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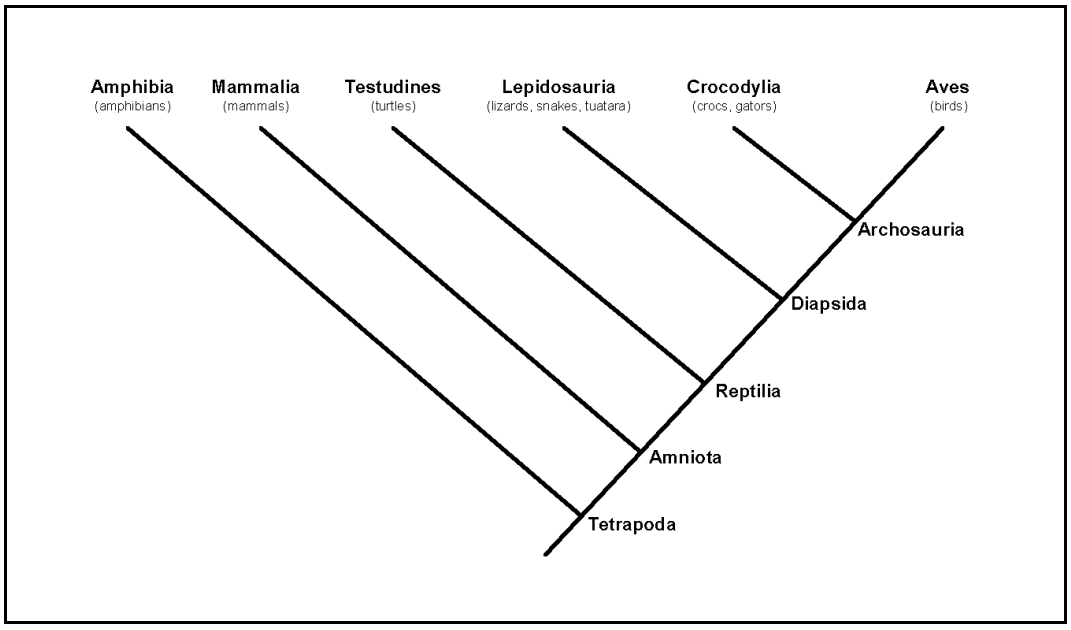

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Cover: Cladogram illustrating a possible phylogeny of the living terrestrial vertebrates (see "What, If Anything, Is a Reptile" within). Source: http://www.geol.umd.edu/~tholtz/G102/102L15phyl.htm

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What, If Anything, Is a Reptile?

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So—What Is a Reptile?

I was recently asked to speak to a third-grade class visiting the Michigan State University Museum for a program on local wildlife. The students sat in front of a diorama showing a typical woodland scene with local plants and animals, and I enhanced the discussion with a collection of mammal skins, skulls and other specimens. As we progressed through the various vertebrate animal groups, I held up the shell of a painted turtle and asked the students what they thought it was. Jeffrey's hand shot into the air. "It's a turtle . . . I think a painted turtle." (I've found that there is very likely to be at least one "hot-shot" budding herpetologist, or paleontologist, in every elementary classroom.) "That's right," I said, "and what kind of animal is a turtle?" Jeffrey confidently stated, "turtles are reptiles, like snakes and lizards and alligators." "And," I inquired, "how do you know that an animal is a reptile?" Jeffrey beamed a broad smile. "That's easy," he said. "A reptile is cold-blooded, with a scaly skin and sharp claws, and it breathes air, and hatches from an egg." And before I could try to catch him on it, he quickly added "except snakes are reptiles that don't have feet or claws, and some kinds don't lay eggs, but have live babies."

Jeffrey's answer was fine, of course, and his basic definition of a reptile was a standard and venerable one that goes back nearly two centuries and is still useful today. But if this bright young student had also added that some reptiles are warm-blooded and have feathers and can fly, he would still have been correct. (And I would have been really impressed!) How can that be? Are birds really reptiles too? And, if so, does that necessarily change the popular meaning of "reptile?"

Well, in the view of most present-day taxonomists (biologists who specialize in naming and classifying living things), birds must be included in the group of animals called "reptiles" (or, more formally, the "Reptilia") if it is to be considered a "natural" group. More on this point later—but it is important to note that there are, at present, at least two possible definitions of "reptile": one being the traditional, vernacular definition used by the general public, "herp" hobbyists and precocious third-graders, and a somewhat different one used by biologists concerned with the evolutionary history of the animals being classified. In this discussion, I will first concentrate on the more complicated biological definitions of "reptile" and "Reptilia" and then return to what implications, if any, the newer concepts of "reptile" have on the common (public) usage of the term.

Most of us were given at least a brief introduction to the classification and naming of animals in our elementary and secondary school science classes. The system of classification used almost universally, at least up until the last couple of decades, is called Linnaean Classification, which was devised by a Swedish naturalist, Carl von Linné (often latinized as Carolus Linnaeus), in the mid-eighteenth century. Between 1735 and 1770, Linnaeus published his *Systema Naturae*, in which he placed the animals (and plants) known to him in a hierarchical system based on increasing, mostly anatomical, similarity. Each species was given a two-part name (i.e., a binomial), consisting of a generic name (referring to the **genus**) and a specific name (referring to the **species**). Thus, there could be one or many species in a single genus, but each species had its own unique binomial. These names are nearly always in Latin (or latinized Greek), which is useful as it gives each animal a name that is the same wherever you are in the world, unlike local or common names that vary greatly between or even within countries. This method leads to the dual names familiar to amateur and professional herpetologists, such as *Chrysemys picta* for the painted turtle, *Thamnophis sirtalis* for the common garter snake and *Thamnophis sauritus* for the eastern ribbon snake. Note that since the last two species are in the same genus, they presumably are more similar to each other than either is to a snake in a different genus, such as *Lampropeltis triangulum*, the milksnake.

We could get into all kinds of trouble and controversy talking about what criteria should be used to define a "species," so we'll leave that topic for another article, and stick with so-called "higher taxa," that is, levels of classification above the genus and species level. As Linnaeus gradually improved his *Systema*, he became more sophisticated in his observations. For example, he had originally placed whales with fish (as swimming animals with fins), but by 1758 (his tenth edition) he had moved them, properly we now know, to the mammals. And he was the first naturalist to recognize that humans should be grouped with the Primates. Names were devised for these higher categories: a group of similar genera was called a **family**, a group of similar families an **order**, a group of similar orders a **class**, etc. Thus we eventually get the traditional "textbook" classification of an organism, here using a milksnake as our example:

Kingdom: Animalia

Phylum: Chordata (the vertebrates would be a subphylum under Chordata)

Class: Reptilia (reptiles, definition discussed later)

Order: Squamata (lizards and snakes)

Family: Colubridae (advanced nonvenomous or rear-fanged snakes)

Genus: *Lampropeltis* (North American milk- and kingsnakes)

Species: *Lampropeltis triangulum* (milksnake)

It is important to note that Linnaeus lived a century before Charles Darwin proposed the idea of descent with modification (i.e., evolution), and also prior to a clear understanding of genetics and inheritance, and he assumed that he was simply categorizing the natural order of God's creation. However, by the close of the nineteenth century, as evolutionary theory gained wide acceptance, the idea that the Linnaean classification system did (and should) reflect actual relationships was adopted by many biologists. (For more information on Linnaean classification see: http://www.linnaeus.uu.se/online/animal/1_1.html.)

Linnaeus did not use the term reptile or Reptilia as a class; instead he lumped the frogs, toads, salamanders, turtles, lizards, snakes and crocodiles in a Class Amphibia. The term "amphibian," which implies an animal that lives both in water and on land, might have seemed more appropriate to him than "reptile," which comes from the Latin "to creep." Laurenti (1768) was the first to use a Class Reptilia, but he also included the animals (then usually called "batrachians") that today are considered "amphibians." It was nearly a century later that Haeckel (1866) recognized that turtles, crocodilians, lizards, snakes, birds and mammals are all *amniotes*—they share a unique type of egg, in which the embryo is enveloped in a fluid-filled sac, surrounded by the amniotic membrane, or amnion, that is lacking in fish, frogs, salamanders and caecilians. He proposed the name Amniota for this taxon (group); this name did not catch on at the time, but at least from that point on the "Class Reptilia" would be permanently separated from the "Class Amphibia."

It should be noted that the traditional "Class Reptilia," as used throughout most of the twentieth century, can essentially be defined as "all amniotes except mammals and birds" (Benton, 2005a). But both the scientific and public view of which animals are reptiles has been based on the morphology (anatomy) of extant (living) animals—that is, characters of the skeleton, skin, and internal tissues and organs. For example, here is a standard dictionary definition of "reptile" taken from *Webster's Ninth New Collegiate Dictionary* (Merriam-Webster, Inc. 1984):

> 1. An animal that crawls or moves on its belly (as a snake) or on small short legs (as a lizard).
> 2. Any of a class (Reptilia) of air-breathing vertebrates that include the alligators and crocodiles, lizards, snakes, turtles, and extinct related forms and are characterized by a completely ossified skeleton with a single occipital condyle, a distinct quadrate bone usually immovably articulated with the skull, ribs attached to the sternum, and a body usually covered with scales or bony plates.

[Note: The occipital condyle is a knob on the back of the skull that connects the skull to the first neck bone; reptiles (and birds) have one, and amphibians and mammals have two.]

As increasing numbers of fossils of extinct vertebrates were discovered, these were inserted into the higher groups of the Linnaean taxonomic system, although these assignments were largely dependent on skeletal characters, since the skin and soft parts were (usually) not available. The leading American vertebrate paleontology text in use for much of the late twentieth century (Romer, 1966) was written by Alfred Sherwood Romer, a skilled comparative anatomist who used skull and skeletal characters to place extinct animals in the proper taxonomic category and to infer ancestor–descendent relationships. In the last few decades, studies of the morphology (anatomy) of both living and fossil animals have been augmented by new techniques that compare the cellular proteins and genes (DNA) of living animals. These *molecular* techniques offer new data that can be used to support or challenge ideas about animal relationships and classification (Hillis et al., 1996; Ferraris and Palumbi, 1996). Morphological and molecular data can be complementary, and taxonomic decisions can often be more robust (i.e., reliable) when both methods are brought to bear on the questions at hand (Maddison, 1996).

To be practical and successful, a biological classification system should serve two functions: it must be a practical reference system for organizing and identifying organisms, and it should also serve as a natural guide to the evolutionary relationships of those organisms (Mayr, 1982). It is certainly possible to devise a classification that is totally artificial, such as separating animals with wings from animals with fins, animals that climb from animals that burrow, etc. This leads to obvious problems, as Linnaeus discovered, such as placing whales and fish in the same group, birds and dragonflies in another. And what do you do with a flying animal that also swims? Thus, a natural, evolution-based system not only makes the most sense to biologists, but can also serve as a practical "hat-rack" classification system understandable by the layperson. And for over a century, the Linnaean classification system was thought to serve both of these functions sufficiently well.

In recent years some taxonomists have suggested the need for a new classification system that emphasizes evolutionary relationships (i.e., phylogeny) of organisms over simple, character-based (mostly morphological) comparisons (e.g., de Quieroz and Gauthier, 1992, 1994). While practically all influential biologists of the early and mid-twentieth century felt that classification should reflect phylogeny (see Mayr, 1942, and Simpson, 1961), they did not question whether the widely used Linnaean system was adequate for the job. Over the last three decades, however, a new system, referred to as Phylogenetic Nomenclature (PN), has been proposed that, its proponents claim, can do a better job of placing taxa (named groups or species) in a stable evolutionary framework. In strict applications of PN, the Linnaean hierarchy of group names are usually discarded, with some writers even advocating the elimination of binomial species names (Cantino et al., 1999; Mishler, 1999). This controversy is complex and ongoing, and we do not need to discuss it in detail here (see Benton, 2000; Harris, 2005).

One recent topic in vertebrate classification that does bear on our discussion is the concept of *monophyly*. A taxonomic group is considered *monophyletic* if it includes an ancestor or ancestral group and all of its descendants. If a group includes the ancestor but leaves out one or more descendant groups, then it is considered *paraphyletic* (Lincoln et al., 1998). Many taxonomists, particularly those supporting PN, believe that monophyly should be a *requirement* for a "good," natural taxonomic group, and, consequently, that a paraphyletic group-

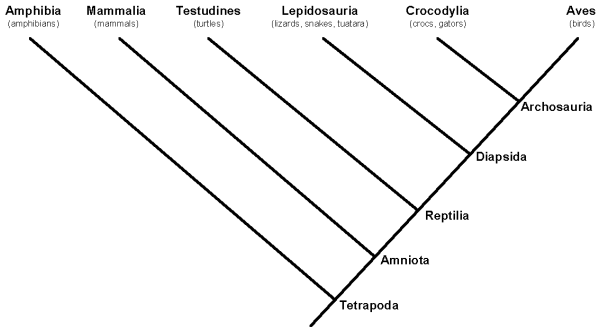
ing is unacceptable. Notably, the traditional definition of the "Class Reptilia" is often cited as an example of a paraphyletic taxon in need of a "make-over."

Prior to the last two decades, a majority of vertebrate biologists and paleontologists freely used the Class Reptilia in a paraphyletic sense. That is (as noted earlier), Reptilia included all the amniotes, fossil and living—except the mammals and birds (Romer, 1966; Carroll, 1988). The Class Mammalia and the Class Aves (birds) can be defined as monophyletic groups by themselves, but leaving them out of the broad definition of "Reptilia" makes this group paraphyletic, because both would have an ancestor that belongs within the traditional definition of "Reptilia." The amniote group that includes the mammals and their ancestors (called the "synapsids") split off very early in the history of amniotes, while birds clearly evolved much later within the "subclass" Archosauria, the taxonomic group that includes dinosaurs and crocodiles and their relatives and ancestors (Benton, 2005b).

One solution to this problem is to simply toss the birds and mammals into the Reptila, making it happily monophyletic. But "Reptilia" then becomes the same as "all amniotes" (i.e., Amniota). This is a bit awkward, especially when it seems to imply that mammals, including humans, are "reptiles"! Luckily, a careful phylogenetic analysis of the Synapsida (mammals and extinct relatives) shows that the group split off from all other amniotes very soon after amniotic reproduction evolved (probably in the mid-Carboniferous period, about 320 million years ago), and that it shows significant differences in skeletal anatomy and physiology (see Pough et al., 2002; pp. 479-482).

For example, we mammals (and presumably our synapsid ancestors) are in some ways more like amphibians than "reptiles"—we have a glandular skin without the unique form of keratin (β keratin) that forms hard scales in reptiles. Most mammals lack good color vision (humans and our primate relatives being notable exceptions) and none excrete uric acid like most "reptilian" amniotes. There is no evidence that synapsids ever laid typical hard-shelled reptilian or birdlike eggs; perhaps the soft membranous-shelled eggs of the most primitive living mammals—the Australian platypus and the echidna (the monotremes)—give us a hint as to what early synapsid eggs were like. In any case, it seems clear that "mammals are not the descendants of any animals closely related to modern reptiles . . . " (Pough et al., 2002). Recent molecular (DNA) studies also support the separation of the synapsid/mammal group from the other amniotes (Laurin and Reisz, 1995; Hedges and Poling, 1999).

With the mammals safely pushed aside, we are left with a "natural" monophyletic "Reptilia," as long as birds are included. Modesto and Anderson (2004) have published a "Phylogenetic Definition of Reptilia" in which they propose a definition that "retains the spirit of traditional concepts for Reptilia." Their definition, though described in technical, phylogenetic terms, essentially equates to "all amniotes except synapsids/mammals." Modesto and Anderson (2004) illustrate their proposed definition by using a *cladogram*, a tree-like branching diagram showing the relationships between various organisms or taxonomic groups. The closer two groups are on the cladogram, the more closely they are related. While Modesto and Anderson did include extinct groups in their analysis, we can illustrate the relationships of the living amniotes in this way:



(From: http://www.geol.umd.edu/~tholtz/G102/102L15phyl.htm)

This version of amniote phylogeny assumes that turtles are a separate lineage from other living reptiles, presumably being direct descendants of primitive "stem" reptiles. These stem reptiles are traditionally called "anapsids," in reference to their solidly roofed skulls without openings behind the eye sockets. Some recent molecular and morphological studies suggest that turtles may be descended from within the advanced "diapsid" reptiles (lizards, crocs, dinosaurs, birds, etc.), which are characterized by having two openings in the back of the skull (summarized by Zardoya and Meyer, 2001, and Orenstein, 2001). Turtles do have an anapsid skull, but it has been suggested that the ancestral turtle had the two-holed "diapsid" skull, and that the openings have been lost in later turtles. This seems possible, as lizards, snakes and birds are clearly diapsids that have lost one or both skull openings, probably during evolutionary changes that led to increased flexibility of the skull bones.

Although the question of turtle affinities is still unsettled, the meaning of "Reptilia" in this arrangement, and as defined in Modesto and Anderson (2004), is unaffected by the exact position of the turtles in the cladogram. A compatible definition of "Reptilia," based on living animals, was proposed earlier by Laurin and Reisz (1995), following Gauthier et al. (1988): "the most recent common ancestor of extant turtles and saurians [lizards, crocodilians, etc.], and all of its descendants."

Modesto and Anderson (2004) used a phylogenetic taxonomy that does not employ Linnaean terms such as "class," although there is no reason why one could not devise a way to do so. Many vertebrate biologists today have adopted a "compromise" taxonomic system—they avoid Linnaean terms at higher levels, especially "class," but continue to use family, genus and species designations. For example, in North America both of the leading college-level herpetology texts use this system (Pough et al., 2004; Zug et al., 2001).

So—A Reptile Is . . .

Now that we have a stable, working definition of the term "Reptilia," what does this mean for how we use the word "reptile"? At least when we are talking only about extant

(living) animals, in a non-technical sense, it needn't change anything. In response to my query on the question, Sean Modesto (pers. com., 3 July 2006) had this to say:

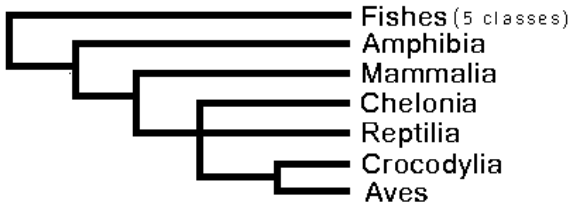
> The . . . definition espoused in Modesto and Anderson [2004] does not reduce the content of Reptilia from that recognized under the traditional view of what a reptile is among modern examples (turtles, snakes, lizards, and crocodiles are all still reptiles). It does, however, mean that one must regard birds as reptiles. . . .

So turtles, lizards, snakes, crocodiles and alligators are certainly all "good" reptiles. But can we still use "reptile" in the traditional sense, to refer to a "scaly, cold-blooded, lung-breathing, amniotic egg-laying (or live-bearing) vertebrate?" Sure—this is a widely understood definition based on living animals, and a newspaper reporter, a third-grade student, or a local herpetology club should not be required to conform to the taxonomic principle that all groups should be monophyletic. But we should define what we mean by "reptile" when appropriate. For example, an author of a popular, non-technical book or article on "reptiles" could simply state, in a short explanatory paragraph, that although morphological and molecular data suggest that birds should be grouped within the Reptilia, he or she will only be discussing "non-avian" (i.e., nonbird) reptiles, and then go on to define what that means.

It is interesting to note that in North America both college-level herpetology texts (Pough et al., 2004; Zug et al., 2001) essentially use the definition of "Reptilia" proposed by Modesto and Anderson (2004), but (along with the vast majority of recent popular and semi-popular herpetological authors) continue to use the word "reptile" in its "non-avian" sense as a term of convenience. It is certainly reasonable for amateur herpetologists to follow this lead.

Or—The Incredible Shrinking Reptilia . . .

One recent alternative proposal for classifying the extant "reptiles" is in need of mention. Collins and Taggart (2002) attempt to reconcile the paraphyly of the traditional Linnaean "Reptilia" in their North American checklist (and on their website for "The Center for North American Herpetology," http://www.cnah.org/taxonomy.asp) by essentially elevating the old reptilian orders to "class" level. Based entirely on living taxa, their proposal places turtles and tortoises in a separate "Class Chelonia," crocodilians in a "Class Crocodylia," and then leaves only lizards and snakes (and presumably the tuatara) in a much-abbreviated "Class Reptilia." A simple cladogram (which Collins [pers. com.] prefers to call a "phylogenetic hypothesis") offered on the website, and repeated here with permission, shows this arrangement:



The "classes" (above fishes) in this proposal are likely monophyletic, but is this as practical a solution as the phylogenetic approach proposed by Modesto and Anderson (2004) or the compromise system adopted by the herpetological textbooks (Pough et al., 2004; Zug et al., 2001)? Collins and Taggart (2002, and on the CNAH website) state that they are attempting to "reconcile the taxonomy with evolutionary history," and emphasize that due to the "arbitrary nature" of higher taxonomy, they "tried to reach a classification in which the maximum explanatory power is retained." It will be instructive to examine if these stated goals are achieved. Despite the assertion that all higher classifications are "arbitrary," Collins and Taggart (2002) apparently believe that their classification is preferable to other recent published classification schemes, and also expect biologists and the general public to adopt their new use of the word "reptile," which (in North America) restricts the term to only lizards and snakes. Their classification would have to be clearly superior to justify such a drastic change, overturning over a century of usage of a commonly understood term.

The published references provided on the website and in the checklist essentially confirm the phylogeny of amniotes outlined in this article (i.e., the paraphyly of traditional "Reptilia" and the close relationship of birds to archosaurs such as crocodiles and dinosaurs). None of their references appear to support the splitting of the old "Reptilia" into separate classes. In response to my inquiries, Collins (pers. com., 9 June 2006) kindly provided some background to their "phylogenetic hypothesis." Collins expressed his opinion that " . . . if you are going to use Linnaean categories, then they should be used throughout (i.e., not just below class or order) . . . " He believes that all higher classifications are "subjective," and that his classification is "based on the available evidence." He is also concerned that many ornithologists might continue to use a "Class Aves" and may be reluctant to include birds in a monophyletic "Class Reptilia."

To start with the last point, there is no doubt that ornithologists are quite aware that birds evolved within the Archosauria, although the question of which branch of the archosaurian line led to birds is still disputed (Mindell, 1997; Benton, 2005b; Feduccia, 2004). Some ornithological authors may prefer to use a "Class Aves" out of convenience, since they are usually focused on living birds and often aren't concerned with ancestry and amniote relationships. The current American Ornithological Union checklist of North American birds (found at http://www.aou.org/checklist/index.php3) begins with a list of recognized orders and does not mention a "class" category.

Is the Collins and Taggart proposal a fully functional, complete Linnaean classification? It would seem not. The traditional orders of "Reptilia" are essentially elevated to "class" level, which leaves them largely equivalent. There appears to be no practical difference between a "Class Chelonia" and a traditional "Order Testudines" (= Chelonia), or a "Class Crocodylia" and an "Order Crocodylia," particularly if these are based on only living forms. Of course, the Collins and Taggart system cannot easily accommodate extinct taxa; their references emphasize molecular systematics, as Collins (pers. com.) prefers, that can only be applied to living animals. Presumed taxonomic relationships can change depending on

whether molecular or morphological studies are used by themselves or statistically combined (Maddison, 1996). For example, as noted above, the relationship of turtles ("Chelonia") to other amniotes is controversial, and conclusions can vary depending on whether molecular or morphological evidence is emphasized (Zardoya and Meyer, 2001).

Collins and Taggart (2002) claim that their classification (or "phylogenetic hypothesis") retains "maximum explanatory power." This statement seems neither intuitive nor readily apparent, especially when comparing their system to the proposal of Modesto and Anderson (2004). What they are largely trying to "explain" is the relationship of birds to the traditional "reptiles." By dividing either a phylogenetic or a traditional Reptilia into its constituent parts, do we gain or lose information? A "Class Chelonia" is just turtles, and the "Class Crocodylia" is just crocodiles and alligators — its interesting relationship to "Class Aves" (birds) is no longer obvious (without the phylogenetic context offered on the website) and nothing is implied about broader evolutionary relationships or functional morphology. Most unfortunately, the default "Reptilia" of Collins and Taggart is just "lizards and snakes" (when applied in North America), leaving the term stripped of its historical meanings and phylogenetic significance, and setting the stage for taxonomic and linguistic confusion.

As noted previously, the Collins and Taggart (2002) classification does result in monophyletic groups and, as it stands, is not erroneous — it is, however, rather meaningless when separated from its phylogenetic underpinnings (i.e., the cladogram on the CNAH website). Collins and Taggart could have avoided unnecessary confusion if they had chosen to simply eliminate the word "Reptilia" from their classification; the long-used name Lepidosauria is available to refer to the Squamata (lizard/ snake) + Sphenodontia (tuatara) group (Benton, 2005b). That way, they could have still divided up the old Class Reptilia into separate classes, if that was their preference, but retained use of the word "reptile" in its informal, popular sense. Collins (pers. com., 6 June 2006) suggests that they considered using Lepidosauria, but goes on to say that "Reptilia is understood worldwide, captures a reader's attention, and sells books; Lepidosauria does not." However, their definition of "Reptilia" (and "reptile") is dramatically different from that "understood worldwide," leaving this explanation unsatisfactory at best.

Far from having "maximum explanatory power," the Collins and Taggart (2002) taxonomy offers no advantages over other published classification systems, but does offer maximum potential for confusion and possibly even anger at scientists trying to change the meaning of well-understood words. It thus falls short both as a phylogeny and as a practical Linnaean classification. The fact that Collins and Taggart insist on changing a century-old popular understanding of the word "reptile" is actually an issue separate from their classification, and the most unfortunate result of their proposal. To scientists, the issue of reptile/bird monophyly is important; to the general public, it's not. (In any case, thanks to all the recent publicity about "feathered dinosaurs," I suspect that the American public would more readily accept the idea of birds as reptiles than the idea that lizards are reptiles, but turtles and crocodiles are not!)

In the absence of a groundswell of support from herpetologists and taxonomists for the Collins and Taggart proposal, this writer recommends its rejection. If one wishes to understand phylogenetic relationships within amniotes, the proposal by Modesto and Anderson (2004) offers a reasonable compromise. If you prefer a formal taxonomic term for "turtles, lizards, snakes, crocodilians and (yes) birds," or for "amniotes other than mammals," then "Reptilia" will work fine. If, on the other hand, you only want an informal, broadly understood word for "cold-blooded, lung-breathing, scaled, amniote vertebrates," (turtles, lizards, crocodiles, etc.) then the word "reptile" still fits the bill.

I'm not ready to tell our third-grade prodigy Jeffrey that his concept of "reptile" was okay a few years ago, but is now wrong. (And I would bet that he'd be delighted to learn that birds are really "feathered reptiles," but simply confused if he was told that painted turtles are not!) In the end, scientists may "own" the term "Reptilia," but the vernacular meaning of "reptile" belongs to everyone else. Use it in good health!

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Extirpation of a Relict Timber Rattlesnake (*Crotalus horridus*) Population in Clark County, Illinois

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The timber rattlesnake (*Crotalus horridus*), a long-lived, late-maturing snake vanishing from much of eastern North America (Brown, 1993; Martin, 1992), is negatively impacted by habitat alteration, particularly the conversion of forests to agriculture. In Illinois, 90% of historical habitat types have been altered (IDENR, 1994) and 70% of the habitat is now agriculture (Bretthauer and Edgington, 2003). Additional anthropogenic activities, such as poaching, vehicles and needless killing have also contributed to the demise of *C. horridus* (see Brown [1993]). Although *C. horridus* historically occurred throughout much of Illinois (including 36 counties [Smith, 1961]), the present-day range of *C. horridus* is restricted to the few large remnants of forest remaining in the Shawnee National Forest of southern Illinois and along the Mississippi River counties (Phillips et al., 1999).

In 2000 and 2001, the Illinois Department of Natural Resources (IDNR) commissioned a landowner survey compiling recent and historic locations of timber rattlesnake observations in Clark County. This report documented numerous credible timber rattlesnake sightings, photographs and accounts. Seventeen reports centered on a relatively remote area of Clark County locally referred to as Rocky Hollow, with one individual vouchered (INHS #16257) as recently as 2000. The county represents the northeastern limit of the range of *C. horridus* in Illinois, although reports of timber rattlesnakes prior to this report being commissioned were few in number (Smith, 1961). Rocky Hollow is a heavily forested island approximately 280 ha in size surrounded by soybean (*Glycine max*) and corn (*Zea mays*) fields. This privately-owned land is located approximately 14 km southeast of Martinsville, Illinois. Creeks in this ridge–valley system flow into a recently constructed man-made lake of approximately 30 ha. Several sandstone rock outcrops, potential *C. horridus* hibernaculum sites (Martin, 1992), occur on hillsides within the forest habitat.

Because many recent and credible reports centered around Rocky Hollow, this area was surveyed daily or every other day for *C. horridus* between April 2002 and November 2004, except during winter while snakes were hibernating. Visual encounter surveys (VES; e.g., overturning rocks and logs, etc.) were used extensively throughout this survey. Because *C. horridus* aggregate in high numbers (often greater than 100 individuals [Brown 1993]) at a single hibernaculum, typically south- to west-facing rocky bluffs (Martin, 1992), habitats with potential hibernaculum sites in the area were identified based on topographic and vegetative maps, and on records obtained from the IDNR survey of property owners. In addition to searching areas adjacent to potential hibernacula more intensively during emergence and ingress, plywood and corrugated tin coverboards were placed in these areas and frequently monitored. Landowners aware of our intent were asked to contact us if any rattlesnake was encountered.[2] Lastly, because ratsnakes (*Elaphe*) often share hibernacula and other habitat with timber rattlesnakes, we implanted radio transmitters into six collected ratsnakes beginning in May 2003 (Foster et al., in press). We had hoped to increase our odds of finding *C. horridus* by radiotracking and using ratsnakes as a surrogate.

After three field seasons spent scouring Rocky Hollow, 10 snake and 7 other reptile and 12 amphibian species were documented, including 4 county records and 11 post-1980 updates (Phillips et al., 1999; see Foster and Mullin [in press]). No *C. horridus* individuals were encountered. A prior survey of amphibians and reptiles at Lincoln Trail State Park, (9 km north-northeast of Rocky Hollow) in 2001 also did not yield any timber rattlesnakes (Foster and Hampton, 2003). It would appear that rattlesnakes have become extirpated from the Rocky Hollow area.

Anthropogenic habitat alteration and fragmentation have been responsible for extinctions of *C. horridus* from Maine, Rhode Island and Ontario, and for dramatic declines observed in 20 other states, including Illinois (Brown, 1993). Loss of suitable habitat surrounding den sites is particularly detrimental to timber rattlesnake survival. This activity is prevalent in the Rocky Hollow area, primarily as forest has been converted to agricultural fields. During our survey, additional forest was lost as it was cleared to make way for a new home and additional agricultural fields. Such habitat loss is at least partially responsible for the suspected disappearance of *C. horridus*, but other factors have contributed to their demise in Rocky Hollow and elsewhere.

As a venomous snake, *C. horridus* is often killed because of unwarranted fears and misconceptions. In the past, rattlesnakes encountered in the Rocky Hollow area have been killed, as documented by the IDNR survey of property owners. Laws protecting this species are now in place but difficult to enforce. The public's perception of this animal must change if *C. horridus* is to persist in Illinois habitats outside of Clark County. In this vein, education must be an integral part of *C. horridus* conservation strategies in Illinois and elsewhere. Such outreach should include posting signs in areas where timber rattlesnakes occur and communication with the public, especially landowners.

Crotalus horridus has a delayed age of first reproduction

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2. On one occasion a landowner did contact us, but the "rattlesnake" turned out to be a juvenile prairie kingsnake (*Lampropeltis calligaster*).

(average of 9 years [Brown, 1991]), a low clutch size (6–10 [Phillips et al., 1999]), and an infrequent reproductive cycle (once every 3–4 years [Brown, 1993]). Neonates experience high mortality (66% in the first year and 50% in the second year [Martin, 1988]), which makes recoveries from population declines nearly impossible for this species. Additionally, because *C. horridus* dens communally, this species is at risk of disappearing even where populations appear stable in parts of Shawnee National Forest. Destruction of a den site can decimate population numbers, and it is crucial that denning areas be protected from human disturbance. Additionally, poaching frequently occurs where timber rattlers can be found in Shawnee (S. Ballard, pers. com.), threatening the long-term existence of *C. horridus* in Illinois. Such activities undermine conservation efforts and cannot continue if this species is to persist.

The future of the timber rattlesnake remains uncertain both in Illinois and across its geographic range. Although we cannot state with absolute certainty that no *C. horridus* individuals remain in Rocky Hollow, the intensity and duration of this survey along with the outcome suggest that if any individuals do remain, numbers are so low that the population is no longer viable (fewer than 40 individuals or 8 mature females [Brown, 1993]) and ecologically extirpated. Because the population status of *C. horridus* is precarious throughout its range, it is critical to document such declines, while remaining populations within the state are monitored and protected. State officials should remain in contact with landowners from the Rocky Hollow area, and any future *C. horridus* observations from Clark County should be investigated further.

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The "False Breeding Season" of the Eastern Newt, *Notophthalmus viridescens*

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Abstract

The terrestrial red eft stage is so different from the body form of the aquatic adult of the eastern newt that the two were considered separate species for nearly 60 years. Some populations lack the eft stage whereas in other populations the adults are aquatic only during the breeding season. In populations in which the adults are permanently aquatic or migrate to breeding ponds in fall, an autumnal mating season may occur, which has been termed the "false breeding season" because oviposition does not occur until the spring mating season. However, this period is not "false" but rather the early portion of an extended mating season made possible by female sperm storage.

The eastern newt, *Notophthalmus viridescens*, is one of the most widely distributed salamanders in North America, and can be found from eastern Texas northward to Canada and then eastward to the Atlantic coast (Petranka, 1998). Four subspecies are recognized. A great deal of literature exists on the life history of the eastern newt, but most of it concerns the northeastern form, the red-spotted newt, *N. v. viridescens*. Much of this interest was sparked by the discovery that many populations have pond-dwelling, aquatic adults and larvae, but the larvae metamorphose into an immature "red eft" stage that leaves the water and assumes a terrestrial existence for anywhere from one (Gibbons and Semlitsch, 1991) to seven (Healy, 1974) years. Red efts, especially younger ones, can be bright vermilion and have granular skin, but as efts reach maturity, the morphology changes once again as the animals migrate back to aquatic, generally lentic habitats (Petranka, 1998). The adult animals are a shade of green dorsally, and have compressed tails. In *N. v. viridescens*, both the eft and the adult have a lateral row of red spots bordered by black, resulting in the traditional common name. In the other subspecies, the red spots are either absent (central newt, *N. v. louisianensis* and the Florida peninsula newt, *N. v. piaropicola*) or form a series of broken lines (broken-striped newt, *N. v. dorsalis*). Aquatic adult males develop especially prominent tail fins during the breeding season. The aquatic adult and the terrestrial eft are so different that the original descriptions by Rafinesque (1820) placed them in different subgenera, and the controversy over whether they represented different species or not was not definitely settled until Cope (1889).

The existence of a terrestrial stage and an aquatic stage is not just limited to *Notophthalmus viridescens*, but is generally characteristic of all salamanders within the Salamandridae referred to as "newts" (including other species in the genus *Notophthalmus* and those in the genera *Cynops, Taricha, Triturus* plus some more obscure taxa), and is the reason for separating out these species by this common designation from other salamanders. Within *Notophthalmus viridescens*, however, some populations contain paedomorphic individuals, which do not fully metamorphose (i.e., larval gills are retained) and which may spend their entire life in a permanent pond (Noble, 1926, 1929; Brandon and Beemer, 1966; Healy, 1974; Reilly, 1986, 1987).

I became interested in variation in the life history of *Notophthalmus viridescens* when studying female sperm storage in a population of red-spotted newts on the Department of Energy's Savannah River site, near Aiken, South Carolina (Sever et al., 1996). In the pond inhabited by the newts we studied, mating took place from December into April, and females, which do indeed store sperm in cloacal spermathecae, kept laying eggs through May. Then something remarkable happened: all of the newts vanished from the pond, not to be seen in the water again until the following October. Thus, the adult "aquatic" stage was not a permanent condition; even the adults in this population had a terrestrial phase.

I wanted to see how widespread this condition was in the literature, but the more I delved into past studies, the more I was impressed with just how much variability exists. The literature is quite extensive, but serious gaps exist in our knowledge of life histories of eastern newts, especially western and southern populations. Studies on the northern red-spotted newt, however, date back into the nineteenth century. One aspect of the life history of the red-spotted newt that has come under much scrutiny is the timing of the breeding season, especially if an autumnal "false breeding season" exists. In this paper, I review some of the relevant literature dealing with the timing of the breeding season in *Notophthalmus viridescens*. I emphasize the older literature, which is not easily accessible. First, however, I shall review the nomenclatural history of the species, and the relationship of the taxonomy to discoveries about the life history of the red-spotted newt.

Taxonomic History

The eastern newt was first described by the great American naturalist Constantine Samuel Rafinesque (Rafinesque, 1820). As mentioned previously, he placed the adult form and the red eft in different subgenera; the genus he choose for both was *Triturus*, a genus Rafinesque described in 1815 that contains the European newts. The adult form, with a type locality of "Lake George, Lake Champlain" in New York, was designated *Triturus (Diemictylus) viridescens* (vulgar name, "Green Ebbet"), and the eft, with no type locality except in the broadest terms ("states of New York, New Jersey, Connecticut, Vermont, etc."), was named *Triturus* (*Notophthalmus*) *miniatus*

("Red Ebbet").

Spencer Fullerton Baird, founder of the herpetological collections at the Smithsonian Institution, removed the two forms from *Triturus*, although he kept them as different species. Baird (1850) noted, however, "Thus, of the highly natural genus *Notophthalmus* (*Diemyctylus*) one species (*Diemyctylus viridescens*) is the most aquatic of all American forms, the other (*D. miniatus*) the most terrestrial; yet the two are so much alike in shape as to render it a matter of some difficulty to distinguish them." Note that Baird seemingly considered the genera *Notophthalmus* and *Diemictylus* interchangeable, but he mentioned *Notophthalmus* first, which gave that name priority. Also, Baird (1850) misspelled *Diemictylus*, and this mistake was perpetuated for the rest of the nineteenth century.

Edward Hallowell, a Philadelphia physician best known for his work on reptiles, expressed even stronger doubts about separation of the forms into different species. He stated (Hallowell, 1856), "*Diemyctylus viridescens* and *D. miniatus* are probably the same, the orange color and roughness being appearances which, the female more especially, presents after a long sojourn on land. At least this may be inferred from the known habits of European Tritons."

The noted American herpetologist and paleontologist Edward Drinker Cope commented on the eastern newt in 1859 in his first publication, written at the age of 18. Cope (1859) wrote, "We include in the above synonyms (of *Diemyctylus viridescens*) those of the nominal species *D. miniatus*, which we think with Dr. Hallowell ('56) is a state of *D. viridescens*. . . . The color or character of the skin seems to be dependent upon the amount of moisture in the situations in which they are found. Those from high and dry spots are redder and rougher than those from marshy situations."

Definitive evidence that the forms were the same species did not come for nearly 20 more years when Kelly (1878) reported that he ". . . brought home a number of *Diemyctylus miniatus* Raf., or little red lizard or red eft, and after keeping them in a dark box filled with saturated moss, they changed their color from a bright vermilion to the olive state characteristic of the *D. viridescens*. . . . The conclusion, then, is that instead of two well-marked species or a species and a variety, we have but a single species, *Diemyctylus miniatus*." Subsequently, Monks (1880), Pike (1886), and Gage and Norris (1890) all reported transformations of captive red efts into the adult form.

Cope (1889) in his magnificent tome *The Batrachia of North America* summarized the available literature and concluded, "There are two forms of this subspecies, which have received the names of *viridescens* and *miniatus*. . . . These have been shown to be stages of one and the same animal; they are not distinguished otherwise than as seasonal forms, which may be by reason of the environment rendered permanent for a longer or shorter time." Cope settled on *viridescens* as the specific name because it was mentioned first in the publication (Rafinesque, 1820) that described both *viridescens* and *miniatus*. But in another twist, Rafinesque also used the generic name *Diemictylus* prior to using *Notophthalmus*. However, the International Commission on Zoological Nomenclature ruled in 1962 that because Baird (1850) first referred *viridescens* to *Notophthalmus* rather than *Diemictylus*, that *Notophthalmus* had preference under the rule of first revisor (ICZN, 1962).

Variation in Life History

The first review of the life-history of the red-spotted newt was by Gage (1891). He opened his paper by stating: "The working out of the complete life-history of this newt has extended from 1819–1820, when Say and Rafinesque first considered it, until the present year. . . . During this period of seventy-two years it has been the subject of numerous investigations; but from the striking changes in coloration, habit, and structure passed through in its various stages of development it has proved unusually puzzling to the naturalist and physiologist."

Gage (1891) established that fertilization in *Notophthalmus viridescens* was internal, by isolating four females from New York from any males. All laid fertile eggs. Gage believed that only 6–7 eggs can be laid before a female requires an additional mating. In New York, the mating/oviposition period was April–June. Gage, however, noted that specimens from autumn appeared to be in breeding condition, and if "the two sexes are placed together a typical mating will occur, and the emission of spermatophores will occur exactly as described for the spring, or proper breeding season. . . . It is not easy to understand the purpose of this autumnal mating, as no eggs were ever found in the oviducts in autumn, and it is not known whether ovulution [sic] takes place at other times than in the spring. . . ."

Jordan (1893), studying a population in Massachusetts, noted that that observations of fall mating by Gage were based upon captive specimens, where their sexual activity may be due merely to the "forced association of the two sexes . . . at a somewhat higher temperature than . . . their natural habitat. . . ." However, Jordan also observed "on several occasions in the autumn months . . . pairs in the ponds engaged in the preliminary '*Liebesspeil*,' but have at no time observed any approach to such an outbreak of sexual susceptibility as occurs in early spring. . . . [I] think that production of spermatophores may take place sporadically in the autumn under natural conditions."

Jordan (1893) further reported, "The seminal receptacles of females captured in the autumn usually contain spermatozoa, although not in the same abundance as in spring. One may account for the presence of the spermatozoa by supposing either that they are the acquisition of a recent mating, or that they have been kept over from the preceding spring. It is possible that both explanations are valid in individual cases. . . . Females that have been kept in confinement all winter are not apt to lay eggs in the spring as are individuals freshly captured." Jordan noted that in the spring, the ovipository season extended from April until the end of June, but that a given female probably lays eggs for no more than eight weeks. One female laid 96 eggs between April 24 and May 13, after being isolated from males (also reported in Jordan, 1891). Jordan thus reasoned that Gage was in error when he stated only 6–7 eggs could be fertilized by one mating: " It does not seem to me *necessary* that more than one mating should occur in a single season, but I agree with Gage that in a state of nature several

matings of the same female may and frequently do take place." Jordan also was the first author to propose that fertilization occurs not in the oviducts, but as the eggs pass through the cloaca.

Pope (1924) based his observations on populations he studied in Illinois (which would be *N. v. louisianensis*) and six northeastern states (Maine, Massachusetts, New Hampshire, New York, New Jersey, Pennsylvania). "The curious phenomenon of mating and depositing spermatophores in the fall has been recorded by both Gage and Jordan, but neither is able to account for it. I have observed it both in the field and the laboratory, but can see no real explanation. The fact that no eggs are laid in the fall seems to make it quite superfluous. I believe, however, that it is merely a preliminary to the spring mating season. . . . [M]ating begins in fall, being interrupted only by the period of inactivity due to cold weather, and beginning again in the spring, as soon as the temperature of the water begins to rise. Newts left in the laboratory will continue mating all winter to some extent, though not as actively as when first captured. I have also seen mating in the middle of July after the usual mating season was over."

Adams (1940), like Jordan, studied newts in Massachusetts. Male newts contained abundant sperm in their vasa deferentia from September through May, and some specimens even retained a few sperm during the midsummer months. Sperm were found in the spermathecae of females ". . . examined in every month of the year but they are especially abundant in the fall and spring." Oviposition, however, was strictly limited to the spring. Out of hundreds dissected, only one female collected during the fall and winter had an oviducal egg, whereas in April–June, eggs were found in the oviducts of some newts from every collection. In both males and females, "The gonads are in a preparatory growth state during the summer and by October have attained the mature condition which results in a false breeding season. . . . The true breeding season of the spring and the false one of the autumn were both observed as Gage (1891), Jordan (1893) and Pope ('24) have described them."

Neither Gage (1891), Jordan (1893), Pope (1924) nor Adams (1940) mentioned whether the adults in the newt populations they studied remained aquatic all year, but clearly, the matings that were observed in fall and spring were based upon specimens observed in or collected from ponds.

Bishop (1941), in his monograph on the salamanders of New York, reported once again a false breeding season in the fall in which courtship occurs and spermatophores may be deposited although no eggs are laid. Bishop always referred to the adults as "aquatic," implying that once they mature and enter ponds, they stay there permanently. Bishop mentioned fall and spring migrations from terrestrial habitats to ponds, but these migrations apparently consisted of maturing efts.

Only a few other state or regional field guides or handbooks seem to report original data on this wide-ranging species, and even these accounts are mostly anecdotal and lack substantive data. For example, the breeding seasons were simply characterized as: winter and early spring by Smith (1961) in Illinois, Mount (1975) in Alabama, and Trauth et al. (2004) in Arkansas; January to May by Minton (2001) in Indiana; and February to May by Gibbons and Semlitsch (1991) on the Savannah River Site in South Carolina. None of these authors mentioned aquatic adults leaving ponds for terrestrial habitats.

Healy (1974, 1975) studied a population in coastal Massachusetts, and definitely stated that adults do not leave the pond. The terrestrial eft stage was 3–7 years. Some newts were paedomorphic, however, and therefore omitted the eft stage. The paedomorphs were able to reproduce for the first time at age two, which gave them a significant reproductive advantage over individuals with an eft stage. Whether mating occurred in fall was not mentioned, but if mating was limited to spring, that would be quite different than the reports of Jordan (1893) and Adams (1940) on red-spotted newts in Massachusetts.

A few studies on populations in the North report that some or all of the adult newts leave the ponds in the summer (sometimes because the ponds have dried up) and spend the fall and/or winter on land. Hurlbert (1969) in New York found both a fall and a spring migration to the breeding sites. The fall migrations almost exclusively involved efts, maturing individuals returning to the water for the first time. Whether or not mating among these maturing individuals occurred in fall was not mentioned by Hurlbert (1969). The spring migration included adults that apparently had hibernated on land.

Gill (1978) and Massey (1990) in the mountains of Virginia, reported a breeding migration in March and April to the ponds, and an August to September emigration to terrestrial hibernacula. Breeding occurred from mid-March to late June (Massey, 1988), and no fall breeding season existed (Massey, 1990). High mortality was found among adults; Gill (1978) found the average female was expected to breed 1.3 times, and Massey (1990) found that 75% of the females that bred one year did not appear in the subsequent year. However, a year after breeding, eight females were recaptured, apparently in April, in pit traps around a partially fenced pond (Massey, 1990). Seven of the females had sperm in their spermathecae, although it was not abundant, indicating no recent insemination. Massey (1990) concluded that the sperm were retained from a previous breeding season, and therefore, these females were inseminated in June of the previous year at latest. Thus, these females had stored sperm for at least 10 months. The viability of the sperm and whether they were in sufficient quantity to fertilize eggs was unknown, but Massey suggested the possibility of between breeding season sperm competition.

However, the pond used in the study by Massey was only partially fenced, and, as noted by Hurlbert (1969), newts following their arrival at a pond wander back and forth between water and land, a phenomenon also recorded in other species, and termed "wandering behavior" (Pimentel, 1960; Hasumi and Iwasawa, 1992). Thus, the female newts could have mated in the current season in this or another pond. Also, if the males in this population are typical of others reported from northern states during the fall and winter (Adams, 1940), the males do possess sperm in their vasa deferentia from September onward, and one cannot definitely rule out a fall mating.

Finally, a study on a related species, *Taricha granulosa*, is noteworthy. Specker and Moore (1980) reported, "Male newts exhibit reproductive behaviors during the fall when androgen levels are high. In fact, male courtship behaviors of amplectic clasping are observed in the ponds during all but the summer months, when androgen levels are lowest. We suspect that the sexual behaviors which occur during the fall are false-breeding activities and no spermatophores are deposited."

Conclusions

As a working hypothesis, a "false breeding season" in the fall occurs in populations in the northern states in which the adults do not leave the pond in summer or fall for winter hibernation on land, either because they are permanently aquatic or because they migrate to breeding ponds in fall and overwinter in them (Gage, 1891; Jordan, 1891, 1893; Pope, 1924; Adams, 1940). Northern populations of eastern newts that do not engage in pre-hibernation mating are those that hibernate on land and do not migrate to ponds until spring (Hurlbert, 1969; Gill, 1978; Massey, 1990). In the population we studied in South Carolina, hibernation does not occur so mating is not interupted, and indeed midwinter is the height of the breeding season (Sever et al., 1996). Note also that we first found adults back in the pond in October, but we did not find sperm in the spermathecae if females, indicating mating activity, until December.

The fact that early authors wondered why mating occurred in the fall when no egg-laying was happening indicates that they underestimated the significance of female sperm storage. Sperm storage allows the decoupling of mating activity form oogenesis, ovulation, fertilization and/or oviposition. The decoupling of these activities furthermore allows extension of the mating season and facilitates multiple matings, which are known to occur in *Notophthalmus viridescens* (Gabor et al., 2000). Thus the "false breeding season" is not really "false", it is simply the early portion of an extended mating season. No one knows how long a female eastern newt can effectively store sperm, but a period of six months is certainly known in other salamanders (Sever et al., 1996), and the 10 months suggested by Massey (1990) is not beyond reason.

The geographic variation in breeding cycles of this widespread species certainly deserves more study. The basic question remains: why do some populations hibernate on land whereas others migrate to ponds (or never leave them) and commence mating in fall? This review on the breeding cycle of the eastern newt illustrates that we still lack basic knowledge about the life histories of even our most common amphibians.

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HerPET-POURRI
by Ellin Beltz

Thanks to Marty Marcus!

Longtime readers of this column will recognize the name of Marty Marcus, Reptile Educator Extraordinare, retired schoolteacher, cornerstone of the Pacific Northwest Herpetological Society, the Key Library, the local YMCA camp and many other great causes. And in all that, he still finds time to clip stories and send them to me. Marty gets another kudos. He actually talked me out from behind the redwoods long enough to give two talks up in Washington State. "Along the way" we visited friends in Port Townsend, which is like visiting Milwaukee by the way when you're in Chicago, but heck when you're that close, why worry? It would have been a much less worry-free trip if my doctor hadn't found a skin cancer in my knee the week before we left. He actually took it out and left ten stitches behind the day before we left. Needless to say, Ken did all the driving. I don't even remember the first two days except that traveling with ten stitches in a knee is not something I recommend. Thank heavens Marty and his 40-year-companion Ann Waldo have a house that's mostly on one level, although the 20 feet elevation change to the parking nearly did me in the first couple of times! Thankfully, too Marty could just turn his hearing aid off and not hear me griping "Ouch, Ouch, Ouch," with every step! I think I gave a good talk to the Library but I was bored with my own PowerPoint presentation by then, so I spent the next two days revamping it and adding in new material from my book, *Frogs: Inside Their Remarkable World*. Then it was time for the PNWHS meeting near Sea-Tac Airport. The room was a hive of activity! Adoptions, food, books, teeshirts and live animals everywhere. It was one of the more interesting herpetological society meetings I've ever been too and I didn't expect much attention when I started talking, but all the hubbub stopped and I got some of the most interesting questions I've ever received after a talk too. So many, many thanks to the PNWHS, the Key Library and most especially to Marty Marcus and Ann Waldo for putting up with perforated and healing me and silent and book-addicted Ken for a whole week! We drove home the long way, through a string of sleepy fishing villages, through clear cuts that look like they were designed to create landslides and forest fires, not preserve habitat or leave anything for our kids. Finally, over one more range of hills, and there were our redwoods! "Moss up," I cried as we donned our fleece jackets (in June). It had been 103 in Eugene in the morning. Now it was 55 in Ferndale at 8 P.M. We knew we were home.

Too many herpetological stories!

After hours of opening mail and comparing it with the electronic gatherings of 12-year contributor Wes von Papineäu, I found that even my skillful network of collectors lets many interesting stories slip through their fingers, while they catch several others. For the rest of this column, and September's as well, the backbone of the material is from Wes; if someone else found the story too, their name is at the end of the paragraph.

Quote of the season

"[Alligators] are not easy to kill. Their hide is thick and their brains are small, and if you miss the target, you'll have succeeded in ticking off one of the Earth's most efficient predators. That won't stop a few people from trying. It will be a miracle if we get through the next few weeks without some half-wit shooting himself, his truck or his drinking buddy instead of the alligator at which he's aiming. . . . Hand-fed gators lose all fear, and will in the absence of table scraps eagerly go after a pet poodle or even a child. Anybody caught feeding an alligator should be bound with duct tape and hauled off in the back of a pickup truck." Carl Hiaasen, in the May 24, 2006, *Miami Herald,* also from Alan Rigerman

Killer wildlife

• The *Chicago Tribune* lorded it over Florida residents in a pointed essay called "Life without predators." They pointed out that its really hard to be killed by large wildlife in Illinois, adding "The only wild animal known to have attacked people lately is a female deer at Southern Illinois University that apparently was defending her fawn. But reptiles are a negligible problem. You could find a few water moccasins and copperheads in southern Illinois, but you'd have to look hard. Rattlesnakes have no more than token representation. Venomous lizards? Only in zoos. Truth is, our winters are even tougher on cold-blooded species than on warm-blooded ones. So any Floridians who have grown leery of the local fauna and are considering alternatives should take two things into consideration when it comes to Illinois. First, there will be no alligators lurking outside your door. And second, even if there were, you can be confident that most of the year, the weather will keep you inside." [June 4, 2006; also from Ray Boldt]

• A rash of recent snakebites and deaths due to alligator attacks prompted the *Gainesville Sun* to total up "the United States' annual average of animal-related fatalities per year during the 1990s."

Average fatalities per year	Animal
0.3	Alligators
0.4	Sharks
15	Snakes
18	Dogs
130	Deer (vehicular collisions)

Sources: International Shark Attack File; U.S. Department of Transportation; Journal: Pediatrics; Centers for Disease Control and Prevention.

Weeki Wachee Screechee "Catchee Takee!"

A nine-foot alligator joined the famous Weeki Wachee Springs Mermaids. "With the mermaids understandably keen to keep the 'live' in 'mermaid,' . . . [the] intruder was quickly dis-

patched before a cheering crowd Saturday morning," reported the *St. Petersburg Times*, May 28, 2006

The hissing of summer lawns

Rattlesnakes are just about everywhere in California. Unfortunately—or fortunately—the area right around where we live in Ferndale is too cold for them! But this year sightings are up all over the Golden State after a long, wet winter and an overheating summer. [*Orange County Register*, June 16, 2006]

How he got to 9 feet

A Florida Highway Patrol Officer witnessed a nine-foot alligator stand up out of the roadside grass, look both ways, wait for a break in traffic and then cross a turnpike exit ramp. Perhaps that's how it got to nine feet! [*Fort Lauderdale Sun-Sentinel*, May 24, 2006; also from Bill Burnett's mom "Hilda"]

Gator Top Ten

The July 5, 2006, *Beaumont Journal* of Beaumont, Texas, reports on Florida data which shows the most common ways to an in-your-face encounter with a live alligator:

1. Attempting to capture/pick up alligator
2. Swimming
3. Fishing
4. Retrieving golf balls
5. Wading/walking in water
6. Snorkeling
7. Pulling weeds/working along water's edge
8. Standing/sitting by water's edge
9. Working on/falling out of boat
10. Skiing/canoeing

Wildlife killer

Recently researchers discovered that American bullfrogs, *Rana catesbeiana*, carry the chytrid fungus, *Batrachochytrium dendrobatidis*, without dying. Other scientists took the long view and looked at museum specimens. They found that while the earliest known specimen bearing chytrid is from South Africa in 1938, the first North American occurrence was in 1961 in the St. Lawrence Valley of Quebec in green frogs, *Rana clamitans*. The *New York Times* reports, "A 2004 paper in the journal *Emerging Infectious Diseases* proposing that the fungus originated in Africa, where the earliest case (1938) was documented; a likely vector was [Clawed frogs] *Xenopus laevis* . . . shipped worldwide from Africa by the thousands, starting in the 1930's, for use in pregnancy tests (the frogs ovulate when injected with the urine of pregnant women). [July 4, 2006] The BBC reported: "Scientists writing in the journal *Biology Letters* say they found non-native North American bullfrogs carry the chytrid fungus and might act as a vector. Those bullfrogs—some reaching 8 inches in length and 1 pound in weight—have been introduced into many nations to be farmed for frog legs, kept as pets or for other reasons. The nations involved are numerous, and include Brazil, Uruguay, France, Italy, Canada and the United Kingdom." [*New York Post Chronicle*, May 24, 2006]

Adding an adder

But do not disturb if you find one, asks the U.K.'s national reptile charity as they ask the British public for information on the Island Kingdom's only venomous snake. The *Highland News*, of Inverness, U.K., reports, "The adder—*nathair* in Gaelic—is a shy and secretive species, susceptible to disturbance and changes to its local habitat. In many areas where it previously occurred it is now less common, and in some areas it is at risk of extinction. . . . Love them or loathe them, the adder has earned a place in culture and folklore, but its poor public image means many have little sympathy for adder conservation." Everyone can view the results at http://www.adder.org.uk thereby adding an adder to their electronic life list. [May 11, 2006]

Subtracting an anaconda

A 1.2 meter anaconda, native to South America was captured in an English shopping center by their security forces. It had escaped from a local wildlife hospital near the giant mall. [Johannesburg, South Africa, *The Independent*, May 17, 2006]

Geology forges salamander

Scientists studying hynobiid salamanders have found that as their lineage is traced back, the effects of geology can be seen in their genes. "What was once a single family in far northern China later became isolated and ultimately different species as deserts and mountain ranges were formed. The family of salamanders was split up as the vast Indian subcontinent was thrust up against Asia, raising the Himalayas and the Tibetan Plateau, creating the great Gobi Desert, and triggering earthquake zones that churned up mountain ranges in the South China–Burma region. That process, geologists know, continues today, and even Mount Everest continues to grow by inches a year. Over countless generations, the scientists say, the salamanders evolved to fit their altered landscapes, yielding the 46 distinct Asian species that are alive today—all with four toes on each foot instead of the five that the world's other salamanders possess." [*San Francisco Chronicle*, May 19, 2006; also from Ken Mierzwa]

Range extensions

- "Immigrant terrapins have been devastating the duckling population in Bramall Park (U.K.) to the distress of local dog walkers. The carnivorous creatures are not native . . . but have somehow managed to set up home. . . . They are not indigenous and they kill the natural wildlife. . . . A council spokesman said, "Thankfully, the terrapins are unable to breed in this country as they require a constant temperature of 25 degrees for the eggs to develop." Traps are being purchased and they will be given to appropriate homes as captured. [*Stockport Express* (U.K.) May 24, 2006]

- Hikers in Hong Kong, China, were warned after a 4.5-meter Burmese python attacked and killed a pet husky dog in a popular park. The 22-kilogram dog was taken while it was off its lead. The *Taipei Times*, July 10, 2006, notes, "Burmese pythons are just one of the species of snake which live in the wilds in Hong Kong countryside which—contrary to most people's opinion of Hong Kong being a high-rise, densely-populated city—covers three-quarters of the total area of the territory."

Were they going to Graceland?
Three alligators have been found this year in Tennessee's McKellar Lake this year. They don't usually show up this far north, but officials suggest perhaps a string of milder winters is permitting the animals to move northward. McKellar Lake is a slackwater offshoot of the Mississippi River in which the animals are known to have ranged historically as far north as St. Louis before being extirpated by early white settlers and the little Ice Age of the middle 1800s. It's still illegal to hunt gators in Tennessee. [Memphis, Tennessee *Commercial Appeal* (from Bill Burnett's old hometown) May 6, 2006]

St. Patrick is rolling
The *Gorey Echo* of Ireland reported on May 18, 2006: "Pandemonium broke out . . . when a local woman was greeted by the sight of an uninvited visitor on the stairs in her home. The three-foot-long [North American] king snake, a type of constrictor, was coiled around the banisters as it surveyed its new surroundings in the house at Clonattin, Gorey. The shocked woman immediately called the local garda' . . . [who] rushed to the scene. On the way, they contacted the local SPCA who put them in touch with . . . a local expert on snakes. . . . There had been serious fears that they were dealing with a dangerous poisonous snake, particularly as the woman involved is a florist who imports flowers for a living. She had received a delivery of flowers the day before and there was a worry that her visitor could have hitched a lift into the country with them." The snake expert who fished the kingsnake out from under the bed said, "She did the right thing though. When in doubt, you don't ask any questions, you just ring the authorities." Meanwhile the garda were giving interviews having never had to deal with a snake in 23 years on the force. The Dublin SPCA said that the issue will become more common; they're getting 20 calls a year about loose snakes.

Froggy courting

• In a glorious nested headline, the *St. Petersburg Times* wrote "Froggy Is A Courtin'—Didn't You Hear? It's Frog and Toad Mating Season. Size Doesn't Matter to Females; They Care about the Boom of the Groom." A 50-year resident said he'd never heard so many frogs and toads, joking with his friends that it was "like a plague, the plague of the frogs." For those who can't stand the noise, a local water garden owner suggests, "Deal with it," while a wildlife biologist said, "Don't move to a wetland. Close the windows. Wear earplugs." [June 5, 2006]

• After three years of drought, Indian villagers decided to organize some frog-marriages, in hopes of bringing on the monsoon. Crop failure causes villagers to move to the towns and switch from farming to other professions. From April until June, most of the subcontinent suffers searing heat, as much as 40° Celsius, relieved by the monsoon. "The residents of Sonbhadra villages, like other tribal villages in Uttar Pradesh, have long believed that marriage of frogs pleases the Rain Gods, and brings rain and good crops. People cheered, blew conches and sang songs, as the priest solemnized the marriage to the chanting of religious hymns by putting streaks of vermilion on the female toad's head. The married toads, picked up from different ponds, were released into water after the ceremony," reported *Ani* of New Delhi, June 25, 2006.

Clueless role models plead guilty
"A couple who pleaded guilty to stealing three geckos from Christchurch's Orana Wildlife Park say they just wanted a pet for their child—and now they are facing a jail sentence," according to Auckland, New Zealand's *One News.* The 21-year-old father and 30-year-old mother "were charged with two counts of theft and one of possessing absolutely protected wildlife after the geckos went missing early last month. The pair stole the geckos over two consecutive days by putting them in Stirton's handbag, going back the second time because they wanted them to mate. Police recovered the geckos two days later after initially fearing they had been stolen for overseas sale on the black market." The father said they were unaware that the species was protected and that "we're surprised that it's such a big issue." [May 3, 2006]

With thanks to everyone who contributed to this month's column particularly those cited above and to all my super contributors: Wes von Papineäu, Bill Burnett's Aunt Peggy (via his mom, Hilda), Bill Burnett, Ms. G. E. Chow, Steve Christy, Marybeth Trilling, The New Zealand Herp Society, Ann Roberts, Alan Rigerman, Ken Mierzwa and maybe you, too. Send clippings to: Ellin Beltz, POB 1125, Ferndale, CA 95536; electronically to "ebeltz@ebeltz.net" please put the words "herp clipping" in the subject line.

Herpetology 2006

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.

CHANGES OVER TIME IN A SNAKE FAUNA

E. Filippi and L. Luiselli [2006, The Herpetological Journal 16(1):29-36] studied the snake fauna of different habitat types in a protected Mediterranean area of central Italy ("Canale Monterano" in the Tolfa Mountains, province of Rome) during the period from August 2002 to September 2003. The collected data were compared to the published data collected at the same study area over 10 years before (1990). Eight different species (seven colubrids and one viper) were captured, six of which were observed in the earlier study. During both surveys, the most common species was *Coluber viridiflavus*, followed by *Vipera aspis*. In the 2002–2003 survey there was a slight increase in the value of the species diversity index but a remarkable increase in the value of species dominance index (due especially to the proportional higher abundance of *C. viridiflavus*). The authors applied various statistical techniques to habitat use states during the two survey periods to document whether the various species modified their habitat preferences between surveys. In terms of habitat preferences, all these indicators showed that there were substantial interspecific differences but that the species-specific preferences remained the same over the two survey periods. There was a decrease in the abundance of *Elaphe longissima* and, to a lesser degree, *V. aspis*, caused especially by clearing brush at an archaeological site where these snakes were very common over 10 years ago. This is potentially relevant in conservation terms, as in places such as Europe, where many of the protected areas are set aside for archaeological or historical (as opposed to biological) reasons, management to maintain sites or improve access may be detrimental to native species. The various habitats differed in their conservation value for snakes. Appropriate management of the "dry-stone walls and oak forests" habitat-mosaic appeared especially important for the conservation of this snake community, and the same may well be true for many other areas in Mediterranean central Italy.

THERMOREGULATION BY FEMALE FOXSNAKES

R. J. Willson and R. J. Brooks [2006, J. Herpetology 40(2): 285-289]] note that although females of oviparous snake species presumably would benefit by modifying their thermoregulatory behavior while gravid, few studies have investigated whether gravid females actually thermoregulate differently than nongravid conspecifics in the field. To this end, the authors recorded body temperatures (T_bs) from female eastern foxsnakes (*Elaphe gloydi*) housed in a large semi-natural enclosure using temperature-sensitive radio transmitters. Contrary to expectations, gravid females did not maintain higher or less variable T_bs than nongravid females. The authors suspect that the thermal environment available to gravid females at their site may render further increases in thermoregulatory effort, beyond that of nongravid females, unnecessary and potentially detrimental, given possible costs of thermoregulation.

LOGGERHEAD SEA TURTLE NESTS

A. M. Foley et al. [2006, Chelonian Conservation and Biology 5(1):32-41] determined characteristics of the sand, level and frequency of tidal inundation, and hatching success at loggerhead sea turtle (*Caretta caretta*) nest sites on 8 low-relief mangrove islands in the northern half of the Ten Thousand Islands in southwest Florida. The sand was generally composed of larger particles and tended to be wetter, more porous, and more saline than on other loggerhead nesting beaches. More than one-third (38.9%) of the nest sites experienced tidal inundation. The mean salinity of inundating water was 26.9% (±9.3, range = 0–40). The water content and salinity of the sand water at nest sites increased with increasing frequency of inundations. The mean particle diameter and total porosity of the sand were negatively related to sand water salinity, perhaps indicating that in the largest-grained, most porous sands, salt was more effectively washed out by rainfall. Hatching success decreased as inundations, sand water content, and sand water salinity increased. However, at nest sites that did not experience inundation, the sand water content and sand water salinity were not related to hatching success. Loggerhead clutches can tolerate a wide range of incubation environments, including a certain amount of inundation. Clutches that are deposited in low-beach areas (close to the water and more prone to inundation) can produce hatchlings. Because the characteristics of loggerhead hatchlings are influenced by the incubation environment, conservation strategies that involve moving all clutches from low-beach areas to high-beach areas may reduce the variety of incubation environments, thus reducing hatchling variability and possibly preventing the expression of characteristics that promote hatchling survival or otherwise increase the reproductive success of females.

BITE-FORCE AND DOMINANCE

J. F. Husak et al. [2006, Copeia 2006(2):301-306] note that the evolution of exaggerated structures that function as weapons in sexually dimorphic species is often explained by intra-sexual selection related to male combat, as these structures are used in fights among males and can determine dominance during such interactions. In many lizard species, males have a larger head than females, a condition attributed to intra-sexual selection. Although head size has been shown to predict dominance in lizards, the way that head size influences dominance remains unclear. The authors staged interactions between body size-matched male venerable collared lizards (*Crotaphytus antiquus*) in the laboratory to test the hypothesis that harder-biting males would be dominant over males with weaker bite-force performance. Winners of staged interactions bit significantly harder than losers, but no measured morphological trait was significantly different between winners and losers. This result indicates the strong role of weapon performance, as opposed to weapon morphology, in determining dominance.

AN UNSUCCESSFUL REINTRODUCTION

E. A. Jayson et al. [2006, The Herpetological Journal 16(1): 69-76] studied human-crocodile conflicts created by mugger crocodiles *Crocodylus palustris* 18 years after a reintroduction to the Neyyar Wildlife Sanctuary, Kerala, India. Twenty-nine mugger crocodiles were reintroduced into the reservoir in the year 1983 and crocodile attacks on livestock were reported from 1985. During the initial period of the study, 21 to 25 Mugger crocodiles were estimated but only 10 to 16 crocodiles were recorded towards the end of the period as nine were removed from the reservoir to reduce the conflict. Fishes provided sufficient prey, but food in the form of large mammals was inadequate. Twenty-nine crocodile attacks on humans were reported prior to the study and six occurred later, including two fatalities. The attacks occurred over 26 km of shoreline and followed previous patterns of attack behavior in crocodiles. Larger crocodiles were more often involved with attacks than small crocodiles. About 2808 houses exist in a narrow belt near the lake shore. As local people utilized the reservoir for various purposes they did not support the conservation of crocodiles in the present circumstances. The case study indicated the failure of the reintroduction program of mugger crocodile in the Neyyar Reservoir.

SECOND SPECIMEN OF A RARE SNAKE

B. L. Stuart [2006, Hamadryad 30(1&2):167-171] reports on a specimen of *Parahelicops annamensis*, a natricine colubrid snake heretofore known only from the holotype described in 1934 from central Vietnam. The second specimen was collected in 1999 in the mountains of southern Laos, ca. 105 km from the type locality. Based on the Laos specimen, the author provides the first information on morphological variation, coloration in life and habitat usage.

CHANGES IN A TURTLE COMMUNITY

G. R. Smith et al. [2006, J. Herpetology 30(2):180-185] point out that knowledge of the long-term dynamics of freshwater turtle communities is important if we are to understand fully the impacts of human-induced changes in their aquatic and terrestrial habitats. These authors present data on a turtle community in Kosciosko County, Indiana, that has been monitored intermittently for more than 20 years and regularly for more than 10 years (1992–2003). The composition of the community has shifted with a decrease in the dominance of painted turtles (*Chrysemys picta*). This shift reflects a decline in the number of *C. picta* over the past decade, whereas numbers of other species have remained relatively constant. Adult survivorship of *C. picta* has declined in the past decade. The proportion of *C. picta* with watercraft propeller damage has increased, whereas propeller damage has remained constant for the two other species for which the authors have data, the northern map turtle (*Graptemys geographica*) and the red-eared slider (*Trachemys scripta*). This study suggests that the turtle community in Dewart Lake has shifted between 1992 and 2003. It seems likely that this shift has occurred because of a decline in *C. picta*, possibly as a result of increased use of the lake by humans.

EXOTIC CRAYFISH AND NATTERJACK TOADS

M. J Cruz et al. [2006, Copeia 2006(2):274-280] report that *Procambarus clarkii*, an American crayfish, was introduced in the SW Iberian Peninsula three decades ago. This region has no native crayfishes; therefore, *P. clarkii* constitutes a potential threat for the embryos and larvae of amphibians, which may lack evolved defenses against it. The effects of this crayfish on the natterjack toad, *Bufo calamita*, were assessed using two complementary approaches. First, the effect of crayfish presence on *B. calamita* breeding habitat use was studied in temporary ponds of Doñana Natural Park (southwestern Spain). Thirty-one temporary ponds were surveyed for the presence of *P. clarkii* and *B. calamita* eggs and tadpoles, and then a regression determined if crayfish were significantly associated with natterjack toad distribution after habitat variables were taken into account. Second, the impact of *P. clarkii* on *B. calamita* embryos was experimentally evaluated in natural ponds with a two × two factorial experiment, using two ponds (one with and one without crayfish) and two treatments (embryos exposed or not exposed to predators). Crayfish presence was a negative predictor of *B. calamita* breeding habitat use; co-occurrence of the two species was limited to only one pond. Moreover, the predation experiment showed that survival of *B. calamita* embryos was strikingly reduced when they were directly exposed to crayfish compared to survival in all other treatments. The results indicated that *P. clarkii* has a strong effect on *B. calamita* reproductive success and that it may play an important role in structuring amphibian communities in temporary ponds.

DIAMONDBACK TERRAPIN POPULATION TRENDS

N. G. Avissar [2006, Chelonian Conservation and Biology 5(1):154-159] compared population structure of northern diamondback terrapins, *Malaclemys terrapin terrapin*, in an unaltered creek in southern New Jersey to data collected 12–13 years earlier. The recent data showed significantly lower average carapace size and fewer adult females compared to the earlier survey. The author speculates that road mortality of nesting females may be responsible for these trends.

FROGS AS INDICATORS OF BIOLOGICAL QUALITY

M. Lebboroni et al. [2006, Amphibia–Reptilia 27(1):73-79] sampled the headwater streams of two basins in central Italy in randomly selected reaches (n = 59) to quantify tadpole occurrence. Environmental and physico-chemical data were collected for each reach. Macrobenthos were also sampled to obtain quantitative indices of biological quality (IBE and BMWP). A longitudinal zonation was evident for the three most common amphibian species found (*Rana italica*, *Bufo bufo* and *Rana* kl. *esculenta*, from higher to lower altitude). A good concordance was recorded between the occurrence of single species, in this order, and a decreasing value of water quality as computed by BMWP. In both basins, the average BMWP and IBE scores for reaches where *R. italica* occurred alone corresponded to the standard judgement of "excellent" to "good" biological water quality. *R. italica* is suggested as a potential bioindicator for small headwater streams.

Unofficial Minutes of the CHS Board Meeting, July 14, 2006

Rich Crowley called the meeting to order at 7:30 P.M. Board members Marybeth Trilling and Erik Williams were absent.

Officers' Reports

Treasurer: Andy Malawy distributed the June financial report and reviewed the balances, income and expenses.

Membership Secretary: Deb Krohn distributed the membership report; total membership stands at 569.

Recording Secretary: Kira Geselowitz read the minutes of the June 16 board meeting. Minor adjustments were made and the minutes were accepted.

Vice-president: Marty Crump will speak at the October 25 CHS meeting. For the past 30 years, in addition to her scientific publications, Marty has written about natural history for the general public and for children. Marty will bring copies of her now-out-of-print book intended for young people: *Amphibians, Reptiles, and Their Conservation*. Linda will be taking preorders for the book.

Corresponding Secretary: Cindy Rampacek reported that she has been working on maintenance of the CHS Yahoo discussion group, purging inactive members.

Sergeant-at-arms: Betsy Davis reported 61 people at the June Show & Tell meeting.

Committee Reports

Shows: Jenny Vollman reminded everyone that the Peggy Notebaert shows are the first full weekend of every month. Jenny mentioned that there will be one extra day in November, the weekend of Thanksgiving, Sunday, November 26. Jenny has arranged four show dates with the Chicago Park District: July 15, Humboldt Park; July 22, River Park; August 19, Jackson Park; September 16, Northerly Island. Mike Dloogatch moved to authorize the execution of the contract with the Chicago Park District committing the CHS to the four show dates. Cindy Rampacek seconded the motion. The motion passed with all in favor. Cindy Rampacek made a motion to authorize the execution of the contract with the Peggy Notebaert Nature Center committing the CHS to six weekends over the last six months of the calendar year 2006 with one extra date over the Thanksgiving weekend. Andy Malawy seconded the motion. The motion passed with all in favor. Rich Crowley informed the board that from now on all contracts to which the CHS is a party will require approval by the board before being signed by an executive board member. The official CHS business address will be used on all contracts. This is to insure proper insurance coverage and conform to Roberts Rules of Order. Members' Night at the Museum of Science and Industry will be July 19. Jenny reminded everyone participating to be there at 4:00 P.M. Jenny also mentioned that the MSI is hosting the Chicago Science Week this year and the CHS is invited to attend. Show dates are September 23–24. The CHS has been invited to participate in the Illinois State Fair in Springfield and they would like us to diplay the two Illinois state herps and as many as possible of the losing candidate species. The show will be Friday, August 11, at the Lieutenant Governor's booth from 10 to 8. Cindy Rampacek mentioned that The Great Lakes Pet Expo would like the CHS to participate in the expo this year. They are currently trying to determine the dates. Linda Malawy reported that the Milwaukee Public Museum will be hosting Snake Days November 18. The annual Midwest Herp Symposium will be November 3–5 in Indianapolis. The Michigan Herp Society Expo will be September 16 in Ionia, Michigan.

Monthly Raffle: Cindy Rampacek has arranged for reptile-related donations from Petco. We are still looking for a raffle coordinator.

Library: Author Marty Crump has donated a copy of *Amphibians, Reptiles, and Their Conservation* to the CHS library.

Old Business

Mike Dloogatch reported that a special supplement to the Bulletin has been printed and will be mailed to members. Extra copies were printed and will be sold to booksellers.

New Business

Jenny Vollman announced that Don Wheeler has offered to let us bind and print a collection of Spot cartoons. Jenny will be looking into this and getting quotes.

Linda Malawy suggested that we should consider having a presence at local reptile swap meets and similar venues. Jason Hood volunteered to set out CHS brochures on his table at the swap.

Roundtable

Deb Krohn shared a nice photo of a plump foxsnake she found curled up in a birdhouse she had been checking.

Deb Krohn passed around a brochure advertising "The Little Critter Sitter," a product intended to help reptiles, amphibians and other small creatures avoid drowning in swimming pools.

Rob Carmichael and the Wildlife Discovery Center will be on television soon. Wildlife Discovery Center was visited by Animal Planet and and will be featured on an upcoming Back Yard Habitat episode featuring the animals on the Middle Fork Savannah. No details are available yet for air date.

Rich Crowley thanked Bob Bavirsha and John Archer for taking in and caring for his animals while he was attempting to sell his house.

The meeting was adjourned at 9:51 P.M.

Respectfully submitted by Zorina Banas, Recording Secretary

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*, 6115 SW 137th Avenue, Archer FL 32618, (352) 495-9024, E-mail: GrmtRodent@aol.com.

For sale: from **The Mouse Factory**, producing superior quality, frozen feeder mice and rats. We feed our colony a nutrtionally balanced diet of rodent chow, formulated especially for us, and four types of natural whole grains and seeds. Mice starting from: pinks, $.17 each; fuzzies, $.24 each; hoppers, $.30 each; weanling, $.42; adult, $.48. Rats: starting with pinks at $.45 each, to XL at $1.80 each. Discount prices available. We accept Visa, MC, Discover or money orders. PO Box 85, Alpine TX 79831. Call **toll-free** at (800) 720-0076 or visit our website: < http://www.themousefactory.com> .

For sale: **high quality frozen feeders**. Over a decade of production and supply. Seven sizes of mice availabe: small newborn pinks up to jumbo adults. Prices start at $25 per 100. Feeders are separate in the resealable bag, not frozen together. Low shipping rates. Free price list. Kelly Haller, 4236 SE 25th Street, Topeka KS 66605, (913) 234-3358 evenings and weekends.

For sale: herp books. *Australia's North, A Natural History of Australia,* vol. 3, by Stanley and Kay Breeden, 1975, 208 pp., an outstanding account of the ecology of primarily the Top End (i.e., Kakadu), includes many reptiles, excellent color and b&w photos (some full page), DJ, hardbound, $35; *Australia's Tropical Rainforests World Heritage* magazine, 2005-6, 16 10"× 16" pp., color photos, main article on mountains of the Wet Tropics, 2 pp. article on snakes featuring the amethystine python, color photo of amethystine on cover, sent folded in half, $4; *Boy's Book of Snakes* by Percy Morris, 1965 (first edition, first printing), 185 pp., many b&w photos, a few ink marks at bottom of introductory pages, hardbound, $20; *The Snakes of Arizona* by Jack Fowlie, 1965, 164 pp., signed by author, hardbound, $55. All books in excellent condition except as noted. Postage and handling $2.50 for orders under $25, free for orders of $25 or more. William R. Turner, 7395 S Downing Circle W, Littleton, CO 80122, (303) 795-5128, e-mail: toursbyturner@aol.com.

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Virtual Museum of Natural History at www.curator.org: Free quality information on animals—emphasis on herps—plus expedition reports, book reviews and links to solid information. Always open, always free.

Line ads in this publication are run free for CHS members—$2 per line for nonmembers. Any ad may be refused at the discretion of the Editor. Submit ads to: Michael Dloogatch, 6048 N. Lawndale Avenue, Chicago IL 60659, (773) 588-0728 evening telephone, (312) 782-2868 fax, E-mail: MADadder0@aol.com

Next time you surf the WorldWide Web, crawl, run, slither, slide, jump, or hop over to the CHS web site!

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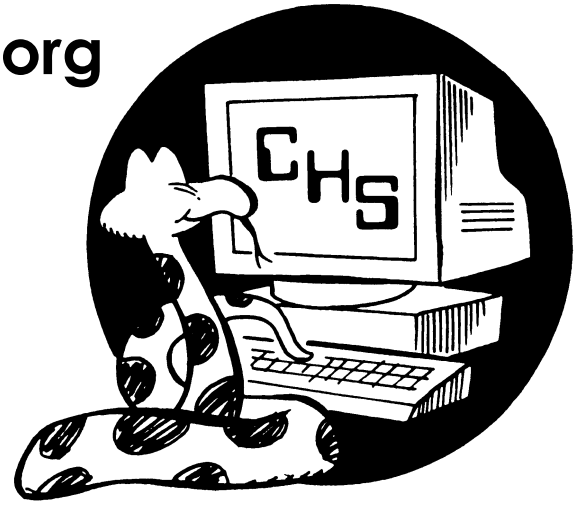

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Chicagoherp.org is accepting applications for banner advertisements or links from herpetoculturists and manufacturers of herp-related products. Visit the site and contact the webmaster for details on how you can sponsor CHS!

UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, August 30, at the Peggy Notebaert Nature Museum, Cannon Drive and Fullerton Parkway, in Chicago. At this meeting **Mike Redmer** will present "A Pilgrimage to Panama Presented in PowerPoint: An Old-fashioned CHS Travelogue, Sans Slides." This program will chronicle the highlights of Mike's recent trip to Panama in May 2006, the purpose of which was to see and photograph some of the last Panamanian golden frogs (*Atelopus zeteki*) remaining in the wild.

At the September 27 meeting **Dan Pearson**, of Gainesville, Florida, will speak on "Keeping and Breeding the Malagasy Spider and Flat-tailed Tortoises, *Pyxis arachnoides* and *P. planicauda*."

And at the October 25 meeting **Marty Crump**, adjunct professor at Northern Arizona University will talk about "Amazing Frogs: Appearance, Behavior and Lifestyle."

The regular monthly meetings of the Chicago Herpetological Society take place at Chicago's newest museum — the **Peggy Notebaert Nature Museum**. This beautiful new 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.

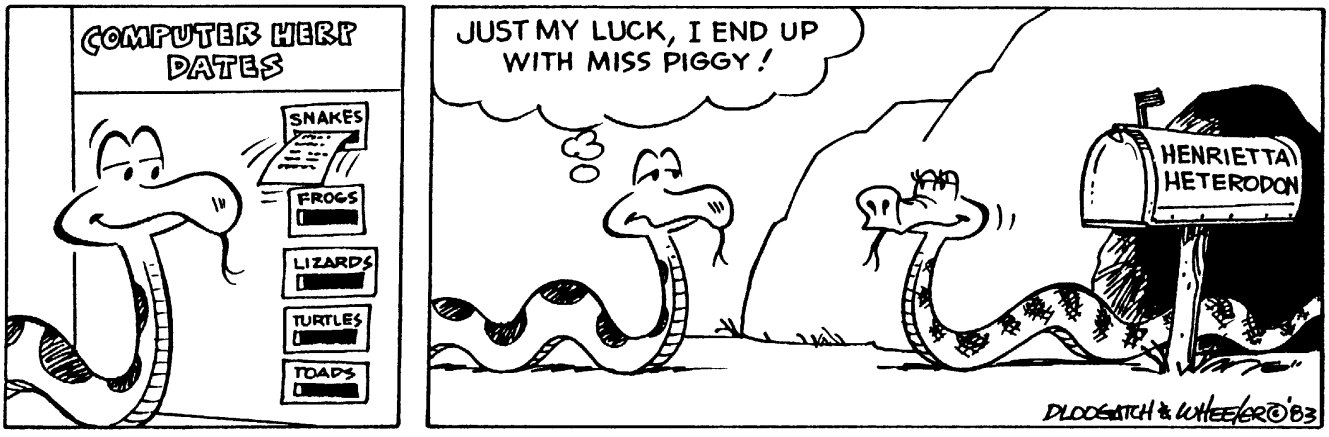
Board of Directors Meeting

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 September 16 board meeting, to be held at the home of CHS Membership Secretary Deb Krohn in New Lenox, Illinois. For directions call Deb at (815) 462-3299.

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 call Lisa Koester, (773) 508-0034, or visit the CTC website: http://www.geocities.com/~chicagoturtle.

THE ADVENTURES OF SPOT



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