

# MASSACHUSETTS FORESTRY CONSERVATION MANAGEMENT PRACTICES FOR SPOTTED TURTLES

Version 2007.1



*Prepared by*

**Leslie Bol and the Natural Heritage and Endangered Species Program,  
Division of Fisheries and Wildlife**

*In collaboration with*

**Division of Water Supply Protection and Bureau of Forestry,  
Department of Conservation and Recreation**

**Forestry Program,  
Division of Fisheries and Wildlife**

**Natural Resources and Environmental Conservation Extension Program,  
University of Massachusetts Amherst**

For further information regarding this document contact Jacob E. Kubel  
[jacob.kubel@state.ma.us](mailto:jacob.kubel@state.ma.us), 508-389-6373

This publication was produced by the Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries and Wildlife. Development of the conservation management practices (CMPs) provided herein was based on an interdisciplinary approach coordinated by the CMP Working Group. The CMP Working Group has approved official implementation of these practices following a public meeting on 13 April 2006 and a formal comment period that ended 28 April 2006.

CMPs are meant to serve as guidelines for landowners and consulting foresters to aid in development of M.G.L. Chapter 132 Forest Cutting Plans that are compliant with provisions of the Massachusetts Endangered Species Act (MESA) (M.G.L. 131A) and its implementing regulations (321 CMR 10.00). In some cases, actual practices required for compliance with MESA may differ from published CMPs. Adherence to CMPs during forestry projects shall not necessarily constitute compliance with other state laws, or with local and federal laws.

### **Current CMP Working Group**

#### Division of Fisheries and Wildlife

##### *Natural Heritage and Endangered Species Program:*

Sarah A. Haggerty  
Jacob E. Kubel  
Henry Woolsey

##### *Forestry Program:*

John Scanlon

#### Department of Conservation and Recreation

##### *Bureau of Forestry:*

Jim DiMaio  
Laura Dooley  
Michael Downey  
Jennifer Fish  
Richard A. Johnson  
Kris Massini  
James Rassman  
Jim Soper  
Alison Wright

##### *Division of Water Supply Protection:*

Greg Buzzell  
Dan Clark  
Herm Eck

#### University of Massachusetts Amherst

##### *Natural Resources and Environmental Conservation Extension Program:*

Scott Jackson

### **Citation**

Please cite this publication as:

Natural Heritage and Endangered Species Program. 2007. Massachusetts Forestry Conservation Management Practices for Spotted Turtles. Version 2007.1. Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife, Westborough, Massachusetts, USA.

**TABLE OF CONTENTS**

SUMMARY ..... 4  
    The Role of Forestry in the Conservation of Spotted Turtles..... 4

CONDENSED VERSION OF THE FORESTRY CONSERVATION MANAGEMENT PRACTICES  
FOR SPOTTED TURTLES ..... 5

SPECIES BIOLOGY ..... 7  
    Species Identification ..... 7  
    Life Span and Time to Maturity ..... 8  
    Similar Species in Massachusetts ..... 8  
    Spotted Turtle Range ..... 8  
    Spotted Turtle Movements and Home Range..... 9  
    Life History of the Spotted Turtle ..... 11

SPOTTED TURTLE CONSERVATION CONCERNS ..... 13  
    Status Across Range ..... 13  
    Turtle Population Biology ..... 14  
    Activities that Impact Spotted Turtle Populations..... 14

SPOTTED TURTLE FORESTRY CONSERVATION MANAGEMENT PRACTICES ..... 16  
    Preventing Turtle Mortality ..... 16  
    Maintaining Vernal Pool Habitat Integrity ..... 17

SELECTED REFERENCES ..... 19

FIGURE AND DATA CREDITS ..... 20

PHOTO CREDITS ..... 20

APPENDIX ..... 21

## **SUMMARY**

The Spotted Turtle is a small turtle recognizable by its smooth dark shell that is spotted with yellow dots. Spotted Turtles require both aquatic and terrestrial habitat to complete their life cycle. Overwintering sites are located in wetlands where Spotted Turtles hibernate singly or in groups. Vernal pools are used in the spring for foraging and mating. During the summer, upland forest is used for estivation, a period of dormancy or reduced activity. During a single activity season, a Spotted Turtle may use a variety of different wetlands and overland movements can be extensive between different habitats.

The primary concern about forestry practices within Spotted Turtle habitat is direct mortality of adults due to crushing by mechanized equipment. Habitat modification surrounding vernal pools and structural alteration of wetland overwintering sites are also concerns. To avoid direct mortality, it is required that access to the harvesting site with motorized vehicles be restricted to when the Spotted Turtle is inactive during the winter. Accordingly, seasonal restrictions will apply to Spotted Turtle Priority Habitat. Seasonal distance restrictions will apply in upland habitat up to 300 feet from wetlands, including vernal pools. In order to maintain vernal pool habitat, retaining >75% canopy cover within 100 feet of vernal pools and >50% canopy cover from 100 to 200 feet from vernal pools is required. In order to maintain the structural integrity of overwintering sites, wetland harvesting by hand-felling is required and crossing wetlands with standing water must be done with temporary bridges or only occur under completely frozen conditions. New landings and skid roads must be located as far away as possible and at least 100 feet from vernal pools and wetlands.

### **The Role of Forestry in the Conservation of Spotted Turtles**

Maintaining forested land in forest use is vital to conserving viable populations of Spotted Turtles. In addition, timber harvesting is often essential for private forestlands to remain economically viable, and if public and private forestlands are to supply renewable wood products to sustain local economies. However, forest managers need to recognize that harvesting can potentially result in direct mortality to individual turtles, and should look to conserve Spotted Turtles and other rare species proactively, in order to maintain the integrity of forest ecosystems.

**CONDENSED VERSION OF THE  
FORESTRY CONSERVATION MANAGEMENT PRACTICES  
FOR SPOTTED TURTLES**

For the full version of the forestry conservation management practices including the management objectives and the rationale supporting them, see page 15.

**Species Identification and Biology** - The Spotted Turtle is a small turtle that is recognized by its smooth dark shell and yellow dots. It spends winters in wetlands. During the active season from March until November, it uses a variety of wetlands, including vernal pools, and terrestrial habitat that can be hundreds of feet from its overwintering site. These turtles start reproducing at 7 to 10 years old and adults can live at least 30 years.

**Forestry Practices** - These management practices are based on the recognition that turtle conservation requires minimizing all sources of adult mortality. Spotted Turtles specifically require maintenance of vernal pool and wetland habitats associated with forested areas. These recommendations are based upon an assumption that motorized timber harvest equipment would only enter the habitat once per decade.

**R** – required management practice

**G** – guideline or recommended management practice

- 
- R** No motorized vehicle shall be used within wetlands.
  - R** No harvesting shall occur in either Certified vernal pools or vernal pools that would meet certification requirements.
  - R** For harvesting within wetlands that is consistent with the Massachusetts Forestry Best Management Practices, the trees that will be harvested shall be marked prior to cutting plan approval and harvesting.
  - R** Wetlands shall be temporarily bridged or crossed only when frozen solid. This will help prevent substrate compression and direct mortality of turtles that are overwintering in the wetland.
  - R** Wetland harvesting shall be done by hand-felling and removing trees by winching so that no motorized vehicles enter the wetland. This will prevent any direct mortality of turtles that are overwintering in the wetland as well as maintain the structural integrity of the habitat.
  - R** New landings and skid roads shall be located at least 100 feet and farther away if possible, from wetlands, including both Certified and uncertified vernal pools.
  - R** Motorized vehicle use, consistent with the Massachusetts Forestry Best Management Practices, may occur between 0 and 300 feet from the edge of wetlands, including either Certified or uncertified vernal pools only between November 1<sup>st</sup> and March 15<sup>th</sup> (Table 4). All motorized vehicles shall be excluded from these areas between March 16<sup>th</sup> and October 31<sup>st</sup>.

Distance from wetland edge, including vernal pools (feet)	Time period when harvesting can occur
0 – 300	Nov. 1 – March 15 <sup>th</sup>
300+	No restriction

**Table 1.** Recommendations for motorized vehicle use for timber harvest activities according to straight-line distance from wetlands, including vernal pools.

- R** If harvesting will occur between March 16<sup>th</sup> and October 31<sup>st</sup>, the boundary of the 300-foot management area from the edge of wetlands, including either Certified or uncertified vernal pools shall be clearly identified by flagging or marking prior to cutting plan approval and harvesting.
- R** 0 – 100 feet from Certified and uncertified vernal pool high water mark: Retain ≥ 75% canopy cover  
100 – 200 feet from Certified and uncertified vernal pool high water mark: Retain ≥ 50% canopy cover  
(see attached table in Appendix 1 for basal area equivalencies)
- R** If harvesting will occur within 200 feet of vernal pools then the boundary of the 100 and 200-foot management areas from the vernal pool shall be clearly identified by flagging or marking prior to cutting plan approval and harvesting. The trees that will be harvested within these two management areas shall be marked prior to cutting plan approval and harvesting.
- G** Leave limbs and tops in the forest, consistent with other laws, regulations, and forestry best management practices, in order to provide cover areas with cooler microclimates.

## SPECIES BIOLOGY

### SPOTTED TURTLE: The yellow polka-dot turtle found in and near wetland complexes

#### Species Identification

<b>Spotted Turtle Biology Quick Reference Chart</b>	
<b>Adult size (carapace length):</b> 3 ½ – 4½ in (9-12cm)	
<b>Size at sexual maturity:</b> 3 ¼ inches (8 cm)	
<b>Number of years to reach sexual maturity:</b> 7 - 10	
<b>Clutch size:</b> 1 - 8 eggs	
<b>Hatchling size:</b> 1⅛ inches (2.8 cm)	
<b>Annual adult survival rate:</b> 95%	
<b>Life span:</b> at least 30 years	
<b>Coloration of shell and skin:</b> shell black with yellow spots; skin gray to black with yellow spots on the upper neck and limbs; and orange, pink or salmon-red on the lower surface of limbs	<b>Shell characteristics:</b> smooth upper shell, lower shell not hinged

The Spotted Turtle is a small black turtle with yellow spots. The upper shell (carapace) is smooth. The lower shell (plastron) is yellow to yellow-orange with large black blotches on each scute (scale). In older individuals, the entire plastron may be black. The skin is usually gray to black with yellow spots on the upper neck and limbs. The skin on the lower surface of the limbs can have an orange, pink or salmon-red coloration.

Males and females can be distinguished by looking at a number of different characteristics. Males have brown eyes, while females have orange eyes. Males have slightly concave plastrons, while females have flat or convex plastrons. The tails of males are thicker and the vent (the common orifice through which the contents of the digestive, reproductive and urinary systems are discharged) on the tail in males is located beyond the edge of the carapace. Hatchlings typically have one spot per scute, the head is always spotted, and the tail is longer relative to the body size, compared to adult Spotted Turtles.



**Figure 1.** Spotted turtles can be recognized by their smooth dark shell dotted by yellow spots. The spots on this old female not as obvious as on younger individuals.

## **Life Span and Time to Maturity**

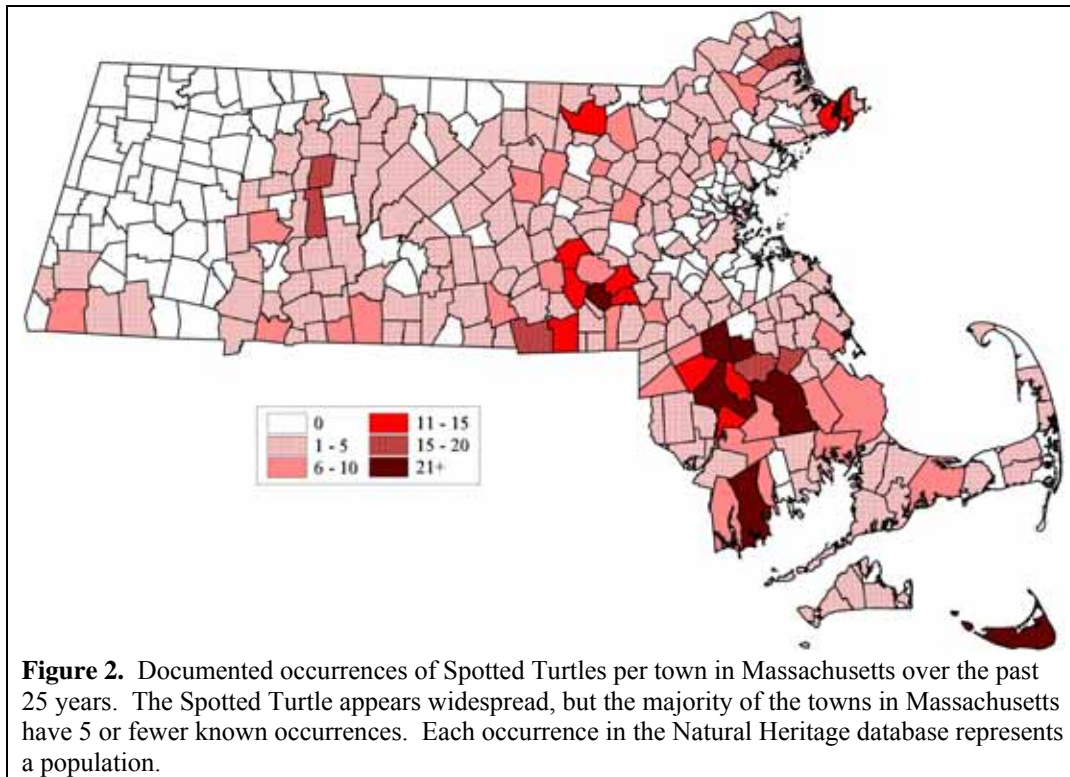
The approximate age of Spotted Turtles can be determined by counting the number of growth rings on the scutes of the plastron. These rings are laid down annually. On older individuals, this method becomes very speculative because of slowed growth and scute wear. Most Spotted Turtles begin to reproduce between the ages of 7 and 10 years. Sexual maturity for Spotted Turtle occurs at a carapace length of approximately 3 ¼ inches. Spotted Turtles living in the wild have been known to survive at least 30 years.

## **Similar Species in Massachusetts**

The only turtle species that might be confused with the Spotted Turtle in Massachusetts are the Blanding's Turtle, Bog Turtle, and Painted Turtle. The Blanding's Turtle is similar in that it also has yellow markings on its shell. However, these markings are not dots like the Spotted Turtle but rather flecks of color. Blanding's Turtles are also larger than Spotted Turtles and their shells have a more domed shape. The plastron of the Blanding's Turtle is hinged and the Spotted Turtle's is not. Blanding's Turtles also have a distinct yellow throat and neck. Older Spotted Turtles that have become darker in coloration and no longer have distinct yellow spots could potentially be confused with Bog Turtles or Painted Turtles. Bog Turtles have a slight ridge along the center of their upper shells and orange patches on either side of their heads, distinguishing them from Spotted Turtles. Painted Turtles have red markings along their sides where their carapace and plastron meet and yellow strips on their heads, distinguishing them from Spotted Turtles.

## **Spotted Turtle Range**

Although there are some populations of Spotted Turtles in southern Ontario and Quebec, the continuous range begins in the extreme southwestern corner of Maine and extends southward along the Atlantic coastal plain and Piedmont to northern Florida. The range extends towards the west through New York, Pennsylvania, central Ohio, northern Indiana and southern Michigan to a small portion of northeastern Illinois. The known occurrence of Spotted Turtles in Massachusetts is shown in Fig. 2. Although the number of sightings of Spotted Turtles has increased in the State since it was first listed, it should be kept in mind that little is known about the status of local populations associated with the majority of these sightings.



### Spotted Turtle Movements and Home Range

Spotted Turtles may use multiple wetlands over the course of their activity season and they are often found within wetland complexes. Overland movements are often made initially in the spring when Spotted Turtles leave the wetland where they overwintered to move to foraging and mating habitats. These habitats are usually in wetlands or vernal pools. Females will leave the mating habitat in order to find nesting sites. Once vernal pools dry up, then Spotted Turtles will move to a different wetland or they may estivate in terrestrial upland habitat before moving back to their wetland overwintering site in the fall. Spotted Turtles will move up to thousands of feet between these different habitats (Table 1). A study in Maine found that average overland movements covered 2600 feet over the course of an activity season and the maximum overland distance traveled was 5500 feet (Joyal et al., 2001).

Individual Spotted Turtles can use an area of land up to several hundred acres in size (Table 2). The amount of land needed to maintain a local population is even greater. Many of the documented sightings of Spotted Turtles in the NHESP database are of five or fewer individuals per town. However, these individuals are part of a local population that will use a larger area than what is required by a single turtle.

Location	Straight-line distance moved from permanent wetland (feet)								# Turtles	# Seasons	Source	
	Different Wetland		Nesting		Estivation		Maximum					
	Avg	Max	Avg	Max	Avg	Max	Avg	Max				
Connecticut				869		541				8	3	Perillo, 1997
Maine	1020	3772	810	1869	121	262				12-33	2	Joyal et al., 2001
Massachusetts*	394							1450		16	2	Graham, 1995
Massachusetts							432	2850		11	2	VHB/Vanassee Hangen Brustlin, Inc., 2000
Massachusetts			816	1023	584	1351	869	3362		26	3	Milam and Melvin, 2001

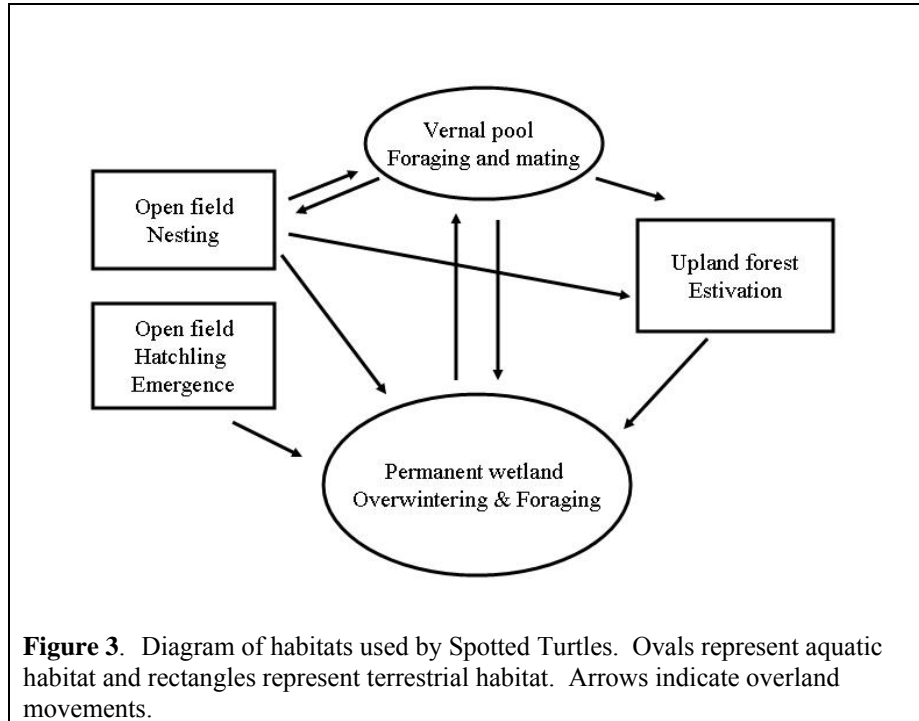
\* Distances traveled were not studied specifically

**Table 2.** Straight-line distances moved by Spotted Turtles away from permanent wetlands.

State	Average (acres)		Maximum (acres)		#	#	Source
	Males	Females	Males	Females	Turtles	Seasons	
Massachusetts	2	1			3	1	Graham, 1995
Massachusetts	4	2			11	2	VHB/Vanasse Hangen Brustlin, Inc., unpub. data
Massachusetts	5	4			17	1	Parsons, pers. comm.
Massachusetts	3	4			12	1	Parsons, pers. comm.
Massachusetts	5	11	14	85	26	3	Milam and Melvin, 2001
Ontario	5	12			15	1	Haxton and Berrill, 1999
South Carolina	12	40	183	237	31	3	Litzgus and Mousseau, 2004
Massachusetts	35	9	191	34	25	5	Tetra Tech NUS, Inc., 2005

**Table 3.** Summary of annual Spotted Turtle home range sizes.

## Life History of the Spotted Turtle



<b>Life History Quick Reference Chart</b>		
<b>WHAT</b>	<b>WHERE</b>	<b>WHEN</b>
Overwintering	Aquatic habitat: sphagnum hummocks, tree root complexes and submerged rocks in forested and scrub-shrub swamps, marshes, bogs and vernal pools	Late fall to early spring: November to mid-March
Spring activity	Aquatic habitat: vernal pools or saturated wetlands	Early spring: mid-March to early April
Terrestrial habitat use	Terrestrial habitat: deciduous forest, coniferous forest, mixed forests, fields	March to November – overland travel occurs throughout activity season, terrestrial estivation occurs from June to September
Courtship and mating	Aquatic habitat: vernal pools or saturated wetlands	April to June
Nesting and hatchling emergence	Terrestrial habitat: open areas with sandy/loamy soils, grass tussocks, sphagnum hummocks	Nesting – June Hatchling emergence – August to October or the following spring
Foraging	Aquatic habitat: vernal pools, marshes, ponds, bogs, streams, emergent wetlands, scrub-shrub wetlands, forested wetlands	March to November

## Overwintering

Spotted Turtles overwinter in a variety of wetland types. They will use wetlands ranging from forested swamps to emergent wetlands and wet meadows. Hibernacula have been found in marshes or swamps with red maple, alder, highbush blueberry and sphagnum moss. Overwintering Spotted Turtles will use sphagnum hummocks, pockets and passageways in submerged tree or shrub roots, and rocks. They can be found in as little as 4-10 inches of water and they will burrow into mud 5-10 inches deep. Some overwintering sites are in wetlands that have a slight current. They are known to return to the same site on an annual basis and overwintering sites are considered a limiting resource on the landscape. Some populations congregate at overwintering sites and hibernate communally.

## Spring Activity

Upon emergence from hibernation, Spotted Turtles often move overland to vernal pools where they forage and may mate. Females will remain in wetland or vernal pool habitat until they begin nesting. All other Spotted Turtles may remain in a vernal pool until it dries up, at which point they will move to a different vernal pool or wetland or begin estivation, a period of dormancy or reduced activity during the summer.

## Terrestrial Habitat Use

Terrestrial habitat use can occur anytime during the Spotted Turtle activity season when individuals move between different types of habitat. The months when Spotted Turtles are known to spend extended periods of time in terrestrial habitats are from June to September. It is during these months that females nest and estivate in upland forest or along forest/field edges. At night and during periods of hot weather, Spotted Turtles retreat to “forms”. These small terrestrial shelters are found beneath leaf litter, in the grass, under logs or brush. They are called forms because when the turtle leaves them, they retain the shape of the turtle’s shell. In the late fall, hatchlings emerge from their nest sites and move overland towards the aquatic habitat. A study of Spotted Turtles in Massachusetts found that turtles spent an average of 37 days a year in upland forest or forest/field edges at an average distance of 583 feet from a permanent wetland (Tables 2 and 4; Milam and Melvin, 2001). Spotted Turtles have been known to spend up to 93 days within terrestrial habitat and have been found to spend more time in terrestrial habitats during dry years. A study of radio-tagged Spotted Turtles in Maine found that individuals spent up to 74% of their time in uplands during their active season (Joyal et al., 2001).

Location	# Days in Terrestrial Habitat		
	Avg	Range	Source
Massachusetts	n/a	4 - 14	Graham, 1995
Connecticut	n/a	7 - 70	Perillo, 1997
Maine	n/a	15 - 89	Joyal et al., 2001
Massachusetts	37	2 - 93	Milam and Melvin, 2001

**Table 4.** Number of days spent estivating within terrestrial habitat.

## Reproduction - Courtship, mating, nesting and hatchling emergence

Courtship and mating occur in the spring. Courtship may begin at the margins of vernal pools and wetlands, but actual copulation occurs in the water. Nesting occurs in June in open areas such as upland fields with well-drained loamy or sandy soils. Females will travel hundreds of feet to find appropriate nesting habitat (Table 1). Spotted Turtles have temperature-dependent sex determination. At cooler incubation temperatures,

males are produced, while at warmer incubation temperatures females are produced. Hatchlings emerge in the late summer or fall, or may overwinter in the nest and emerge the following spring.

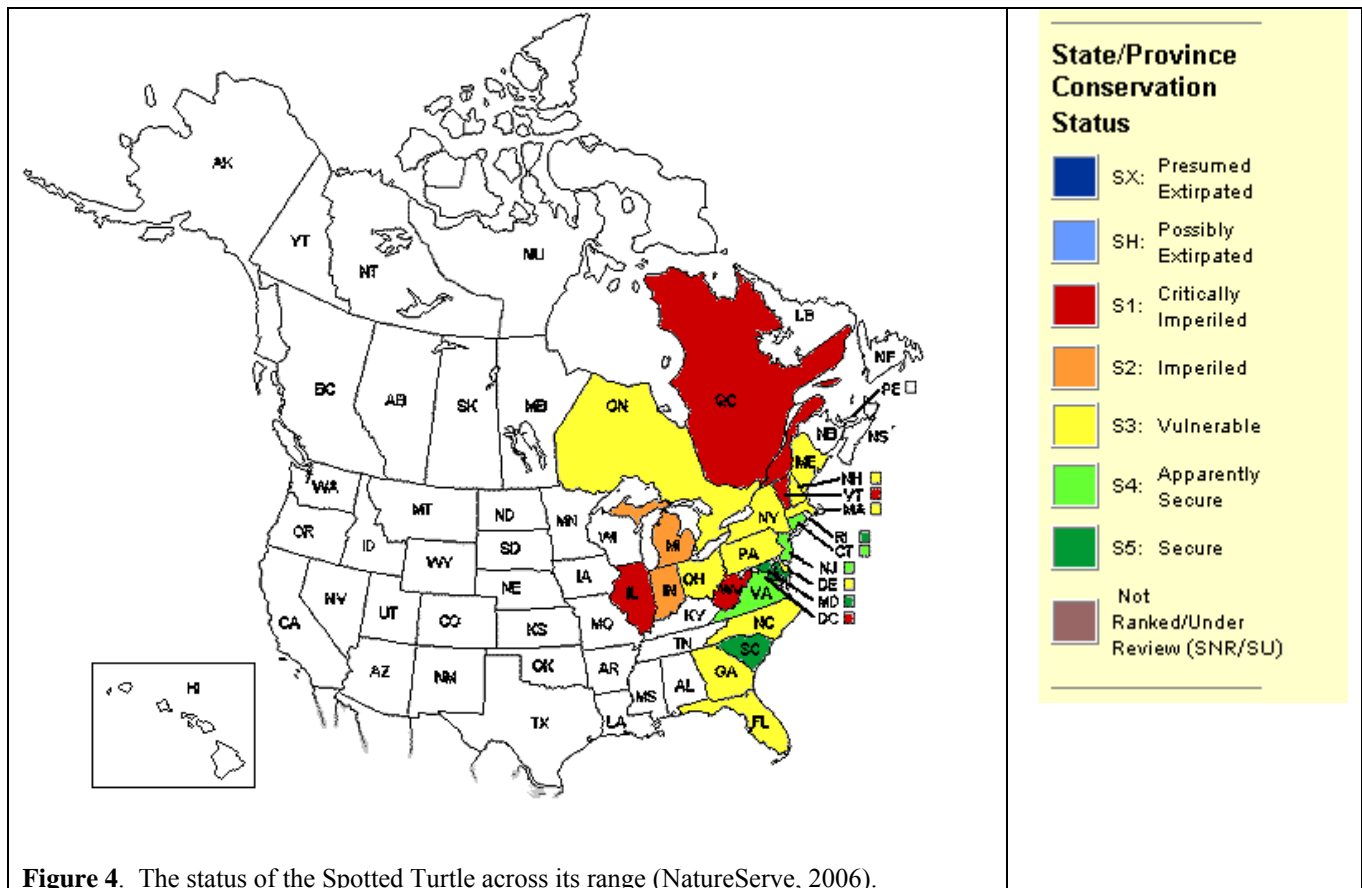
## Foraging

Spotted Turtles are omnivores, eating both plant and animal matter. They primarily eat while in the water, unlike other turtle species such as the Wood Turtle which eats both on land and in the water. The plants that Spotted Turtles consume are aquatic grasses and filamentous green algae. The animal matter that is eaten, either alive or as carrion, includes aquatic insect larvae, small crustaceans, snails, the tadpoles of frogs and toads, mole salamanders, and fish. Vernal pools are an important source of many of these prey items.

## SPOTTED TURTLE CONSERVATION CONCERNS

### Status Across Range

The Spotted Turtle is not currently listed as an Endangered species at the federal level in the United States. In Canada, it is federally listed as Endangered. At the state level in the United States, it is listed as Endangered in Vermont, Indiana, and Illinois, and critically imperiled in West Virginia. In Maine, Michigan, South Carolina, and Ohio, it is listed as Threatened. In New York, it is a species of Special Concern. The Spotted Turtle is listed in Massachusetts as a Species of Special Concern. It was originally added to the Massachusetts rare species list because of a lack of documented occurrences. Although the number of records in the state has increased since it was initially listed, it continues to remain a species of concern for the reasons outlined below.



## **Turtle Population Biology**

Turtle fossils date back over 200 million years to the Late Triassic period. Over time, turtles have evolved a reproductive strategy that makes them vulnerable to human disturbances. Hatchling survival from nests and juvenile survival is very low while the time to sexual maturity is long. These characteristics are compensated by adults being long-lived and reproducing multiple times. Increases in population size tend to take a long time and the potential time to recover from a population decline is also long.

The classic story of the tortoise and the hare is a useful comparison to think of when considering the reproductive strategies of turtles as compared to many mammal species. In the same way that the movement of the individual animals differs, so does the amount of time needed to reach sexual maturity. Hares can start reproducing within a year of being born, while many turtle species take a decade to become a reproductive adult. Therefore, the potential to increase the size of a mammal population such as the hare occurs over a much shorter time frame than for turtles. Similarly, recovery from a population decline can occur much faster for a mammal than for a turtle.

The chances for a long life are much better for the turtle than for the hare. The slow and steady adult turtle lives a much longer life. A long life together with multiple years of reproduction compensates for low rates of hatchling and juvenile survival in turtles. However, this reproductive strategy that has evolved in turtles makes them exceptionally vulnerable to any disturbances that increase the rate of adult mortality. The survival of adult turtles on an annual basis is typically greater than 95%. Long-term studies of turtle populations as well as models of population dynamics indicate that increased mortality rates of adults that are as low as 2-3% annually may be enough to lead to the ultimate loss of a local population.

## **Activities that Impact Spotted Turtle Populations**

Habitat destruction, degradation or alteration, and fragmentation all threaten Spotted Turtle populations. Turtles are also particularly vulnerable to any activity that consistently reduces adult survivorship on a yearly basis. For example, populations in which adults cross roads in order to access habitats needed for completion of their life cycle are at a higher risk of extirpation because of road kills. The specific activities outlined below are concerns for many turtle species as well as for Spotted Turtles specifically.

### **Commercial and casual collection**

Collection for the domestic and international pet trade, as well as for home pets, has contributed to the decline and extirpation of Spotted Turtle populations. The Spotted Turtle and the closely related Bog Turtle, Wood Turtle and Western Pond Turtle have been popular species for the pet trade. It has been estimated that close to 5,000 turtles of these four species were exported from the United States between 1989 and mid-1994 (Burke et al., 2000).

Illegal collection and sale of Spotted Turtles has been discovered in a number of states. In Vermont, illegally collected turtles were confiscated by the Department of Fish and Game in 2003, including Spotted Turtles. Similarly in Michigan, 14 people involved in illegal reptile trade including Spotted Turtles were charged and fined.

### **Roadkill**

Mortality of turtles because of road kill is a concern for all North American turtle species. Of particular concern is that many of the individuals moving across roads and being killed are female turtles looking for nesting habitat. Highways with high traffic volumes become impenetrable barriers that isolate turtle populations and prevent dispersing individuals from maintaining genetic diversity across populations. Even smaller roads with moderate traffic volumes can cause enough mortality to cause a population to decline.

A modeling study that investigated the effects of road density and traffic volumes on turtles found that for semi-terrestrial turtles such as the Spotted Turtle, roads could contribute enough to annual adult mortality that positive population growth could not be maintained. Mortality rates greater than 5% were determined to cause decline in the size of local turtle populations based on previous long-term studies of various turtle species (Gibbs & Shriver, 2002).

In Massachusetts, increased mortality rates because of road kill is certainly a concern and has been documented. Close to 11% of the records in the Massachusetts Spotted Turtle database are based on observations of dead turtles killed on roads.

## **Predation**

In recent decades, raccoon and skunk populations have benefited from the availability of additional food sources such as garbage, bird seed and food for pets, provided by humans in commercial and residential areas. These mammals are efficient turtle nest predators. For turtle populations that border on areas developed for residential use, besides the direct loss of habitat, the increase in nest predators such as raccoons and skunks can be very detrimental to the hatching success of nests and greatly reduces the number of young turtles that are born and survive. Nest predation can destroy the majority of a turtle population's reproductive output on a yearly basis.

## **Mortality and injuries from heavy equipment**

Spotted Turtle populations are often found in areas with agricultural activities. They are known to use agricultural fields that border forested land for estivation and foraging. Mortality and injuries can result from Spotted Turtles being run over by agricultural and other heavy equipment. In Massachusetts, mortality of Spotted Turtles related to haying activities has been documented.

## **Forestry**

Maintaining forested habitat in association with vernal pools and wetlands is essential for the conservation of Spotted Turtles. The impacts of timber harvesting are recognized as having significantly fewer lasting effects as compared to other permanent changes in land use, such as residential and commercial development. However, certain precautions should be taken during timber harvesting in order to maintain the long-term viability of Spotted Turtle populations within forested areas.

The greatest concern during forestry operations are turtles being run over and crushed by mechanized logging equipment. This could occur when turtles are moving between wetland types, nesting, estivating, or hatchlings are emerging and moving to wetlands. Direct mortality could also occur when wetlands are being harvested. The chance of killing multiple turtles is increased with wetland harvesting because Spotted Turtles overwinter in wetlands, sometimes in groups. Habitat modification surrounding vernal pools and structural alteration of wetland overwintering sites are also concerns. Vernal pools are used for foraging and mating. The prey base of invertebrates and amphibians in vernal pools requires cool, moist, and shaded surrounding conditions.

## SPOTTED TURTLE FORESTRY CONSERVATION MANAGEMENT PRACTICES

The following management practices apply to Spotted Turtle Priority Habitat. These recommendations were made with the assumption that motorized timber harvest equipment would only enter a site once per decade. Reducing the frequency that motorized vehicles enter Spotted Turtle habitat would be beneficial in minimizing direct mortality of adults. For long-term management, heavier cuts spaced at longer intervals would be favored over lighter cuts at more frequent intervals, as long as the canopy cover around vernal pools is maintained. The canopy cover within 100 feet of vernal pools should be maintained at 75% or greater. The canopy cover from 100 – 200 feet of vernal pools should be maintained at 50% or greater.

**R** – required management practice      **G** – guideline or recommended management practice

### Preventing Turtle Mortality

#### Conservation management objective

Avoid direct mortality of Spotted Turtles from any timber harvest activity involving motorized vehicles.

#### Rationale

Individual survival of long-lived adults is important since they need to reproduce many times before they replace themselves in the population. Potential mortality of adults is avoided by not using motorized vehicles in areas or at times when Spotted Turtles will be present.

#### General management recommendations

Adjust the timing and location of motorized vehicle use for timber harvest activities, so that Spotted Turtles are inactive or less likely to be occupying terrestrial habitat.

#### Specific management practices

- R** No motorized vehicles shall be used within wetlands.
- R** Wetlands shall be temporarily bridged or crossed only when frozen solid. This will help prevent substrate compression and direct mortality of turtles that are overwintering in the wetland.
- R** Wetland harvesting shall be done by hand-felling and removing trees by winching so that no motorized vehicles enter the wetland. This will prevent any direct mortality of turtles that are overwintering in the wetland as well as maintain the structural integrity of the habitat.
- R** Motorized vehicle use, consistent with the Massachusetts Forestry Best Management Practices, may occur between 0 and 300 feet from the edge of wetlands, including either Certified or uncertified vernal pools only between November 1<sup>st</sup> and March 15<sup>th</sup> (Table 5). All motorized vehicles shall be excluded from these areas between March 16<sup>th</sup> and October 31<sup>st</sup>.

Distance from wetland edge, including vernal pools (feet)	Time period when harvesting can occur
0 – 300	Nov. 1 – March 15 <sup>th</sup>
300+	No restriction

**Table 5.** Recommendations for motorized vehicle use for timber harvest activities according to straight-line distance from wetlands, including vernal pools.

**R** For harvesting within wetlands that is consistent with the Massachusetts Forestry Best Management Practices, the trees that will be harvested shall be marked prior to cutting plan approval and harvesting.

**R** If harvesting will occur between March 16<sup>th</sup> and October 31<sup>st</sup>, the boundary of the 300-foot management area from the edge of wetlands, including either Certified or uncertified vernal pools shall be clearly identified by flagging or marking prior to cutting plan approval and harvesting.

### Maintaining Vernal Pool Habitat Integrity

#### Conservation management objective

Avoid altering vernal pool habitat and affecting the invertebrate and amphibian populations that are an important food source for Spotted Turtles.

#### Rationale

Vernal pools are important habitats for Spotted Turtles to complete their life cycle, providing foraging, breeding, and sometimes overwintering habitat. It is beneficial to maintain shade, coarse woody debris, forest floor litter, and water quality within the pool, as well as eliminating any potential sources of sedimentation or erosion adjacent to vernal pools.

#### General management recommendations

Maintain a mostly closed-canopy forest and minimize forest floor disturbance within 200 feet of vernal pools.

#### Specific management practices

**R** No harvesting shall occur in either Certified vernal pools and uncertified vernal pools.

**R** New landings and skid roads shall be located at least 100 feet and farther away if possible, from wetlands, including both Certified vernal pools.

**R** 0 – 100 feet from Certified and uncertified vernal pool high water mark: Retain ≥ 75% canopy cover  
 100 – 200 feet from Certified and uncertified vernal pool high water mark: Retain ≥ 50% canopy cover  
 (see tables in Appendix for residual basal area requirements equivalent to 75% canopy cover)

- R** If harvesting will occur within 200 feet of vernal pools, then the boundary of the 100 and 200-foot management areas from the vernal pool shall be clearly identified by flagging or marking prior to cutting plan approval and harvesting. The trees that will be harvested within these two management areas shall be marked prior to cutting plan approval and harvesting.
  
- G** Leave limbs and tops in the forest, consistent with other laws, regulations, and forestry best management practices, in order to provide cover areas with cooler microclimates.

## SELECTED REFERENCES

- Burke, V. J., J. E. Lovich, and J. W. Gibbons. 2000. Conservation of Freshwater Turtles. Pages 156-179 in M. W. Klemens, editor. Turtle Conservation. Smithsonian Institution Press, Washington and London.
- Calhoun, A. J. K., and P. deMaynadier, editors. 2004. Forestry habitat management guidelines for vernal pool wildlife. Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York.
- Carroll, D. M. 1991. The Year of the Turtle: A Natural History. Camden House Publishing, Inc., Charlotte, Vermont.
- Congdon, J. D., A. E. Dunham, and R. C. V. L. Sels. 1993. Delayed sexual maturity and demographics of Blanding's turtles (*Emydoidea blandingii*): implications for conservation and management of long-lived organisms. Conservation Biology **7**:826-833.
- Donahue, D. F. 1997. A guide to the identification and protection of vernal pool wetlands of Connecticut. State University of Connecticut Cooperative Extension System, West Hartford, CT.
- Ernst, C. H., J. E. Lovich, and R. W. Barbour. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington and London.
- Ernst, C. H., and G. R. Zug. 1994. Observations on the reproductive biology of the spotted turtle, *Clemmys guttata*, in Southeastern Pennsylvania. Journal of Herpetology **28**:99-102.
- Fowle, S. C. 2001. Priority sites and proposed reserve boundaries for protection of rare herpetofauna in Massachusetts. Pages 1-107. Massachusetts Division of Fisheries and Wildlife, Westborough, Massachusetts.
- Gibbs, J. P., and W. G. Shriver. 2002. Estimating the effects of road mortality on turtle populations. Conservation Biology **16**:1647-1652.
- Gibbs, J. P., and D. A. Steen. 2005. Trends in sex ratios of turtles in the United States: Implications of road mortality. Conservation Biology **19**:552-556.
- Graham, T. E. 1995. Habitat use and population parameters of the spotted turtle, *Clemmys guttata*, a species of special concern in Massachusetts. Chelonian Conservation and Biology **1**:207-214.
- Haxton, T., and M. Berrill. 1999. Habitat selectivity of *Clemmys guttata* in central Ontario. Canadian Journal of Zoology **77**:593-599.
- Haxton, T., and M. Berrill. 2001. Seasonal activity of spotted turtles (*Clemmys guttata*) at the northern limit of their range. Journal of Herpetology **35**:606-614.
- Joyal, L. A., M. McCollough, and M. L. Hunter, Jr. 2001. Landscape ecology approaches to wetland species conservation: a case study of two turtle species in Southern Maine. Conservation Biology **15**:1755-1762.
- Lewis, T. L., J. M. Ullmer, and J. L. Mazza. 2004. Threats to spotted turtle (*Clemmys guttata*) habitat in Ohio. Ohio Journal of Science **104**:65-71.

- Litzgus, J. D., and R. Brooks. 1998. Reproduction in a northern population of *Clemmys guttata*. *Journal of Herpetology* **32**:252-259.
- Litzgus, J. D., and T. A. Mousseau. 2004. Demography of a southern population of the Spotted Turtle (*Clemmys guttata*). *Southeastern Naturalist* **3**:391-400.
- Litzgus, J. D., and T. A. Mousseau. 2004b. Home range and seasonal activity of Southern spotted turtles (*Clemmys guttata*): implications for management. *Copeia* **2004**:804-817.
- Milam, J. C., and S. M. Melvin. 2001. Density, habitat use, movements, and conservation of spotted turtles (*Clemmys guttata*) in Massachusetts. *Journal of Herpetology* **35**:418-427.
- NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.7. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>.
- Perillo, K. M. 1997. Seasonal movements and habitat preferences of spotted turtles (*Clemmys guttata*) in North Central Connecticut. *Chelonian Conservation and Biology* **2**:445-447.
- Seburn, D. C. 2003. Population structure, growth, and age estimation of Spotted Turtles, *Clemmys guttata*, near their northern limit: an 18-year follow-up. *Canadian Field-Naturalist* **117**:436-439.
- Tetra Tech NUS, Inc. 2005. Calendar Year 2004 Turtle Investigation Report - Naval Air Station South Weymouth, Massachusetts. Pages 1-20. Report for Naval Air Station South Weymouth, Massachusetts. Weymouth, MA.
- VHB/Vanasse Hangen Brustlin, Inc. 2000. Route 44 State-listed rare turtle study. Page 46. Prepared for the Massachusetts Highway Department, Watertown, Massachusetts.

## **FIGURE AND DATA CREDITS**

Thanks to the following people for their time and expertise regarding Spotted Turtles in MA:

Joan Milam  
Robert Brooks  
Brad Compton

Figure 2 was created by Tara Boswell.

## **PHOTO CREDITS**

Mike Jones

## APPENDIX

**Table 1. Draft residual basal area levels of trees >4 inch dbh sampled with a BAF-10 prism for 75% canopy cover within 0-100 ft of vernal pools in Spotted Turtle Priority Habitat.**

Average Stand dbh (inches)	Forest Type*					
	WP, WK, RP, SR, PP, HK, TK, CD, SF	WH, HH	BW, RM, BC, BB, SM, BM, BE	W0, PO	OH	OR, OM
4	50	40	25	20	15	10
5	60	50	35	30	25	20
6	70	55	35	30	25	20
7	80	65	40	35	30	25
8	85	70	45	40	35	30
9	90	70	45	40	35	30
10	95	75	50	45	40	35
11	95	75	50	45	40	35
12	100	80	55	50	45	40
13	105	85	55	50	45	40
14	110	90	60	55	50	45
15	110	90	60	55	50	45
16	115	95	65	60	55	50
17	120	95	65	60	55	50
18	120	100	70	65	60	55
19	120	100	70	65	60	55
20	125	105	75	70	65	60
21	125	105	75	70	65	60
22	125	110	80	75	70	65
23	125	110	80	75	70	65
24	130	115	80	75	70	65
25	130	115	85	80	75	70
26	130	120	90	85	80	75

\*Refer to Ch. 132 Forest Cutting Plan form for definition of forest types.

**Table 2. Draft residual basal area levels of trees >4 inch dbh sampled with a BAF-10 prism for 50% canopy cover within 100-200 ft of vernal pools in Spotted Turtle Priority Habitat.**

Average Stand dbh (inches)	Forest Type*					
	WP, WK, RP, SR, PP, HK, TK, CD, SF	WH, HH	BW, RM, BC, BB, SM, BM, BE	W0, PO	OH	OR, OM
4	35	30	20	15	10	5
5	40	35	20	15	10	5
6	45	40	25	20	15	10
7	50	40	25	20	15	10
8	55	45	30	25	20	15
9	60	50	30	25	20	15
10	65	55	35	30	25	20
11	65	55	35	30	25	20
12	70	60	40	35	30	25
13	70	60	40	35	30	25
14	75	60	40	35	30	25
15	75	65	45	40	35	30
16	75	65	45	40	35	30
17	80	65	45	40	35	30
18	80	65	45	40	35	30
19	80	70	50	45	40	35
20	80	70	50	45	40	35
21	85	70	50	45	40	35
22	85	70	55	50	45	40
23	85	75	55	50	45	40
24	90	75	55	50	45	40
25	90	80	60	55	50	45
26	90	80	60	55	50	45

\*Refer to Ch. 132 Forest Cutting Plan form for definition of forest types.