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## Turtle Guardian Program Evaluation 2018-2021



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*Kids and Communities Saving Turtles*



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## Background and Purpose

The Turtle Guardians program grew out of a need to collaborate and build capacity to save an imperilled group of species whose populations have declined by more than 50% in the last 20 years. Turtles provide fundamental ecosystem services such as nutrient transfer, pest control and seed dispersal, that are important for the health of wetland ecosystems. The Turtle Guardians program also addressed gaps and needs in turtle conservation, because data sharing related to turtles between conservation groups was limited, and prior to the inception of the program, no cohesive and collaborative effort across the province or in most regions existed to support turtle recovery. Finally, Turtle Guardians focuses on working with kids and communities using a grassroots approach, for which programming was not extensive prior to its inception.

The fundamental focus of the effort is to build capacity for citizen science (now known as community science) which consists of community members actively monitoring and reporting species observations, and then performing related conservation actions such as advocacy, supporting mitigation implementation, raising awareness and supporting the development of skills through sharing knowledge.

Community science has the potential to increase nature-connectedness which results in greater caring and therefore advocacy and conservation for nature. Community science also has the capacity to support the body of scientific knowledge through the provision of data across broader scales than would be possible without public volunteer involvement.

The backbone of this effort is formed primarily by The Land Between (TLB) charity and partner, Scales Nature Park through its Saving Turtles at Risk Today (START) project. The Turtle Guardians program works with another 11 core groups across the province. Together these groups form a steering committee which has designed a strategic program where staff and community/citizen scientists can graduate to levels of increasing skill related to turtle conservation. Volunteerism has also been encouraged at various levels of commitment throughout the program. The program is multi-faceted to allow for recruitment and skill-development through various means, opportunities, and across demographics. The team has also designed tools to facilitate awareness, skill-development, monitoring and species reporting.

The list of partners includes: Scales Nature Park, Georgian Bay Turtle Hospital, Toronto Zoo, Ontario Nature (removed in 2020 after lead representative left; agency was unaware of agreements and uninterested in continuing with our program), TLB, EcoKare, Trillium Lakelands District School Board, Road Less Travelled School, Thames Talbot Land Trust, Friends of Kingston Inner Harbour, Canadian Wildlife Federation, Blazing Star Environmental, and the Frontenac Arch Biosphere.

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In 2018, the lead agencies were successful in obtaining an Ontario Trillium Foundation Grow grant to develop and expand the Turtle Guardians program. As part of the requirements for the grant, and to support the program going forward, a comprehensive evaluation of the effort is required.

This report looks at the program elements and design to assess whether the infrastructure and processes/protocols address aspects and needs to support the science of recovery; and takes a critical view to assess whether community science is providing meaningful impacts for turtle conservation and recovery. The evaluation also assesses whether program elements are effective to increase commitment of volunteers, to facilitate meaningful experiences, to share knowledge and relationships among and between volunteers and agencies/programs, and therefore to support the creation of social norms and an enduring program.

The evaluation will address the 4 goals/learning outcomes as outlined in the Ontario Trillium Foundation Grow Grant which are as follows:

- 1. What is the impact of Citizen Science on the ability to plan meaningfully for conservation (change in data volume, area, and durability) for turtles?*
- 2. What is the impact of Citizen Science on the ability to conserve turtles in Ontario; therefore, the ability to identify conservation priorities; assess prospective mitigation sites (ecopassages etc); and on leveraging interests in order to apply conservation measures?*
- 3. What is therefore, ultimately, the effectiveness in turtle recovery (population stability and reversing losses)?*
- 4. Finally, what is the durability/sustainability, strengths and weaknesses of the program- and therefore the sustainability of the resulting conservation achieved.*

To support the evaluation, collaborative meetings to glean staff and steering committee insights took place each year. Volunteers were interviewed, and surveys were provided to volunteers, stakeholders, and clients.

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## Program Design Elements

The Turtle Guardians program was designed to address interrelated aspects that are needed to achieve good recruitment levels of volunteers, and also meaningful skill-development to advance wildlife conservation efforts.

### **1. Awareness: Outreach and Education**

Tools and campaign/marketing elements are foundational to cultivating interest and recruiting volunteers across demographics, cultures, and communities. To increase knowledge and community participation, the program has created multiple educational events:

- **Turtle Walks** (prior to Covid-19) where families walk to raise awareness of nesting turtles during peak nesting season; these are chaperoned by Ontario Provincial Police.
- **Workshops and presentations** including displays and public interactive events such as library visits, and farmer's market booths.
- **Curriculums**- grade school curriculums that meet Ontario Expectations across subjects from math to geography, and including Indigenous studies and Indigenous knowledge curriculums. Curriculums included activity sheets (known as black list masters) and companion videos. The program offers school site visits or zoom classes with live turtles. Each curriculum supports conservation actions and relates back to the Turtle Guardians program.
- **Turtle and Reptile camps** geared to ages 7-12 and which correspond to achieving Level 1 and 2 Guardianship
- **Mural** in downtown Haliburton with a swimming turtle, attributed to the Turtle Guardians program
- **Online educational media and social media** including TikTok, Facebook, YouTube, Instagram, and Twitter
- **Turtle tours**- offered to the public throughout the season
- **Turtle birthday parties** offered through Scales Nature Park, in person pre-Covid and virtually
- **Turtle-fest- annual events** held at the Turtle Guardians Headquarters and Scales Nature Park to honour volunteers, showcase hatchlings and program efforts. These have been scaled back since Covid-19 but as they are outdoors they are still draws.

To raise awareness and cultivate community interest, the program has created various campaigns and marketing materials:

- **The Turtle Guardian brochure**, which reads like a treasure map and includes fun facts about turtles and hotline numbers to report/take injured turtles.

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- **Banners and displays** communicating program details, identification of turtles and fun facts including how to help turtles
  - **Newsletters, new releases, articles, television interviews, and radio interviews** at regular intervals throughout the program
  - **“It takes 60 years to replace just one”** is inscribed on **billboards** in two locations in Ontario and the collaborative is moving to expand the billboards to the 400 series highway using GoFundMe and letters to corporate sponsors as vehicles to build capacity
  - **“You’re a turtle hero”** is inscribed on small square business **cards** that also include contact information and a call to action to volunteer. These are given to anyone that staff and volunteers find helping turtles, and are given to those that call in a nest or turtle through hotlines.
  - Artistic 20s style **posters and postcards** for all levels of volunteerism
  - **Turtle Guardians calendar-** geared towards kids with turtles in constructed scenes (e.g. at the beach, gardening etc.) The fun calendar includes interesting facts about Ontario turtle species each month.
  - Stickers and other swag/store items
  - **Turtle vehicles-** painted PT cruisers are used to drive around the highlands. These vehicles have program and contact information on them. They are used by staff during the summer season as a way to market the effort of the program and raise awareness for turtle conservation.
  - **High visibility vests** with “Turtle Research in Progress” and bumper stickers/magnets are provided to all Road Researchers. These vests have contact information and also promote our efforts while promoting turtle conservation.
  - **Sandwich board and lawn signs** that indicate “Turtle Research in Progress” have been developed and deployed where Crossing Guards are monitoring sites, and are used in partnership with local municipalities.

The steering committee has explored other avenues to connect people to nature through turtles and therefore to facilitate greater caring and capacity for conservation of all turtle species. Some of these may be conducted in the future. Activities that are known to engender these results include:

- Turtle art evenings
- Turtle art competitions
- Photography competitions

### **Social Media and Marketing:**

- The new TikTok account is showing promise with 253 followers and over 2498 likes indicating a high viewership
- Turtle Guardians Facebook account has 3992 followers and 3758 people who like the page. About 50% of posts reach +2000 Facebook users that promote events and general turtle

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knowledge. The remaining posts range between 5000 and 25000 views? with a few high scorers of over 40000, 60000 and the highest viral post at 300,000 views. These latter posts typically communicate the presence of turtles on roads and how to help them.

- Turtle Guardians YouTube channel is fairly new (2021) and has 35 only subscribers, however views range from 5 to 1500, showing promise for growth.
- The program's Instagram account has 799 followers that are loyal with an average between 40 and 70 likes per post.
- Twitter does not seem to be used to its full potential. No new posts have been added recently. Perhaps this is due to the audience being more scientific or political in nature, however this platform can be used in a variety of ways, including to communicate life cycles of turtles and events for the collaborative.
- The Turtle Guardians calendar is popular with reports of sales reaching 4000 each year and generating important revenue for the collaborative. There is potential to expand through brokers and in new areas in the future.

## Outreach:

- The Turtle Guardians program has been featured in Kawartha Cottage and Cottage Life **Magazine** in the past 3 years and has been on **Global television** 3 times (once a year). **Radio interviews** occur with Canoe FM in Haliburton at regular intervals and articles are featured in local **newspapers** across the region.
- Teachers of 11 different classes in 11 different schools, including Georgina Island First Nation Elementary School, have also taken part in online classes or workshops with Turtle Guardian staff, and have expressed positive results, including having submitted artwork, and videos created by students, and thank you cards.
- Volunteers have indicated that the **high visibility vests** worn are helpful to slow traffic, and that at crossing sites, they receive many questions from the public, with cars often stopping to ask questions about turtle biology and behaviour.
- Volunteers have indicated that when the **sandwich board signs** are erected, traffic is notably slower and they perceive that there is less mortality. Indeed results from the Turtle Guardians collaborative related to turtle mortality does indicate a reduction in finding carcasses where staff and volunteers regularly monitor roads.
- The response to the **billboards** was evident through social media feedback where comments included "about time" and "we need one at this location". The \$3500.00 raised through the GoFundMe Campaign is also proof these billboards were a success.
- "Report Turtles" signs were installed below traditional turtle crossing road signs within the District of Muskoka, instructing drivers to call the START project Turtle Hotline to report observations and obtain advice on where to transport injured turtles.

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- **Turtle Camp/Reptile Camp:** prior to Covid-19 4 collaborative partners provided camp for kids across Ontario with the following results:
    - 70 children at The Land Between's Turtle Camp
    - 25 children at Scales Nature Park's Reptile Camp
    - 20 children at the Frontenac Arch Biosphere's Turtle Guardian Camp
    - ~ 20 children at the Thames Talbot Land Trust Level 1 Turtle Guardian workshop

## Recommendations

- Continue outreach, social media and marketing activities as resources allow, while examining which activities provide the best outcomes for the resources used.

## 2. Community Science

The Turtle Guardians program has created 5 graduated levels of community science for volunteers to participate in. Each level provides information related to various aspects of turtle ecology/life cycles, through the use of related tools, protocols, and training modules and supports. These levels provide immediate sources of mitigation through public awareness and also provide direct conservation efforts for turtles by training these volunteers to move turtles off roads and out of harm's way. Additionally, these levels also allow volunteers to aid in the protection of turtle nests and subsequent hatchlings. The increased visibility of caring individuals who demonstrate vigilance and safety for turtles on roads within communities will create social norms and make drivers more aware of these vulnerable species. The program includes these graduated levels and themes:

### Level 1:

- Observations- pass the turtle identification test and become a Level 1 Guardian to report where and when turtles are seen, including their behaviour.
- Crossing Guards- volunteers that monitor areas where turtles cross in cities or zones that contain high traffic and subsequent mortality. Crossing guards take shifts of 1-3 hours and provide a highly visible conservation message to communities.

### Level 2:

- Nest Sitters- on-call volunteers who "babysit" nesting females on road shoulders until they are finished nesting and can be moved out of harm's way. The nest can then be protected using a nest cage, or excavated by staff under wildlife permits if laid in a precarious area. Nest sitters also monitor caged nests to aid hatchlings to safety when they emerge.
- Wetland Watchers- adopt a wetland- before and after nesting season volunteers look for turtle basking activity once a week and record all wildlife sightings to the program.

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**Level 3:**

- Tunnel Assessing- trained senior volunteers assess mapped potential underpass sites to assess feasibility of installing specialized concave fencing to direct turtles to culverts.
- Road Researchers- Volunteers adopt sections of roads to walk, cycle, or drive, and report all turtles observed (including dead individuals) to support scientists in assessing search effort and therefore relative population trends in local areas.
- Community conservation projects- students can design their own conservation project in their community with staff support.

**Level 4:**

- Advanced training for volunteers that are involved in activities typically prohibited but allowed through government permits, to enable close interaction with conservation projects (i.e. temporary turtle holding and transportation)
- Training includes online seminars and in-person workshops to facilitate equal ability participation under science permits (ie. activities where there is some training and less physical options other than just Level 5 physically intensive training)

**Level 5:**

- Research and Science Permits- Advanced training for activities typically prohibited but allowed through government permits (i.e. egg excavation). This level is partnered with Scales Nature Park who leads the training and holds the necessary scientific research permits

To assist with Community Science, the Turtle Guardians program collaborative has developed the following tools:

- a. Public reporting hotline(s) at Scales Nature Park and Turtle Guardians headquarters
- b. Websites
- c. Smartphone Apps : Turtle Guardians for Level 1 and general public, Reptailers for Level 3 Road Researchers, the START app for advanced research (Level 5)
- d. iNaturalist turtle observation project
- e. Training videos and protocol documents
- f. Online web portal reporting forms and downloadable PDFs

**Related Results:**

- 567 Turtle Guardian enrolled volunteers (July 2021)
- Total turtle observations: 58796
- 586 km<sup>2</sup> of area impacted through on-the-ground implementation
- 1323 km of roads were covered in 2020 that were not previously covered in 2013-2019



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- 1108 km of roads were covered in 2021 that were not previously covered in 2013-2020

### **Recommendations:**

- Approach interest clubs such as hiking clubs, cycling clubs etc.
- Target local hunters and anglers as a stakeholder group
- Target high schools and post secondary institutions for volunteers and to offer skill development opportunities
- A volunteer management strategy and system is recommended to ensure momentum, interaction and interest is maintained
- Seek funding to purchase a large supply of binoculars to be loaned to Wetland Watchers
- Create an educational video of how to properly install a nest cage, including drawbacks (ie. predators still get in, poaching, vegetation creating shade, etc.)
- Create a way to track how many nest cages were installed and the outcome of the nests (ie. determine hatching success based on empty shells versus rotten/infertile eggs)
- Create a verification system to confirm species. This is important in order to protect wetlands under current legislation
- Create sub-committees with volunteers to look at how to better meet objectives within specific geographic areas. By allowing volunteers to have a chance to say how things work, it can result in more support and excitement with Community Science efforts

## **3. Research**

Wildlife research by trained staff and senior volunteers involves rigorous data collection, which utilizes and expands on the preliminary findings that may have been supported by junior community scientists.

### **Recommendation**

Support research and conservation efforts of partner organizations and recovery teams through the recruitment and training of staff and volunteers, the collection of community science data, the promotion of activities, the sharing of resources, and the development of conservation tools and standards that can be shared across organizations and with participants. In turn, communicate project results and best practices to Turtle Guardian volunteers.

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## 4. Mitigation of Threats and Species Recovery

Mitigation planning, and mitigation itself, can be conducted and improved through the contributions of community scientists. General observations can assist with identifying hotspots for road mortality (and other threats), as well as optimizing the location of turtle crossing signs, turtle tunnels, and exclusion fencing. With appropriate training, Turtle Guardians can perform specific, standardized assessments of potential turtle tunnel/ underpass sites, place temporary signs to caution drivers, patrol roads, guard female turtles while nesting (Level 3), place protective nest cages, or even excavate eggs (Level 5) and transport them to an incubation facility (e.g. Scales Nature Park, The Land Between, Georgian Bay Biosphere).

The data generated through these activities can help to inform mitigation planning and persuade road management agencies to undertake mitigation efforts. This is a long term effort, and frequently involves municipal outreach and partnership development to improve the odds of success.

While the mitigation effects of driver awareness signs (e.g. “Turtle Crossing”) have been shown to lessen over time, when paired with call to action signs (e.g. “Report Turtles- 705-955-4284”), the benefits are enhanced and appear to persist over years.

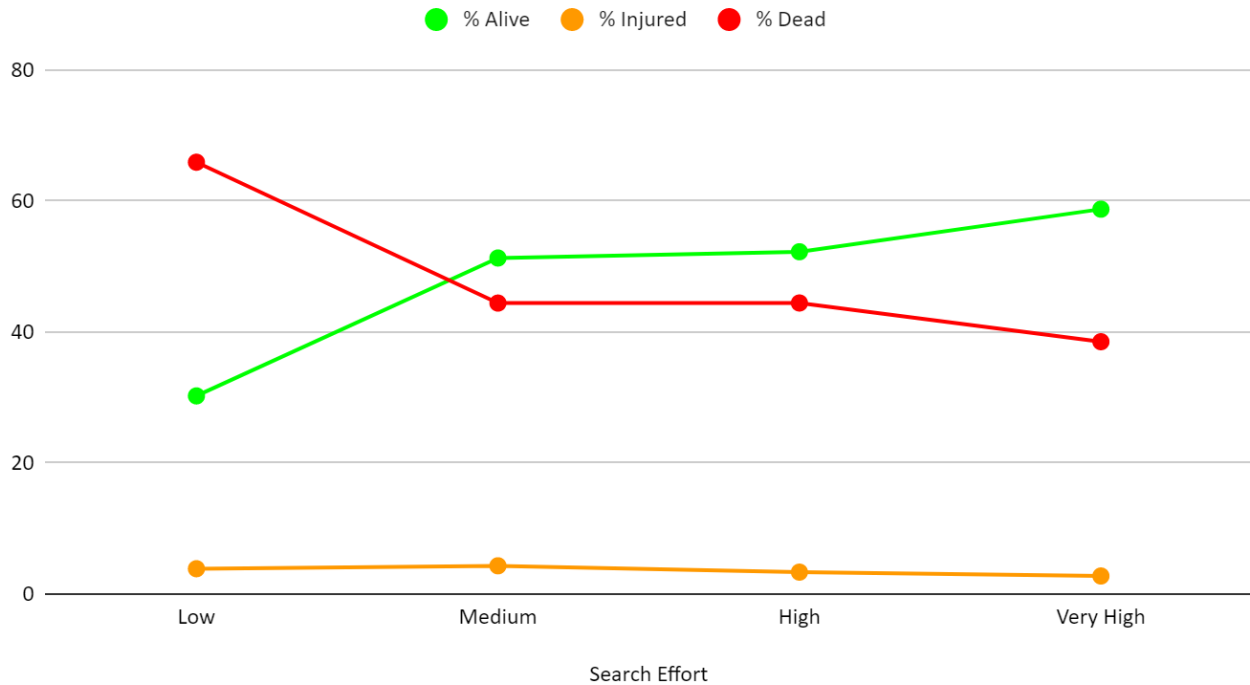
The mitigation effects of protective nest cages and egg incubation programs have been amply demonstrated at various sites in North America, most notably in Ontario at the Upper Thames River Conservation Authority for Spiny Softshell Turtle recovery. A 20 year program there has resulted in dramatic improvements in recruitment rates and population size for this endangered species. Individuals released as hatchlings from lab incubated eggs have now been recorded as adult females laying eggs for a new generation. The Turtle Guardians program has not been in place long enough to assess any results related to these activities within the program area, however, it is reasonable to expect that they would provide significant benefit to local populations.

The direct mitigation of road mortality through road patrols has not been well established, as few studies examine the problem at a broad enough scale over a long enough period of time. However, it is theorized that the presence of people who will intervene in a manner to assist turtles, can reduce the risk of road mortality for turtles. Their activities may include moving a turtle out of harm’s way, transporting an injured turtle for treatment, observing a nesting female during her process of choosing a nest site and laying eggs to ensure she is not run over, placing temporary signs to warn drivers, and other situational tasks. Increasing any of the number of people, the extent of their presence, the intensity of their activities, etc. should result in decreased road mortality.

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Preliminary analysis of START project data demonstrates this direct mitigation effect, as shown in the graph below. Turtle observations from selected roads with similar characteristics (2 lane, paved, 80 km/h speed limit) and sufficient search effort (varying levels from 2013-2019) were sorted into three categories, alive, injured, or dead. Since increased search effort will increase all three categories (excluding hypothetical asymptotes being approached), the relative proportions of alive, injured or dead turtles were compared across varying levels of search effort for each road during each year. As shown in the graph, as search effort increased, the proportion of alive turtles increased, and the proportion of dead turtles decreased. Interestingly, the most significant changes occur between low (once per 3-7 days) and medium (once per day) search effort, suggesting that a level of activity achievable by volunteers should be sufficient to effect major benefit. Further improvements are incremental and only really noticeable at a very high level of search effort (5+ times per day) that can be achieved only by the most dedicated volunteers, or paid staff with a focus on specific roads. It must be noted that this analysis is based on a subjective assessment of the search effort level per road per year. Efforts are ongoing to better quantify the levels of search effort in order to improve the rigour of this analysis. It should also be noted that this analysis specifically excluded data related to community volunteers, in order to better standardize the results between roads and years. However, for the consideration of broad trends, it is notable as an indicator that the activities of trained people engaged in activities to protect turtles can be an effective mitigation strategy for some roads where such activities may be undertaken safely. It is not considered to be an effective approach for major highways where high traffic levels would require an impossibly high level of search effort, and personnel safety would be compromised.

## % Turtles Alive/Injured/Dead vs Search Effort



### Related Results:

- Number of tunnel assessments performed: 149
- Number of Nest Sitters trained: 42
- Number of nesting turtles observed: 1084
- Number of eggs incubated (2018-2021): 58082
- Number of hatchlings released (2018-2021): 48139
- Number of turtles moved off of roads: 803
- Total turtle observations: 58796

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## **Evaluation Areas/Key Questions**

The Grow Grant goals are expressed in term of what is the collaborative attempting to learn, test or demonstrate, and which is outlined as the following:

- 1. The impact of Citizen Science on the ability to plan meaningfully for conservation (change in data volume, area, and durability) for turtles;*
- 2. The impact of Citizen Science on the ability to conserve turtles in Ontario; therefore, the ability to identify conservation priorities;*
- 3. Assess prospective mitigation sites (ecopassages etc); and on leveraging interests in order to apply conservation measures;*
- 4. Therefore, ultimately, the effectiveness in turtle recovery (population stability and reversing losses).*
- 5. Finally, what is the durability/sustainability, strengths and weaknesses of the program- and therefore the sustainability of the resulting conservation achieved.*

These goals can be assessed by exploring the following Evaluation Areas/ Key Questions (as outlined in the OTF Grant):

### ***1. How can we measure population trends (baselines and change over time) using Turtle Guardian Community Science programs?***

Population trends in larger areas are extremely difficult to quantify, as mark-recapture sampling is ineffective at this scale in moderate timeframes. Baselines would be difficult to capture at this scale and this has not been done before through traditional methods. It may be possible to use local population estimates derived through other methods and extrapolate across a larger area to determine a baseline.

However, with a large volume of community science data, over a long period of time, it would be possible to establish a “baseline of observations” that is a proxy and not directly linked to a population estimate, and then examine whether the number of observations of a species changes over time. This would be extremely valuable, and would represent the best available information for many species at such a scale, across such a large geographic range.

### **Recommendations**

This is dependent on the species and habitat types as well as staff and volunteer capacity. For example, spring basking surveys for Map Turtles via canoe along a long stretch of river will provide much better

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and more repeatable population estimates than wading through a large wetland complex looking for Blanding's Turtles. Accounting for these variances will be required. A useful goal may be to define population and habitat hotspots. While there may be connections to other habitats, there will always be core habitat areas, and locating these areas across large landscapes should be a community science goal. Possible approaches include road surveys, nesting observations, basking surveys, habitat delineation based on ortho-imagery and later ground-truthing, but for community science to be useful it needs to have a focus on repeatability over time. It will be important to consider the timing for each of these as well. Nesting surveys are typically conducted in June, the highest rates of observations for basking surveys would likely be in May. Ground truthing a site may have to occur in both early spring and late summer to get a sense of water levels throughout the season. Defining the geographical scales at which it may be possible to attempt to identify baselines and trends, and the minimum timelines involved, will be an important step. Keep in mind that this needs to be very long term to best understand trends in a long-lived species, such as turtles.

## ***2. Can we better chart distribution and abundance of turtles as a result of the Turtle Guardian program? (numbers, types of new viable records)***

### **Distribution**

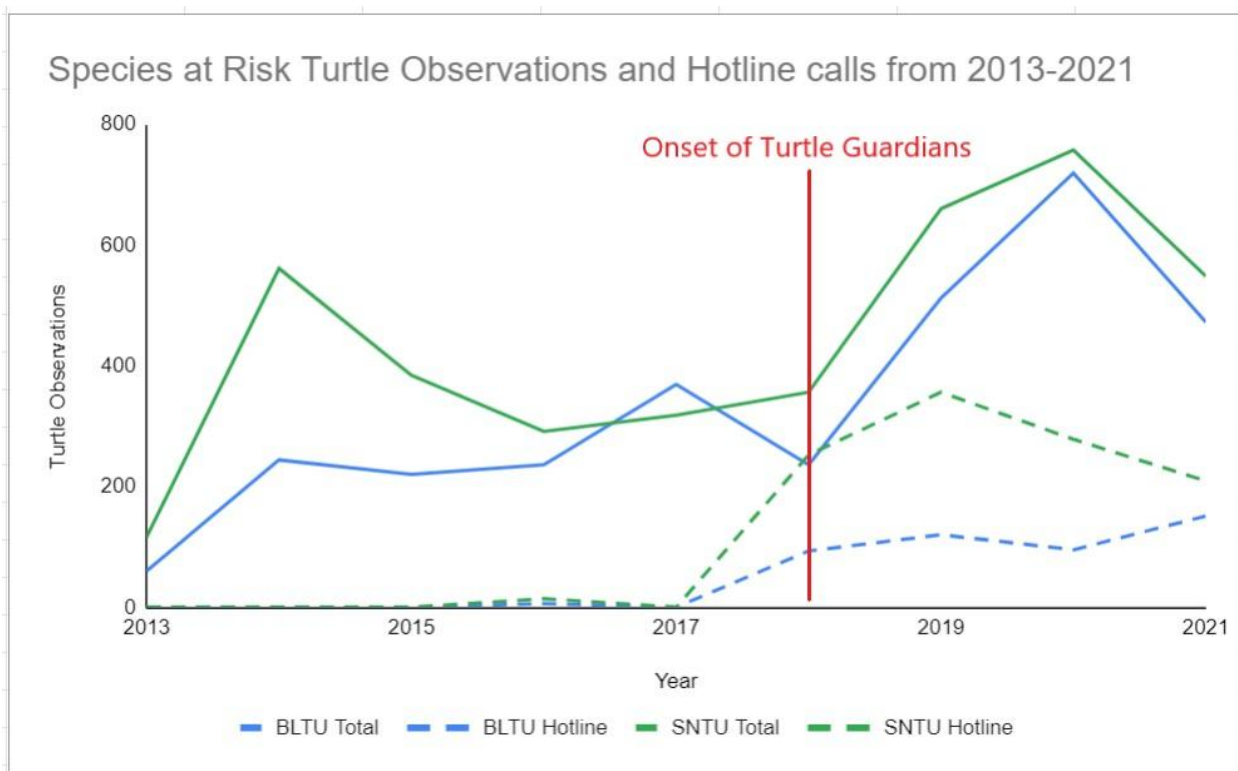
There will always be more of the general public than there are turtle researchers. The turtles of Ontario are easily identified to species, and most species are relatively conspicuous when basking on rocks or logs. Even those that are cryptic are readily spotted when they leave the water to lay eggs. People are interested in turtles, and generally feel positively about them. Therefore, there is a strong role that can be played by the public through community science in understanding the distribution of turtles. The new apps and other tools help to generate more observations, especially by making community science easier and more accessible to children and families.

Programs that engage the public to report observations, and tools that make such reporting easier, allow for filling knowledge gaps related to turtle species. One example is the Turtle Hotline, which enables reporting and also two way communication to provide situationally relevant advice. When feasible, trained teams can respond to priority calls. Calls to the Turtle Hotline can result in significant conservation benefits to species at risk. Below are several examples that demonstrate this.

- 1) In 2014, researchers with the START project drove a road in Muskoka 20 times daily during the 2014 nesting season. From 2015-2021, this road was driven approximately 8 times daily. No Spotted Turtles were observed, and the nearest known population of this endangered species was 20 km away. In 2019, a local citizen sent a picture of a Spotted Turtle crossing this road to

the “Turtle Hotline”. Researchers were subsequently able to locate appropriate habitat north of the road, and upon searching that habitat, they discovered a new population of this species.

- 2) From 2013-2019, researchers with the START project monitored a nest site in Muskoka that is heavily used by Blanding’s Turtles. This site is checked 2-3 times per night during nesting season. No Spotted Turtles were observed at, or even within nesting distance of this site. In 2020, a member of the public called the turtle hotline to report a Spotted Turtle at this site. The research team responded rapidly and found this turtle, which was gravid and searching for a nest site. Note that this is a different site than referred to in 1).
- 3) Hotline calls generate a significant number of species at risk turtle observations. The graph below shows total START project observations and those related to hotline calls, by year, for both Blanding’s and Snapping Turtles. The total number of Blanding’s Turtle observations resulting from hotline calls is particularly significant, with a major increase coinciding with the onset of the Turtle Guardians program. The drop in 2020 and 2021 is attributed to pandemic-related lockdowns during the spring of each year.



- 4) Direct reports of turtles from Turtle Guardians resulted in 621 observations of all species in 2020. By contrast, observations generated by The Land Between field staff totalled 407.

These examples help to demonstrate the importance of citizen science in contributing to a better understanding of the distribution of turtle species in Ontario.

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## Recommendations

Similar data for comparison is best, but even random, sporadic data collection can be useful. Can you tap into iNaturalist, NHIC and ORAA data to see where hotspots already are in your area? Can you continue with a data sharing agreement with NHIC, and have staff do bi-annual data pulls from iNaturalist? You can also work with iNaturalist to have a “project” for the areas you want to target, allowing automatic pooling of new data that comes in for observations and road mortality.

## Abundance

As discussed above regarding population monitoring, abundance is difficult to measure but may be feasible through some of the strategies already identified or recommended.

## Recommendations

- Ensure efforts are not biased by availability of people. If near a city centre, there will be more volunteers and more data available.
- Target volunteer efforts, where possible, in areas deemed useful due to data gaps or suspected importance.

Over time, with a similar amount of community science effort repeated over years, it should be possible to identify trends in relative abundance. This is likely to be best done by examining the number of species observations along a road during nesting season in relation to effort, and by comparing counts of basking turtles (for conspicuous species) in the early spring. These are long term efforts which are not suitable for evaluation over a three year period.

### ***3. Are we able to better assess/target conservation areas/actions/needs? (the increase/refinement in identifying road-mortality hotspots; prospective ecopassages/tunnels; significant wetlands; nests)***

Community science enables the collection of more data over larger areas, and while the rigor of the data is variable depending on training, modes of collection, and individual skills, the basic observation data gathered does enable modeling for mitigation options and other conservation efforts. As discussed previously, this is most notable where there is consistent, long term, data.

### ***4. Can we use community science data for in-depth research? (e.g. climate change responses)***



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Community science data can be used for in-depth research, especially if it is generated by people who have participated in training programs to increase the reliability of data. The usefulness depends heavily on the research questions being asked, but this is true of all data. For example, locations of individual turtles may not matter in a behavioural study, but they do matter in home range or habitat usage studies- two examples that are often performed on turtle populations. Many such studies are limited by the number of researchers available to search for turtles across an area. Community volunteers who send digital images of turtles they find, which allow for individual identification by researchers, are contributing extremely useful data.

A general consideration for in-depth research is that different survey methods typically provide different results, so be sure to compare apples to apples. For example, for road mortality surveys, various modes of transportation (car, bicycle, on foot) will change what is found. Car surveys miss many animals. Bike surveys are better, but miss some animals. Surveys on foot may find more animals, but cannot cover as much distance within time allotments. You may need to determine which is best for a given area, and compromises may result from conflicting goals (e.g. documenting road mortality versus finding nesting females). Additionally, the inability to standardize the approach related to how intensive surveys were alters the depth and rigor of the results and applications. For example, whether volunteers included adjacent ditches (many animals end up in the ditch due to force of the hit, predators or moving before dying) each time when on foot or cycling, versus driving yields different results. Standardizing search effort against the mode of the search will generalize results if conducted over long periods of time to yield rigor. Short term surveys will be ineffective for research purposes except for alerting agencies about areas that require protection or mitigation, but will not yield information related to trends.

Climate change is always a tough one, and even with robust data sets there is an element of assumption in many cases. With that being said, using community science to monitor early season observations of basking, moving and nesting activities, could lend itself to more in-depth research.

### **Recommendations:**

- Whenever possible, obtain digital images of all turtles, especially species at risk so that identification can be confirmed
- Aim to record age class and sex whenever possible.
- Ensure consistent data collection as much as possible for comparative analysis (for example every Monday and Thursday).
- Predators and scavengers remove many road killed turtles, so a consistent survey program would be needed to provide either high accuracy of number of animals (daily)

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- Consider determining the rate at which predators and scavengers remove dead turtles in your target regions.

## **5. What is the impact of community science on the implementation of conservation activities?**

### **Leveraged support and awareness**

Community science programs can increase public awareness of conservation needs, and also of activities being undertaken. This can be utilized to improve the chances of success, and/or the degree of success, that such activities can achieve. This increased awareness may result in the leveraging of additional resources, both financial and in-kind, that can increase the success of conservation activities and enable more of them to be undertaken.

### **Recommendations**

Create and support local champions. Ensure these people are well-recognized and publicized for their efforts, such as providing a yearly volunteer appreciation day, or awards. For organizations or individuals with properties that support turtles, seek out opportunities to increase or improve habitat on their lands.

### **Overall impacts of community science on awareness, stewardship and conservation**

Measuring the overall impacts is challenging, but worthwhile wherever possible. As demonstrated above with respect to road mortality reductions and knowledge gap filling, the impacts can be significant.

A particular example that demonstrates the impact of training community members to conduct community science is shown below. The first class of Level 4 Turtle Guardians training was delivered in 2019, through the START project, to enable community volunteers to get more involved in conservation and allow them to legally engage in activities under the project's research permits. One of these Turtle Guardians was extremely enthusiastic about patrolling her street for turtles with her young son, and recruiting her neighbours to help. The hotline call volume for her street, Switch Road went from 11 in 2018 to 63 in 2019 and then 120 in 2020 as shown in the table below. Over a three year period, Switch Road had the most hotline calls of all roads within the project area, which is truly remarkable since it is only 4 km long, compared to the second place road which is 15 km long. This is an extreme example, however it does illustrate the potential for tremendous benefits from engaging community members and training them to be able to assist with conservation work.

Road Name	2018	2019	2020	Total calls
Switch Road (4km)	11	63	120	194
Doe Lake Road (15km)	41	76	29	146
Muskoka Road169	34	32	47	113
Southwood Road	19	32	26	77
Highway 11	11	26	25	62
Housey's Rapids Road	12	36	18	66
Highway 12	2		27	29
Muskoka Road 118 West	9	13	19	41
Barkway Road	8	27	8	43
Peninsula Rd	9		9	18

A further benefit of community engagement is demonstrated within this table. Selected secondary roads within the project area had professionally developed signs installed that instructed drivers to “Report Turtles- 705-955-4284”. Five of the top 10 roads (out of ~200) by hotline call volume, had these signs installed in 2018 (light blue), and a sixth in 2019 (dark blue). Two of the remaining roads are major highways, where such signs would not be feasible. Signage can clearly be effective at increasing community engagement with turtle conservation, though the effect of a dedicated and trained Turtle Guardian in a neighbourhood can be even greater.

## Recommendations

- Create a detailed list of sites impacted by Turtle Guardian activities.
- Define specific, quantifiable metrics that can be tracked over time and analyzed.
- Use surveys of the public employing numerical values (e.g. Likert scales) to assess changes in awareness.

## ***6. What is the durability of the program? Can it be measured through quantitative and/ or qualitative methods?***

With sufficient resources to keep key staff in place, the Turtle Guardians program appears to be reasonably durable. The program has created a sense of community across participants and engaged the general public in a way that has developed interest in turtle conservation that should persist. This

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interest has also created a demand for some activities that can be used to generate revenue. For example, Turtle Camp had a waiting list for available spaces, at times. Such revenue streams may be very useful during times of unstable funding from other sources.

With all eight Ontario turtle species listed as “at risk” federally, and seven of them (minus the painted turtle) listed provincially, these species should continue to be a priority for funding from government agencies, foundations, and corporations. Therefore, it is reasonable to conclude that programs such as Turtle Guardians should be able to persist for the foreseeable future.

It is impossible to assess the durability of the program quantitatively, due to the nature and number of unknown variables such as changes in governments, changes in agency priorities, etc.

## **Recommendation**

- Create Turtle Guardians chapters across The Land Between to improve local engagement, build capacity, and increase durability. This may also open doors for new donors or sponsors which will generate additional resources to support the program.
- Create different avenues beyond surveys to gain volunteer responses. Volunteers may be more willing to share insights, issues and feel heard if there are multiple ways to connect with the program for feedback

## **Volunteer survey results:**

A survey of volunteers was administered to examine attitudes and values about volunteering with the Turtle Guardians program, and The Land Between as well as their connection to nature. Fourteen volunteers completed this comprehensive survey.

Many of the respondents have learned more about turtles and other plants and animals in their ecosystems. A number of respondents also highlighted how they are more observant of their natural environment since getting involved in The Land Between, and how their involvement has channelled their focus. Notably, one respondent explained that although they had a strong background in the field, their involvement has helped them solidify previously acquired skills.

Respondents were asked about their lifestyle and activities. While there was an even split of year-round and seasonal residents, the majority owned property in the region and had been coming to the area for 11 or more years. When asked about the activities they partake in outside, the majority focused on low-impact activities such as hiking or animal watching. Interestingly, none of the respondents spent their time hunting and trapping, though hunting and trapping is a common activity in cottage country.

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To be more inclusive, The Land Between may consider adopting new programs that would be of interest to hunters or trappers.

Respondents were asked about their volunteer experience at The Land Between. When asked about “why” they volunteer for The Land Between, it is obvious that the volunteers share values with one another including caring for the environment and fulfilling their moral principles. It is pretty apparent that these were pre-existing feelings and not deeply influenced by The Land Between, although it is probable that there is some influence.

Most of the volunteers had positive feelings about The Land Between, including liking the organization, feeling valued in their work, receiving adequate training, etc. One volunteer in particular seemed quite frustrated with the organization as they signed up or were never contacted. As this was a single volunteer, it is impossible to conclude this as any kind of trend. However, it is important for both volunteer engagement and organizational reputation that everyone is followed up on. Volunteer coordination is recommended as a significant part of an employee's portfolio. One aspect of the feedback also included that they wished they had more opportunity to connect with staff and volunteers. The volunteer appreciation event in the summer is the perfect example of an opportunity to connect supporters of the organization. Other volunteer feedback for the organization centred around the repetitiveness of data entry and the slightly difficult way to record volunteer hours.

Respondents were asked about their connection to nature. Using the inclusion with nature scale developed by Schultz (2002), respondents mostly felt a closer relationship with nature, although a few felt further from nature. It is obvious from their responses that the respondents came to the organization with a pre-existing appreciation of nature. When asked about the influence of volunteering for The Land Between on their connection with nature, a correlation is not as obvious, although cannot be discounted for having some impact. However, all of the respondents agree that their skills in the field have improved/advanced since becoming involved in The Land Between. The respondents agree that their involvement in The Land Between has improved their knowledge of biodiversity, keen observation of the environment, and solidified their skills in the field.

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## Impact Summary Against OTF Expressed Goals

### ***1. The impact of Citizen Science on the ability to plan meaningfully for conservation (change in data volume, area, and durability) for turtles***

The Turtle Guardians program has recruited participation in Community Science across Ontario from over 500 enrolled members and from the general public. The results have increased the knowledge base as it pertains to areas where turtles need mitigation for threats, and has also provided new data in areas that have not been actively monitored previously. It is clear that the program, and community science generally, supports planning for conservation. Recommendations include increased targeting and frequency of several types of monitoring, such as road surveys, where the rigor of the data would be more reliable as fewer turtles would be missed. Wetland monitoring is ineffective unless conducted at specific times (e.g. early spring), so targeting is critical for any such efforts to be useful. The recommendation here would be to communicate the value of the data more clearly to the public, including the role of observations in protecting habitats, and the need for effort within a critical window of time. Another recommendation would be to approach sports clubs, cycling and hiking groups in particular, in order to synergize with their existing activities.

### ***2. The impact of Citizen Science on the ability to conserve turtles in Ontario; including the ability to identify conservation priorities; assess prospective mitigation sites (ecopassages etc); and on leveraging interests in order to apply conservation measures.***

Community science provides a broader level of conservation effort than traditional research activity is able to offer, since it is less constrained by available resources and specific locations. This supports mapping, assessments of threats, modeling of mitigation sites, and other planning activities at regional or greater scales.

Through continued training and relationship building with volunteers, the quality of volunteerism increases, as the volunteer is more experienced and involved. This creates a feeling of ownership that can translate into advocacy (e.g. two situations where volunteers have approached their municipality directly to advocate for mitigation) and this advocacy can have a significant impact since it originates from community members rather than from agency or NGO that may be perceived as an outsider.

A recommendation would be to ensure volunteer relationships are maintained throughout the year as well as during the summer season, and recognized where possible.

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### ***3. Therefore, ultimately, the impact of community science on the effectiveness in turtle recovery (population stability and reversing losses).***

Turtle recruitment rates are extremely low. The best available science, from nearby Algonquin Park, suggests that 1 in 1400 snapping turtle eggs will survive to become an adult snapping turtle 20 years later. This translates into approximately 60 years to replace each snapping turtle. The loss of adult turtles through road mortality, or other threats, has a tremendous impact due to this extreme reproductive life history. Mitigating the loss of adults is critical to turtle conservation, however roads and traffic levels are increasing even as habitat loss continues. Therefore, reversing population declines and recovering species will require an enduring effort over many years, across broad areas, and using all methods and tools available. Turtle populations can benefit from, and be stabilized by, consistent efforts that include volunteerism, advocacy, and partnerships, all of which have evidently been facilitated and cultivated through this emerging program. A stable source of funding for enduring capacity is required, and we recommend that the collaborative access multiple streams of revenue and resources, which will ensure the level of effort can be maintained over the long term. Creating local chapters of the program may be a way to rally the forces that are required for turtle conservation across the landscape of southern Ontario. Advancing campaigns to urban centres is an avenue that should be pursued. The recent upsurge of turtle conservation activity in Brampton, centred around Heart Lake, is indicative that the appetite is present in urban settings.

### ***4. Finally, what is the durability/sustainability, strengths and weaknesses of the program- and therefore the sustainability of the resulting conservation achieved.***

There is clearly a groundswell of interest that has been created by this effort, as media coverage and volunteerism are increasing. Due to this the collaborative's capacity has also grown, however stable sources of income are still elusive, and additional support must be identified. However, the development of skills and knowledge and the subsequent expertise that is felt by volunteers is enduring and impactful, and these gains are stable and transferable. The collective and visible efforts to save turtles under this banner are becoming a social norm and are creating ripple effects that are evident in communities across Ontario- demonstrated by those stopping their vehicles to save turtles, and even the numbers of shares of social media posts, with one in particular reaching 300,000 viewers. People take pride in their involvement with turtle conservation, and this pride is contagious. Therefore while the collaborative's funding base is still tenuous, the social support may provide the resources for an enduring effort. The brand is also expanding across areas and new partners are joining the collaborative to offer programming elements and recruit volunteers. Again, a form of a

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franchise or chapter is recommended to ensure local engagement and and generate volunteer support at necessary levels.

Key strengths of the Turtle Guardians program include the experience and resources of the various partner organizations, the branding that makes the program recognizable and desirable, and the sense of ownership that participants develop through their efforts.

Significant weaknesses of the program lie mainly with the middle to long term instability of funding resources, and the difficulty of maintaining digital tools such as smartphone apps without long-term, qualified staff that are typically not found in conservation organizations. The latter could be fixed by resolving the former.

Overall, the program has generated considerable results for turtle conservation, has demonstrated significant growth over the past few years, and appears to offer tremendous potential for the future. I hope that it will continue to achieve great things.

Sincerely,

A handwritten signature in black ink that reads "Jeff Hathaway". The signature is written in a cursive style and is placed on a light grey rectangular background.

Jeff Hathaway, Hons. B. Sc.