

Clean Annapolis River Project

Wood Turtle Research, Conservation, and Stewardship in the Annapolis River Watershed 2014-2015

Final Project Report to Nova Scotia Habitat Conservation Fund

(1) Project goal and objectives

The goal of this project is to ensure the long-term persistence of the wood turtle in the Annapolis watershed by gaining an understanding of the wood turtle's habitat usage and needs, and the threats and impacts posed to the species and their habitat. This information will be used to engage community members in conservation and stewardship efforts.

Specific objectives include:

- Conduct habitat, population and ecological research on the Annapolis River watershed population of wood turtles
- Continue to identify and assess threats to wood turtle habitat in the Annapolis River watershed
- Recruit, train and involve volunteers in wood turtle surveying, monitoring and stewardship activities in order to build organizational capacity and develop a skilled and engaged volunteer base
- Engage the community through outreach and education activities to promote understanding of the ecological needs and importance of the wood turtle
- Engage landowners and stakeholders in the development and adoption of stewardship actions
- Continue to contribute to a provincial wood turtle recovery strategy
- Contribute new data to the central wood turtle database maintained by the Mersey Tobeatic Research Institute (MTRI)

(2) Outline of the work completed

2.1 Visual Surveys

Systematic visual surveys of terrestrial and aquatic habitat were conducted in areas of known and suspected wood turtle habitat within the Annapolis River watershed between May and October 2014. Protocols for data collection and handling of turtles were based on those developed by the Blanding's Turtle Recovery Team (2007). All survey data was recorded in an internal database and contributed to the central Species at Risk Turtle Database, maintained by Mersey Tobeatic Research Institute (MTRI).

2.2 Radio Telemetry

Radio transmitters were attached to the carapace of individual turtles using methods developed by the Blanding's Turtle Recovery Team (2007). Five turtles were equipped with radio transmitters in the 2014 field season. Radio telemetry was conducted bi-weekly at a minimum between May and October, and nesting females were tracked daily during the nesting season. Telemetry sessions were conducted through November 2015 to identify overwintering sites that were monitored monthly throughout the winter.

2.3 Nest and emergence surveys

Nest surveys were conducted based on methods established by the Blanding's Turtle Recovery Team (2007). Surveys were conducted at 3 sites with previously documented nesting activity, in Aylesford, Greenwood and Lawrencetown. Tagged females were tracked daily, and their locations provided to observers completing nest surveys. Confirmed nests were monitored daily, beginning 50 days after oviposition. Emerged hatchlings were notched and released on site once data collection was complete. Nests covers were replaced after the first observation of hatchling emergence, and nests monitored for an additional week. After one week, nests were excavated in order to identify eggs or hatchlings that failed to emerge. In the case that emergence was not observed, nests were excavated after 120 days, and unhatched egg data was collected. All data was recorded in an internal database and contributed to the central Species at Risk Database.

2.4 Water Quality

Water quality samples were collected throughout the season upon observance of a wood turtle, using a mercury thermometer from May through August, and a YSI Professional Plus multiparameter sonde unit (Model: Pro 10102030) from September to December. Parameters measured using the YSI included: water temperature, dissolved oxygen, specific conductivity, conductivity, pH, total dissolved solids and salinity.

2.5 Mapping Preferred Wood Turtle Habitats

Locations within the watershed containing habitats with ideal nesting soil types and preferred vegetation cover for wood turtles were identified through a GIS analysis, and were incorporated with information about locations of agricultural and forestry land use activities. This information was analysed to identify and prioritize the areas containing the most preferential habitat characteristics for wood turtles, and was used to develop a series of maps to help CARP staff target future areas for additional visual and nesting surveys.

2.6 Stewardship Plans

Stewardship plans were developed collaboratively between CARP and private land owners and managers to identify areas of each property containing important wood turtle habitat, and created tailored suggestions for actions participating landowners could undertake to promote wood turtle conservation and stewardship initiatives.

2.7 Public Outreach and Education

A variety of educational and outreach materials were developed for the project. Materials were developed in order to achieve a broad range of objectives, including raising awareness about wood turtles and threats to their population in the Annapolis River watershed, increasing awareness about the Wood Turtle Monitoring and Stewardship Project, engaging landowners in stewardship actions, and engaging members of the public in volunteer actions.

Interpretive panels and turtle crossing signs were installed in select parts of the watershed in areas frequented by wood turtles. Outreach events included presentations, creation of pamphlets, posters and newsletters promoting the project and the conservation of wood turtles. A few small volunteer school and naturalist groups were targeted in public engagement project activities, and assisted with field surveys. Educational events focused on promoting stewardship actions among landowners/managers and raising public knowledge about the wood turtle.

(3) Results

3.1 Visual Surveys

Seven visual survey efforts occurred between April and October, with the aid of several volunteers. A total of 205 hours were spent on visual surveys, 190 hours of which were completed by volunteers.

Turtles were observed during one (in April) of these surveys, accounting for 3 individuals, all of which were previously notched.

3.2 Radio-telemetry

Five turtles were equipped with radio-transmitters in 2014. Radio-telemetry for these five individuals commenced in May, where four individuals were tracked until October, and one until September. The transmitters on turtles #455, and #471 were removed on September 16, 2014, and on October 14, 2014, respectively, as they reached their battery expiration dates. These were refurbished for later use.

Thirty-five telemetry field days were conducted throughout the 2014 season. Effort was increased during the nesting season (late May-June), to increase chances of observing nesting activity. A total of 525 hours of effort were spent conducting radio-telemetry, 77 of which were completed by volunteers. Telemetry sessions concluded in December, after three turtles equipped with radio-transmitters (#608, #452, and #500) had moved into over-wintering sites, and were tracked monthly throughout the winter.

3.3 Nesting and Emergence Surveys

Nesting surveys were conducted in areas where past nesting activity had been observed and in areas where females of reproductive age were being radio-tracked. Four nests were protected in 2014, one of which was a suspected nest in a new nesting location where a partial nesting event was observed. Volunteers were instrumental in nest monitoring efforts in 2014, contributing a total of 242 volunteer hours to nesting surveys.

Emergence surveys commenced after 50 days of incubation. A total of 135 volunteer hours were contributed to emergence surveying efforts in 2014. Of the four nests that were protected and monitored in 2014, only 1 showed successful emergence after an incubation period of 79 days. Fifty percent of eggs successfully developed, emerged and were live-released at their nest site. The remaining two nests, and the suspected nest in Torbrook did not produce any live hatchlings upon careful nest excavation 120 days after nesting occurred.

3.4 Overwintering Surveys

Overwintering surveys were completed from December 2014 to March 2015, and monitored the locations of 3 turtles (452, 500, 608). The two female turtles (452, 500) were observed to exhibit high site fidelity, overwintering no more than 200 m from their 2013 overwintering locations. Turtle 608 was observed to move a much greater distance, overwintering in a different water body and about 6 km away from his previous year's location.

3.5 Mapping Preferred Wood Turtle Habitats

GIS analysis of the Annapolis watershed produced 10 maps identifying preferred habitat areas for wood turtles, and the accuracy of the maps was assessed by comparing areas identified as preferred nesting habitats to locations where actual nesting occurred. The 3 monitoring nesting grounds were captured by the GIS analysis, indicating that the maps could provide a useful tool to help identify areas for new surveys to determine the full range of wood turtle populations in the Annapolis River watershed.

3.4 Stewardship Plans

Five stewardship plans were developed in areas of known or suspected wood turtle habitat, 2 of which were for private landowners, and 3 with farm properties (1 mink farm and 2 cranberry farms). All of the properties signed stewardship agreements.

3.5 Outreach Activities

Thirty-five community outreach events were conducted across the watershed, and included over 700 participants. These events included volunteer training events, guest presentations for youth organizations and community based organizations, a radio presentation for CBC Morning, and activities and displays at public events.

A variety of outreach materials were developed and distributed. Electronic materials include: project webpage; social media posts on Facebook, Twitter and Instagram; powerpoint presentations; displays.

Print materials included a Wood Turtle Monitoring and Stewardship pamphlet; posters for all events and volunteer opportunities; "Have you seen a wood turtle" posters; "Have you seen a wood turtle" ID cards; press releases in local newspapers and community publications (Annapolis Spectator, Bridgetown Reader, Chronicle Herald, Kings County Register and Advertiser, Nova News Now); and articles in CARP's Waterstrider newsletter.

(4) Assessment of achievements and lessons learned, measured against the project goals and objectives

What you will do (activities)?	What should result (outcomes)?	How will you evaluate each activity?	Evaluation/Assessment
<p>Data collection- wood turtle land and water visual surveys</p> <p>-Systematic and repeatable land and water based visual surveys conducted on rivers and tributaries within the Annapolis River watershed from April to September</p> <p>-Turtle notching will be conducted based on the protocol developed by DNR</p> <p>-Standardized wood turtle data cards will be used to ensure consistent data collection (Appendix C)</p>	<p>-Identification of new (un-notched) turtles</p> <p>-Re-capture of previously marked turtles</p> <p>-Collection of mark-recapture data</p> <p>-Collection of data from all turtles will provide information required to analyze habitat use, population range and population demographics</p> <p>-Collection of data from previously marked turtles will allow for analysis of home range size and preferred habitat</p> <p>-Collection of wood turtle behavioural data</p> <p>- Contributions made to provincial wood recovery strategy through sharing of data</p> <p>-Data contributed to central wood turtle database, maintained by the</p>	<p>-Contribution of 2014 data collected from all turtles (new and recaptures) in addition to that collected in the 2012 and 2013 seasons, allowing for improved knowledge of the species over a more extensive area</p>	<p>√9 un-notched individuals identified</p> <p>√4 previously notched turtles identified (re-captured)</p> <p>√5 visual surveys conducted and data collected</p> <p>√52 radio-telemetry sessions conducted and data collected</p> <p>√All data added to internal database and submitted to provincial database</p> <p>√All GPS data mapped and analyzed</p> <p>√All behavioural and habitat data analyzed</p> <p>√205 hours of volunteer effort on visual surveys</p> <p>√Group visual survey sessions organized for community volunteers and school groups</p>

	Mersey Tobeatic Research Institute (MTRI)		
<p>Data collection- radio telemetry</p> <p>-Radio transmitters will be used to track turtles throughout the field season and during overwintering if funds are available.</p> <p>-Standardized wood turtle data cards will be used to ensure consistent data collection</p> <p>-Transmitters will be attached using methods established by the NS DNR, Acadia University and the Wood Turtle Recovery Team</p>	<p>-Effective monitoring of wood turtle movement and distribution, including over-wintering sites</p> <p>-Increased knowledge of habitat use</p> <p>-Data available for identifying areas of critical habitat and for targeting stakeholders through stewardship activities</p> <p>-Contributions made to provincial wood recovery strategy through sharing of data</p> <p>-Data contributed to central wood turtle database, maintained by the Mersey Tobeatic Research Institute (MTRI)</p>	<p>- Contribution of 2014 data collected from all turtles (new and recaptures) in addition to that collected in the 2012 and 2013 seasons, including knowledge of habitat use, mating, nesting areas and travel corridors</p>	<p>√Telemetry training sessions conducted with community volunteers</p> <p>√77 hours volunteer effort on radio-telemetry</p> <p>√All data added to internal database and submitted to provincial database</p> <p>√All GPS data mapped and analyzed</p> <p>√All behavioural and habitat data analyzed</p> <p>√5 turtles tracked during the field season</p>
<p>Data collection – habitat assessment</p> <p>-Characterization of sites where wood turtles are identified</p>	<p>- Improved understanding of wood turtle habitat needs</p> <p>- Increased understanding of wood turtle ecology</p> <p>- Contributions made to provincial wood turtle database, maintained by the Mersey Tobeatic Research</p>	<p>-GIS analysis to be conducted to identify preferred habitat and habitat use patterns; analysis will provide additional information for central wood turtle database</p>	<p>√GIS analysis and mapping conducted, 10 maps created to inform wood turtle investigations</p>

	Institute (MTRI)		
<p>Data collection – water quality</p> <p>-Samples will be collected to measure: pH, dissolved oxygen, total dissolved solids and temperature</p>	<p>- Water quality data assessed at turtle overwintering sites</p> <p>- Contributions made to provincial wood turtle recovery strategy through sharing of data</p> <p>- Data contributed to central wood turtle database, maintained by MTRI</p>	<p>- 20 dissolved oxygen samples collected at 4 sites</p> <p>- 20 pH samples collected at 4 sites</p> <p>- 20 total dissolved solids samples collected at 4 sites</p> <p>-140 temperature samples collected at 16 sites</p>	<p>√26 dissolved oxygen samples collected at 8 sites</p> <p>√26 pH samples collected at 8 sites</p> <p>√26 total dissolved solids collected at 8 sites</p> <p>√183 temperature samples collected at 23 sites</p>
<p>Data collection- nesting and emergence surveys</p> <p>-Nesting surveys conducted as per methods established by the Blanding’s Turtle Recovery Team (2007)</p> <p>-Data will be recorded using established NS Turtle Nesting and Observation Card (Appendix C)</p>	<p>-Identification of new females (un-notched or previously marked) in target areas</p> <p>-Hatchlings notched for future identification to allow for future mark-recapture data collection</p> <p>-Contributions made to provincial wood turtle recovery strategy through sharing of data</p> <p>-Data contributed to central wood turtle database, maintained by MTRI</p>	<p>-minimum of 3 sites monitored and assessed through nest and emergence surveys</p> <p>-Identification of critical nesting habitat</p> <p>-Nest protection and successful release of emerged hatchlings</p> <p>-Collection of emergence data (measurements, weights, notching).</p>	<p>√ 241.5 hours of volunteer effort on nesting surveys</p> <p>√135 hours of volunteer effort on nest monitoring and emergence surveys</p> <p>√4 areas monitored and assessed through nest and emergence surveys</p> <p>√4 nests protected</p> <p>√7 hatchlings from 1 nest successfully emerged and released on site</p> <p>√emergence data collected, analyzed and entered into internal database and provincial database</p>

<p>Data collection – overwintering surveys (if additional funds secured)</p> <ul style="list-style-type: none"> - Temperature loggers deployed to collect data, and create a thermal profile for water temperature - Additional collection of site characteristics and turtle behaviour data 	<ul style="list-style-type: none"> - Improved knowledge of the effects of parameters such as temperature, dissolved oxygen and pH on hibernacula selection, and turtle overwintering behaviour - Improved knowledge of turtle behaviour at overwintering sites - Improved knowledge of overwintering site selection and characteristics for wood turtles in the target area 	<ul style="list-style-type: none"> - Overwintering data collected at 4 overwinter sites 	<p>✓Overwintering data was collected at 3 sites (lack of additional funds to do more)</p>
<p>Conservation- nest site protection</p> <ul style="list-style-type: none"> -Screen enclosures placed over nests to prevent predation 	<ul style="list-style-type: none"> -Increased success of hatchling emergence due to decreased predation 	<ul style="list-style-type: none"> -Hatchlings measured and weighed -Hatchlings notched to allow for mark-recapture data collection -Improved recruitment of wood turtles in subsequent years 	<p>✓7 hatchlings from 1 nest successfully emerged and were released on site</p> <p>✓emergence data collected, analyzed and entered into internal database and provincial database</p>
<p>Outreach & education</p> <ul style="list-style-type: none"> -Train volunteers in data collection activities 	<ul style="list-style-type: none"> -Capacity developed throughout the local community in field data collection methods - Community members actively 	<ul style="list-style-type: none"> -Project leader will track number of volunteers recruited and trained during 2014 season, and keep 	<p>✓95 volunteers were recruited and trained to help with various project activities, contributing over 658 hours of work</p>

	engaged in conservation and stewardship practices	records of volunteer hours committed - A minimum of 10 volunteers trained, resulting in increased organizational capacity	
Outreach & education - Public presentations and activities held throughout the community	-Community members educated about wood turtles, wood turtle habitat, and conservation/stewardship practices -Increased community support for project and participation in project initiatives -Key stakeholders educated about wood turtles, wood turtle habitat, and conservation/stewardship practices -Reduced threats to wood turtles and their habitat from private landowners and other stakeholders	-Minimum 5 community presentations -Presentation and outreach event attendance will be tracked	√35 community outreach events conducted, including presentations, activities and public booths
Outreach & education - Targeted stewardship activities with key stakeholder groups (agricultural community, industry, etc.)	-key stakeholders educated about wood turtles, wood turtle habitat, and conservation/stewardship practices -Reduced threats to wood turtles	-Outreach and Education Strategy will be used to evaluate delivery of programs and activities - Minimum 5	√Over 8 presentations and meetings were delivered to/ held with key stakeholder groups √Over 7 industry specific communications tools were developed

	and their habitat from private landowners and members of industry	presentations/meetings to key stakeholder groups - Minimum 5 industry specific communications tools developed	including pamphlets, newsletters, presentations, display booths and handouts
Outreach and education -Electronic and social media campaign	-Community members educated about wood turtles, wood turtle habitat, and conservation/stewardship practices -Increased community support for project and participation in project initiatives	- Minimum 40 updates to social media pages throughout project lifecycle - Dedicated project webpage updated with current project information -Content update provided to project partners for external websites	√Regular social media posts to CARP Facebook, Twitter and Instagram. Over 52 updates made throughout project lifecycle √Project webpage updated and hosted on CARP website √Content updates provided to partners for external websites
Outreach and education - Volunteer appreciation and recognition by hosting a volunteer banquet	- Volunteer contributions recognized through volunteer banquet - Increased satisfaction with volunteer program and incentive to continue participation	- Increase number of volunteers compared to 2013 - Expected increase in volunteer retention in future years	√95 volunteers participated in wood turtle activities in 2014, compared to 21 volunteers in 2013 √Over 60 percent of volunteers indicated a desire to participate again in 2015
Stewardship - Engage with community	- Reduced wood turtle mortalities resulting from vehicle collisions	- Number of signs installed will be mapped and	√Turtle crossing signage and an interpretive sign were installed and

members and relevant government agencies in areas of critical wood turtle habitat to install wood turtle crossing signs.	- Increased community awareness about wood turtles conservation and stewardship	reported on	reported on
<p>Stewardship- Landowner Stewardship Agreements:</p> <ul style="list-style-type: none"> - identify priority land parcels using GIS - work with landowners to develop stewardship plans for their properties; seek commitment to specific actions defined in the plan through signature of a stewardship agreement with landowners 	<ul style="list-style-type: none"> - list of high priority landowners to engage in stewardship activities developed -landowners engaged in development of site specific stewardship plans -stewardship plans signed and implemented by landowners -reduction of practices that threaten wood turtles and their habitat 	<ul style="list-style-type: none"> -Minimum 6 landowners engaged, and 3 landowners committed to stewardship plans -Follow up meetings will be scheduled with landowners to assess success in implementation 	<ul style="list-style-type: none"> √6 Landowners engaged about prospective stewardship plan development √5 new Stewardship Plans completed and Stewardship Agreements signed √2 follow-up meetings with landowners with newly developed stewardship plans

(5) Recommendations for follow-up steps to the project.

It is recommended that radio transmitters should be attached to male and female wood turtles from different and new river systems in order to gain a better understanding of movements in newly identified habitat areas. Priority for radio-tracking should preferentially be given to sexually mature females, in order to increase the chances of observing nesting activity, identify new nesting habitats, and allow for the subsequent protection of nests.

Visual surveys are an important means to increase knowledge of wood turtle populations within the watershed and allow for comparison of data across populations and seasons. Areas identified in 2014 to contain preferred habitat types through GIS analyses should be prioritized, to identify and shortlist new sites for future visual surveys in regions where limited or no knowledge exists concerning wood turtle populations. In lieu of reduced availability of resources, volunteers should be recruited and trained to create localized teams across the watershed that can survey targeted areas, and improve recapture, reporting, and identification of new captures.

Nest monitoring and emergence surveys are a relatively simple way to increase recruitment to the local population of wood turtles. Several areas known to support nesting activity have been identified, and should be the focus for nesting surveys in future years. Future effort should include the identification of new nesting areas; continued visual surveys will likely lead to the identification of additional areas with high-quality nesting habitat. Ongoing engagement with land-users and members of the public to identify nesting areas should also be pursued. Social media and public outreach events can be used to recruit individuals who may have information about historical nesting sites.

Stewardship plans are an excellent tool for guiding stewardship actions and promoting the implementation of best management practices on private lands. Soliciting new landowners to participate in plan development can be challenging; continued effort to develop long-term relationships with key stakeholder groups, such as agricultural landowners/managers, is required to facilitate future recruitment of landowners. Efforts should also be made to build relationships with landowners/managers with properties containing important known nesting and forage habitats. Support should also be provided for landowners who have signed Stewardship Agreements through the project.

While CARP's outreach programs have been well attended and the project has received coverage from a variety of local media sources, there is an ongoing need to raise awareness about wood turtles and the threats placing them at risk. Many members of the public are unaware that the Annapolis River watershed supports a population of wood turtles, let alone that they are a species at risk. It is recommended that active outreach programs such as events, guest presentations and public booths, are continued in future years of the project. Field days should also be held to invite members of the public to gain hands-on experiential knowledge of wood turtles and their habitat needs. Expanding the number of volunteer opportunities is another approach that can be used to raise local awareness and encourage participation in stewardship actions. Continued volunteer training is also a good option for reducing the amount of field time required by project staff.

The wood turtle is a charismatic species that garners the interest of many individuals. As a result, CARP's Wood Turtle Monitoring and Stewardship project generates a high level of community interest, provides rewarding experiences for volunteers, and an excellent educational opportunity for local students. The continuation of this project is an important way to increased community engagement in the protection of wildlife, to foster stewardship and appreciation for species at risk such as the wood turtle, and to conserve their habitats within the Annapolis River watershed.