

Eastern Georgian Bay Initiative

2022 Funding

Final Report

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Table of Contents

Summary and Milestones	3
1. Introduction	5
2. Project Area and Permitting	6
3. Combined START and CARES Activities	7
3.1 Field Activities and Data Collection	7
3.2 Walking Surveys (May-October)	8
4. Saving Turtles at Risk Today Project	10
4.2 Boot Camp (early May)	11
4.3 START Field Surveys (May-September)	11
4.4 START Nesting Surveys (June-July)	11
5. Conservation Action, Research and Education about Snakes Project	13
5.1 CARES Project Activities	13
5.2 CARES Training (March)	14
5.3 CARES Egress Hibernacula Surveys (April-May)	14
5.5 CARES Gestation Surveys (June-Aug)	14
5.6 CARES Neonate Surveys (July-Aug)	15
5.7 CARES Ingress (Sept-Oct)	15
6. Habitat Protection	16
7. Community Engagement	18
7.1 Community Volunteer Training (April-June)	19
7.2 Educational Programming	19
7.3 Reptile Hotline	20
8. Observational Data	21
8.1 Observations	21
8.2 Injured and Dead Reptiles and Amphibians	23
9. Road Mortality Mitigation	25
10. Research Partnerships	28
11. Conclusion	29

Summary and Milestones

Snake field work focused primarily on the Eastern Massasauga Rattlesnake, particularly identifying and monitoring hibernation (48) and gestation (118) sites. This season, a total of 377 Massasauga observations were recorded; 247 juveniles, subadults and adults, and 130 neonates. We saw a drastic decline in the number of snake observations this year, when compared to previous years. This was caused in part by Covid-19 outbreaks among field staff, which slowed field operations during some critical survey windows. However, gestating snakes were only observed at 18 of our 108 previously known and monitored gestation sites and 12 newly discovered sites. Considering the high level of detectability of gestating females (when previously used sites are known), we expected to see more gestating snakes than we did. Even with our decreased effort compared to previous years, it didn't account for the lack of individuals that appeared to have produced offspring in 2022. This data has not been analyzed yet, though it seemed to be the case anecdotally.

Additionally, the only known Eastern Foxsnake hibernacula along the southeastern portion of the Georgian Bay coastline was surveyed in partnership with Georgian Bay Islands National Park staff, as a preliminary effort to launch a long-term monitoring program at this site. One individual was captured, processed and had a passive integrated transponder implanted to aid with future identification surveys. This hibernacula was the site of a two year research project in 2003-2004, which estimated that it may be used by up to 200 Foxsnakes.

Monitoring road mortality hotspots via walking surveys continued this season. This year, 218 targeted road surveys were completed. Additionally, non-target roads were opportunistically surveyed for individuals, to identify additional hotspots and to move individuals out of harm's way. During these road surveys, 610 at risk reptiles were found alive and were moved out of harm's way and 58 at risk individuals were found injured and were transported for treatment or humanely euthanized when necessary (with approval due to extensive untreatable injuries). This season, 3 species at risk needed to be field euthanized; 1 Northern Map Turtle, 1 Snapping Turtle and 1 Eastern Hog-nosed Snake. Another 207 at risk individuals were found dead on the road and were noted for future hotspot monitoring and potential mitigation.

Community volunteer training continued via both in-person and virtual programs, with 37 volunteers completing training this year. Many submitted observations of reptiles through the hotline throughout the season. Only 63 educational programs were delivered due to pandemic-related complications, and staffing shortages.

Observations of threatened and endangered species triggered habitat protection under the Endangered Species Act, increasing the project's triggered protection by 307 km², from 4253 km² in 2021, to 4608 km². It is becoming increasingly difficult to survey in areas lacking current habitat protection after 9 years of surveys in Muskoka (largely thanks to funding through the Rogers Foundation and now with additional efforts through EGBI), as our previous observations have enabled thorough coverage of this landscape and few gaps remain. 2775 at risk reptile observations were recorded this year. Most notable observations included:

- Two Massasauga Rattlesnakes observed mating, which is considered quite rare
- Nest searching Spotted Turtle- first one for the project!
- Hatched 3 Eastern Musk Turtle nests
- Nesting Northern Map Turtle travelled 20 km to nest

Table 1. 2022 proposed project milestones, modifications, and results.

Proposed Milestone	Modifications	Results	Notes
30 previously confirmed hibernation or gestation sites for Eastern Massasaugas will be monitored	None.	112 gestation and 15 hibernation sites were monitored.	Milestone greatly exceeded.
30 new or potential hibernation or gestation sites for Eastern Massasaugas will be surveyed	None.	18 potential hibernation sites (7 confirmed) and 14 potential gestation sites (12 confirmed)	Completed.
1 known Eastern Foxsnake hibernation site will be surveyed and long-term monitoring plan established	None.	Site visited and established plans and communication with Georgian Bay Islands staff.	Completed. 1 individual Foxsnake captured and marked
15 new potential sites for Blanding's or Spotted turtles will be monitored	None.	25 potential sites were surveyed to determine presence.	Exceeded. 5 new locations confirmed.
15 previously confirmed sites for Blanding's or Spotted turtles will be monitored	None.	32 previously confirmed sites surveyed.	Milestone greatly exceeded.
4 snake walking surveys, weekly	Increased to 6 sites due to increased focus on snake road mortality mitigation.	6 sites, 102 surveys conducted.	Completed.
15 turtle walking surveys, every other week	None.	15 sites, 116 surveys conducted.	Completed.
900 hotline calls/texts	None.	842 hotline reports received.	Almost completed.
2000 species at risk observations recorded	None.	2775 species at risk observations recorded	Milestone exceeded.
Minimum 500 sq. km of new habitat protection enabled under Ontario's ESA	None.	306.89 sq. km protected	Milestone not met, due to Covid outbreaks during critical times
Creation of educational video about species at risk reptiles	Carried forward from 2021	Video completed and uploaded to youtube	Completed.

1. Introduction

Funding from the Eastern Georgian Bay Initiative (EGBI) supported field conservation activities and community engagement efforts for both the Georgian Bay Conservation Action, Research, and Education about Snakes (CARES) Project and the Saving Turtles At Risk Today (START) Project. This is not a complete report of all activities conducted through these projects, it instead focuses on the aspects of the projects which are funded by EGBI, as well as their results for the conservation of our target species; primarily the Eastern Massasauga rattlesnake, Eastern Hog-nosed snake, Blanding's turtle, and Spotted turtle. Eastern Foxsnakes and Eastern Musk turtles have so far been tangential to our efforts, though we are planning to expand our work with Eastern Foxsnakes in 2023 depending on available resources.

The CARES Project was launched in 2020 with funding support from the EGBI. The CARES Project focuses on the conservation of species at risk snakes in the eastern Georgian Bay region and is focused primarily on addressing road mortality, habitat loss, filling knowledge gaps, and decreasing persecution of the Eastern Massasauga rattlesnake, Eastern Hog-nosed snake (*Heterodon platyrhinos*), and to a lesser extent, the Eastern Foxsnake (*Pantherophis gloydi*). This project works in tandem with the START Project and leverages its pre-existing funding and resources for turtles to create more conservation efforts for snakes in the region. Both CARES and START teams are trained to work with both local turtles and snakes. This was the third year of the CARES Project and each year continues to be successful in completing or exceeding expected milestones.

The START and CARES Projects are conducted in collaboration with the Georgian Bay Turtle Hospital, the Canadian Wildlife Federation, Laurentian University and The Land Between. Additional partners include McMaster University, Muskoka Lakes Farm & Winery, the Gravenhurst Rifle and Revolver Club, the Gravenhurst Conservation Club, the Couchiching Conservancy, the Nature Conservancy of Canada and the Georgian Bay Biosphere. As usual, the project was well received within the community and we expect additional academic and community partners to join in the future.

The START Project commenced in 2013, and due to the need for turtle conservation work in central Ontario, the scope of the project rapidly expanded. Results from this project are especially relevant to the management and conservation of turtles across the southern edge of the Canadian shield, sometimes known as "The Land Between", which is estimated to contain a large proportion of Ontario's remaining turtle populations. Other long term turtle work in central Ontario occurs along the Georgian Bay coastline and in Algonquin Park, however, these locations don't share the typical habitat conditions, anthropogenic influences and climate of the region, so their results are unlikely to be representative.

Five of six turtle species (Blanding's, Spotted, Snapping, Northern Map, Eastern Musk and Midland Painted) found in the region are classified as "at risk", with a seventh (Wood) already extirpated. Blanding's and Spotted turtles in particular have suffered catastrophic declines south of the Canadian shield. Anthropogenic threats such as road mortality, habitat loss,

subsidized predators, collection and persecution are the primary causes of this observed decline. Core objectives of this project are to prevent, reduce and offset road mortality and subsidized predation as threats to populations of these species, to report observation for species at risk to facilitate habitat protection, and to estimate population sizes of turtle species found in the area. Additional objectives are to identify nesting, overwintering, aestivation and road crossing hotspots, to reduce collection for the food and pet trades, and to increase public knowledge and awareness regarding related conservation issues in the region.

The education goals related to EGBI funding pertain to both turtles and snakes, and details are presented in section 8.2 (Educational Programming). However, in general, our education efforts continue to be greatly constrained by the Covid-19 pandemic. Some progress was made this year, with 63 programs being delivered in person, however we were hoping for more.

The START project received core funding (\$173,000) from the Rogers Foundation through the Canadian Wildlife Federation (as it has for the last 8 years). With funding from the EGBI being more limited this year, it was not directly used for turtle work, however, since the project goals and activities are so closely entwined, we presented significant results about it here. The EGBI remains our only core funder for snake work in central Ontario.

Our work also received some funds through a partnership with The Land Between through their federally funded Community Nominated Priority Places project; this was primarily for turtle conservation. Several federal wage subsidy programs allowed for hiring additional field technicians, such as Young Canada Works, Canada Summer Jobs, and Youth Employment Strategy internships through ECO Canada and the Clean Foundation. Wage subsidy funding totalled over \$689,000 this year. Core project funding from sources like the EGBI are critical in leveraging such wage subsidy funds and using them effectively.

2. Project Area and Permitting

The overall 2022 project area extended from the Georgian Bay coastline to the eastern edge of Haliburton County, and from Bradford to Parry Sound and Huntsville (Figure 2).

Some project activities may occur across the entire landscape (i.e. hotline call response), while others happen only within specific areas (i.e. turtle capture and notching, snake capture and rattle painting) or for specific species (i.e. blood sampling). Snake-focused fieldwork occurs only in northern Simcoe County, Muskoka, and Parry Sound within the range of the Eastern Massasauga Rattlesnake.

Multiple permits and authorizations are required to conduct many of these project activities. Activities not covered under this permit were registered through the ESA registry, including capture, processing, and blood sampling. A Wildlife Scientific Collector's Authorization (WSCA) and authorization from the Wildlife Animal Care Committee (WACC) were obtained from the Ministry of Natural Resources and Forestry (OMNRF) from the Southern

Region for all project activities. An additional permit was obtained from Ontario Parks regarding work within parks and protected areas. This year we were extremely grateful to receive all permits in a timely manner, so we could begin our activities close to our projected start date.



Figure 2. Map representing the current permitted project boundary of the Georgian Bay Reptile Conservation Project in red. Areas 2-7 were permit amendments regarding specific situations.

*Please note, not all activities occur equally across the landscape.

3. Combined START and CARES Activities

3.1 Field Activities and Data Collection

Both START and CARES Project technicians are equipped to capture and process any species at risk turtles, and non-venomous snakes within the permit area. Particular teams are outfitted to process the Eastern Massasauga Rattlesnake. In general, processing kits are equipped with callipers, spring scales, triangular files, blood sampling kits, and a measuring tape. All technicians are also required to wear closed-toed footwear that is at least ankle high, such as rubber boots, neoprene wetsuit boots or hiking boots. Each team is also equipped with a waterproof Android smartphone (Sonim XP8) to record data in the field. We continued to use customized cloud-based Google Sheets for this field season. This approach continues to work but

does have some issues such as the significant amount of staff time required to error check and correct any errors that are found. It is our hope that we will be able to use different software to collect data next year to improve efficiency and productivity.

Wetsuits, binoculars, and canoes all continue to be used extensively by project staff and volunteers to enable wetland surveys. In many instances, binoculars were used by teams to survey for basking turtles in wetlands where we didn't have access to the private land. Canoes were used extensively this year in open water areas, particularly for Map Turtle surveys. A donated 26' boat, previously used for Map Turtle surveys on Lake Muskoka, may be used for Eastern Foxsnake surveys along Georgian Bay in the future. This would assist in accessing more remote areas. We hope to use this boat during Eastern Foxsnake surveys along the Georgian Bay coastline in future years, to access harder to reach areas.

To process Massasaugas, lead technicians carried snake hooks and tubes, triangles and modified pillow cases to safely capture and handle rattlesnakes. Clear plastic tubes were used to safely hold the snakes in order to obtain morphometric data, as well as allow the painting of rattles for mark-recapture purposes.

3.2 Walking Surveys (May-October)

In the 2022 field season, the fourth year of walking surveys were completed for the START Project (Table 2). Walking surveys consisted of teams of 2 or 4 technicians surveying for herptiles along a designated 1 km stretch of road, which was previously identified as a road crossing/mortality hotspot. Within the project area, there are 15 road sections designated for walking surveys, and each is surveyed bi-weekly from April to October. In total, 116 surveys were conducted across the 15 sites, resulting in 776 road-associated observations. The goal of these surveys is to identify how different road types (speed, traffic, substrate, etc.) impact herptiles, in addition to monitoring known road mortality hotspots.

In addition to the turtle specific walking surveys, this year we continued monitoring 6 CARES walking survey sites, which focus on areas where higher snake road mortality rates were found in prior years. These surveys were completed on a weekly basis, with 102 surveys completed this season, and 486 road-associated observations recorded. The results of the START and CARES walking surveys are presented in Table 2.

In addition to targeted walking surveys, any reptile encountered on the road opportunistically, was also noted. In total, 1262 road-associated observations were recorded, of which 341 were reptiles. 32 of these were confirmed as species at risk, and were primary target species under the EGBI funding. We hope to continue these surveys for an additional year before quantifying our results.

Table 2. 2022 walking survey observation results for turtles, snakes and amphibians.

Species	Alive	Injured	Dead	Total
Turtles	16	0	112	128
<i>Blanding's Turtle</i>	0	0	5	5

Species	Alive	Injured	Dead	Total
Turtles	16	0	112	128
<i>Midland Painted Turtle</i>	16	0	101	117
<i>Snapping Turtle</i>	0	0	4	4
<i>Unknown Turtle</i>	0	0	2	2
Snakes	24	1	142	166
<i>Massasauga Rattlesnake</i>	1	0	7	8
<i>E. Hog-nosed Snake</i>	0	0	2	2
<i>Dekay's Brownsnake</i>	2	1	20	23
<i>E. Gartersnake</i>	14	0	47	61
<i>E. Milksnake</i>	1	0	9	10
<i>N. Watersnake</i>	2	0	16	18
<i>N. Red-bellied Snake</i>	2	0	21	23
<i>N. Ribbonsnake</i>	0	0	5	5
<i>N. Ring-necked Snake</i>	0	0	7	7
<i>Smooth Greensnake</i>	2	0	7	9
<i>Unknown Snake</i>	0	0	1	1
Five-lined Skinks	0	0	0	0
Anurans	234	0	597	831
Caudates	0	0	16	16
Totals	274	1	867	1141

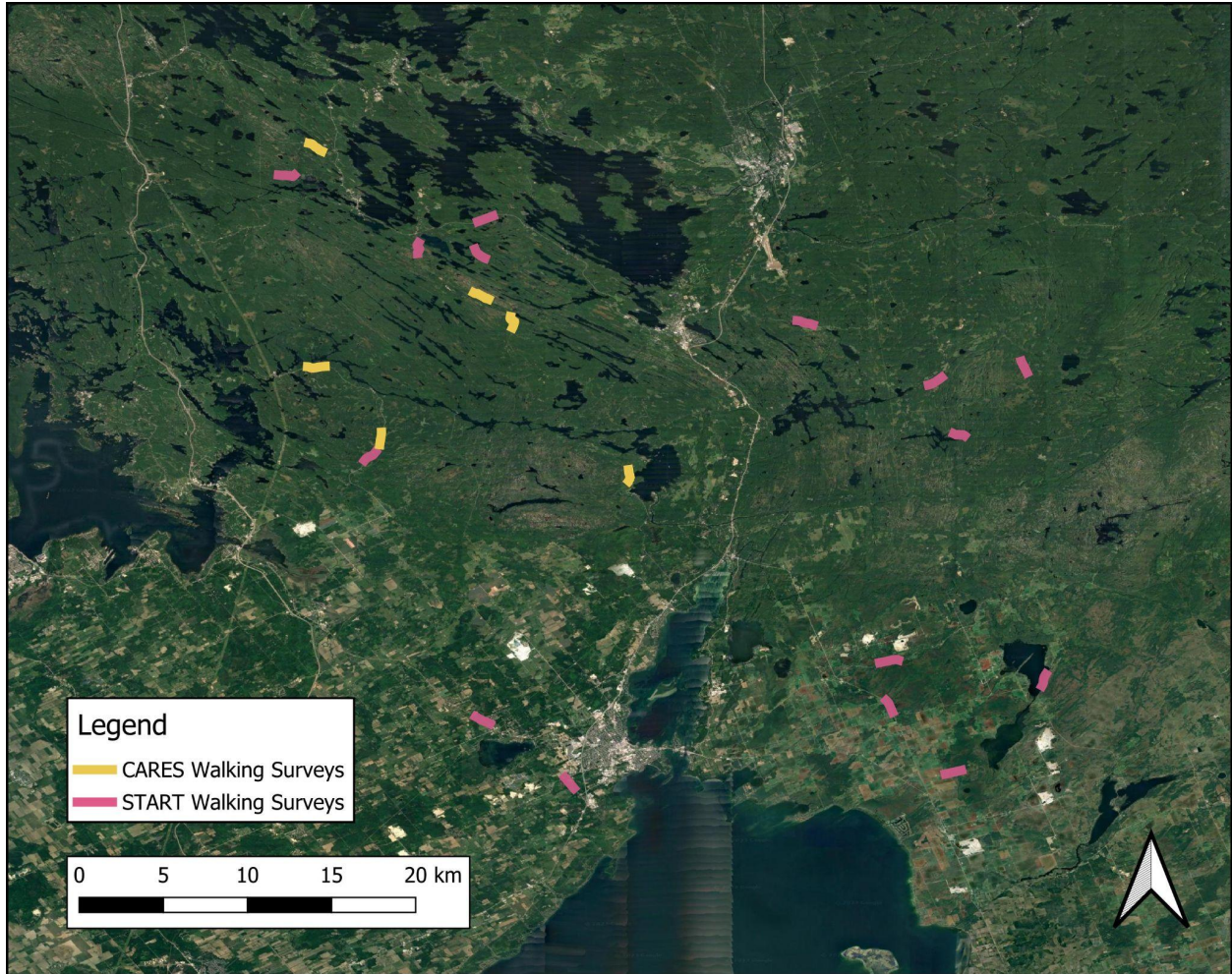


Figure 3. Map displaying locations of the walking surveys.

4. Saving Turtles at Risk Today Project

Preseason turtle fieldwork began in early April, with limited staff and some volunteer field technicians under the guidance of our Field Projects Manager, Kelsey Moxley. This is a critical time for Spotted Turtle activity, due to their early emergence from hibernation.

Early in the season, previously identified populations of Spotted Turtles were targeted for surveys. We have begun to analyze data and generate population estimates for our three largest populations within the project area. Documentation of these populations is currently being written for a peer-reviewed journal article. Even though we didn't discover a new population of Spotted Turtles this year, they continue to be a target species for the project, and field technicians captured and processed 82 individuals and observed an additional 22 this season. We were able to collect data from 17 new individuals to the project that were captured at 6 of our frequently surveyed populations, expanding our demographic datasets for them. Within 2 of our known populations, a combined total of 7 gravid Spotted Turtles were found this year; as opposed to four gravid Spotted Turtles found from 2013-2021. 16 individuals are being radio tracked by a Laurentian University Masters student (though separate permits and under the guidance of Dr.

Jackie Litzgus). Staff and volunteers have been able to aid these efforts. Of note, during one of these tracking events, a hatchling Spotted Turtle was captured and processed by staff. This is the second hatchling observed within this population, suggesting good recruitment. We aim to continue to monitor this population by surveying it during the optimal season to gain more insight on population dynamics.

4.2 Boot Camp (early May)

Due to Covid-19, this year's boot camp once again included a requirement for quarantining upon arrival and throughout the training period. Training included classroom presentations, and hands-on practice with captive turtles using the live collection at Scales Nature Park, in addition to training days in the field. Specific topics included identification of species at risk reptiles, safe handling of live turtles and snakes, sex determination of turtles and snakes, measurement methods, weighing turtles and snakes using Pesola spring scales, blood sampling, data collection and entry, mapping, satellite image interpretation, field site selection and survey planning, field safety procedures, first aid, canoe paddling and canoe-over-canoe rescue, and cold water safety.

Field training days included introduction to a wide variety of sites, such as bogs, swamps, beaver ponds, fens and rock barrens. This provided opportunities to learn which survey methods are appropriate for the terrain, and what equipment is necessary to make the field day a success.

Training was led by Kelsey Moxley, Field Projects Manager with 9 years of experience directly with the START Project. This year we were safely able to have 43 staff and volunteers participate in the training, while operating within strict Covid-19 quarantine protocols. Staff candidates who successfully completed training were hired for the summer. Some volunteers who completed training were also hired and others continued to volunteer for a minimum of one month following the training period. Volunteers completing this process learn many transferable skills and gain critical experience.

4.3 START Field Surveys (May-September)

Following Boot Camp, teams were quickly deployed to their field stations across the study area. Due to the generous support of Muskoka Lakes Farm & Winery, we were able to base a remote field team to live in the north-west end of the active survey area on their property near Bala. Blanding's Turtles continue to be a priority target species for the project. Field technicians were able to capture and notch 121 new Blanding's turtles, recapture 67 previously notched individuals, and observe an additional 338 this season (such as basking turtles that evaded capture, or were observed on private property where we don't have access to enter wetlands). The total number of notched Blanding's turtles is now 1690 individuals, with even more observations, from 2013-2022. We are unaware of any other project with such a large collection of data on this species in Ontario. We hope to continue collecting this data to aid with future conservation efforts, such as road mitigation, and contributing to the scientific community through analysis of individual morphometrics and genetic studies.

4.4 START Nesting Surveys (June-July)

EGBI funding was not used directly for activities pertaining to turtle nests. However, since our snake teams find turtles and our turtle teams find snakes, these efforts are synergistic.

For this reason, some information on nesting season activities has been included here. More details are available if required. Please note that turtle nesting surveys are only performed along roads, so they also double as road mortality surveys during this peak time. However, our intent with these surveys goes well beyond counting dead animals and excavating turtle eggs. We actively work to mitigate road mortality of turtles and snakes, especially Blanding's turtles, through these intensive surveys and the resulting monitoring of females at roadsides. Details regarding this effort, and a preliminary analysis of data, may be found in section 10 (name of section 10).

Eggs are the most vulnerable life stage of turtles. Most turtle eggs are eaten by predators, primarily mammalian mesopredators such as raccoons, foxes, and opossums. Although natural nest predation rates are high, artificially increased predation rates ("subsidized predation") in areas of human influence have been identified as a significant threat to turtles. Based on past nesting surveys and analyses completed by our previous M.Sc. student Hannah McCurdy-Adams while at Laurentian University, the predation rate of turtle nests along roadsides is approximately 80% in Muskoka. It is unclear whether this rate is natural or not, as it is difficult to determine a natural rate in a modified landscape. Increasing hatching rates and recruitment into the population has been documented as an effective strategy to offset threats and slow or reverse turtle population declines. Since road mortality is a significant threat in our region, and subsidized predation may also be significant, at least in some areas, a goal of the project is to increase hatching rates by reducing predation of turtle eggs. However, it takes many turtle hatchlings to offset a single adult killed on a road, so directly reducing road mortality is more important than simply hatching more turtle eggs. Both strategies are used with this conservation project, since neither is likely to be sufficient in isolation in the foreseeable future.

Nesting season started in early June. Field staff and volunteers received additional training regarding nesting protocols. During these surveys, staff and volunteers conducted evening (and sometimes morning) surveys along roads in addition to daytime surveys in wetlands. Road surveys were conducted by car, bicycle, or occasionally on foot. Hotline calls also led to nest locations along roads and on private land as well as females crossing the road before or after laying their eggs. All nest locations were recorded. Where feasible, intact turtle nests may be protected with a nest cage, constructed of wire mesh, or wood and wire mesh, with exit openings for hatchlings. These cages can be effective at reducing the predation of nests by mammalian mesopredators. Due to concerns expressed by local municipalities in 2015 about nest caging on road shoulders, and our research results from 2014-15 regarding cages being run over, stolen, picked up and moved by the public, nests being destroyed by grading as well as results from other projects with stolen eggs, etc., we continue to avoid nest caging on road shoulders. Since 2015, most of our nest caging has been done on private lands, and roadsides outside of the right-of-way or where guardrails would protect the cages. Also, on private or public lands, there are places where it is unsuitable to cage nests, such as active construction sites, sporting facilities, and private driveways. All of these locations are deemed "precarious", in that caging is not feasible to protect the eggs, leaving them vulnerable to predators with a high probability of predation. Nests that cannot be caged are typically excavated and the eggs extracted for captive incubation. Eggs from partially predated or other nests are also recovered for captive incubation. Since the vast majority of our nesting survey effort is focused on roads and road sides, partially to help reduce road mortality of adult females, most of the nests that we encounter are excavated. We do not typically actively survey for nests in locations where we could cage them. Some eggs are also recovered from dead or injured turtles found on roads, though these aren't 'nests' in the

strictest sense. Table 3 summarizes nest survey results. In total, 1208 nests were excavated from precariously laid areas, resulting in 27,998 turtle eggs captively incubated, and 22,577 hatchlings released.

Table 3 . Turtle nest survey results for the 2022 season. These numbers partly reflect that Snapping turtle nests are easier to find following the female leaving the nesting site.

Species	Predated Nests	Caged Nests	Excavated Nests	Extracted Eggs
Blanding’s Turtle	18*	0	102	3
Northern Map Turtle	2	0	19	1
Musk Turtle	0	0	2	0
Midland Painted Turtle	141	3	198	34
Snapping Turtle	326	1	887	15
Total	487	4	1208	53

**Identification of predated Blanding’s Turtle nests can be extremely challenging as they can look similar to other species, leading our technicians to typically label them as unknown. These 18 nests are presumed to be Blanding’s based on nest location, egg size, shape and composition in addition to historic observations in the area.*

5. Conservation Action, Research and Education about Snakes Project

5.1 CARES Project Activities

This year the majority of targeted snake surveys continued to focus on Massasauga Rattlesnakes. Typically targeted surveys for Massasaugas are more useful than for other snake species due to their predictable habitat choices, basking behaviour, and limited home range size. Mid-season snake surveys are terrestrial in nature, focusing on edge habitat and rock barrens adjacent to confirmed or suspected Massasauga hibernacula; however, during ingress (fall) and egress (spring) periods we survey suitable wetlands. Overall, our efforts for this species continue to focus on evaluating road mortality threats in the eastern Georgian Bay region south of Parry Sound, identifying and confirming hibernacula and gestation sites, monitoring gravid females at gestation sites, and filling data gaps. During surveys, field technicians captured and processed 192 Massasauga Rattlesnakes, with 181 additional observations. Individuals were encountered during both targeted snake surveys and incidentally during turtle surveys. These numbers are significantly lower than what we encountered in 2021, and could be due to a variety of factors, such as overwintering mortality, reduced numbers of gestating females, survey timing, etc. We hope that next year’s surveys and future analysis will shed some light on the cause of these lower numbers.

Due to their cryptic nature, broad habitat preferences, and wide distribution, Eastern Hog-nosed Snakes were not targeted, but were located incidentally during surveys- 14 were captured and processed, with an additional 6 individuals found dead on the road. The extremely limited distribution of Eastern Foxsnakes within the project active area, in addition to their population occurring largely in protected habitat, limits our ability for targeted surveys of this

species. However, we completed a preliminary monitoring survey of a communal hibernation site on the southeastern Georgian Bay coast, where one individual was captured and PIT tagged. Assuming our proposed work is funded we intend on expanding our focus on Eastern Foxsnakes significantly, in partnership with Georgian Bay Islands National Park.

5.2 CARES Training (March)

Pre-season staff were trained for snake processing methods provided by Taylor Kennedy, our CARES Project Coordinator. Venomous snake handling training only given to select senior technicians with previous experience, to assist in pre-season surveys in April.

5.3 CARES Egress Hibernacula Surveys (April-May)

One team per day focused on snake-specific surveys at the beginning of the field season. During this time period, only a few senior field technicians were conducting these spring surveys. Volunteers and other technicians were also recruited in order to increase search effort of field sites, but their main role was to observe the presence of snakes.

Following the acquisition of permits, the focus was on monitoring and confirming hibernacula, and surveying viable habitat to confirm new sites for Massasaugas. These surveys targeted the southern and eastern regions of the eastern Georgian Bay population, where Massasaugas had previously been observed. Hibernacula were confirmed by observing the presence of Massasaugas that had not yet left their hibernation sites, which have key habitat characteristics. Our first observation at a hibernation site was on May 5, 2022 in one of the known and frequently monitored hibernation sites within the project area. The first new hibernation site was confirmed on May 10, 2022. The CARES Project observed rattlesnakes in 12 hibernation sites in 2022; 8 of these sites were new.

5.4 Additional CARES Training (June-July)

Training was provided by Project Coordinator, Taylor Kennedy, to prepare selected field technicians and volunteers for safe handling and processing Massasauga Rattlesnakes, Eastern Hog-nosed Snakes, and Eastern Foxsnakes. Lead field technicians were trained to safely hook, bag and tube rattlesnakes for processing. Their partners were taught “secondary duties”, which consisted of measuring, counting subcaudal scales, and painting rattles. Each year a unique paint colour is assigned as the proximal rattle segment colour. For example, this year's colour was neon pink, whereas neon green on the proximal rattle indicates the snake was caught in 2020. In following years, when a snake is caught, a new colour will be assigned for that year. To identify the hibernaculum a snake uses, an additional segment was painted with a unique colour designated to that site. Painting the rattle allows technicians to visually identify if an individual snake has previously been captured, which prevents unnecessary recaptures and reduces the stress for the snake.

5.5 CARES Gestation Surveys (June-Aug)

A greater focus was placed on Massasauga gestation surveys as the turtle nesting season started winding down. These teams focused mainly on Severn township and southwestern Muskoka District. An additional team, stationed at our Bala field base (Muskoka Lakes Farm & Winery) surveyed for Massasauga gestation locations in that area.

Gestation sites were considered confirmed if a female was present at the same location at

least 7 days after first observing her at a 'suitable' site. Sites were also confirmed if a female with a larger than average girth was observed late in the season at a suitable site, or giving birth. Potentially gestating females were only processed if lead technicians felt that minimal stress would be incurred to the snake and no potentially gestating snakes were processed after July 15th in order to reduce potential stress during a critical stage in neonatal development. After site confirmation, females were monitored weekly or bi-weekly when possible until neonates were born. Through these surveys, 28 Massasauga gestation sites (32 gestating females) for the 2022 field season have been confirmed. Of these 28 sites, 19 of them were confirmed to be birthing sites. Through careful monitoring of a large number of females, we have noticed that some of them seem to leave their gestation site just prior to giving birth. They move to another suitable rock or crevice in the vicinity, where they give birth. We hope to study this behaviour in more detail in the future, as it could have an impact on the success of gestation site construction projects, which are often created for mitigation purposes.

Switching the focus of some field technicians from turtles to snakes during this critical period proved invaluable. Monitoring snakes on a landscape scale over our large permit area is a tall task; as such a high level of search effort is required.

5.6 CARES Neonate Surveys (July-Aug)

Neonate snake surveys consisted of returning to confirmed gestation sites to capture and process neonate (young of year) rattlesnakes. The first neonates were found on August 4, 2022. As more neonates were born over the following weeks additional teams were added to help keep up with the capturing and processing of these babies. When a clutch of neonates was found they were captured using small snake hooks, a triangle, and a modified pillow case, just as adults are captured and processed. We tried to mark neonates by painting their natal segment (button), but if this is done before their first shed, the paint is lost with the rest of the shed skin. This makes mark-recapture studies with neonates challenging, as they typically disperse from the gestation site soon after their first shed. Photographs of their dorsal patterns are taken during processing and will be used for identification as a contingency to rattle painting, although it does require more staff time for analysis. This year we found significantly fewer snakes using gestation sites than in previous years. In the 3 years we have been monitoring snakes so far we have seen drastic differences in the number of rattlesnakes reproducing offspring. It is evident that continued monitoring of the population on a landscape scale in combination with analysis of environmental factors could provide valuable information for the future conservation of the species. In total, 130 Massasauga neonates were observed during the 2022 field season, 105 of which were captured and processed, despite a greater knowledge of specific site usages and continued efforts this was a huge decline from the 555 observed in 2021.

5.7 CARES Ingress (Sept-Oct)

Once neonate rattlesnakes were fully dispersed from their gestation sites, technicians began focusing on wetland and terrestrial edge habitat surveys. Habitat viability surveys were conducted to investigate and confirm suspected hibernation sites and previously confirmed hibernation sites continued to be monitored. The last rattlesnake of the season was found in a confirmed hibernation site on October 5, 2022.

6. Habitat Protection

Another goal related to targeting Blanding's Turtles and Eastern Massasaugas is the generation of new observations in new locations to extend habitat protection under the Endangered Species Act (ESA). Other threatened and endangered species observations also trigger this protection, including Spotted Turtles, Eastern Foxsnakes, and Eastern Hog-nosed Snakes. In 2022 we continued extending our survey efforts to sites that had not previously been surveyed by the project, or viable sites that had been unsuccessfully surveyed in the past. This led to the identification of several species at risk occurrences in areas not previously protected by our efforts. With these observations, we were able to build upon habitat protection from the last nine years of START Project efforts. Currently through cumulative project efforts, we have almost completely covered southern Muskoka with habitat protection due to our species at risk observations. Several new Blanding's Turtle locations were identified, resulting in an increased area of protected wetland under the ESA. Geographic Information System (GIS) mapping of all threatened and endangered herpetofauna encounters for the 2022 season was completed, and protected habitat resulting from threatened and endangered species observations were mapped (Figure 4). In 2022, the amount of protected wetland and upland habitat that does not overlap with previous years effort is 306.89 km². This is below the planned milestone of 500 km², largely due to three Covid-19 outbreaks among our staff in June, July, and August, which are crucial windows to survey for our target species. These caused the cancellation of some field activities, notably multi-day backcountry survey trips to sites with data gaps that would have generated new habitat protection. While we had hoped to avoid any pandemic-related issues this year, sadly we could not avoid them.

The cumulative habitat protection triggered by all threatened and endangered species encountered from 2013-2022 is now 5181.84 km². Table 6 shows a breakdown of habitat protection by taxa group and project year. More significantly, 4608.24 km² of this area was not previously protected through conservation reserves or provincial parks. This is equivalent to about two thirds of the land area of Algonquin Park, and is greater than the entire District of Muskoka. While this protection is not absolute, at a minimum it triggers requirements for mitigation or other measures to protect species at risk. We believe this to be a significant achievement for the conservation of these target species, and all other species that share their habitats across the Georgian Bay watershed.

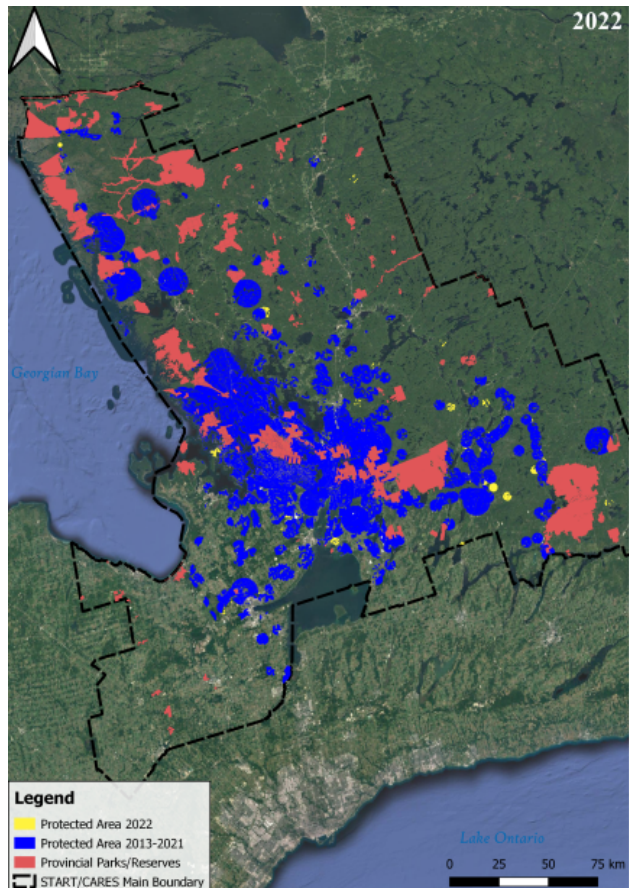


Figure 4. Map showing newly protected habitat resulting from 2022 observations of threatened and endangered species.

Table 6. A breakdown of the designated habitat protection (in km²) for threatened and endangered species due to nine years of START Project and three years of CARES Project data collection, by taxa group (with overlap). Critical habitat was calculated from a species observation within 2 km for Blanding’s Turtles, 1 km for Spotted Turtles, 1.2 km for Massasauga Rattlesnakes, and 5 km for Eastern Hog-nosed Snakes. The bottom row of totals represent the cumulative amount of protected area within the START study area, excluding overlap.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Cumulative Protected area by Turtle Observations	636.4	782.8	785.3	1060.5	1390.3	1634.0	1924.1	2746.8	3682.1	3930.7
Cumulative Protected area by Snake Observations	0.3	352.7	624.4	755.2	906.4	982.7	1133.1	1616.9	1913.5	2039.3
Cumulative Total (excluding overlap)	636.7	932.6	1067.6	1407.2	1732.7	1732.7	2126.7	3527.4	4827.2	5134.09

Annual Increase	636.7	295.9	135.0	339.6	325.5	0	394.0	1420.1	669.1	306.89
Cumulative Total (outside of existing parks)	486.2	739.6	868.8	1165.8	1463.0	1463.0	1827.2	2759.5	4253.6	4608.24

To give a better understanding of how protected habitat is designated, we will break down Blanding’s Turtle habitat protection into the descriptive categories. Protected area by turtle observations is mostly calculated by Blanding’s Turtle encounters, which is separated into descriptive habitat categories. There are three categories under which Blanding’s habitat can be designated in the OMNRF General Habitat Description for the Blanding’s Turtle. Category 1 includes protection of nesting and overwintering habitat and the area within a 30 m radius of the occurrence. Category 2 includes the wetland complex (all suitable wetlands and water bodies within 500 m of each other) up to 2 km away from an occurrence, and the terrestrial area within 30 m around the suitable habitat. Category 3 encompasses a buffer zone from 30 m to 250 m around the suitable habitat areas identified in category 2, within 2 km of the occurrence.

This can be done for Massasauga rattlesnakes as well. Category 1 includes 30 m around gestation sites and 100 m around hibernacula. Category 2 protects open and semi-open habitats [include sparse forests, forest clearings, forest edges, fields, meadows, alvars, shorelines, rock barrens, and wetlands (such as fens, bogs, marshes and swamps)], within 1.2 km of an observation. Category 3 includes all forests up to 1.2 km surrounding any rattlesnake observation.

7. Community Engagement

The reptile hotline, previously known as the turtle hotline, continues to be a useful tool for gaining local insight about locations to survey, locations of species at risk individuals, for recruiting volunteers, and for meeting landowners who give us permission to access their land. This continues to increase in effectiveness, with over 842 reports (calls/texts) in 2022, as discussed further below in Section 7.3. This is a slight increase in contacts from 2021, and it is good to see the numbers increasing again. This result is a little below our projected milestone of 900 reports, which we attribute to the three Covid-19 outbreaks suffered by our staff in June, July, and August. These reduced our presence on the roads during nesting season, when we often hand out cards with the hotline number to drivers, as well as negatively affecting us in other ways.

New landowners continue to show interest in allowing us access to excellent habitat on private lands, due in part to our community involvement, and the reptile hotline. We hope to increase surveys on private land in the upcoming seasons, as it’s a great way to easily gain additional habitat protection through species at risk observations, and encourage conservation efforts. We also hope to install more ‘Report Reptiles’ signage around the project area to encourage additional submissions from the public.

The project generates a lot of interest in volunteering with our conservation efforts. This year we continued to have fewer volunteers than in the past (pre-Covid), but the volunteers we did have accompanied staff into wetlands to catch and process turtles, assist with data entry, etc., in addition to going out nightly with staff to complete road nesting surveys, and survey rock

barrens for species at risk snakes.

Educational programming continued to be hampered by the Covid outbreaks, and especially staffing issues. It has proven difficult to recruit staff for public education roles due to a combination of people's reluctance to take on such roles, and an overall lack of experience due to the absence of public programming since 2020. However, 63 programs were conducted over the course of the year. We did have additional programs scheduled, however, due to Covid-19 outbreaks in both our staff and the event organizers, we were unable to attend some. More details are in Section 8.2.

7.1 Community Volunteer Training (April-June)

This year we continued our training program for keen members of the public who were interested in becoming more involved in our reptile conservation efforts, but were unable to participate in Boot Camp due to physical limits, full time jobs, etc. This two stage training process allowed community volunteers to become more actively involved in our work.

For stage one we trained 37 local community members to identify, handle and help conserve turtle and snake species identified along roadsides. Training included the collection of accurate location data, road safety, usable digital images, and communications with the project reptile hotline dispatch. This training was completed specifically to provide better data for the START/CARES Projects, and to enable community members to be more involved in the conservation of reptiles.

A select group of 12 stage one community members were invited to participate in the second stage of training. This stage of training was focused on turtle nesting activities and consisted of nest caging, egg excavation, and a better understanding of relevant permitting. The addition of these community volunteers allowed project activities to expand northwards, in addition to being able to respond to more hotline calls quickly and to excavate more at risk turtle eggs. One of our community volunteers was able to find and excavate 46 nests, which is more than all but one of our field technicians!

7.2 Educational Programming

As Covid-19 restrictions were lifted, we were able to attend more community events than in the past two years. Educational staff, volunteers and field technicians were able to spread educational messaging regarding the conservation of the project's target reptile species, in addition to providing information about the START/CARES Projects. Programs typically included live examples of snakes and turtles, from Scales Nature Park, for participants to handle, and often led to discussions about how volunteers can help our conservation initiatives. Reptile hotline cards were given out and people were encouraged to submit their observations of reptiles and amphibians within the project area. Typically, programs were geared towards a family-friendly audience, however, we provided 2 workshops with a more thorough overview of identification features and conservation topics, targeted to more of an adult audience. These were done in partnership with the Georgian Bay Biosphere.

Unfortunately, staffing challenges for educational programs continued into the 2022 season and have contributed difficulties. Following the pandemic, finding educational staff has been extremely challenging and at no time in the last two years have we been able to hire and train a fully functional education team. In September, our Education Coordinator left our operations after working with us for a year. Unfortunately, we have not been able to find a

replacement for her. As of early December, 63 programs have been completed- fewer than we had anticipated for this year. We hope to overcome some of these challenges, and return to typical program delivery.

In addition to providing in-person educational programs, we finished the proposed educational video for the species at risk reptiles found along Georgian Bay. This video was proposed in 2021, removed as a goal but then reinstated and carried forward into 2022. This 20 minute video features the six target reptile species of the EGBI, and includes information on conservation efforts in the region as well as how people can get involved. It is now available on our youtube channel here: <https://youtu.be/qTUUi3F68aM>. We hope to expand our conservation messaging to all people who use the landscape by promoting this video through social media.

7.3 Reptile Hotline

The Reptile hotline continued to gain traction this year. Information about the hotline was shared via social media posts, during educational programs, and at road-side stops during field work about how and when to call the number. Members of the public were encouraged to call this number whenever they encountered a ‘rare, nesting, dead, or injured turtle’ within our study area. Depending on the location, species, and circumstances, a research team would be deployed to the reported location to process the reptile and cage or excavate the nest. There were over 828 calls/texts in 2022. Our busiest day occurred on June 7th with 53 calls in one day. Notable calls provided 161 Blanding’s turtle observations, 5 Eastern Hog-nosed snake observations, along with other species at risk observations.

As shown in Figure 6, hotline calls continue to generate a significant and increasing number of Blanding’s turtle observations over the years, often in new areas where we would not have otherwise encountered them. We hope to continue the promotion and use of this hotline for the upcoming field season, including posting additional signage along roads that are hotspots for reptiles within the project area.

Blanding's Turtle Observations and Hotline calls from 2013-2022

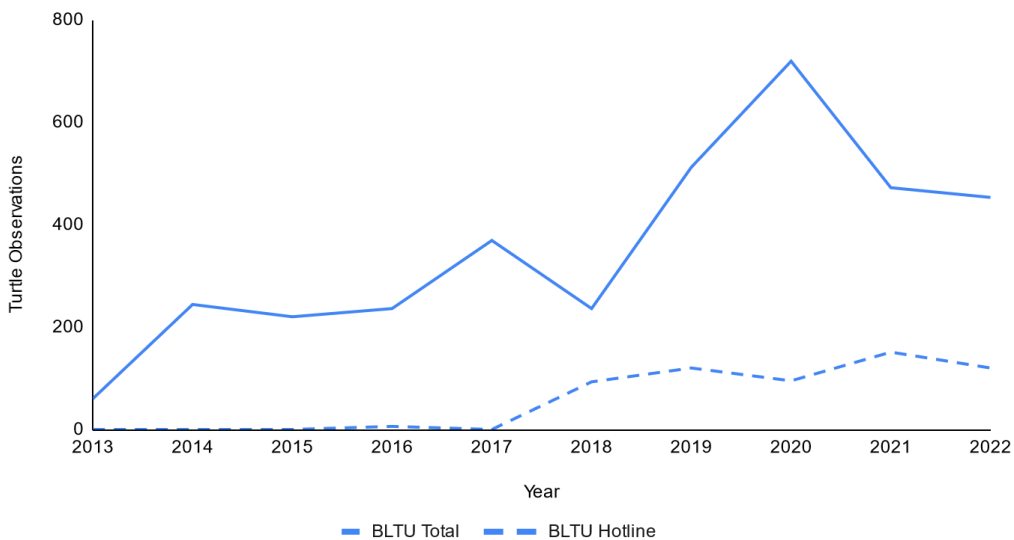


Figure 6. Total Blanding’s turtle observations (solid line) and Blanding’s turtles observations from hotline callers (dotted line) in 2013-2022.

8. Observational Data

8.1 Observations

Through targeted field surveys and incidental observations, we record all reptile and amphibian encounters, particularly species at risk (SAR). Typically, every individual observation of a SAR is recorded, however, species that are not at risk may only be recorded to confirm presence in an area, calling dates, track road mortality, etc. In 2022, a total of 7020 individual encounters of 31 reptile and amphibian species were recorded. Of these, 3432 encounters were of 10 different SAR, which is slightly elevated from last season’s number of species at risk observations (Table 8). This season, more focus was placed on identifying locations of species at risk individuals, and this may explain why the total number of observations is lower than in 2021, while the total number of species at risk observations increased from last year.

All observation data was submitted to the OMNRF Natural Heritage Information Centre, and observations that occurred in Parks and Protected Areas were also submitted to iNaturalist under the Ontario Herps Project. Figure 7 shows the locations of all herptile species that we recorded in 2022.

Over the last 9 years of the project we’ve processed a total of 4348 SAR turtles within the project area and observed 4762 more. The ratio of processed to observed individuals testifies to the great efforts of our staff and volunteers to capture and mark turtles, as well as the consistent strong leadership and training we have provided through Boot Camp. Over the 3 years of the CARES Project we processed 1050 SAR snakes and observed an additional 1243 more. As

mentioned in Section 6, our lower number of snake observations this year compared to previous years could be due to multiple factors influencing the population, and/or it's ability to be observed. We hope the continuation of this project will help us to better understand these changes in upcoming years.

Table 8. Species at risk totals for processed (captured), and observed (not captured) in 2022 and between 2013-2022. These numbers partly reflect that we were surveying predominantly for turtles and snakes; lizard encounters were generally through incidental observations.

Species	2022			2013-2022		
	Processed Individuals	Observed (not captured) Individuals *	Total Individuals	Processed Individuals	Observed Individuals	Total: All Years
Blanding's Turtle	195	319	455	1879	1568	3447
Spotted Turtle	83	128	211	510	189	699
N. Map Turtle	79	78	157	304	878	1182
Snapping Turtle	91	1956	2047	1641	2095	3737
E. Musk Turtle	2	5	7	14	32	46
Massasauga Rattlesnake	192	181	373	1014	1253	2267
E. Hog-nosed Snake	14	6	20	49	85	134
E. Foxsnake	1	4	5	2	14	16
N. Ribbonsnake	0	46	46	0	508	508
Five Lined Skink	0	57	57	0	714	714
TOTALS	657	2780	3432	5413	7336	12750

*Inclusive of nest only observations.

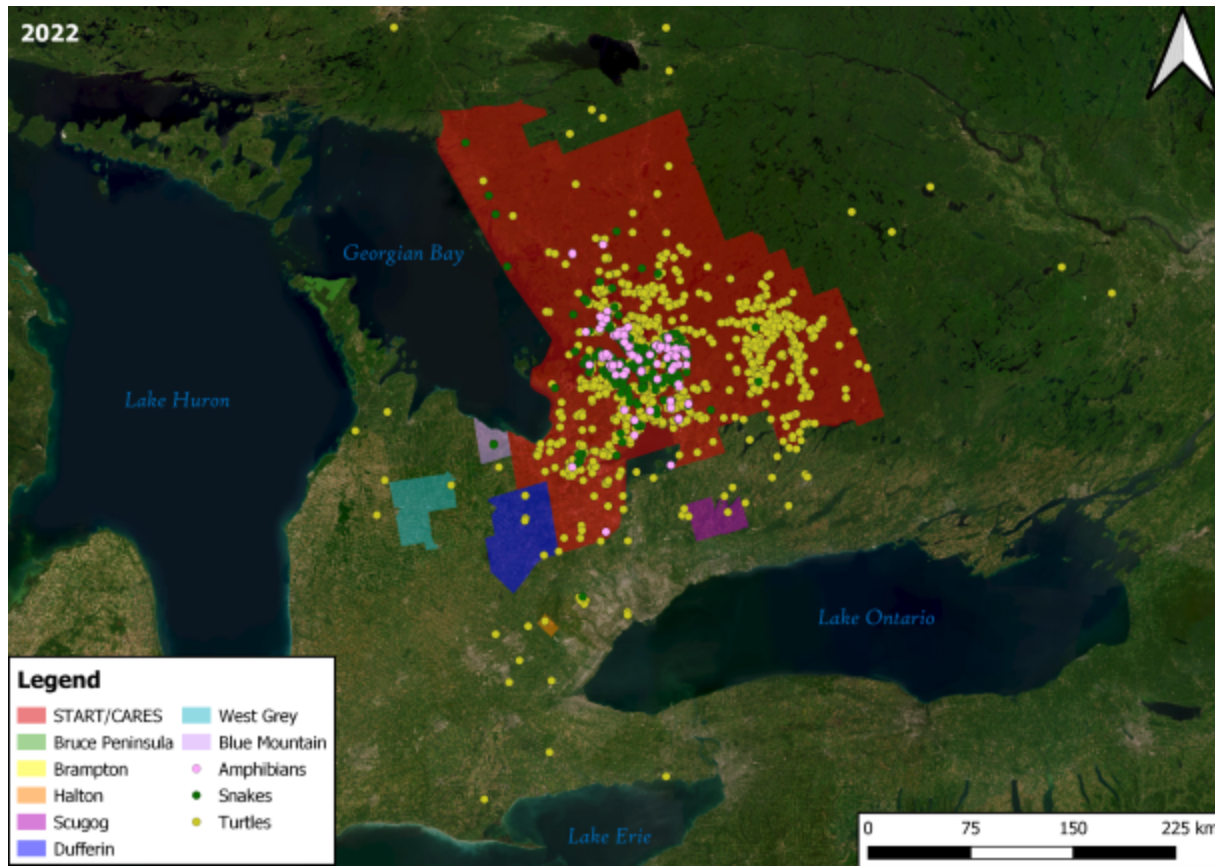


Figure 7. All herpetile species (SAR, non-SAR individuals) that were observed and/or processed within the project boundary in 2022. Please note, dots outside the project boundaries are observations only.

8.2 Injured and Dead Reptiles and Amphibians

As in years past, this year we functioned as a transportation node for the Ontario Turtle Conservation Centre (OTCC), facilitating the movement of injured and rehabilitated turtles back and forth between the Georgian Bay watershed and Peterborough. Through START and CARES Project field technicians and community volunteers, 14 injured turtles were collected to be transported to OTCC, or their approved drop off veterinarians, to receive treatment. In addition to sending the more serious cases to the OTCC, we were able to rehabilitate 3 individuals, 2 turtles, and 1 frog at the Georgian Bay Turtle Hospital (GBTH). Table 9 details individuals field technicians attempted to transport for medical treatment.

Table 9. Reptiles and amphibians taken in to receive medical treatment in 2022.

Species	Dead on Arrival	Died Waiting Transport	Taken to GBTH*	Taken to OTCC*	Total per Species Group
Turtles	3	6	2	14	25
Snakes	3	1	0	0	4

Frogs	1	0	1	0	2
Unk. Herp	2	0	0	1	3
Total	9	7	3	15	34

*These numbers only include what our community volunteers and field technicians brought in to care, not what members of the public brought in.

Field technicians also came across 27 (3 Blanding’s Turtles, 18 Midland Painted Turtles, 5 Snapping Turtles, 1 Map Turtle) recently deceased turtles where viable eggs were extracted and captively incubated for release at the Georgian Bay Turtle Hospital. The number of recently deceased turtles in 2022 is almost double what was encountered in 2021.

We found another 516 turtles, 342 snakes and 506 amphibians that were already dead (or dying) on the road or roadside. Ten individuals (1 Northern Map Turtle, 1 Midland Painted Turtle, 1 Snapping Turtle, 1 Eastern Hog-nosed Snake, 6 other snakes) were found near death, being previously hit by a vehicle, with no chance of survival from treatment. These were field euthanized upon discovery, after receiving authorization from Jeff Hathaway or Kelsey Moxley. Historically, we have seen increasing numbers of dead reptiles and amphibians near or on roads. However, this season, we saw a slight decrease in these numbers. Section 9 discusses road mortality in more detail, with respect to our efforts to mitigate it through targeted road surveys.

Table 10. START/CARES Road Encounters for 2022

Species	Dead on Road/ Roadside	Injured on Road/ Roadside*	Field Euthanasia	Total per Species
Blanding’s Turtle	36	9	0	45
N. Map Turtle	4	0	1	5
M. Painted Turtle	358	49	1	408
Snapping Turtle	107	40	1	148
E. Musk Turtle	2	0	0	2
Unk. Turtle	11	0	0	11
E. Massasauga Rattlesnake	26	2	0	28
E. Hog-nosed Snake	7	0	1	8
N. Ribbonsnake	8	1	0	9
Non-SAR Snakes	301	8	6	315

Unk. Snake	17	0	0	17
Amphibians (incl. unk)	506	1	0	507
Totals	1383	110	10	1503

*some individuals were reported to the hotline, and therefore the outcome is unknown.

During the field season, tissue samples of most dead species at risk individuals were collected by field technicians and frozen. Tissue samples or whole carcasses are currently housed in our freezer pending transfer to Dr. Stephen Lougheed at Queen’s University. Meg Britt has started their PhD with Dr. Lougheed, using a genomic approach to studying Eastern Massasauga ecology across Ontario. Additionally, some samples were collected for the Canadian Biogenome Project to help their efforts to establish biogenomes for Canadian species at risk.

9. Road Mortality Mitigation

Since 2013, we have had a growing presence in Simcoe-Muskoka and beyond, with extensive effort spent patrolling roads in search of reptiles- especially nesting turtles. This allows us to monitor road mortality, assess hotspots, guard female turtles while nesting, and excavate eggs along the road shoulders, where they otherwise would have been run over. While these activities are individually important, we have been working towards a larger goal- to directly mitigate turtle road mortality through our presence on the roads during critical time periods. With enough search effort, we should be able to find more alive turtles, and prevent them from being hit.

As the search effort scales up, the trends should become noticeable. If a road is driven multiple times per day, we should find the number of live turtles increasing and the number of dead turtles levelling off. This may be best examined using the proportion of alive/injured/dead turtles found, as more effort will, to some extent, increase the numbers of all categories. Note that roads of different characteristics (traffic volume, speed, surfacing) are likely not comparable, as the search effort relative to the odds of a turtle being killed are different.

We have not yet examined this approach for snakes, though we suspect that it will be less effective since snakes are not persistent along roads compared to nesting turtles, or compared to dead turtles. Live snakes tend to keep moving, and dead snakes are more likely to be completely removed by scavengers, rendering them undetectable later.

Preliminary analysis of data from 2013- 2021 was included in the 2021 final report. We have updated the analysis to include our 2022 findings. Road-associated observations of alive/injured/dead turtles during nesting season were used each year. Please note, the dates of nesting season fluctuate each year. This captured the time period of most road surveys, with consistent effort within each year, but varying somewhat between years. Following nesting season, we do not consistently patrol roads so the search effort would be too variable to include.

Also, the search effort values used so far are qualitative rather than quantitative, being divided into categories of low (once per week), medium (several times a week), high (once or twice per day) and very high (3-5 or more times per day), with each road being assigned a value

based on our estimation of how much search effort it had. This is applied to the whole road, despite some segments of the road being driven much more than others. Another refinement will be to quantify the search effort based on our location tracking of each time. This will allow a total number of trips to be calculated for each road segment. With these caveats in mind, some results are included here. Figure 8 shows the proportion of alive/injured/dead turtles, for a subset of 6 roads with similar characteristics. All are two lane, paved roads with 80 km/h speed limits. At low search effort, about $\frac{2}{3}$ of turtles found were dead, with $\frac{1}{3}$ found alive. As the search effort increases, these proportions equalize and then reverse.

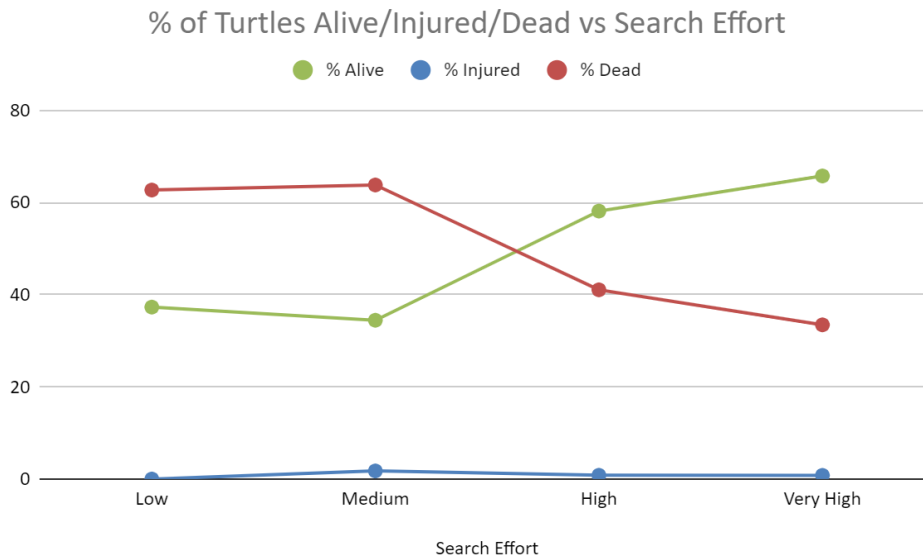


Figure 8. Proportions of alive, injured, and dead turtles found on six roads from 2013-2022 based on search effort.

This is the trend we predicted to see, where with increasing search effort, the percentage of live turtles found on roads increases and the percentage of dead turtles decreases. Also, as predicted, the proportion of injured turtles decreased with increasing search effort. These results suggest that the threat of road mortality, along roads with these characteristics, can be mitigated by the presence of trained personnel who can move and chaperone turtles. This is especially important for these paved, two lane roads, which are numerous and are a significant source of mortality for adult turtles. Installing exclusion fencing or other mitigation structures on all of these roads would be a Herculean task, with enormous costs. Although we think that fencing is an excellent approach, it is not going to occur on these roads in any reasonable time frame. We suggest that our approach is more cost effective, more flexible, and faster to enact, and can be used effectively to mitigate road mortality.

The results from individual roads suggest that search effort by trained staff and volunteers can make a difference for turtles along these roads. Figure 9 shows the average number of turtles and the proportions of alive, injured and dead encountered on Upper Big Chute Road during years of low, medium, and high search effort. As the search effort increases, more turtles, and more alive turtles, are found.

Upper Big Chute Road (Figure 9) shows a similar trend, as did the other four roads used in the pooled analysis.

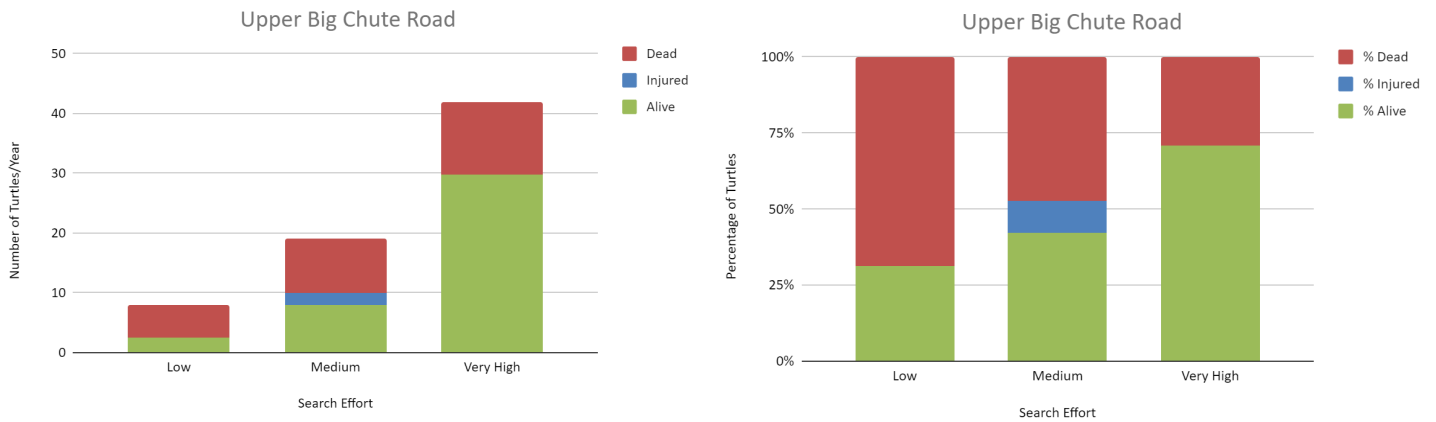


Figure 9. Graphs for Upper Big Chute Road showing the number of turtles encountered per year based on search effort (left) and the percentage of turtles encountered based on search effort (right).

In contrast, for Highway 11, which is partially controlled access, with heavy traffic and a 90 km/h speed limit (with many cars exceeding this), our results are not encouraging. While the trend is present, as shown in Figure 10, it is slight at best and still approximately 75% of turtles encountered are dead. We do not expect that this kind of road mortality mitigation can be effective on a highway of this nature. We believe that exclusion fencing would be the only effective solution for such highways.

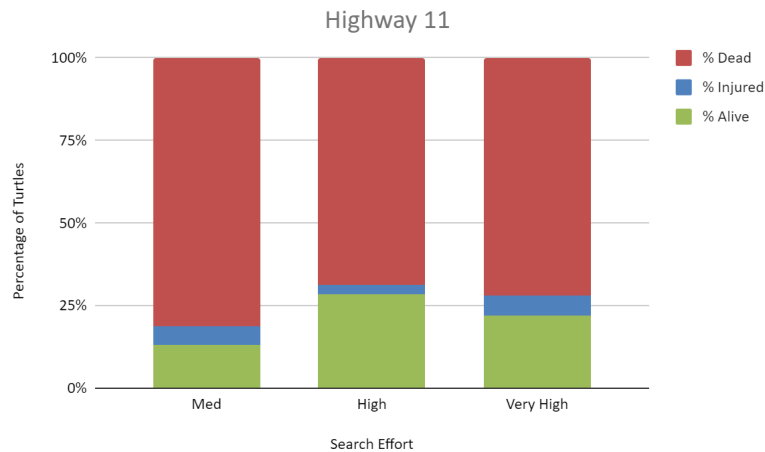


Figure 10. Graph showing the percentage of turtles encountered based on search effort for Highway 11.

Additionally, for gravel roads with low traffic, there appears to be little generalized need for mitigation efforts, though it would likely be useful in specific hotspots. The number of dead turtles encountered on such roads is quite low. Figure 11 shows one example of such a road. As mentioned previously, there may be other reasons to survey these roads, such as to monitor

known nesting sites or other hotspots, capture and mark species at risk, etc. but it is not needed for general mitigation purposes.

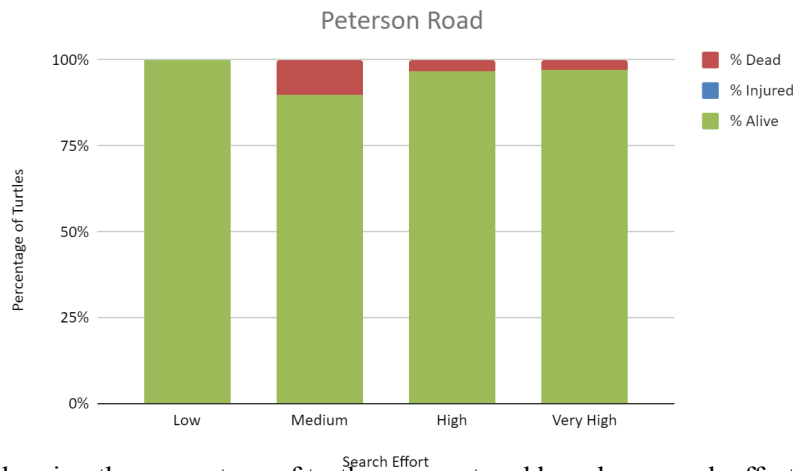


Figure 11. Graph showing the percentage of turtles encountered based on search effort for Peterson Road.

We look forward to refining this analysis further through quantifying search effort more accurately, and excluding dates when survey activity would not have been consistent such as between the end of each year’s nesting season and the end of the active season. We also plan to add in the effects of public hotline calls and community volunteer activities, as these would add to the overall conservation effort occurring on these roads. Further, we are undertaking a cost-benefit analysis to compare the cost of this effort with the potential cost of installing and maintaining fencing along these roads.

Given the promising results of this preliminary analysis, we hope to continue to increase search effort along the roads of central Ontario through recruiting and training more community volunteers, collaborating with other conservation organizations, and adding more staff teams to cover new roads in new areas.

10. Research Partnerships

As the project completes its ninth season, there is a large and growing dataset available to better understand the ecology and conservation of species at risk reptiles in central Ontario. There are several fourth year thesis students utilizing this data for their projects at the University of Guelph and Laurentian University.

Field Projects Manager, Kelsey Moxley continues to utilize this data. Currently Kelsey is continuing to work with former staff member, Maddie Kellett, to complete a population demographic analysis for central Ontario Spotted Turtle populations; one of which is believed to be one of the largest populations in Ontario. This will include population density, sex ratios, body size, etc. of these populations and compare them to their southern population counterparts.

Additionally, Kelsey, Maddie and Scott Gillingwater have written a manuscript for submission on facial colouration differences between male and female Blanding’s Turtles. This will aid in sex identification of Blanding’s Turtles without the need to capture or handle the individuals. There is no published data on their facial colouration, and we hope to fill this knowledge gap.

One of our past conservation technicians has continued to develop a predictive model to determine which nights of nesting season will be the most active. With the use of the START Project dataset, this technician is analyzing which parameters (i.e. air temperature, precipitation, etc.) may best predict turtle nesting behaviour. If any positive correlation prevails, construction of a predictive model will occur, using the correlated factors to help predict which nights during nesting season will be the busiest. This will aid with the deployment of field teams to target the most active and effective areas within the larger survey area.

Senior field technician Meg Britt has started a PhD with Dr. Stephen Lougheed at Queen's University. She is hoping to determine the genomic variation within populations and across the province for the Eastern Massasauga Rattlesnake. This will inform future conservation goals and help with managing a new captive breeding population for future reintroduction efforts in the Carolinian zone populations.

Additionally, Ginger Elliott and Sarah Jane Stanger Guy (Incubator Technician) will be starting their M.Sc. with Dr. Stephen Lougheed at Queen's University, in partnership with the African Lion Safari. Ginger and Sarah Jane will be creating an assisted reproductive breeding protocol for species at risk snakes. We hope their efforts will assist with the Eastern Massasauga Rattlesnake captive breeding population plans, and the overall species survival plan (SSP).

Stephane Thibeault completed a preliminary field season with us, which began to inform his M.Sc. with Dr. Jacqueline Litzgus at Laurentian University. Steph has undertaken our previously delayed Spotted Turtle radio-telemetry work at our best site for this species in Muskoka. He will be describing habitat usage at an inland site, in addition to establishing if facial colouration is a sexually selected trait for Spotted Turtles.

11. Conclusion

We believe the Saving Turtles at Risk Today (START) Project and the Conservation Action, Research and Education about Snakes (CARES) Project have both continued to expand successfully. We hope to continue and improve upon the use of conservation tools, new technologies, and effective community engagement to slow or reverse species at risk population declines through threat mitigation, habitat protection, boosting recruitment and public education. We further hope to continue adding to our long-term dataset for reptiles and amphibians, specifically focusing on species at risk turtles and snakes in central Ontario, to enable a better understanding of populations, habitat usage, threats, and conservation actions that may be undertaken. We continue to discuss the future goals of the project with key researchers and partners. By welcoming academic input, we aim to gather useful data and conduct valuable research to further the conservation of turtles and snakes in the area, and across Ontario.

We plan to attract additional graduate students and funding as the project moves forward, and are especially seeking candidates for projects specifically involving the radio-tracking of head-started juvenile Blanding's Turtles, determining genomic distribution of Northern Map Turtles across central Ontario and genomic analysis of parental lineage in Blanding's and Spotted turtles across the study area.

We are waiting to hear if the Rogers Foundation will fund the project again, however, they have for the last 8 years, so chances are high it will continue. We hope to submit a proposal for the Eastern Georgian Bay Initiative soon in order to continue the specific work that it funds in

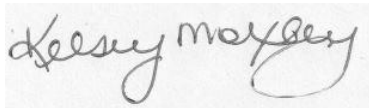
this region. We have also applied for other significant funding and the outcome of these applications will define how the project proceeds in 2023 and beyond. In particular, we aim to launch an Eastern Foxsnake radio-telemetry project to identify hibernation sites between Waubaushene and Twelve Mile Bay, though this will require at least 3 years of confirmed support.

Overall, we feel that the START Project has been a resounding success throughout the past 9 years, and specifically this year as described above. The third year of the CARES Project has gone extremely well. We look forward to the continued development of our reptile conservation efforts.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Jeff Hathaway". The signature is fluid and cursive, written on a light-colored background.

Jeff Hathaway, START Project Director
and

A handwritten signature in black ink, appearing to read "Kelsey Moxley". The signature is fluid and cursive, written on a light-colored background.

Kelsey Moxley, Field Projects Manager