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Cover: Northern map turtle, *Graptemys geographica*, from the DesPlaines River, Will County, Illinois. Photograph by Michael Redmer.

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The Future of Map Turtles: Will the Mutts Take Over?

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Mapping the distributions of our native map turtles could soon become an exercise of historical interest.

The southeastern United States has the greatest aquatic diversity of any place on earth. I first became aware of this in the mid-1970s while compiling an atlas of the freshwater fishes of North America (Lee et al., 1980). Of the 770+ species of freshwater fishes then known from North America, 580 (75%) occur in the Southeast. Subsequently a number of additional species have been described, with the majority of these also dwelling in the Southeast. The diversity is not limited to fishes. Reptiles and amphibians, crayfish, freshwater mollusks and aquatic insects are all well represented, and many are endemic to specific drainage systems. North of the Potomac River, south of central Florida, and west of central Texas this diversity of native fauna declines rapidly as does endemicism. Overviews of this can be found in Holt (1972) and Hackney et al. (1992); the pattern is irrefutable. It can be seen by simply thumbing through distribution maps of almost any field guide. The diversity of freshwater turtles in southeastern North America is particularly impressive and rivaled only by the chelonian fauna assemblage of Southeast Asia.

One group of aquatic turtles exhibiting a surprising amount of diversity in southeastern North America is the genus *Graptemys*. Of the 12 recognized species, 9 (75%) are endemic to specific rivers or river basins and for the most part these each have relatively limited distributions. Half of these species were not even recognized prior to 1950, and several were not described until the early 1990s. Over half are at some level of conservation concern, and all are listed as CITES Appendix II or III species (U.S. Fish and Wildlife Service, 2005). A brief overview of the 9 endemic and three wider ranging species, as well as their current conservation status follows:

Endemic species:

Barbour's Map Turtle, *Graptemys barbouri*. Florida and Georgia: Apalachicola River, as well as sections of the Choctawhatchee, Aucilla, Wacissa and Ochlockonee Rivers. IUNC low risk/nearly threatened, proposed for listing by the U.S. Fish and Wildlife Service (USFWS).

Cagle's Map Turtle, *Graptemys caglei*. Texas: Guadalupe and San Antonio Rivers, may be extirpated from the latter. IUNC vulnerable.

Escambia Map Turtle, *Graptemys ernsti*. Florida and Alabama: Rivers flowing into Pensacola Bay and the Pea and Choctawhatchee Rivers. IUNC low risk/nearly threatened, proposed for listing by USFWS.

Yellow-blotched Map Turtle, *Graptemys flavimaculata*. Mississippi: Pascagoula River. USFWS threatened, IUNC endangered.

Pascagoula Map Turtle, *Graptemys gibbonsi*. Mississippi and Louisiana: Pascagoula and Pearl Rivers. IUNC low risk/nearly threatened, proposed for listing by USFWS.

Black-knobbed Map Turtle, *Graptemys nigrinoda*. Alabama and Mississippi: Alabama, Tombigbee, Black Warrior, Coosa, Tallapoosa and Cahaba Rivers. IUNC low risk/nearly threatened, proposed for listing by USFWS.

Ringed Map Turtle, *Graptemys oculifera*. Mississippi and Louisiana: Pearl River. USFWS threatened, IUNC endangered.

Alabama Map Turtle, *Graptemys pulchra*. Alabama, Georgia and Mississippi: Mobile Bay drainage. Proposed for listing by USFWS.

Texas Map Turtle, *Graptemys versa*. Texas: Colorado River drainage on the Edwards Plateau. IUNC low risk/threatened.

Wide-ranging species:

Northern Map Turtle, *Graptemys geographica*. Upper Mississippi Basin, the Great Lakes region, and the Susquehanna, Juniata, Delaware and Hudson Rivers.

Ouachita Map Turtle, *Graptemys ouachitensis*. Mississippi Basin.

False Map Turtle, *Graptemys pseudogeographica*. Mississippi Basin.

While the majority of these species are endemic to specific drainages and states, collectively they also present an interesting mosaic of allopatric and sympatric distributions. The complexity of this faunal assemblage was not fully appreciated until the early 1990s (Lovich and McCoy, 1992). While the range maps depicted in various publications show the general distributions of each species, to some degree these maps are misleading in that the turtles themselves are mostly restricted to just the actual rivers and not the entire river basin. Furthermore, many of these map turtles occur only in major portions of the rivers, and are absent from 1st and 2nd order streams and impounded sections of the rivers; rarely are they found throughout the entire river system. Pollution and habitat destuction have clearly also taken a toll. For example, the northern map turtle was apparently extirpated from the Allegheny River in Pennsylvania due to degradation from pollution (Hulse et al., 2001). Acid mine wastes are believed to have had a major impact on much of the former indigenous aquatic fauna of the Allegheny River system (Ortman, 1913). Reduction in the size of populations and the occurrence of isolated relict populations resulting from impoundments and similar habitat alterations, as discussed below, will make any of the species vulnerable to genetic pollution from the release of pet-trade turtles.

Map turtles have been in the pet trade since the 1950s. As a

child I recall seeing them for sale in Maryland pet stores in the mid-'50s. However, today's market has been enhanced both in volume and in commercial distribution. Because of this, pet trade introductions of false map turtles occur well outside the species' natural range (Barbour and Lovich, 2009), and this includes foreign countries. Haffner (1997), for example, reported this species as being introduced in France. Natural hybridization within this genus has not been formerly addressed, due in part to the allopatric distributions of the majority of species. However, map turtles raised on turtle farms readily hybridize. This is a result of mixed species assemblages used as breeding stock. A decade or so back, I sorted through a shipment of several hundred farm-hatched map turtles looking for hatchlings of various species to photograph. All of the individuals in the shipment exhibited signs of hybridization, and I suspect they where not simply hybrids, but that the parent stocks were mostly hybrids as well. Otherwise some random percentage of the pairings should have been right. The turtles being sold were almost certainly varying combinations, and re-combinations, of false, Ouachita, and Mississippi map turtles. A DNA study of these commercial farm pond hybrid swarms would be interesting, but I trust there are more important ways to best spend much needed turtle research funds.

I visited the Daytona Beach tourist and tee shirt shops on Florida's route A1A in September 2011. At least four shops had signs advertising that they were selling "live baby turtles" (Figure 1). I did not check any of the similar stores but suspect many of the others were also selling turtles. Each of the shops displayed 50 to 130 hatchling turtles that sold from $12.00 to $14.95 each. They also sold "turtle set ups," which included a container, a year's supply of food and a turtle. The prices of these varied from shop to shop and ranged from $20 to $49.99 depending on the size of the container. The "large" containers were the traditional oval plastic bowls with an island and a plastic palm tree. The islands were so small and low that they would only hold one turtle, and unless water covered the top of the island it would not be deep enough to cover the turtle's shell when they were swimming. The small "set ups" were simply clear plastic boxes that would be the right size for filing 3× 5 index cards. The turtles themselves were crowded into tanks (Figure 2), one of which had extremely dirty water. Filthy may be a better term. Signs stated they were "yellow-bellied turtles." One store had 100+ map turtles and 15–20 yellow-bellied sliders, and one had 10 or so map turtles and about 30 sliders. The other two stores were each selling 100+ map turtles. They at first appeared to be mostly false map turtles, but there was a lot of individual variation and signage stated that customers were not allowed to handle the turtles. It would have been informative to examine them closely. When I asked the sales personnel about the turtles they had no idea as to what type of turtles they were, let alone which species.

In previous years these same shops sold mostly hatchling red-eared sliders (*Trachemys scripta elegans*), at similar prices, and sometimes given free if the "turtle set ups" were purchased. The latter gimmick was an attempt to get around the federal regulation prohibiting the sale of turtles under four inches.

Recently Florida passed regulations that stopped the sale of red-eared sliders because released pet turtles were becoming established and were competing and interbreeding with native species. As of 1 July 2007, red-eared sliders could no longer be sold in the state, and after 1 January 2008, it was illegal for non-licensed people to have a red-eared slider under four inches in carapace length. The intent of this regulation is different than the federal one banning the sale of turtles under four inches due to health risk to children. Florida considers the sliders to be injurious wildlife, and the state's wildlife agency was concerned about the growing numbers of unwanted pets that were being released (Lee, 2010). The response of the turtle farmers and retail dealers was simply to provide different turtles. Red-eared

Figure 1. Tourist shops in Daytona Beach, Florida, advertising the sale of "baby" turtles. September 2011.

Figure 2. Map turtles and yellow-bellied sliders for sale in tourist shops in Daytona Beach, Florida. September 2011. Variation in map turtle head patterns is suggestive of intra-generic hybridization. Note the plastic boxes behind the display, the small turtle "set ups" being sold with the purchase of a turtle.

sliders were crossbred with yellow-bellied sliders and the Florida sales continued. This is interesting in that one of the major intents of the regulation was to prevent intergradations in wild populations from released turtles. In addition hieroglyphic river cooters (*Pseudemys concinna hieroglyphica*) also appeared in shops in Florida. While hieroglyphic cooters are no longer considered a valid taxon (Seidel, 1994) this current realignment of the subspecies of cooters has been questioned (Jackson, 1995). Whatever proves to be correct is of little relevance here. Genetic scrambling within the species and subspecies of *Pseudemys* in Florida and elsewhere becomes likely with the mass introduction of this genus into the pet trade. And now we see mass numbers of *Graptemys* added to the equation.

The obvious problem is that the current regulations have simply resulted in the exchange of one issue for several others. Concerns of introduced injurious wildlife are of course not limited to turtles, but here is a case where there was concern for mass intergradations of red-eared sliders with the native subspecies—the yellow-bellied slider. With the shift in sales to cooters and genetic designer sliders (*scripta* × *elegans*) to circumvent the law, the entire intent of the new regulations was immediately nullified. Now with the use of various species of *Graptemys* and their hybrids by the pet trade any number of wild populations of map turtles could quickly become genetically compromised. In addition, even if map turtles become established in drainage systems in the Southeast that do not harbor native map turtles other native fauna—most notably endemic freshwater mollusks—could be jeopardized. The fact that Daytona is a popular tourist destination makes it inevitable that the pet-trade map turtles will become widely distributed, and as in red-eared sliders, feral populations are likely to spring up most anywhere. Unless state regulations are developed in conjunction with neighboring states they are at best ineffective in slowing the establishment of feral populations. The spread of feral turtles resulting from the release of pet turtles is not controlled by individual state regulations as states share drainage basins with adjacent ones. The problem is exacerbated by the fact that tee shirt and beachwear shops in tourist communities are selling the pet turtles so they become dispersed widely by their clientele. States with stricter regulations and enforcement fail to benefit from their efforts in that these turtles continually enter their state as a result of the travels of vacationing families. How can we realistically expect to educate the general public about the irresponsibility of releasing cute pet turtles that have outgrown their aquariums (Sellers and Lee, in press)?

The fact that many of our species of map turtles are of global (IUCN), national (USFWS), or regional (state listings) conservation concern is important, but even wide-ranging species, or apparently stable endemic species, still remain vulnerable to genetic swamping by introduced feral species and their hybrids. Populations could exhibit major genetic pollution issues within decades. While agencies recognize the problems involved with habitat loss, in many cases direct and indirect threats from exotic species remain unaddressed, debated, circumvented or dismissed.

In October 2011 the late Joe Collins, creator of The Center for North American Herpetology, released a report that the U.S. Fish and Wildlife Service was looking at the status of a number of southeastern freshwater species. The list included 5 map turtles as well as 23 other species of reptiles and amphibians from 13 southeastern states. The original request to reevaluate the status of some 374 different aquatic species came from the Center for Biological Diversity (2011) and was cosponsored by a number of southeastern regional conservation organizations. Within days herp hobby groups began circulating emails addressing their concerns that this could infringe on their rights to keep and sell many of these species. The turtle interest groups were particularly outspoken. As usual the commercial herp community was not particularly concerned about the species' well-being in the wild, but they were very alarmed that possible additional listings under the Endangered Species Act might hurt them economically. It was clear that they had no interest in supporting the pending protection of any these species.

The threat of extensive and widespread hybridization resulting from the release of unwanted pet turtles is real. In North Carolina, for example, the state passed regulations prohibiting the sale of any turtles of any size as pets. This was done in conjunction with the Federal Food and Drug Administration's 1975 act preventing sales of turtles under four inches. Yet, today the sliders found around Raleigh and other major cities in the state are mostly intergrades between the native yellow-bellied slider, *Trachemys scripta scripta*, and the pet trade red-eared

sliders, *T. s. elegans*. This is in spite of a formerly large population of the native subspecies and a well-enforced ban of sales of pet turtles within the state. While clearly some of the introductions were prior to 1975, unwanted turtles continue to be released in local waters. This is a result of the large numbers of red-eared sliders that continue to be sold in tourist shops in Myrtle Beach, South Carolina. Myrtle Beach is a popular tourist designation for North Carolina residents, and is located just across the state line.

While state wildlife agencies have been doing a good job of managing game species for nearly a century, reptiles and amphibians and other nongame responsibilities were really not under most states' jurisdiction until the early 1970s. Meaningful programs were slow to develop, and in many cases major issues still remain to be addressed. Most states have developed laws that address native species with limited or no provisions for species or subspecies protected in other states, and there is considerable variation in the strength and level of enforcement from state to state. The Florida regulations addressing the sale of red-eared sliders was clearly well intended, but the pet industry in their efforts to circumvent it, have not only nullified the concept of preventing injurious wildlife introductions with the substitution of *scripta* × *elegans* intergrades into the pet market, but now we see the genetic diversity of the southeastern *Graptemys* complex potentially compromised. Florida more than any other state has seen the detrimental effect of exotic plants and animals on its various ecosystems. I have no doubt that they will redraft regulations to effectively address these issues. But all of this takes time, and the pet turtle market will continue to sell turtles to visiting tourists.

The interim solution is simple. The FDA has regulations in place prohibiting the sale of turtles under four inches. "Public distribution . . . in connection with a business . . . shall be subject to a fine of not more than $1,000 or imprisonment for not more than 1 year, or both, for each violation, in accordance with section 368 of the Public Health Service Act (42 U.S.C. 217)." States have the power to enforce this act, and several southeastern states are doing this very effectively. Long-term solutions will require better federal regulations of commercial sales of all species of turtles. However, it is possible that the pet industry itself, and their advertisers, could self regulate the business and perhaps make meaningful reptile and amphibian conservation a key component of their business plans. More effort needs to put into educational campaigns to inform the general public of the endless cycle of health, humanitarian, and conservation issues created by the turtle farms.

Addendum

I realize all these articles on the mass production of disposable pet trade turtles are sounding like a broken record, but issues continue to evolve more quickly than solutions. The purpose of this note is to provide several points that I overlooked, and others that came to light just after this article had been submitted.

In my attempt to outline the species composition of the genus *Graptemys* I forgot to include the most recently described species. There are actually 13 currently recognized species, ten of which are endemic to specific drainage basins or small geographic areas. The Pearl River population of what was formerly the Pascagoula map turtle has been elevated to a full species.

Pearl River Map Turtle, *Graptemys pearlensis*. Mississippi and eastern Louisiana, endemic to the Pearl River. Due to its recent recognition as a distinct species (Ennen et al., 2010) the conservation status of this species has not yet been fully addressed. The species has been proposed as threatened by the IUCN (van Dijk, 2011). In addition, in that the distribution of the Pascagoula map turtle, *Graptemys gibbonsi*, is now limited to just the Pascagoula River, arguments in favor of the proposed listing of that species by the USFWS under the Endangered Species Act are also strengthened. In terms of the potential for hybridization with pet trade released map turtles this not only adds one more endemic species to be concerned about, but it reduces the range of *G. gibbonsi* by about half, making it more vulnerable to possible genetic pollution.

The U.S. Fish and Wildlife Service published an "undecided" position in April 2012 regarding the inclusion of *Graptemys* for a CITES II listing (U.S. Fish and Wildlife Service, 2012a). The wording of this ruling is as follows:

> 22. Map turtles (*Graptemys* spp.) - Inclusion in Appendix II and three species in Appendix I
> There are 12 or 13 species of North American map turtles (*Graptemys* spp.), depending on taxonomy. The SSN recommended that the United States propose 3 species of map turtle (*G. caglei*, *G. gibbsoni* [sic], and *G. pearlensis*) for inclusion in Appendix I and the remaining map turtles for inclusion in Appendix II. The WCS, CBD, and the IUCN Tortoise and Freshwater Turtle Specialist Group recommended that the United States propose all map turtles for inclusion in Appendix II, noting the recommendations of the Conservation Working Group at the St. Louis U.S. Turtle Trade Workshop held in September 2010. This genus is for the most part endemic to the United States with one species (G. geographica) extending into Canada. Map turtles are popular in the pet trade and may also be sold for human consumption. They are protected to varying degrees by State laws within the United States. Two species of map turtles (*G. flavimaculata* and *G. oculifera*) are protected under the ESA. The United States included map turtles in Appendix III on June 14, 2006. Trade data (1999 and 2010) indicate that the United States exports about 226,000 live specimens per year. Currently we are monitoring trade in these species, assessing the effectiveness of their inclusion in Appendix III, and working with the AFWA CITES representatives who are coordinating with the States to ensure conservation of these species. As a result, the United States remains undecided about proposing to include the species in Appendix I or II, pending consultations with the AFWA CITES representatives and Canada and the availability of additional information. We seek further information about the species' population status, threats to the species, and, in particular, the impact to the species from international trade.

An abbreviated version of the above was published in the Federal Register on 11 April 2012. Since 14 June 2006, all map turtles still remain listed under Appendix III (CITES, 2011).

My primary concerns on the mass marketing of pet hatchling map turtles to the general public were the problems this can cause in turning our various endemic map turtle populations into genetic swarms, but like red-eared sliders, map turtles can also

transmit *Salmonella* to small children and people with immunity disorders. Not only was one of the stores in Daytona displaying the hatchlings in dirty water, a number of the turtles had sores on their necks and other signs of infections. The problems with aquatic turtles and *Salmonella*, while a different issue entirely from the environmental concerns, are not imagined ones. Nor are they without serious consequence.

The warning below is condensed from a news release posted on the Internet just before Easter, and the start-up of the spring market for baby bunnies, chickens and turtles (Worcester County Health Department, 2012):

> Maryland's Department of Health and Mental Hygiene is reminding parents that baby animals can pass Salmonella and other harmful bacteria to people.
>
> The Centers for Disease Control (CDC) has been researching and investigating three Salmonella outbreaks that are ongoing and associated with turtle exposures. The outbreaks have been linked to 63 people in 16 states.
>
> Six Maryland residents have been identified as having an infection linked to the outbreaks. All six cases reported exposure to a baby turtle.
>
> Three of those cases were from people who had bought the baby turtle. The U.S. Food and Drug Administration strictly prohibits the sale of pet turtles with shells that are four inches or smaller.

For several decades I have attempted to address, or at least expose, the inconsistency in state, federal and various agency regulations and their enforcement regarding turtle conservation. An online publication is now available that reviews the current regulations regarding amphibians and reptiles native to the United States (U.S. Fish and Wildlife Service, 2012b). This report is up to date through February 2012. The report shows that all 13 species of map turtles are protected in one or more states. Thirteen different states, most of them in the Southeast, have at least one species listed as in need of protection. Mississippi protects eight. Many are listed as state endangered or threatened, while others are listed as having some form of additional protection within that state. One of the primary goals of this report is to "Facilitate communication and collaboration among states to address challenges in regulating amphibian and reptile use and in enforcing existing laws." Hopefully this document will become an important tool for redrafting current laws so that our native species can receive more adequate and uniform protection from commercial interests that now successfully move animals to states with weak regulations to "legalize" their sales. Unfortunately such a document does not exist for species occurring outside of the United States, and for commercial wildlife dealers, reptile expo events, and chain pet stores this online resource will become a handy map for circumventing existing state laws.

Let's watch.

I thank Katrina Smith, Peter Paul van Dijk, and Jeff Lovich for bringing my attention to much of the information presented here. I must add that I was pleased to see the son of one of my long-term friends as co-author of an account of the Pearl River map (Ennen et al., 2012). I recall several decades ago, in his parent's back yard, taking pleasure in teaching him how to blow empty beer cans off a log with a .22 pistol. Roger Birkhead, then 10–12 years old, was a good student; the cans were pulverized.

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Historical Sightings and Recent Surveys of the Herpetofauna of the James River Park System

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The James River Park System spans a large swath of the James River at Richmond, Virginia, just northwest of where the river is navigable for merchant shipping. Though you are engulfed by a metropolis at many areas of the park, you might feel for a long while that you have arrived in a primeval wilderness. I grew up near one entrance now known as Pony Pasture. As a young person of about ten years I went with my father to collect river water for an aquarium. While my father collected the water I ventured along the bank among tall grass and exposed knee-high rocks. When I approached a head-high (for me at the time) boulder, I luckily happened to look down to see my right food poised to step on a large coiled and perhaps sleeping northern copperhead (*Agkistrodon contortrix mokasen*). Adrenaline equipped my left leg with the energy to vault me over the snake, heart nearly jumping out of my chest. Later, in 1972, Hurricane Agnes flooded the James and sent a dinner-plate-sized painted turtle (*Chrysemys picta*) uphill and into my yard. I discovered it one morning, disoriented under my parent's residential mailbox.

By the late 1970s I ventured to the area now known as Pony Pasture and found a few individuals of what would become the icon of the park system, the spotted salamander (*Ambystoma maculatum*) in a vernal pool located near the drive-in entrance to this park's parking area. Until 1980 I continued to see a few salamanders in this pool but by 1981 with growing commitments I didn't get to see the park early enough to view spotted salamanders. By the late 1980s, growing citizen interest and concern in the natural areas by the James River made the spotted salamander the token icon of the park. Now Riverside Drive (the road that salamanders must cross) is occasionally closed in March through early May on rainy nights when the salamanders are migrating. Still, many are killed by traffic and students from my alma mater, Virginia Commonwealth University (VCU), monitor the migration and road deaths of these tiny and yet charismatic creatures.

For a significantly wilder river view and greater potential for herpetological discoveries a short drive toward downtown Richmond, with a turn at 42nd Street, brings you to a small parking area under dense shade of towering tulip trees, red maples and sweet gums. The entrance leads you to a steep stone stairway making it difficult to explore the understory here. It is usually wet and somewhat slippery as well. But, as part of a VCU ecology class led by Dr. Charles Blem in 1986, I and about 10 students sifted through leaf litter and beneath fallen logs to find dozens of the cryptic, recalcitrant and diminutive red-backed salamanders (*Plethodon cinereus*). At that time and even into my explorations in 1987, 1988 and 1990, I saw many

salamanders, but by 1999 I could find no more than two. While various factors may influence salamander numbers, I did find one introduction in 2001 that may indirectly and negatively affect salamander densities. The introduction was an invasive herb, garlic mustard (*Alliaria petiolata*). In 2001 I found six or so garlic mustard plants on the hilltop at the entrance to the park and there was nothing barring their progress in colonizing the salamander-inhabited slope. By 2002 garlic mustard had progressed to the slopes and I picked as much as I could find. Since that time I have heard some field scientists suggest that garlic mustard may be harmful to woodland salamanders by changing soil chemistry and thus driving away their invertebrate prey. One study by Maerz and Blossey (2002) has been undertaken to quantify the negative impact of garlic mustard on the red-backed salamander.

Also during one of the field trips led by Dr. Blem, we witnessed a very complaisant northern copperhead stretched full length and basking on the railing, allowing us to pass without so much as twitching.

Late in the 1980s, the mid and then late 1990s, I made more trips to the 42nd Street entrance and explored further into the park. Once you arrive at a metal bridge that juts riverward and terminates with an observation deck that provides a fair river view; you can descend a spiral stairway which takes you to the humid and sweetly earthy-smelling ground of alluvial forest. You immediately encounter a walking trail sometimes alive with joggers, dog walkers and bicyclers. But then you turn north toward the river, leave the people behind, and scramble across sunken low-rise boulders, some open sand and mud, beneath black gum, willow oak and green ash trees. In spring 1995 I saw a single spring peeper (*Pseudacris crucifer*) at eye-level, resting on a black gum leaf. In spring of 1999 I heard the buzzing call of a Cope's gray treefrog (*Hyla chrysoscelis*) here.

Heading toward the river you soon find yourself among larger boulders, swaths of exposed wide-domed boulders with dense vegetation clinging to the interstitial spaces and occluded, fishless backwaters of the river. In one of these backwater areas in 2002, I found an algae-covered, writhing pool full of large tadpoles of *Lithobates* species reminding me of the connection that primitive peoples made between amphibians and the chthonic world mentioned in Kuzmin (1999). I found several adult southern leopard frogs (*Lithobates sphenocephalus*) and a few adult pickerel frogs (*Lithobates palustris*) in the vicinity, placing those species as the putative parents of the tadpoles in the backwater pond. It was near this pond in a thickly vegetated margin of a poolside boulder that I saw the tail of a snake and quickly grabbed it to pull out an eastern wormsnake (*Carphophis amoenus amoenus*), which lived up to its placid characterization mentioned by Mitchell (1994) while I took several pictures.

Continuing on toward the actual river, on a trail of sorts leading to a pawpaw covered island, I continued to search for northern copperheads, but never saw another. From the river shoreline of the pawpaw island you see the gurgling to raging river, boulders strewn everywhere. Ubiquitous great blue herons stalk unfortunate smallmouth bass, sunfish and frogs. The only sign of the bustling city on the north shore is the silent sentinel of the Carillon, a bell tower built as memorial to Virginia soldiers who fought and died in World War I.

To the south of the Carillon view are short-statured boulders, sparsely vegetated sand bars and more sun-exposed occluded backwaters, marsh and swamp. Here in almost any given springtime you will find dozens of toadlets ranging in color from greenish brown to almost black of the American toad (*Anaxyrus americana*); although these toadlets were common I've never happened upon an adult. No doubt adults are there and their apparent scarcity, at least near the river, may derive either from successful or attempted predation by those persistent great blue herons. Here I found the bullfrog (*Lithobates catesbeianus*). This usually common species, maybe due to the perseverance of the herons, was hiding in tree-screened pools. This frog probably also breeds in the same pools as the southern leopard frog and pickerel frog. In 2000 I saw a solid green bullfrog clearly eight inches long from its snout to its pubis-ischium. No doubt, this frog attained such a size as a predator of the smaller leopard and pickerel frogs.

While the James River Park System remains popular these and potentially many more herps have a dynamic mosaic of habitats in which to breed and live out their lives. Threats to the park are many. For example, in 2011 a Richmond City Council member proposed some legislation that would slash funding for the park system. I, along with possibly thousands of fellow Richmond residents emailed the councilman to such an extent that the legislation was dropped. On the other hand hurricanes don't respond to petitions and just as Agnes displaced the painted turtle in 1972, Isabel in 2003 scoured the back channel where the southern leopard and pickerel frogs were breeding the previous year. But hurricanes, unlike council legislation, can create as well as destroy. No doubt the pickerel, southern leopard and bull frogs found equally suitable post-Isabel breeding sites.

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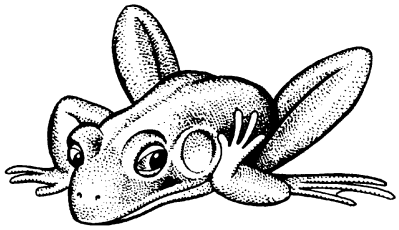
Maerz, J. C., and B. Blossey. 2002. A study of the impact of non-indigenous plant invasions on woodland salamander fitness and abundance (www.invasiveplants.net/impsal.htm)

Mitchell, J. C. 1994. The reptiles of Virginia. Washington and London: Smithsonian Institution Press.

The Tympanum



Dear CHS Members and Grants Committee,

I'm writing to report on the 2010 research season for our wood turtle study in Cheshire County, New Hampshire. I apologize for the late reporting.

The year 2010 was an exciting one for wood turtle study in Cheshire County. We found 8 males and 2 females and nearly half of the wood turtles found were aged over 40 years. This was nearly the opposite ratio of the 2009 research season when most were females and under the age of 25. In fact, two males at Site No. 5 appear to be approximately 70 years old! (see below).

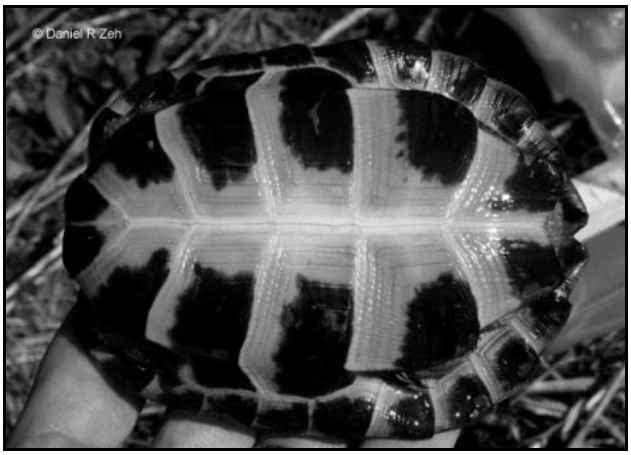
Turtles #26 (above) and #27 (below) were estimated to be about 70 years old.

We tracked 12 wood turtles in total for the year. Six were new finds and six were 2009 turtles that kept the transmitters through the winter. Three new transmitters fell off in late summer 2010 due to a paint issue on the transmitters (stock was subsequently repainted by the manufacturer at no charge). Two transmitters were recovered in the fall of 2010 and the turtles released unharmed. The six remaining wood turtles were tracked through the winter (2010–2011) and found to hibernate in the same areas where they spent the spring and summer. One transmitter signal was never picked up in 2011 although I checked the surrounding area every 2 months starting in March 2011. I suspect transmitter failure although it is impossible to verify without finding the turtle. All other transmitters were recovered in the spring of 2011 and the wood turtles released unharmed.

Demographics

For the season, we identified a total of 10 turtles through visual surveys. Six turtles were found at our initial site in Swanzey (Site No. 4), 2 new turtles were found at our second site in Richmond (Site No. 2), and 2 were found at a new site in Surry (Site No. 5). In total, males outnumbered the females: 8 males to 2 females.

We estimated age by counting rings on the plastron for turtles less than 25 years old. For turtles clearly older than 25, we estimated the age by judging the wear on the plastron using methods developed by Jones (2009). Male ages ranged from 13 to 70+; the two females were aged 6 and 8. Weights ranged from 186 g to 1026 g (average weight of all individuals was 698 g).



Plastron of turtle #23, the youngest wood turtle found in 2010..

Habitat Use

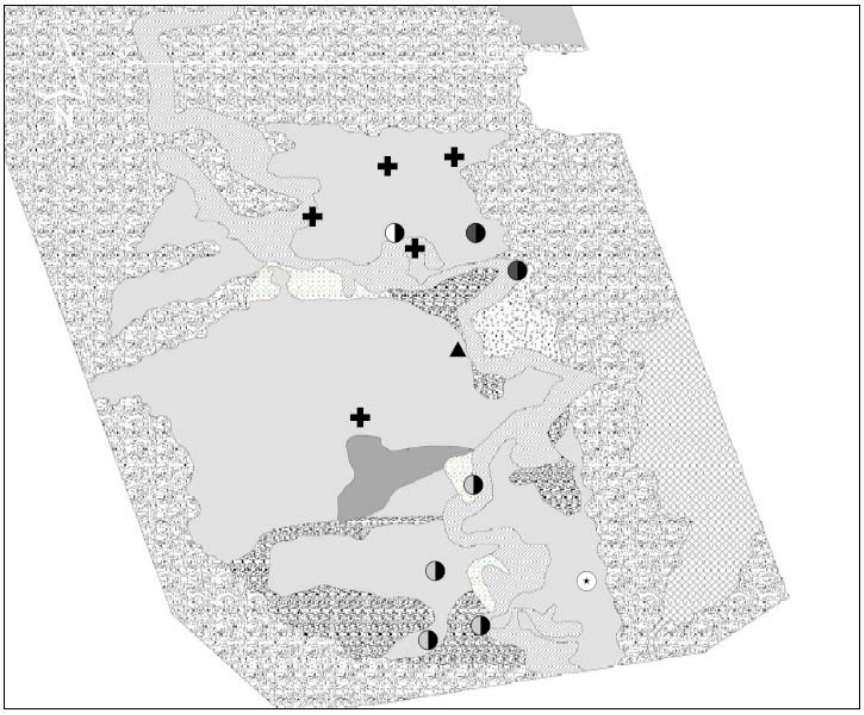
Of the ten turtles found in 2010, six turtles were tracked for radio-telemetry at Site No. 4 (3), Site No. 2 (1) and Site No. 5 (2). In addition, six turtles were continuously tracked in Richmond (5) and Site No. 4 (1), totaling 12 turtles tracked in 2010.

Habitat vegetation was delineated at Site No. 2 by Antioch University New England (AUNE) graduate student Mirka Zapletal. In 2010, most of the meadow areas were dry whereas in 2009, many areas remained wet through much of the summer season. As can be seen in the accompanying map, wood turtles were often found in the meadow areas.

An ongoing concern is that wood turtles are often found as much as 300 m away from water but state regulations do not protect small streams such as the one at Site No. 4, which is productive wood turtle habitat.

Turtles were tracked by AUNE graduate students at random times per week at varying times of day for the season and GPS points were taken each time a turtle was located. The resulting GPS points for Site 2 are shown on the map.

We attempted to identify wood turtle nesting areas in 2010 and looked for nests and potential nesting sites. We discovered one



nest site and broken egg pieces at Site No. 2. After walking the length of the creek, we identified four similar sandy areas as potential nesting areas. At Site No. 5, we concentrated in an area where a turtle (unidentified) was seen nesting in previous years. Wildlife cameras were set up at sites 2 and 5, and monitored regularly throughout June and July.

Turtle #26, tracked in high grasses by AUNE graduate student Angie Michael.

We did not find any evidence of nesting but we did find that wild turkeys were frequently using the sandy areas we identified for dust baths. Raccoons, skunks and deer were caught on several cameras. Raccoons and skunks are known to be nest predators so their presence is noteworthy, but on camera none appeared to disturb the potential nesting sites and we did not find any other disturbed nests.

The turtles that were radio-tracked in 2009 and 2010 represent a significant effort in researching wood turtle populations in Cheshire County, New Hampshire, for the first time.

Thank you very much for your support of my research. Your support was critical to this work and reports are being sent to the conservation commissions of Surry, Swanzey, and Richmond, New Hampshire.

Dan Zeh, James Cook University, Townsville, Queensland, 4811, Australia. danzeh01@gmail.com

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Jones, M. T. 2009. Spatial ecology, population structure, and conservation of the wood turtle, *Glyptemys insculpta*, in central New England. Wildlife and Fisheries Conservation. University of Massachusetts, Amherst. 266 pp.

Answers to Herp-Acrostic #21

The quotation was taken from page 83 of *Song of the Snake* by [Eric] Worrell:
"How long does it take to die from the bite of a taipan or a tiger snake? It's a common question, but not a good one, as there is no answer. There are also no answers to a million other questions about snake-bite."

A. White's
B. O'Shea
C. Rainbow
D. Round Island boa
E. Epithet
F. Leaf
G. Litter
H. Southeast Asia
I. Ottoman
J. Nominate
K. Graeme Gow
L. Onion
M. Florist
N. Tent tortoises
O. Hooknose
P. Endemic
Q. Squeakers
R. Noose
S. Abbott
T. Kangaroo rat
U. Equine

Herpetology 2012

In this column the editorial staff presents short abstracts of herpetological articles we have found of interest. This is not an attempt to summarize all of the research papers being published; it is an attempt to increase the reader's awareness of what herpetologists have been doing and publishing. The editor assumes full responsibility for any errors or misleading statements.

EXPLOITATION OF REPTILES IN INDONESIA

V. Nijman et al. [2012, The Herpetological Journal 22(2):83-89] report on the commercial trade in three reptile species harvested for different purposes in western Indonesia (Kalimantan, Java, Sumatra) for international markets: (1) Tokay geckos, *Gekko gecko*, traded for medicinal uses, (2) Javan filesnakes, *Acrochordus javanicus*, harvested for skins, and (3) Asiatic softshell turtles, *Amyda cartilaginea*, harvested for meat; each species is also exploited for the pet trade, but to a lesser extent. All three species are harvested from wild populations. None of the species are protected by Indonesian law, but there is a national harvest and export quota system in place to prevent overexploitation. For each species, the authors collected data from catchers, middlemen and exporters on harvest volumes, catching locales, turnover and prices, and compared these figures with the quota allocated by the Indonesian authorities. The trade in *G. gecko* from Central and East Java (3 traders, 2006) amounts to around 1.2 million individuals annually, greatly exceeding the national quota of 50,000 *G. gecko* for the entire year and representing a monetary value for exporters of around one million US$ / year. The annual trade in *A. javanicus* (in five cities in East and South Kalimantan, and North Sumatra, Riau (central Sumatra) and South Sumatra, 2005-6) was estimated at around 300,000 individuals from Kalimantan and 30,000 from Sumatra, exceeding the national quota of 200,000 individuals / year and representing a monetary value for exporters of at least three million US$ / year. The trade in *A. cartilaginea* was monitored in three cities in North Sumatra and Riau in 1999: 200,000–450,000 individuals were traded in 1998 and 1999, greatly exceeding the national quota of 10,000, with a monetary value for exporters in excess of ten million US$ / year. The authors conclude that implementation of wildlife trade regulations by and large are not abided by many reptile traders and are not sufficiently enforced by the Indonesian authorities, and further note that the quota-setting process rarely involves non-detriment findings based on reliable biological information. In order for reptile trade to be sustainable in Indonesia, it is paramount that non-detriment findings are undertaken and existing regulations are sufficiently enforced.

PIPE REFUGES IN THE NEOTROPICS

E. Ferreira et al. [2012, The Herpetological Journal 22(1):59-62] evaluated the usefulness of arboreal pipe refuges for studying Neotropical herpetofauna, by quantifying the effects of microhabitat variables and pipe coloration on pipe occupancy rates. The study was conducted in two areas of Brazil, within the Amazonia/Cerrado ecotone. The authors used 55 sets of refuges that each comprised three pipes with different colors (white, gray and black). They recorded 122 occupancy events by four hylid and one scincid species. Refuge color did not significantly affect occupancy rates. Environmental data explained a significant portion (10.6%) of the total variance of occupancy, with vegetation type and height of opening being most important.

JAMAICA BAY DIAMOND-BACKED TERRAPINS

K. A. Muldoon and R. L. Burke [2012, Canadian J. Zoology 90(5):651-652] note that as with other turtles, the postemergent movements, overwintering behaviors, and survivorship of hatchling diamond-backed terrapins (*Malaclemys terrapin*) are poorly known, but anecdotal reports suggest that they may spend more time on land than most aquatic turtles. The authors investigated this behavior using drift fences with pitfall traps on the island of Ruler's Bar, Jamaica Bay, New York, fall 2006 to spring 2008. They captured 324 live hatchling terrapins (95 recaptured at least once) and found 43 dead. After emergence from nests in the fall, most hatchlings moved upland away from the water; this pattern was reversed in the spring. Hatchling body sizes shrank during winter, probably owing to desiccation, and hatchlings were more likely to move on warmer days and days without precipitation. Some hatchlings were recaptured on land as long as 9 months after emergence. As a result, hatchling *M. terrapin* were seen on land from April to December, well outside fall and spring during which they emerge from nests, and there was strong evidence that hatchling *M. terrapin* overwinter on land outside their nests. One important nest predator (raccoons, *Procyon lotor*) was also an important hatchling predator, as were Norway rats (*Rattus norvegicus*). Future work should investigate the terrestrial microhabitats used by hatchling *M. terrapin*, and management should protect hatchlings during this life stage.

SNAPPING TURTLE HABITAT SELECTION

J. E. Paterson et al. [2012, Canadian J. Zoology 90(2):139-149] note that habitat selection is the disproportionate use of habitat compared with availability. Many studies have focused on specialists, but few have considered habitat selection in populations that are generalists, which can be composed of generalist individuals or individuals that specialize on different habitats. The authors tested habitat selection and individual specialization in a northern population of a supposed generalist, the snapping turtle (*Chelydra serpentina*), during the active season and winter using telemetry. Habitat selection was tested at two spatial scales by comparing random points to home ranges and turtle locations using Euclidean distances. Turtles selected home ranges from the habitats available in the population range. However, at the population level, all aquatic habitats were equally preferred, and the population behaved as a generalist owing to individuals specialized on different habitats. Over half of the individuals showed evidence of individual specialization on different habitat types. Turtles did not select habitat within home ranges during the active season, but overwintering turtles chose locations that were colder than haphazard stations in the same habitats, likely to reduce metabolic costs and the risk of acidosis. These findings have implications for the management of this species at risk and for understanding the evolution of resource generalization.

PYXIE FROG CONSERVATION

C. A. Yetman et al. [2012, The Herpetological Journal 22(1): 23-32] report that until now nothing has been known about the age of wild giant bullfrogs (*Pyxicephalus adspersus*); yet this information has important conservation implications for this regionally threatened species. The authors quantified and compared the age, body size and body condition of adult male and female *P. adspersus* caught during spawning events at peri-urban breeding sites in Diepsloot and at Glen Austin and Bullfrog pans in Gauteng Province, South Africa. Age was estimated from lines of arrested growth (LAG) counted in cross-sections of phalanges. Males and females from all three sites possessed 6±2 (max. 16) and 4±1 (max. 11) LAG, respectively, suggesting shorter female longevity. Individuals with <3 LAG were not found at the breeding sites, implying that newly metamorphosed *P. adspersus* require at least three years to reach sexual maturity. There was no significant difference in the LAG counts of same-sex animals between the three sites. However, mean male snout–vent length, mass, and body condition was greatest at Glen Austin Pan, and lowest at Bullfrog Pan. The latter is possibly explained by chemical contamination of Bullfrog Pan from an adjacent disused landfill. At Glen Austin Pan males and females sampled in 2004–2006 for this study were significantly shorter than those sampled at the same site in 1992–1993 for a different study. Results of this study suggest that male *P. adspersus* may live for 20 years or more in the wild, but at some peri-urban breeding sites adult life expectancy is declining. Juvenile *P. adspersus* are most threatened by terrestrial habitat transformation because they take ?3 years to mature, during which period they may move great distances from their natal site. Differences in the size and condition of *P. adspersus* between the study sites suggests that the species requires site-specific management in addition to conservation at larger spatial scales.

RATSNAKE MORTALITY PATTERNS

P. J. Weatherhead et al. [2012, J. Herpetology 46(1):100-103] notes that a recent study of ratsnakes (*Elaphe obsoleta*) in Texas found that adult mortality was higher for females than males, consistent with the cost of reproduction in snakes being higher for females. To determine whether the same pattern prevailed in a northern population of ratsnakes, the author used radio-telemetry data to test several predictions of the cost-of-reproduction hypothesis. Contrary to there being a cost to reproduction, mortality rates did not differ between juvenile and adult snakes and, contrary to females having a higher cost of reproduction, mortality rates among adults did not differ between males and females. The only evidence consistent with reproduction increasing mortality risk was higher winter mortality for females in poor condition following egg laying. Mortality did not vary with activity but increased with time spent basking, although group differences in basking were not sufficient to produce differences in mortality. High risk of winter mortality in this population may require all ratsnakes to behave in ways that mask mortality costs associated with reproduction. To determine whether these results for ratsnakes in Ontario are anomalous or reflect something more substantial about the cost of reproduction in snakes, details of mortality patterns from more species, ideally with diverse ecologies, are needed.

ALPINE NEWT MOVEMENTS AMONG DRYING RUTS

O. Kopecký et al. [2012, Herpetozoa 24(3/4):127-134] note that in unpredictable habitats, it is advantageous to amphibians to reduce the risk of weather-induced offspring mortality by utilization of several reproductive patches. In European deciduous forest landscapes, ruts caused by vehicular traffic, typically comprising small vernal or ephemeral pools with variable hydroperiod, are at times used as breeding habitats by some species of amphibians. Previous research shows that in such systems newts move among ruts within a single reproductive season. The aim was to characterize such movements by means of a capture-mark-recapture study of the alpine newt, *Mesotriton alpestris*, during two years differing in water availability, and to detect possible sex-specific differences. Movement among ruts differed between years according to sex. In the year with higher pool drying frequency, more females changed ruts than in the year when stable conditions prevailed. Among the adults that changed ruts, however, the mean number of aquatic patches visited was higher in males. These results show that the sexes can react differently to environmental correlates and that alpine newts are well adapted to utilize networks of temporary pools.

ECOLOGY OF A BRAZILIAN CAECILIAN

A. O. Maciel et al. [2012, J. Herpetology 46(1):47-50] note that basic ecological information is lacking for most caecilian populations, especially those of the Neotropical region where only few and nonquantitative ecological data were obtained for a small number of species. The Neotropical genus *Caecilia* is the most diverse of Gymnophiona with 33 species, for which natural history information is restricted to the description of clutch size for just one species. The authors provide natural history data based on 61 specimens of *Caecilia gracilis* found in a riparian forest in Cerrado biome in northeastern Brazil. No sexual dimorphism was found in morphometric and meristic data analyzed, probably because of functional constraints related to subterranean life. No specimens were found in the dry season, but in the wet season they were found at soil depth ranging from 5 to 31.5 cm, suggesting that seasonal vertical migration in *C. gracilis* occurs. In terms of both frequency and number, earthworms were the most important prey items encountered, thus suggesting a specialized diet in *C. gracilis*. Trematoda and Nematoda parasites were found in low numbers and at low prevalence.

FORENSIC SNAKESKIN IDENTIFICATION

B. W. Baker et al. [2012, The Herpetological Journal 22(2):79-82] demonstrate that near-infrared (NIR) imaging with an alternate light source (ALS) and digital photography are useful tools for revealing and documenting original dorsal skin patterns found on dyed snake leather products. They used an ALS at NIR wavelengths to reveal dorsal patterns on a tanned and dyed reticulated python skin (*Python reticulatus*) submitted for forensic analysis. Under NIR imaging, this pattern was easily photographed using a digital camera designed specifically for forensic ultraviolet (UV) and infrared (IR) photography. These methods have great potential for species identification based on highly modified animal products (such as dyed snake leather), thus contributing to CITES enforcement efforts.

Advertisements

For sale: rats and mice—pinkies, fuzzies and adults. Quantity discounts. Please send a SASE for pricelist or call Bill Brant, *THE GOURMET RODENT*, PO Box 430, Newberry, FL 32669-0430, 352-472-9189, E-mail: GrmtRodent@aol.com.

For sale: from **The Mouse Factory**, producing superior quality, frozen feeder mice and rats. Our mice and rats are vacuum-packed to greatly extend freezer life by reducing freezer burning and preserving vitamin and nutrient content. We feed our colony a nutrtionally balanced diet of rodent chow, formulated especially for us, and four types of natural whole grains and seeds. For a complete price list please visit our web site, www.themousefactory.com. We accept all major credit cards, PayPal or money orders. Call us **toll-free** (800) 720-0076 or send us an e-mail at info@themousefactory.com. Write us at PO Box 85, Alpine TX 79831.

For sale: **highest quality frozen rodents**. I have been raising rodents for over 30 years and can supply you with the highest quality mice available in the U.S. These are always exceptionally clean and healthy with no urine odor or mixed in bedding. I feed these to my own reptile collection exclusively and so make sure they are the best available. All rodents are produced from my personal breeding colony and are fed exceptional high protein, low fat rodent diets; no dog food is ever used. Additionally, all mice are flash frozen and are separate in the bag, not frozen together. I also have ultra low shipping prices to most areas of the U.S. and can beat others shipping prices considerably. I specialize in the smaller mice sizes and currently have the following four sizes available: Small pink mice (1 day old—1 gm) , $25 /100; Large pink mice (4 to 5 days old—2 to 3 gm), $27.50 /100; Small fuzzy mice (7 to 8 days old—5 to 6 gm) , $30/100; Large fuzzy mice / hoppers (10 to 12 days old—8 to 10 gm), $35/100 Contact Kelly Haller at 785-234-3358 or by e-mail at kelhal56@hotmail.com

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UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, April 25, at the Peggy Notebaert Nature Museum, Cannon Drive and Fullerton Parkway, in Chicago. **Tony Gamble**, a postdoctoral researcher at the University of Minnesota, will speak to us about "Ancient Lands and Sticky Hands: Gecko Biogeography and Evolution." Tony has just received a 3-year grant from the National Science Foundation to examine the evolution of sex determining mechanisms in geckos, a project that builds upon his dissertation research. Tony has conducted herpetological field work throughout the United States and Puerto Rico as well as Brazil, Peru, Mexico, Australia, Namibia, and South Africa.

Special weekend meeting, Saturday, June 16, 3:00 P.M., at the Kent Fuller Air Station Prairie/Tyner Center, 2400 Compass Road, Glenview. To learn more about the Tyner Center, visit their website: http://glenviewparks.org/index.php/facilities-parks/kent-fuller-air-station-prairietyner-center. This will be the perfect opportunity to attend a CHS meeting for those of you who have trouble making it on Wednesday evenings. Come a few hours early and explore the prairie. You're welcome to bring a cold picnic lunch, but no grilling will be possible, and all trash must go home with us. At this meeting **Chip Cochran** will share his research on venom variation in the speckled rattlesnake and show how a CHS grant has helped further his research. Chip graduated from the University of Arizona with a degree in Ecology and Evolutionary Biology. He is currently a graduate student at Loma Linda University, "studying intraspecific venom variation in order to continue my quest to travel the world while bothering various venomous snakes."

The June 27 meeting will be our popular and always well-attended annual **Show & Tell** meeting. Bring an animal that you find interesting for one reason or another and be prepared to give a short (under five minutes) presentation to the group. Don't be shy. Neither age (yours) nor commonness (the animal's) should be a limitation.

The regular monthly meetings of the Chicago Herpetological Society take place at Chicago's newest museum—the **Peggy Notebaert Nature Museum**. This beautiful building is at Fullerton Parkway and Cannon Drive, directly across Fullerton from the Lincoln Park Zoo. Meetings are held the last Wednesday of each month, from 7:30 P.M. through 9:30 P.M. Parking is free on Cannon Drive. A plethora of CTA buses stop nearby.

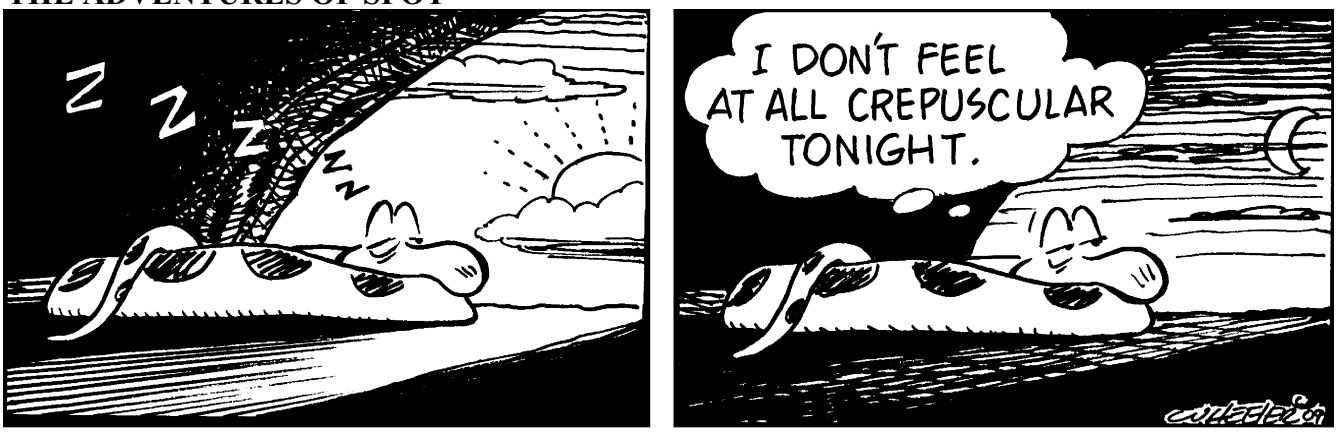
Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? If so, mark your calendar for the next board meeting, to be held at 7:30 P.M., June 15, in the adult meeting room on the second floor of the Schaumburg Township District Library, 130 S. Roselle Road, Schaumburg.

The Chicago Turtle Club

The monthly meetings of the Chicago Turtle Club are informal; questions, children and animals are welcome. Meetings normally take place at the North Park Village Nature Center, 5801 N. Pulaski, in Chicago. Parking is free. For more info visit the group's Facebook page.

THE ADVENTURES OF SPOT



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