerly snake, and by extension arrive at equivalent achievements. While an increase in basking may allow northern garter snakes to achieve similar levels in reproduction and growth to more southerly snakes, it would also lead to a lifestyle where a high level of exposure was a necessity. If exposure is unavoidable, such snakes might be pressed to develop ways that mitigate the increase in predation attempts that result from an increase in exposure. Many North American snakes mitigate predation attempts through a Batesian Mimicry strategy, whereby mimetic species of snakes look very similar to a truly venomous model, such as the coral snakes of the genus *Micrurus* (Davis Rabosky et al. 2016).

It may seem outlandish to consider these erythristic gartersnakes as mimetic of coral snakes since gartersnakes are generally longitudinally striped, rather than banded like *Micrurus*. Some gartersnakes may appear loosely banded when the skin is stretched to reveal angularly-arranged dashes of colour, but even in this context, *T. sirtalis* can hardly be considered truly banded. However, findings from Kikuchi and Pfennig (2010) demonstrate this may not particularly matter since limitations to predator cognition permit imperfect mimicry and that in some scenarios imperfect mimics may be under little or no selective pressure to improve. Potential pattern mismatches between *T. sirtalis* and *Micrurus* aside, it may also seem outlandish that red gartersnakes from boreal North America could be coral snake mimics given that *Micrurus* is only found in sub-tropical and tropical regions. However, studies analyzing sympatry between mimics and their models reveal counter-intuitive results which demonstrate mimics are most similar to their model where their model is rare or absent (Pfennig and Mullen 2010). Grasping why this occurs is rooted in considering the probability that a given predator might encounter the truly venomous model. Where the model occurs, mimics can afford to be crude because a high encounter rate with the model selects for extreme avoidance of even the most approximate lookalikes in a would-be predator. In areas where the model is rare or absent, the encounter rate with the model is low or zero so predators are under very low selective pressure to avoid any semblance of the model's patterning. Accordingly, only the very best mimics—by bearing extreme resemblance to the model—are afforded *any* protection in places where the model is rare or absent (Harper and Pfennig 2007). This phenomenon received stunning support when Akcali and Pfennig (2014) demonstrated that mimicry improved in a mimetic species after its sympatric model became locally extirpated. That three species of mimetic *Lampropeltis* are found various distances between 600 and 1500 km from the closest populations of *Micrurus* also lends strong support for this concept. In summary, the absence of a venomous model is not reason to discount a mimetic lifestyle in snakes, and resemblance to a model should be highest where the model is rare or absent.

It may not matter that there are no coral snakes in the boreal forest since Broad-winged Hawks (Fig. 4), Northern Harriers, Red-tailed Hawks, American Kestrels, Sandhill Cranes, and Great Blue Herons are migratory birds that breed in boreal regions, eat snakes, and spend their winters in tropical areas within the range of *Micrurus* (Powell et al. 2016; Sibley 2014). Presumably these birds' fear of red or banded snakes would be transferable across landscapes. Assuming the former, it is not so unlikely that these migratory birds of prey would apply a selective pressure on gartersnakes

that would leave more erythristic individuals alive than more cryptically-coloured individuals. This could lead to exaggeratedly redder individuals in cold climates where an increase in snake basking combined with selectivity by the birds could lead to a red morph of *T. sirtalis* that was effectively mimetic of *Micrurus*. Though a far cry from some of North America's incredibly precise *Micrurus* mimics, these erythristic gartersnakes could be best mimetic phenotype *T. sirtalis* can manage given a contiguous range and gene flow with southern snakes under different selective pressures.

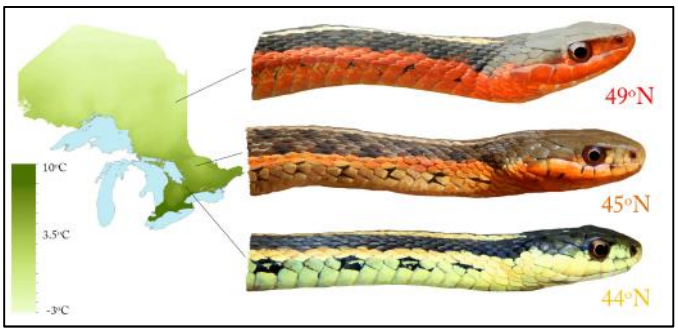

Figure 3. Does life in a colder environment promote erythrism? With the exception of the Montréal area, profoundly erythristic gartersnakes are known from boreal regions in northeast Ontario and [probably continuously to?] central Manitoba. Erythristic snakes appear absent from the southern range, but "standard" morphs are present in northern regions where erythrism is present. Erythrism may also be clinal, given that some mid-latitude snakes show red-orange colouration that is more intense than that of southern snakes but less so than true erythristic snakes from the far north. The green scale bar represents average annual temperature in degrees Celsius.

Adaptive or random?

Speculations on genetic drift and natural selection need not be considered exclusively; the origin of erythrism may be rooted in random genetic drift and maintained by natural selection, or vice versa. In fact, rapid phenotypic changes are associated with range expansions and both random genetic drift and directed natural selection have meaningful roles in this regard (Bittner and King 2003; Swaegers et al. 2015; Noguerales et al. 2016).

Could an exaggerated need for basking in boreal regions leave gartersnakes more susceptible to predation? If at least some of these predation pressures were inflicted by migratory birds with a fear of red snakes, might that be a cause for the high-latitude red-morph *T. sirtalis*? Speculation aside, the only way to truly assess this would be through a series of tests of exacting design. Do northern gartersnakes spend more time basking than southern gartersnakes? Or in more exposed positions? If so, does this lead to an increase in predation attempts compared to more southerly populations? If so, do redder snakes receive fewer predation attempts than less red snakes? Is avoidance of red snakes biased toward migratory birds that spend winters in landscapes with *Micrurus*? If so, which bird species encourage red morphs most? The tools needed to address some of these questions could include time-energy budget analyses, outdoor cages to observe basking tendencies, snake models made of artificial materials of varying colour, motion-sensor remote cameras to capture predator-model interactions, and even computer-generated niche models that elucidate range overlap among red morph gartersnakes and different bird species. If these tests don't receive support, mechanisms investigating genetic drift and its role in the northward post-glacial expansion of *T. sirtalis* might be investigated. Genomic samples paired with simulations of range expansion might elucidate if areas with erythristic gartersnakes match areas expected to exhibit significant carryovers from genetic drift.

Figure 4. Broad-winged Hawks (*Buteo platypterus*) breed in temperate and boreal regions of eastern Canada, eat snakes, and spend their winters in landscapes where venomous coral snakes (genus *Micrurus;* shown) can be found. If they have a fear of red snakes and exert selective pressures on snakes while hunting on their breeding grounds, could this elicit a mimetic strategy in Canadian gartersnakes?

Figure 5. "Hudson Bay Toads" (bottom) are well-marked by definition, and some individuals display red, orange, yellow, white, and black markings that could be taken as aposematic. Many tropical anurans (like *Atelopus varius*; shown at top) exhibit these same universally-recognized colours to warn predators of their toxicity.

Better red than dead?

Given the questions outlined above, collecting evidence to support or refute the ideas herein would be arduous and time-consuming. Before committing to the time and effort needed to test these ideas, one might look to build confidence on the matter by looking for an analogous system where this same string of logic would predict a similar outcome. The gartersnake complex on the Pacific coast (e.g. Janzen et al. 2002) include *T. s. concinnus* and *T.s. infernalis* which qualitatively look like *Micrurus* mimics and might offer more support that *Thamnophis* can indeed achieve mimetic phenotypes. Another such system might occur with American Toads (*Anaxyrus americanus*) in the Hudson Bay regions of Ontario and Quebec (Fig. 5). This local "morph" has been described as the subspecies "*Bufo americanus copei"* (Ashton et al. 1973; Yarrow and Henshaw 1878), though Green (1996) points out that species-species distinctions in this group are difficult enough to formalize, let alone colour morphs within a species. Regardless, these "Hudson Bay Toads" are distinctively marked with black, red, and white blotches and stripes and recall an aposematic appearance—colours that predators of tropical anurans universally avoid (Richards-Zawacki et al. 2013). Tests similar to the ones described above for gartersnakes might elucidate if an increased need for these boreal toads to bask elicits a Batesian (or even Müllerian!) Mimicry strategy that emulates toxic models from the tropics.

Canada's herpetofauna has a recent, post-glacial origin. The distributions of Canadian species reflect their post-glacial invasion of this landscape, and their genomes have been shaped and sorted by this history and these journeys. The Common Gartersnake may be an ideal organism to investigate how genetic drift and natural selection interplayed across this saga since this snake's distribution spans Carolinian and high-Boreal landscapes, and it displays a multitude of phenotypes. Questioning what forces explain the origin and persistence of erythristic gartersnakes may offer insight into how genotypes and phenotypes relate across regions, time, range expansions, and contractions —and, it just may clear up if, at least in some cases, it is better to be red than dead.

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Secrecy or Transparency with Herpetological Data

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A contemporary trend in most governmental and non-governmental agencies is to be as transparent as possible with information and data while respecting personal privacy. That being said, we live in a time where we are often under video surveillance and our electronic communications are monitored. This activity no doubt promotes public safety but it is somewhat uncomfortable knowing that “Big Brother is watching” (Orwell 1949). A similar dilemma exists in scientific communications. We are expected to be honest and accurate so that readers can completely understand, scrutinize, and replicate our work. However, scientific publications can also help poachers to locate wildlife (Stuart et al. 2006, Lindenmayer et al. 2017). The

question of how secretive to be with data to protect herpetofauna in general, and especially species at risk, is one that most field biologists, graduate students, and resource management staff need to deal with on a regular basis. Concerns about illegal collection of reptiles at Point Pelee National Park in the past resulted in cameras that caught no poachers but occasionally revealed researchers relieving themselves in the woods. While we try to make certain human activities more transparent, we tend to shroud activities of other species in secrecy, especially species-at-risk.

Concerns also exist to protect the privacy of landowners. Over the past four decades, I have established agreements with many private landowners, resource managers of protected areas, and managers of companies, to access their lands to conduct herpetofaunal surveys. I typically explain that our work is for non-profit scientific research purposes to create knowledge that can be used to educate people and help conserve the species. The range of concern regarding use of data from or regarding their properties varies widely.

We have had a few interesting hostile “get off my property” experiences, occasional invitations to “come on in for a coffee”, and some “go ahead I don’t care what you do as long as you don’t damage anything” responses. Once a rural landowner seemed overly friendly after I introduced myself and wanted me to come inside until I introduced my field assistant and spouse. She then lost interest in being surveyed! The opposite reception occurred once when we accessed a remote conservation area in the wee hours via a farm lane that had been illegally closed. We were approached by a shotgun-toting farmer on an ATV who asked “What the hell we were looking for?” To which I replied “Looking for the pond to do a frog survey”. His response was “Yeah, right; now tell me what you are really looking for”. We somehow convinced the fellow that we were indeed herpetologists but he continued to check on us during subsequent visits. Years later we discovered that the fellow had become a guest of her majesty for operating a large-scale illegal crop growing operation. In some areas, the first question we get is “Are you government?” These come from landowners who had bad experiences in the past after allowing surveys of their property that resulted in their land-use being restricted. However, most private residence owners and farmers in Canada understand the importance of amphibians and reptiles on their properties and have a sincere interest in conservation and education. We always assured our hosts that data derived from their properties remains in our own privately held databases and that we never give out specific detailed location information to other parties without permission. Recently, this has become a problem as journals often want datasets published. Most landowners nevertheless tell us to use the data how we best see fit. The vast majority of our experiences have been very reassuring about the genuine good nature of most people and we have forged many friendships with our hosts over the years.

Managers of government properties and protected areas have nearly always been very helpful and realize that the information we gather comes from publicly-owned lands. Once we were surveying in a national park and picked up fresh road-killed anurans. A colleague of ours analysed the specimens and found that they were highly contaminated with DDT, DDE, and other toxins (Russell and Hecnar 1996, Russell et al. 1999). We informed the park managers that they had an urgent problem. They brought in their own scientists who duplicated the analyses corroborating our results and immediately began taking measures for public and staff safety. While the necessary remediation was major and expensive, the park was grateful that we brought the issue immediately to their attention and they cooperated fully providing information for our reports and publications in the interest of health and safety, and respecting our intellectual property rights.

Quite the opposite occurred another time, when I was denied access to survey wetlands on a regional hospital property. The reason given was that if anything harmful was detected on their property they would not want the information getting into public hands. Hearing this from an institution whose primary role is human health care was particularly disturbing. This case was especially ironic, as my home institution provided the land for the hospital, leveraging development of a medical school. Personally it was a disappointment because of my efforts serving on the site development committee to design the hospital grounds with green spaces and wetlands that promote healing while simultaneously conserving natural habitat so that health of wildlife was not harmed.

Like most of my colleagues who conduct field surveys, I pass my records on to the landowners and ultimately to provincial herpetofaunal field atlases. For private landowners, I provide approximate coordinates that place the point within a map square but not identifying the property per se. Atlas projects such as Ontario Nature’s Reptile and Amphibian Atlas (ORAA) then typically report locations on a 10 km^2 grid for privacy but still facilitating distribution mapping. The exception being for two particularly sensitive species, the Wood Turtle and Spotted Turtle, for which the ORAA does not produce range maps at any resolution.

Two turtle species that are threatened by illegal collection in Canada, the Wood Turtle (top - juvenile) and Spotted Turtle (bottom) (photos by Joe Crowley)

Species at risk (COSEWIC or COSSARO) location data are considered sensitive, so data are sent to the Ontario Ministry of Natural Resources and Forestry's Natural Heritage Information Centre. The reason for secrecy regarding precise locations of species is to reduce illegal collection and other types of human disturbance. This, I have been told is especially important due to staff and budget reductions for enforcement. For example, a couple of years ago we found baited minnow traps modified to capture game fish in two ponds we were monitoring on a conservation area. We could not access the authorities as it was a weekend and left a message on a tips phone line. We were contacted for additional information two months later. I understand the argument but wonder if a more transparent policy would be more effective. Point Pelee National Park highlight's the presence of the endangered Five-lined Skink as an umbrella species. They don't provide precise details on skink location or microhabitat, but informing the public has brought more well-meaning eyes into the field when enforcement resources are challenged. Almost every time that I am working in the park, visitors report seeing a big hairy guy flipping logs who is probably looking for reptiles.

Being chair of the Important Areas for Reptiles and Amphibians program (IMPARA) for CHS, I sometimes hear concerns that we should not list presence of species at risk in areas under nomination. I understand these concerns but seriously wonder if more transparency and more eyes of concerned naturalists in the field may better protect all species, not just species at risk. More transparency through education also helps to foster interest and concern about wildlife in young people and the public in general helping to fight the increasing trend of nature deficit disorder (Louv 2005).

It remains unclear if secrecy regarding wildlife locations in scientific communications functions as intended. It may in fact, reduce quality of scientific communication for future researchers ultimately impeding conservation efficacy. Those who apply to the government to gain access to sensitive data for use in their research soon find that the burden of proof is now being placed on the innocent. The trend of hiding information almost seems like a step towards eliminating misdeeds before they can even be imagined (Dick 1956). The worst-case scenario occurs when agency archives lose data entrusted to them for safekeeping. This occurred with data on endangered skinks twice in my career. Considering that population declines and threats to amphibians and reptiles in Canada mirror the global situation (Lesbarrères et al. 2014), the issue of secrecy versus transparency, and access to information on herpetofaunal species at risk, is an important matter that needs to be considered.

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Why You Should Publish in the Canadian Field-Naturalist

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There are many research projects or studies that just aren't big enough for the major scientific journals. Maybe the sample size is limited, the results are not bold and exciting enough, or the study concerns basic natural history. Few journals accept articles based on natural history of species, and yet this information is often valuable in developing recovery actions for species at risk. What does the species eat? What kind of habitat does it use for nesting, or overwintering? How many eggs does it lay, what percentage are fertile, and how long does it take for the eggs to hatch? What are the effects of drought or flooding on behaviour? Often these details remain unpublished and can't benefit others working on the same or related species.

One journal that accepts natural history research in herpetology is the Canadian Field-Naturalist (CFN), which has been published continuously since 1879 by the Ottawa Field-Naturalists' Club. It is a peer-reviewed journal publishing articles on ecology, behaviour, taxonomy, conservation, and other topics relevant to Canadian natural history. CFN publishes papers on amphibians and reptiles every year and even has an associate editor for herpetology. Currently it is Dr Ron Brooks, Professor Emeritus at the University of Guelph. Ron needs no introduction to most herpetologists, but for younger members who aren't aware, Ron was the leader of the Algonquin Park turtle project, based out of the Wildlife Research Station, for decades. He supervised an army of graduate students who worked on a wide variety of species including anurans, salamanders, Musk Turtles, Painted Turtles, Snapping Turtles, Spotted Turtles, Blue Racers, and Eastern Foxsnakes.

In other words, CFN has a long history of publishing amphibian and reptile papers and is ready for yours. Full disclosure: I am not neutral on the topic of CFN, as I am on the publications committee. I do want your articles to go to CFN, but more importantly I want to see your data published anywhere, not languishing in your old field book or on your hard drive, where they benefit no one.

CFN has published amphibian and reptile papers on a wide variety of topics. A sampling since the year 2000 includes papers on amphibian introductions (Warkentin et al. 2003), amphibian decline (Seburn et al. 2008, 2014), colour variants (Gilhen 2010, Gilhen and Scott 2014, Moore and Ouellett 2014), diet (Mahoney and Lindeman 2017), exotic species (Seburn 2016), habitat use (Wilkinson et al. 2007, Seburn 2010, Dixon-MacCallum et al. 2017), mortality events (Catrysse et al. 2015), nest predation (Riley and Litzgus 2014), northern herpetology (Slough and Mennell 2006, Reiter et al. 2008, Desroches et al. 2010), range expansions (McAlpine et al. 2009, Weller 2009, Desroches et al. 2006), reproductive biology (Gilhen and Strum 2007, Wright 2008, Randall et al. 2014), road ecology (Haxton 2000, Fortney et al. 2013, Choquette and Valliant 2016), spatial ecology (Schuler and Thiel 2008, Paisley et al. 2009, Imlay et al. 2016), species interactions (Moldowan et al. 2015), survey methods (Moore 2009, Flanagan et al. 2013), tail breakage (Bowen 2004), and unusual predation events (Olson 2006, Vanderhoff 2007, Halliday 2016).

Here are some additional compelling reasons for publishing in CFN:

- CFN has a high acceptance rate. Many journals inflate their "impact factor" by rejecting solid papers just because they are not on a currently hot topic. CFN believes in publishing solid research and competent natural history observations that have value in the long term.
- Publication in CFN can be free of charge for authors lacking institutional funds. Page charges in many journals can be high and this can deter some researchers from publishing their results.
- Papers in CFN are freely available to read. Some journals maintain exorbitantly priced paywalls around all their articles. CFN places the latest four issues (1 year) behind a paywall, to provide an incentive to subscribing to the journal (online subscriptions are only $40/year), but previous articles can be downloaded free of charge as PDFs.
- Papers in CFN are widely cited. Haxton (2000), a paper on Snapping Turtle road mortality, has been cited more than 100 times, and Ashley and Robinson (1996), a seminal paper on road mortality along the Long Point causeway, has been cited over 370 times. Most papers don't rack up these kind of citations, but papers published in CFN are not overlooked.

In addition, CFN is currently assembling a special herpetological issue to honour Dr Francis Cook, the distinguished herpetologist, and former editor of CFN.

Francis literally wrote the book on amphibians and reptiles of Canada: the classic Introduction to Canadian Amphibians and Reptiles. If you are interested in contributing a paper to this special issue please contact me by email to see if there is still space available.

Anyone who has spent time in the field studying a species has seen interesting things likely unrelated to the main purpose of their study: the types of nest site locations, the kinds of wetlands used for hibernation, or unusual home range size. CFN is a great outlet for some of those observations or side projects. Taking the time to write up those notes can help flesh out your resume and ensure the results are not lost.

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FIELD NOTES

Managing an Ecological Trap in a Partially Mined Peatland in Southern Ontario

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Reptiles require environmental cues such as temperature and moisture gradients to locate suitable habitats to complete their annual life cycle. Anthropogenically-altered habitats, including partially mined peatlands, agricultural fields, and road surfaces, mimic these cues and attract such temperature-dependent animals (i.e. ectotherms). However, these altered habitats can act as an ecological trap where such habitats can leave individuals exposed to predators and unfavourable abiotic conditions like extreme thermal fluctuations, ultimately causing an increase in mortality risk. Ecological trap theory suggests that the continued presence of a trap will drive populations to extinction (Battin 2004). Using my study site, a partially-mined peatland, as a basis for this theory, I have collected supporting evidence since 1998 (Yagi M.Sc. Thesis). Such evidence includes results from radio telemetry and mark-recapture studies, thermal selection studies (Yagi and Litzgus 2012; 2013), assessments of wintering habitat conditions (Fig. 1), and continuous mortality observations after wildfires and harsh winter conditions (Yagi and Planck 2004; 2008; 2012; Yagi and Planck, unpublished data). The next phase of this project is to work with partners to continue to monitor these populations, determine refugia needs for turtles and implement optimal hibernacula selection (Yagi and Tattersall, unpubl. data) for various snake species until the ecological traps are mitigated and the species-at-risk populations are recovering.

Acknowledgments

Long-term projects involving complex ecosystems are challenging to study. After nearly 20 years, this project is just now beginning to come together and I hope will contain valuable information for years to come. I wish to thank those people in my life that

encouraged me to “stay the course”; my husband Kevin Yagi; my mentor and friend Dr. Roy Jonathan Planck, my former supervisor and manager Joad Durst and Ian Hagman, Dr. Gordon Ultsch, Dr. Glenn Tattersall and Dr. Jackie Litzgus. My field technicians, Rob Tervo, Devin Mills, David Denyes, Katharine Yagi, Amy Parks (nee Brant), Michelle Karam (nee Martin), Cathy Blott, Olivia Groff, and Luke Gray. Finally this project would not be possible without the support of our partners, Ontario Ministry of Natural Resources and Forestry, Niagara Peninsula Conservation Authority, Ontario Species at Risk Recovery Fund, Environment Canada-Habitat Stewardship Fund, Laurentian University and Brock University.

Figure 1. Successful “forced hibernation” of two neonatal snakes.

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Yagi A.R and G. Tattersall (in prep) Forced hibernation: a technique to ensure overwinter survival of neonate temperate snakes.

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Ojibway Prairie Reptile Recovery (OPRREC)

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Spring came early this year down at the Ojibway Prairie in Windsor, Ontario. We had our first Massasauga observation on the 10th of April (the earliest observation on record for this population). The small 'Ojibway' population of Massasaugas survived the winter, and as of May 1st we have made 11 observations of 5 individuals (2 adults, 2 sub adults and 1 juvenile). With an estimated total population size of 15 snakes, extirpation is only a matter of time. A permit application to begin long term population augmentation was submitted to the province this past March. I will keep you all posted on our progress.

Snapping Turtles Hatched from Eggs Salvaged from Road-killed Females

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On 16 June 2017, Erinn Lawrie and Rhiannon Moore of the Lake Huron Centre for Coastal Conservation recovered 2 large female Snapping Turtles from the road that had been hit and killed by motor vehicles. Their two clutches of eggs were recovered and a total of 26 eggs were incubated by Jory Mullen (SAR biologist with the Huron Stewardship Council), an authorized wildlife custodian. Of these, 8 hatched and were released by Erinn into the Saugeen River in Paisley, Ontario. It was a happy moment releasing them into the wild!

Hatchling Snapping Turtles that were salvaged from road-killed females and released (photo by Erinn Lawrie)

BOOK REVIEWS

This section of TCH includes reviews of not just books but other vehicles for the dissemination of information that might interest Canadian herpetologists.

Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America

Robert Powell, Roger Conant, Joseph T. Collins
Houghton Mifflin Harcourt 2016. 494 pp.

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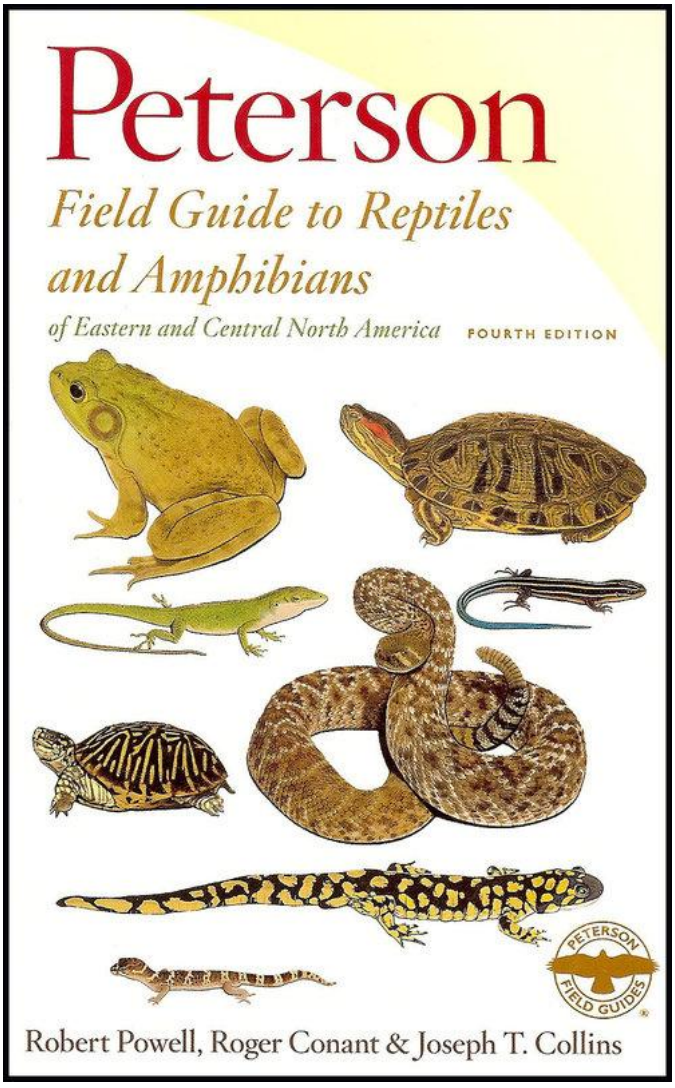
There are many field guides out there, but there's a reason the Peterson series remains the best-selling collection of all time. There was nothing quite as indispensable to a young herpetologist living east of the 100th meridian as the Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. The First Edition was released in 1958, but the one I eventually bought and clung to was the much-expanded 1975 Second Edition that featured 574 taxa and included more territory—all of Texas and North Dakota plus the states between, as well as northward through Manitoba and "Keewatin" (eventually incorporated into Canada's Northwest Territory, and now Nunavut). I never picked up on the 1991 Third Edition because by then I also had a photo-based Audubon guide, which I considered more useful in some respects. But I think that assessment did a disservice to the Peterson book, and I was happy to get hold of a Fourth Edition to reacquaint myself with Isabelle Hunt Conant's marvellous and timeless illustrations (even if one complaint about the volume is that these have been reduced in size to accommodate coloured reference tabs on page edges).



The 2016 Fourth Edition reflects 25 years of changes in our knowledge, and includes descriptions of 122 newly recognized species (including recently established non-natives), updated maps, and new figures and photos. Colour illustrations and drawings continue to highlight key details for accurate identification. Over a hundred colour photographs and 322 colour distribution maps accompany species accounts that provide key characteristics, comparisons with similar species, and descriptions of habitats and ranges, as well as subspecies, voices, and conservation status (of note is that most of the trademark behavioural descriptions have been dropped to accommodate so many new critters—another reader-voiced complaint).

Lead authored by Dr. Robert Powell, professor of biology at Avila University in Kansas City, Missouri, the volume retains the name of its original author—the late Roger Conant, director and curator of reptiles at the Philadelphia Zoo—as well as its updater, the late Joseph T. Collins, founder and director of the Center for North American Herpetology. The book continues to be sponsored by the National Audubon Society, the National Wildlife Federation, and the Roger Tory Peterson Institute.

Although a revision was timely and much-needed, one can always expect good and bad when changes of such magnitude must be incorporated. Some negatives are referred to parenthetically above. Other reviewers have noted that if Texas—which also appears in the companion western field guide—were dropped from the eastern version, it would eliminate 40 taxa that only occur there, making it unnecessary to reduce the size of descriptions for the remaining species. I concur on that account, adding my lament to the loss of behavioural information, as well as the fact that more invasives could—or should—have been added (maybe they need their own field guide at this point). On the positive ledger, a lot of taxonomy has been updated, most of the new photos are helpful, and the clearer, more colourful, more detailed range maps moved from an appendix at the back (in the 1975 edition) to go with their respective species accounts (in the 1991 edition) have been retained—in some cases even more detailed. Distributions for Canadian species are, for the most part, correct or close to it (one sour though understandable note: ranges for unisexual complexes of Ambystomatid salamanders are woefully inadequate and fundamentally incorrect).

Despite a few hiccups, the Fourth Edition is nevertheless a welcome improvement, and thus the Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America remains a crucial resource for professional and amateur herpetologists, naturalists, outdoor enthusiasts, and students.

THESIS ABSTRACTS IN CANADIAN HERPETOLOGY

TCH publishes abstracts of recently completed Honours, M.Sc., and Ph.D. theses from Canadian universities and professors. Students or their supervisors are invited to send abstracts to the Editor.

Binns, A.E. B.Sc. 2017. Laurentian University (Supervisor: J.D. Litzgus)

The skinny on snake stress: Does working in outreach programming negatively impact snakes?

Growing concerns regarding the environment have created a focus on education about the natural world. While there are many variations of environmental education, current studies suggest that hands-on learning may be critical for long-term retention of curriculum content. Hands-on and experiential learning are tools often used in outreach education, which include exhibits, guides, and demonstrations with live animals to enhance learning. There are many benefits to using live animals in outreach education; however, it is important to understand the impact of this programing on the animals being used. The purpose of our study was to examine the effect of working in outreach programs on proxies of stress in colubrid snakes. We hypothesized that if snakes were stressed by working in outreach programs, then as a snake's number of hours worked increased, its feeding frequency and overall body condition would decrease. Because body condition and feeding frequency are both factors that correlate with stress responses in vertebrates, we measured body condition (median of residuals of a regression of mass over length) and feeding frequency in three groups of snakes (control n=4, low work n=10, high work n=3) over an 11-week period. In contrast to our predictions, we found no relationship between number of hours worked and body condition, and no relationship between number of hours worked and feeding frequency of the study snakes. These results indicate that snakes may not be stressed by working in outreach programing, but our study was limited in sample size and duration. Future work should include a focus on habituation and assessments of variation in husbandry and its effects on chronic versus acute stress in an outreach setting.

Dillon, R.M. B.Sc. 2017. Laurentian University (Co-supervisors: S. Boyle and D. Lesbarrères)
Willingness to utilize mitigation tunnels by Eastern Gartersnakes.

Human activity has been strongly linked to the declines of herpetofauna populations. The effects of roads on herpetofauna have become increasingly well studied and are considered of critical importance to reptile conservation. Roads are not only a source of direct mortality, but also fragment landscapes, affect gene flow and spatial ecology. Attempts to mitigate these threats commonly include fencing to prevent wildlife from accessing the road and ecopassages to provide safe crossing points. Mitigation is often species-specific but the dynamics of mitigation success and species-specific responses are poorly understood. The Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) is commonly killed by cars so we conducted a willingness to utilize (WTU) experiment with this species in order to understand their behaviours when interacting with ecopassages. Snakes collected in Presqu'ile Provincial Park, ON, Canada, where ecopassages had been recently installed, were used in two arena trials. First, the snakes were exposed to an enclosed arena and were given options to move through the tunnel or stay in the arena. Second, snakes were exposed to an open arena allowing them to bypass the tunnel if they chose or move through the tunnel. All snakes were willing to use the tunnels when given no other options, but when given a choice, 58.8% chose to use the tunnel, while the rest bypassed it. This indicates that there is neither aversion nor preference to using the tunnels. Across trials, mean time to decision was ~1 min and mean time to successfully cross the tunnel was ~3 min, though significantly shorter in the second trial, possibly showing a learning behaviour. Analyzing how specific species interact with mitigation infrastructure broadens our understanding of how connectivity structures facilitate gene flow and access to critical resources, and ultimately increases our ability to mitigate road effects successfully.


Eastern Gartersnake (photo by Joe Crowley)

Edkins, T. M.Sc. 2017. University of Regina (Co-supervisors: C.M. Somers and R.G. Poulin)
Variable habitat selection and space use among bullsnake (*Pituophis catenifer sayi*) populations: distance between seasonal habitats drives space use.

The spatial distribution of resources determines space use and habitat selection by snakes. Particularly in northern areas, the proximity of overwintering den sites to summering habitat likely influences space use. The resources driving seasonal migrations among habitats may vary among populations and thus, space and habitat requirements may also vary. In addition, human modification may affect resource use by altering available habitats and resources. Although previous studies have reported differences in spatial ecology among populations, the driving factors of this variation remain to be addressed for many species. Bullsnakes (*Pituophis catenifer sayi*) reach their northern range limits in southern Saskatchewan, where they are currently listed as Data Deficient. Many studies have focused on core range areas, while northern studies have focused on one population in the Frenchman River Valley, Saskatchewan. The habitat and space requirements identified in these previous studies, however, may not be relevant to all Bullsnake populations.

My thesis examined Bullsnake space and habitat use among independent populations in three river valleys (Frenchman River, South Saskatchewan River, and Big Muddy Valleys) in Saskatchewan, with varying habitats types (natural and anthropogenic) and availability. I tracked Bullsnakes using radio-telemetry, estimated home range areas and movement patterns, and measured third and fourth order habitat selection. The objectives of my research were (1) to examine the extent to which habitat selection and space use may vary among populations and (2) to identify important habitat features in common among snakes from different populations.

Saskatchewan Bullsnakes demonstrated variable space use and movement patterns among populations, exceeding space use requirements previously observed in southern areas. One population (in the Big Muddy Valley), on average, used 2.7 to 3 times less space, travelled 2.3 to 2.7 times shorter distances from overwintering sites, and had greater home range overlap than snakes from the other populations (Frenchman and South Saskatchewan River Valleys). This suggests that Bullsnakes in the Big Muddy Valley had a close spatial association between seasonal habitats.

Bullsnakes appear to be flexible in terms of their third order habitat selection. Native habitats were used as expected across all valleys, but human-modified

habitats were used at different frequencies across populations. These differences in habitat selection among populations are most likely due to differences in habitat availability among landscapes. Fourth order habitat selection, however, was similar among populations, with Bullsnakes selecting for sites typically within 1 m of a refuge site (including burrows, cement pads, and rock piles).

Overall, it appears that Bullsnakes occupy variable sized home ranges and move variable distances to meet resource requirements. Bullsnakes also appear to be flexible in terms of how they meet resource requirements across their geographic range via habitat selection at a broad spatial scale. My study did find, however, that at a fine spatial scale refuge sites are an important habitat feature for Bullsnakes. Conservation and management strategies are typically broad and assume populations of the same species have similar habitat requirements. However, my results indicate that this is not the case and thus, management plans may not be applicable to all populations.

Marchand, K.A. M.Sc. 2017. University of Regina (Co-supervisors: C.M. Somers and R.G. Poulin)
Movement, habitat selection, and resource use by western painted turtles (*Chrysemys picta bellii*) in an urban environment near their northern range limit.

Understanding resource use is necessary to properly manage and conserve habitats for long-lived species, especially for populations residing urban settings. I studied habitat selection, space use, and isotopic resource use of an urban population of Western Painted Turtles (*Chrysemys picta bellii*) residing in Wascana Creek in Regina, Saskatchewan from May 2015 to April 2017. Using radio-telemetry to track movements, I determined habitat selection at multiple spatial (Johnson's second and third order habitat selection) and temporal scales (active season; encompassing emergence, nesting, and post-nesting) using compositional analysis. I found that turtles selected for shoreline habitat over urban/parkland and open water (second order). The characteristics of the selected shoreline (third order) varied between habitat areas; however, they did not substantially differ across the active season. Within creek habitat, turtles chose shoreline habitat randomly. Within marsh habitat, turtles selected for particular shoreline features, preferring treed shoreline across all three periods of the active season. Across the active season, both male and female turtles moved significantly more during emergence than during nesting and post-nesting periods and movements were larger in marsh habitat than creek habitat. Suitable overwintering locations were limited within the study area, and were warmer and deeper than those randomly available, likely ensuring that their overwintering locations did not freeze. There was no significant difference in the dissolved oxygen level between used and available overwintering sites.

I measured stable isotopes of carbon and nitrogen from nail samples to examine isotopic resource use within and among the populations in two habitats (marsh and creek). Isotopic niche size varied across the population as a result of variation in body size, sex, and location. Isotopic niches overlapped between 26-77%, with the least overlap between males and females. This indicates that although Western Painted Turtles are generalist omnivores, there is indication of distinct isotopic resource use by subgroups. By comparing the isotopic values found in the turtles to those found in prey using a Bayesian Mixing Model analysis, I found that all turtles consumed low proportions of a wide variety of potential prey items, but there were differences among subgroups. Female and sub-adult turtles in the marsh consumed a higher proportion of crayfish and males consume a higher proportion of amphipods, whereas turtles in the creek consumed a higher proportion of chironomid larvae in comparison to the other available prey items.

Turtles in this urban environment require aquatic systems with high productivity and diversity, vegetated shorelines to provide buffers from disturbance as well as provide suitable basking areas (i.e. banks with overhanging trees), and protected overwintering habitat that is at least 2 m deep. My findings indicate that turtles take advantage of a wide range of resources; however, there are particular requirements that are necessary to ensure their survival and long-term persistence in this environment.


Greater Short-horned Lizard (photo by Nick Cairns)

Powell, G.L. Ph.D. 2016. University of Calgary (Supervisor: A. Russell)
Evolution of Dermatocranial Shape in Horned Lizards (Phrynosoma).

Synapomorphies of the iguanian genus *Phrynosoma* include morphological, physiological and behavioural characters that are associated with myrmecophagy. One such feature is the dermatocranial horn array which I hypothesized is a key innovation that has promoted the posited adaptive radiation of this genus. To explore this I first described the dermatocranium of *Phrynosoma hernandesi* and used this as the basis for a review of dermatocranial variation among the species of the genus. Comparative and ontogenetic criteria were used to determine homology among the horns of the dermatocranial horn array. A plesiomorphic horn array, present in the last common ancestor of the genus, was retrieved, and its expression determined in the extant species of the genus. Geometric morphometric analysis of ontogenetic dermatocranial form change in *Phrynosoma hernandesi* indicated that allometry accounts for ~53% of the total sample form variance, and localized allometric integration of the posterior regions of the dermatocranium is suggested. Sexual shape dimorphism is minimal. Allometry-free shape variance was concentrated in the posterolateral and posterior regions of the dermatocranium. A modularity hypothesis dividing the dermatocranium among six modules is supported.

A phylogenetic geometric morphometric analysis of dermatocranial shape variation of all species of *Phrynosoma* (excepting *P. sherbrookei*), and the callisaurine species *Holbrookia maculata* and *Cophosaurus texanus*, indicated that the assumption of a Brownian motion evolutionary model does not apply to the evolution of body size and dermatocranial shape in this clade. Evolutionary modes of maximum body length, head length, dermatocranial centroid size at maximum body length, and dermatocranial shape for *Phrynosoma* alone are non-Brownian motion in nature, suggestive that the genus constitutes an adaptive radiation. Occupation of a phylomorphospace generated for dermatocranial shape is consistent with this conclusion. Phylogenetic shape change early in the evolution of *Phrynosoma* is, however, inconsistent with the hypothesis that the dermatocranial horns constitute the key innovation for this adaptive radiation, although a well-developed horn array is basal for the genus. I conclude that both the short-horned and long-horned conditions are alternative means of protect the brain by extending the periphery of the dermatocranium.

Trowbridge, C.M. B.Sc. 2017. Laurentian University (Supervisor: J.D. Litzgus)
The effects of wind turbines on reptile and amphibian population ecology.

With depleting fossil fuel resources and greater demand for alternative energy sources, wind energy has become the new green energy, but it may not be as "green" as we think. Observed impacts of wind turbines on birds and mammals have raised concerns for animal populations; however, little research has been done on the impact of wind turbines on reptiles and amphibians, taxa that are among the most at-risk globally. We examined species diversity and evenness of reptile and amphibian populations in replicated wetlands in Southern Ontario that were close to wind turbines (< 2 km, treatment sites) and far from wind turbines (> 5 km, control sites). Using a gamma-hurdle analysis, we found marginally significant differences between site treatments, with slightly lower diversity and evenness in wetlands close to turbines. Post hoc analysis revealed that one treatment site was significantly different from all other sites, and re-analysis without this site resulted in the treatment effect no longer being significant. We found that species diversity and evenness were significantly higher later in the season, indicating a stronger seasonal effect on reptile and amphibian population ecology than proximity to wind turbines. All study sites were located over 0.7 km from a turbine, as such, the sites may be far enough to be unaffected by the wind turbines implicating a protective buffer distance between wetlands and turbines. Because of the small scale of our study, and because the habitat surrounding our study sites was agricultural, it is inappropriate to extrapolate our results to the effects of wind turbines in all environments. Future studies should use population data from before and after turbine construction to observe population responses during all phases of wind turbine installation and operation.

RECENT PUBLICATIONS IN CANADIAN HERPETOLOGY

TCH lists recent publications by Canadian herpetologists working in Canada and abroad. Please send to the Editor a list of your recent papers, and send citation information for new papers as they come hot off the presses.

Boyle, S., J.D. Litzgus, and D. Lesbarrères. 2017. Road surveys vs. circuit theory to predict hotspot locations:

benefits and challenges for implementing road-effect mitigation. Biodiversity and Conservation (doi: 10.1007/s10531-017-1414-9).

Cairns, N.A., L.J. Stoot, G. Blouin-Demers, and S.J. Cooke. 2017. Using behavioral observations to develop escape devices for freshwater turtles entrapped in fishing nets. Journal of Fish and Wildlife Management 8: 4-14.

Cicchino, A., N.A. Cairns, and S.C. Lougheed. 2017. Reproductive phenology of temperate, female frogs: Missing data in a changing world. Herpetological Review 48: 10-15.

Colley, M., S. Lougheed, K. Otterbein, and J.D. Litzgus. 2017. Mitigation reduces road mortality of a threatened rattlesnake. Wildlife Research 44(1): 48-59 (doi: 10.1071/WR16130).

Dixon-MacCallum, G.P., K.A.H. Bell, and P.T. Gregory. 2017. Edge-habitat use by Northwestern Gartersnakes (*Thamnophis ordinoides*) in Saanich, British Columbia. Canadian Field-Naturalist 131(1): 37-45 (doi: 10.22621/cfn.v131i1.1751).

Dupuis-Désormeaux, M., V. D'Elia, C. Cook, J. Pearson, V. Adhikari, and S. MacDonald. 2017. Remarkable male bias in a population of Midland Painted Turtles (*Chrysemys picta marginata*) in Ontario, Canada. Herpetological Conservation and Biology 12: 225-232.

Edge, C., N. Rollinson, R. Brooks, J. Congdon, J. Iverson, F. Janzen, J. Litzgus. 2017. Phenotypic plasticity of nest timing in a post-glacial landscape: How do reptiles adapt to seasonal time constraints? Ecology 98(2): 512-524.

Gutowsky, L.F.G., L.J. Stoot, N.A. Cairns, J.D. Thiem, J.W. Brownscombe, A.J. Danylchuk, G. Blouin-Demers, and S.J. Cooke. 2017. Acceleration biologgers reveal post-release behavioural impairments of freshwater turtles following interactions with fishing nets. Animal Conservation 20: 350-359.

Halliday, W.D. and G. Blouin-Demers. 2017. Common gartersnakes show density dependence in habitat selection despite no density dependence in growth. Herpetology Notes 10: 275-282.

Hayhurst, L., C. Rodgers, S.J. Hecnar, and M.D. Rennie. 2017. *Notophthalmus viridescens* (Eastern Newt). Geographic Distribution. CANADA: ONTARIO: Kenora District: International Institute for Sustainable Development – Experimental Lakes Area (IISD-ELA). Herpetological Review 48(1): 117-118.

Hecnar, S.J. and D.R. Hecnar. 2016. *Hyla chrysoscelis* (Cope's Gray Treefrog), *Hyla versicolor* (Gray Treefrog), and *Pseudacris crucifer* (Spring Peeper). Dispersal by motor vehicle. Herpetological Review 47(1): 108-109.

Hecnar, S.J. and D.R. Hecnar. 2017. Natural history note: *Lithobates sylvaticus* (Wood Frog) Hibernation. Herpetological Review 48(1): 165-166.

Hecnar, S.J., D.R. Hecnar, D.J. Brazeau, J. Prisciak, A. MacKenzie, H. Brown, and C. Lawrence. 2017. A comparative study of coastal dune/savanna herpetofaunal communities in the Carolinian zone of the Laurentian Great Lakes. Journal of Herpetology: *in press*.

Jain-Schlaepfer, S.M.R., G. Blouin-Demers, S.J. Cooke, and G. Bulté. 2017. Do boating and basking mix? The effect of basking disturbances by motorboats on the body temperature and on the energy budget of the northern map turtle. Aquatic Conservation: Marine and Freshwater Ecosystems 27: 547-558.

Keevil, M.G., B.S. Hewitt, R.J. Brooks, and J.D. Litzgus. 2017 Patterns of intraspecific aggression inferred from injuries in an aquatic turtle with male-biased size dimorphism. Canadian Journal of Zoology 95: 393-403 (doi: 10.1139/cjz-2016-0182).

Litzgus, J.D. 2017. The illegal turtle trade: Why I keep secrets. The Conversation (Canada). https://theconversation.com/the-illegal-turtle-trade-why-i-keep-secrets-85805.

Maida, J., K. Larsen, C. Hooper, and C. Bishop. 2017. *Crotalus oreganus* (Western Rattlesnake). Mortality. Herpetelogical Review 48(2): 447.

McAllister, J.M., J.R. Maida, O. Dyer, and K.W. Larsen. 2016. Diet of roadkilled Western Rattlesnakes (*Crotalus oreganus*) and Gophersnakes (*Pituophis catenifer*) in Southern British Columbia. Northwestern Naturalist 97: 181-189 (doi: 10.1898/NWN15-25.1).

Moldowan. P.D., R.J. Brooks, and J.D. Litzgus. 2017. Assessing cranial dimorphism in the midland painted turtle (*Chrysemys picta marginata*) using a photographic questionnaire. Chelonian Conservation and Biology 16(1): 76-82 (doi: 10.2744/CCB-1235.1).

Munscher, E.C., B.P. Butterfield, S. Carstairs, M. Dupuis-Désormeaux, J. Munscher, W. Osborne, and B. Hauge. 2015. The turtle head immobilization system (THIS): A tool for faster and safer handling and processing of aggressive turtle species. IRCF Reptiles & Amphibians 22(4): 173-177.

Paterson, J.E. and G. Blouin-Demers. 2017. Density-dependent habitat selection predicts fitness and abundance in a small lizard. Oikos: *in press*.

Paterson, J.E. and G. Blouin-Demers. 2017. Distinguishing discrete polymorphism from continuous variation in throat colour of tree

lizards, *Urosaurus ornatus*. Biological Journal of the Linnean Society 121: 72-81.

Patterson, L.D., C.A. Darveau, and G. Blouin-Demers. 2017. Support for the thermal coadaptation hypothesis from the growth rates of *Sceloporus jarrovii* lizards. Journal of Thermal Biology: *in press*.

Retamal Diaz, F. and G. Blouin-Demers. 2017. Northern snakes appear much more abundant in old fields than in forest. The Canadian Field-Naturalist: *in press*.

Riley, J.L., J.H. Baxter-Gilbert, and J.D. Litzgus. 2017. A comparison of three external transmitter attachment methods for snakes. Wildlife Society Bulletin 4(1): 132-139 (doi:10.1002/wsb.748).

Weller, W.F., J. McCarter, L. Gagnon, S. Brinker, C.E. Copeland, M.J. Oldham, F.W. Schueler, and S. Thompson. 2017. New records of amphibians and reptiles from Cockburn Island, Manitoulin District, Ontario, Canada. Herpetological Review 48(3): 593-595.

NEWS AND ANNOUNCEMENTS

2017 CHS Award Recipients

Amanda Bennett
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This year we had the pleasure of recognizing some very deserving individuals who have made significant, meaningful contributions to the study and conservation of amphibians and reptiles in Canada, particularly Western Canada. Our Blue Racer Award recipient was Dr. Pamela L. Rutherford, Associate Professor in the Department of Biology at Brandon University in Brandon, Manitoba. The Blue Racer award recognizes Pamela's significant contributions to reptile and amphibian conservation in Canada, in particular her work in prairie ecosystems and with Prairie Skink populations in Manitoba. Her ongoing, dedicated service to the conservation of amphibians and reptiles includes participation in both local and national organizations, including CARCNET, COSEWIC, and her recent election to the CHS Board of Directors.

Dr. Cynthia Paszkowski was presented the Michael Rankin Distinguished Canadian Herpetologist Award for significant and long-standing contributions to the study of amphibians and reptiles in Canada. Cindy has authored over 110 publications in refereed journals, contributing to our knowledge of monitoring techniques for anurans, movement ecology of salamanders and snakes, as well as general ecology and behaviour of a diverse array of vertebrates inhabiting Alberta. She is a Professor in the Department of Biological Sciences at the University of Alberta in Edmonton, Alberta, where she has supervised dozens of graduate and undergraduate students, fostering a curiosity and love of learning in the next generation of ecologists.

The E.B.S. Logier Communications Award was presented to Scott Gillingwater and Alistair MacKenzie, for their comprehensive "Photo Field Guide to the Reptiles and Amphibians of Ontario", published by the St. Thomas Field Naturalists. The book includes all of the essential biological facts, diagnostic characteristics, and commonly encountered colour morphs that are necessary to identify the species. The information is organized and presented in an intuitive and easy-to-use format, and its compact design makes for an easy-to-carry paperback field guide. This field guide is an excellent resource for novice and expert herpetologists alike, and it is an important contribution to the conservation of amphibians and reptiles of Canada.

The Silver Salamander Award is presented to an individual or an organization in recognition of a specific contribution to the conservation of amphibians and reptiles in Canada. This year, we were delighted to present the award to Doug Collicutt, for his contribution to the development of the Manitoba Herps Atlas. Doug has been an essential promoter of natural history in Manitoba, through contributions such as the "What's Outdoors" column in the Winnipeg Free Press and NatureNorth.com (Manitoba's online nature magazine). NatureNorth.com hosts the Manitoba Herps Atlas, giving all Manitobans a chance to contribute to the knowledge and conservation of Manitoba's reptiles and amphibians.

Each year, awards are given out for the best student platform presentation and best student poster presentation at our annual CHS conference. The 2017 conference included a variety of interesting and excellent student presentations, and we thank everyone who contributed presentations and posters at the conference. Our 2017 student presentation award winner was Damien Mullin (Laurentian University), for his talk entitled: "Comparison of behaviour, growth rates, and survivorship among three cohorts of headstarted Wood Turtles (*Glyptemys insculpta*) post-release". Our student poster award winner was Steven Kell (Laurentian University), for his poster: "Nesting in close quarters: Causes and benefits of high density nesting in Painted Turtles". Congratulations to the 2017 award winners; we look forward to hearing about more student research at the 2018 meeting.

To help students get to the annual CHS conference, we provide student travel bursaries (valued at $250

each) to a randomly drawn subset of applicants who present either a presentation or poster at the conference, are travelling greater than 500 km to be there, and are CHS members. This year's travel bursary recipients were Steven Kell, Kelsey Marchand, Jared Maida, Patrick Moldowan, and Stephanie Winton. Travel award bursary applications are due by August 31st of each year and applications are circulated to the membership by August 1st each year. Be sure to submit your application to take advantage of this excellent opportunity.

Congratulations to all of this year's award winners, and thank you for your ongoing dedication and contributions to the field of herpetology in Canada.

Connie Browne presenting the Michael Rankin Distinguished Canadian Herpetologist Award to Cynthia Paszkowski (top left); Stephen Hecnar presenting the Blue Racer Award to Pamela Rutherford (top right); and this year's travel bursary award winners (bottom)

2018 CHS Conference Location

Joe Crowley
crowleyjf@gmail.com

Western Rattlesnakes, Western Yellow-bellied Racers and Western Skinks are a few of the species that we might expect to find during our 2018 CHS conference field trip—we are headed to western Canada for the 2018 conference! Dr. Karl Larson has kindly offered to host the 2018 CHS conference at Thompson Rivers University in Kamloops, B.C. The date has not been confirmed yet, but it will likely be in mid-late September. More information about next year's conference will be provided as it becomes available; we will post updates on our conference webpage and on the CHS facebook page as details unfold.

Western Rattlesnake habitat in interior BC (top) and a Western Rattlesnake (bottom) (photos by Joe Crowley)

Help Prevent the Spread of Disease! A Decontamination Protocol for Field Work with Amphibians and Reptiles in Canada

Joe Crowley
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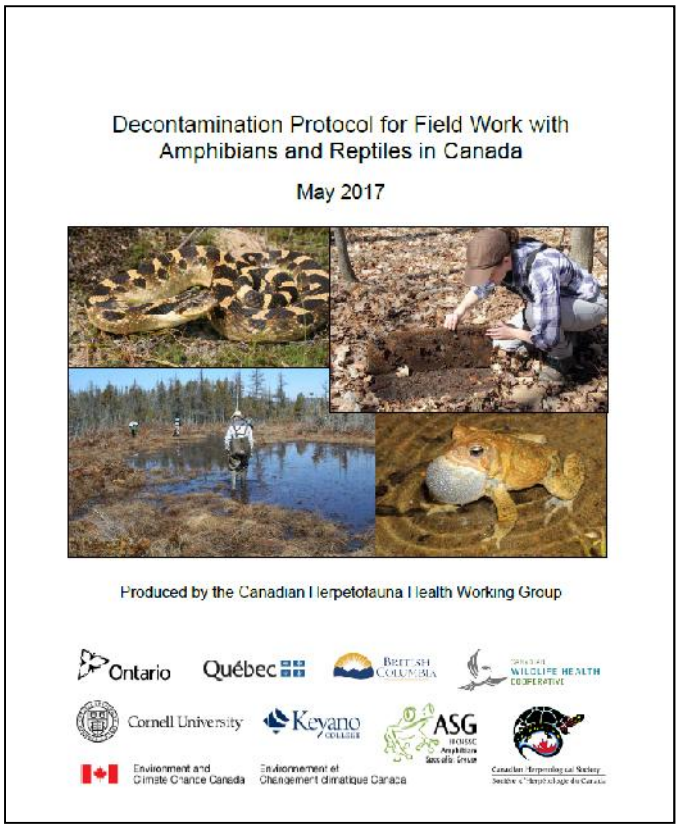
Diseases pose a significant threat to Canada's amphibian and reptile species. Diseases such as Chytrid

Fungus and Ranavirus are present in Canada, and the spread of these diseases can result in mass die-offs and even local extirpation of the affected populations. The potential introduction and spread of *Batrachochytrium salamandrivorans* (*Bsal*), which decimated European salamander populations after its introduction there, may result in a mass extinction event if introduced to North American. Anyone conducting field work with amphibians and reptiles (or any species, for that matter) has the potential to inadvertently spread disease; re-using equipment between sites or even just visiting multiple sites without disinfecting footwear is all it can take. In order to help address this threat, the Canadian Herpetofuanal Health Working Group has published a best management practices document entitled "A Decontamination Protocol for Field Work with Amphibians and Reptiles in Canada".



The working group is comprised of representatives from the Canadian Wildlife Health Cooperative (CWHC), the CHS, the Canadian IUCN Amphibian Specialist Group, provincial and federal governments, and independent biologists. The protocol provides guidance on how to minimize the risk of introducing or spreading disease when conducting field work. Changing or disinfecting equipment between sites is one of the most important recommendations, and the protocol provides guidance on easy ways to achieve this. We strongly encourage anyone who is conducting field work to review this protocol and adhere to its recommendations. The protocol is available on the CWHC website: http://www.cwhc-rcsf.ca/bsal.php. Assisting in preventing the introduction and spread of disease is a relatively simple but very important way that everyone can contribute to amphibian and reptile conservation in Canada.

Spiny softshell (Photo by Nick Cairns)

Graduate Student Opportunities

ReNewZoo is a NSERC CREATE graduate training program that partners academic ecologists and conservation biologists with zoos/ aquariums. There is a need for conservation professionals who can provide expertise and navigate the zoo/aquarium workplace as these organizations expand their conservation mandate. ReNewZoo students will work seamlessly with zoos, aquariums and other conservation organizations across Canada and globally to aid in the conservation of biodiversity. Upon completion, students will be awarded a certificate in Zoo Conservation, officially recognized by Canada's Accredited Zoos and Aquariums (CAZA).

How to Apply: Students applying to ReNewZoo must possess an undergraduate degree in a relevant discipline (Biology, Conservation, Ecology, etc.). Students should contact ReNewZoo Co-Grantees directly by visiting our website (https://www.renewzoo.ca/) or by contacting the Program Director, Albrecht Schulte-Hostedde at aschultehostedde@laurentian.ca.

Canadian Herpetological Society
Société d'Herpétologie du Canada

CHS/SHC MEMBERSHIP FORM

Membership begins and ends on January 1 of each year. Multi-year membership allows you to avoid the hassle of re-registering every year and protects you from increases in membership fees.

Student Membership: **$20 / year** ☐ **or $90 / 5 years** ☐

Regular Membership: **$30 / year** ☐ **or $135 / 5 years** ☐

Yes, I wish to donate to the on-going work of the Canadian Herpetological Society in the amount of: $25 ☐ $50 ☐ $100 ☐ Other (Please specify):_____

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Please mail this form, along with your membership fee, to:
Jose Lefebvre, Acadia University, Biology Dept., 33 Westwood Ave, Wolfville, NS, B4P 2R6.

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