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Carol Gay
Secretariat
Maine Outdoor Heritage Fund
37 Wiscasset Road
Pittston, ME 04345
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Dear Carol,

On behalf of Maine Audubon, I am pleased to present this Final report for the ***“Improving Wildlife/Road Crossing Data to Protect Maine’s Rare Turtle Species”*** project (Grant Number MOHF – 172-01-02). The amount of the award was \$16,243.

The goal of this project was to build on Maine Audubon’s existing wildlife road crossing work and work with GIS models and survey protocols developed by the Maine Department of Inland Fisheries and Wildlife (MDIFW) to engage volunteers and staff to collect data on turtle crossing locations, and recommend mitigation options for reducing road mortality of both rare and common turtle species.

Funding from Maine Outdoor Heritage Fund helped support Maine Audubon’s efforts to greatly expand MDIFW’s ability to gather information to identify and mitigate high mortality road crossing locations for turtles using community scientists. Additionally, by engaging the general public in this project through recruitment, training, and surveys we provided outreach to Maine people on the effects of roadways on turtle populations. An ongoing, long-term goal for this project (which extends beyond the timeframe of this grant) is to create local advocates within a variety of communities who can educate their neighbors and local elected officials in order to mitigate problem crossing areas when they are identified.

A. Review of the project’s success in meeting the stated objectives:

Highlighted below are the objectives and outcomes from the grant application.

1. *Work with MDIFW to refine GIS models that identify high priority road segments for surveys, including evaluation of additional survey areas associated with high incidences of common turtle mortality.*

Maine Audubon worked with MDIFW staff to refine existing GIS models previously used to identify high priority road segments for surveys for state-listed turtle species. The GIS model was expanded to include criteria relating to common turtle species as well. Specifically, as part of the model, road segments were selected if they were within 100m of the preferred wetland types for the state-Endangered Blanding's turtle, state-Threatened spotted turtle, or painted and snapping turtles; especially if roadways intersected clusters of these wetlands. Other criteria used include traffic levels (road segments with ≥ 500 vehicles/day) and speed limits (road segments with speed limits ≥ 45 mph). Interstates and other highways were excluded as possible survey routes for legal and safety reasons. Road segments were between one-quarter mile and one mile in length, although most were in the range of one-half mile long.

- 2. Recruit 40-50 volunteers to survey variable length stretches of roadway by walking or biking and looking for rare and common turtles and/or shells or any other wildlife they see. We will recruit volunteers through community presentations, emails, targeted press releases, social media, websites, newsletters, and flyers as well as through direct outreach to past volunteers. We will use existing volunteer lists including past Endangered Species Road Watch volunteers, volunteer lists from the Maine Amphibian Monitoring Program, and other interest local groups (land trust, lake associations, etc.). Match volunteers to routes created in Objective (1).*

Over the course of 3 years, Maine Audubon recruited and trained 138 volunteers to conduct surveys, and of those trained 63 actually selected road segments and conducted surveys. Many of those volunteers surveyed multiple sites, and many conducted surveys over multiple years. Volunteers were recruited through articles in the Maine Audubon quarterly magazine *Habitat*, flyers in and around communities where training workshops were held, social media, Maine Audubon website, targeted press releases, and direct outreach to local land trusts and lake associations as well as to past volunteers from the Endangered Species Road Watch, Wildlife Road Watch, Maine Amphibian Monitoring Program, etc.

Volunteers were asked to identify the town or towns in which they preferred to survey, they were sent maps of all the identified routes in those towns, and they identified their top three survey routes from the potential routes identified with the GIS model described above. Routes were then assigned from these prioritized lists. Many volunteers surveyed more than one route and several volunteers surveyed in multiple towns.

- 3. Hold three training sessions in different regions of the State during Year 1, two training sessions in Year 2, and two training sessions in Year 3 for new participants, in advance of surveys to teach volunteers and DOT interns proper survey techniques, species identification, and how to use the new mobile application for data collection and submittal.*

In consultation with MDIFW, we changed the number of trainings held each year to two trainings per year, but an additional training was added in Year 2 in response to a specific request. In 2020, due to COVID restrictions, one in-person training was held and the second training was converted into a pre-recorded online training. Potential volunteers were trained on turtle biology and natural history, species identification, survey and data collection protocols, and safety.

Because the Road Ecology Center at UC Davis in California was unable to provide a mobile application to use with the Maine Wildlife Road Watch project as promised, we instead used [iNaturalist](https://www.inaturalist.org) for data collection, mapping, and display. We created the [Maine Turtle Roadkill Survey](https://www.inaturalist.org/projects/maine-turtle-roadkill-survey) (<https://www.inaturalist.org/projects/maine-turtle-roadkill-survey>) project within iNaturalist, designed as an invitation-only project for volunteers who had attended a training workshop. At the workshops, we trained volunteers on the use of iNaturalist and the associated mobile application. The pre-recorded training materials created during the COVID-19 lockdown are now available for future online trainings as well.

More specifically, we accomplished the following:

- In 2018, we held two training sessions, one in York with 33 attendees, and one in Augusta with 26 attendees. Because of the concentration of turtle species, including most of the state-listed turtle species, in the southern portion of the state, we endeavored to hold at least one training in this part of the state each year.
- In order to provide additional training to different parts of the state, while still retaining some focus in the southern part of the state, in 2019 we held one training in Gray with 18 attendees, one in Holden with 14 attendees, and a last minute request for a town-specific training in Kittery, but only 4 of the expect 12 community members showed up.
- With COVID-19 just beginning to be detected in early 2020, we were only able to hold one training workshop, in Houlton up in northern Maine with 22 attendees, before activities were restricted statewide. We initially cancelled the two planned workshops with over 100 registrants, but we decided to provide pre-recorded training materials online to allow volunteers to watch the trainings at a time that suited them best. We then followed up with those potential volunteers and provided the remainder of the training materials and assigned them survey routes. From the online trainings, we only had 15 people watch the training materials on their own, receive additional training materials, and conduct surveys. Now that we have more experience with Zoom and other online training tools it is clear that we should have conducted a live online workshop.

At in-person trainings, we provided volunteers with reflective safety vests, rulers to provide scale to the photos of animals observed, large plastic baggies to collect materials if a volunteer needed assistance in identifying turtle remains or turtle shell fragments. We also provided latex gloves in Year 1 and 2, but they were unavailable in most marketplaces in 2020 due to the pandemic.

4. *Volunteers will conduct 4-5 surveys per year per site for three years from May through September along 30-40 road segments and will record data from surveys using a new mobile application for incorporation into a master database and map. Previous efforts have found that many surveyors prefer to work in pairs rather than alone so there is a higher number of surveyors than routes.*

In consultation with MDIFW, we changed the number of surveys per year per site to a minimum of 3 from May through September, with additional surveys encouraged but not required. Surveyors were asked to document any wildlife interacting with the road, whether roadkill or live and attempting to cross the road, with particular focus on turtles. Volunteers were also invited to document any turtles seen crossing roads or turtle roadkill anywhere in the state, not simply on their selected survey route(s). These incidental data will help us re-evaluate our GIS model to reflect where turtles are actually seen crossing roads.

Over 200 road segments were surveyed by 63 volunteers over 3 years in 127 towns in all 16 counties. Of those, over 100 were found to have observations, 84 of which had observations of turtles—either turtle roadkill, turtles observed crossing or attempting to cross the road, or turtle nests found on the sandy shoulder of the road segment. Of the 84 road segments with turtle observations, 27 had more than one turtle sitting over the 3-year period. The iNaturalist mobile application was used by most volunteers to bring the data directly into the iNaturalist database and maps. For the few volunteers who submitted data on paper forms, observations were mapped and translated into a digital format.

In all, 1120 wildlife observations were documented by road survey volunteers over the 3 years of the project in the following taxonomic groups:

- 363 amphibians
- 82 birds
- 36 insects

- 154 mammals
- 346 reptiles. Of these, 286 observations were of turtles--including 2 dozen nests—and 60 were of snakes. Of the identifiable turtles, there were:
 - 99 snapping turtles
 - 122 painted turtles
 - 3 musk turtles
 - 1 box turtle (state-Endangered)
 - 2 Blanding's turtles (state-Endangered)
 - 1 spotted turtle (state-Threatened)
 - 1 wood turtle (state Species of Special Concern)
- The remainder of the observations were unidentifiable to taxonomic group.

The most surprising result was that approximately one-third of the turtle observations were not found on modeled survey routes, they were incidental observations. This is exciting information because it will hopefully allow us to refine our GIS model to more accurately predict where turtles are at higher risk of mortality on roads, but it does mean we need to go back to the drawing board and rethink our understanding of road mortality risk for turtles.

5. *Conduct GIS and other data analyses to identify landscape and/or crossing structure features that lead to higher rates of turtle crossing attempts, with interim summary analyses after each field season and a comprehensive analysis after the completion of the project in 2020.*

All data collected and entered into iNaturalist were downloaded from the site into a comma delimited file (.csv) for import into ArcGIS. Each year had less than 100 turtle observations distributed across the landscape thus we felt that we could not make any types of predictions or statements based on such low annual results for turtles. With the full collection of data from three years, we can now see that the observations of turtles crossing roads in areas not identified by the GIS model had meaning. Because of the surprising result that so many turtle observations were on road segments that were not identified by the GIS model, the first step is to reevaluate that model.

One factor that seems to not be a determining factor is speed limit; road segments with turtle observations include segments with speed limits ranging from 25mph to 60mph. In addition, streams and rivers were wetland features not targeted with the GIS model, but many of these incidental turtle observations appear to be associated with streams or rivers. This could suggest that road/stream crossings that allow for wildlife passage could be important factors in reducing turtle mortality in Maine.

Additional analyses will be conducted to identify the roadway and landscape features that may be identifying features of potential sites for high turtle mortality. Additionally, it may be that we do not have a large enough pool of data to be able to distinguish the features or specific combination of features that determines whether it is a high turtle mortality site or not, but further analysis is needed to determine if that is the case.

6. *Submit final report to MOHF, including a list of tiered mitigation strategies. Share report and results with MaineDOT, MDIFW, municipalities, and the public with a goal of reducing wildlife roadway mortality.*

Strategies to reduce turtle mortality are varied and must be determined on a site-by-site basis. The simplest, and most affordable, is to simply display "Turtle Crossing" signs during the active season for turtles. By displaying the sign only during the active season of turtles "sign fatigue", in which viewers fail to notice signs over time, can be reduced and driver awareness can be enhanced. Handmade signs by local residents, conservation groups, scout groups, etc. can also be very effective in increasing driver awareness and improved wildlife outcomes. Depending on the location, reduced speed limits and other traffic calming techniques can be used as well; this is often effective in residential areas especially when coupled with outreach and local education.

Where possible, such as when planned road maintenance activities provide opportunities, more significant projects such as fencing to keep turtles off roadways and creation of or improvement to crossing structures to allow for wildlife passage can provide safe options for turtles to move across the landscape without crossing over roadways. These more permanent solutions are more expensive but can be more effective when implemented correctly. Information on high turtle mortality at existing undersized road/stream crossing structures can improve grant applications to the DEP culvert grant program when other criteria are met and when the replacement structure will provide a more natural streambed with dry banks within the crossing structure to allow wildlife to pass unimpeded. As the coordinator for the Stream Smart program, we will work closely with DEP staff to incorporate this information into their application review where appropriate.

This report will be distributed to MDIFW, MaineDOT, the volunteers who assisted in the data collection, the towns where areas of high turtle mortality were identified, and the general public. It will be posted on the Maine Audubon [Maine Turtle Roadkill Survey webpage](#). Additionally, Maine Audubon will present an overview of the project and the results at a webinar for the public in spring 2021.

7. *Partner with MaineDOT to develop a plan for implementing recommendations for mitigation at priority sites.*

Turtle observation sites on state roads will be catalogued and shared with MaineDOT to evaluate against their ongoing roadwork and maintenance plans. Because MaineDOT develops work plans years in advance, and because adding wildlife mitigation measures are significantly less expensive when incorporated into planned work, the likelihood of implementing these mitigation measures is higher at sites where work is already planned.

Based on the discovery that many of the incidental turtle observations are often in proximity to road/stream crossings, we will partner more closely with DEP on locations of turtle observations that might be associated with road/stream crossings at municipal sites for potential incorporation into prioritization criteria for the DEP culvert replacement grant program.

B. Detailed accounting of how funds were spent as well as in-kind services and matching funds requested, secured and spent and amount of dollars leveraged.

See attached final project budget form. Line item notes follow:

- All MOHF funds were expended (\$16,243), however, Maine Audubon overall spent less on the total project than anticipated due to a number of factors including less travel due to COVID-19, and reduced staffing.
- While we had anticipated using habitat connectivity funds from existing grant funds from the Sally Mead Hands Foundation, we instead were awarded a grant of \$2500 from the Margaret Burnham Charitable Trust specifically to further this project. This smaller grant ended up being suitable due to the reductions in expenses described above.
- We hadn't anticipated rental fee expenses, but the expense was minimal. An additional rental fee was anticipated for our last workshop site, but with the cancellation due to COVID-19 there were no other rental costs.
- The estimate of In-Kind contribution from our partners at MDIFW and MaineDOT was fairly accurate at over \$8,000, and would have been higher with additional travel costs if the last training had not been cancelled. We had in-kind contributions of staff time and travel from two IFW staff for meetings to develop the GIS model and the project overall, as well as trainings and materials, and for DOT staff who attended trainings and spent staff time conducting surveys on a number of state roads.

C. Communication efforts and press related materials:

Maine Audubon has communicated about the Maine Turtle Roadkill Survey project in a variety of ways and to a variety of audiences. There was our direct outreach around our upcoming training workshops through flyers distributed in the communities where we would be holding workshops, press releases in area papers, and trainings were advertised on our website in upcoming events, blogs, and with the creation of new webpages solely for this project. In addition, the project was highlighted annually in our quarterly magazine *Habitat*, including in a two-page feature article in 2018 to kick off the project, which is mailed to 5200 subscribers. We also recruited for volunteers through direct email efforts to past volunteers from other projects (Endangered Species Wildlife Road Watch, Maine Amphibian Monitoring Program, etc.), area land trusts and lake associations, and through our partners on the project. Outside media interest resulted in an article in the [Brunswick Times Record/Portland Press Herald online on March 1, 2020](https://www.pressherald.com/2020/03/01/maine-audubon-aims-to-stop-turtles-from-getting-squished/) (<https://www.pressherald.com/2020/03/01/maine-audubon-aims-to-stop-turtles-from-getting-squished/>) the [Houlton Pioneer Times/Bangor Daily News online on March 16, 2020](https://bangordailynews.com/2020/03/16/act-out/maine-audubon-project-hopes-to-prevent-turning-turtles-into-roadkill/) (<https://bangordailynews.com/2020/03/16/act-out/maine-audubon-project-hopes-to-prevent-turning-turtles-into-roadkill/>); the author attended our last in-person training in Houlton), and reference to the project on [Maine Calling on May 12, 2020](https://www.mainepublic.org/post/citizen-science-helping-gather-data-safely-good-use-lockdown-time) (<https://www.mainepublic.org/post/citizen-science-helping-gather-data-safely-good-use-lockdown-time>). In addition to the materials and outreach detailed above, we also had a number of opportunities to communicate about this project with a wide variety of audiences:

- In 2018 we were asked to give a talk on the project to the animal rights non-profit organization Voice for the Animals, and we have also contributed an article with an update on the project to their newsletter annually.
- In fall of 2018 we also gave a talk at the Northeastern Transportation and Wildlife Conference held in Amherst, MA, detailing the project and preliminary results from the first year. Progress on the project was also detailed annually to the Staying Connected Initiative of which we are a member.
 - In the first year of the project we also created a webpage dedicated specifically to this project, the [Maine Turtle Roadkill Survey](https://maineaudubon.org/projects/road-watch/maine-turtle-roadkill-survey/) (<https://maineaudubon.org/projects/road-watch/maine-turtle-roadkill-survey/>) page, with links to all the training materials and to the [iNaturalist project page](https://www.inaturalist.org/projects/maine-turtle-roadkill-survey) (<https://www.inaturalist.org/projects/maine-turtle-roadkill-survey>).
- 2019 was a busy year for requests for talks on this project; in the spring we had requests to speak to two 4th grade classes in Scarborough as well as high school students in Portland on Earth Day. In the fall, the Federal Highway Administration requested an online talk that was broadcast to their field staff across the country, highlighting community science projects addressing vehicle/wildlife collisions. A brown bag talk was also given on this project in October 2019 at Wells Reserve.
- With COVID-19 affecting transportation patterns across the globe in 2020, we saw an uptick in interest in the effects those changes were having on wildlife populations. Because of early reports that spring migrating amphibians had higher survival rates as they crossed roads in 2020 we had several inquiries into whether we had seen the same results. Unfortunately, with such a small sample size, and with traffic rebounding in the summer compared to the spring, we were not able to detect such a trend, but we continue to communicate with colleagues studying such effects.

D. Supporting Materials:

The following is a sample of the communications, photos, and materials we have generated on this project.

Website

Our Maine Turtle Roadkill Survey website (<https://maineaudubon.org/projects/road-watch/maine-turtle-roadkill-survey/>) presents information about the program, upcoming presentations and workshops, information and a link to [the associated iNaturalist page](#), turtle identification and natural history information, and links to partners, wildlife rehabilitators, and additional resources:



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MAINE TURTLE ROADKILL SURVEY



While turtles may move slowly, they can travel large distances and often do so every year as they move between habitats. Maine's turtle species generally overwinter in streams, rivers, marshes, and ponds. As winter turns into spring, they emerge from their wintering sites to bask, forage, and ultimately to breed and nest before returning to their wintering grounds. Those journeys inevitably bring many turtles across roadways.

For slow-moving species like turtles, getting across a roadway alive is a real challenge. And for species that live a long time but don't reproduce until they're quite old (Maine's turtle species reach breeding maturity between 7-18 years of age), losing just a few breeding adults annually can lead to a declining population, or even local extinction.



Snapping Turtle photo by Ari van den Akker

iNaturalist – Maine Turtle Roadkill Survey

Surveyors can use the mobile application for field data collection or can enter survey data into iNaturalist through the website. Anyone can view the observations, and identifications are verified through crowd-sourcing where it is possible. Additionally, other project curators can pull data from any other iNaturalist projects, such

as those for the Maine Amphibian and Reptile Atlas Project (MARAP), that meet their data criteria (i.e. geographic location, taxonomic group, etc.).

Maine Turtle Roadkill Survey

ADD OBSERVATIONS

MAINE AUDUBON MAINE DEPARTMENT OF TRANSPORTATION AND CONSTRUCTION MAINE DOT

Stats

Totals	Most Observations	Most Species	Most Observed Species
1243 Observations »	mozeal234 286 observations	mozeal234 29 species	Painted Turtle 119 observations
109 Species »	tristan1aber 81 observations	sharon99 22 species	Snapping Turtle 90 observations
59 People »	swanson166 74 observations	llatt02 18 species	Northern Leopard Frog 59 observations
	shagerty 67 observations	gbeekman 14 species	Pickerel Frog 45 observations
	llatt02 64 observations	shagerty 14 species	Common Garter Snake 31 observations

Map | Satellite

Quebec City, NEW BRUNSWICK, MONTEAL, SHERBROOKE, VERMONT, NEW HAMPSHIRE, MASSACHUSETTS, CONNECTICIT, OTTAWA, ALBANY, PROVIDENCE, SAINT JOHN, NOVA SCOTIA, PRINCE EDWARD ISLAND

Members 105 members

View All Members »

Your Membership 67 observations

Add from Your Observations
Download template for use in the bulk uploader

Export Observations
Atom / CSV

Usage stats

Project Curator Tools

- Find Suitable Observations
- Find Unsuitable Observations
- Export with Hidden Coordinates
- Filter by Curator Identification

Training Sessions

Training sessions included information on turtle identification, survey protocols, data collection and how to use iNaturalist, and safety protocols.



Maine Turtle Roadkill Survey

SEEKING VOLUNTEERS ACROSS MAINE!
 Your help is essential to the success of this project.
 Please attend a training session to find out what you can do.

TRAINING SESSIONS Free to the public

Saturday, March 30, 9 am - 12:30 pm
 Warden Service Headquarters
 15 Game Farm Road, Gray

Saturday, April 6, 9 am - 12:30 pm
 Fields Pond Audubon Center, Holden

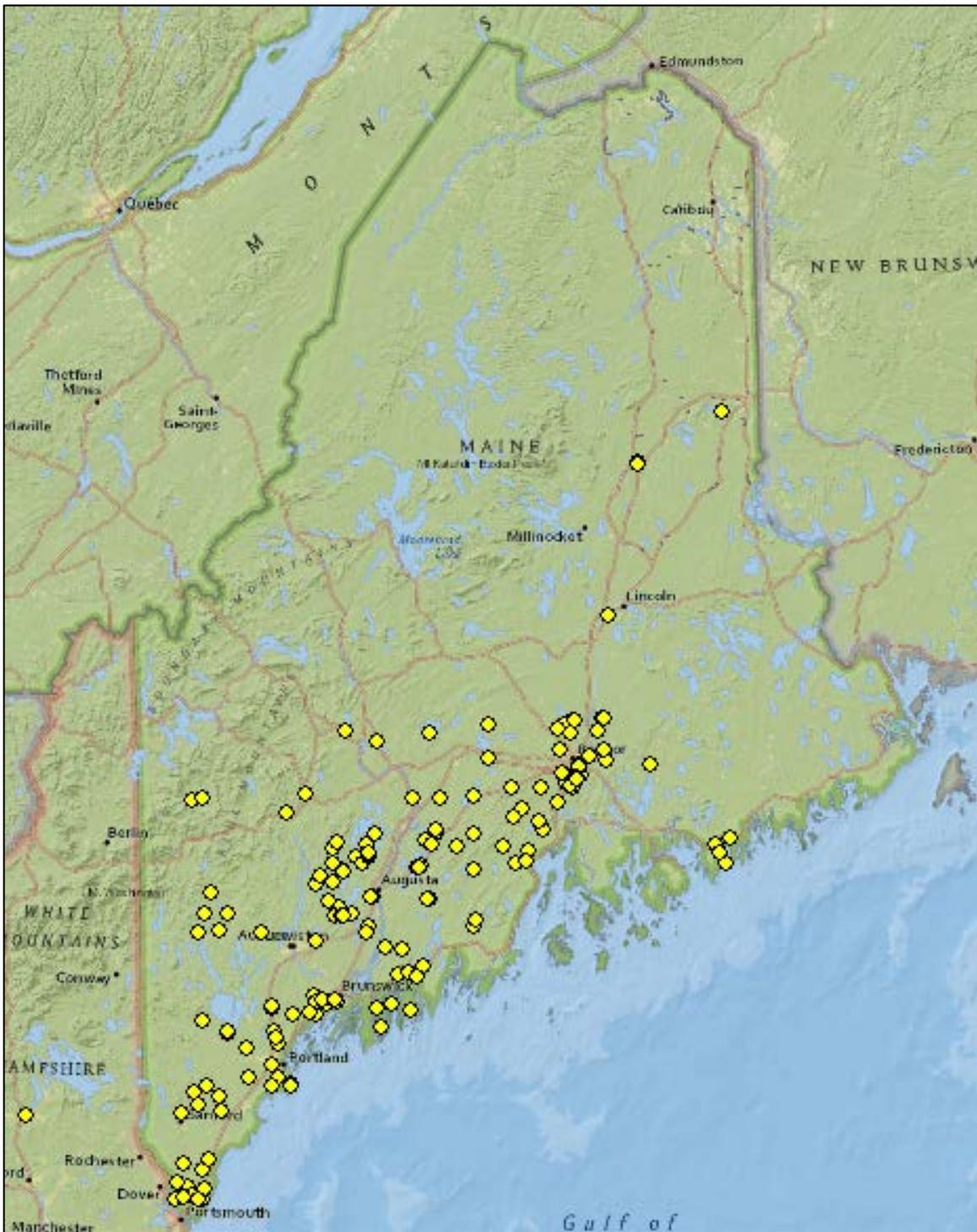
RSVP
 maineaudubon.org/events
 (207) 781-2330 ext. 225
 Please let us know if you would like to participate, but cannot attend.

MAINE AUDUBON MAINE DEPARTMENT OF CONSERVATION MAINE DOT



Turtle Observations on Roadways

Map of turtles observed in roadways across Maine from 2018 through 2020. Note the higher concentration of turtle observations in southern and central Maine which is a feature of the distribution of both turtles and observers in the state.



Observers and Observations from Surveys

Surveyors were encouraged to work in pairs, to wear highly visible clothing, and to capture data using the iNaturalist mobile application. Live and dead wildlife were documented, as were locations of turtle nest sites.



Surveyors documenting roadkill



Live box turtle observed attempting to cross road



Predated turtle nest with turtle egg shells



Shell fragment remains of turtle roadkill

Mitigation Options

For sites where high turtle mortality is detected, there are some options to consider to reduce the mortality due to vehicular collisions. These include signage and appropriate crossing structures.



E. Follow-up Work Planned:

Maine Audubon will continue to work closely with MDIFW and MaineDOT to refine our GIS models and survey efforts to help determine the variables on the landscape that drive vehicle/turtle collisions and associated turtle population declines. Then we can propose appropriate mitigation programs to avoid and minimize the impacts on turtle populations. If we can identify specific features that predict locations of high turtle mortality with more certainty, we can evaluate areas that have not been surveyed for their potential using models. But the results of this project suggest we need to rethink our assumptions and reevaluate the model as it stands.

The information gleaned from the incidental turtle observations suggests that road/stream crossings may be a more significant feature on the landscape for turtle mortality than we had realized. We will consider targeted surveys associated with road/stream crossings to determine how significant a feature they are. Because Maine Audubon is the coordinator of the Stream Smart program in the state—a program of outreach and education designed to improve habitat connectivity through appropriate sizing and installation of road/stream crossings—we are in an excellent position to highlight this important new information. We will share these results with our Stream Smart partners and incorporate the information into our training materials and our training programs as early as spring 2021.

In addition, we will work with the DEP to incorporate this information into their culvert replacement grant program. The program is designed to financially assist municipalities in their efforts to improve habitat connectivity and protect roads and public safety through improved road/stream crossings. Any data that can help DEP prioritize crossings that have documented wildlife mortality is a benefit to the program. We will also share these results with the Maine Forest Service, Maine Forest Products Council, Natural Resources Conservation Service, and Soil and Water Conservation Districts as they work with private landowners to help them improve habitat connectivity on private land.

F. Summary and Conclusions:

During the last three years, from 2018-2020, volunteers all across Maine walked sections of road near wetlands, looking for turtles that may have tried to cross the road searching for resting, feeding, or nesting sites. Unfortunately, most of them don't make it, and that can have devastating effects on their populations. By identifying those areas where the most turtles are killed, and working with Maine Department of Inland Fisheries and Wildlife and MaineDOT, we hope to guide community members and state and local officials to take action to reduce the number of turtles killed each year across the state.

Over the life of the project, we trained 63 volunteers who conducted at least three surveys of their assigned routes between May and the end of September. Volunteers surveyed 200 routes in 127 towns in all 16 counties, and documented 1120 instances of dead or live animals trying to cross the road. Two hundred eighty-six of those observations were of turtles, including all seven of the native turtle species found in Maine (three of which are rare, threatened, or endangered), plus two dozen turtle nest sites. Two results surprised us: nearly one-third of all turtle observations were incidental—i.e., they were found on random roadways not pre-identified using a GIS model; and approximately one-quarter of all turtle observations were near road/stream crossings.

This suggests we need to reevaluate our GIS model to determine how these areas were missed, and focus more attention on improving road/stream crossings not just for fish but also for turtles! We will use the data to try to identify specific features of the crossings that make them difficult for turtles to use, such as a lack of a dry bank through the crossing, high water velocity, a lack of appropriate substrate, etc. Our ongoing work coordinating the Stream Smart program to improve road/stream crossings for fish and wildlife and public safety could have real and immediate impacts on the survival of turtles in the vicinity of these improvements.

We thank the Maine Outdoor Heritage Fund and IFW for making this study possible, and especially for helping to identify areas in the state where we need to better protect our native turtles in Maine.

Sincerely,



Sarah A. Haggerty
Conservation Biologist