Wood Turtle

(Glyptemys insculpta) in Ontario

Ontario Recovery Strategy Series

Recovery strategy prepared under the *Endangered Species Act, 2007*

February 2010

Natural. Valued. Protected.

Ministry of Natural Resources

Ontario

About the Ontario Recovery Strategy Series

This series presents the collection of recovery strategies that are prepared or adopted as advice to the Province of Ontario on the recommended approach to recover species at risk. The Province ensures the preparation of recovery strategies to meet its commitments to recover species at risk under the Endangered Species Act, 2007 (ESA, 2007) and the Accord for the Protection of Species at Risk in Canada.

What is recovery?

Recovery of species at risk is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of a species' persistence in the wild.

What is a recovery strategy?

Under the ESA, 2007, a recovery strategy provides the best available scientific knowledge onwhat is required to achieve recovery of a species. A recovery strategy outlines the habitat needs and the threats to the survival and recovery of the species. It also makes recommendations on the objectives for protection and recovery, the approaches to achieve those objectives, and the area that should be considered in the development of a habitat regulation. Sections 11 to 15 of the ESA, 2007 outline the required content and timelines for developing recovery strategies published in this series.

Recovery strategies are required to be prepared for endangered and threatened species within one or two years respectively of the species being added to the Species at Risk in Ontario list. There is a transition period of five years (until June 30, 2013) to develop recovery strategies for those species listed as endangered or threatened in the schedules of the ESA, 2007. Recovery strategies are required to be prepared for extirpated species only if reintroduction is considered feasible.

What's next?

Nine months after the completion of a recovery strategy a government response statement will be published which summarizes the actions that the Government of Ontario intends to take in response to the strategy. The implementation of recovery strategies depends on the continued cooperation and actions of government agencies, individuals, communities, land users, and conservationists.

For more information

To learn more about species at risk recovery in Ontario, please visit the Ministry of Natural Resources Species at Risk webpage at: **www.ontario.ca/speciesatrisk**

RECOMMENDED CITATION

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AUTHORS

This recovery strategy was prepared on behalf of the recovery team by David Seburn. Carolyn Seburn, David Seburn, Jim Trottier and Lauren Trute worked on earlier versions.

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DECLARATION

The Ontario Ministry of Natural Resources has led the development of this recovery strategy for the Wood Turtle in accordance with the requirements of the *Endangered Species Act, 2007* (ESA 2007). This recovery strategy has been prepared as advice to the Government of Ontario, other responsible jurisdictions and the many different constituencies that may be involved in recovering the species.

The recovery strategy does not necessarily represent the views of all of the individuals who provided advice or contributed to its preparation, or the official positions of the organizations with which the individuals are associated.

The goals, objectives and recovery approaches identified in the strategy are based on the best available knowledge and are subject to revision as new information becomes available. Implementation of this strategy is subject to appropriations, priorities and budgetary constraints of the participating jurisdictions and organizations.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy.

RESPONSIBLE JURISDICTIONS

Ontario Ministry of Natural Resources
Environment Canada, Canadian Wildlife Service – Ontario
Parks Canada Agency

EXECUTIVE SUMMARY

The Committee on the Status of Species at Risk in Ontario (COSSARO) has designated the Wood Turtle (*Glyptemys insculpta*) as endangered in Ontario, and the species is listed in regulation as endangered on the Species at Risk in Ontario List. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) lists the species as threatened. The Wood Turtle is declining across much of its range and often occurs in small, disjunct populations. Given the long life history common to many turtles, any chronic increase in adult mortality can lead to a population decline. Significant threats include habitat loss, road mortality and collecting for the pet trade.

The goals of this recovery strategy are to halt the decline of Wood Turtle populations in Ontario, and to restore and maintain viable self-sustaining populations throughout the current range.

The recovery strategy addresses four primary objectives:

- Maintain the present range and distribution of Wood Turtles in Ontario
- Achieve and maintain minimum viable population levels of Wood Turtles throughout their current range in Ontario
- Reduce Wood Turtle mortality and human-related threats to the species
- Reduce illegal collection of Wood Turtles

Priority actions that are recommended to address these objectives include continuing to clarify the distribution, significant habitats and abundance of Wood Turtles in Ontario; protecting significant habitats that have been identified; continuing to manage the most vulnerable populations; and reducing the threat of illegal collection.

It is recommended that a Wood Turtle habitat regulation prescribe riverine corridors, hibernation sites, nesting sites and upland habitat adjacent to the riverine corridor in areas where Wood Turtles are found, known to occur or known to have occurred. A mapping methodology is recommended to identify and quantify the spatial extent of this habitat on a regional or local scale.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 BACKGROUND INFORMATION

1.1 Species Assessment and Classification

COMMON NAME: Wood Turtle
SCIENTIFIC NAME: *Glyptemys insculpta*
SARO List Classification: Endangered
SARO List History: Endangered (2008), Endangered – Not Regulated (2004)
COSEWIC Assessment History: Threatened (2007), Special Concern (1996)
SARA Schedule 3: Special Concern (June 5, 2003)
CONSERVATION STATUS RANKINGS: GRANK: G4 NRANK: N3 SRANK: S2

The glossary provides definitions for the abbreviations above.

1.2 Species Description

The Wood Turtle is a medium-sized turtle that can grow to 23 centimetres in carapace (top shell) length (Ernst et al. 1994). The carapace is brownish grey and is rough and sculptured, with concentric ridges and grooves. The scutes of the carapace have a raised, irregular pyramidal appearance. The plastron (bottom shell) is yellowish with large, dark blotches on the outer part of each plate. The legs and head of this species are dark brown on top; the neck, chin and inside of the forelimbs vary from yellow to orange to red in colour. Wood Turtles are typically 28 to 38 millimetres at hatching (Ernst et al. 1994). Hatchlings lack the sculptured shell and bright colouring of adults.

Recent taxonomic changes have resulted in the moving of the Wood Turtle from the genus *Clemmys* to *Glyptemys* (Holman and Fritz 2001, Feldman and Parham 2002).

Wood Turtles require at least 17 to 18 years to reach maturity in central Ontario (Brooks et al. 1992). Populations at the species' northern limit may require longer periods to reach maturity. Size rather than age may be more important in determining maturity; females mature at a minimum carapace length of 18.5 centimetres and males at 19.9 centimetres. Wood Turtles at least 46 years old have been documented in the wild (Ernst 2001). Females lay one clutch of eggs per year, but not all females nest each year. Average clutch sizes vary from 8.0 to 10.7 (range: 3–15) in Ontario (Brooks et al. 1992, Foscarini 1994, Smith 2002). Multiple paternity (more than one father for a clutch) has been confirmed in Ontario (Galbraith 1993). The sex of Wood Turtles, unlike that of many other turtles, is not dependent on temperature (Ernst et al. 1994).

1.3 Distribution, Population Size and Trends

The distribution of the Wood Turtle is patchy throughout much of the southern half of the Great Lakes–St. Lawrence Basin. In the United States, the species ranges from Maine in the northeast, south to Virginia and westward through New York to eastern Minnesota (figure 1).

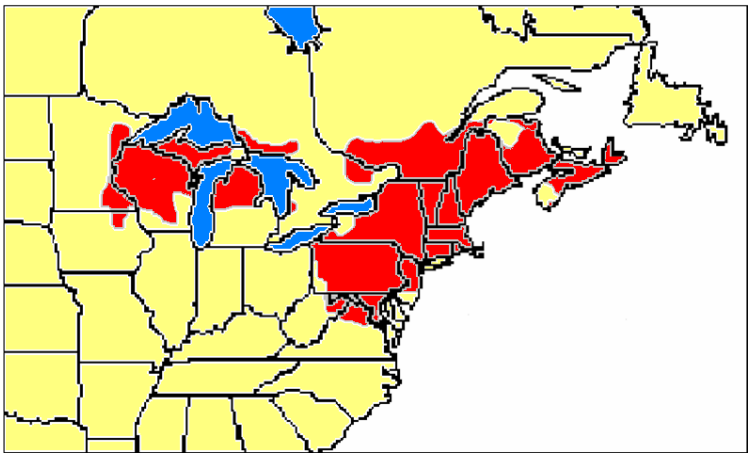

Figure 1. Distribution of Wood Turtle (© 2005, Marina Amato)

The World Conservation Union (IUCN) designates the Wood Turtle as vulnerable globally. It is listed on Appendix II of the Convention on International Trade in Endangered Species (CITES), making international trade in this species legal but strictly regulated (consult http://www.cites.org/eng/app/index.shtml for more details). Globally the Wood Turtle was ranked (in 2001) as apparently secure (G4), in the United States (in 1996) as apparently secure (N4) and in Canada (in 1998) as vulnerable (N3) (NatureServe 2008). The species is considered critically imperilled (S1) in one state and imperilled (S2) in five states and two provinces (table 1).

The Canadian distribution of the Wood Turtle is limited to four provinces: southern and central Ontario, southern Quebec, Nova Scotia and New Brunswick (table 1). Approximately 8 percent of the global distribution of this species is found in Ontario (Cowin 2005). The distribution in Ontario is separated into three main areas: southern Ontario, eastern Ontario and north of Lake Huron (figure 1). The Natural Heritage Information Centre (NHIC) identifies 43 extant element occurrences (EOs), although many of them are based on single observations (some of which might be of released captive individuals) and probably are not viable populations (Oldham 2006).[1] Limited information on the historic distribution of Wood Turtles in Ontario is available, but the NHIC lists 18 EOs in the province as being either historic or extirpated (Oldham and Austen 1998). The species is now considered historic in 10 counties and regional

[1] NHIC is in the process of updating the EOs for the Wood Turtle, and the number of extant EOs will probably change as a result of this work.

municipalities, mainly in southern Ontario (Durham, Essex, Halton, Hamilton-Wentworth, Kent, Lanark, Ottawa-Carleton, Parry Sound, Victoria and Waterloo).

Table 1. Subnational ranks for Wood Turtle (NatureServe 2008)

S-Rank	State/Province
S4 – Apparently Secure	Maine, Maryland
S3 – Vulnerable/ S4 – Apparently Secure	Pennsylvania
S3 – Vulnerable	Connecticut, Massachusetts, New Brunswick, New Hampshire, New Jersey, New York, Nova Scotia, Vermont
S2 – Imperilled/ S3 – Vulnerable	Michigan
S2 – Imperilled	Minnesota, Ontario, Quebec, Rhode Island, Virginia, West Virginia, Wisconsin
S1 – Critically Imperilled	Iowa, Ohio[2]
SH – Historic	District of Columbia

The size of the Ontario Wood Turtle population is not known, but the number of adult Wood Turtles in the province has been estimated at approximately 1,085 (COSEWIC 2007). Long-term monitoring data that can provide population trends are available for only a few populations. One population in southern Ontario declined approximately 70 percent from 1992/93 to 2002 (Cameron and Brooks 2002). The drop in population size occurred suddenly and is probably the result of poaching. At one site in central Ontario, a decline in population of approximately 30 percent to 50 percent has occurred since 1990 (R. Brooks pers. comm. 2003). The population is also thought to be declining at another site that has been studied since 2001 (L. Trute pers. comm. 2005). Poaching may have been a factor in the decline of both populations, although this has not been substantiated.

1.4 Habitat and Biological Needs

Habitat needs

In general, Wood Turtles are confined to areas with rivers and streams that have moderate current, hard sand or sandy gravel substrates, nearby nesting sites (Harding 1991, Buech et al. 1997, Wesley 2006) and diverse terrestrial habitats (Quinn and Tate 1991, Kaufmann 1992b, Foscarini 1994). Throughout the active season, this turtle may be found in rivers, streams, bogs, swamps, wet meadows, woods, upland fields and farmland (Harding and Bloomer 1979). Meandering rivers with moderate to fast current and sand or sand gravel substrate may afford prime habitat (Buech et al. 1997). The

[2] The Wood Turtle is known from only a few specimens from northeastern Ohio. The species may not be native to Ohio, and no extant populations are known from the state.

species uses aquatic habitats for hibernation, thermoregulation, rehydration, social interaction and mating (Harding and Bloomer 1979, Kaufmann 1992a, b, 1995). A Wood Turtle habitat model for northern Ontario determined that the following features appear to be essential to predicting the presence of Wood Turtles along a stream: (1) at least some sand or gravel bars; (2) deep pools, undercut muddy banks, log jams or beaver dams; and (3) open/herbaceous, short shrub, tall shrub and wooded habitat types present in the riparian zone (Wesley 2006).

The terrestrial habitat Wood Turtles use is highly variable, ranging from agricultural fields to forested areas. They appear to select relatively open habitats (Compton et al. 2002, Arvisais et al. 2004). The habitat selected in one area in Quebec consisted of young mixed forest stands (16 years old), with moderate shrub cover (35%) and a total canopy closure of 0 percent to 50 percent (Arvisais et al. 2004).

Wood Turtles often make long-distance movements over land. Home ranges in Ontario vary among populations, ranging from 5.6 hectares (Foscarini 1994) to 358 hectares (Greaves 2007). Home range size tends to increase with latitude (Greaves 2007). Although Wood Turtles typically remain close to their home river or stream, many individuals move long distances away from water. Individuals have been found up to 599 metres from water in a forested landscape in Maine (Compton 1999). Long-distance movements from water have also been observed in Ontario, where Wood Turtles have been observed more than 390 metres (Smith 2002), 440 metres (Greaves 2007), and 600 metres from water (L. Trute pers. comm. 2005). In one population, 27 percent of radio-tracked turtles (all female) were located between 300 and 500 metres from water (Ontario Ministry of Natural Resources [OMNR] unpublished data).

The stretch of stream Wood Turtles occupy can vary substantially. Generally, in the northern portion of its Ontario range, the species occupies longer stretches, possibly because certain key habitats, such as nesting sites, are limited. Wood Turtles have been documented to move up to 12 kilometres along a stream in northern Ontario (P. Wesley pers comm. 2006), although movements are typically less than 6 kilometres (Greaves 2007). In southern Ontario, movements of less than 2 kilometres are more typical (OMNR unpublished data).

Wood Turtles hibernate in aquatic habitats, and hibernacula in Ontario have been located in both rivers and creeks, in deep pools and river bends (Foscarini 1994, Quinn and Tate 1991). These turtles enter hibernation between October and November, depending on the location (Ernst et. al. 1994). They may hibernate communally and return to the same sites year after year (Bloomer 1978, Harding and Bloomer 1979, Foscarini 1994), but this is not true for all populations (Greaves and Litzgus 2007, 2008). Hibernation sites have flowing water and do not freeze to the bottom. Wood Turtles were reported to hibernate in the main river rather than tributary streams or oxbows at a site in northern Ontario (Greaves and Litzgus 2007, 2008). The main river was colder (about 0 degrees Celsius) and had more stable temperatures and higher levels of dissolved oxygen (12.6 parts per million) than adjacent aquatic habitats (Greaves and Litzgus 2008). Within the river, Wood Turtles remained in locations under

about 1 metre in depth and less than 2 metres from shore (Greaves and Litzgus 2007, 2008). They made small movements during winter, but their average winter home range varied from 3.4 square metres to 7.1 square metres over two winters (Greaves and Litzgus 2007, 2008). They emerged from hibernation during April (Greaves and Litzgus 2007).

Nest sites have been described as having sandy soil and abundant light. Nesting has been observed on a wide variety of modified habitats, including road shoulders, railway embankments, clearcuts, utility rights-of-way (Harding 1991), agricultural fields, pastures, old fields (Kaufmann 1992b) and gravel pits (Foscarini 1994). In northern Ontario, nest sites occurred on sand and gravel bars (Wesley 2006). Buech and others (1997) found that natural nesting areas in Minnesota occurred along south-facing sandy points and cutbanks of third-order[3] or larger meandering rivers. Nests were excavated 1 metre or more above the water in areas with less than a 40 degree slope and less than 20 percent ground vegetation that were close to water and had low disturbance. While some females nested up to 150 metres from water, most nested within 10 metres of the stream. In Ontario, females have been documented to move up to 5 kilometres to nest (Greaves 2007). Nesting typically occurs from late May to mid-June in Ontario (Smith 2002).

Foraging habitat has been described as being tall shrub and woods habitat with diverse and intact understorey vegetation (Wesley 2006). Prime foraging habitat is often floodplain areas. Thermoregulation sites for Wood Turtles must be open areas that receive abundant solar radiation. These habitats are typically areas of herbaceous or short shrub cover (Wesley 2006).

Biological Needs

In addition to the habitat requirements outlined above, Wood Turtles require a diverse food resource. They are omnivores and eat a variety of invertebrates, as well as fruits, leaves and even fungi (Ernst et al. 1994).

Like all turtles, Wood Turtles are ectotherms, or “cold-blooded.” They require an external heat source (generally, they bask in the sun) to maintain their optimum body temperature. Experimental studies have demonstrated that Wood Turtles can control their body temperature by selecting their location (Dubois et al. in press). To be able to thermoregulate, however, Wood Turtles need a wide selection of locations (from full shade to full sun).

[3] A source or headwater stream is considered a first-order stream. When two first-order streams flow into each other they form a second-order stream. When two second-order streams flow into each other they form a third-order stream.

1.5 Limiting Factors

The life history strategy of the Wood Turtle is typical of that of many long-lived species and is characterized by delayed maturity and extended longevity, with repeated bouts of reproduction (iteroparity) and low rates of recruitment. Such a strategy is very effective as long as adult mortality rates remain at low levels. However, turtle populations are prone to decline with even modest increases in adult mortality rates (e.g., Congdon et al. 1993). Compounding the problem, turtles do not respond to lower population densities with increased reproductive output (Brooks et al. 1991, Galbraith et al. 1997). In addition, Wood Turtle populations in Ontario are at their northern limit, and hatching success is low or virtually nil in cool years (Foscarini 1994, Smith 2002).

1.6 Threats to Survival and Recovery

Ontario Wood Turtles face a number of significant threats, most of which are widespread and ongoing.

Habitat Loss, Degradation and Fragmentation

Both the aquatic and terrestrial habitats of Wood Turtles are threatened. Agriculture in southern Ontario and forestry in central and northern Ontario are the two primary activities that have caused the loss and degradation of Wood Turtle habitat. Agriculture can reduce the amount and quality of terrestrial habitat available, can contaminate terrestrial and aquatic habitats, and can lead to the direct mortality of Wood Turtles (e.g., Saumure and Bider 1998, Saumure et al. 2007). Similarly, forestry activities (e.g., conversion of forest to roads and landings) can reduce the amount of terrestrial habitat that is available and can lead to increased mortality on forest access roads. Other activities, such as recent residential and cottage lot development, including shoreline alteration and stabilization along riverfront lands, have affected Wood Turtle habitat in some areas (D. Coulson pers. comm. 2001). Changes in stream flow patterns can cause flooding of nests, as well as loss of sandbars due to the washing of sand downstream (Wesley 2006). Clearing of vegetation along rights-of-way within Wood Turtle home ranges may also lead to poorer body condition (e.g., loss of weight, poor health) and adult mortality (Wesley and Brown 2006).

Subsidized Predators

Turtle predators (e.g., raccoons, skunks) exist at unnaturally high levels in many areas because of “subsidies” (e.g., food waste, crops) that humans provide (Mitchell and Klemens 2000), lack of large predators, or fragmentation of habitat, which results in the creation of more edge habitat. Nest predation rates in excess of 80 percent have been reported from two locations in Ontario (Brooks et al. 1992, Foscarini 1994).

Collecting

Collecting for the pet trade is the most insidious threat, because a single, systematic collection event can eliminate a large portion of a population. This is exemplified by a population in Ontario that declined by approximately 70 percent from 1993 to 1995, probably as a result of one or more illegal collecting episodes (Cameron and Brooks 2002). A web search in 2005 for Wood Turtles for sale, along with a review of published retail prices (Levell 2000), found that individual adult Wood Turtles typically retail for between US$75 and US$150. Incidental collecting can also have serious effects: two Wood Turtle populations declined by almost 100 percent within 10 years of the opening of an area to recreational use (Garber and Burger 1995). Recreational activities such as fishing, hiking and all-terrain vehicle (ATV) use during the nesting season may interfere with nesting activities and expose nesting females to the threat of collecting.

Road Networks

Vehicles are a threat that tends to affect adult females seeking nesting sites. In Ontario, roads run parallel to many streams containing populations of Wood Turtles. A number of Wood Turtles found killed on roads have been documented from a variety of locations in the province. Modelling studies predict that populations of semi-terrestrial turtles (e.g., Wood Turtles) will probably be killed on roads at rates that exceed sustainable levels in many areas with high road density (Gibbs and Shriver 2002). The creation of forest access roads can increase the likelihood of turtle collecting by increasing access to previously remote areas, and can lead to an increase in edge predators (COSEWIC 2007).

Off-road Vehicles

Use of off-road vehicles can have a significant effect on turtles. Such vehicles have struck and killed Wood Turtles (B. Steinberg pers. comm. 2008) and can destroy their nests (COSEWIC 2007, Greaves 2007).

1.7 Knowledge Gaps

Key knowledge gaps that should be filled to assist in the recovery of the Wood Turtle include:

- the number of extant populations in Ontario;
- estimates of population size and trends for most populations across Ontario;
- the spatial extent of most populations in Ontario;
- information on genetic variability among Wood Turtle populations in Ontario. Wood Turtles have been found to have extremely low variability in their mitochondrial DNA across their range (Amato et al. 2008). This may not be a conservation concern, as low levels of mitochondrial DNA variation have been found in a number of species of turtles. In contrast, relatively high genetic variability has been found in the six known Quebec populations through the use

of microsatellite markers (Tessier et al. 2005). The relative genetic uniqueness of each of the major populations in Ontario remains unknown.

1.8 Recovery Actions Completed or Under Way

Research and Monitoring

- A draft protocol has been prepared for conducting presence-absence surveys for Wood Turtles (L. Trute pers. comm.2008).
- Surveys have been occurring at two populations since the mid-1980s. Surveys at other populations began in the early 2000s. The level of detail for each population varies and is largely dependent on the availability of staff and funding.
- Research on the demography and habitat use of previously unstudied populations has been undertaken (e.g., Wesley 2006, Greaves 2007).
- Habitat characteristics of hibernation sites have been described (Greaves and Litzgus 2007, 2008).
- Federal departments have been conducting inventories of the Wood Turtle (and other species at risk) on lands within and adjacent to the known range of this species in Canada.

Regulation and Enforcement

- Draft Stand and Site Guide for protecting Wood Turtles and their habitat during forestry operations on Crown land has been prepared and is currently being used by forest management planning teams (OMNR in prep.). Protection includes prohibiting operations around nesting areas and hibernacula, and applying seasonal timing restrictions for forest harvesting and road use.
- Reduced speeds have been posted in areas within OMNR's jurisdiction where Wood Turtles are frequently encountered on or near roads. Whether the restrictions are being complied with, however, is unknown.
- The timing and location of road maintenance (e.g., grading, dust control) has been altered on roads near Wood Turtle populations, where the roads are within OMNR's jurisdiction.
- Educating enforcement officials (e.g., conservation officers, customs officers) continues at the local level. Some OMNR districts have created booklets, fact sheets and identification cards and provided them to enforcement and district staff to facilitate their identification of turtles and other species at risk.

Habitat and Population Management

- Active population management was initiated at one population in the spring of 2003. Population analysis suggested that the population would continue to decline without active intervention in the form of "head-starting" (Cameron and Brooks 2002). In this process, eggs were collected and incubated, and the hatchlings were reared and released once they weighed 250 grams. From 2005 to 2008, 44 head-started juveniles were released.
- Nest site creation or rehabilitation has been undertaken at a number of sites. At the site where head-starting is occurring, where the growth of invasive vegetation had degraded the habitat, enhancement of nesting habitat was undertaken in

1997. As a result, turtles used the enhanced habitat rather than the shoulder of the road. Additional nesting areas were created in 2007. Two nest sites were constructed at a site in northern Ontario in 2006, where Wood Turtles were nesting on a busy logging access road. Nest sites were also created at another location in 2004, again where Wood Turtles were nesting on a busy logging road. Generally, Wood Turtles readily use created nesting areas.

- The Nature Conservancy of Canada has acquired one parcel of land containing Wood Turtle habitat.
- Several areas where Wood Turtles live now fall within regulated provincial parks or other protected areas that resulted from OMNR's Ontario's Living Legacy parks and protected areas strategy.

Outreach and Education

- OMNR held a landowner appreciation event in 2007 at the site where head-starting is occurring. Landowners were educated about Wood Turtles and the status of the population.
- Several "turtle crossing" signs obtained from Turtle S.H.E.L.L. have been erected at locations where turtles, including Wood Turtles, are frequently encountered. These signs have also been placed near visitor centres to increase public awareness. As well, education of OMNR staff and members of the forest industry, who are the main users of these roads, is ongoing.

2.0 RECOVERY

2.1 Recovery Goal

The goal of this recovery strategy is to halt the decline of Wood Turtle populations in Ontario and to restore and maintain viable self-sustaining populations throughout their current provincial distribution.

2.2 Protection and Recovery Objectives

The objectives of this recovery strategy (table 2) focus on the four major issues that affect Wood Turtle survival: habitat, population viability, turtle mortality and illegal collecting.

Table 2. Protection and recovery objectives

No.	Protection or Recovery Objective
1.	Maintain the present range and distribution of Wood Turtles in Ontario
2.	Achieve and maintain minimum viable population levels of Wood Turtles throughout their current range in Ontario
3.	Reduce Wood Turtle mortality and human-related threats to the species
4.	Reduce illegal collection of Wood Turtles

2.3 Approaches to Recovery

Recovery approaches have been organized into four broad themes: research and monitoring, enforcement, habitat and population management, and outreach and education (table 3). The relative priority of the recovery approaches is classified as urgent, important or beneficial.

Table 3. Approaches to recovery of the Wood Turtle in Ontario

Relative Priority	Recovery Objective	Approach to Recovery	Threats or Knowledge Gaps Addressed
Research and Monitoring			
Urgent	1	Continue to update information about species range and distribution: – Finalize a standardized survey protocol – Conduct additional surveys following standardized survey protocols – Submit results to the NHIC and the recovery team – Apply data sensitivity policies regarding the confidentiality of site-specific locations	Knowledge gap: – Number of extant populations, spatial extent of populations
Important	1, 2	Develop and implement a long-term strategy to monitor population demographics: – Set objectives and protocols for monitoring population demographics (e.g., nesting activity and hatching success) and changes in habitat quality – Select the number and location of populations to monitor for population trends and demographics – Implement and assess the results of monitoring – Undertake detailed analysis of combined data sets on habitat, telemetry, behaviour, habitat impacts, etc.	Knowledge gap: – Population size and trends
Important	2	Determine the population status throughout Ontario: – Estimate the size of known populations using mark-recapture or other methods – Monitor for changes in egg and hatchling mortality	Knowledge gap: – Population size and trends
Beneficial	2	Conduct genetic profiling of known populations: – Set objectives and protocols for genetic research – Collect and analyze DNA samples from Wood Turtles across the province	Knowledge gap: – Genetic variability

Relative Priority	Recovery Objective	Approach to Recovery	Threats or Knowledge Gaps Addressed
Enforcement			
Important	3, 4	Educate enforcement officials: – Deliver presentations at enforcement workshops, stressing the magnitude of illegal trade in turtles, the potential high retail value of turtles and the ecological effect of poaching – Distribute species identification materials and passive integrated transponder (PIT) tag protocols to enforcement officers to facilitate enforcement	Threat: – Collecting
Important	4	Develop and maintain partnerships to reduce illegal trade: – Meet with representatives of the pet trade, conservation officers and other enforcement agencies outside Ontario to provide information on the threat of collecting and to share strategies for discouraging collecting – Develop a strategy for reducing illegal trade in Wood Turtles and other species at risk	Threat: – Collecting
Urgent	4	Increase enforcement activity: – Increase enforcement activity in areas with populations at greatest risk – Enforce a ban on off-road traffic in nesting areas of parks and protected areas, as applicable – Ensure compliance of forest operations in the vicinity of Wood Turtle areas of concern (AOCs)	Threat: – Collecting, use of off-road vehicles, habitat loss
Habitat and Population Management			
Urgent	1, 2	Secure protection of key habitats: – Secure protection through landowner agreements, conservation easements, land purchases, rezoning of park land, application of park policies for species at risk, etc. – Review and provide input to municipal/official plans, environmental impact studies, natural environment reports for aggregate extraction, etc.	Threat: – Habitat loss

Relative Priority	Recovery Objective	Approach to Recovery	Threats or Knowledge Gaps Addressed
Urgent	1, 2	Engage in effective forest management planning: – Apply appropriate AOC prescriptions in forest management plans – Apply data sensitivity policies regarding the confidentiality of site-specific locations	Threat: – Habitat loss, collecting, road networks, use of off-road vehicles
Urgent	1, 2	Enhance or create key habitats: – Identify and prioritize sites for habitat enhancement or creation – Rehabilitate nesting habitat to increase available habitat at highly vulnerable sites (e.g., roadsides) and/or where suitable nesting sites are limited – Increase buffers from agricultural lands	Threat: – Habitat loss, road networks
Urgent	1, 2	Implement a head-starting program: – Update protocols for head-starting as new information becomes available – Undertake a head-starting program at sites where the turtle population is known to be declining; collect and incubate eggs and raise hatchlings to an appropriate size before releasing them – Monitor released hatchlings with appropriate technology – Collect and analyze all dead hatchlings to determine the cause of death	Threat: – Collecting
Important	2	Reduce nest predation: – Take action to reduce nest predation (e.g., nest protection) at sites, as required	Threat: – Subsidized predators
Urgent	2	Mitigate road mortality: – Apply site-specific mitigation measures (e.g., signage, fences, artificial nesting sites, seasonal road closures, rerouting of trails) to priority sites as identified by the recovery team – Provide input to road planning processes (i.e., Ministry of Transportation, forest access, municipal, etc.)	Threat: – Road networks
Outreach and Education			
Urgent	3	Educate landowners: – Continue outreach to landowners regarding the needs of Wood Turtles – Encourage landowners to watch for and report poachers – Prepare and distribute land stewardship documents to landowners	Threat: – Habitat loss, collecting

Relative Priority	Recovery Objective	Approach to Recovery	Threats or Knowledge Gaps Addressed
Urgent	3	Educate land managers and land management agencies: – Provide information to OMNR staff, Sustainable Forest Licence (SFL) staff, municipal planning staff, conservation authorities and managers of federal lands on the application of relevant legislation, policy and guidelines, and habitat protection/ mitigation measures – Provide input into management plans to protect habitat in parks and protected areas	Threat: – Habitat loss, subsidized predators, collecting, road networks, use of off-road vehicles
Important	1, 2, 3	Erect road signs to caution or warn drivers (e.g., “Give Wildlife a Brake,” “Turtle Crossing”): – Erect signs in areas where off-road or road mortality is known to or could occur – directly address the threat of ATV use through ATV dealers, magazines and clubs	Threat: – Road networks – Use of off-road vehicles
Important	3	Educate the general public: – Include information in natural heritage programs on the legal protection of wildlife and prohibitions against its removal – Provide education sessions to the general public (e.g., to schools, naturalist groups) through presentations, while maintaining strict confidentiality regarding data – Issue annual press releases on spring movements of turtles, stressing that many of these are females searching for nest sites – Distribute flyers/posters on penalties for illegal possession of specially protected reptiles to pet stores that carry reptiles – Include the Wood Turtle on brochures, posters and other species at risk educational material	Threat: – Collecting, road networks, use of off-road vehicles

Relative Priority	Recovery Objective	Approach to Recovery	Threats or Knowledge Gaps Addressed
Urgent	3	Enhance professional communication and partnerships: – Maintain strong communications within the recovery team – Maintain communication with people involved in Wood Turtle recovery activities in other provinces (Quebec, New Brunswick, Nova Scotia) and the United States – Exchange information with other turtle head-starting projects – Build and maintain communication and partnerships within and between agencies, university researchers, and non-governmental organizations	

2.4 Performance Measures

Because Wood Turtles grow slowly and mature late, recovery of populations is expected to be a slow process. In addition, measurement of adult population size and evidence of successful recruitment are difficult to obtain. Significant changes in reproductive success may go undetected unless monitoring is sufficiently intensive to measure reproductive rates and age structure. Therefore, long-term, consistent and carefully planned monitoring, as well as adherence to the precautionary principle, are essential to the success of the recovery strategy.

Evaluating Achievement of Recovery Objectives

Recovery results should be evaluated against objectives at five-year intervals, as follows:

Objective 1 Maintain the present range and distribution of Wood Turtles in Ontario:

Measure the number and distribution of identified populations still extant at five-year intervals.

Objective 2 Achieve and maintain minimum viable population levels of Wood Turtles throughout their current range in Ontario:

Monitor changes in nesting activity and hatching success at selected populations representing the range of habitat types and distribution of Wood Turtles in Ontario. This information provides an indication of the size and health of adult populations. Long-term monitoring of nesting locations, combined with marking of adult females, will show whether recruitment into the adult age class is occurring. The population where head-starting is occurring should be included to determine whether head-starting has been successful.

Objective 3 Reduce Wood Turtle mortality and human-related threats to the species:

Monitor population sizes at five-year intervals to ensure that populations are not declining.

Objective 4 Reduce illegal collection of Wood Turtles:

Monitor for any evidence of collecting events or trade in Wood Turtles in Ontario.

Evaluating Achievement of the Recovery Goal

Progress toward the recovery goal should be evaluated at five-year intervals. Recovery success should be measured on the basis of changes in distribution, abundance and population viability. It is expected that beneficial changes will not be detected for several years.

2.5 Area for Consideration in Developing a Habitat Regulation

Under the ESA 2007, a recovery strategy must include a recommendation to the Minister of Natural Resources on the area that should be considered in developing a habitat regulation. A habitat regulation is a legal instrument that prescribes an area that will be protected as the habitat of the species. The recommendation provided below by the author will be one of many sources considered by the Minister when developing the habitat regulation for this species.

The recovery team recommends that the habitat regulation prescribe as habitat the areas on the habitat range map (figure 2) where Wood Turtles are found, known to occur or known to have occurred, and include the following features: riverine corridor, hibernation sites, nesting sites and upland habitat adjacent to the riverine corridor (see section 1.4 for a description of these features). To identify and quantify the spatial extent of the habitat on a regional or local scale, it is recommended that the mapping methodology described below be used.

Figure 2. Areas of Ontario in which regulation of habitat is recommended

<u>Recommended Mapping Methodology</u>

The following steps are to be repeated for each population/occurrence. For populations/occurrences about which information is limited or lacking, it is recommended that information regarding the spatial extent of occurrences be collected prior to the delineation of habitat, pursuant to the regulation.

Step 1 – Identify and locate all observation records for a given population/occurrence.

Step 2 – Determine the known length of the stream used by Wood Turtles on the basis of the two most distant observation locations along the stream.

Step 3 – Identify an area perpendicular to the occupied stream length. In forested landscapes, Wood Turtles have been documented to move up to 600 metres from water (see section 1.4 for details). Therefore, it is recommended that on forested landscapes a minimum of 500 metres be regulated to protect Wood Turtle habitat. In landscapes significantly altered by human activity, such as agriculture, typically less natural habitat occurs adjacent to streams, and in such landscapes a 500 metre zone would include working farmland. Therefore, it is recommended that the regulated habitat be reduced to a minimum 200 metres in such landscapes. The regulated habitat should extend a minimum of 500 metres (or 200 m) on either side of the stream between the two peripheral records measured from the high water mark.

Wood Turtles can make long-distance movements along streams, and stream characteristics can change over time. Therefore, it is essential that a sufficient length of stream be regulated to adequately protect the population. The known occupied habitat is probably less than the complete habitat Wood Turtles use, so it is recommended that the regulated habitat be extended beyond the known occupied stream length. Within forested landscapes, and when the occupied stream reach is well known from intensive research, it is recommended that the regulated habitat be extended 3,000 metres (one half the typical range length of a Wood Turtle) beyond the known occupied stream in each direction. In the case of populations for which knowledge about the occupied stream length is poor, it is recommended that the regulated habitat be extended up to 6,000 metres in each direction, where habitat exists.

Wood Turtles in agricultural landscapes in southern Ontario typically make shorter movements and have smaller home ranges. Under these conditions, it is recommended that the regulated habitat be extended up to 2,000 metres beyond the known occupied stream length in each direction, where habitat exists.

Step 4 – The habitat regulation should prescribe as habitat an area of 500 metres (or 200 metres in landscapes significantly altered by human activity, such as agriculture, in southern Ontario) around all oxbow lakes/ponds, wetlands, ephemeral ponds and occupied tributaries that are connected or adjacent to the main river or stream.

Step 5 – The habitat regulation should prescribe as habitat an area of 300 metres around all known or potential nesting sites if they occur outside of the otherwise regulated habitat.

Step 6 – The habitat regulation should prescribe as habitat an area of 300 metres around all known hibernation sites if they occur outside of the otherwise regulated habitat.

GLOSSARY

Committee on the Status of Endangered Wildlife in Canada (COSEWIC): The committee responsible for assessing and classifying species at risk in Canada.

Committee on the Status of Species at Risk in Ontario (COSSARO): The committee established under section 3 of the *Endangered Species Act, 2007* that is responsible for assessing and classifying species at risk in Ontario.

Conservation status rank: A rank assigned to a species or ecological community that primarily conveys the degree of rarity of the species or community at the global (G), national (N) or subnational (S) level. These ranks, termed G-rank, N-rank and S-rank, are not legal designations. The conservation status of a species or ecosystem is designated by a number from 1 to 5, preceded by the letter G, N or S reflecting the appropriate geographic scale of the assessment. The numbers mean the following:

1 = critically imperilled
2 = imperilled
3 = vulnerable
4 = apparently secure
5 = secure

Endangered Species Act, 2007 (ESA 2007): The provincial legislation that provides protection to species at risk in Ontario.

Species at Risk Act (SARA): The federal legislation that provides protection to species at risk in Canada. This act establishes Schedule 1 as the legal list of wildlife species at risk to which the SARA provisions apply. Schedules 2 and 3 contain lists of species that at the time the act came into force needed to be reassessed. After species on Schedule 2 and 3 are reassessed and found to be at risk, they undergo the SARA listing process to be included in Schedule 1.

Species at Risk in Ontario (SARO) List: The regulation made under section 7 of the *Endangered Species Act, 2007* that provides the official status classification of species at risk in Ontario. This list was first published in 2004 as a policy and became a regulation in 2008.

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RECOVERY STRATEGY DEVELOPMENT TEAM MEMBERS

NAME	AFFILIATION
Jim Trottier (co-chair)	Ontario Ministry of Natural Resources (OMNR)
Lauren Trute (co-chair)	OMNR
Karine Beriault	OMNR
Ron Brooks	University of Guelph
Daryl Coulson	OMNR
Mike Elioff	Ontario Turtle and Tortoise Society
Scott Gillingwater	Upper Thames River Conservation Authority
Jeff Hathaway	Sciensational Sssnakes!!
Kathy Irwin	OMNR
Bob Knudsen	OMNR
Tom Lobb	Huron Fringe Field-Naturalists
Mike Malhiot	OMNR
Chris Risley	OMNR
Brad Steinberg	OMNR
Technical Advisors	
Kim Barrett (Smith)	Conservation Halton
Joe Cebek	Trent University
Mike Hall	OMNR
Jeremy Inglis	OMNR
Kara Vlasman	Parks Canada