ALGONQUIN WILDLIFE RESEARCH STATION

2024

RESEARCH REPORT


Photo: Samantha Stephens

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AWRS
ALGONQUIN WILDLIFE RESEARCH STATION

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A MESSAGE FROM THE CHAIR OF THE BOARD OF DIRECTORS

Greetings friends of the Algonquin Wildlife Research Station!

The AWRS is a place for curious people, and that's true in multiple meanings. It is a drive to understand more about the natural world that brings people to the Station. It also takes a special constitution to enjoy days, weeks, or months on end in the woods, amid biting insects and inclement weather, in the spirit of enquiry and knowledge. In addition, there's a magic to this place that can be found around every corner: a student encountering a salamander for the first time, launching a canoe for a day of fieldwork while a majestic bull moose feeds along the opposite lake shoreline, netting a roaming turtle not seen in over a decade, and the camaraderie that comes with a campfire and gazing up at the Milky Way. Discovery and experiential learning are inherent in this place.

The AWRS is where we've met some of our best friends. It's where we've started careers and made careers. For some, it was a home for a life-changing summer or home for a decade, or several. The Station is also home to the longest ecological research and monitoring programs in the world, and this is the natural complement to world-class nature interpretation in Algonquin Park.

The Station means a lot of things to a lot of people. At 80 years, now is a reflection and inflection point for the facilities and organization. In June 1944, the Wildlife Research Area and Station was established and subsequently operated by the Ontario Department of Lands and Forests later turned Ministry of Natural Resources. In 1983, leadership of the Station transitioned to a volunteer user committee overseen by a rotating group of Ontario universities. In 2010, the AWRS was incorporated as a Canadian not-for-profit organization. As of 2023, the AWRS received charitable status and strategic recruitment of board membership is helping to fill gaps in fundraising, partnerships, and governance.

A passion for wildlife, wild spaces, and Algonquin Provincial Park burns as bright as ever. While conducting fieldwork, I am regularly stopped by park visitors curious about the latest wildlife science and wanting to know more about their favourite park. In moving the Station forward we must channel this enthusiasm. At the same time, challenges related to limited staff capacity and aging infrastructure are top of mind. Keeping the Station and its facilities relevant and in line with user needs is critical. Thanks to the efforts of many, the Station is financially stable and turning modest annual profits that are being gradually reinvested in maintenance and renewal. This includes compliance updates to animal care facilities and, I hope in time and with available funding, targeted modernization of cabin and classroom spaces to increase functionality alongside potential for teaching and training.

I am very optimistic about the future of the Station and I believe passionately about our vision: to be a leader in experiential learning and wildlife research. Our charity profile on CanadaHelps securely processes donations and issues tax-deductible receipts. Please consider monthly giving as a means of providing sustained support.

As is true year after year, the small staff team is at the heart of the Station. The jack-of-all-trades role of Kevin Kemmish, as Station Manager, cannot be overstated and the Board of Directors extends sincere thanks for his responsibility in daily operations. Drayke Evans eagerly assumed the role of Acting Station Manager while Kevin took a leave of absence this past summer. He did an excellent job and maintained an active snake monitoring program in the process. Station visitors are indebted to Farqd Barghash for yet another delicious menu spanning spring through autumn. Alex Wong, Assistant Cook, helped in the kitchen and could be counted on to deliver the latest

in world events during mealtimes. Alex Thorne, Station Host turned Assistant Manager, worked to maintain and upgrade facilities. Dav Nemethy-Fekete tackled no shortage of odd jobs in backfilling the Assistant Manager role. As Communications Manager, Samantha Stephens continues to bring research to life via her photography, presentations in the broader community, and forward strides in fundraising and partnership initiatives. I am incredibly grateful to the hard work and dedication shown by Station staff over the past year. Likewise, on behalf of the AWRS, sincere thanks to Ontario Parks for steadfast support of operations and long-term ecological studies.

A Station alumni reminded me during a weekend gathering in September that the "events of today is the history of tomorrow." The Station, under Samantha's initiative, is actively archiving and digitizing content—photos, audio recordings, written stories, and material otherwise. Please reach out to the Station to contribute!

Thank you for taking time to learn about the latest research at the AWRS. Looking forward to seeing you at Lake Sasajewun,

Dr. Patrick Moldowan
AWRS Interim Board Chair

OUR MISSION

TO INSPIRE
Environmental stewardship, a community of collaboration, and a connection with nature through educational workshops, public events and social media.

TO EDUCATE
Scientists, the public, and policy makers by facilitating peer-reviewed publications, producing research reports, and hosting field courses and workshops.

TO CONSERVE
Biodiversity, ecological integrity, and a culture of field-based learning by providing facilities and logistical support for research projects, with an emphasis on long-term ecological studies.

SUPPORT THE STATION

You can make a one-time donation or sign up to be a monthly supporter on our CanadaHelps profile. Your support helps us maintain and improve our infrastructure, grow our staff team, and create educational content and programs.

FROM THE MANAGER'S DESK

At the close of 2024, we celebrated the 80th anniversary of the Algonquin Wildlife Research Station. This milestone highlights the organization's lasting significance in Canadian research, its role in providing experiential learning opportunities, and its ability to foster lifelong friendships and a keen interest in natural history. Our Alumni Weekend gave us a chance to reflect on the stories, research, and passion that have shaped our journey and brought us to where we are today. Over the past 80 years, the AWRS has evolved in many ways, but one thing remains constant: it has always been a community of discovery, with conservation, education, and inspiration at its core.

With these foundations in place, we now look ahead to the future, embracing a new chapter as a charitable organization. The 2024 season marked our first full year operating as a charity. Behind the scenes, we are working hard to build capacity and plan for the future. We look forward to rolling out these efforts in the coming months and years. Be sure to stay connected through our social media and newsletter to learn how you can be part of this exciting new chapter.

As I read through this report, I was excited to see all that was accomplished in 2024. These achievements were made possible through the hard work and dedication of many. I want to recognize those who supported the Station and its users throughout 2024 including Ontario Parks, the Ministry of the Environment, Conservation and Parks, Canada Summer Jobs, The Friends of Algonquin Park, The Portage Outpost and Wild Ontario. We greatly appreciate the generosity of our monthly donors on CanadaHelps, as well as everyone who made one-time donations or contributions throughout the year. Your financial support is vital to our success as a charity.

Our ongoing success would not be possible without the unwavering support of the AWRS staff team. We extend our thanks to the AWRS Board of Directors for their continued guidance and expertise. This year, our team had new members including Alex Wong, Alex Thorne, and Dav Nemethy-Fekete, alongside returning staff Farqd Bargash, Samantha Stephens, and Drayke Evans. I thank the staff team for all their tenacity and adaptability. It is their dedication that keeps the Station moving forward. A special thank you goes to Drayke Evans for stepping in as Station Manager during the summer months while I was on leave. Knowing the Station was in his capable hands made the transition smooth and ensured a high level of service during our busiest time.

Finally, we would like to recognize the researchers, field course students, and all Station users who bring a passion for learning and discovery to the Station. You are the heart of what makes this place so special. A sincere thank you to those who contributed to this report—your enthusiasm for your work is truly inspiring, and we are proud to share it with others.

Kevin Kemmish

Kevin Kemmish
Station Manager

We pay our respects to the traditional stewards of the land on which the AWRS exists and of Algonquin Park in its whole. The Station and much of Algonquin Park are located within unceded Algonquin territory. Algonquin Park as a whole also contains territory of the Anishinaabeg, specifically the Chippewa, Ojibwa and Nippissing, and lands under the Robinson-Huron Treaty of 1850 and the Williams Treaties of 1923. This land has also been used by Métis and other Indigenous people as it includes major travel routes on its rivers and waterways. We are always open to learning and discussion.

Photo: Samantha Stephens

Past and current researchers and staff gathered at the Station during the Alumni Weekend. Photo: Samantha Stephens

AN UPDATE ON THE LONG-TERM TURTLE STUDY

Written by Dylan Kaufman & Dr. Matthew Keevil

The 2024 field season marks the 53rd year of turtle monitoring at the Station. In May and June, we focused on recapturing Midland Painted Turtles that are part of the long-term study at our Arowhon site in order to continue to monitor growth and survival of these individuals, and mark newly encountered individuals. We captured a total of 221 Painted Turtles over the season. We also continued our annual nesting surveys at the Arowhon railbed, recording information on 47 nests with known maternal identities.

This year we successfully recaptured sixteen small juvenile Painted Turtles that had been previously released as part of an experiment on hatchling survival conducted by former graduate student Dr. Jessica Leivesley. A juvenile turtle can be recognizable by their unique plastron (underside of the shell) markings. A particular objective this season was to assign IDs to these juvenile turtles and add them into the long-term mark-recapture study while they are still young enough that the resemblance to their 'baby photos' is clear. The plastron patterns of Painted Turtles provide a way to identify individuals that are too small for a pit tag or notching. However, it remains unknown how these patterns fade and change over the turtles' lifespan. The number of recaptured juveniles from the initial experiment may increase as further photo analysis reveals additional matches among the other young turtles captured in 2024. These recaptures will help to generate more precise knowledge about survival during the first year or two of life following hatching, which is the least known period of a turtle's life.

> "THIS YEAR WE SUCCESSFULLY RECAPTURED SIXTEEN SMALL JUVENILES THAT HAD BEEN PREVIOUSLY RELEASED AS PART OF AN EXPERIMENT ON HATCHLING SURVIVAL..."

Excitingly, we encountered two Blanding's Turtles in the Arowhon area. The first turtle was carrying eggs and was a known individual, 374N; a female first captured during the 2023 season. We found her by following her tracks across sandy soil to her overnight hiding spot near the end of a nesting survey. The second Blanding's Turtle was a male captured for the first time by chance during a cleanup of the site while he was crossing the road. Blanding's Turtles have previously occurred at apparently very low densities on the western highlands of Algonquin and new individuals are rarely encountered. It is interesting to consider whether recent new adult captures—a perceptible increase compared to previous field seasons—signals a gradually increasing abundance or merely good luck by field crews.

In conjunction with Dr. Patrick Moldowan and assistance from other Station researchers and staff, baseline monitoring of Snapping Turtle nesting around the Station continued in 2024. This is the longest running component of the turtle research program, which began in 1972. The number of nesting females at the Lake Sasajewun dam declined by approximately 50% in the late 1980s following a mortality event caused by River Otter predation on hibernating turtles. In the decades since that event, populations have been stable at the new, lower normal until recent years when we've detected that populations may be falling again. Opportunistic observations of recent winter predation by otters have coincided with disruptions in survey effort because of the COVID-19 pandemic and changes in crews and survey intensity as research priorities shifted with successive graduate student projects. These potentially confounded effects on nesting counts will be resolved with further data collection and mark-recapture analysis. Only eleven nests were observed on the focal nesting area at the Sasajewun dam, and an additional eleven among nearby nesting areas, which is just half of the typical nesting numbers we saw ten years ago, and less than a fifth of peak abundance seen in the 1970s and 1980s. This likely signals a recent, real decline. Further data collection and analysis integrating nesting and aquatic trap surveys will clarify this potential trend. ♦

LEFT: An image of hatchling 155 (top) and hatchling 27 (bottom) released in 2022 as part of Dr. Jessica Leivesley's experiment. RIGHT: An image of hatchling 155 (top) and hatchling 27 (bottom) recaptured by the 2024 field research team. These images reveal how juvenile Midland Painted Turtles can be identified by their plastron markings. Photos: Dr. Jessica Leivesley and Dr. Matthew Keevil.

ACKNOWLEDGEMENTS

We would like to thank Dr. Njal Rollinson and Dr. Jacqueline Litzgus for managing funding and support for this year's turtle monitoring season. Thank you to Dr. Patrick Moldowan for assistance in the field and with turtle processing along with Samantha Stephens, Farqd Barghash, and other researchers and staff who contributed time and company while assisting in nesting surveys. We would also like to express our appreciation for Kevin Kemmish, Drayke Evans, Samantha Stephens, Farqd Barghash, Alex Wong and Alex Thorne for maintaining an excellent culture at the Station, making work in Algonquin Park a pleasure. Lastly, we would like to thank all researchers who worked alongside us for contributing to the Station's fun and lighthearted dynamic.

Photo: Samantha Stephens

THE SEARCH FOR LOST TURTLES

Written by Dr. Patrick Moldowan

It's hard to match the feeling that follows finding something that has long been missing. You know that feeling of search-and-find: the sock that went AWOL in the laundry months ago, a keepsake from a loved one that has been overlooked at the back of a cabinet drawer, the reading glasses that were atop your head the whole time, or the keys that are incessantly vanishing when you are in a rush. We only have ourselves to blame when inanimate objects are misplaced, overlooked, or otherwise forgotten. What about when something of desire has an active role in hiding?

To know anything about turtles is to know that they live a long time. This affords them a lot of opportunity to move around. Aesop's fable of the tortoise and the hare taught us that the steadfast determination of the tortoise leads to slow and steady gains, and a lot of ground covered. The rough and tumble lives of turtles can take them to distant and unexpected places. This makes understanding some of the basics of turtle biology challenging.

The Search for Lost Turtles was an endeavour to address unknowns. By recapturing long lost individuals there is great potential to plug knowledge gaps related to growth, survival, longevity, and movement—fundamentals that shape the biology and conservation of these outstanding creatures. *The Search* also presented an opportunity to address a pressing uncertainty about a focal study population of Snapping Turtles: Is the apparent population decline of recent years true and, if so, what might explain the downward trend in abundance?

In my fifteen year involvement with the study of turtles at the AWRS, I've come to know some turtles that are homebodies and others that are roamers. Within the past decade, colleagues and I have recaptured Snapping Turtles that have been absentee for 16, 21, even up to 27 years. In some cases, these turtles were recaptured in areas that are surveyed nearly every year. Where have they gone in the interim? How many are still out there? What can this teach us about how they use the landscape and what is needed to protect the places where they travel through and live?

"TWO SNAPPING TURTLES MARKED AS HATCHLINGS, AND THEREFORE OF KNOWN AGE, WERE RECAPTURED FOR THE FIRST TIME THIS SUMMER..."

From May until early September, with a pivot in June for nesting surveys, I was on the water and trapping turtles. In total, I sampled eleven lake and river sites for a total of 937 trap days, averaging fourteen trap sets per day that were checked twice daily. A key objective was to sample well-monitored sites, historical sites, and connecting waterbodies to—hopefully—leave no turtle in the area overlooked. Several sites within the Wildlife Research Area were minimally visited, never mind sampled, since the 1980s. Opening trails, portaging canoes, repairing hoop traps, and transporting ripe fish guts as bait made for a memorable summer.

Despite extensive trapping, I did not find turtles from the earliest years of the study (1972–1976). Although this was reason for some disappointment, summer 2024 was anything but anticlimactic. Trap captures verified who was still alive and present and will be used to refine regional population estimates, which in-turn inform our understanding of the decline. Additional natural history observations were aplenty. For example, two turtles that nested near the Station in June were later encountered at considerable distances upstream. Snapping Turtle N02 nested at the Highway 60 car bridge and North Madawaska River in June and was recaptured in early September in the lower Amoya Swamp, a 7.5 km distance by watercourse. After 40 years in the study, this is the first home lake record for N02! Similarly, Snapping Turtle A436 was found wandering through the forest near the Amoya Swamp in early September (we were surprised to see each other!), having been previously observed in June nesting on the dam at Lake Sasajewun (5.6 km by watercourse). These observations complement past research on Snapping Turtle nesting migration and, importantly, illustrate that human impacts (e.g., road mortality of nesting females) can have negative consequences that extend to distant wetlands.

Snapping Turtle N02 hiding in plain sight. Photo: Dr. Patrick Moldowan.

Two Snapping Turtles marked as hatchlings, and therefore of known age, were recaptured for the first time this summer: Snapping Turtle 997 and 1000 are now mature males of 26 and 23 years of age, respectively. Both have settled in lakes north of the Station for the time being. Notably, the number of turtles captured relative to the amount of trapping effort expended (commonly called catch-per-unit-effort, CPUE) has declined in core sites, such as Lake Sasajewun. This has encouraged a revisit of old field notebooks to see if additional historical estimates of CPUE can be calculated to quantify the decline of Snapping Turtles. Other notable Snapping Turtle observations from this past summer include consumption of waterfowl, use of natural nesting sites, depredation by otter, timing of entry into overwintering sites, and habitat changes through beaver abandonment and colonization of monitored wetlands. Among other lessons, I learned that it's much easier to walk into a site to check water conditions *before* carrying in a canoe …

What has become of Snapping Turtles marked in the early years of the study? There were 126 Snapping Turtles marked between 1972–1976 (Figure 1). Most individuals marked during this period were females nesting on the dam at Lake Sasajewun or in the broader Wildlife Research Area. The last time that individuals

Photo: Samantha Stephens

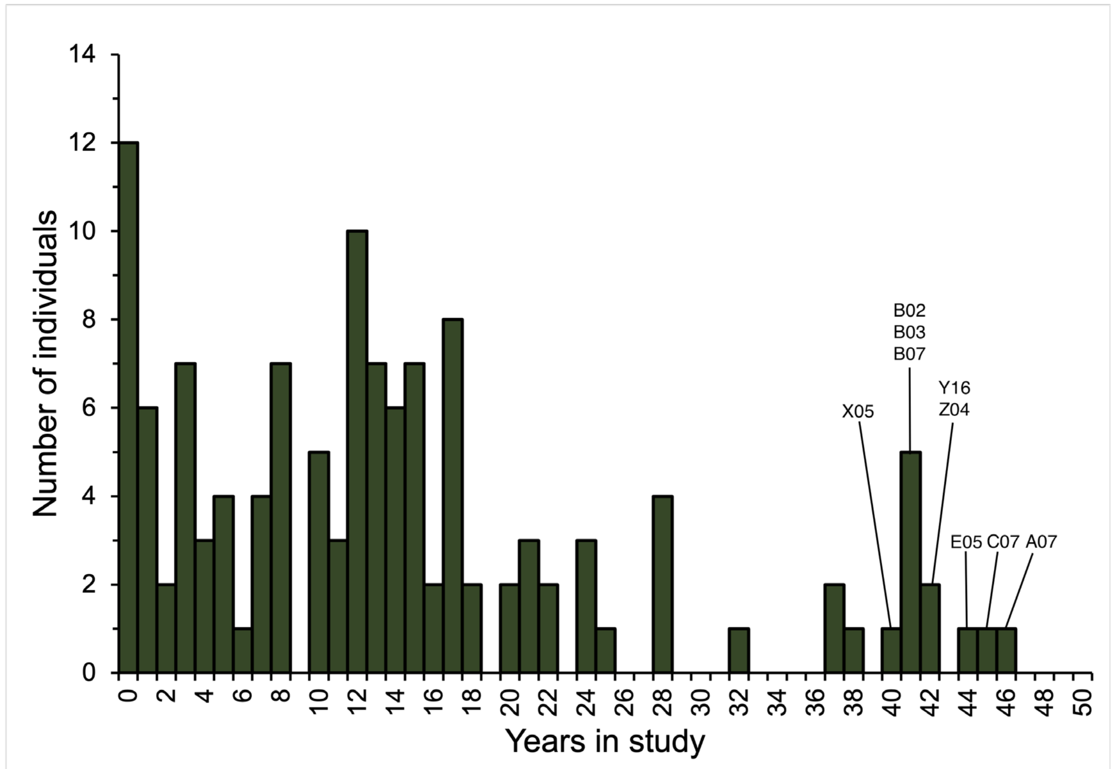

FIGURE 1: Capture history of Snapping Turtles marked in the Algonquin study between 1972–1976. A value of zero years in study describes individuals captured only once. Nine individuals marked during the period of 1972–1976 have capture histories of at least 40 years: X05, B02, B03, B07, Y16, Z04, E05, C07, and A07.

from this marked cohort were seen was in 2019 (individuals C07 and E05). The individual that has been in the study the longest (A07) was last seen in 2018. Nine individuals with capture histories of 40 years or longer have been captured within the past decade (Figure 1). It is not unusual for males to go unsampled for extended periods due to transience, but the absence of these females, some of whom had nearly continuous capture/nesting histories from the 1970s until their time of disappearance, is suggestive of two possibilities: these turtles have stopped reproducing at advanced ages and have stopped attending nesting sites (unlikely since there is scant evidence of reproductive senescence in turtles!) or these individuals have died.

This population is in apparent decline, but why? The cause(s) of decline in this population is unknown, leaving room for speculation. The mass mortality of Snapping Turtles in Lake Sasajewun in the 1980s was unambiguously caused by depredation by River Otters. Social learning and specialization in foraging strategy by otters might explain why the 1980s mortality event occurred suddenly and was limited to three winters. Mortality caused by otter depredation is likely a contributing factor to the contemporary decline, but there is limited evidence. Also, there have not been any major habitat changes that might account for the recent (ongoing?) decline.

A possible explanation for the population decline is the advanced age of individuals that formed the initial cohort marked in this study. Some individuals that were tagged as large adults in the 1970s and 1980s have reached (minimum) estimated ages of at least 80–100 years. The maximum life span of adult Snapping Turtles is unknown—interesting biologically and perhaps central to this mystery. Turtles aged approximately 80–100 years would have hatch dates in the 1930–1950s, timing that coincides with a large increase in the opening of forest and subsidization of local nesting habitat through logging. Logging was apparently widespread north of Lake of Two Rivers prior to 1930. By at least 1934, a logging road travelled north through a timber limit that centred around what would become the Wildlife Research Area and logging camps were present on Kathlyn Lake (1936–1938), Lake Sasajewun

(1938–1940), Iris Lake (1938–1940), and Crossbill Lake (1940–1942). Logging up to shorelines as well as the burning of slash was commonplace, resulting in further loss of canopy and open expanses of bare ground—favourable conditions for turtle nesting. Logging ceased in the area following the establishment of the Wildlife Research Area in 1944. Putting this into a turtle timeline:

<1930–1950s: Areas of open canopy and exposed soil due to logging might have provided increased access to nesting habitat and increased localized population recruitment.

1944 onward: Forest succession would have gradually eliminated subsidized nesting habitat created by logging; succession would take many decades.

1950–1960s: Snapping Turtles that hatched in the preceding decades would have reached sexual maturity at 16–20 years of age.

1972: Study of Snapping Turtles began at the AWRS and a sizable cohort could have been established and reproducing.

The long lifespans of turtles might explain why regionally elevated populations persisted until recently in regions of the North Madawaska River. Under this 'logging population boom hypothesis,' the current reduction in Snapping Turtle abundance is a consequence of reduced nesting site availability, reduced recruitment in the post-logging era, the mortality event caused by otters in the 1980s, and, most recently, the gradual attrition of the post-boom adult population. Speculation persists, but further consultation with historical maps and parks archaeologists is underway to understand if this idea is valid. We know that the Dekay's Brownsnake and Eastern Hog-nosed Snake, two species that favour warmer and more open habitats, occurred in western Algonquin Park in at least the mid- to late 1900s. These species apparently colonized the more open and warmer (micro)climate areas of the Algonquin Dome created by logging. These species are seemingly absent from the park today, squeezed out by natural forest regeneration and the return of predominantly closed

Photo: Samantha Stephens

canopy habitats. If these snakes experienced a temporary boom due to logging and the increased availability of open habitats, why not Snapping Turtles too?

Summer 2024 was a deep dive into the turtles of the long-term study. I'm left wondering: Are some of the old timer turtles still out there? I'm willing to bet so. Some traps have been carefully stored at strategic sampling sites for the next opportunity to go searching. ♦

ACKNOWLEDGEMENTS

The Search for Lost Turtles was inspired by and came to be through many conversations with Dr. Ron Brooks; he was intensely curious about the fate of turtles in the Wildlife Research Area that have long been absent. This project and forthcoming research honours Ron's curiosity and commitment. This project would not have been possible without support from Ontario Parks, especially Jennifer Hoare (Gelok) and Lauren McKey. Dr. Jackie Litzgus and Dr. Njal Rollinson provided much collaborative support and Dr. Matthew Keevil lent an ear to many ideas in progress. I'd like to thank Samantha Stephens for field assistance and project support. Thanks also to the Creel Hut at Lake Opeongo for a nearly bottomless supply of trap bait!

Photo: Samantha Stephens

YELLOW SPOTS ON A BLACK CANVAS: EACH PATTERN TELLS A STORY

Written by Dylan Kaufman & Dr. Patrick Moldowan

As the ice melts on Bat Lake each spring, a contingent of researchers await the amphibian march that has occurred annually—likely for thousands of years. The chorus of frog calls, reverberating from the lakeshore and the trees, marks that the breeding season is well underway. All nine amphibian species that call the Bat Lake area their annual breeding site have their own courtship displays and territorial disputes: each individual desperate to contribute to the next generation. However, one species has been the primary focus of our research efforts for the past fifteen years and is the reason we brave the cold each spring.

In our study, Spotted Salamanders have been captured through aquatic trapping and drift fence surveys. Spotted Salamanders at Bat Lake make an excellent study system due to their abundance, the relative predictability of their breeding season, and their unique spot markings. Thanks to the variability in size, shape, and placement of yellow spots along the salamanders' backs, every individual is uniquely patterned and can thus be recognized. We take photos of newly captured individuals and register these salamanders in a 'spot ID' database. Then, when we recapture these registered individuals, we can take a photo and match it to a registered individual, using a spot matching software. Approximately 3,000 of the estimated 24,000 individuals in this population have capture histories that inform us of the various aspects of their biology including growth, survival, longevity, reproduction, and more.

RECURRING VISITORS

While some salamanders are recaptured multiple years in a row, not all salamanders in the study are caught each year. In fact, some salamanders have surprisingly long gaps in their capture histories, and most salamanders have only been captured once. There are a multitude of reasons that may contribute to these asymmetries in capture histories.

One factor that makes a salamander likely to be encountered is how regularly they breed. Not every salamander breeds every year, but it is not clear what factors contribute to skipping reproduction. When they do breed, they tend to follow the same path to and from Bat Lake. This contributes to a second factor that affects the likelihood of being captured: trap placement. If the path that a salamander takes overlaps with a trap, then that individual is likely to be captured by the research team.

We have some salamanders that are recurring visitors to our traps. For example, salamander 1702 and salamander 1704 were first captured in the same trap in 2009 and both have been recaptured in seven subsequent years (2010, 2011, 2013–2016, and 2017). Salamander 1670 has also been a long-term visitor to the lake and a contributor to the study with captures in 2009, 2011, 2014–2017, and 2019, and individual 3158 has a particularly impressive six-year capture streak (2012–2017)! Salamander 0076 was captured in 2008 and had five recaptures, the last of which was in 2017. When we compare Salamander 0076's size over the decade between first and last capture, we see that he grew eleven millimetres in body length and increased in weight by two grams.

GHOSTS AT THE LAKE

There is a subset of individuals that have been scarcely recaptured, and yet their histories are invaluable to the study. Though we might presume a

ABOVE: Salamander 1704 was captured eight times between 2009–2017. Here you can see the identical spot pattern in each photo that helps us recognize him. Photos: Dr. Patrick Moldowan.

Photo: Dr. Patrick Moldowan

salamander that has not been seen for over a decade may have perished, alternatively these infrequent recaptures suggest that our capture methods may consistently miss certain individuals. It also demonstrates that these salamanders are capable of long lifespans.

Salamander 1113 was first captured in 2009 and recaptured in 2010 but then disappeared for five years before being recaptured in 2016. Similarly, Salamander 3421 was first seen in 2013 and next seen in 2019. Salamander 1275 was first observed in 2009, went missing in action for three years (2010–2012), then was reliably recaptured for five straight years (2013–2017). Salamander 2078 boasts one of the most impressive gaps in capture having been encountered for the first time in 2009 and then recaptured over a decade later in 2021 during which she grew four millimetres in length and 0.75 grams in mass.

The capture histories of salamanders—who gets caught, when, and where—has been on our mind lately as we work with collaborators to complete comprehensive population analyses. Compared to the potential thirty-year lifespan of Spotted Salamanders, the Bat Lake Inventory of Spotted Salamanders (BLISS) project is still in its infancy. Each year provides a new roster of captured individuals that contributes to building a more reliable understanding of salamander growth, survival, and overall life history. There is no doubt that the continuation of this study will yield more surprises and allow us to answer more questions about our spotted subjects for years to come. ♦

> "IN FACT, SOME SALAMANDERS HAVE SURPRISINGLY LONG GAPS IN THEIR CAPTURE HISTORIES, AND MOST SALAMANDERS HAVE ONLY BEEN CAPTURED ONCE."

ACKNOWLEDGEMENTS

We would like to thank all undergraduate and graduate researchers who have contributed to this impressive dataset over the past fifteen years. Thank you to Kevin Kemmish, Drayke Evans, Samantha Stephens, Farqd Barghash, Alex Wong, and Alex Thorne for jointly creating the positive and welcoming culture at the Station this past field season. Thank you to Dr. Glenn Tattersall and Dr. Njal Rollinson for historic and ongoing BLISS research funding, respectively. Lastly, a special thanks to the Bat Lake Spotted Salamanders!

EASTERN RED-BACKED SALAMANDER MOVEMENT & DISPERSAL: PRELIMINARY RESULTS

Written by Dr. Alison Ochs

Eastern Red-backed Salamanders are one of the more common species of terrestrial salamanders in the northeast, often found tucked under the rocks and logs they call home. While easily overlooked, this species is critical to nutrient cycling and maintaining food webs in forest habitats. Due to their sensitive, permeable skin, they stick to cool, moist habitats where they can travel, forage, and find mates without worry of drying out. It is common knowledge that this species can most often be found in closed-canopy forests and tend to avoid open fields and other sunny, dry areas. Despite the abundance of Eastern Red-backed Salamanders in closed-canopy forests of the northeast, little is known about their movement and dispersal. Early studies have suggested that Eastern Red-backed Salamanders move less than half a metre per day on average, but more recent translocation studies have found that salamanders can ably navigate back to their home ranges from distances of over twenty metres, likely by landmarks rather than scent trails or other means. Genetic studies have also found that salamander populations separated by difficult terrain such as roads remain genetically linked, suggesting that dispersal is occurring over these barriers, despite the common assumption that salamanders avoid approaching these areas. One study in Virginia tested the dispersal of Eastern Red-backed Salamanders into an open field by setting up simulated forest habitats and monitoring these "forest" patches for salamander dispersal. David Marsh and his team found that dispersal occurred quickly in plots placed five metres from the forest edge, and while it occurred more slowly at twenty-five metres away, Eastern Red-backed Salamanders were able to make their way there before the end of the study. During the study, they also attempted to control for salamanders that might have already been present within the fields. In these control sites, where a barrier prevented salamander dispersal, Eastern Red-backed Salamanders were still found, suggesting they were already present in the open field. I sought to answer two questions raised by this study and our lack of knowledge of Eastern Red-backed Salamander movement: first, will Eastern Red-backed Salamanders disperse into new habitat across roads? And second, are Eastern Red-backed Salamanders present in open areas, despite the lack of apparent suitability?

> "DESPITE THE ABUNDANCE OF EASTERN RED-BACKED SALAMANDERS IN CLOSED-CANOPY FORESTS OF THE NORTHEAST, LITTLE IS KNOWN ABOUT THEIR MOVEMENT AND DISPERSAL."

To answer these questions, I set up three experiments in Algonquin Park. First, I replicated David Marsh's dispersal experiment in an open field, with three "forest" plots set near the forest edge on the far side, and three set across a little-used gravel road from the forest edge. I also used matching plots of wooden boards set within the forest to compare dispersing salamanders to local populations. Second, I set out twenty wooden boards at two open-canopy rock barrens at which park staff had observed Eastern Red-backed Salamanders or Ring-necked Snakes, a salamander specialist. Finally, I conducted nighttime surveys (visual encounter surveys) and placed wooden boards on either side of a gravel


Photo: Dr. Alison Ochs

ABOVE: A “forest” plot set in an open field across from the forest edge. The plot is shaded, covered in leaf litter and wooden boards, and watered twice per week to simulate forest conditions. This plot is set next to a gravel road, over which salamanders must cross to reach.

road that had been used for previous salamander research by David LeGros. In all experiments, salamanders found under boards or during surveys were marked to identify where they had first been found, and if they had been recaptured in a new location. My goal was to see if salamanders would disperse from the forest into new “forest” habitat across a road, would occur in unaltered rock barren habitat, or would move from one side of the road to the other. I collected data from September to the end of October, when the year’s first snowstorm cut my field season short.

Only eleven salamanders were found at the dispersal experiment: eight within the forest area and four at the “forest” plots in the field. While this was not enough data for a strong statistical analysis, and no salamander first seen in the forest was next seen in a “forest” plot, one salamander did appear in a “forest” plot across the road from the forest edge; this salamander either dispersed from the forest by moving across the road, or moved over a very large stretch of open field to reach that site. Either option lends support to the hypothesis that Eastern Red-backed Salamanders are capable of dispersing much farther than previously supposed. I also found eighteen salamanders in the rock barrens: sixteen individuals, and two that were recaptured, suggesting that they had either remained within the open canopy area for several weeks or had left and returned, which would require substantial movements to reach the forest edge. While abundance in rock barrens is likely quite low compared to forested areas, it is clear that Eastern Red-backed Salamanders can inhabit these areas and move through them when needed, even at substantial distances from the forest edge. Unfortunately, the visual encounter surveys only located a total of thirty-one Eastern Red-backed Salamanders and three recaptures. With so few recaptures, it was impossible to tell if salamanders were crossing the road or retreating deeper into the forest after their initial capture. I did notice one lively Eastern Red-backed Salamander approaching the road edge during a particularly rainy night, but she unfortunately stopped and quickly retreated when confronted with the bright headlamp before completing her intended movement.

While it is my personal opinion, given LeGros’ re-


Photo: Dr. Patrick Moldowan

search findings that Eastern Red-backed Salamanders would inhabit wooden boards placed in the centre of the road, that Eastern Red-backed Salamanders are indeed capable and willing to cross gravel roads when conditions are favourable—such as warm, rainy nights—more research is needed, using additional methods, to test this hypothesis. Salamander counts were much lower than I expected for Algonquin, where Eastern Red-backed Salamanders are known to be abundant. However, I was looking specifically in areas that Eastern Red-backed Salamanders are known to avoid: open fields, open rocky areas, and along roads. I may not have seen the success that David Marsh saw in his experiment in Virginia, but I suspect that the wonderful habitat of Algonquin Park was, in fact, working against me—with so much pristine, excellent habitat around them, why would salamanders bother living in areas along roads or near fields that are hotter and drier, with less opportunities for foraging or surface activity? It may be that Eastern Red-backed Salamander movement is density-dependent, relying on large populations in small areas with high competition for resources to push individuals to move into less-than-ideal habitats; an idea for future studies to explore. ♦

ACKNOWLEDGEMENTS

This study would not have been possible without the support of the Algonquin Wildlife Research Station staff including Station Manager Kevin Kemmish, Assistant Manager Drayke Evans, and Head Cook Farqd Barghash, advice and suggestions from David LeGros, and the support of the Geomatics and Landscape Ecology Research Lab at Carleton University. This project was further supported by the Fahrig Lab, led by Professor Lenore Fahrig at Carleton University.

HOW DO SALAMANDERS KNOW THAT WINTER IS OVER?

Written by Danilo Giacometti, Dr. Patrick Moldowan & Dr. Glenn Tattersall

Amphibians have long fascinated researchers due to their unique life cycles and sensitivity to environmental change. However, many aspects about the biology of fossorial (i.e., burrowing) amphibians remain a mystery. Indeed, fossorial amphibians like the Spotted Salamander spend most of their lives underground, emerging to the surface only briefly to breed or to forage. This is especially true during the winter, when Spotted Salamanders retreat to burrows to escape freezing conditions aboveground. Previous research demonstrated that Spotted Salamanders occupied vertical burrows in the winter, indicating that animals might be able to move vertically in the soil. However, the extent to which internal and external factors may affect salamander underground movement remained unclear.

Spotted Salamanders from this research site partake in overland breeding migration in early spring. This migratory period occurs after salamanders have spent close to six months underground, possibly without access to any food. But if salamanders are underground for the entirety of winter, how do they know that spring is starting? Previous research from this site showed that the soil from the forest that surrounds the lake (i.e., where salamander burrows are located) experiences a major shift in the temperature gradient between shallow and deep soils, a phenomenon known as soil temperature inversion (Figure 1). In the winter, shallow depths are colder than deep ones, but as spring arrives, the gradient shifts such that shallow soil become warmer than deep soil. Since all aspects of the biology of salamanders are sensitive to temperature, one can expect that soil temperature inversion serves as a signal for animals to leave their winter refuges and begin their overland journey to breeding ponds.

Since studying Spotted Salamanders in the wild is virtually impossible during the winter—one would have to break through metres of ice or snow and dig through frozen ground to find the individuals—we mimicked wintertime conditions in the lab at Brock University. Using a vertical thermal gradient ranging from -1.5ºC–15ºC (Figure 2), we examined how salamanders responded to temperature cues at different depths, and whether their activity levels changed with temperature shifts that mimicked soil temperature inversion (i.e., active versus overwintering thermal gradient configuration). With this experimental setup, we were able to address three non-mutually exclusive hypotheses that took into consideration external and internal factors. As external factors, we considered salamander responses to temperature and gravity; since we used a vertical thermal gradient, salamanders should spend more energy to stay at the top than at the bottom of the gradient. We considered migration restlessness as our internal factor of interest, which we quantified by measuring changes in activity levels (i.e., how much salamanders moved under either thermal gradient orientation) in response to soil temperature inversion.

Our findings suggested that temperature was not the primary factor affecting salamander behaviour. Indeed, Spotted Salamanders sampled all gradient temperatures, a fact that attests to this species' ability to tolerate a wide range of temperatures. Previous research indicated that migration restlessness was characterised by a surge in movement often seen in animals preparing to migrate. Our results matched this pattern, as evidenced by salamanders being more active when the thermal gradient was under the active orientation compared to the overwintering orientation. This result is novel, as migration restlessness was previously reported to occur mostly in birds, one species of turtle, and one species of newt. Additionally, we also found that salamanders tended to move upward against gravity regardless of gradient orientation, a behaviour known as negative geotaxis. To take these findings from the lab to natural settings, it is possible that

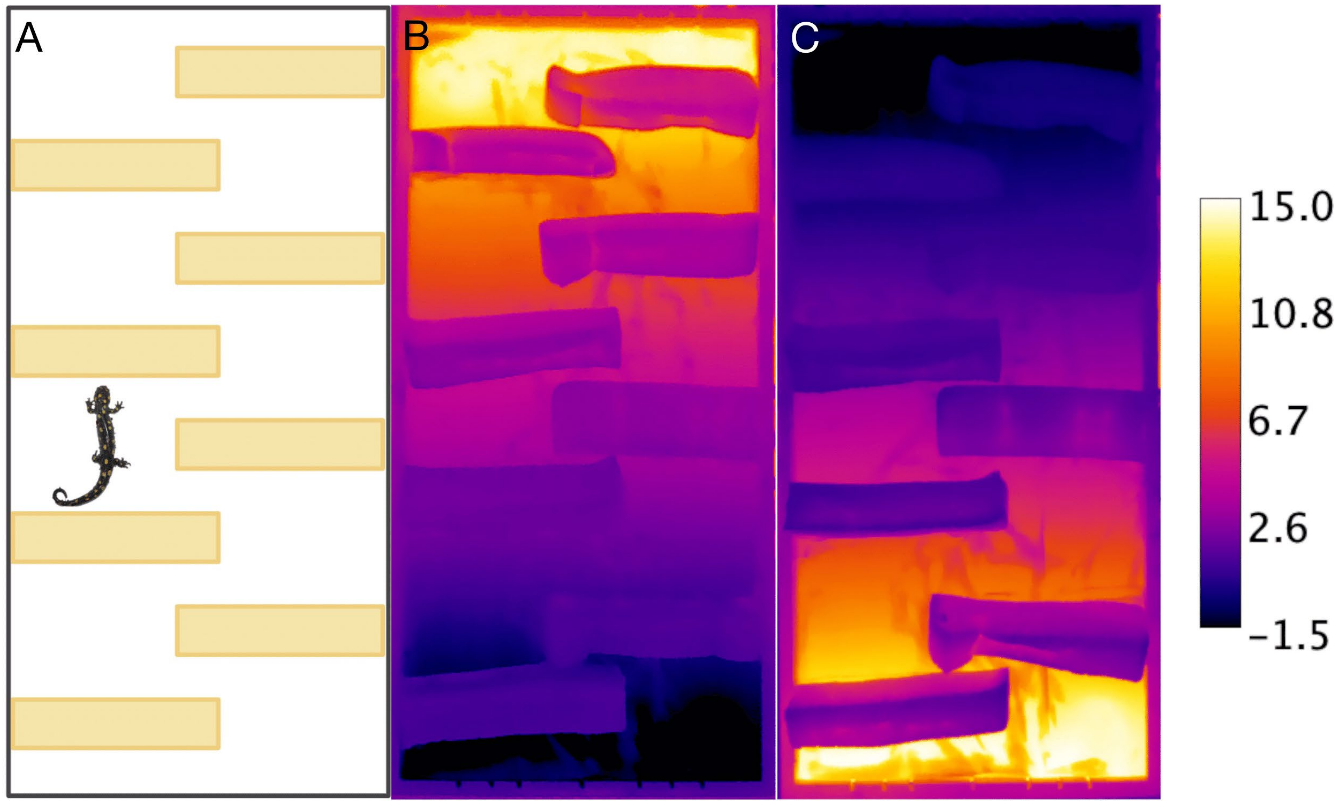

FIGURE 2. (A) Schematic of the vertical thermal gradient used to assess the impact of thermal inversion and gravity on salamander behaviour. Thermal image of the active (B) and overwintering (C) thermal gradient configurations. Thermal gradient temperatures (°C) in (B) and (C) are colour-coded according to the temperature scale in the far-right panel.

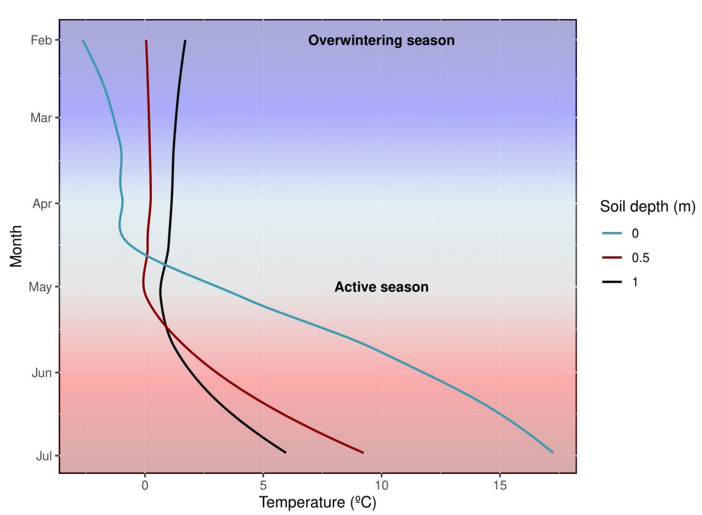

FIGURE 1. Representation of soil temperature inversion in the forest surrounding the research site.

salamanders occupy relatively shallow burrows in the winter, which should experience substantial temperature variation, and that their behaviour is controlled by a circannual impetus to migrate. Therefore, the combination of a wide thermal tolerance, a tendency to move upward against gravity, and migration restlessness may explain why salamanders begin their spring migration at just the right moment, maximising their chances of reproductive success while avoiding the dangers of emerging from underground too early and potentially freezing. ♦

ACKNOWLEDGEMENTS

We thank Ontario Parks, the Ministry of Northern Development, Mines, Natural Resources and Forestry, the Algonquin Wildlife Research Station (AWRS), Dr. Njal Rollinson and Kevin Kemmish for facilitating access to the research site and our study animals. We are grateful to all the researchers who were ever involved with the long-term salamander research based at the AWRS. We thank Brock University's Animal Care Services for assistance with animal care and Brock University's Machine Shop for building the thermal gradient used in our study. Dr. Glenn Tattersall was funded by a Natural Sciences and Engineering Research Council of Canada Discovery Grant (RGPIN-2020-05089), and Danilo Giacometti was funded by a Roger Conant Grant-in-Herpetology provided by the Society for the Study of Amphibians and Reptiles.

AN UPDATE ON THE SMALL MAMMAL PROJECT

Written by Sydney Miller, Cameron Lefebvre & Sami Fitzgerald

In 2024, the Algonquin Small Mammal Project proudly marked its 73rd field season. Sydney Miller, a masters student at Laurentian University, led the field team again this year. Sydney was joined by Cameron Lefebvre, a Laurentian undergraduate student, who contributed to the ongoing small mammal data collection while simultaneously conducting his own undergraduate research project. The project also benefited from the support of the Ontario Ministry of Natural Resources (OMNR), which provided staff members on a weekly or bi-weekly basis to assist with trapping and data collection. Key contributors from the OMNR included Sami Fitzgerald, Mel Abberger, Alex Heffernan, Lucy Van Haaften, and Lauren Crawshaw.

LONG-TERM MONITORING

Each year, the small mammal team conducts live-trapping to collect critical rodent demographic data—such as body mass, sex, and reproductive condition—as well as monitoring population trends. The small mammal project used seventeen historical traplines along the Highway 60 corridor in Algonquin Park to continue this long-term study. We captured a total of 544 individuals of various species, including Deer Mice, Woodland Jumping Mice, Red-backed Voles, Eastern Chipmunks, Red Squirrels, Northern Flying Squirrels, and several shrew species. Notably, in 2023 trapping efforts yielded only 224 individual captures, making 2024 a high population year for small mammals.

COVID-19 SAMPLING

We continued our SARS-CoV-2 (COVID-19) sampling for the third consecutive year as part of an ongoing project to detect and monitor the virus in wildlife populations. This is being done to better understand its potential impacts on both human and wildlife health. The SARS-CoV-2 project is led by Dr. Jeff Bowman's team (OMNR) in collaboration with Sunnybrook Research Institute and the Wildlife Emerging Pathogens Initiative. Additionally, this work has been supported by the Canadian Safety and Security Program, which is run through the Department of National Defence.

Sampling for SARS-CoV-2 was conducted periodically from May to August for a total of 219 swabs from almost 200 individual animals. The majority of these animals were Deer Mice, but sampling extended to Woodland Jumping Mice, Red-backed Voles, and even a few Red Squirrels. This year, external rectal swabs were taken instead of oral swabs as it has been shown that rectal swabs provide more accurate results. Additionally, we did not collect swabs from the same individuals, unless two or more weeks had elapsed since the original swab date. As of December 2024, no cases of SARS-CoV-2 have been detected in the small mammals of Algonquin Park. Other virus detection work is ongoing.

GLUCOCORTICOID LEVELS

Cameron Lefebvre's undergraduate research is assessing the relationship between glucocorticoid levels and the presence of gastrointestinal parasites in wild populations of Deer Mice in Algonquin Park from May to August in 2024. Glucocorticoid hormones play many important physiological roles in the body, including the immune response, and previous literature has found that parasitic infections can increase glucocorticoid levels of the host.

Since the eggs of parasites reside within the feces of Deer Mice, we can collect data about parasite infection by collecting fecal samples left behind by individuals that were captured in the live traps. We are also able to analyze fecal samples for glucocorticoid concentrations.


Photo: Lucy Van Haaften

Cameron is predicting a positive relationship between glucocorticoid concentrations and the number of parasites. Investigating this relationship can help validate previous research that has looked at this relationship and provide a basis for further research into the intricacies of host-parasite influences, interactions, and consequences for hosts.

> "AS OF DECEMBER 2024, NO CASES OF SARS-CoV-2 HAVE BEEN DETECTED IN THE SMALL MAMMALS OF ALGONQUIN PARK."

GASTROINTESTINAL PARASITE INFESTATIONS

Sydney Miller's graduate research is examining the effects of gastrointestinal parasitic infection by helminth worms on small mammal physiology and health. This research aims to determine whether Deer Mice, Woodland Jumping Mice, and Red-backed Voles in Algonquin Park exhibit differing susceptibility to parasitic infections. These parasites, transmitted through the consumption of infected arthropods or fecal matter, can have significant detrimental effects on their hosts, including body mass loss. Driven by curiosity about the differences in infection rates among these rodent species and the broader impacts of helminth infections, Sydney designed a comprehensive study to address these questions. As part of her research, Sydney implemented an experiment using an ivermectin treatment to reduce helminth infections and monitored the effects of infection and treatment on the immune responses of rodents through blood smear analysis. Blood smear samples were collected from adult rodents to measure immune response variations related to helminth parasitism. Infected rodents received either a single oral dose of ivermectin (10 mg/kg) or a control dose of 17.5% sucrose solution administered via pipette. Each morning, 50% of captured rodents received the ivermectin treatment, while the remaining 50% received the control dose. This dosing regimen was maintained throughout the field season, with each individual rodent receiving consistent treatment type for the duration of the experiment. Following the initial administration, the rodents were observed for fourteen days before receiving a second dose, during which additional blood smears were collected. Infected rodents underwent four rounds of treatment over the course of the sixteen-week experiment from May to August 2024. This design enabled detailed tracking of how infections influenced host characteristics such as body mass. The experiment also investigated host traits, including age, weight, and reproductive condition, that could influence susceptibility to infection. To further assess infection dynamics, the small mammal research team collected fecal samples prior to treatment administration to identify and quantify helminth eggs and evaluate the relationship between helminth parasitism and rodent immune responses under the two treatment types. This approach will provide valuable insights into the complex interactions between small mammals and their parasitic infections, contributing to a deeper understanding of host-parasite dynamics in Algonquin Park. We look forward to sharing those results when we have completed our data analyses. ♦

ACKNOWLEDGEMENTS

We extend our gratitude to Dr. Albrecht Schulte-Hostedde (Laurentian University) and Dr. Jeff Bowman (Ministry of Natural Resources) for their valuable support of the small mammal team and our research. A sincere thank you goes to all members of the small mammal team for their exceptional efforts, as well as to field course students and Station researchers and staff who showed interest in the project and assisted with data collection. We are also deeply appreciative of the Algonquin Park staff for providing opportunities to engage and inspire young researchers, fostering their enthusiasm and contributions to our fieldwork. The success of the 2024 small mammal field season would not have been possible without the dedication and support of these individuals.

UNDERSTOREY RESTORATION TECHNIQUES OF THE RED PINE PLANTATION AT CACHE LAKE

Written by Estella Crosby

The understorey of a forest is the ground-level vegetation beneath the main canopy, and it has beneficial impacts on the forest ecosystem, such as increasing the overall vegetation diversity, providing more varied habitat for insects and other wildlife, and increasing soil nutrients. In pine plantations, the understorey is sparse to non-existent due to shading from tree branches in the canopy, as well as the thick layer of fallen pine needles, which can suppress vegetation growth and acidify the soil. Pine plantations are prevalent in Algonquin Provincial Park, as well as the rest of Ontario and there is interest in learning how they can be restored to a more functional forest habitat. However, the cost of restoration projects, as well as the time they take, are major barriers to restoration. This research project is testing understorey restoration techniques that are both time and cost-effective.

The fieldwork portion of this four-year research project studying understorey restoration of the pine plantation at Cache Lake concluded in summer 2024. The first two years of this project were led by my wonderful colleague Jason Phoenix, and I am in charge of the second two years. In the first two years of this project, park staff thinned the existing pine trees and applied herbicide to invasive vegetation. Then, Jason and his team measured out an experimental grid and applied understorey restoration treatments that we are testing. These include the "applied nucleation" treatment, which involves the planting of native shrubs and tree species scattered throughout the site. Beaked Hazel shrubs and Yellow Birch trees were used as the nuclei in this experiment. This technique takes less time and costs less than fully planting the area, and mimics natural succession. This should ideally increase the recruitment of more of these native species, as well as provide beneficial habitat for other native plants. Another treatment we are testing is "windthrow guards" which in this experiment involves planting a ring of goldenrod around native shrubs or trees, to reduce damage or death from wind damage.

> "...THE MOST COMMON PLANT & INSECT SPECIES OBSERVED ARE NATIVE, WHICH IS VERY PROMISING."

RESEARCH QUESTIONS

My research questions for this project are: (1) which treatments are most effective at restoring understorey plant and insect diversity and richness? (2) Which treatments are the most effective at restoring chemical soil parameters? (3) Are windthrow guards effective at reducing the mortality of transplanted shrubs?

METHODS

To answer these questions, I performed four kinds of ecosystem monitoring this summer, with a few minor changes compared to last year. The first was soil sampling, which occurred once, as the properties of the soil for which I am testing are unlikely to change significantly from month to month. I am testing for pH levels, as well as concentrations of some important plant nutrients, including nitrate-nitrogen, potassium and phosphorus. The second was vegetation monitoring, where I identified all the plant species within a set area (called a quadrat, pictured above) and estimated what percentage of the ground they cover. This survey occurred four times. This summer I changed the vegetation surveys from occurring in an 8 m^2 area to a 1 m^2 area. This was to save time and be more accurate. As I am not the tallest person, I often doubted my ability to accurately estimate what percentage of the ground a plant species covered in an 8 m^2 area. Additionally, as you may expect, identifying all the plant species in a 1 m^2 area takes much less time, so I was able to survey more plots this year. The third was insect trapping. I used two kinds of traps: pollinator traps for pollinating insects, and pitfall traps for ground-level insects. The traps were left out for 48-hour periods twice throughout the summer and then collected. The insects were then stored in ethanol to preserve them and brought back to the lab in Waterloo for identification. The fourth and final was the plant mortality survey, which occurred once during the summer. For this, I went to every treatment plot which received transplanted native plants for the applied nucleation and/or windthrow guard treatments and recorded if the transplanted plants were still alive or not.

Photo: Estella Crosby

PRELIMINARY RESULTS

Although I do not have all the results yet, I do have some preliminary results. The most commonly observed insect families were hoverflies with 56 individuals observed. This is followed by ants with 53 individuals observed. The most frequently observed vegetation species was Wild Red Raspberry with 208 total observations. This was followed closely by mayflowers with 204 total observations. It is important to note that these numbers are not the total number of individual raspberry or mayflower plants observed; rather, it is the number of plots within the research site that had at least one raspberry or mayflower plant present. Although these are not all the results, the most common plant and insect species observed are native, which is very promising. Additionally, as of 2024, 83% of the nucleation transplants had survived and 89% of the applied nucleation transplants with the windthrow guard had survived. Although there is no statistical evidence yet, the fact that such a high percentage of both treatment types survived is promising. However, it should be noted that four years is not a long time in terms of the forest plant community, or ecosystem recovery, so while these results are promising, we won't know definitively how well the area is recovering for many years. ♦

ACKNOWLEDGEMENTS

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THE DEVELOPMENT OF A HISTORICAL & ARCHAEOLOGICAL PROJECT

Written by Dr. Raymond (Sandy) Hunter

I am an archaeologist and historian, and so I have a different focus than most of the wildlife researchers that stay at the Station. I am drawn to Algonquin Provincial Park and the Station by many of the same factors that animate ecological research, including the spectacular environment, and the diversity of flora and fauna it hosts. However, my interest is in the human history of the place, and—as an environmental archaeologist—the relationship between the natural environment and that human history.

Recently, I've developed an interest in how the human use of the Algonquin region has shaped its ecology through the last century and a half, and, in turn, I'm interested in how the environment of the park has shaped human use of it. In Algonquin, these interests translate to a focus on logging. I'm developing a research project on logging histories in the park, and in particular how different modes of logging in different time periods impacted the forest in different ways. One aspect of this study is an examination of the ruins of logging camps in the park. As anyone who has spent a significant amount of time in Algonquin knows, these ruins dot the landscape—indeed, there is hardly a lake or river that does not feature a crib, camp, chute, or dam dating to the historic logging era.

Studying these rapidly decaying infrastructures, which are often deep in the park and difficult to access, poses challenges. At this stage, my work focuses on developing methodologies for efficiently documenting logging infrastructure remnants using remote GIS applications and photogrammetry. I am using the ruins of two logging camps at the Station to test these methods. The first is the Stephenson Site, an early Camboose Shanty near the Station's Director's Cabin that I helped investigate alongside Rory MacKay in 2023. Rory wrote about that work in the Station's 2023 Research Report. Research at the site suggests it was used by the Perley and Pattee lumber company, likely in the 1890s. The Stephenson Site is in poor shape. Little remains on the surface except for the stones of the camboose, a central hearth that once provided heat and light to the 50-odd men who lived in it through the 19th century winter timbering season. Counterintuitively, the poor condition of the camp makes it an ideal place to test our methods and ensure they will work even in locations with especially poor preservation.

The second logging camp in the vicinity of the Station is a short hike beyond the north end of Lake Sasajewun up the Madawasaka River. It will be familiar to anyone who has travelled from the Station up the river. This camp is elaborate in comparison with the Stephenson Site. It dates to the late 1940s, when it housed

"AT THIS STAGE, MY WORK FOCUSES ON DEVELOPING METHODOLOGIES FOR EFFICIENTLY DOCUMENTING LOGGING INFRASTRUCTURE REMNANTS USING REMOTE GIS APPLICATIONS AND PHOTOGRAMMETRY."

workers who cut lumber for the McRae company mill on The Lake of Two Rivers. The walls of many buildings at the site are still partially standing, and there is considerable other evidence of human occupation: metal cans, bottles, a root cellar, and so on! The park evaluated the site in 1973, but it hasn't been looked at since. In summer 2025, I hope to spend time mapping the site and documenting surface remains—work I will also carry out at other sites in the park. This work will offer a foundation for a more expansive study of the social and ecological impacts of historic logging in Algonquin's forests. ♦

A pipe bowl excavated from the remnants of the Stephenson Site shanty on the grounds of the Algonquin Wildlife Research Station. Photo: Dr. Raymond Hunter.

WHITE TRILLIUM MONITORING IN ALGONQUIN PARK

Written by Kristin Olson

WARMING WILL CAUSE SOME PLANTS TO SHIFT THEIR RANGES

Recent climate change has led to an increased interest in the role that climate has in determining where and how well plant populations grow. As the climate continues to warm, areas previously too cold to support certain plant species may become warm enough for these species to become established. In the northern hemisphere, this warming may cause many plants to expand their ranges into previously unoccupied northern regions. Populations growing near a plants' northern range edge—the area north of which the species no longer occurs—are geographically well positioned to lead these range expansions.

Even though edge populations may be physically positioned to lead range expansions, low population fitness (e.g., smaller individuals, lower seed production) may slow establishment into newly warmed areas. Ecological theory suggests that edge populations have low fitness because they are growing in habitat that is less suitable for them than habitat near the centre of a species' range. However, studies have showed mixed results when testing this theory. The lack of consistent support across studies may be because, although edge populations tend to be far from the geographic center of a species' range, the conditions near a species' range edge may be suitable enough to support healthy populations.

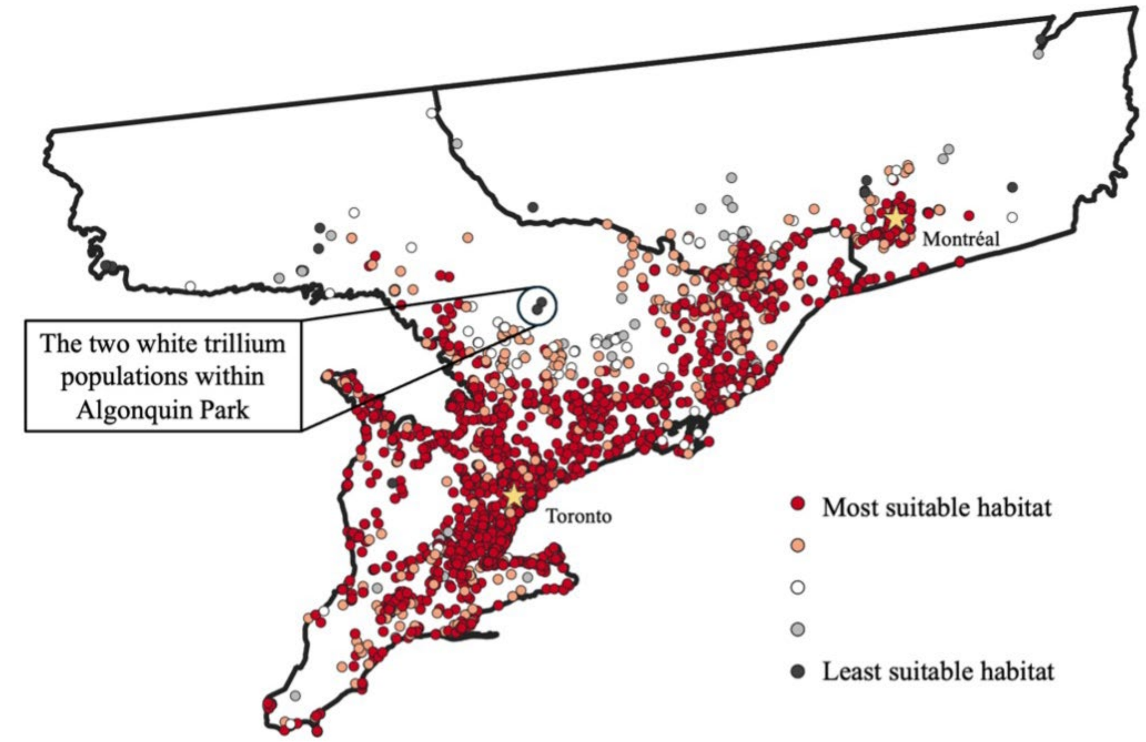
LAYING THE FOUNDATION FOR LONG-TERM PLANT MONITORING IN THE PARK

An area that may see particularly impactful warming is Algonquin Provincial Park. The park's relatively high elevation leads to colder temperatures within the park than in the surrounding areas. This difference in temperature is one reason why many plants that grow abundantly less than 100 km south of the park have a difficult time thriving within the park. One plant that grows all over southern Ontario but not in Algonquin Park is White Trillium. Algonquin Park is home to the two northernmost populations of White Trillium in the region. These "northern range edge" populations are geographically situated to lead range expansions but may not be fit enough to rapidly do so.

To better understand how the populations of White Trillium in Algonquin Park will respond to climate change, we needed to compare the fitness of populations across the flower's geographic range and across the range of habitat conditions that it is known to grow under. For my study, I used ecological niche modeling to quantify habitat suitability across White Trillium's range. Then, over the course of two growing seasons (2023 and 2024), I visited 56 unique White Trillium populations and collected data on population performance. I visited many populations both years, including the populations within Algonquin Park, laying the foundation for long term monitoring. I predicted that edge populations would (1) be growing in habitat that is less suitable than habitat near the range-centre and (2) have smaller individuals, lower plant density, and fewer flowering individuals.

RESULTS & INFERRED TRENDS

Across all 56 populations that I visited, I found that edge populations were generally growing in habitat that was relatively less suitable for them, but that this didn't have a clear impact on population fitness. While edge populations did have a lower density of plants, the plants that were present tended to be larger with higher reproduction rates compared to populations closer to the range-center. The populations of White Trillium in Algonquin Park followed this same trend: plant density was relatively low but the plants that



ABOVE: The location of White Trillium populations within Algonquin Provincial Park relative to all other known populations in Canada. The colour of each dot indicates how suitable the habitat in that area is for White Trillium. White Trillium in Algonquin Park are growing close to the flower's northern range edge and in habitat conditions that are relatively less suitable than the conditions most other populations are experiencing.

were there tended to be large and most of them were reproductive. What we have learned so far is that just because habitat conditions near the northern range edge are different from those which White Trillium typically prefers, healthy individuals can still persist.

My results suggest that for populations growing in habitat with relatively low suitability, a lower plant density might prevent individuals from having to compete for resources such as light availability. This allows them to grow to a larger size and have a greater seed output. High seed production in less suitable habitat ensures a population persists despite potentially low germination rates. Studies on competition between adult individuals, seed germination, and seedling survival are all necessary to better understand why edge populations of White Trillium are larger in size and have a greater reproductive output than central populations.

Between the two growing seasons that my study took place, plant density of the White Trillium populations in Algonquin remained consistent. However, both populations tended to be more reproductive in 2024 than in 2023. The spring of 2024 saw a very early spring thaw—about two weeks earlier than historical averages! Abnormally warm spring temperatures led to a longer growing season, potentially allowing individuals more time to initiate reproduction. It is important to note that these data are inferred trends from only two seasons of observations. Yearly monitoring will paint a more well-rounded picture of how White Trillium will respond to the inevitably irregular climatic changes that are to come. ♦

ACKNOWLEDGEMENTS

Thank you to Nora Bartram-Forbes for her contribution to data collection in 2023 and 2024; this project wouldn't have been possible without her hard work and dedication. Thanks to Dr. Anna Hargreaves and Dr. Jenny McCune for their supervision and guidance. Many thanks to the land managers and owners who granted us access to various White Trillium populations. Lastly, thank you to everyone at the Station for providing a supportive and fun environment!

Photo: Samantha Stephens

ESTABLISHING A SNAKE MONITORING PROGRAM

Written by Drayke Evans

Algonquin Provincial Park is a world-famous nature destination due to the impressive array of boreal species that call it home, most notably the 'charismatic' animals such as moose, wolves, loons and beavers. A group of animals that lives in the shadows of these typically beloved wildlife are snakes. Snakes are extremely shy, secretive animals that spend much of their lives under cover objects unless they need to feed, mate, or warm their bodies by basking in the sun. They are not aggressive and, when confronted, they attempt to escape as their bite is useless in fending off large predators such as humans. If being overlooked was the only anthropogenic problem for snakes, then they might still be thriving in Ontario. Unfortunately, almost every species of snake in Ontario is declining due to combinations of habitat destruction, road mortality, undeserved persecution, and other threats. The six species that currently live within the park's borders have been granted some degree of refuge, however very little is known about where they may exist within the park and the size of their populations. In nearly a century of biological monitoring and research in the park, snakes have received virtually no formal attention from the scientific community. However, in May of 2023, this would change.

A NOTABLE GAP IN THE PARK'S SCIENCE

As the Assistant Manager of the Station since April 2023, I was surprised to discover that in the eighty years of wildlife research conducted here, not a single study has ever been carried out on snakes. Though an unfortunate fact, it also doesn't come as too much of a surprise, as their small sizes and cryptic lifestyles make them highly difficult to mark or tag with tracking equipment. That being said, there are still ways in which population trends can be monitored.

COVERBOARD SURVEYS AT THE AWRS

I was both excited and honoured when Ontario Nature reached out in the spring of 2023 to invite the Station to participate in their long-term monitoring protocol of snake populations. Their goal is to develop an effective methodology to detect population trends of Ontario snakes over a ten-year period. Coverboard surveys are a standard method for monitoring reptile and amphibian populations due to their simplicity and cost-effectiveness. Since Ontario snake species like to spend time under cover objects, coverboards attract snakes and provide researchers a way to detect their presence on the landscape. This type of study is also non-invasive and requires very little handling time to collect sufficient data. To conduct one of these surveys, all you need is twenty-four two-by-four-foot pieces of plywood that are about a half inch in thickness, a device to measure temperature, a stopwatch, and a holding bin. The boards are laid out in a line, five metres apart. For our study, I went out every five to nine days and checked underneath each board. If a snake was found, I placed it into the holding bin and collected data including photographs, species, age, sex and behaviours. These surveys took place from May to September.

"...VERY LITTLE IS KNOWN ABOUT WHERE THEY MAY EXIST WITHIN THE PARK & THE SIZE OF THEIR POPULATIONS."

A Northern Red-bellied Snake. Photo: Drayke Evans

PRELIMINARY RESULTS

While there is currently insufficient data to draw any conclusions, there is preliminary data that is worth mentioning. In the first year of the study, the Eastern Gartersnake (*Thamnophis s. sirtalis*) was the only snake species found during our coverboard surveys. However, the second year yielded two additional species: the Northern Red-bellied Snake (*Storeria o. occipitomaculata*) and the Northern Ring-necked Snake (*Diadophis punctatus edwardsii*). Interestingly, every snake that has been captured in the two years of this study has been a juvenile. We hope by continuing our monitoring, we can detect additional species such as the Smooth Greensnake (*Opheodrys vernalis*) and Eastern Milksnake (*Lampropeltis t. triangulum*), species that are considered quite rare along the Highway 60 corridor.

THE BIGGER PICTURE

The Station will continue participating in this annual survey and hopefully expand the study by establishing surveys at other locations in the park. Ultimately, we aim to establish a baseline data set of snake populations in Algonquin Provincial Park. Community members and park visitors can help contribute to our knowledge about snakes by uploading their snake sightings to Algonquin Provincial Park's project on iNaturalist. Understanding where different species are found—whether it is in the park, or not—directly assists biologists by revealing which locations could be further surveyed or protected. ♦

ACKNOWLEDGEMENTS

I would like to thank both Ontario Nature and the Algonquin Wildlife Research Station for making this opportunity possible. Thank you to Ontario Parks for purchasing coverboard materials for this project. The conservation impacts provided by these organizations is invaluable. I would also like to thank Station Manager Kevin Kemmish for his assistance with project planning. Lastly, thank you to Amanda Semenuk and Farqd Barghash for helping out with surveys.

ENTOMOLOGICAL CONNECTIONS

Written by Dr. Stephen A. Marshall

The Station is a great place to find connections, and I spent a bit of time there in the early spring and fall of 2024 looking for connections between immature insects and their associated adult forms. I had recently been asked if I would update my 1997 booklet, "Insects of Algonquin Park", which I originally wrote when Dan Strickland, who was at that time the Chief Park Naturalist for Algonquin Park, asked me to prepare a short, easily readable introduction to insects for interested park visitors. Prior to that project, I had spent a fair bit of time in Algonquin paddling my canoe around the east and west sides, helping to teach field courses at the Station, and doing a fly inventory at Scott Lake, so I had assembled enough insect photos (slides, of course) and records to produce a booklet that was okay for the time. However, by 2024 it was out of date, and out of print. Since I wanted any update to include more life cycle photos, that is adult and immature individuals, I needed to spend time in the park gathering new material. The Station was booked up for much of the summer but had space during black fly season and then again in the fall—perfect for my purposes—so I showed up equipped with cameras, nets, blacklights and other paraphernalia and was made to feel totally welcome by Station personnel and fellow Station users.

I have done primary research on insects of the park in the past, even describing a few new fly species and a new genus. The fly *Pullimosina geminata* is still known only from the park, and Scott Lake remains the only Canadian locality for the genus *Volumosina,* which is restricted to old-growth forests. This year my activity was more natural history focused than "research" as I tried to match up larvae (immature individuals) from the lake, river, wetlands and woods with their associated adult forms. In some cases, as when *Siphlonurus* mayflies emerged in numbers from the little spring at the bottom of the hill from the Cookhouse, or when hordes of *Leptophlebia* emerged from Bat Lake just as I arrived on the scene, it was just a matter of being in the right place at the right time. Often, however, the work involved picking through gallons of mud or other material to find larvae to identify and associate with adults or scanning thousands of adult caddisflies and mayflies at a blacklight sheet to find the adults to match the larval photos. I wasn't always successful—I failed to find the larva of the most photogenic caddisfly in the park, *Hydatophylax argus*, even though a couple of adults landed on my cabin door, and I wasn't able to find Strongcase Caddisfly (Odontoceridae) larvae even though adult *Psilotreta* showed up at my blacklights in numbers. All great fun, and all very successful thanks to the rich insect fauna around the Station.

"MANY OF THE INSECTS I ENCOUNTERED THIS PAST SUMMER HAD NOT YET BEEN FORMALLY RECORDED IN THE PARK..."

While it was rewarding for me to find many unexpected insect taxa at the Station and nearby, I do find it remarkable that there are still so many surprise taxa at such a long-established research site. Many of the insects I encountered this past summer had not yet been formally recorded in the park, and most were not previously documented from the Station grounds, specifically. The updated "Insects of Algonquin Park" booklet will help park visitors and field course students at the Station learn about insects, but it will be too general and limited to serve as an identification aid except for a handful of selected genera and families. Hopefully, in the future an authoritative and reasonably comprehensive species list can be assembled for some of the key habitats on Station property. This would serve as a more useful starting point for students daunted by the difficulty of identifying insects without a site-specific list. ♦

ABOVE: A nymphal *Leptophlebia cupida* (Leptophlebiidae) from Bat Lake. BELOW: An adult *Hydatophylax argus* (Limnephilidae) from the Station's Director's Cabin. Photos: Dr. Stephen A. Marshall.

FINDING FUN, FRIENDS & FAMILY DURING FREED

Written by Mariel Terebiznik, Aranya Iyer, Ceara Das, Amber Chanthavong & Averyn Ngan

The Station holds a special place in the heart of the thousands of people that have passed through its facilities in the past eighty years. As co-founders of Field Research in Ecology and Evolution Diversified (FREED)—an organization dedicated to increasing access to field research and naturalist skills for Indigenous, Black, and/or Racialized undergraduate students through overnight excursions—we could not find a more perfect home for our excursions than the Station. Here, we have everything we need from learning facilities, cabin space, naturalists and long-term researchers working in Algonquin Provincial Park, all our animal and plant teachers, and the most incredible, supportive staff that are part of our growing community! In 2024, FREED held three excursions at the Station. In May, we welcomed fourteen undergraduate students from Trent University, the University of Waterloo, and Wilfrid Laurier University for a five-day excursion. Then, in August, we held two back-to-back week-long excursions for fifteen students from the University of Guelph and McMaster University, followed by fifteen more students from the University of Toronto. We had the privilege of watching our students (or FREEDlings as we call them) come together and form deeper relations with each other and the land as they learned about field research and outdoor skills. They were guided by our FREED instructors and leaders who were eager to share their knowledge and experiences spanning the conservation sector as graduate students, conservation practitioners, park naturalists, consultants, non-profit leaders, and Indigenous speakers. But don't just take it from us—we have three personal reflections from FREEDlings from each excursion sharing their experiences below.

MAY REFLECTION: CEARA DAS

During FREED, I experienced a unique connection between my love for the outdoors and my identity as a person of colour. I felt such a sense of belonging while birdwatching with Aranya (FREED co-director and Associate Specialist, WWF-Canada) and my new friends while being attacked by blackflies because, for the first time in my life, I was surrounded by people with experiences and interests so similar to mine. Until FREED, I had never been to a remote area such as a provincial park, mostly due to my family's lack of knowledge and interest, so this program allowed me to explore with like-minded people in a comfortable environment. One of my favourite memories was sitting in the Station Cookhouse after dinner one night with Sherryann (FREED leader, Trent graduate student) who was also from Guyana. This was the only time I met someone with the same background as me in my entire university career. I asked her many questions about Guyana and we joked, speaking in Creole sporadically. At one point, quite a few students of Caribbean descent were sitting at the table, laughing loudly and playfully arguing about our cultures. It was the most I'd laughed in a long time, and never with other Caribbeans who were not related to me. The friendly and casual atmosphere at the Station made me feel at home right away. From catching bees with Lydia (FREED leader, University of Ottawa graduate student) and the group during the pollinator workshop to learning about bear safety with Micheline (MNRF Provincial Co-

Photo: Michael Alexander

ordinator for Human Wildlife Management), I was surrounded by friendly faces that helped me learn more about what I care about most: the environment. Even when I had a severe allergic reaction during a scavenger hunt and needed to be driven to meet an ambulance, I was still in good spirits and even saw a moose!

AUGUST WEEK ONE REFLECTION: AMBER CHANTHAVONG

When asked about my fondest memory from FREED, the bog walk at Wolf Howl Pond always comes to mind. This is where the turtle workshop took place, organized by Reta Meng (FREED leader, McMaster University graduate student), and was the workshop I had eagerly anticipated since learning about this week-long expedition. On that day, I remember the cloudy sky and misty cold air gracing my skin as my friends and I helped each other out of a wobbly canoe. With each step, my foot grazed the soft, springy *Sphagnum* moss and slowly sank into the unexpectedly warm water below. I reached down, gliding my hand over the red foliage, feeling plush leaves against my palm. Around me, I heard the footsteps of others, their excited voices blending with the gentle sound of water flowing along the bog. Cradled softly by the mat of intertwined plants and with my ankles submerged in the pond, I felt a sense of embrace unique to anything I had felt before.

'More-than-human' was a frequently used term I hadn't known before this event. During other workshops, we reflected on our interactions with animals, plants, rocks, and other more-than-human beings and discussed ways to foster more kind and respectful relationships with them. Like many others exposed to negative narratives and stigmas surrounding snakes, I have always been quite frightful of them. I mention this because during the bog walk, Mariel (FREED

Co-Director & Assistant Park Planner with Ontario Parks) found a snake and asked if we would like to hold them. It might seem a bit silly, but it took a considerable amount of courage to set aside my preconceived fears and redefine this relationship. The snake was calm and felt surprisingly soft in my hands.

I have always been drawn to conservation biology but often felt disconnected from nature. Having spent most of my life indoors and being a rather reserved person who deeply cherishes the familiar, the outdoors was an unknown and scary space. Surrounded by like-minded childhood friends, I never felt I was missing out—until university when I heard about others' incredible experiences with activities like canoeing and fieldwork. As I pursued my studies, my background and identity influenced my sense of belonging. Being a woman of colour with limited experience in outdoor settings, I felt out of place in this predominantly white domain. Participating in FREED changed my relationship with ecology. It gave me the skills to find confidence in the field and helped me strengthen my connection with nature. While in Algonquin, I learned new ways of interacting with the landscape and more-than-human beings. This growth would not have been possible without the diverse, wonderful, and welcoming community of naturalists who made me feel like I truly belong.

> "THE FRIENDLY AND CASUAL ATMOSPHERE AT THE STATION MADE ME FEEL AT HOME RIGHT AWAY."

AUGUST WEEK TWO REFLECTION: AVERYN NGAN

In August, I attended a weeklong FREED event for University of Toronto students at the Station. On our fourth night there, about ten other students and I headed down to the Lake Sasajewun dam to go stargazing. We were all tired from a long day of learning about aquatic ecology while wading in the Madawaska River, examining insect-plant interactions, and having career talks with FREED leaders. That same morning, most of us had even chosen to get up at 6:00 am to go birding with Drayke, the Station Manager, at the airfield before the day's workshops began. Despite our exhaustion, the skies were clear and we were not going to miss our chance to see the stars.

When we arrived at the dam, we huddled in a little circle to turn off all our phone screens and headlamps so that our eyes could adjust to the dark. As our lights went out, we clutched at each other and looked up at the sky—sounds of amazement echoed around the group. A whole ocean of stars lay above us, so open and big it felt like I was falling towards it. We decided to continue our stargazing while lying on the gravel ground, squished together like a pack of sardines.

As we lay there, one of my classmates was telling us about the constellations, naming the brightest stars and pointing out where a planet was in the sky. I remember soaking in the moment in disbelief at how I got there, as this was the kind of thing I dreamed of when I chose Environmental Science as my major. I had just spent the past few days getting my first taste of fieldwork, learning how to identify trees, fish, birds, and insects. During the next few days, I would learn how to start a fire and I would hold a bird in my hand for the first time. Not only was I getting hands-on experience in the field that I'm passionate about, I was also being driven to tears from laughing so hard with new friends—friends who had similar career goals, and who could talk for hours about a niche species they've been researching. I had never been around a group of university students who expressed such pure excitement towards what they were studying. I felt inspired and invigorated, and incredibly at home. ♦

PEER-REVIEWED RESEARCH PAPERS

Giacometti D, Moldowan PD & GJ Tattersall. 2024. **Ups and downs of fossorial life: migration restlessness and geotaxis may explain overwintering emergence in the Spotted Salamander**. Journal of Experimental Biology 227(21): jeb249319.

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Algonquin Life Magazine. 2024. Much Ado About Mice, Voles: Algonquin Park Small Mammal study endures. Features the small mammal study. [Print]

Journal of Parasitology. December 2024. Acceptance of the 2024 Henry Baldwin Ward Medal: A MacGyver Approach to Parasitology. Written by Janet Koprivnikar. [Online]

Our Forest Magazine. Breaking Barriers to Access for Fieldwork: A look into Field Research in Evolution and Ecology Diversified. Written by FREED Co-Director Vanessa Nhan with images by Samantha Stephens. [Print & Online]

MacTV, Below the Radar & Ideacom international. 2024. Peat the Magnificent/Secrets in the Peat. Featuring Amanda Semenuk and Finn Pawlick-Potts. [Live broadcast & online]

National Geographic Books. October 2024. World From Above. Features image of salamander-eating pitcher plant by Samantha Stephens. [Print]

The Royal Society Blog. September 2024. Uncovering seasonal shifts in the thermoregulatory strategies of a burrowing salamander. Written by Danilo Giacometti and Glenn Tattersall. [Online]

DEFENDED THESES & STUDENT PROJECTS

Connell, Kaitlyn. 2024. Infestation Patterns of Trombiculid Mites on Small Mammal Hosts. Undergraduate Thesis, Laurentian University.

Gadoury, Jack. 2024. Morphological abnormalities, injury, and the evolution of temperature-dependent sex determination in a widespread reptile. Undergraduate Thesis, University of Toronto.

Wantanabe, Emile. 2024. Sex differences in acoustic response of adult snapping turtles (*Chelydra serpentina*) to a perceived conspecific. Undergraduate Thesis, University of Toronto.

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