

INTRODUCTION

The wood turtle is distributed in the United States from the Midwest to the Northeast, but it is not abundant. Many states in the Midwest are concerned about a seeming scarcity of wood turtles and have classified the wood turtle as "threatened", "endangered", "special concern", etc. However, better information is needed on the status of wood turtles. Our research unit has studied the movements and habitat use of wood turtles on a Minnesota river for one year. We believe we now have enough information on the habitat requirements of wood turtles to be able to guide a survey for wood turtles in other watersheds and to monitor their reproduction and abundance. Our objective is to provide tentative guidelines for surveying and monitoring wood turtles that can be tested in the field. This document contains a description of the natural history of wood turtles and proposed procedures for surveying and monitoring wood turtles. We intend to evaluate these guidelines during 1991 on two cooperative projects; one with the Minnesota DNR and the other with the . Subsequent to our experience on these projects, the guidelines will be revised.

WOOD TURTLE NATURAL HISTORY

Historically, wood turtles were found in or near the moving water of medium-sized streams, rivers, and nearby riparian habitats in forested regions. Size of the channel can range from about 2-30 m as long as the bottom substrate is predominately sand or sand and gravel. Thus, they are not likely to be found in very small streams or very large rivers, or where the bottom substrate is predominately clay, silt, or muck. They tend to be associated with clear streams in reaches with intermediate gradients. Thus, they are also not likely to be found in polluted streams or stream reaches dominated by very slow moving water and extensive eutrophic pools, or rock and boulder rapids.

Wood turtles spend most of the year in riverine habitats. During winter, they hibernate on the bottom of streams. Spring and fall, they spend most time in the water, but emerge during the day in warm weather to bask and feed. However, wood turtles may become entirely terrestrial for a period during July and August. During the spring and fall transition periods, we found wood turtles basking near water in mature speckled alder and lowland hardwood floodplains. During the terrestrial period, they used a broad variety of forest and nonforest habitat types near water. They used both conifer (pine, spruce, and balsam fir) and hardwood (aspen, white birch, and lowland hardwood) forest habitats. They also used tall shrub habitats such as willow and mature speckled alder. Wood turtles seem to favor edge situations that have a well developed, but not overly dense ground vegetation layer. Thus, we also found them near the edges of nonforest habitats such as small grass openings, sedge meadows, and sphagnum bogs. Wood turtle use of ecotones between and on the margins of habitat types is probably related to their food habits. They are omnivorous, eating things such as the leaves of forbs, mushrooms, berries (e.g. strawberries, blueberries, raspberries), and invertebrates such as insects and worms. Wood turtles forage in the ground vegetation layer of terrestrial habitats. Some foods such as worms are found under dense canopies of mature lowland hardwoods and speckled alder, but other foods like berries are found where light reaches the ground such as in openings and under sparse

tree canopies. There is little information on their food habits relative to aquatic foods.

The requirements of wood turtles for terrestrial habitats are general and most of these habitats are ubiquitous. Their requirements for aquatic resources seem only somewhat specific and constraining. So, what seems to be causing the scarcity of wood turtles? The basic problem seems to be poor recruitment to the population. Wood turtles are very long-lived species. They become sexually mature when about 12-15 years old and many live into their 30's and older. Females produce one clutch of 6-12 eggs annually. Clutches are laid in open sandy or sand-gravel nesting areas with preferably no vegetation. Such nesting areas require considerable disturbance to maintain, which might explain why wood turtles are usually found on medium-sized riverine systems and not on small streams, i.e. small streams don't produce a sufficient volume of water during flood stage to produce the hydraulic forces necessary to create and maintain nesting areas. The incubation period for wood turtle eggs is relatively short compared to other species, about 60 days under laboratory conditions. Because delayed overwinter emergence has not been observed in wood turtles, there may be selective pressure for wood turtle eggs to hatch before winter. The specific nest site requirements and short incubation period may be a response to this selective pressure. The small clutch size and long life span suggests a life history strategy which has historically experienced difficulty with reproduction, i.e. because probability of survival of a clutch (and probably hatchlings as well) in any given year is low, females must produce many clutches over a long life span to replace themselves.

Although the habitat requirements of wood turtles are generally broad, two factors seem to limit their distribution and abundance: availability of nesting areas and nesting success. Natural nesting areas used by females include sandy beaches on islands and main shoreline areas, sandbars, and cutbanks. However, females also nest in gravel and borrow pits and on highway and railroad banks near stream or river crossings. Although this has probably enhanced the availability of nesting areas, there is also a down side; the traffic produces adult mortality. Other direct negative effects of human activity on nesting areas include loss of nesting areas to impoundment, channelization, and bank restoration projects, and recreational use of sandy areas by swimmers, boaters, and canoeists. Human activity has also indirectly affected the nesting success of wood turtles. The expansion of the human population into forested regions brought an expansion of the range of skunks and raccoons into portions of the range of wood turtles where they did not historically exist. These species are very efficient predators of wood turtle eggs. Thus in addition to fox, wood turtles now cope with two more important egg predators. The cultural activities of man have negatively impacted wood turtles in other ways. For example, factors such as pollution, land use changes in the riparian zone (urbanization and agriculture), siltation, and collection for the pet trade have probably negatively affected wood turtle populations in many areas. As a result of these cultural influences, the current distribution of wood turtles differs from their historical distribution.

WOOD TURTLE SURVEY PROCEDURES

A survey is generally a single effort aimed at determining the occurrence, abundance, or spatial distribution of a species. For example, the objective of

a survey might be to delineate the range of a species. Knowledge of the distribution of wood turtles is generally based on fortuitous observations. Few surveys have been conducted to determine which watersheds contain wood turtles and where wood turtles are distributed within a watershed.

The following guidelines are proposed for surveying wood turtles within a watershed. The goal is to provide some direction that managers can use to conduct a survey of the distribution of wood turtles in their area. The objective, outline, and procedures for surveying wood turtles are:

Objective: Delineate the spatial and density distribution of wood turtles within a watershed

Outline:

- 1) Fully specify current understanding of wood turtle habitat requirements and decide on criteria to define suitable habitat
- 2) Delineate areas within a selected watershed where habitat requirements are likely to be present, using criteria defining suitable habitat
- 3) Look for wood turtles in both suitable and unsuitable habitat; allocating effort in proportion to likelihood of finding them
- 4) Revise the understanding of habitat requirements if presence of wood turtles differs substantially from the classification

Survey Procedure:

- 1) The habitat requirements of wood turtles are described above, including the notion that the occurrence of nesting areas seems to be a factor that defines the occurrence and abundance of wood turtles in northeastern Minnesota. The survey procedures are predicated on this understanding. The generalized habitat requirements of the wood turtle are as follows:

Determinants of Suitable Habitat

Medium-sized riverine systems

- a) Sand and gravel substrate present
- b) Cutbanks and sandbars present
- c) Low level of pollution
- d) Low level of siltation

Smaller sized rivers and streams are acceptable if the following cultural features have produced nesting areas (these same cultural features may enhance wood turtle abundance on larger riverine systems):

- a) Bare banks on railroad and highway stream crossings
- b) Gravel pits and borrow pits in proximity to water

Generally forested riparian zone

- a) Upland woody vegetation
- b) Edge, ecotone, and small opening habitats

2) Because wood turtles were historically found in medium-sized streams with sand and gravel substrate (these conditions created suitable nesting areas), the first step is to stratify the survey by delineating areas where medium-sized streams (which also conform to the other constraints) intersect sand and gravel soils, using soil or geological survey information and a GIS system. Several strata may be necessary, depending on confidence as to the suitability of soil type and/or landform class information for predicting the occurrence of nesting areas. High sinuosity is more likely to produce nesting areas than straight stretches. The second step is to modify the stratification so as to include the potential for human activity to create nesting areas where they historically did not exist, and so enlarge the spatial distribution of wood turtles or enhance their abundance. At this point, two options are available: conclude the survey by searching for wood turtles within each strata or include a third, intermediate step to enhance the accuracy and efficiency of the search. Choose the former if the objective is primarily to obtain an estimate of the spatial distribution of wood turtles. Choose the latter if the objective includes emphasis on obtaining a density distribution of wood turtles. The latter, or third step would use aerial and photo reconnaissance, float trips, and/or spot ground checking to examine potential nesting areas. The location of nesting areas would be incorporated in the stratification of stream segments before any ground search for wood turtles is initiated.

3) Having classified stream segments as to their suitability for wood turtles, search for wood turtles in the field. If the job is too big, survey a representative sample of each segment class. Conduct the wood turtle survey preferably in spring, or secondarily in fall. These seasons are good because wood turtles are found in or close to water (winter is poor because they become dormant under the ice and summer is poor because many turtles spend weeks away from water in upland ground vegetation where they are virtually impossible to find). In spring, wood turtles are most visible. Snow cover flattens the dead vegetation, and they can be found basking near water. Also, late spring to early summer is a good period to locate nesting females at potential or known nesting areas. Fall is also good, but wood turtles don't bask as much and standing dead vegetation obscures visibility. Although spring would be the best season, fall may also be feasible for surveying wood turtles in some areas.

Conduct the survey with two or three persons meandering along the stream, looking for wood turtles in the water (polarized glasses help reduce surface glare on the water surface) and within about 10-15 m of shore. During spring and fall, wood turtles spend the night in the water. When the air temperature rises above the water temperature during the day, especially warm sunny days, wood turtles are more likely to leave the water and bask on the shore. Thus, conduct the survey under select weather conditions. Give preference to warm sunny afternoons and avoid cold cloudy mornings. During the former wood turtles are likely to bask on the bank. During the latter, they are more likely to be in the water (although wood turtles can be found easily under some water conditions, they are more difficult to find if light conditions are poor or if the water is deep or in flood stage).

As an option, mark wood turtles according to a numbering scheme coordinated with DNR, sex, age, weigh, measure (maximum length and width of the carapace and length of the plastron), and pin-point their location on an aerial photo along with date of capture.

4) Given the results of the stratification and ground survey, review and revise the classification system as necessary so as to enhance accuracy of future predictions.

WOOD TURTLE MONITORING PROCEDURES

What do we really mean when we say we want to monitor the status of wood turtles. All of us have an intuitive notion of what it means to monitor a species. For example, we might follow some measure of the population over time to determine if the population is changing and if so, in what direction. We could term this a 'canary in the coal mine' or 'early warning' objective. However, numerous other objectives could be formulated to address other, more species specific concerns. Furthermore, we could monitor wood turtles by measuring numerous variables and indices, each of which is valid, but measures something different. Because such information is costly to obtain and resources are usually inadequate, it is important to scrutinize our objectives and examine the resources available for monitoring at the outset.

Monitoring is usually suggested in the context of some perceived problem. Obviously, ones objective and application of resources should address the problem. What then, is the perceived problem with wood turtles that we would want to monitor them? There are several. Wood turtles are thinly distributed and nowhere abundant; some wonder if this is historically normal or if wood turtles are disappearing. Wood turtles are vulnerable to illegal collection; in some regions, experts fear they are being collected into oblivion. A high proportion of wood turtle nests are destroyed by egg predators; some wonder if the proportion is excessive. All studies of the age structure of wood turtle populations show few immature turtles; some wonder if there are too few to maintain the population. We can paraphrase these concerns about wood turtles as population decline, illegal collection, egg predators, and poor recruitment. Unfortunately, there is no single measure that would collectively address all of these concerns. How then do we approach this problem? A problem encompassing multiple concerns can be addressed by identifying the concerns, selecting a measure that could be monitored to address each concern, and then choose which concerns can be addressed with the resources available.

Knowledge of the status of wood turtle populations is unknown across the range of the species, except for a few specific locations where long term studies have been conducted. We know that human cultural activities have probably impacted wood turtle populations, but the evidence is circumstantial and anecdotal. The following guidelines are proposed for monitoring wood turtles within a watershed. The goal is to provide some direction that managers can use to conduct their own monitoring program for wood turtles. The objective, outline, and procedures for monitoring wood turtles are:

Objective: Determine the status of the wood turtle population on a selected watershed over time (or some more specific wording)

Outline:

- 1) Identify local concerns that impact the status of the wood turtle
- 2) Choose parameters to be monitored that measure response of wood turtles to those concerns
- 3) Choose a measurement frequency and duration
- 4) Select representative population units to be monitored
- 5) Measure parameters at specified frequency over chosen time interval

Monitoring strategies and procedures:

- A. At a minimum, assure the integrity of wood turtle reproduction by managing nesting areas (identify all nesting areas used by wood turtles in the watershed and incorporate them into management plans to assure that these sites are not degraded or eliminated by management programs).
- B. If there is some concern about population decline, illegal collection, or egg predators, in addition to assuring the integrity of nesting areas, extensively monitor reproduction and abundance of wood turtles at a sample of nesting areas representative of the concerns, e.g. if the objective is to monitor illegal collection, one could choose to monitor nesting areas that differed in degree of accessibility, etc.

Monitor wood turtles at the selected nesting areas in spring. Visit nesting areas several weeks prior to and during nesting to mark and sex all turtles found on and within some specified area surrounding each nesting area (choose boundaries that maximize capture efficiency). Visits on sunny afternoons would maximize capture efficiency. Subsequently visit nesting areas to determine the number of nests destroyed at each. Because most eggs should hatch in mid-August, a single visit in late August might be sufficient to count destroyed nests. More frequent visits may be necessary to determine the minimum number of nests destroyed if disturbance is expected, e.g. flooding, ORV disturbance, etc. Compare estimates of the number of nests present (use estimate of the number of females present during the nesting season) to the number of nests destroyed. Monitor an index to or estimate of the population, adult survival, and nest success over time. Use models to estimate whether nest success and adult survival are adequate to maintain local populations.

- C. If there is some concern about poor recruitment, in addition to monitoring nest success and adult survival, also monitor the age structure of the immature segment of the population to determine if survival of immature wood turtles is adequate to maintain the population. In spring or fall, monitor the wood turtle population within a specified distance of a representative sample of nesting areas to determine the age structure of the population at different locations over time. Use models to estimate whether recruitment is adequate to maintain local populations.