

## SUMMARY

*of the*

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# EASTERN BOX TURTLE REGIONAL CONSERVATION WORKSHOP

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### Editors

Chris Swarth

*Jug Bay Wetlands Sanctuary*

Susan Hagood

*The Humane Society of the United States*

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**OF THE UNITED STATES®**



# Introduction

This report is a summary of a workshop held on September 28, 2004, at the National Wildlife Visitors Center at the Patuxent Research Refuge in Laurel, Maryland. Sponsored by Jug Bay Wetlands Sanctuary and The Humane Society of the United States (HSUS), the workshop was the first in what we hope will be a continuing series of workshops on the conservation of the eastern box turtle (*Terrapene carolina carolina*). Our goal was to bring together individuals actively engaged in box turtle research and conservation to assess the status of this species and the challenges it faces. Our objective was to discuss the population status and conservation of the eastern box turtle and to develop a set of recommendations for actions necessary to ensure its survival.

Sixty herpetologists and conservationists attended (see Appendix A for a list of participants). C. Kenneth Dodd, Jr., Ph.D., author of *North American Box Turtles: A Natural History*, gave the keynote address. Topics addressed by other speakers included population modeling, disease, long-term population studies at the Patuxent Wildlife Research Center, and habitat use with regard to development impacts. Summaries of speaker presentations are presented below in the order in which they were given, along with, where appropriate, figures representative of the presentations.

Afternoon breakout sessions grouped workshop participants into subject areas to begin the process of identifying critical needs and making recommendations. Topics included research needs, development threats and habitat loss, public education, state and federal protection, and others. Recommendations of the breakout sessions are also listed in this report.

## Background

Few long-term population studies of the eastern box turtle have been conducted, but the conclusion reached in most such studies is that populations are seriously declining (Stickel 1978; Williams and Parker 1987; Schwartz and Schwartz 1991; Hall et al. 1999). A number of reasons have been cited for these declines: habitat destruction, alteration and fragmentation; road-based mortality; destruction by mowing and land-clearing machinery; unnaturally high predation on eggs, hatchlings, and juveniles by subsidized predators (e.g., raccoons, dogs); and removal of adults from the wild for household pets (McDougal 2000; Thorbjarnarson et al. 2000; Dodd 2001).

Turtles in general have evolved a suite of life history traits that severely limit the ability of populations to withstand additional sustained loss of breeding-age adults and anthropogenic declines in recruitment into the breeding population (Congdon et al. 1993; Gibbs and Amato 2000). These include high adult survivorship and longevity, high egg and hatchling mortality, a low rate of recruitment into the breeding population, and relatively late maturity and low fecundity.

Many basic questions about the status and natural history of the “common” box turtle remain unanswered. In addition, the increasing impact of humans on this species raises many more questions to which answers are urgently needed. For instance, to what extent are populations



genetically distinct; how are environmental pollutants and meso-predators influencing egg and hatchling survival and population demographics; what level of road-based mortality, if any, can a population of a given size sustain; how is disease affecting populations now and what are the implications for the future; what is the best approach to take with “rescued,” displaced, and rehabilitated turtles and those turtles in areas that are slated for development; what effect might relocation have on resident turtles; and do populations that have experienced declines actually “recover”?

A number of states have regulations and laws that provide some degree of protection to box turtles, yet many states offer no protection (see Appendix B for a summary of state regulations). Where laws and regulations exist, enforcement is uneven or nonexistent, and there are many threats that fall outside the realm of current regulations.

By identifying gaps in our current knowledge of box turtles and major threats to their existence and by developing a set of recommendations that, if implemented, will help to stabilize populations (see Klemens 2004 for new ideas on turtle conservation), we aim to prevent box turtles from becoming candidates for state or federal endangered species lists. We support the concept that the time to save a species is before it becomes endangered. The recommendations that flowed from the breakout sessions are aimed primarily at state resource agencies, federal resource protection agencies, and nongovernmental organizations that are involved with wildlife conservation. We hope that this workshop is a first step in developing range-wide conservation programs aimed at slowing, halting, and eventually reversing the decline of this uniquely vulnerable species.

We thank the personnel at the U.S. Fish and Wildlife National Wildlife Visitor Center for their kind assistance and for providing state-of-the-art workshop facilities at no charge. We also thank The HSUS and the Friends of Jug Bay for their financial support. Mike Quinlan, Amber Heramb, and Marney Finkle provided invaluable assistance in organizing the workshop. We express special thanks to Ken Dodd for agreeing to be our keynote speaker, to the other workshop speakers, and to the breakout session leaders. The workshop would not have been possible without their help.



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## **Workshop Speakers**

**Sandy Barnett**

Mid-Atlantic Turtle & Tortoise Society and the National Aquarium at Baltimore

**C. Kenneth Dodd, Jr., Keynote Speaker**

Florida Integrated Science Center, U.S. Geological Survey

**Paula Henry**

Patuxent Wildlife Research Center, U.S. Geological Survey

**April Johnson**

College of Veterinary Medicine, University of Florida

**Richard Seigel**

Department of Biological Sciences, Towson University

**Chris Swarth**

Jug Bay Wetlands Sanctuary

## **Breakout Session Leaders**

**Janet Ady**

National Conservation Training Center, U.S. Fish and Wildlife Service

**I. Lehr Brisbin, Jr.**

Savannah River Ecology Laboratory

**Will Brown**

Blue Ridge Biological

**Lynn Cassell**

Anne Arundel Veterinary Emergency Clinic

**Don Forester**

Department of Biological Sciences, Towson University

**John Hadidian**

The Humane Society of the United States

**Tim Maret**

Pennsylvania Biological Survey and Shippensburg University

**Joe Mitchell**

Department of Biology, University of Richmond

**Holly Niederriter**

Division of Fish and Wildlife, Delaware Department of Natural Resources and Environmental Control

**Glenn Therres**

Maryland Department of Natural Resources

# Presentation Summaries

## KEYNOTE PRESENTATION

### *Fascination, Inquiry, and Action: Challenges to Conserving Box Turtles in the 21st Century*

C. Kenneth Dodd, Jr., Ph.D.  
Florida Integrated Science Center  
U.S. Geological Survey  
Gainesville, FL

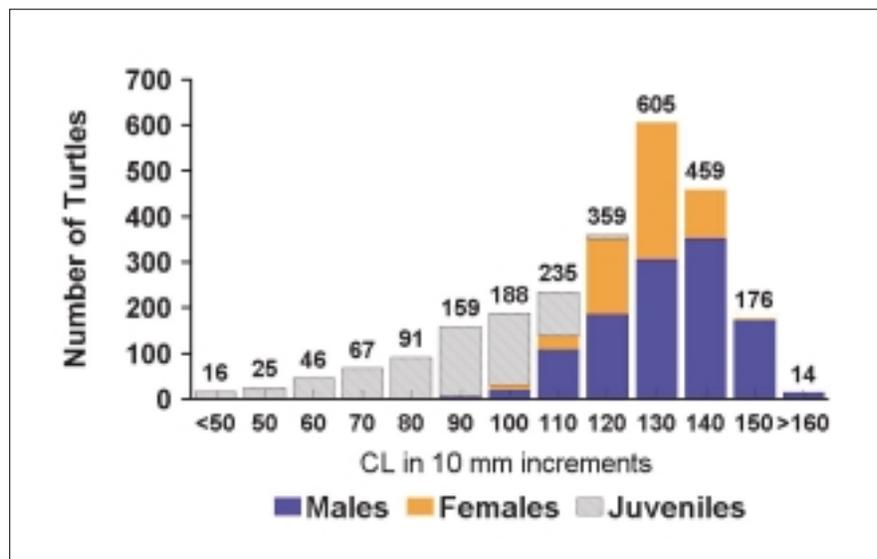
Long-term studies of long-lived species permit the integration of life history and population models for developing effective conservation and management programs. Descriptive biological data help ecologists and resource managers understand a population at a single point in time, while models can help us understand population dynamics through time. Together, models and natural history information provide the tools needed to determine a species' population status and trends, and to direct conservation efforts where they can do the most good.

My studies of the Florida box turtle (*Terrapene carolina bauri*) on Florida's Egmont Key focus on activity patterns and habitat use, reproduction, population size, density and biomass, population structure and demography, and shell anomalies and injuries. Additional studies concentrate on the biology of juvenile box turtles, the growth and age at which turtles reach sexual maturity, and adult survivorship and recruitment.

Our data from 1991 to 2001 indicate that sex ratios of adult turtles are somewhat to strongly biased in favor of males, although we found no heterogeneity in capture probabilities. Likewise, no significant differences in gender-based survival probabilities were found. Estimates of the finite rate of increase of the population indicate that males increased by 4% during the study period and females decreased by 2.6%.

I believe that this is due not to differential mortality, but rather to differential nest-site selection in a species characterized by temperature-dependent sex determination. Serious mortality associated with storms and hurricanes in the early to mid-90s has also very likely influenced population demographics.

I discuss management recommendations that will benefit box turtles on Egmont Key, including protecting fruiting plants from direct and indirect herbicide treatments; discouraging



## Challenges and Observations: The Conservation of Box Turtles

- Perceptions do not constitute substantive supporting information on which to make conservation decisions.
- Perceptions are often wrong and difficult to overcome, among both the public and the scientific community.
- Perceptions of abundance and distribution are often based on out-of-date information, imperfect memory, and inappropriate extrapolation.
- There is a strong underlying hostility toward environmental issues, stoked by misinformation and a lack of nature-based values and understanding, among certain segments of the population.
- The “everybody knows that” fallacy is alive and well in the highly opinionated scientific world.
- Data are often lacking, anecdotal, and sometimes misunderstood.
- Even when good data are available, the people who should listen often do not.
- Even published information needs to be read critically, with attention to methodology: “garbage in, garbage out.”
- It may or may not be valid to extrapolate data from one study to the next:
  - northern vs. southern populations [reproduction]
  - population dynamics [local variation]
  - biophysical requirements [habitat requirements]
- Some resource managers have legal constraints. If they do, you must learn what they are and be able to differentiate between legislative and administrative constraints.
- Some managers have financial constraints. Can you partner to lessen these constraints?
- Some managers have philosophical differences. For example, ecosystem vs. species management; different perceptions of need; limited vision and personal bias.
- Some managers do not care or see more work created for them. Try persuasion first, then, if necessary, determine other creative methods of influencing policy.

burning (or, if allowed, conducted only during the winter); restoring vegetation to a more natural state; mowing only during the hot afternoon, when turtles are less likely to be in open grassy areas; regulating visitors and providing them with information about box turtles; prohibiting pets on the island, particularly dogs; and continued monitoring of the population. Many of these measures will help conserve box turtle populations in other areas.

There are many challenges to box turtle protection, even on a relatively protected site such as Egmont Key. These become even more daunting in developed areas, where habitat destruction, degradation, and fragmentation are occurring. Disease, endocrine-disrupting compounds and other toxicants, regional and global climate change, and public apathy are other factors that negatively impact turtles. Given these challenges, it is critical that the many amateur and professional biologists with box turtle data publish those data so that others, and in turn the species, may benefit.

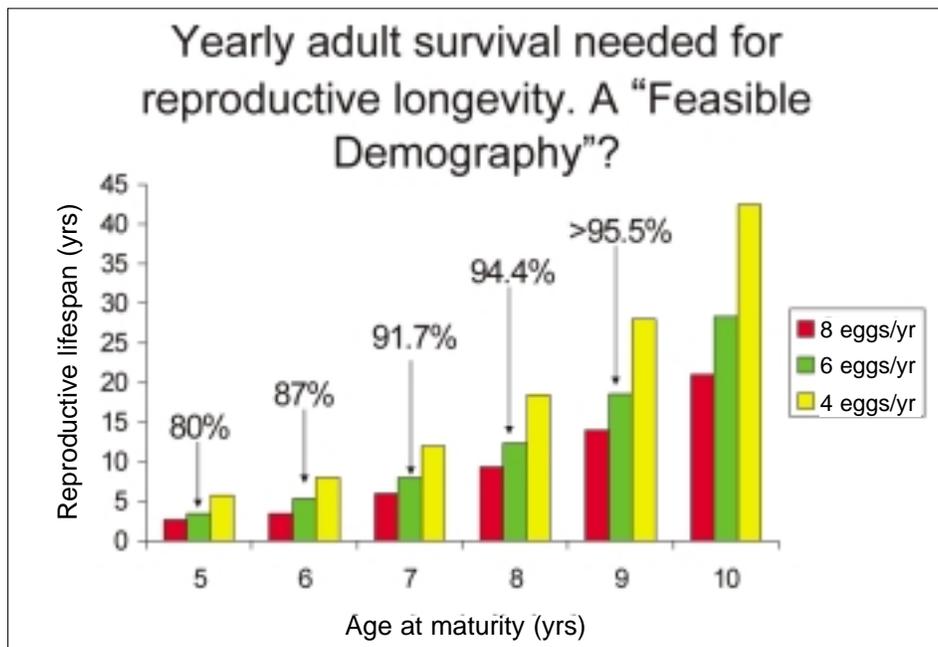
As Archie Carr once said: “Everybody likes box turtles.” Despite the range of anthropogenic threats to this species, I believe that this is largely true. And therein lies hope for its future. It will take a concerted effort by those in attendance here and many, many more to alert the public to the plight of this species and to ask and answer the questions that are crucial to its future. This workshop is evidence that concern is well established and that the necessary process has begun. I urge all of you to see it through as much and as far as you are able.

# *The Importance of Population Demography in the Conservation of Box Turtles: What Do We Know and What Do We Need to Learn?*

Richard A. Seigel, Ph.D.  
Towson University  
Towson, MD

Turtles are characterized by life history traits that include delayed sexual maturity, high adult survival, and low fecundity. As a result, even small changes in the survival of individuals in a population can lead to the gradual disappearance or extirpation of a population. Population models indicate that the viability of most turtle populations depends on the survival of older juveniles and adults; the survival of eggs and hatchlings is less critical. Given the difficulty of conducting population studies on long-lived species, models are of increasing importance in making conservation and management decisions.

The data that are needed to establish feasible demographic models include the age of sexual maturity, annual adult survival rates, and reproductive longevity. In order to improve the existing models, additional field data are needed urgently. Most important among these data are the age when turtles become sexually mature and rates of adult and juvenile survival. Of somewhat less importance are data on clutch size and frequency and nest survival. Models should be further refined by studies of multiple populations and from different geographical areas.



The phrase “feasible demography” refers to a suite of life history characteristics that must exist in a population in order for that population to remain stable through time. The graph at left demonstrates the interaction of reproductive life span (y-axis), age at maturity (x-axis), three different annual egg production scenarios, and the minimum adult survivorship (percentages) that are required to maintain a “feasible demography.”

As age of maturity goes up, reproductive life span and annual adult survivorship must also rise in order to maintain a stable population. A population in which females mature at five years of age and lay six eggs per clutch requires an adult survivorship rate of only 80% and a reproductive life span of less than five years to maintain a stable population. As the age of maturity increases (for example, nine years), the conditions needed to maintain a stable population change dramatically. A species that reaches sexual maturity at nine years requires a greater than 95% adult survivorship rate and a reproductive life span of a minimum of 20 years depending on annual egg production. These high rates of adult survivorship and long reproductive life spans may not exist because of the many human-induced mortality factors now operating in box turtle populations. The impact of increased mortality and general habitat degradation is the gradual decline in the size of a population and a disruption of a “feasible demography.”

# *Long-Term Population Studies at Patuxent Wildlife Research Refuge*

Paula Henry, Ph.D.

USGS, Patuxent Wildlife Research Center

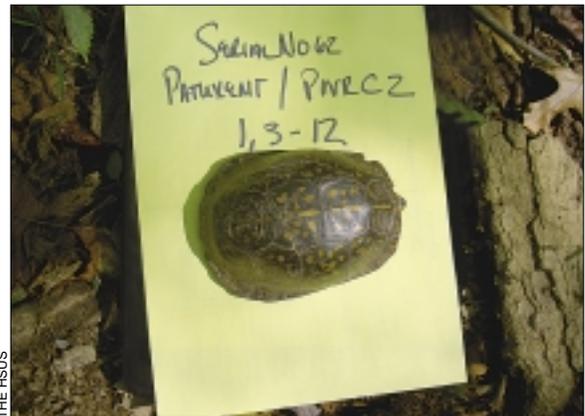
Laurel, MD

Population studies of the eastern box turtle have been conducted by U.S. Fish and Wildlife Service biologists at the Patuxent Wildlife Research Center since 1942, when Lucille Stickel, Ph.D., initiated what has become one of the longest ongoing wildlife studies in North America. The 11.8 hectare study site is along the forested floodplain of the Patuxent River: no managed tree or other vegetation clearing has occurred since 1945. Systematic searches were conducted within established grids, and the use of thread trailing was used to describe home range relationships and to generate population estimates. Researchers can and do collect data using different methods; detailed descriptions of the methods used for marking, recovering, and measuring individuals are therefore critical in comparing the results of separate box turtle studies. Dr. Stickel was among the first to fully describe her field methods, thus providing invaluable guidance that has ensured that subsequent work is conducted in precisely the same manner.

The Patuxent Refuge study site has been revisited multiple times over the active season, at least one season every 10 years, from 1955 through 1995. Researchers documented a significant population decline between 1965 and 1975. In 1995 a greater proportion of a younger age class of turtles was observed than previously recorded, indicating a possible decrease in the rate of decline. However, only 70 turtles (190 sightings) were found in 1995, less than 25% of the 291 turtles found in 1955. If the decline was due in part to the loss of individuals to a hurricane in 1972, it has taken almost 30 years for the population to begin recovery. A study spanning many decades such as this one reinforces the message that, as a result of the turtles' life history strategy, loss of individuals from a single catastrophic event can leave the population unstable and vulnerable for many years.

Dr. Stickel's other contributions to the study of box turtles are extensive and include growth, morphometrics and scutellation analyses, and descriptions of home range behaviors. Although there are challenges in maintaining and analyzing data from single sites over the decades, there are definite advantages when covering long-lived species such as the box turtle. Perhaps because the refuge is a protected research site, center biologists have confirmed the persistence of individuals and their behavior. Over the years we have retrieved several older turtles, some marked more than 50 years ago, and many found near the original release site.

I am currently planning the 2005 census at the Patuxent study site. In addition to this count, planned 2005 activities include conversion of the existing data set into an electronic format, mapping in GIS format for the refuge, and updating population model analyses.



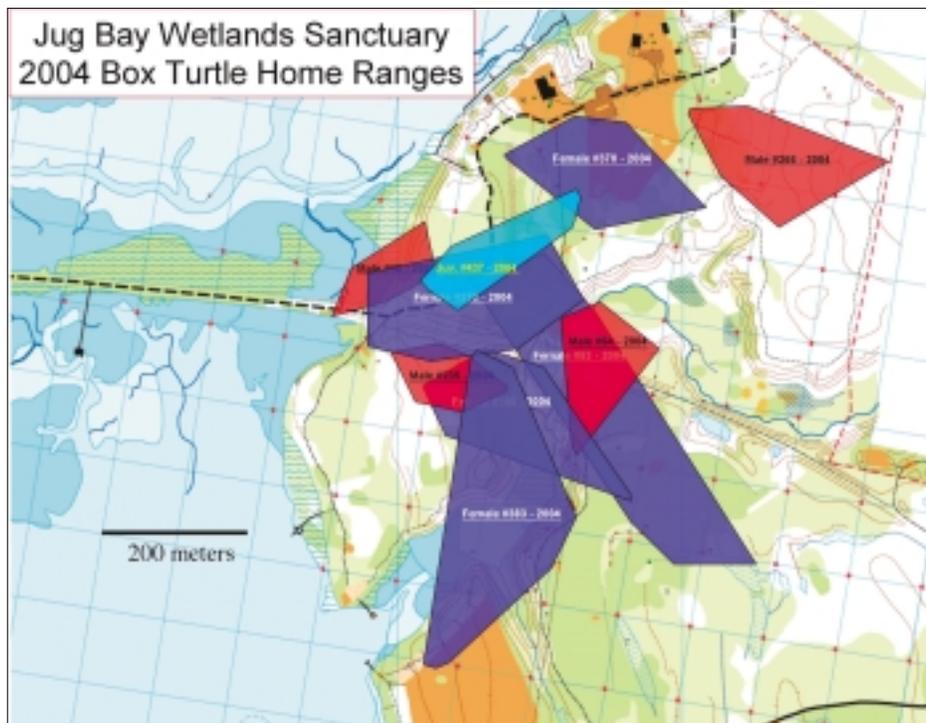
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*One of the older Patuxent study box turtles, still being tracked.*

# Home Range Characteristics of Box Turtles

Chris Swarth  
Jug Bay Wetlands Sanctuary  
Lothian, MD

**B**ox turtle home ranges are often described as varying from less than one hectare to several hectares in size. Many researchers also describe males as having larger home ranges than females. From 2000 through 2004, we used radio telemetry to study the home range characteristics of 41 different box turtles (25 females; 13 males; and 3 juveniles) that inhabit riparian forests and wetlands along the tidal Patuxent River at the Jug Bay Wetlands Sanctuary. More than 33% of females had home ranges that exceeded 4.5 hectares, and seven female home ranges exceeded 10 hectares. Mean female home range was 6.2 hectares, whereas mean male home range was only 1.2 hectares. We tracked the same five females for two to three seasons and found that home range size varied considerably from one year to the next, thus providing a more complete picture of home range. Most females used tidal wetlands and managed meadows during their active season, whereas males confined most of their activity to the deciduous forest and did not generally use wetlands or meadows. Females occupied wetlands for foraging, for rehydrating after nesting forays, and for thermoregulation. Meadows were used for nesting.



Data from our five-year study strongly suggest that female box turtles have much larger home ranges than males and that females use more habitats than do males. Gender difference in the use of habitat has important conservation and resource management implications. Studies in other areas are needed to determine if the patterns we documented are widespread.

Housing development and road construction fragment the habitats that box turtles need for survival and reproduction. Development destroys turtles and their habitats outright, and numbers are further reduced, slowly over time, when turtles are crushed by vehicles while they attempt to cross the roads which now crisscross their environment. Because females travel greater distances and move among more habitat types (while seeking nesting areas, water, foraging locales and overwintering sites), they are at greater risk of being crushed by vehicles than are males. Mortality from vehicles and housing development clearly reduces the overall size of populations and may lead to biased sex ratios if one sex (female) is subject to a higher rate of mortality than the other. Through a better understanding of the movement patterns and habitat needs of box turtles, it may be possible to reduce some of the impacts of modern, large-scale suburban development and road building.

# *Box Turtle Iridovirus*

April Johnson, DVM  
College of Veterinary Medicine  
University of Florida  
Gainesville, FL

**I**ridoviruses are large, nonenveloped, double-stranded DNA viruses within the family *Iridoviridae* and are capable of infecting invertebrates and poikilothermic (endothermic) vertebrates. In 2003 and 2004, several mortality events occurred in which iridovirus was detected (17 of 70 turtles) in a Pennsylvania box turtle population. Retrospective studies have detected iridovirus in a past die-off of box turtles in Texas, and it may be the cause of other undiagnosed chelonian mortality events.

Clinical signs of turtles infected with iridovirus are ill-defined and include signs of upper respiratory tract disease and swelling of the neck tissues and oral plaques (similar to herpesvirus infections). The course of disease appears to be rapid, in contrast to mycoplasma infections, and some turtles die without demonstrating any symptoms.

There are several tests available to diagnose active iridovirus infections. Light microscopy can be performed on tissues when a turtle dies, or biopsy samples taken from a live individual to look for characteristic lesions and intracytoplasmic inclusion bodies. Electron microscopy can be performed to detect virus particles. The polymerase chain reaction (PCR) detects viral DNA and indicates an active infection. Virus isolation also indicates an active infection and requires fresh tissue to be inoculated onto cell cultures.

The iridovirus enzyme linked immunosorbent assay (ELISA) is a test designed to detect anti-iridovirus antibodies in turtles and tortoises. It does not indicate a current infection with the virus, but indicates that a turtle has been exposed to the virus at some point in its life and has developed an immune response against that virus. Funding has been provided by the Disney Conservation Fund and Morris Animal Foundation to do a seroprevalence study of antibody exposure in gopher tortoises and box turtles. Testing will be free of charge to those interested in submitting samples.

We are conducting an ongoing study and are seeking additional turtle specimens. If a turtle is found dead and is in relatively fresh condition, but it is not possible to take tissue samples, the whole body can be shipped on ice packs (not dry ice) to the University of Florida (see address below). If a necropsy is possible, the preferred tissues (about 25 milligrams), include the tongue, spleen, liver, and kidney. For all samples, provide contact information, location of sample (GPS coordinates, if possible), species, date of collection, and wild or captive status of individual. Ship samples on ice packs by Federal Express, overnight priority mail, to Dr. April Johnson at the University of Florida, 2015 SW 16th Ave., Building 1017, Room V2-238, Gainesville, FL 32608 (352-392-4700, Ext. 5256 or Ext. 5775).

# *A Children's Educational Program— The Natural History & Conservation of the Eastern Box Turtle*

Sandra Barnett  
Mid-Atlantic Turtle & Tortoise Society  
and the National Aquarium at Baltimore  
Baltimore, MD

**W**ith the goal of raising young people's awareness of and concern for the plight of the eastern box turtle and discouraging them from taking wild turtles as pets, the Mid-Atlantic Turtle & Tortoise Society (MATTS) ([www.matts-turtles.org](http://www.matts-turtles.org)) is developing a computer-based program on this species for free distribution to middle schools and high schools. The program includes a slide presentation, age-appropriate text that teachers can read or use as an aide in discussing the slide show, and a list of recommended websites and printed material on box turtles.

Using many colorful photographs, the program introduces children to these marvelous reptiles, describing their unique shell characteristics, sensory abilities, and sex identification (it is often harder than you think!). Examples of habitat are shown and habitat requirements highlighted. Students take a trip through each of the four seasons of these long-lived animals, learning how box turtles spend their time, find mates, control their body temperature, and feed. Natural mortality factors (e.g., predation, severe winter freezes) are discussed, as well as the threats to the survival of box turtles due to human activity. Habitat loss and fragmentation are the primary threats to this species, but collision with motor vehicles and, to a lesser extent, collisions with power mowers, attacks from raccoons and dogs, burning in leaf piles, and collection as pets also jeopardize box turtles.

Steps are outlined that young people can take to insure a better future for box turtles. Even small acts such as moving turtles out of the roadway and not collecting turtles from the wild can reduce the risk of extinction of the local population. Kids can also help by making sure that dogs do not roam free, pet food and garbage are not made accessible to turtle predators such as raccoons, parents burn leaf piles as soon as they are raked up, and mowing is done in the heat of the day, when box turtles are less likely to be out.

The program points out that the single most important factor in conserving box turtles is setting aside large tracts of high quality habitat that are not laced with roadways. Families, school groups, and social clubs can all help by contributing to organizations, such as The HSUS Wildlife Land Trust and the Nature Conservancy, that purchase and preserve land where box turtles occur.

At an approximate cost of one dollar per copy (cost of CD, mailer, and postage), small-scale distribution of the program to schools can be accomplished through funding by MATTS. Larger scale distribution may be possible through organizations such as The HSUS.

# Summary of Breakout Sessions

## *Research Needs*

Facilitators: Tim Maret, Joe Mitchell, Jr., and I. Lehr Brisbin

**T**here is a critical need for more information on many aspects of box turtle biology. We recommend the continuation and expansion of field research in the following areas:

1. Basic life history studies, particularly those that investigate geographic and habitat differences among populations;
2. The effects of small population size and reduced gene flow on the genetic structure of populations;
3. Hatchling biology, including survival and mortality, movements, and habitat use;
4. Impacts of suburban and rural housing development on population structure and stability;
5. Sociological investigations of the human component of human and turtle interactions;
6. Potential costs and benefits of repatriation efforts, as indicated by scientific studies employing proper experimental design/procedures;
7. Infectious diseases and their effect on populations;
8. Turtle behavior, particularly in relation to movements and habitat use;
9. Habitat characteristics, including the effects of habitat fragmentation and natural succession;
10. Population ecology and demography;
11. Effects of invasive plant species on the habitats used by turtles;
12. Basic turtle physiology, including the effects of endocrine disruptors;
13. Prioritizing causes of mortality and threats, identifying critical life stages, and determining ways to minimize mortality due to human influences; and
14. Identifying key road crossings and devising methods to mitigate vehicle mortality and the other negative effects of roads on turtles.

Related to the need for a more thorough understanding of box turtle biology is the need for improved communication among researchers and the adoption of standard research techniques. This need becomes

especially important when one considers the long life span of box turtles and the value of maintaining long-term studies for a decade or more. We therefore recommend the following:

1. Develop a list of researchers and study sites, and coordinate a network of researchers to facilitate communication;
2. Develop a centralized data bank where researchers can access information collected by others (e.g., DNA, photos, tissues, population characteristics, marking and measuring techniques);
3. Implement standardized research techniques, including turtle marking schemes, home range measurements and analysis, and the incorporation of new technologies;
4. Reanalyze old data to investigate long-term trends; and
5. Provide an alternate outlet for communicating and publishing the results of studies because many researchers do not publish study results in peer-reviewed publications.

## *State and Federal Regulations*

Facilitators: Glenn Therres and Holly Niederriter

**E**xisting regulations and laws vary widely among states where box turtles live. We recommend that state regulatory agencies consider the following actions to help conserve box turtle populations:

1. Protect box turtles now before they reach the point where they need to be placed on state lists;
2. Coordinate population status assessments and management plans among states;
3. Develop a common definition among states for “Species of Special Concern”;
4. Work with nongame advisory boards within the various state heritage programs to ensure that each state assesses box turtle population status and periodically reviews and improves box turtle regulations;
5. Develop mechanisms to better enforce existing population conservation regulations;
6. Review and increase, if necessary, existing fines and penalties, and work to encourage compliance;
7. Create web hyperlinks on state wildlife agency websites in order to more easily share information on species status and regulations among states; and

8. Make regulations easily available to the public by posting information in pet stores, veterinary offices, zoos, nature centers, and in magazines, mailings, and web pages.

*Summary points:*

1. Utilize the state threatened and endangered species listing process, if appropriate, including the species of special concern process;
2. Coordinate regulations among states, including population status definitions;
3. Improve and strengthen law enforcement (e.g., increase fines and penalties); and
4. Distribute information to the public and encourage public education partnerships.

Recommendations for state habitat protection regulations:

1. State wildlife and natural resource protection agencies should have the legal authority to protect box turtle habitat—work to increase both public and agency awareness of this species’ vulnerability to extirpations;
2. Use existing habitat protection opportunities which work to benefit box turtles indirectly; and
3. Use conservation easements and other tax incentives for land protection.

We recommend that federal regulatory agencies do the following:

1. Make use of the indirect protective measures provided in the Endangered Species Act;
2. Consider whether the box turtle or any of its subspecies should be proposed for candidacy under the Act;
3. Establish a mitigation fund or “superfund” for box turtles;
4. Investigate potential mechanisms to protect the public from disease transmission without the negative impact to wild populations that results from the current prohibition on the sale of turtles having a carapace length of less than four inches;
5. Integrate box turtles into federal land management planning;
6. Since each state currently is working on a comprehensive wildlife protection strategy as a condition of receiving federal state wildlife grants, use this opportunity to ensure that box turtles are included in protective strategies;
7. Consider changes in the inheritance tax structure as it relates to land development and habitat destruction and fragmentation; and
8. Consider enhancement of protections under the Convention on International Trade in Endangered Species of Flora and Fauna (CITES).

*Summary points:*

1. Examine the feasibility of listing the box turtle on the Endangered Species List;
2. Develop proactive mechanisms for species at risk;
3. Locate and utilize additional funding sources (e.g., state wildlife grants); and
4. Enhance CITES protections.

## *Repatriation and Rehabilitation of Box Turtles*

Facilitators: Don Forester and Lynn Cassell

**T**he following recommendations are directed at individuals and organizations that are involved in the rehabilitation and repatriation (returning turtles to a natural habitat) of box turtles:

1. Determine whether head-starting hatchlings increases their survivability compared with non-head-started hatchlings;
2. Determine the impact of repatriated turtles on preexisting populations;
3. Determine the survival rates of turtles that are repatriated to novel habitats which are already occupied by an existing population;
4. Determine the survival rates of turtles that are repatriated to novel habitats where box turtles do not occur;
5. Determine the survivability of injured turtles that receive surgical or medical care and rehabilitation;
6. Advise rehabilitation centers and veterinarians that box turtles that are removed from the wild for care or rehabilitation should, whenever possible, be released to a location that is within 0.5 miles of the original capture site; and
7. Provide wildlife rehabilitators with information on the basic biology and ecology of box turtles.

## *Development Threats and Box Turtles*

Facilitator: John Hadidian

**T**he following recommendations are directed to community planners, land-use planning agencies, and commercial housing developers:

1. Conservationists should work with developers to lessen the impact of development on turtles and their habitats. Potential strategies include:

- a. Cluster houses and other buildings and create protected natural areas;
  - b. Manage the existing habitat for box turtles, using the best available practices;
  - c. Educate community members about the box turtles that live in their area, their needs and vulnerabilities, and simple backyard management techniques that residents could use to aid box turtles;
  - d. Have site consultant engineers report equally to developers and conservationists.
2. Influence land use policies by working with “open space” boards, partnering with as many conservation groups as possible;
  3. Consider land banking strategies;
  4. Strategies for protecting turtles on sites to be developed may include:
    - a. Find a supporter among developers;
    - b. Set aside land at the development site for long-term protection;
    - c. Using the best available methods, rescue turtles for later release back on site after construction has been completed or at nearby protected sites with good quality habitat. This option requires more information about the impact of such strategies on the relocated turtles, the resident turtles at the release site, population genetics, and the potential for disease transmission.
  5. Consider the need for an organization to:
    - a. Determine local and regional box turtle protection needs;
    - b. Ensure that existing protections are enforced and that new regulations are implemented as needed;
    - c. Apply political pressure;
    - d. Publicize the plight of the box turtle and the importance of public cooperation in its protection.

## *Box Turtle Conservation Education*

Facilitators: Janet Ady and Will Brown

**T**hese recommendations and ideas are grouped somewhat arbitrarily under the various categories and organizations that appeared to be most appropriate. Much of this information and many of these recommendations could apply to a number of organizations, and the ideas presented in one category could easily be used by many groups and in a number of different situations.

### **Local, State, and Federal Agencies**

- Encourage training and education for local government, state, and federal park rangers, wildlife biologists, and naturalists so they can provide accurate information about box turtles to the public. County and municipal personnel should be targeted because they may be better able to reach local communities. Federal agencies would

include, but are not limited to, the National Park Service, U.S. Fish and Wildlife Service, Natural Resources Conservation Service, and U.S. Geological Survey. Re-educate the “choir”—those wildlife management professionals who are already teaching the public about wildlife in general and would be well positioned to incorporate box turtles into their message.

- Encourage local municipal agencies to work with non-profit organizations like the Nature Conservancy, National Wildlife Federation, World Wildlife Fund, and Defenders of Wildlife to take advantage of their expertise in managing habitats for wildlife, including box turtles.
- Work with state cooperative extension service personnel to develop outreach efforts to advise homeowners, farmers, and large landowners about ways to maintain and improve box turtle habitat.
- Resource management agencies, whether public or private, that have responsibility for box turtle habitat, should foster good communication between individuals and divisions in order to encourage box turtle conservation. Law enforcement and maintenance employees, who may be most likely to observe and interact with box turtles, may know little about these animals. They should have basic knowledge about what to do when finding a turtle crossing a park road or discovering someone attempting to remove a turtle from a park. Wildlife biologists in these organizations could provide the training or information exchange. Institutions without staff biologists could bring one in for staff training.
- Develop partnerships with state Departments of Transportation to provide input into their management of road edges, culverts, and other features so as to reduce turtle crushing by vehicles. Transportation departments should be encouraged to leave medians and sides of roadways unmown, or they should mow less frequently in order to reduce box turtle deaths from mowing. Reduced mowing also lowers roadside maintenance costs. Devise ways for turtles to cross roads safely. Reduce road building wherever and whenever possible.
- Provide information to Animal Control officers and animal “pounds” so they can take the best action possible when they do take a turtle into their possession.
- Encourage box turtle conservationists to join local planning and zoning boards.

## **Nongovernmental Organizations (NGOs)**

- NGOs should be encouraged to work with government agencies when they acquire land so these agencies can assess the need for road construction and the consequent impacts on turtles of road-building plans.
- Ask NGOs to use box turtles as mascot species for larger habitat conservation issues.

- Use existing monitoring programs as models (i.e., Frog Watch, “Journey North”).
- Ask the National Audubon Society, National Wildlife Federation, and Sierra Club to run articles about box turtle conservation in their magazines. Check with the National Oceanic and Atmospheric Administration (NOAA) and the Discovery® Channel about making a film on box turtles.
- Hold up The HSUS as a model—work with similar organizations.
- Make certain that local humane societies and large wildlife rehabilitation centers have up-to-date information on the best way to handle issues relating to box turtle care and the eventual return of rehabilitated turtles to their natural habitat.
- Land acquisition conservation groups such as the Nature Conservancy and the Trust for Public Land should be encouraged to purchase and protect box turtle habitat. Once such land is acquired, best management practices for box turtle conservation should be put in place (e.g., minimal to no road building, controlled burns at times least likely to harm box turtles, maintaining open nesting habitat, etc.).

## **Nature Centers and Environmental Education Centers**

- Provide nature and environmental centers with the new University of North Carolina box turtle guide and the new MATTS box turtle conservation CD.
- Provide them with new information on the importance of keeping box turtles wild and about ways in which the public can preserve and enhance box turtle habitat.

## **Rehabilitation Centers and Veterinarians**

- Provide general information on box turtle ecology and habitat needs. Stress the importance of returning rehabilitated box turtles to the same location where they were originally collected.
- Retrain professionals so that they know proper care of turtles during and after rehabilitation.
- Produce a CD or slide show for rehabilitators to teach them about box turtle biology and natural history in order to enhance their rehabilitation work and the eventual release of turtles.
- Post regulations in veterinary offices, pet stores, grocery stores, nature centers, and other locations where people who might keep box turtles will see them.
- Get veterinarians to collect locality data from those who bring turtles to them.

- Speak at veterinarian conferences to inform veterinary professionals about what to do with box turtles.

## **Professional Organizations**

- Contact existing box turtle organizations and provide them with information on conserving populations and habitats.
- Contact the AZA (American Zoo and Aquarium Association), AAZK (American Association of Zoo Keepers), and SSAR (Society for the Study of Amphibians and Reptiles) to learn of their efforts and to share information with them.

## **Landowners and Community Groups**

- Advise homeowners, farmers, and larger landowners about how they can maintain and improve habitats for turtles using best management practices. Key issues include lawn mowing and burning of brush piles. Turtles are known to use brush piles for resting, shelter, and during winter dormancy.
- Reduce lawn mowing and set blades high to avoid hitting turtles.
- Work with landowners to help them conserve known local populations.
- Use prescribed burning as a habitat management tool, where appropriate.
- Contact homeowner and civic associations to inform them about box turtles.
- Create “turtle friendly” communities where there is landscaping and other planning methods that make places livable for turtles.
- Consider approaching churches and other faith-based organizations. In South Carolina the Presbyterian Church supports a box turtle research project by Savannah River Ecology Laboratory scientist Lehr Brisbin called “tagging turtles for Jesus.”
- Use a model suggested by Will Brown: Educate and work with landowners about quality of life issues, set aside land for turtles, create habitat buffers, etc.
- Produce a door hanger or brochure for new homeowners and housing developers.

## **Commercial Businesses**

- Provide general information to pet stores on regulations and care relating to box turtles. Other commercial targets for providing general information on box turtle conservation include: garden centers, hardware stores, landscape companies and nurseries, and golf course associations.

## Industry and Utilities

- Power companies holding easements under power lines should be educated about box turtle conservation and best management practices for such conservation.
- Provide information to power companies, utility companies, tree harvesting, and paper companies because they control large tracts and right-of-way lands. Encourage them to maintain habitat strips along power line rights of way. Offer to train their personnel.

## Schools

- Box turtle conservation programs should be made available to teachers of all grade levels.
- Encourage teachers to incorporate box turtle conservation into school curricula where it might fit into units on ecology, environmental science, or animal behavior. This must be coordinated with existing education and science requirements. Be aware of science or ethical issues that may arise. Do not reveal the exact location of turtle colonies during educational programs.
- Provide schools with the new University of North Carolina box turtle guide and the new MATTS box turtle conservation CD.
- Elementary and high school students can assist with research projects. Need to have proper permits and study methods so that studies are legal and appropriate.
- Work with schools and make on-site visits to teach about turtles. Get schoolchildren to study areas where they could have contact with turtles.
- Do presentations to schoolchildren using captive turtles who cannot be released back into the wild.
- Create an *ABCs: Basic Turtle Information* or a *Box Turtles for Dummies* book.
- Adopt-a-turtle program—school classes can observe an existing box turtle research study and they could sponsor a marked turtle.
- Get high school students to do publicity and to print brochures.
- Hold a Box Turtle Festival Day and come up with catchy phrases like, “Come out of your shell for a day” or “Think outside the box,” etc.

## Turtles as Pets

- Discourage keeping box turtles as pets.
- For those who do have pet box turtles, provide better information on the proper care of captive turtles, cage size, nutritional foods, and when necessary, how to find a good home for an unwanted captive turtle.

## **Turtles and Roads**

- Develop a brochure that informs motorists about the safe and proper action when a turtle is found on the road.
  - Only stop your car on the road edge if it is safe.
  - Put the turtle on the side of the road in the direction that it is going, provided that it has not been injured. Do not take it to a park or nature center.
  - Keep fingers away from the turtle's head and mouth.
  - Wash hands after handling.
  - Praise the positive efforts of those who assist box turtles to cross roads safely.
  - Explain the negative impacts on the individual turtle and the population if it were to be removed or "saved" from the environment where it was discovered.

## **Nature Centers, Wildlife Rehabilitation Centers, or Schools: "Found" or "Saved" Turtles**

- Provide potential receiving organizations like nature centers and schools with contact information of agencies or reptile groups so they can determine the best action with a turtle that is brought to them.
- Develop protocols for what to do when nature centers are given turtles.
- Train staff and volunteers of nature and rehabilitation centers and veterinary clinics, and employees of pet stores to properly handle incoming calls/visitors regarding wild box turtles. A standard questionnaire should be used to record all pertinent information so as to return, whenever possible, individual turtles to the locations where they were found.
- Educate rehabilitators about turtles and their natural history and the importance of returning rehabilitated turtles to the habitat where they were originally collected.

## General Public Education

- Create an *ABCs: Basic Turtle Information* book for a variety of audiences.
- *Box Turtles for Dummies* book.
- Get phone numbers of organizations, professionals, and experts who could be called to answer questions from the public.
- Create and distribute an easy access pamphlet.

## Funding Ideas

- Nature of Learning grants.
- National Fish and Wildlife Foundation funds for on-the-ground projects that could have an educational component.
- NOAA's Bay Watershed Education & Training (B-WET) Program.
- Chesapeake Bay Trust.
- Approach businesses: Wal-Mart, Whole Foods, MBNA, AstraZeneca (pharmaceutical company).
- Hold an auction—ask organizations to donate items or to provide services to auction.

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## Appendix A—Participants

# *Eastern Box Turtle Regional Conservation Workshop*

September 28, 2004

Patuxent Wildlife Research Center

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## Appendix B

### *Box Turtle Regulations Summary*

State regulations as of Sept. 15, 2004, and contact information	Do box turtles have a protected status within the state? I.e., endangered/threatened, special concern	Is commercial collection of box turtles allowed?	How many box turtles can be collected for personal use?	What type of permit/license, if any, is required to take box turtles from the wild?
<b>ALABAMA</b> Mark Sasser Nongame Wildlife Coordinator 334-242-3867	Unlawful to collect or offer for sale or trade for anything of value any box turtle or reproductive product except by permit	No	Written commissioner's permit required which shall specifically state what the permittee may do with regard to said species	Scientific collection permit required for box turtles
<b>ARKANSAS</b> Kelly Irwin Herpetologist 877-847-2690	Species of special concern	Effective Sept. 1, 2004 no new licenses were issued for any person or operation engaged in the importation, propagation, sale, transport, barter, or distribution of box turtles. All commercial activity with any <i>Terrapene</i> will be prohibited after June 30, 2005.	Six wild caught by hand	Fishing license \$10.50 resident/ \$32 nonresident
<b>COLORADO</b> Tina Jungwirth Herptile Coordinator 719-227-5237	No	No	Four per year	
<b>CONNECTICUT</b> Julie Victoria Wildlife Biologist 860-642-7239	Species of special concern	Closed	Closed	Closed
<b>DELAWARE</b> Holly Niederriter Nongame & Endangered Species Biologist 302-653-2880	No	No	One	No permit required
<b>FLORIDA</b> Paul Moler Herpetologist 352-955-2230	Nongame wildlife	May not be sold	Two	No permit required

State regulations as of Sept. 15, 2004, and contact information	Do box turtles have a protected status within the state? I.e., Endangered/ threatened, special concern	Is commercial collection of box turtles allowed?	How many box turtles can be collected for personal use?	What type of permit/license, if any, is required to take box turtles from the wild?
<b>GEORGIA</b> Jon Jensen Herpetologist 478-994-1438	Nongame species	No	Four may be possessed; may not be held as pets.	No permit required
<b>ILLINOIS</b> Scott Ballard Herpetologist 618-993-7023	No	No	The daily catch limit for amphibians and reptiles is eight of each species. The possession limit for amphibians and reptiles is 16 of each species.	Fishing license \$13 resident/ \$25.50 nonresident
<b>INDIANA</b> Zack Walker Herpetologist 812-334-1137	Protected	No	A box turtle can be obtained as a gift from someone who has box turtles under a special purpose turtle possession permit in Indiana, from another state (if obtained lawfully), or if a wild collected turtle is in your possession prior to November 1, 2004.	Special purpose possession permit (free)
<b>IOWA</b> Daryl Howell Conservation & Recreation 515-281-8524	Threatened and endangered list	No	No	Closed
<b>KANSAS</b> Ken Brunson Wildlife Diversity Coordinator 620-672-0792	No	No	Five	Hunting license \$19 resident/ \$71 nonresident
<b>LOUISIANA</b> Jeff Boundy Herpetologist 225-765-2815	Yes	No	Four	Fishing license \$9.50 resident/ \$60 nonresident
<b>MAINE</b> Phillip deMaynadier Biologist 207-941-4239	Endangered	No—only snapping turtles may be collected from the wild	No	Closed

State regulations as of Sept. 15, 2004, and contact information	Do box turtles have a protected status within the state? I.e., Endangered/threatened, special concern	Is commercial collection of box turtles allowed?	How many box turtles can be collected for personal use?	What type of permit/license, if any, is required to take box turtles from the wild?
<b>MARYLAND</b> Scott Smith Wildlife & Heritage Division 410-827-8612	Yes	No	One without permit	No permit required for one (\$25 permit required for more than one)
<b>MASSACHUSETTS</b> Jonathan Regosin MassWildlife 508-792-7270	Species of special concern	No	Closed	Education/science permit \$1
<b>MICHIGAN</b> Lori Sargent Endangered Species Specialist 517-373-9418	Species of special concern	No	Need special permit to collect	Research permit
<b>MISSOURI</b> Jeff Briggler Herpetologist 573-751-4115	No	No	Five	Five without permit for personal use
<b>MISSISSIPPI</b> Bob Jones Herpetologist 601-354-7303	Nongame animal	No	Four may be collected and possessed for personal use	Small game hunting/fishing license—\$8.00
<b>NEW HAMPSHIRE</b> Mike Marchand Wetlands Biologist 603-271-2461	Species of special concern	No	0	
<b>NEW JERSEY</b> Dave Golden NJ Endangered & Nongame Species Program 609-628-2103	Yes—listed as a species of special concern	No	0	
<b>NEW YORK</b> Alvin Breisch Amphibian and Reptile Specialist 518-402-8855	Protected under a 1905 law. Population in terrible shape. Want to increase protection.	No	Six box turtles may be possessed for personal use	Hunting license
<b>NORTH CAROLINA</b> Sarah Cross Herpetologist 919-553-3094	Yes	No	Five	No license for five or fewer; captivity license or permit required to possess more than five

State regulations as of Sept. 15, 2004, and contact information	Do box turtles have a protected status within the state? I.e., endangered/threatened, special concern	Is commercial collection of box turtles allowed?	How many box turtles can be collected for personal use?	What type of permit/license, if any, is required to take box turtles from the wild?
<b>OHIO</b> Carolyn Caldwell Wildlife Management and Research 614-265-6329	Species of special interest; considered native reptile	Only captive bred or imported with proper documentation	Four or fewer wild-caught	Propagating license \$25 noncommercial/ \$40 commercial
<b>OKLAHOMA</b> Mark Howery Natural Resources Biologist 405-521-4619	No	Unlawful to engage in any commercial activities involving any species or sub-species, if more than one exists or reptiles or amphibians collected from the wild that are indigenous to or whose range extends into Oklahoma	Year round season—may take six per day for personal use	Resident or nonresident hunting license required for all reptiles
<b>PENNSYLVANIA</b> Chris Urban 814-359-5113	No	No	Two per day may be taken from the wild; two may be possessed for personal use	No
<b>RHODE ISLAND</b> Chris Raithel Wildlife Biologist 401-789-0281	Yes	No		Special permit from department
<b>SOUTH CAROLINA</b> Steve Bennett Herpetologist 803-734-3930			Yes	
<b>TENNESSEE</b> Richard Kirk Coordinator 615-781-6619	No	No		Free turtle permit required to take turtles not protected in state except box turtles
<b>TEXAS</b> Andy Price Natural Resources Scientist 512-912-7022	Nongame wildlife	Yes	10	Nongame dealer permit or valid commercial collection permit
<b>WISCONSIN</b> Bob Hay Herpetologist 608-267-0849	Endangered	No	No	Collected by permit for research purpose only

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