

Wood Turtle Monitoring and Stewardship in the Annapolis River Watershed

2017-2018 Final Report
PUBLIC VERSION

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**Please note that any sensitive data, including coordinates of turtle locations, private landowners names, etc., have been removed from this version of the report.*

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Nova Scotia Habitat Conservation Fund (contributions from hunters and trappers) and
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2.0 Acknowledgements

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CARP would like to thank the members of the Nova Scotia Wood Turtle Recovery Team for their ongoing support for this and other projects that aim to ensure the long-term persistence of the wood turtle.

CARP would like to thank the many volunteers who contributed their time to support the field component of this project. Without volunteer support for visual surveys, nesting surveys and nest monitoring, this program would not have been possible.

3.0 Introduction

Wood turtle description and ecology

The wood turtle (*Glyptemys insculpta*) is a medium-sized, semi-aquatic turtle, ranging in size from 16 to 25 cm in length as adults (COSEWIC 2007; MacGregor & Elderkin, 2003). The carapace is gray-brown in colour (Figure 1) with a sculptured woody appearance, caused by pyramidal circular rings or growth lines. The plastron is yellow with a pattern of black or dark coloured blotches and has no hinge (Figure 2). The skin on the head and upper body of the wood turtle is often dark brown, while the skin on the throat, tail and undersides of the legs is often yellow, orange or red in colour (Figure). They are a long-lived species, reaching sexual maturity between the ages of 11 to 22 (with 16 years being the average). In the wild, wood turtles have an average lifespan of 30 years, compared to 50 years in captivity.



Figure 1. Wood turtle carapace



Figure 2. Wood turtle plastron

The wood turtle can be found distributed throughout northeastern North America (MacGregor & Elderkin, 2003). In Canada, the wood turtle can be found in Nova Scotia, New Brunswick, Quebec and Ontario. In the United States (US), the wood turtle can be found in Virginia, New York, Wisconsin, Minnesota and Iowa (MacGregor & Elderkin, 2003; Ernst & Lovich, 2009). In Nova Scotia, wood turtles have been reported in 31 watersheds throughout the province, although little is known about their abundance in many of these areas (MacGregor & Elderkin, 2003). The estimated population in Nova Scotia is between 2000 to 7000 individuals (Environment Canada, 2015). The largest known population of wood turtles in Nova Scotia can be found within the St. Mary's River watershed.



Figure 3. Adult wood turtle

The wood turtle is the most terrestrial of the four freshwater turtle species in Nova Scotia, but still requires water for many of its seasonal activities (COSEWIC 2007; MacGregor & Elderkin, 2003) such as thermoregulation (Dubois et al., 2009), mating (Ernst & Lovich, 2009) and hibernation (Greaves & Litzgus, 2007). In Nova Scotia, the wood turtle requires a stream or river that is clear, meandering and moderately flowing (COSEWIC 2007; MacGregor & Elderkin, 2003). A sandy or sand-gravel area is required for nesting although wood turtles will also make use of artificial nesting sites such as gravel pits, road shoulders and residential sites. Riparian areas and forested habitat are preferred wood turtle habitat;

however they are also found in habitats such as flood plains, meadows, hay and agricultural fields, oxbows and beaver ponds.

Wood turtles in Nova Scotia face a variety of natural and anthropogenic threats. Anthropogenic threats include accidental mortality as a result of vehicles or agricultural equipment, habitat loss and degradation, such as residential and commercial development, forestry practices, water management, and changes in ecological dynamics or natural processes, such as subsidized predation (Environment Canada, 2015). Illegal collection as pets or for consumption has also been identified as a potential threat. In the Annapolis River watershed, which includes extensive road networks and a relatively large amount of land in agricultural production, accidental mortality as a result of collisions with vehicles or farming equipment are significant threats to wood turtles (Environment Canada, 2015; MacGregor & Elderkin, 2003).



Figure 4. Wood turtle range

Species at risk status

In Canada, the wood turtle is currently listed as *threatened* under the Federal Species at Risk Act (SARA). The wood turtle was first added to the SARA Registry in 1996 as a species of special concern, and re-examined and listed as threatened in Schedule 1 of SARA in 2010. Environment Canada (2015) has determined the recovery of the wood turtle in Canada to be both technically and biologically feasible. In 2015 a draft Recovery Strategy for the Wood Turtle (*Glyptemys insculpta*) in Canada was released, and open to public comment until April 1, 2016. Once a final Recovery Strategy has been approved, Wood Turtle Action plans will be posted to the Species at Risk Public Registry. These Action Plans are due for submission by 2020 and will guide conservation actions.

In Nova Scotia, the wood turtle was first listed under the Nova Scotia Endangered species act as *vulnerable* in 2000. After re-examination this designation was changed to threatened in 2013. These designations are largely imparted because of the wood turtle's sensitivity to human activities and land use practices.

Between 2005 and 2008 NS DNR completed wood turtle surveys within the Annapolis River watershed and 75 wood turtles were recorded. CARP initiated surveys in 2012 to re-assess the population and has developed a monitoring and stewardship program that is ongoing. There are a number of remaining data gaps regarding the local population of wood turtles, including the full extent of their range, and population size and structure.

3.1 Project Goals and Objectives

The overall goal of the Wood Turtle Monitoring and Stewardship project is to ensure the long-term persistence of the wood turtle and its habitat in the Annapolis River watershed. More broadly, the project aims to engage community members in environmental conservation and stewardship activities, using the wood turtle as a focal species.

Project objectives and outcomes as outlined in the contribution agreements for the 2017-2018 project season are outlined in Table 1.

Table 1. Project objectives and associated outcomes 2017-2018

	Funding stream		
Activity Type	Nova Scotia Habitat Conservation Fund (Funds from Hunters and Trappers, administered by Nova Scotia Department of Natural Resources)	Habitat Stewardship Program Species at Risk (Environment and Climate Change Canada)	Associated Results and Outcomes
Surveys, Inventories and Monitoring	Visual surveys <ul style="list-style-type: none"> Systematic and repeatable land and water based visual surveys conducted on rivers and tributaries within the Annapolis River watershed Turtle notching will be conducted based on the protocols developed by DNR Standardized wood turtle data cards will be used to ensure consistent data collection Group tracking field sessions organized for volunteers 		Threats to SAR and/or their habitat that are caused by human activities are stopped, removed and/or mitigated. Identification of new areas of wood turtle habitat within the Annapolis watershed for future stewardship efforts; identification of high risk threats (e.g. areas of frequent road crossings) for future targeted management and/or stewardship actions.
Surveys, Inventories and Monitoring	Radio telemetry <ul style="list-style-type: none"> Radio transmitters will be used to track turtles throughout the field season and during overwintering Standardized wood turtle data cards will be used to ensure consistent data collection Transmitters will be attached using methods established by the NS DNR, Acadia University and the Wood Turtle Recovery Team for monitoring using radio-telemetry Group tracking field sessions organized for community members 		

Surveys, Inventories and Monitoring	GPS Tracker Trial <ul style="list-style-type: none"> Low cost commercial GPS trackers will be retrofitted for experimental use on wood turtles GPS tracking data will allow for refined habitat use and movement data, which can be used to assess risk to key threats 	Human activities identified as posing a high risk will be targeted for human impact mitigation and habitat project actions.
Habitat improvement	Nest protection program coordination and Implementation: Nesting surveys <ul style="list-style-type: none"> Nesting surveys conducted as per methods established by the Blanding's Turtle Recovery Team (2007) Data will be recorded using established NS Turtle Nesting and Observation Card Emergence surveys <ul style="list-style-type: none"> Emergence surveys conducted as per methods established by the Blanding's Turtle Recovery Team (2007) Data will be recorded using established NS Turtle Nesting and Observation Card Nest protection program coordination <ul style="list-style-type: none"> Screen enclosures placed over nests to prevent predation and monitored during emergence window Nest enclosure building workshops organized and open for public participation 	<p>Important habitat for SAR recovery is improved and/or managed to meet their recovery needs.</p> <p>Increased recruitment to local wood turtle subpopulations through reduced nest predation; community capacity developed for continued nest protection activities; implementation of Nova Scotia wood turtle stewardship plan.</p>
Habitat protection	Stewardship Plan Development <ul style="list-style-type: none"> Development of stewardship plans 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 Support provided by CARP staff for implementation of stewardship plans 	<p>Threats to SAR and/or their habitat that are caused by human activities are stopped, removed and/or mitigated.</p> <p>Landowners/managers aware of threats to wood turtle on their properties and actively making decisions to remove or mitigate threats; implementation of Nova Scotia wood turtle stewardship plan.</p>
Program planning and development	Data sharing to support provincial recovery initiatives <ul style="list-style-type: none"> Data entry and analysis. Prepare final report including project activities, the results of data analysis, GIS mapping, lessons learned and recommendations 	Threats to SAR and/or their habitat that are caused by human activities are stopped, removed and/or mitigated.

	<ul style="list-style-type: none"> Disseminate report to public stakeholders, funders and project partners Participate in wood turtle species recovery working group 	Working relationships developed and maintained among key stakeholders allowing for sustained SAR recovery efforts.
Human impact mitigation	<p>Educational signage</p> <ul style="list-style-type: none"> Produce and install educational interpretive panels that address high risk threats to wood turtles 	<p>Threats to SAR and/or their habitat that are caused by human activities are stopped, removed and/or mitigated.</p> <p>Awareness raised about local threats to wood turtles and stewardship options among community members residing in areas of ecologically important habitat; implementation of Nova Scotia wood turtle stewardship plan.</p> <p>Community members educated about wood turtles, wood turtle habitat, and conservation/stewardship practices; Increased community support for project and participation in project initiatives.</p>
Outreach	<p>Volunteer training</p> <ul style="list-style-type: none"> Visual survey and radio-telemetry training workshop In-field training for community groups and organizations Nesting and emergence training workshop Individual field training sessions 	<p>Project benefits are sustained over time by engaging Canadians to participate directly in activities that support the recovery of SAR</p> <p>Community participation in voluntary stewardship actions; community capacity to support citizen science programs that target wood turtles</p>
	<p>Youth Leadership Training</p> <ul style="list-style-type: none"> Conduct a series of training sessions with youth representatives from schools within the Annapolis River watershed 	Project benefits are sustained over time by engaging Canadians to

	<ul style="list-style-type: none"> • Involve youth participants in field-based project activities • Youth presentations given at respective schools 	<p>participate directly in activities that support the recovery of SAR</p> <p>Youth leaders knowledgeable about SAR and threats to their habitat, and able to communicate this information among peers and community members; youth leaders actively engaged in SAR conservation activities.</p>
	<p>Outreach and education</p> <ul style="list-style-type: none"> • Electronic and social media campaign • Press releases in local newspapers and other publications • Project specific articles included in CARP's quarterly newsletter • Public education events 	<p>Threats to SAR and/or their habitat that are caused by human activities are stopped, removed and/or mitigated.</p> <p>Awareness raised about local threats to wood turtles and stewardship options among community members residing in areas of critical habitat; implementation of Nova Scotia wood turtle stewardship plans.</p> <p>Community members educated about wood turtles, wood turtle habitat, and conservation/stewardship practices; Increased community support for project and participation in project initiatives.</p>

4.0 Methodology

4.1 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 July 2016. Field teams recorded location and effort using Nova Scotia Turtle Daily Effort Cards (Appendix 1). Data for any individual turtles observed during surveys was recorded using Nova Scotia Turtle Observation cards (Appendix 2). Protocols for data collection and handling of turtles were based on those developed by the Blanding's Turtle Recovery Team (2007).

Data collection for each observed turtle included: notch code, GPS coordinates of location and a location description (position, habitat at capture, perch, etc.), weather conditions, turtle behaviour, and measurements. 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).

Notch codes were used to mark each individual turtle, and were assigned to CARP by MTRI staff. Notch codes 451 to 500 were assigned to CARP staff. Left and right marginal scutes are assigned specific values (Appendix 3) which when summed, provide an individual turtle ID number. A ½" triangular file was used to file notches on previously un-notched turtles.

4.2 Radio Telemetry

Radio transmitters were attached to the carapace of individual turtles using methods developed by the Blanding's Turtle Recovery Team (2007). Transmitters were glued to the rear marginal scutes of the carapace using epoxy. New turtles identified as candidates for radio telemetry were transported to the CARP office in a 40L plastic bin. After the transmitter was attached, turtles were held for a maximum 24 hours to provide time for the epoxy to set. Turtles were then transported back to and released at location where they were collected.

Three turtles were equipped with radio transmitters prior to the 2017 field season. Three additional transmitters were available for use and were equipped to new individuals during the 2015 field season. Transmitter units have approximately an 18 month lifespan, after which they must be removed in order to avoid having units expire while they are attached to turtles and subsequently lost. Units can then be refurbished for future re-use.

Radio telemetry was between May and October, with more frequent sessions focused on reproductive females during the nesting season. Telemetry sessions were conducted through November 2016 to identify overwintering sites and concluded once turtles were consistently identified in overwintering sites. Individual turtle observations were recorded on Nova Scotia

Turtle Observation Cards (Appendix 2) and survey efforts recorded on Nova Scotia Turtle Daily Effort Cards (Appendix 1). Telemetry data was recorded in an internal database and contributed to the central Species at Risk Turtle Database.

4.3 Nest and emergence surveys

Nest surveys were conducted based on methods established by the Blanding's Turtle Recovery Team (2007). Surveys were conducted at sites with previously documented nesting activity, or in areas with known females of reproductive age and suitable nesting habitat. Nesting surveys were conducted throughout June, and effort was recorded using Nova Scotia Turtle Daily Effort Cards (Appendix).

Data about individual turtles observed nesting or attempting to nest was recorded on Nova Scotia Turtle Nesting Observation Cards (Appendix 4). Morphometric data was collected only after females had completed nesting activity. Protective nest covers were placed on all nests where oviposition was observed, in order to prevent nest predation.

Confirmed nests were monitored daily, beginning 60 days after oviposition. Nest monitoring effort was recorded on Turtle Emergence Effort Cards. In the case of hatchling emergence, data was collected for the nest site on Turtle Emergence Cards, and individual hatchling data was documented on Turtle Hatchling Observation Cards (Appendix 5). 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. All data was recorded in an internal database and contributed to the central Species at Risk Database.

4.4 Stewardship Plans

Stewardship plans were developed collaboratively between CARP and private land owners and managers. Potential properties were selected based on known sightings of wood turtles, presence of wood turtle habitat(s), and landowner interest in active participation in the project. An effort was made to engage a number of landowners within the same community, to address stewardship issues at a larger scale than individual properties.

A property assessment form was developed to guide data collection for each property. Information collected included habitat types present on the property, a description of key habitat features, and specific threats to wood turtles on or near the property. Geospatial information was collected using a handheld computer and ArcPad GIS software. Data collected included boundaries of habitat types and locations of important habitat features.

This data was used to produce property specific habitat maps using ArcGIS. Stewardship actions were recommended based on the outcomes of property assessments, taking landowner/manager property goals and objectives for their property into consideration. Recommendations were linked to specific habitat type of features identified on the property maps.

4.5 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.

Outreach events targeted public engagement in project activities, including visual surveys and nest monitoring and protection. Educational events focused on promoting stewardship actions among landowners/managers and raising public knowledge about species at risk, including the wood turtle.

5.0 Results

5.1 Visual Surveys

Visual survey efforts were concentrated from late April through June, when conditions were more favourable for observing turtles, with vegetation at its least dense. Twenty three (23) visual surveys were completed (Table 2). A total of 204.73 effort hours were spent on visual surveys, 171.30 hours of which were completed by volunteers (Table 3). Visual survey locations focused on expanding the confirmed range of wood turtles and included Brickton (Figure 1), the Fales River (Figure 2), Kingston (Figure 3), Lawrencetown (Figure 4), Middleton (Figure 5), and the South River in Aylesford (Figure 7).

Turtles were observed during 3 of these surveys, accounting for 3 individuals, none of which were first captures. Weather conditions seemed generally unfavourable during May, with many cool grey days, and may have had an impact on the success of visual surveys.

Table 2 Visual survey locations 2017

Date	Area	Section*	Turtle observed?
03-May-17	Fales River		NO
03-May-17	South River		YES the Hulk (recapture)
03-May-17	South River		NO
04-May-17	South River		YES Chip (recapture)
05-May-17	Brickton to Paradise		NO
06-May-17	Brickton to Paradise		NO
08-May-17	Brickton to Paradise		NO
11-May-17	Black River		NO
11-May-17	Black River		NO
11-May-17	South River		YES Myrtle (recapture)
12-May-17	Lawrencetown		NO
12-May-17	Lawrencetown		NO
12-May-17	Lawrencetown		NO
16-May-17	Lawrencetown		NO
16-May-17	Brickton to Paradise		NO
16-May-17	Wilmot		NO
18-May-17	Wilmot		NO
18-May-17	Wilmot		NO
19-May-17	Lawrencetown		NO

23-May-17	Brickton to Paradis	NO
29-May-17	Brickton to Paradise	NO
31-May-17	Lawrencetown	NO
07-Jun-17	Brickton to Paradise	NO

*Section named have been removed from this version of the report

Table 3. Visual survey effort, 2017

Area	Section*	Total Effort (hours)	Volunteer Effort (hours)
Brickton		47	43
		1.5	0.75
		52.67	45.82
Black River		1.5	0.75
		4.25	2.83
Fales River		5.2	3.47
Lawrencetown		15	13.5
		13.25	7.75
		3.5	2.33
		6	3
South River		8	54
		41	39.17
Wilmot		2.67	1.33
		1.53	0.77
		1.67	0.83
TOTAL		204.73	171.30

*Section named have been removed from this version of the report

Figure 1. Brickton survey area

Removed due to sensitive data

Figure 2. Fales River survey areas and observations

Removed due to sensitive data

Figure 3. Kingston Survey areas and observations

Removed due to sensitive data

Figure 4. Lawrencetown survey areas and observations

Removed due to sensitive data

Figure 5. Middleton survey area

Removed due to sensitive data

Figure 6. Nictaux observation

Removed due to sensitive data

Figure 7. South River survey areas and observations

Removed due to sensitive data

5.2 Radio Telemetry

Three turtles (#456, 458, 461) were equipped with radio-transmitters prior to overwintering between November 2016 and April 2017. Radio-telemetry for turtle #465 and 461 commenced on April 16, at which time both individuals were identified as being submerged in their overwintering areas. Terrestrial activity was first observed on May 3 by turtle #458.

During the 2016-2017 field season a new female turtle (#466) from the Berwick area was equipped with a radio-transmitter, but after a short period of successful tracking, this turtle was no longer able to be located. There were no observations of this turtle during the 2017-2018 field season.

Turtle #461 was successfully tracked until May 24, 2017, after which only an erratic signal of 5% or less could be obtained. This type of erratic signal can be caused by the overhead powerlines present at the site. It is unclear whether the radio-transmitter malfunctioned, lost battery power, or whether the turtle moved out of range. Increased visual survey effort in spring 2018 is recommended to try to relocate this individual.

On May 30, 2017, turtle #470 was observed incidentally during water quality sample collection. This turtle had been previously observed on May 10, 2013. A radio-transmitter was equipped to the turtle in the hope of identifying her nesting territory.

At the end of the field season radio-transmitters were removed from turtles #458 and 456 and sent for refurbishing. The overwintering location of turtle #470 was identified so that radio-tracking can recommence in spring 2018.

Twenty nine (29) telemetry field surveys were conducted throughout the 2017 season (Table 4). A total of 221.75 hours of effort were spent conducting radio-telemetry, 181.33 of which were completed by volunteers (Table 5). Individual turtle observations resulting from both radio-telemetry and visual surveys are presented in section 4.3.

Table 4. Radio-telemetry sessions, 2017

Area	Date	Section(s)*	Turtles observed/located?	Comments
16-Apr-17	Fales River		YES	
26-Apr-17	South River		YES	Miss Chris (458)
26-Apr-17	Fales River		YES	Jenny (456), Sandy (461)
03-May-17	Fales River		YES	Jenny (456), Sandy (461)
03-May-17	South River		YES	Miss Chris (458)
04-May-17	South River		YES	Miss Chris (458)
11-May-17	South River		YES	Miss Chris (458)
11-May-17	Fales River		YES	
24-May-17	Fales River		YES	Jenny (456), Sandy (461)
07-Jun-17	South River		YES	Miss Chris (458)
22-Jun-17	South River		YES	Miss Chris (458)
22-Jun-17	Kingston		NO	2% signal on Princess
22-Jun-17	Fales River		YES	Predated nest found
28-Jun-17	Kingston		YES	Princess (470)
28-Jun-17	Fales River		NO	
06-Jul-17	Kingston		NO	
09-Jul-17	Kingston		NO	89% signal on Princess
12-Jul-17	Kingston		NO	83% signal on Princess
19-Jul-17	South River		YES	Miss Chris (458)
02-Aug-17	South River		YES	Miss Chris (458)
23-Aug-17	South River		YES	Miss Chris (458)
23-Aug-17	Fales River		YES	Jenny (456)
29-Aug-17	Fales River		YES	Jenny (456)
29-Aug-17	Kingston		YES	Princess (470)
29-Aug-17	South River		YES	Miss Chris (458)
12-Sep-17	South River		YES	
27-Sep-17	Kingston		YES	Princess (470)
25-Oct-17	South River		YES	Miss Chris (458); transmitter removed
25-Oct-17	Fales River		YES	Jenny (456); transmitter removed

*section data has been removed

Table 5. Radio telemetry effort, 2017

Area	Section*	Total Effort (hours)	Volunteer Effort (hours)
Fales River		63.30	49.72

Kingston	22.08	15.58
	7.08	1.42
South River	129.28	114.62
TOTAL	221.75	181.33

**section data has been removed*

Table 6. Radio transmitter unit data

Serial Number	Date shipped to CARP	Date Attached to turtle	Frequency	Turtle #	Turtle name	Anticipated expiry	Date removed	Date shipped for refurbishing
183540		11-May-16	172.992	461	Sandy	May-16	Apr-18	<i>in office</i>
	23-Oct-14	Oct/Nov 2014	172.992	452	Red Rocket	May-16	09-Aug-15	
	14-May-13	09-Jul-13	172.992	471	Oli	Jan-15	14-Oct-14	<i>* sent for refurbishing</i>
183539	21-Jun-16	02-Oct-16	172.932	456	Jenny	Dec-17	25 October, 2017	<i>in office, received April 24, 2018</i>
	14-May-13	05-May-15	172.932	458	Ms Chris	Nov-14	24-Jul-15	
		03-Jun-13	172.932	500	Annie	Nov-14	25-May-15	
	14-May-13	27-May-13	172.932	548	Jules	Nov-14	03-Jun-13	
74247	23-Oct-14	21-May-15	172.401 (.402)	456	Jenny	Nov-16	02-Oct-16	<i>in office, received April 24, 2018</i>
		12-Apr-13	172.402	608	Hannley	Oct-14	06-Oct-14	
74252		03-Aug-17	172.520	458	Miss Chris	Mar-18	25 October, 2017	<i>in office, received April 24, 2018</i>
	21-Jun-16	07-Jul-16	172.520	467	Ping	Mar-18	November 2 (mortality)	
	21-Jan-14	ca. 16 September 2014	172.520	608	Hannley	Jun-15	27 July, 2015	
		May-14	172.520	455	Jimmy		16-Sep-14	
		29-Apr-13	172.522	566	Little Miss	Jan-14	06-Sep-13	
		10-Jul-12	172.522	523	Earl	Jan-14	29-Apr-13	
74257	16-Jul-15	24-Jul-15	172.664	458	Ms Chris	Jan-17	02-Aug-17	<i>in office, received April 24, 2018</i>
		30-Apr-13	172.665	452	Red Rocket		28-Oct-14	<i>* sent for refurbishing</i>
		26-Apr-13	172.665	451	Boomer		30-Apr-13	

	donated from MTRI	08-Jun-16	172.639	466	Raindrop	Nov-17	<i>still attached</i>	
small unit	donated from MTRI	31-May-17	172.080	470	Princess	Apr-18	<i>still attached</i>	

5.3 Turtle observations

During the 2017 field season a total of 11 individual turtles were observed through visual surveys, nesting surveys, radio-telemetry, or incidental to other activities (Table 8). The only first capture observed was a mortality (Figure 8). This individual was found on the side of a road with a cracked carapace and is suspected to have been struck by a passing vehicle. Since 2012 CARP has observed and notched a total of 43 individual turtles (not including emerged hatchlings). A summary of all observations is presented in Table 9 and Figure 1 through Figure 7.



Figure 8. Mortality reported on Highway 201, Nictaux

Table 7. Survey methods and resulting observations

Sighting method	Individuals observed*	Total Observations	First captures
Visual survey	3	3	0
Radio-telemetry	4	17	0
Incidental to radio-telemetry	3	3	0
Nesting survey	3	11	0
Incidental (other)	2	2	1 mortality

*Individual turtles were potentially observed using multiple-methods

Table 8. Individual turtles observed, 2017

Turtle #	Name	Notch Code	Sex	Age Class	Area	Date of first capture/	# observations 2017	Sighting method(s)	Reproductive female?
452	Red Rocket	L11-R2,8,9	F	A	Kingston	recapture	2	N	✓
453	Chip	L11-R2, 3, 8, 9, 11	F	A	South River	recapture	1	V	✓
456*	Jenny*	L11-R2,8,9,10	F	A	Fales Rlver	recapture	11	R	✓
457	Lucky Lady	L10-R2,8,9	F	A	Lawrencetown	recapture	5	N	✓
458*	Miss Chris*	L10, R2,8,9,11	F	A	South River	recapture	11	R	✓
461*	Sandy*	L9, R2, 8, 11	F	A	Fales River	recapture	6	R	
470*	Princess*	L8-R2	F		Kingston	recapture	5	I,R	
522	The Hulk	L9,11-R2,3	M	A	South River	recapture	1	V	
545	Linds	R2, 3, 8, 10, 11	F	A	South River	recapture	2	N	✓
572	Myrtle	L9, 11-R2, 3, 8, 10	F	J	South River	recapture	1	V	
	Unidentified	N/A	N/A	N/A	Nictaux	Vehicle collision	1	I	N/A

*denotes turtles equipped with radio transmitters

Table 9. Summary of annual observations 2012-present

Year	Area	Section*	Individuals observed	First Captures	Males	Females	Undetermined Sex	Nesting females	Adults	Juveniles
2017	Total		11	1	1	9	1	3	11	0
2017	Fales River		2	0	0	2	0	0	2	0
2017	Kingston		2	0	0	2	0	1	2	0
2017	Lawrencetown		1	0	0	1	0	1	1	0
2017	South River		5	0	1	4	0	1	5	0
2017	Nictaux River		1	1	0	0	1	0	1	0
2016	Total		19	6	6	12	1	3	18	1
2016	Annapolis		2	0	1	1	0	0	2	0
2016	Berwick		1	1	0	1	0	0	1	0
2016	Fales		3	1	1	2	0	0	3	0
2016	Lawrencetown		3	1	1	2	0	2	3	0
2016	South River		10	3	3	6	1	2	9	1

2015	Total	18	4	6	12	0	6	15	3
2015	South River	11	2	4	7	0	2	9	2
2015	Annapolis	1	0	0	1	0	1	1	0
2015	Annapolis	4	0	1	3	0	2	4	0
2015	Fales	2	2	1	1	0	1	1	1
2014	Total	17	9	8	7	2	3	14	3
2014	South River	6	1	3	2	1	0	5	1
2014	Annapolis	6	5	3	3	0	2	6	0
2014	Annapolis	4	2	1	2	1	1	3	1
2014	Black River	1	1	1	0	0	0	1	0
2013	Total	18	9	7	9	3	3	17	1
2013	South River	10	1	5	5	0	2	10	0
2013	Annapolis	5	5	2	3	0	0	5	0
2013	Annapolis	1	0	0	1	1	1	1	0
2013	Black River	2	0	0		2	0	1	1
2012	South River	1	0	1	0	0	0	1	0

**section data has been removed*

Based on data from wood turtle observation cards for all survey methods employed during the 2017 season, individuals were most frequently observed in aquatic habitat (n=16), accounting for 34% of observations (Table 10) .

It should be noted that certain habitat types are not amenable to observations, and are likely under-represented in the data collected. For example, it is often not possible to visually locate turtles in aquatic habitats, and agricultural fields are often not surveyed in the late summer until harvest, to avoid causing crop damage. The number of observations for individuals in nesting substrate is biased as a result of the increased effort to observe nesting events.

The most frequently observed behaviours based on all observations were terrestrial stationary (n=15) and aquatic stationary (n=15), each accounting for 33.33% of all observations (Table 11). Again, it should be noted that the number of observed nesting attempts is disproportionately high, as survey efforts targeted turtles that were likely to nest.

Table 10. Habitat type at observation

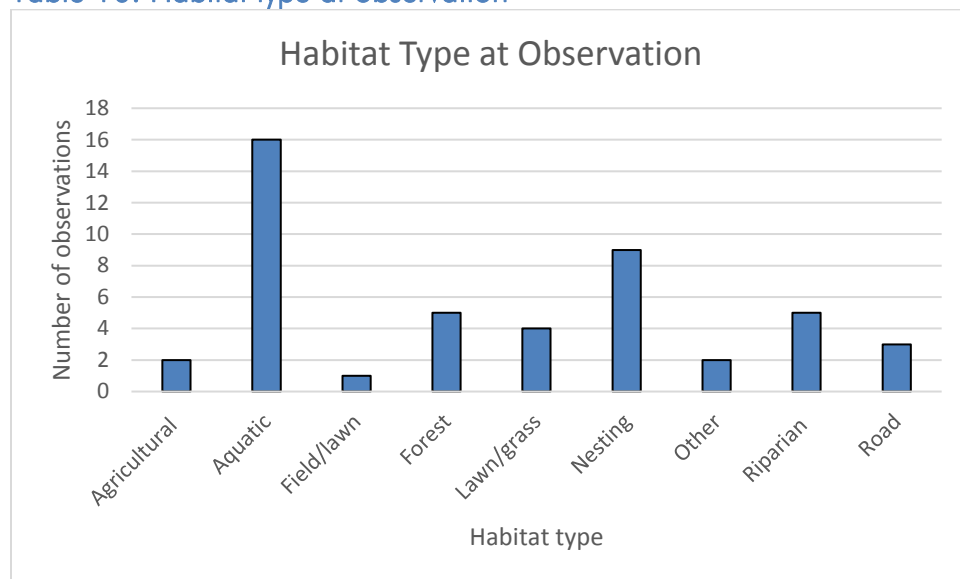


Table 11. Behaviour at observation

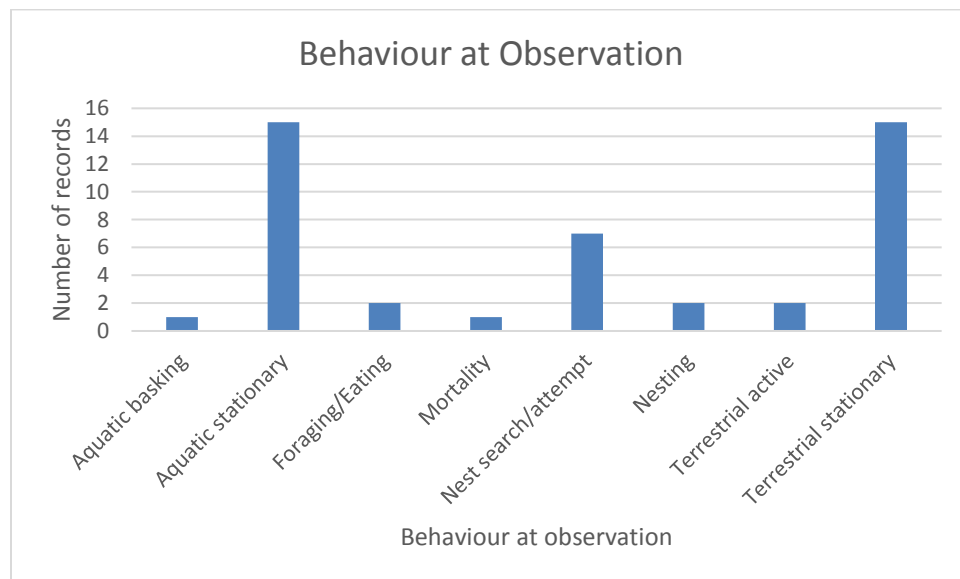


Table 12. Position vs. air temperature

Observations for position at observation were grouped into three categories based on air temperature during observation. When temperature was under 10°C turtles are most likely to be found in aquatic habitats, with 100% of individuals found submerged in the water (Table 12). 57% of turtles were observed on land when temperatures were between 10 to 20 °C and 84% when temperatures were between 20 to 30 °C. The data also suggests that as

temperatures increase, turtles will more frequently be observed covered or partially covered, likely a response to aid in thermoregulation.

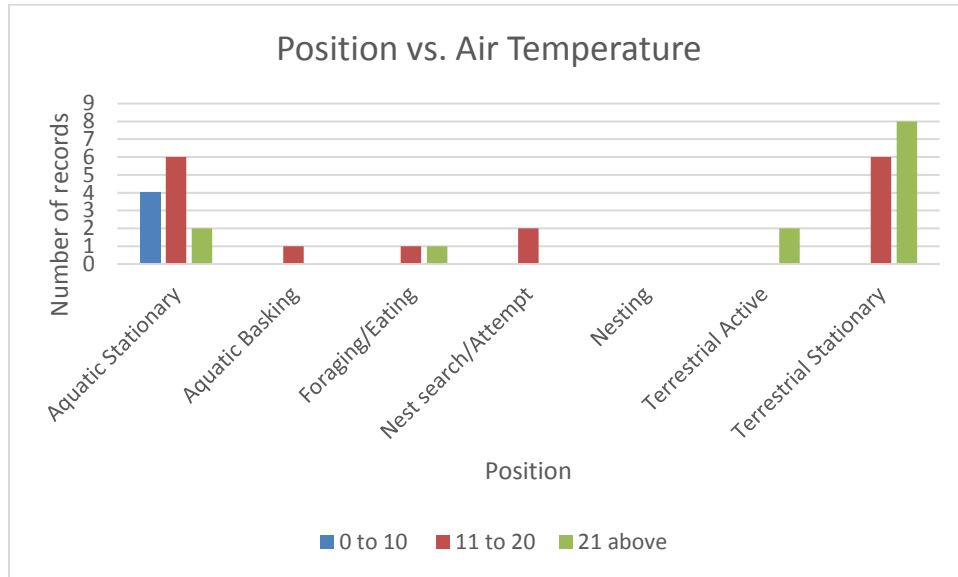


Table 13. Habitat type vs. month

5.4 Nesting Surveys

Nesting surveys were conducted in areas where past nesting activity has been observed in the past and in areas where females of reproductive age were being radio-tracked. This included sites in the Fales River (Figure 2), Kingston (Figure 3), Lawrencetown (Figure 4) and South River (Figure 4) areas. A total of 94.2 hours were spent on nesting surveys, with 87.7 of those hours conducted by volunteers.

Three females were observed during nesting surveys, however only 2 turtles were observed laying (Table 14). Observation dates from the 2016 and previous field seasons are presented in Table 11 to inform planning for 2017 nesting surveys.

Table 14. Monitored nest 2016

Mother's #	Mother's Name	Date Laid	Location description/event description	Date emerged/excavated	Incubation time	Clutch Size	Fate of eggs/hatchlings
475	Lucky Lady	11 June 2017	19:00 nest search 19:45 digging 20:00 nest search 20:15 digging 22:30 laying 22:47 burying Nest covered following day (12 June, 2017)	September 24- 4 hatchlings emerged; October 2- 1 live hatchling and 1 dead embryo excavated; October 10- 6 partially developed embryos excavated	106 days	12	4 hatchlings emerged and released at site; 1 live hatchling excavated and released at site; dead and partial embryos brought into lab and discarded
545	Linds	17 June 2017	July 16- nest search July 17- nest covered	No successful emergence	n/a	unknown	No successful emergence

Table 11. Historical nesting observations

Turtle Number	Turtle Name	Section/Area*	Past nesting dates	Dates observed 2016	Dates Observed 2017
500	Annie		3 June 2013	June 5,6,8	n/a
452	Red Rocket		9 June 2015		June 8, 12
457	Lucky Lady		18 June 2014	June 14-24	June 6,7,8,11
			24 June 2015		
458	Ms Chris			June 21, 22, 24	n/a
459	Nina		16 June 2015	Nested June 19	n/a
475	Luna		19 June, 2014		n/a
500	Annie		3 June 2013	June 5,6,8	n/a
553	Chip		18 June 2013		n/a
545	Linds		27 June, 2013		June 16, 17

*section and area removed

Emergence surveys were conducted by a volunteer living in close proximity to the nest, and commenced after 60 days of incubation. A total of 37 of emergence surveys were completed. Hatchling incubation time for Lucky Lady (#457) took 106 days. Five of 12 eggs successfully developed, and hatchlings were released on site. The nest belonging to Linds (#545) did not yield any hatchlings.

5.5 Stewardship Plans

Ten stewardship plans were developed in 2017, in areas of known wood turtle habitat.

Section removed due to sensitive and confidential information

5.6 Outreach

Outreach events included a variety of indoor and field-based educational programs, summarized in (Table 11) Approximately 551 individuals

Youth volunteer Sophie with a newly recorded wood turtle



were engaged through outreach and educational events, presentations, field days and training programs during the 2017 field season.

Table 15. Outreach events and presentations, 2016-2017

Event name	Location	Audience
13-Apr-17	Rotary Park, Middleton	Volunteers
19-Apr-17	Boat Launch, Lawrencetown	Volunteers
20-Apr-17	Stronach Park, Kingston	Volunteers
27-Apr-17	St. Mary's Elementary, Aylesford	School enrichment project
8-May-17	Fales River	Volunteers
4-May-17	St. Mary's Elementary, Aylesford	School enrichment project
8-May-17	Brickton	Volunteers
9-May-17	Lawrencetown	Volunteers
10-May-17	Lawrencetown	Volunteers
11-May-17	Aylesford	School enrichment project
12-May-17	Lawrencetown	Volunteers
15-May-17	Brickton	Volunteers
16-May-17	Lawrencetown	Volunteers
24-May-17	Fales River	Youth Leadership Program
28-May-17	Milford House	General public (families)
29-May-17	Wilmot	General public (youth)
31-May-17	Lawrencetown	Youth Leadership Program
5-Jun-17	Lawrencetown	Youth Leadership Program
7-Jun-17	Aylesford	Youth Leadership Program
12-Jun-17	Champlain Elementary School, Granville Ferry	School enrichment project
31-Jul-17	Lawrencetown Exhibition	Farming/agriculture community
28-Jun-17	Kingston & Fales River	Youth Leadership Program
19-Jul-17	Middleton	General public (youth)
22-Aug-17	Aylesford	General public
23-Sep-17	Lawrencetown	Woodlot owners
2-Oct-17	Fales River	General public (youth)
17-Oct-17	NSCC Middleton	General public
18-Oct-17	COGS	General public
19-Oct-17	NSCC Digby	General public
19-Oct-17	Kingston Library	Local landowners
6-Nov-17	Middleton Regional High School	School enrichment project
29-Jan-18	West Kings High School	School enrichment project
3-Mar-18	New Ross	Woodlot owners

A variety of outreach materials were developed and distributed, including:

- Electronic materials
- Project webpage
- Social media posts on Facebook, Twitter and Instagram
- You-tube video
- Powerpoint presentations
- Interviews and contributions to support other related recovery initiatives

Print materials

- “Wood Turtle Information” English and French versions
- “Wood Turtle Stewardship in Your Backyard” information brochure in English and French
- Posters for all events and volunteer opportunities
- “Have you seen a wood turtle” posters in English and French
- “Have you seen a wood turtle” ID cards in English and French
- Press releases in local newspapers and community publications including the Chronicle Herald and Annapolis Valley Register
- Articles in CARP’s Waterstrider newsletter

Public signage

A interpretive panel was designed and 4 copies were produced (2 English and 2 French) (Figure 9 and Figure 10), to be erected in areas of high human traffic on the Fales River, Greenwood, and the Annapolis River in Kingston. These signs will help to educate the public on species identification, encourage appropriate public reporting, and raise awareness about local species at risk. The print files for these panels are available to be used by other organization and has been uploaded on the SAR portal (www.speciesatrisk.ca).



Figure 9. Interpretive panel, French version



Figure 10. Interpretive panel, English version

Three nesting habitat signs were erected at locations of high human use, including 2 farm properties and a sewage treatment plant (Figure 11). These signs help to mitigate disturbance of nesting habitat and provide required information for reporting of nesting activity. All 3 landowners are willing to have signs erected in future years.



Figure 11. Nesting area sign

6.0 Discussion and Recommendations

6.1 Visual surveys

Any future visual survey effort should continue to be planned for late April through the end of May, when vegetation is at its least dense. It was noted by staff and project volunteers that as early as the first week of June vegetation severely impeded ability to make visual observations. Continued volunteer training is a good option for reducing the amount of field time required by project staff. It is important that in future years that the project leader(s) continue reiterating the importance of completing effort cards to volunteers, even when turtles are not observed. The anticipated online app to record survey effort on phones or tablets in the field may help reduce the number of cases that data is not recorded and/or submitted and the time required following up with volunteers about data card submission.

Future visual survey efforts should be focused on expanding the known range of wood turtles in the Annapolis watershed by targeting areas with little or no past survey effort. Notes from outreach events about historical observations can be used to identify target survey sites for the 2018 field season. The habitat model developed by Ikanawtiket may also provide additional information that can be used to plan future survey efforts. It is recommended that this model

be applied to the watershed and that initial results are ground truthed prior to scheduling the 2018 field season.

6.2 Radio-telemetry

Radio-tracking on a semi-weekly basis was sufficient for gathering general data about habitat use, without losing the approximate location of individuals. Priority for radio-tracking was given to sexually mature females, in order to increase the chances of observing nesting activity. It is recommended that as the project continues, once nesting territories have been identified that transmitters are removed, so that they are available to be equipped to newly identified females.

Grade 4 and 5 students from St. Mary's Elementary radio-tracking wood turtles in Aylesford



Two commercial GPS units (i-got-U model 120) were modified based on a method presented by Allan et al. (2013), in their study of the brushtail possum. Due to the weight of the retrofitted units, they were unsuitable to be equipped to many turtles, as the cumulative weight of the transmitter and GPS tracker must be less than 5% of the turtles' total body weight. An option for maintaining a satisfactory waterproof seal was not identified. It is not recommended to pursue this option in the future.

6.3 Nest and emergence surveys

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.

It is often difficult to retain nest and emergence survey volunteers. These activities take a great deal of time, and rarely result in turtle observations, which may be a deterrent to long-term volunteer participation. However, there are a small number of volunteers who are willing to dedicated a great deal of time to these efforts. Targeted recruitment of nest monitoring volunteers who live in close proximity to nesting sites may help address issues with time commitment and avoiding gaps in survey effort.

Lucky Lady, a female turtle, during a nesting survey in June 2017



6.4 Stewardship plans

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 and requires dedicated effort and resources. Recruiting new landowners requires long-term relationship development and can be disrupted when there is staff turnover or other breaks in program continuity. It is recommended that a mechanism to highlight successful work with private landowners in order to gain public trust and credibility. Field days on existing stewardship properties may be one method to achieve this.

Continued effort to develop relationships with key stakeholder groups, such as agricultural landowners/managers, is required to facilitate future recruitment of landowners. It is recommended that CARP continue to work collaboratively with key players in the agricultural sector, including the Nova Scotia Department of Agriculture and the Nova Scotia Federation of Agriculture. The co-development of outreach and education programs may be more effective at engaging the target audience, rather than CARP developing and hosting events in isolation of other stakeholder organizations.

Members of the public learning about wood turtles from CARP's Youth Leaders at Oaklawn Farm Zoo



6.5 Public outreach and education

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. It is recommended that active outreach programs such as events, guest presentations, and field days are continued in future years of the project. Continued effort to develop volunteer capacity and recruit new volunteers is another approach that can be used to raise local awareness and encourage participation in stewardship actions.

Including the wood turtle project as a component of CARP's Youth Leading Environmental Change program has proved to be an excellent way to engage members of the public in project activities, increase public awareness about the program, and develop local volunteer capacity. It is recommended that a youth leadership component be included in future years of the project. Local schools and youth organizations also present tremendous opportunity to engage local youth and families in field activities and other stewardship actions. Programs such as Options to Opportunities provide opportunity to bring students in the field to assist with visual surveys and other special projects; these types of partnership have also resulted in the recruitment of co-op students who are able to support field activities such as visual surveys. In some cases, youth participants have also suggested new properties to target in stewardship activities (eg. students who have observed wood turtles on their property).

7.0 Project alignment with the Recovery Strategy for the Wood Turtle (*Glyptemys insculpta*) in Canada

In order to support National efforts to recover the wood turtle CARP has aimed to align project activities to the proposed Recovery Strategy for Wood Turtles in Canada. CARP's wood turtle project currently addresses each of the six broad recovery strategies identified. Table 16 provides an outline of the area where CARP's current project aligns with the national *Recovery Strategy*. Once the final version of the Recovery Strategy and subsequent Action Plans are released, CARP should ensure that project objectives and activities continue to align with these documents.

With five years of experience delivering the Wood Turtle Monitoring and Stewardship Project, CARP is in an excellent position to act as a model for other watershed and community based organizations that are interested in becoming involved in the recovery of wood turtles. CARP has developed a broad variety of educational and outreach materials that can be used or adapted to facilitate these types of initiatives. CARP is also in an excellent position to field test new methodologies and tools, such as MTRI's proposed data collection app and the standard transect monitoring protocol being developed by members of the Recovery Team.

Table 16. Recovery Strategy for Wood Turtles in Canada, Adapted from Canada's Recovery Strategy (Environment Canada, 2015)

Broad Strategy for Recovery*	Priority*	General Description of Research and Management Approaches*	CARP Project Alignment
Reduction of adult mortality, injury and illegal collection	Urgent	<ul style="list-style-type: none"> - Protect Wood Turtle individuals through legislation and regulation tools. - Continue to develop and implement reduction and mitigation techniques (e.g., best management practices) to address threats to individuals. - Develop a federal/provincial strategy to address illegal collection as pets and for consumption. 	<ul style="list-style-type: none"> -development and installation of public signage (e.g. interpretive panels, turtle crossing signs) -development of and implementation support for stewardship plans -collaboration with key stakeholder groups to promote uptake of BMP's

Conservation, management and restoration of habitat	Urgent	<ul style="list-style-type: none"> - Conserve or manage Wood Turtle habitat through legislation, regulation, administrative and stewardship tools. - Continue to develop and implement reduction and mitigation techniques (e.g., best management practices) to address threats to habitat where required and at a relevant scale. - Promote an integrated habitat management approach at the watershed scale. - Determine habitat restoration needs in streams where Wood Turtle habitat is declining. 	<ul style="list-style-type: none"> -development of and implementation support for stewardship plans - engagement of private landowners and managers in stewardship actions -identification of restoration opportunities on public and private lands, and implementation of restoration activities (e.g. riparian zone restoration)
Communication and outreach	Necessary	<ul style="list-style-type: none"> - Develop and implement communication strategies appropriate to reduce adult mortality, reduce threats and conserve habitat. - Encourage the transfer and archiving of information and tools, including Traditional Ecological Knowledge (TEK). - Improve and maintain cooperation between stakeholders. - Promote research initiatives on the species. 	<ul style="list-style-type: none"> - development and implementation of a multi-faceted public outreach and education program, including events/presentations, print/electronic educational materials, etc. -contribution to provincial database and data sharing with partner organizations -collaboration with relevant stakeholder groups -creation of opportunities for public engagement in stewardship activities
Improvement of recruitment where needed	Necessary	<ul style="list-style-type: none"> - Document recruitment needs in streams where the Wood Turtle is declining or where viability is deemed to be compromised. - Improve recruitment (where needed) in streams where the Wood Turtle is declining or where viability is deemed to be compromised. 	<ul style="list-style-type: none"> - nest activity monitoring and documentation across the Annapolis River watershed -nest protection and monitoring to increase recruitment
Surveying and monitoring	Necessary	<ul style="list-style-type: none"> - Develop and implement provincial monitoring plans. - Develop and promote the appropriate use of standardized protocols (e.g., 	<ul style="list-style-type: none"> -monitoring and data collection across the Annapolis River watershed (visual survey, radio-telemetry) -sharing of data through provincial database and with provincial species recovery team

		data collection, handling, marking) and databases. - Improve the knowledge on local populations (e.g., abundance, suitable habitat size, threats, key habitats).	-data collection expanding the confirmed range of the wood turtle in the Annapolis -collection of data required by ECCC for the identification of critical habitat
Research	Necessary	- Verify the extent of local populations and most appropriate recovery scale. - Determine minimal habitat and population requirements to ensure local population viability (e.g., suitable habitat size, number of mature individuals). - Determine the full range of adverse effects (e.g., indirect effects, knowledge gaps) from identified threats as well as potential threats (including at the watershed scale). - Refine knowledge of habitat needs (e.g., females foraging habitat, brackish water) in order to develop a better understanding of spatial and temporal use.	- identification and documentation of range of wood turtle sub-population(s) in the Annapolis River watershed -identification of specific threats to wood turtles and their habitat -documentation of habitat use and behaviour in the Annapolis River watershed (visual surveys and radio-telemetry)

*as identified in the Recovery Strategy for the Wood Turtle (*Glyptemys insculpta*) in Canada

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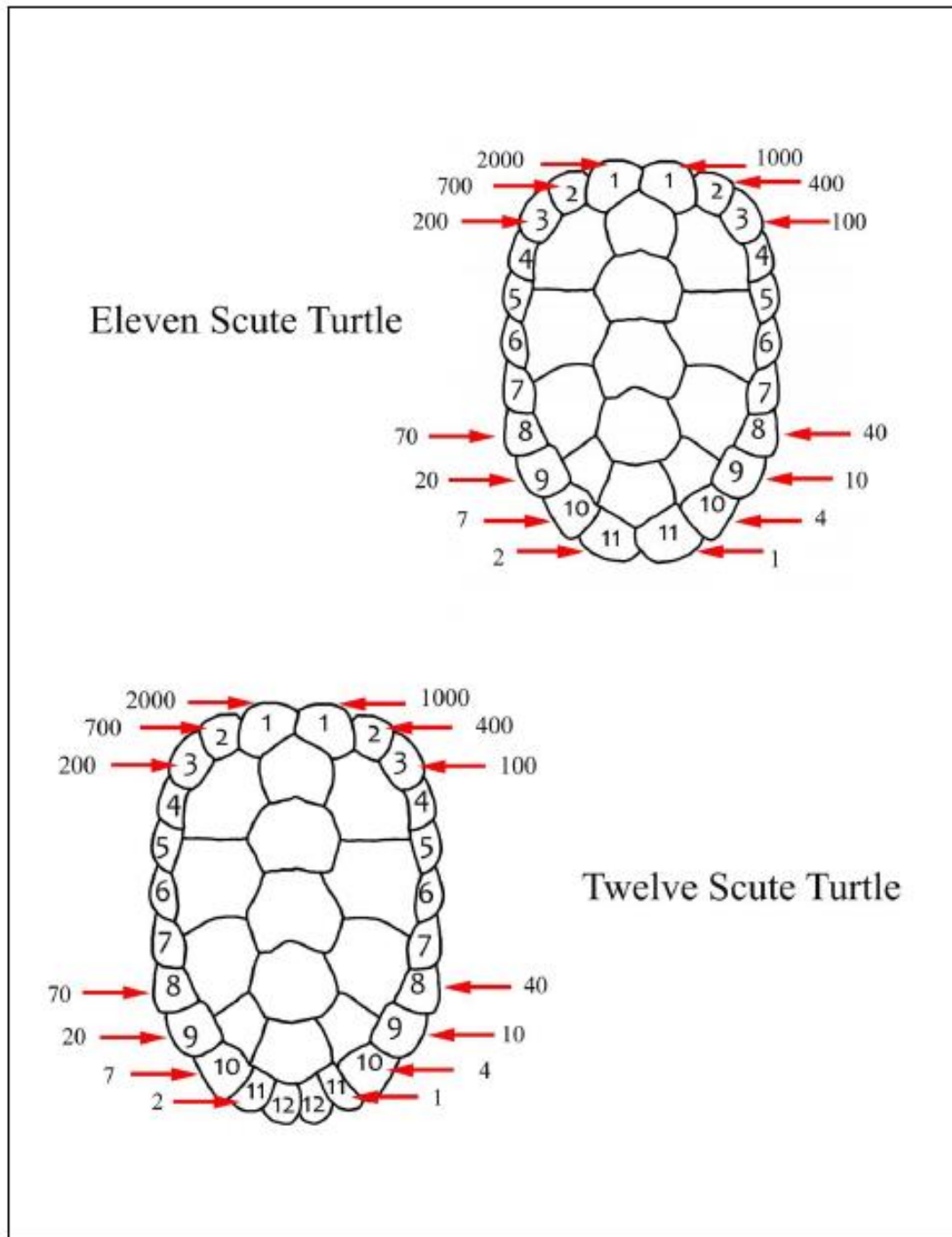
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Appendix 2. Nova Scotia Turtle Observation Card

NOVA SCOTIA TURTLE OBSERVATION CARD		Entered? <input type="checkbox"/> # _____											
<p>Species <input type="checkbox"/> Blanding's <input type="checkbox"/> Snapping <input type="checkbox"/> Wood <input type="checkbox"/> Painted</p> <p>Notches _____ Turtle Number (w,s) _____</p> <p>Name _____ Sex <input type="checkbox"/> M <input type="checkbox"/> F <input type="checkbox"/> J Gravid <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Date _____ (dd-mm-yy) Time _____ (24 hr)</p> <p>Cap. type <input type="checkbox"/> First Capture <input type="checkbox"/> Recapture <input type="checkbox"/> Escaped/Not Identified <input type="checkbox"/> Predated nest only: Suspected cause _____ <input type="checkbox"/> Intact nest only (no turtle observed) Nest ID _____</p> <p>Status <input type="checkbox"/> Alive <input type="checkbox"/> Dead: Suspected cause _____</p> <p>Handling type <input type="checkbox"/> Handled & released on site <input type="checkbox"/> Not handled <input type="checkbox"/> Handled & brought into lab</p> <p>Sighting method <input type="checkbox"/> Visual survey <input type="checkbox"/> Nesting survey <input type="checkbox"/> Radio tracking Freq _____ <input type="checkbox"/> Incidental to radio tracking <input type="checkbox"/> Trapping Session _____ # _____ <input type="checkbox"/> Incidental to trapping Distance to trap (m) _____ <input type="checkbox"/> Incidental to other research (e.g. ribbonsnake sampling) <input type="checkbox"/> General observation / other (put details in comments)</p> <p>Sighting type (if tracking) <input type="checkbox"/> Turtle seen: first seen _____ min after pinpointing <input type="checkbox"/> Pinpointed but not seen: <input type="checkbox"/> Searched for 10 min <input type="checkbox"/> General location only (put details in comments)</p>	<p>Observer who wrote card _____</p> <p>Additional observers _____</p> <p><i>Please refer to maps for population / area / section designation</i></p> <p>Project _____ Population _____</p> <p>Area _____ Section _____</p> <p>Location description (where the site is relative to fixed landmarks) _____ _____</p> <p>UTM (please use NAD 83 datum or specify in comments) East: _____ North: _____ Zone _____</p> <p>UTM Source <input type="checkbox"/> GPS unit (60+ second fix) Accuracy _____ m <input type="checkbox"/> 1:50 000 Topo <input type="checkbox"/> 1:10 000 Topo <input type="checkbox"/> Air photo grid</p> <p>Precipitation <input type="checkbox"/> None <input type="checkbox"/> Drizzle / mist <input type="checkbox"/> Moderate - heavy rain <input type="checkbox"/> Light rain <input type="checkbox"/> Snow flurries <input type="checkbox"/> Moderate - heavy snow <input type="checkbox"/> Other: _____</p> <p>Wind speed <input type="checkbox"/> Calm <input type="checkbox"/> Light <input type="checkbox"/> Moderate <input type="checkbox"/> Strong</p> <p>Estimate percent cloud cover _____ %</p> <p>Air temp _____ °C Water temp _____ °C</p>												
<p>Behaviour (check only 1) <input type="checkbox"/> Aggression / Courtship <input type="checkbox"/> Atmospheric Basking <input type="checkbox"/> Aquatic Basking <input type="checkbox"/> Foraging/Eating <input type="checkbox"/> Aquatic Active <input type="checkbox"/> Aquatic Stationary <input type="checkbox"/> Copulating <input type="checkbox"/> Terrestrial Active <input type="checkbox"/> Terrestrial Stationary <input type="checkbox"/> Nest Search/Attempt <input type="checkbox"/> Nesting: Nest ID _____ Clutch size _____</p> <p>Position In water: <input type="checkbox"/> Submerged <input type="checkbox"/> Carapace Exposed <input type="checkbox"/> Head Exp. On land: <input type="checkbox"/> All Exposed <input type="checkbox"/> Partially Covered <input type="checkbox"/> Covered</p> <p>Dist. from: nearest water _____ m or nearest land _____ m</p> <p>Habitat at capture <input type="checkbox"/> Terrestrial <input type="checkbox"/> Flooded <input type="checkbox"/> Normally aquatic</p> <p>Perch (if applicable) <input type="checkbox"/> Sphagnum <input type="checkbox"/> Grass/ Sedge <input type="checkbox"/> Emergent Veg. <input type="checkbox"/> Mud <input type="checkbox"/> Rock <input type="checkbox"/> Log/ Sticks <input type="checkbox"/> Lodge/ Dam <input type="checkbox"/> Buried in substrate <input type="checkbox"/> Bottom <input type="checkbox"/> Other: _____</p> <p>General habitat description (dominant vegetation / features) _____ _____ _____</p> <p>Comments _____ _____ _____ _____ _____</p>	<p>Measurements <i>(Blanding's - do all measurements; other species- do those denoted)</i></p> <table style="width: 100%; border: none;"> <tr> <td>CL _____ cm (s, w)</td> <td>PRE _____ cm (s)</td> </tr> <tr> <td>CW _____ cm (s, w)</td> <td>POST _____ cm (s)</td> </tr> <tr> <td>CW_{Bridge} _____ cm (w)</td> <td>LPS _____ cm</td> </tr> <tr> <td>PL _____ cm (s, w)</td> <td>HT _____ cm (w)</td> </tr> <tr> <td>PW _____ cm (s, w)</td> <td>CON _____ cm</td> </tr> <tr> <td>PW_{Femoral} _____ cm</td> <td>WT _____ g (s)</td> </tr> </table> <p>Upper Lip (Blanding's) <input type="checkbox"/> Striped <input type="checkbox"/> Solid</p> <p>Annuli <input type="checkbox"/> New growth <input type="checkbox"/> Visible, no new growth <input type="checkbox"/> Worn Smooth</p> <p>Annuli count: from plastron _____ from carapace _____</p> <p>Algae present on limbs (blue green)? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Algae present on shell (green, fuzzy)? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Detailed description of all identifying features (e.g. scars) _____ _____ _____</p> <p>Procedures (check all that apply) <input type="checkbox"/> Photo _____ <input type="checkbox"/> Numbers _____ <input type="checkbox"/> Scan _____ <input type="checkbox"/> Photographer _____ <input type="checkbox"/> Blood sample _____ <input type="checkbox"/> Vial # _____ <input type="checkbox"/> Skin sample _____ <input type="checkbox"/> Vial# _____ <input type="checkbox"/> Transmitter attached _____ <input type="checkbox"/> Frequency _____ <input type="checkbox"/> Transmitter removed <input type="checkbox"/> GPS Logger attached <input type="checkbox"/> GPS Logger removed</p>	CL _____ cm (s, w)	PRE _____ cm (s)	CW _____ cm (s, w)	POST _____ cm (s)	CW _{Bridge} _____ cm (w)	LPS _____ cm	PL _____ cm (s, w)	HT _____ cm (w)	PW _____ cm (s, w)	CON _____ cm	PW _{Femoral} _____ cm	WT _____ g (s)
CL _____ cm (s, w)	PRE _____ cm (s)												
CW _____ cm (s, w)	POST _____ cm (s)												
CW _{Bridge} _____ cm (w)	LPS _____ cm												
PL _____ cm (s, w)	HT _____ cm (w)												
PW _____ cm (s, w)	CON _____ cm												
PW _{Femoral} _____ cm	WT _____ g (s)												

Card modified: 16-May-10

Appendix 3. Nova Scotia wood turtle notch code scheme



Appendix 4. Turtle Nesting Observation Card

Turtle Nesting Observation Card

Species ☐ Blanding's turtle ☐ Snapping turtle
☐ Wood turtle ☐ Painted turtle

Turtle ID _____

Turtle Name _____

Date _____

Population _____

Area _____

Section _____

Observers _____

Capture type

- ☐ New turtle (no prior notches)
☐ Previously notched turtle
☐ Turtle not identified
☐ Predated nest only
☐ Intact nest only (no turtle seen)

Handling type

- ☐ Not handled
☐ Handled and released on site
☐ Handled and brought into lab
If handled, was the turtle gravid?
☐ Yes ☐ No

Method

- ☐ Nesting survey ☐ Other (please put details in comments)
☐ Incidental to tracking
☐ Radio tracking (Freq _____)
If tracking, how closely did you track the turtle?
☐ Turtle Seen ☐ Pinpointed ☐ General area

Weather at first sighting

- Precip* ☐ None ☐ Light rain
☐ Drizzle/mist ☐ Heavy rain
Wind ☐ Calm ☐ Light
☐ Moderate ☐ Strong
Cloud cover _____ %

Activities: IF THE TURTLE NESTED, PLEASE FILL OUT DETAILS ON BACK. UTM source: ☐ GPS unit ☐ Air photo with grid ☐ Other

Time	UTM East	UTM North	Activity	Air	Location (where on the site was the turtle) and comments
3	4				
3	4				
3	4				
3	4				
3	4				
3	4				
3	4				
3	4				
3	4				
3	4				

Activity key FP: Face ploughing D: Digging L: Laying B: Burying C: Concealing
 TB: Terrestrial basking AB: Aquatic basking NS: Nest search AA: Aquatic active TA: Terrestrial active
 TS: Terrestrial stationary AS: Aquatic stationary ML: Move onto land RW: Return to water G: Gone

Nest Details

Don't forget to fill out the turtle ID on the front of the card!

Nest ID _____ # Eggs _____
☐ Nest Protected ☐ Eggs collected for laboratory incubation
☐ Nest Predated ☐ Nest Moved

UTM of nest (NAD 83 datum):

Easting _____ Northing _____

UTM source: ☐ GPS unit Accuracy _____ m
☐ Air photo in kit ☐ Other _____

Digging Start: _____ Laying Start: _____

Laying Finish: _____ Burying Start: _____

Concealing Start: _____ Nest Finish: _____

Egg#	Time	Egg#	Time
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Dist. to water: _____ m Dist. to veg: _____ m

Height above water: _____ m

Temperature loggers: _____

Identifying features -Check the turtle list to confirm features

Measurements

CL _____ cm
 CW _____ cm
 CW_{Bridge} _____ cm
 PL _____ cm
 PW _____ cm
 PW_{Femoral} _____ cm
 PRE _____ cm
 POST _____ cm
 LPS _____ cm
 HT _____ cm
 CON _____ cm
 WT _____ g

Procedures (check all that apply)

☐ Photo Numbers _____
 Taken by _____
☐ Scan
☐ Blood sample Vial _____
☐ Skin sample Vial _____
☐ Transmitter attached Freq. _____
☐ Transmitter removed
☐ GPS Logger attached
☐ GPS Logger removed

Comments

Card modified 17-May-2011

Blanding's Turtle Emergence Card			
Nest description			
Nest ID:	_____	UTM (NAD 83) East:3	North:4
Mother's ID:	_____	UTM Source	<input type="checkbox"/> GPS unit (60+ second fix) Accuracy _____ m
Date laid:	_____	<input type="checkbox"/> 1:50 000 Topo	<input type="checkbox"/> 1:10 000 Topo <input type="checkbox"/> Air photo with grid
Clutch est. at laying:	_____	Location description _____	
Population:	_____	_____	
Area:	_____	_____	
Section:	_____	_____	
Nest Status		<input type="checkbox"/> Full emergence <input type="checkbox"/> Partial emergence <input type="checkbox"/> No emergence	
Cause of failure		<input type="checkbox"/> Nest flooded <input type="checkbox"/> Nest predated <input type="checkbox"/> Unknown <input type="checkbox"/> Other _____	
Summary			
Total emerged hatchlings:	_____	Total incubated eggs:	_____
Total excavated live hatchlings:	_____	Incubated eggs that emerged:	_____
Total excavated dead hatchlings:	_____	Total captive reared:	_____
Total excavated eggs:	_____	Total tracked after emergence:	_____
Estimated number of escapees:	_____	Date excavated:	_____
Clutch size estimate at emergence:	_____	Nest depth (cm):	_____
Comments (include excavation details)			

Card modified 05-Sep-2007

[illegible]

- Fate:** 1. Hatchling released at nest site
2. Hatchling released away from nest (put details in comments)
3. Hatchling brought in to lab (put date died or released in comments)
4. Egg incubated
5. Egg opened and discarded
6. Egg or hatchling reburied
Add a T after fate if the hatchling had a transmitter attached

Appendix 6. Notched individuals, Annapolis River Watershed

Turtle #	Name	Notch Code	Sex	Age Class	Area	Section	Date of first capture	Reproductive age?
205	Hank	L3- R10,11	M	A	South River			
451	Boomer	R2,8,9,11			(Annapolis) Kinston		April 26, 2013	
452*	Red Rocket*	L11-R2,8,9	F	A	(Annapolis) Kinston		30 April, 2013	✓
453	Brucie	L11-R2,8,9,11	M	J	Fales		21-May-15	
453	Stubs	L11-R2,8,9,11	M	A	South River		7 May, 2013	
453	Chip	L11-R2,8,9,11	F	A	South River		2007	
454	Nick Jr.	R2,8,9,10	M	A	Annapolis		recapture	
454	Little C	R2,8,9,10	U	J	Black River		May 8, 2013	
455	Jimmy	R2,8,9,10,11	M	A	Annapolis		2014 (deceased 2014)	
456*	Jenny*	L11-R2,8,9,10	F	A	Fales		21-May-15	✓
457	Lucky Lady	L10-R2,8,9	F	A	Lawrencetown			✓
458*	Miss Chris*	L10, R2,8,9,11	F	A	South River		28-May-15	
459	Nina	L10,11-R2,8,9	F	A	South River		14-Jun-15	✓
460	Sarah	L9-R2,8	F	A			18 June, 2014	✓
461	Sandy	L9, R2,8,11	F	J	Fales		May 11, 2016	
462	Frederick	L2,8-R9,11	M	A	Lawrencetown		2016	
463	Sam	L9,11-R2,8,11	U	J	South River		May 26, 2016	
464	Eden	L9-R2,8,10	M	A	South River		May 26, 2016	
466	Raindrop	L9,11-R2,8,10	F	A	Berwick		June 7, 2016	✓
467	Ping	L9,10-R2,8	M	A	South River		July 7, 2016	
470	Princess	L8-R2	F		Annapolis		May 10, 2013	
471	Oli	L8-R2,11	M		Annapolis		10 May 2013	
472	Baby Ben	L8,11-R2	U	J	South River		2014	
475	Luna	L8-R2,10,11	F	A	Lawrencetown			✓
480	Mapleton	L8-R2,9	M	A	Annapolis		29 July, 2014	
490	Mr. Squishy	L8,9-R2	M	A	Black River		3 August, 2014	
497	Mikjik'ijj	L8,9,10-R2	U	J	Annapolis			
500*	Annie*	L0-R2,3	F	A	Kingston		2 June 2013	
520	May	L9, R2,3	F	A	South River			
521	Curly	L9-R2,3,11	M	A	South River		2006	
522	The Hulk	L9,11-R2,3	M	A	South River		6 May 2013	
523	Earl	L9,11-R2,3,11	M	A	South River		July 12, 2012	
542		L11-R2,3,8	F	A			2005	
453		L12-R2,3,8,11	F	A	South River			
545	Linds	R2,3,8,10,11			South River		22 June, 2013	✓

548	Jules	L10-R2,3,8,11			South River		27 May, 2013	
551		R2,3,8,9,11		J	South River		2007	
552	Big Foot	L11-R2,3,8,11			South River		7 May, 2013	
554		R2,3,8,9,10		J	South River		2007	
555		R2,3,8,9,10,11		J	South River		2007	
556		L11-R2,3,8,9,10		J	South River		2007	
565	Moe	L9-R2,3,8,10,11	M	A	South River		recapture	
566	Little Miss	L9,11-R2,3,8,10	F	A	South River		29 April, 2013	
567		L9,10-R2,3,8	M	A	South River		2006	
568	Rudy	L9,10-R2,3,10			South River		29 April, 2013	√
569		L9,10,11-R2,3,8	M	A	South River		2006	
570		L8-R2,3	M	A	South River		2006	
572	Myrtle	L9,11-R2,3,8,10	F	J	South River		2015	
576		L9,11-R2,3,8,9,10		J	South River		2007	
577		L8,10-R2,3	M	A	South River		2007	
578		L8,10-R2,3,11					2007	
579		L8,10,11-R2,3	F	A	South River		2007	
592		L8,9,11-R2,3	M	A	Kingston		2008	
593		L8,9,11-R2,3,11	M	J	Milville		2008	
594		L8,9-R2,3,10		J	Milville		2008	
595		L8,9-R2,3,10,11		J	Aylesford		2008	
600		L3-R2	F	A	South River		2008	
601		L3-R2,11	M	A	South River		2008	
603		L3,11-R2,11	F	A	Aylesford		2008	
604		L3-R2,10		J	South River		2008	
605	Jeanie	L3-R2,10,11	F	J	South River		2009	
606	Randy	L3,11-R2,10		J	South River		2009	
607		L3,10-R2	M	A	South River		2009	
608*	Hannley*	L3,10-R2,11	M	A	South River		2010	

Appendix 7. Tractor/operator stewardship guide reminder sheet



Wood turtle conservation practices

Key reminders:

- Raise mower blades to 15 cm (6 inches) during the wood turtle active season, April-October (peak season May-September)
- Maintain natural vegetation along watercourses as a buffer zone
- Avoid using machines in potential nesting habitat (open gravel-sand areas) when possible. Nesting occurs in June and hatchlings emerge by October of the same year
- Report all wood turtle observations. Include a photo if possible, report as soon as possible:
 - toll free 1-866-727-3447
 - sightings@speciesatrisk.ca

Thank you for supporting the recovery of this species at risk



Wood turtle in a cornfield in Aylesford (July)



Adult wood turtle



Top shell (carapace)



Bottom shell (plastron)



Hatchling, about the size of a toonie

For more information: Katie McLean, (902)-532-7533, katiemclean@annapolisriver.ca, www.annapolisriver.ca