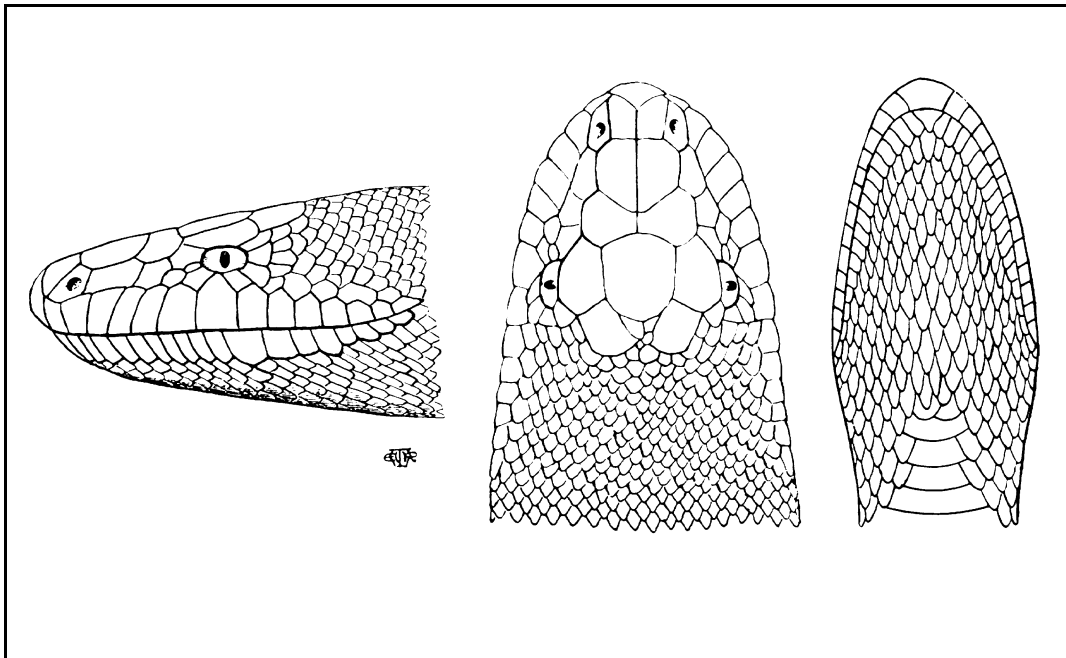

BULLETIN

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Volume 44, Number 11
November 2009



BULLETIN OF THE CHICAGO HERPETOLOGICAL SOCIETY

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Use of Remote Cameras to Monitor Rock Ledge Microhabitat of Timber Rattlesnakes (*Crotalus horridus*)

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Introduction

Timber rattlesnakes in southeast Minnesota hibernate in dens associated with rock outcrops high on south or southwest slopes of bluffs. Most often the hibernacula are found in or near "goat prairies." Gravid females remain at dens or in nearby rocky habitat, whereas males and nongravid females disperse during the summer and may end up at lower elevations. Concern about loss of goat prairies through succession has spurred efforts to remove invasive shrubs and trees via cutting or controlled burns. Because logistical considerations limit burning to spring or autumn, it is important to understand the timing of when snakes enter and leave particular dens, including variability among and within populations. Cochran (2008) studied the phenology of timber rattlesnakes in southeast Minnesota by direct observation. Snakes were usually first observed in mid-May. During most years, snakes were last seen in late September, although in one year they were observed at one den site until 10 October. Direct observation of neonates and indirect evidence from the timing of shedding indicated that births occurred from late August until late September, but most young were born during a two-week period that varied among years from the first and second week of September to the second and third week. Both adults and neonates were observed above ground even after heavy frosts. Snakes were observed at lower elevations primarily from early July until early September, but a few records occurred as late as early October.

The purpose of the present study was to investigate the potential for using remote cameras to monitor the timing of rock ledge use by timber rattlesnakes. Remotely-triggered cameras have been used previously to monitor occurrence of timber rattlesnakes (Sadighi et al., 1995). Another study used fixed videography to study predation behavior (Clark, 2006).

Methods

We conducted research in 2007 on south- or southwest-facing slopes of bluffs in Houston and Winona counties in southeast Minnesota (because the timber rattlesnake is a threatened species in Minnesota, precise locations are not included here). At the Houston County site on 22 May, we placed a Cuddeback digital remote camera beneath an overhanging rock ledge where we had previously observed a rattlesnake. However, we obtained few photographs at this spot and moved the camera to a location beneath a second rock ledge, where we had observed as many as six snakes, from 13 June through 5 October. We referred to this second ledge informally as the "three-story flat" because snakes were observed here at three levels. Most snakes were observed on the middle shelf, where the camera was set, but it was the uppermost crevice that seemed to penetrate underground. The camera was programmed to take

photographs at one-hour intervals in addition to photographs triggered by motion. At the Winona County site, we placed a Bushnell digital remote camera beneath an overhanging rock ledge from 27 July through 6 October. This camera took photographs only in response to motion. At each location in Houston and Winona County, the camera was set beneath one end of an overhanging ledge and pointed toward the opposite end, and it was held in place with small rocks and screened from passers-by with a rock slab or woody debris. Memory cards for the cameras were changed at intervals of 7–14 days. Photographs produced by both cameras were stamped with dates and times (all times referred to below are Central Daylight Savings Time).

We placed temperature recorders (HOBO) beneath the same overhanging rock ledge as the camera at the Houston County site to record temperature on the ground surface beneath the ledge and the exposed ground surface temperature approximately two meters away from the ledge. Temperatures were recorded each hour of the day, starting at 6 P.M. on 10 July, when the temperature recorder was first placed on the bluff.

Results and Discussion

Insights into Rattlesnake Biology

We obtained 163 photographs of timber rattlesnakes. The Houston County camera yielded 57 photographs, whereas the Winona County produced 106.

The camera in Houston County captured images of timber rattlesnakes from late May through late August. However, there were several periods when few photographs were obtained. A rattlesnake was present at the ledge where the camera was first set on 22 May (after the snake retreated back out of sight), but only two photos were obtained from 22 May to 13 June, when the camera was moved to the "three-story flat." Five rattlesnakes were present on 22 May and six on 13 June, and the camera was left there until the end of the study. During two periods with no rattlesnake photos (5–10 July and 2–14 September), the camera had been dislodged and moved downslope, and was lying face up. During the period 19 July to 13 August, for no obvious reason, very few rattlesnake photos were obtained.

The camera set beneath the Winona County ledge captured photographs of timber rattlesnakes from late July through late August. This represented most of the time that the camera was set out (27 July through 6 October).

We were able to collect information about the use of rock ledge habitat throughout the day. This topic will be dealt with in detail elsewhere, but timber rattlesnakes at both sites were generally photographed beneath overhanging ledges from mid-morning through late afternoon, when substrate surface temper-

atures beneath the overhangs were cooler than those out in the open. An example is shown in Figure 1.

Timber rattlesnakes may exhibit “spook” behavior if disturbed at dens or basking sites and become much more difficult

to observe (Brown, 1992, 1993). The results of this study suggest that to avoid disturbing timber rattlesnakes at ledges, as for example in this study when the memory card in a camera was changed, it would be best to visit study sites before 10:00 A.M.



Figure 1. “A Day on a Ledge.” Photographs taken by the remote camera at the Houston County site (the “middle floor” of the “three-story flat”) on 28 June 2007. Most photographs were taken hourly, and they are arranged in rows from left to right and down the page. Photographs in response to motion were taken at 10:09 and 10:10 A.M. At 9:00 P.M., the snake is apparently climbing to the “top floor” to the crevice that leads underground.

Figure 1. (cont'd)



Remote cameras can provide anecdotal information about the timing of biological events. For example, an image of a female timber rattlesnake giving birth was obtained at the Winona County site at 12:49 P.M. on 25 August.

Interactions between Snakes and Cameras

Sometimes rattlesnakes made contact with a camera (Figure 1) or with rocks used to hold a camera in place, and they may have been responsible for shifting cameras out of position on

Figure 1. (cont'd)



some occasions. One snake used the crevice between a camera and rock to shed its skin, a piece of which appeared in subsequent photographs. On 13 September, on the Winona County bluff, the camera was found positioned on its back with 2–3 newborn snakes basking on it. After these snakes were carefully

herded off the camera and it was carefully lifted from the ground, several more newborns were discovered beneath it.

Other Animals that were Photographed

In addition to timber rattlesnakes, other animals were occa-

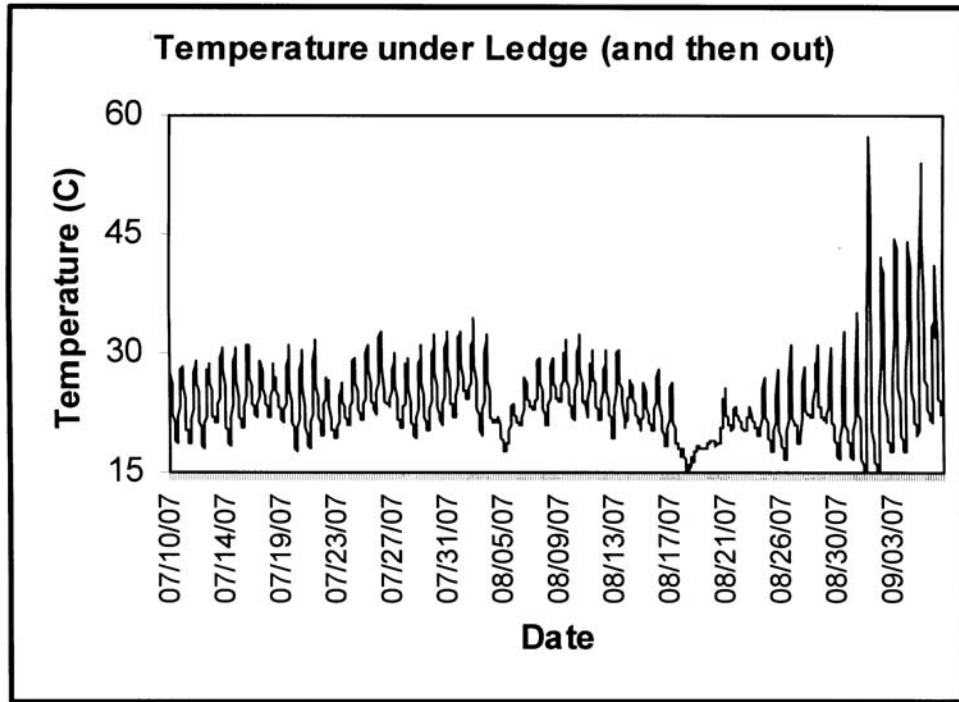


Figure 2. Substrate surface temperatures at the Houston County site. Temperature was recorded hourly, initially beneath an overhanging ledge. At the end of August, however, the temperature recorder was moved approximately two meters downslope from the ledge, apparently by a raccoon, and thereafter recorded temperature of the exposed ground.

sionally photographed (all in Houston County). Data on six-lined racerunners (*Aspidocelis sexlineata*) will be presented elsewhere (Cochran and Schmitt, 2008, in preparation); but we note here that a rattlesnake and racerunner were photographed together on two occasions (8 June at 2:09 P.M. and 24 June at 2:45 P.M.). Other visitors included at least one raccoon (3 photographs), a fox squirrel (one photograph), a house wren (one photograph), and what appeared to be a cave cricket (one photograph). Some of these represent potential predators (raccoon) or prey (squirrels, wren) of timber rattlesnakes. A raccoon was probably responsible for moving one of the tempera-

ture recorders out from under the ledge to exposed ground downslope (Figure 2).

Acknowledgments

We would like to thank the Chicago Herpetological Society for a grant used to purchase one of the remote cameras and Chris Kendall for access to one of the study sites. Stephen Schmitt is grateful to Saint Mary's University of Minnesota for its support of undergraduate research.

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Aberrant Pattern in the Allegheny Dusky Salamander (*Desmognathus ochrophaeus*) from Erie County, Pennsylvania

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Adult *Desmognathus ochrophaeus* usually have a dorsal pattern consisting of a straight-edged, light stripe, bordered by darker pigment on the sides. However, considerable variation exists in this pattern (Petranka, 1998). For instance, the stripe may be gray, brown, yellow, orange, or red, depending on the individual's age and sex (Orr, 1989). Older males tend to be uniformly dark brown to brownish black, with the dorsal stripe obscured. Here, I report on an aberrant pattern observed in two individuals from the Asbury Woods Greenway, Erie County, Pennsylvania (42.05210°N 80.17959°W [WGS 84]).

On 8 September 2000, an adult male *D. ochrophaeus* was found beneath a small slab of shale, along an intermittent stream. The specimen had a brownish head, was brownish black on the body, with an obscure dorsal stripe. There was also extensive bluish flecking and small blotches on all dorsal surfaces (Figure 1). The specimen superficially resembled a Jefferson salamander, *Ambystoma jeffersonianum*, which also occurs at the site. The ventral surface was uniformly pigmented, and was for the most part without flecking.

A second adult male was found 13 October 2003, under shale, near a spring seep in the Oxbow Territory. This specimen was darker on the head, and the dorsal stripe was more obscure than that of the first specimen. The light line from the eye to the angle of the jaw, a character that is useful in identifying sala-



Figure 1. An adult male *Desmognathus ochrophaeus* from Asbury Woods Greenway, Erie County, Pennsylvania, with bluish blotches and flecking incorporated in pattern.

manders in the genus *Desmognathus*, was pigmented with bluish flecks. On the body, the bluish blotches and flecking were similar to those seen previously in the specimen of September 2000 (Figure 2). The ventral surface was normally pigmented and lacked bluish flecking.

As far as I'm aware, this is the first report of a Pennsylvania *D. ochrophaeus* having this apparently uncommon pattern. Although the pattern described above resembles that of *A. jeffersonianum*, the low frequency of *D. ochrophaeus* with this pattern at the site, suggests that it is not an example of mimicry. Interestingly, the pattern was only observed in males; perhaps the aberrant pattern is a sex-linked trait.

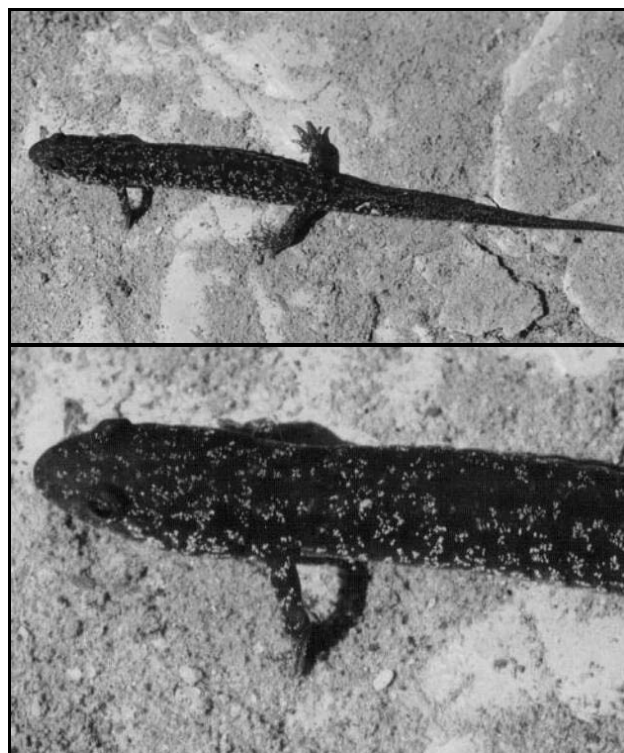


Figure 2. top) Second adult male *Desmognathus ochrophaeus* with bluish blotches and flecking from Asbury Woods Greenway, Erie County, Pennsylvania. bottom) A close-up of the animal above.

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Note on Reproduction of *Pholidobolus montium* (Squamata: Gymnophthalmidae) from Ecuador

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Abstract

Reproductive tissues from 31 adult *Pholidobolus montium* were histologically examined. Males from May, August and November were undergoing sperm formation (= spermiogenesis). Five of seven (71%) females from May were reproductively active. Mean clutch size for four females was 1.8 ± 0.5 SD, range = 1–2. The smallest reproductively active male measured 37 mm SVL; the smallest reproductively active female measured 46 mm SVL. *Pholidobolus montium* appears to exhibit an extended reproductive cycle which also occurs in other species of gymnophthalmid lizards.

Pholidobolus montium is known from Ecuador and Colombia at elevations of 2590–3352 m (Montanucci, 1973; Uetz and Hallermann, 2009). To my knowledge, the only information on reproduction of *P. montium* is in Montanucci (1973). The purpose of this note is to add information on the reproductive cycle of *P. montium* from a histological examination of museum specimens as part of an ongoing survey of reproduction in South American lizards. The first information on the testicular cycle of *P. montium* is presented.

Forty-one *P. montium* were examined from the herpetology collection of the Natural History Museum of Los Angeles County (LACM), Los Angeles, California. The sample consisted of 23 males (mean snout–vent length [SVL] = 43.6 mm \pm 3.5 SD, range: 37–50 mm); eight females (mean SVL = 48.1 mm \pm 3.9 SD, range: 43–54 mm) and 10 juveniles (mean SVL = 25.3 mm \pm 1.9 SD, range: 23–28 mm). Specimens were from: **Ecuador**, Pichincha Province: (LACM) 58729, 58731–58737, 58739, 58740, 58742–58744, 58748, 58751–58760, 58762, 58764, 58766–58770, 58772–58775, 58777, 58778, 58780, 109608, 109609, Azuay Province: LACM 147161.

Gonads were dehydrated in ethanol, embedded in paraffin, sectioned at 5 μ m and stained with Harris hematoxylin, followed by eosin counterstain (Presnell and Schreiber, 1997). Enlarged ovarian follicles (> 4 mm) were counted; no histology was done on them. Male and female mean body sizes (SVL) were compared using an unpaired *t* test (Instat, vers. 3.0b, Graphpad Software, San Diego, CA).

Twenty of 21 males from May were undergoing spermiogenesis (= sperm formation). The smallest spermiogenic male measured 37 mm SVL (LACM 58767). One slightly larger male of 39 mm SVL (LACM 58752) was in late recrudescence

(prior to sperm formation); secondary spermatocytes but no spermatids were present. One male each from August (LACM 109608) and November (LACM 147161) were undergoing spermiogenesis.

Females were significantly larger than males (unpaired *t* test, $t = 3.02$, $df = 29$, $P = 0.005$). Monthly stages in the ovarian cycle are in Table 1. Five of seven (71%) females from May were reproductively active. Mean clutch size for 4 females was 1.8 ± 0.5 SD, range: 1–2. The smallest reproductively active female (enlarged follicles) measured 46 mm SVL (LACM 58748).

All ten juveniles were collected in May. Five of this group measured 23–24 mm SVL (mean = 23.6 mm \pm 0.54 SD) and were likely neonates born earlier in the year. The time of birth of the remaining larger five which ranged between 26 and 28 mm SVL (mean = 27.0 mm \pm 0.71 SD) is not known.

Montanucci (1973) reported species of *Pholidobolus* produces clutches of two eggs, occasionally depositing a single egg on two consecutive days. Multiple clutches are known for *P. montium* (Montanucci, 1973). *Pholidobolus montium* with large yolked follicles or oviductal eggs were collected in February, June, July and October (Montanucci, 1973). These observations, along with mine, indicate *P. montium* exhibits an extended reproductive cycle. My findings of one August and one November male undergoing sperm formation provide further evidence of prolonged reproduction.

It appears from previous studies of other species of gymnophthalmid lizards (Telford, 1971; Dixon and Soini, 1975; Sherbrooke, 1975; Harris, 1994; Vitt and Avila-Pires, 1998; Goldberg, 2008) that extended reproductive cycles with production of clutches of two eggs are typical for gymnophthalmid lizards.

With 36 genera and more than 160 species in the family Gymnophthalmidae, extending from southern Central America to southern South America (Zug et al., 2001), additional investigations are needed before the diversity in reproductive cycles in this group of lizards can be ascertained.

Acknowledgment

I thank Christine Thacker (LACM) for permission to examine *P. montium*.

Table 1. Monthly stages in the ovarian cycle of 8 *Pholidobolus montium* females from Ecuador.

Month	<i>n</i>	No yolk deposition	Early yolk deposition	Follicles > 4 mm	Oviductal eggs
May	7	2	1	3	1
August	1	1	0	0	0

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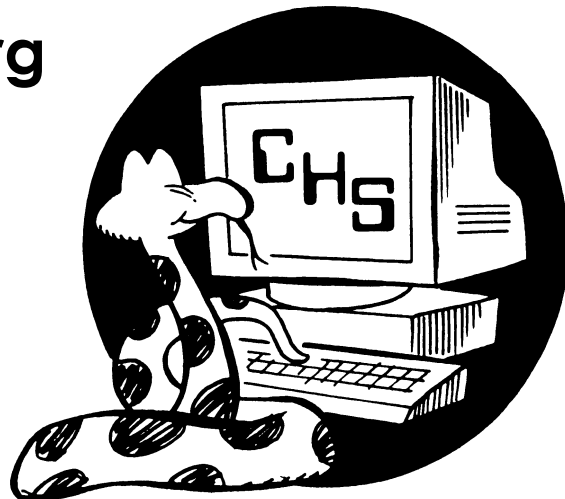
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What You Missed at the October Meeting

John Archer
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Some of you may already have known Matt Goode before I had the pleasure of meeting him. He is a key figure in a current National Geographic program about king cobras (*Ophiophagus hannah*). You can find more info about that program, *Serpent King*, here: <http://channel.nationalgeographic.com/series/wild/3633/Overview>. After doing a little research on Matt, I knew why he was involved in a radiotelemetry project in India studying king cobras, I just couldn't figure out how he got involved.

Because I don't get that channel, I haven't seen the TV program, but I did view the clips on the web site for *Serpent King* and Matt starred in one. In the clip he's a serious scientist, anesthetizing a large cobra, surgically implanting transmitters and recorders, and carefully reviving the huge animal with mouth-to-mouth resuscitation (Relax. He used a straw.) I'm absolutely certain that he's a superb scientist,



Arizona, Tucson, and an expert in radio-tracking snakes. He has anesthetized and tagged or implanted transmitters in thousands of snakes covering some 20 different species, mostly desert species of the Southwest. He's published multiple papers and is so well known and respected that when Rom Whitaker needed help with a radio-tracking study of king cobras, Matt's name was on the short list of highly experienced researchers dealing with snakes and telemetry. Because of numerous appearances on TV, Rom is one of the most famous, at least in the U.S., conservationists working in India. When he asked Matt to help out with a telemetry study of king cobras, Matt said sure. For a couple of years Matt has

implanted transmitters in the largest venomous snake in the world in an ongoing attempt to learn about the habits of these huge snakes, and he was willing to share some of his experiences with us at October's meeting.

Modestly, Matt started by giving credit to Rom Whitaker and Gowri Shankar for being the stars of the project. The study was conducted using the Agumbe Rainforest Research Station (ARRS) as a base on land bought by Rom as a step toward a king cobra nature preserve. Gowri Shankar is a "... dashing Indian Omar Sharif hepato-guy and the chicks really dig him." Gowri works for ARRS and rescues and relocates king cobras when needed, frequently using creative methods devised on the spot. Throughout his talk Matt stressed that the initial goal is to find out something about the life history of king cobras, and because of the small number of snakes that have been radio-tracked, no strong scientific conclusions have been

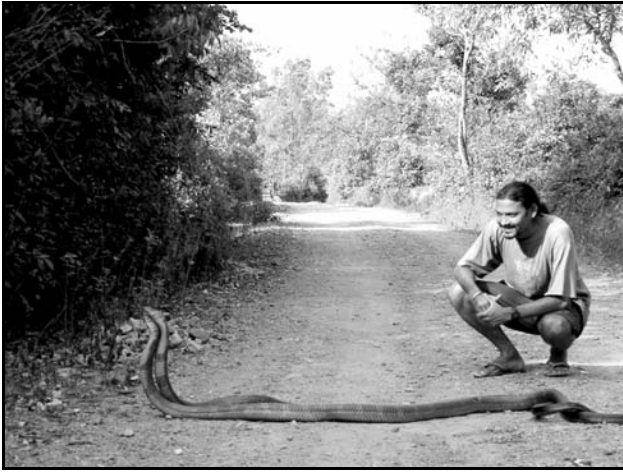


but I'm now equally certain that he's not deadly serious. The fact that he flew up from Tucson in the company of his good friend Roger Repp was a hint that my impressions from the clip may be in error. I know Roger Repp. While not an academic, he does serious science, including telemetry studies, in the Tucson area and is the president of the Tucson Herpetological Society, which has a nice web site featuring some of Roger's writing. I've had the privilege of herping with Roger and I've read his writing and I know that while he's extremely accomplished, he is certainly not serious. He and his writings are hilarious. Maybe it's a flaw in my character, but I tend to enjoy the company of not-so-serious people. Matt Goode and Roger Repp easily fell into my favorite type of companions, and I had the pleasure of hanging around with them for a couple of days. You should be so lucky.

Matt Goode is a research specialist at the University of



Rom Whitaker holding the tail of a king cobra.



Gowri Shankar, one of the principles in the king cobra study, watching a pair of mating cobras.

reached. That was fine with us, because what they have observed is fascinating.

Agumbe is in southwest India just by the Western Ghats. It's one of the rainiest places on earth, with thickly forested mountains and lush vegetation interrupted occasionally by clearings of villages and fields. Matt had gorgeous pictures that unfortunately did not show up well on the screen (we're working on it). He said that the study would be impossible without the cooperation of the Indians. He praised the enthusiasm of the students that worked with the project and mentioned how important their local guide Wittala was. After tracking a cobra through dense jungle all day, Wittala got you home! It was difficult to get the permits needed from the Indian government because of the Indian reverence for all life, but that reverence also meant that snakes, particularly king cobras, are considered holy by most and rarely killed. Snakes are relocated if they're in areas where they're not wanted. Matt mentioned that relocated snakes rarely fare well, and the results of tracking two relocated snakes backed this up, but he frequently repeated that



A small snack for a king cobra, a Malabar pit viper (*Trimeresurus malabaricus*).

they have tracked very few snakes so far, so it's difficult to be definite about "regular" behavior.

Matt showed us gorgeous pictures of some of the other animals found in Agumbe, including the Malabar pit viper (*Trimeresurus malabaricus*), a frequent prey of the king cobra, and a beautiful shot of a large-scaled painted calotes (*Calotes grandisquamis*). He also included a rather gory but very bright image of his bloody foot covered with leeches, which were so common that he eventually simply let them get their fill and drop off on their own. Such are the joys of fieldwork. Then he talked about the king cobras.

Because the radio-implanted animals were followed all day every day, the researchers managed to capture some exceptional footage of some extraordinary activities. Matt said that he finds king cobras to be very alert and aware of their environment. Even from long distances they will watch the researchers, unlike his normal study subjects, rattlers, which stay still, seemingly unaware and uncaring. Actually he began to say unblinking, but admitted that it would be difficult for any snake to blink. Matt said that while his normal studies involved snakes considerably smaller than cobras, he was familiar with King Cobras, and indeed had been bitten by Kings on occasion. You'll need to check the photo for the punch line. Serious research. Not so serious researcher.



Matt had numerous film clips, all of which were fascinating even though we had trouble playing some. During a clip of a king cobra subduing and consuming a rat snake (*Ptyas mucosus*), Matt made the point of how aggressive and strong these nine- to ten-foot-long rat snakes are. Even the native handlers don't let these snakes bite them because of the strength of the bites, and yet the tough leather-like skin of the cobras allowed the cobra to be bit again and again with no visible harm. At one time the rat snake even bit the cobra's eye. The cobra's venom appeared to incapacitate none of its prey that we watched; all of the snakes were still thrashing as the as the cobra swallowed them.



A male king cobra consuming a female, possibly because she is gravid by another male and unwilling to mate.

Several clips illustrated what I thought was the most compelling anecdote that Matt talked about. Called to relocate a snake, Gowri arrived to find a pair of cobras. The male promptly left the area and Gowri demonstrated his skill in tracking by following it for four kilometers (2.5 miles) where it crawled into a burrow. Gowri then returned to find the female already tracking the male. The female followed the male's trail exactly, and crawled into the same burrow. While watching the burrow, the film crew observed another male approach and enter. Shortly after both males emerged from the burrow and began to fight. The interloping male chased the first male away, reentered the burrow, and came out courting the female. The female was gravid and seemed unresponsive to the new male's affectionate moves. After some time courting, the new male bit the female behind the head and then ate her. One of the film clips on the web site above shows some of this event. This allows for all kinds of speculation, and certainly points toward areas that need more research.

Matt had a film clip of a female cobra building one of the large and very symmetrical nests that the king cobras build. She would grasp leaves in a coil and drag them into place. Once she lays the eggs she guards the nest. He had clips from Google Earth showing the movements of a relocated and radio-implanted male that moved 139 kilometers (86 miles) in ten months, and while Matt attributed that much movement to the snake being out of its home range, even snakes within their home range have moved up to 8 km (5 miles) in one day.

He showed photos of a king cobra, tongue-flicking as it swam, tracking a Malabar pit viper through a stream while the viper held very still. The cobra passed the viper without finding it, then climbed a tree and carefully watched the stream. When the viper moved, the cobra saw and attacked, eventually consuming the viper.

In the other clip on the *Serpent King* web site, Matt is shown anesthetizing a cobra, which he mentions is the only time that he handles the huge snakes, and then inserting a radio transmitter and a few button data collectors. Matt says that the anesthesia is the trickiest part of the implant surgery. The drama begins when he attempts to revive the cobra. With much animation and superb acting, Matt recreated how his attempt really played out. Not shown on the film clip was Matt first breathing a light and

shallow breath into the snake in an attempt to fill its lungs. In Matt's more frequent study subjects, this requires slight pressure to assure that one does not over-inflate the snakes' lungs. His first breath accomplished nothing. His second breath, which he thought was a lot stronger, accomplished nothing. Matt was doing an imitation of the big bad wolf on the last pig's house now, and with a huge outflow of air, he said he finally saw the snake's lungs slightly inflate and felt the pressure of the outgoing air on his face. The snake recovered, and Matt proclaimed that the primary finding from his studies in India will be that king cobras have really bad breath.

Well once again I feel as though I've cheated you into thinking that this is an accurate account of one of our speakers. Matt touched on cultural values surrounding the king cobra, the future of king cobras, the future of king cobra studies, the personalities of the people, the Western Ghats, the lay of the land, the weather in that part of India, the Indian bureaucracy, and mostly, king cobras, an 18-foot-long venomous snake that is reluctant to bite, has a very tough hide, has sexual color dimorphism, builds and guards a nest, occasionally eats other members of its own species, travels long distances, is very alert and aware, will charge a human in a bluff display, can rear to where it is eye to eye with a six-foot person, appears to approach monogamy in that it may guard the female it mates with, and consumes pit vipers like they're candy. To get all that info and entertainment you pay \$25 each year and have to show up at a meeting. Where else are you going to find that kind of bargain?

For those of you who do not get my occasional emails (email me if you want on the list), Illinois now has a few new protected animals. The smooth softshell turtle is now listed as endangered and the ornate box turtle and the mudpuppy are listed as threatened. These changes took effect October 30, 2009, and there will be a short grandfather period to apply for permits on animals now in your possession. You can download a permit application from the Illinois Endangered Species Protection Board site: http://www.dnr.state.il.us/esp/permit_ita_info.html. And the application forms will be on hand at the November meeting as well. Apply as soon as possible. In other changes that are taking effect, the Blanding's turtle has been elevated from threatened to endangered and the eastern ribbon snake has been down-listed from endangered to threatened.

We have shows going on nearly every weekend, from small demonstrations at nature centers to major displays in museums. One of our missions is to educate, and this is one way we approach that goal. Help out. Volunteer to bring an animal to one of these events. They're fun and you're helping your society. I know that many of you do these types of things on your own. If you want me to put the events in emails let me know the particulars and I'll publish who, what and when. That's it for this month. We hope to see you at a meeting!

I Smell... ADVENTURE!

by Y. Tom Rajan

Hands-on Herping Skills

In the small English village my wife is from, there was this jolly old village loony. He was an odd old man in one of those jungle safari adventure hats and deerhunter trousers who carried himself with a certain sense of Victorian pride. You'd see him at the bus stop or walking along the main road. Shoulders back, head up, spine straight as an arrow — poking his walking stick with purpose at each stride, as if he were setting the pace for a division of troops that followed behind.

He was the kind of guy it tickled you to look at and people would comment about. Must have been mad as a hatter, but he seemed pleasant enough and didn't stink of gin or anything like that.



One day over dinner conversation, my wife's brother Rob said that he had talked to the man. Rob stopped the car on his way to work to ask if he wanted a ride. He asked where the guy was heading, to which the man boldly replied, "Nairobi Hunt Club. But eh— the local train station will do fine, thanks."

It was long ago and I wasn't even there, but I can still hear the words played back in my head, in the stiffest and most deep throated English accent you can imagine. . . .

Nairobi. NAI-ROBI. NIY-ROW-BEE.

It is just such a manly word. So it has stuck in my head ever since as to what kind of place Nairobi must be. Man's country in deepest, darkest Africa.

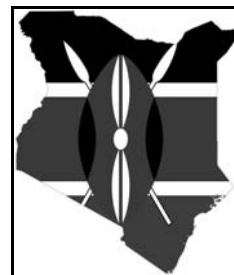
In April 2009 it was my son Ollie's turn for a big adventure. He's 10 years old and I'm taking him to Africa. NI-ROW-BEE! We're going black mamba hunting.



As a father, I love the fact that I can do fantastic, supernatural, and impossible things in the eyes of my kids. They see an

animal on TV that kills a beast 100 times its own size with one bite, spits venom to blind, and disappears down any hole. And I have the power to take them there to see it for real. So if you're a 10-year-old kid who loves snakes, what in the world could be cooler than going to Africa to hunt for elapids?

For the first leg of our trip we are staying at Bio-Ken snake farm on the East African coast. This place is part tourist attraction, part snake farm, and part venom research center. Started by James Ashe in 1980, it is a tiny island of science-fact in an ocean of wide-eyed African mythology. If you are unlucky enough to be bitten by a dangerous snake, then Kenya is much like many other humble places in the world. The people are panicky, resourceless, armed with a lot of dangerous misinformation, and many hours away from the nearest hospital. But Bio-Ken is a place of calm, measured, case study and effective treatment.



Several African governments recently mis-spent a fortune on Indian-produced antivenom that **does not work** on African snakes. They bought it against the protest, insistence, and advice of international experts. But, well—it was cheaper. So it's as if they got really cheap Ford repair parts . . . but nobody realized that they all drive GMs. I'm betting that they'll figure it out after 300 or 400 people die.

Bio-Ken maintains an antivenom trust, does education and seminars on snakebite for people from around the world, and provides free consultation to local snakebite victims when needed. It's hard for me to still think my job is very important in comparison, when I realize how many hundreds of lives these people must have saved over the years and how many thousands of cases they must have consulted on.

When I travel, I really like to support local causes. It's one way to make friends. What's more, I'd like my son to have a sense of responsibility in helping the world just a little bit. So we have brought along a full hockey bag filled with stuff from the USA to donate to Bio-Ken. Midwest Tongs was very generous in donating snake-handling equipment. We also brought things like spitting cobra goggles, anti-mite medication, and some home-made snake hooks with wide flat surfaces for heavy bodied vipers and pythons.

Sanda Ashe is the widow of Bio-Ken's founder and carries on his fine work today as director of the center. Corresponding via email before I even meet her, I find that **I love this lady**. She's tough as hell, yet kindhearted. She loves animals, but



turns super brutal when it is the right thing to do. During our visit she once told me that, “Being sentimental has no place in conservation.” English, but only having lived in Britain for about 8 years, she’s from the generation that was

there through Africa’s self-discovery and growing pains after colonization ended. From big cats to whip scorpions to tribal warfare, she’s full of stories about every living thing in Africa.

Before we left for our trip, I had talked to Sanda a few times about the supplies we would bring to donate. The first thing she asked for was some sort of forceps that have a cushioned nose and do not clamp down too hard. The Bio-Ken staff were using the existing sharp model of clamps to move around rats and in Sanda’s words they were, “. . . hurting the poor animals’ tails. They would squeak in pain when clamped too hard.”



The rats she was talking about were “feeders” for the snakes. The snakes are milked for venom. The venom is used in the production of antivenom, which saves thousands of lives each year.

These rats would be dangled into a cage on feeding day and die a horrible death within 30 seconds of a cobra strike. That part was necessary and inevitable. But until that time, she wanted the rats to have a happy life as best they could. She *hated* the unnecessary torture of even the smallest creature.

First impressions really do last, and for the rest of my life I will remember Sanda as someone who cared about *all* living things. What a kind soul.

One of the first things I was eager to do at Bio-Ken was to see a viper strike. Like using a microwave or driving in the snow, being close to venomous snakes can be a dangerous venture. I had already given Ollie 100 safety speeches about it. But to see it for himself was much more powerful than anything I could tell him or quote statistics about.

Vipers are a family of snakes known for their amazingly fast strike. Gaboon vipers (*Bitis gabonica*) may be the quickest of



all. Never mind their 2.5-in-long fangs and their stunning coloration, the way that their muscles work is just astounding. They can sit still in the same spot for weeks. Being cold-blooded, everything slows down and they don’t need food or water all that much. They just sit and wait. The ultimate lazy opportunist. Then one day a rat walks by. There is a very subtle expansion of ribs taking in air and then . . . BANG!! The strike is super-zoomy-lightning fast. They are kinda like a house plant that violently kills stuff once in a while.

Sanda pointed out that somebody should do a study of their muscles and blood flow. Humans can’t sit in the same position for more than a day or two without getting bed sores and losing muscle mass to atrophy. Yet these snakes can sit for weeks with no problem and then strike from a standing stop at speeds literally faster than the refresh rate of the human eyeball.

It is really hard to describe how fast it is. I have a standard demo I like to do with non-snake people, so that they get the idea. I say that I’ll show them how fast a snake strikes. I point my left shoulder towards their chest and hold up my right hand poised like a snake behind my right shoulder. I say to get ready because I’m going to strike and they have to react. I say a few more words to distract them and then mid-sentence: BANG—hit them with my *left* hand which is actually much closer to their body. It was a cheap shot and they never had a chance.

To see a snake strike in action is just like that. Several people I’ve talked to who have been bitten describe it almost as if they were offended by the whole thing. It makes you want to say, “Hey! That was not fair! I didn’t know we had started!” It’s not car-crash fast, where time slows down and you feel helpless watching it unfold. No, no—this is over before you have a chance to move, or think, or say, “Ok, I’m ready.” It is like you only witness it in the past tense.

You could probably avoid a bite by reading the snake’s mood, watching its behavior, and steering clear of the eyes / heat pits and so forth. But the only truly safe way to avoid a gaboon viper bite is to **never be within strike range in the first place.**

So when it was feeding time for the gaboons, Ollie got a front row seat. First, the snake was sitting in the corner of the cage. Then with a blur and a thud, it was dug into the side of the rat. Point made for Ollie. No safety speech needed after that.



I have video of a few snakes striking. It is really cool to watch. But Ollie needed to see this with his own eyes to really get the point. It is like a great epiphany moment where you suddenly understand. You no longer wonder how it works or what it’s really like.

There are many things like this in life. For example, there’s nothing like the first time you see the ocean. It doesn’t matter if

you are an Olympic swimmer or own a Ph.D. in marine biology or watch the Survivor TV show all your life . . . you really just have to see it and smell it, feel the sting in your eyes and get the sick taste of salty water in your mouth.

Travel is full of such moments. Our trip was no exception. Here are some of the things that we learned firsthand:

- **Spitting cobras don't hiss when they spit.** They just spit. To see it for real for the first time was very strange. I guess they always put in a sound effect on TV when you see it. And since people make a noise when they spit, you'd just assume that cobras do as well. But I have a camera and clothes doused with venom that prove I know otherwise. Maybe some species are different, but the large brown spitting cobra (*Naja ashei*) that we saw was absolutely silent when it spit.

- **Spitting cobras don't automatically spit.** It seemed to me that they are most eager to spit when they are lined up with a good eye shot. There's a trick where you can put two thumb-tacks in the bottom of your shoe. When you raise your foot in the snake's face it looks like eyes, and that gets them to spit. But they don't seem to spit for just no reason in any direction.

- **Spitting cobras can spit through a snake bag.** Good tip!!

- **The fangs of some rear-fanged colubrids are actually right below the eye.**

- **Hinged fangs of vipers.**

During a hike with our hosts from Bio-Ken we caught a wild puff adder (*Bitis arietans*). It was a great experience to see the camouflage and patience of this snake. They collected it for the snake farm and we examined the animal. As we walked on 10

min later Ollie commented about his "wow" moment that this was the first time he had actually seen viper fangs with the sheath, the back-up fangs growing nearby, the hinge action, etc.

- **Elapid fixed fang structure.** We also came along for a green mamba (*Dendroaspis angusticeps*) capture. I was really surprised by how large the fangs were. These are fixed fanged elapids, so I had always imagined fairly stumpy little fangs right at the front of the mouth like maybe skinny rice grains. But they are still curved and pretty long—just not hinged or nearly as long as vipers'.

- **Recurved teeth of pythons.** When I was talking about big constrictors a while ago, a non-herp friend made a comment to the effect of, "Well at least it doesn't hurt when they bite you." Oooh. No. The way I'd describe it is like being clamped hard by a very long-toothed hacksaw. Not a personal experience, thankfully.



- **Black mambas are hyper aware!** I'd guess the snake farm has about 60 black mambas (*Dendroaspis polylepis*) and 50 green mambas. They are kept behind the maintenance shed, in a long L-shaped arrangement of small-hole chicken wire cages. Two or three snakes per cage—green on one leg of the L and black on the other. We stood nearer the green mamba cages, about 20 yards from the black mamba cages. The greens were distracted and disinterested. One was stalking a chick, another was trying to climb. Most were just lying still at the bottom of the cage. I pointed this out to Ollie. Then I said, "Now look at the black mambas." Every single one of those snakes was pointed right at us, even the ones 40 yards away. Some were giving a threat display of flattened neck or open mouth. But every single one was looking us in the face. Wow—they say that they're smart and fast. It was spooky to realize that they were so tuned in and keenly aware of us.

- **Captive snakes are no match for wild ones.** Just like the family dog compared to a Montana wolf, they are very different animals. Handling a caged black mamba is nothing like pulling a fresh one out of a tree!

- **Local snakebite treatment is crazy.** A puff adder bite came in to the Bio-Ken center while we were there. The man was bitten on the finger and so his friend had immediately done him the "favor" of burning the flesh off with a piece of charcoal. He then went to a clinic where he was given an injection in each buttock. There is no record of what he was given, but it wasn't antivenom. None of these things are effective treatment and in fact seriously complicate how symptoms present. But in the end it was determined that it was a dry bite with no venom injected in the first place and no need for losing that finger. Crazy.

- **Snakebite is never an automatic death sentence.** It is very dangerous and a lot of people do die. But not always and not necessarily. It is very rare for someone to die in under 6 hours from a snakebite. For example, black mamba venom only attacks the nervous system controlling muscles. You eventually stop breathing and die. But since the common distribution of ventilators in modern times, people can actually "ride out" a bite. After several days in the hospital, the effects wear off and all goes right back to normal. The venom does not affect the heart, so as long as the machine keeps breathing for you, then you've got a good chance. There is a story of a whole village who did shifts one by one on a manual ventilator squeeze bag for 4 days of constant care, that kept a patient alive. The vil-lager pulled through just fine.

It can be really hard to remember things out of books. I must have seen a picture of a green mamba 500 times. But I still wasn't sure how to ID it out in the bush among the 15 other species of green African tree snakes. I had forgotten a key field guide at home and so this was really critical to us out on our own. But after seeing one in the wild *just once*, I will never again confuse it with another snake. Sanda told us about them. . . . Look for the "smile" where the upper lip is distinct



from the lower, making it look like a wide long smile. It also has a pretty heavy body for a tree snake, no black specks, coffin shaped head, and light-colored belly. Now I know it— 100% forever.

Green Tree Snake



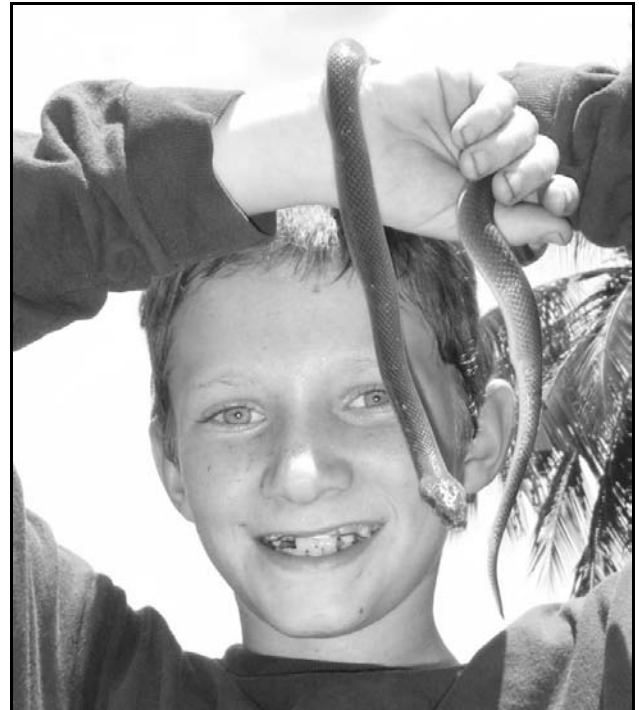
“Smiling” Green Mamba



Everybody should have some hobby or outside interest. For my son and me it is herpetology. A big part of this trip was to get some first-person herp hand skills and see things with our own eyes. I think people don’t do this enough. Go see and smell and touch the things that you’ve studied or seen on TV. Scrape together some time and money to go explore the real world.

I’ll never forget the first time I caught a legless lizard in South Carolina and realized the 50 obvious reasons why they are not classified as snakes. They are **lizards**—no doubt. Pulling a wild anaconda off a river bank in Brazil and examining its spurs made me realize how complex their evolution must have been in a way that reading never could.

Get out there! You'll find that 5 minutes with the animal is better than 50 hours in the library!



The author thanks Gracie Lynch for her first tier editing and creative input.

Tom lives in southeast Michigan with his wife and three children. He travels for work as well as for play, and chases snakes wherever possible in either case.

You can get more info on the Bio-Ken Snake Park and Research Centre at www.bio-ken.com. Make a donation, plan a snake safari, or just cruise their snake-filled web pages for fun. Please feel free to contact the author for more info at yTomRajan@hotmail.com. As he likes to say, “I Smell . . . ADVENTURE!”

Herpetology 2009

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.

SHELTER USE BY INDIGO SNAKES

N. L. Hyslop et al. [2009, Copeia 2009(3):458-464] note that the eastern indigo snake (*Drymarchon couperi*), a threatened species of the southeastern Coastal Plain of the United States, has experienced population declines because of extensive habitat loss and degradation across its range. In Georgia and northern Florida, the species is associated with longleaf pine habitats that support gopher tortoise (*Gopherus polyphemus*) populations, the burrows of which *D. couperi* uses for shelter. The extent that *D. couperi* uses these burrows, in addition to the use of other underground shelters and the microhabitat features associated with these structures is largely unknown. From 2003 through 2004, the authors conducted a radiotelemetry study of *D. couperi* ($n = 32$) to examine use of shelters and microhabitat in Georgia. They used repeated measures regression on a candidate set of models created from a priori hypotheses using principal component scores, derived from analysis of microhabitat data to examine microhabitat use at underground shelters. Proportion of locations recorded underground did not differ seasonally or between sexes. In winter, over 90% of underground locations were tortoise burrows. Use of these burrows was less pronounced in spring for males. Females used abandoned tortoise burrows more frequently than males year-round and used them on approximately 60% of their underground locations during spring. Microhabitat use at underground shelters was most influenced by season compared to sex, site, or body size. Females in spring and summer used more open microhabitat compared to males, potentially in response to gestation. These results suggest that the availability of suitable underground shelters, especially *G. polyphemus* burrows, may be a limiting factor in the northern range of *D. couperi*, with important implications for its conservation.

GROWTH OF PARADOX FROG TADPOLES

J. R. Downie et al. [2009, The Herpetological Journal 19(1): 11-19] note that the genus *Pseudis* is unique among anuran amphibians in that body growth occurs mostly or entirely in the larval phase, with huge tadpoles metamorphosing into adult-sized frogs. Tadpole growth rate, metamorphic duration and tadpole habitat were studied in the paradox frog *Pseudis paradoxo* in Trinidad, West Indies, in order to assess the factors which may have led to the evolution of this unique life history. Growth rate was shown to be similar to other tropical tadpoles: *Pseudis* simply continued to grow, rather than progress to metamorphosis. Metamorphic duration fitted well with a model based on tadpole size. Sexual dimorphism in tadpole size was apparent, with females larger than males at metamorphosis. *Pseudis* tadpoles initially possess highly cryptic patterning, which is lost as they grow larger. The costs and benefits of continued growth in the larval phase in a permanent tropical swamp habitat are discussed in terms of potential predators and food availability to both *Pseudis* larvae and adults.

AMERICAN CROCODILES ON TURNEFFE ATOLL

T. R. Rainwater and S. G. Platt [2009, The Herpetological Bulletin 107:3-11] report that surveys of the American crocodile (*Crocodylus acutus*) in Turneffe Atoll, Belize, over the last decade have suggested that populations remain stable but are increasingly threatened by habitat loss, particularly human development of critical nesting beaches. In May, June and July 2008 the authors used a combination of spotlight surveys and nest counts to evaluate the current status of *C. acutus* populations in Turneffe Atoll. A total of 23 *C. acutus* was observed along 46.6 km of survey route (0.49 crocodiles/km) during spotlight surveys in May, and 8 crocodiles were observed along 45.3 km of survey route (0.18 crocodiles/km) during late June–early July, yielding an overall 2008 encounter rate of 0.34 crocodiles/km. This encounter rate was significantly lower than that reported for surveys conducted in 2002. Two recently hatched nests, both on the same beach, were found during nest counts; no nests were found on other beaches known to have routinely yielded nests in the past. The number of nests found in this study is 4- to 10-fold lower than those reported from 1994 to 2004, suggesting a reduction in breeding females in the Turneffe Atoll crocodile population. Development of two important nesting beaches on Blackbird Cay since 2004 has likely rendered these habitats unsuitable for future nesting. The combination of low crocodile encounter rates, reduced nesting activity and human alteration of known nesting beaches observed in this study suggests a possible decline in the *C. acutus* population in Turneffe Atoll. Continued population assessments will be essential in monitoring the status of *C. acutus* in Turneffe Atoll, and immediate management and conservation efforts should be made to protect beaches on Blackbird, Calabash, and Northern Cays to provide critical nesting habitat for crocodiles.

EMERALD TREE BOAS SPLIT INTO TWO SPECIES

R. W. Henderson et al. [2009, Copeia 2009(3):572-582] note that the arboreal boa *Corallus caninus* is widely distributed across northern South America (the Guianas and Amazonia). The authors examined geographic variation based on examination of 192 specimens from throughout the range, and revised its taxonomy on the basis of quantitative and qualitative analyses of morphological characters (meristics, morphometrics, and color patterns). Based on the high number of lateral blotches on the body and the high number of scales across the snout, populations south of the Rio Amazonas and west of the Rio Negro are identified as a species (or, potentially, a species complex) separate from *C. caninus*, and the name *Corallus batesii* is resurrected for those populations. The distribution of *Corallus caninus* is restricted to the Guiana Shield (north of the Rio Amazonas and east of the Rio Negro).

EFFECTS OF FLUORESCENT TRACKING POWDER

S. A. Orlofske et al. [2009, *Copeia* 2009(3):623-627] note that fluorescent powder is gaining attention as an effective method for tracking terrestrial amphibian movements, particularly for species that are too small for conventional tracking equipment. The technique requires coating portions of an animal with fluorescent powder, releasing the animal, and following the trail of powder as it is progressively lost during movement. Recent studies have shown that fluorescent powder has no negative effects on survival or growth. However, a substance that coats the skin, a major respiratory organ in most amphibians, may have sublethal effects on performance and consequently behavior. The authors tested the effect of fluorescent powder application on the respiration of lungless red-backed salamanders, *Plethodon cinereus*, and lunged terrestrial red-spotted newts, *Notophthalmus viridescens*. In comparing species with contrasting skin textures and primary modes of respiration, expectations were to find *P. cinereus*, the species relying solely on cutaneous respiration, more sensitive to fluorescent powder. Standard metabolic rate and total oxygen consumption for both species were measured before and after application of the powder. No significant differences in respiration were found between control and powdered salamanders. Independent of treatment, SMR was 6 to 16% higher during the post-treatment trial in both species, and likewise, total oxygen consumed increased by 8 to 20% in *P. cinereus* and by 7 to 10% in *N. viridescens*. These results, in combination with other recent work, suggest that fluorescent powder is a safe technique for tracking amphibians.

REVERSIBLE MELANIZATION IN TURTLES

J. W. Rowe et al. [2009, *J. Herpetology* 43(3):402-408] note that some freshwater turtle species show substrate color-convergence of the dorsal integument, thus facilitating crypsis. Because turtles move among aquatic habitats with variable substrate colors, the authors tested whether melanization was reversible in juvenile midland painted turtles (*Chrysemys picta marginata*) and red-eared sliders (*Trachemys scripta elegans*). Individuals were reared as controls (on black or white substrates for 160 days) or as reversal treatments (on black or white substrates for 80 days and then reversed treatments from black to white or white to black). Mean intensity (a measure of total reflectance of the visual spectrum) of the third vertebral scute of the carapace (TVSC) and dorsal head skin (DHS) of black substrate control groups declined (turtles darkened) slightly in *C. p. marginata* but more so in *T. s. elegans*. In the white substrate control groups, mean intensity of TVSC and DHS increased (turtles lightened) substantially in both species. During the first 80 days in both species, intensity of the TVSC and DHS of black-white and white-black reversal groups largely paralleled the black and white substrate control groups, respectively. Following reversal of substrates in both species, mean TVSC and DHS intensities of the black-white and white-black reversal groups converged with the white and black substrate control groups, respectively. Reversal of TVSC and DHS melanization was complete, or nearly complete, by day 160. Therefore, it seems plausible that, in both species, reversible melanization could allow substrate color convergence in juveniles that experience different environments with variable substrate colors.

LAND USE EFFECTS ON FROG IMMUNE SYSTEMS

S. T. McMurry et al. [2009, *J. Herpetology* 43(3):421-430] note that at least 25,000 playa wetlands exist in the southern Great Plains, and most are embedded in cropland-dominated watersheds, resulting in sediment-induced alterations in hydrology and potential contamination from agricultural chemicals. These stressors have been hypothesized or shown experimentally to affect the development and function of the immune system of amphibians. The authors hypothesized an association between land use and immune function in playa amphibians. They compared body mass index (body mass/SVL), spleen mass index (spleen mass/SVL), and splenocyte count index (splenocyte count/SVL) in three developmental stages (tadpoles, metamorphs, juveniles) of *Spea bombifrons* and *Spea multiplicata* collected from playas embedded in either cropland or native grassland watersheds. Body mass indices of *S. bombifrons* and *S. multiplicata* tadpoles collected from grassland playas were 39% and 29% greater, respectively, than those from cropland playas. Similar responses were observed for spleen mass and cellularity in both species, as spleen mass indices and spleen cellularity indices of *S. bombifrons* tadpoles from grassland playas were 330% and 1,000% greater, respectively, than for tadpoles collected from cropland playas. Spleen mass and cellularity of *S. multiplicata* also were influenced by land use, but differences were smaller and more consistent across developmental stages. This is the first field study to link habitat alteration with altered immune system development in amphibians.

OCCURRENCE OF THE IDAHO GIANT SALAMANDER

A. J. Sepulveda and W. H. Lowe [2009, *J. Herpetology* 43(3):469-484] note that species distribution and abundance depend on a balance between local and landscape-scale processes. To successfully manage populations in regions with anthropogenic disturbances and habitat fragmentation, an understanding of processes at each of these spatial scales is important. A model selection approach was used to identify an effective spatial scale to manage the Idaho giant salamander, *Dicamptodon aterrimus*. Data from field surveys were used to compare support for local and landscape-scale models that explain *D. aterrimus* occurrence and density in 40 streams distributed throughout the Lochsa River basin, Idaho. Local-scale models included covariates that reflect patch quality. Landscape-scale models included variables that reflect predictions from metapopulation theory about the importance of patch size, connectivity, and fragmentation. Results suggest that landscape-scale processes are important controls on *D. aterrimus* occurrence and that this species has broad habitat requirements within streams. Specifically, the probability of *D. aterrimus* occurrence was highest in roadless drainages and lowest in spatially isolated streams and in drainages with high old-growth forest density. Surprisingly, *D. aterrimus* density was greatest in streams with a high proportion of embedded substrate and fine sediment. The positive association with embedded substrate may reflect adaptation to a high frequency of natural disturbances, such as landslides, in the study area. The authors suggest that management and conservation efforts for this species focus on protecting roadless areas and restoring stream connectivity in human-impacted areas, rather than on only improving habitat quality within streams.

SURVIVAL OF TOE-CLIPPED SALAMANDERS

M. A. McCarthy et al. [2009, *J. Herpetology* 43(3):394-401] note that toe clipping reduces the return rate of some wild amphibians, but effects of toe clipping on recapture rate and survival rate (the two components of return rate) have not been quantified for salamanders. Mark-recapture data for Jefferson salamanders (*Ambystoma jeffersonianum*) were analyzed to estimate these effects using eight different statistical models. These models allowed (1) the effect of removing each toe to remain constant or to increase proportionally with the number of toes removed; and (2) recapture rate and survival rate to remain constant or vary among years. The predicted effect on the return rate was similar for all eight models, with a reduction of about 15–20% when three toes were removed. The predicted effect on survival and recapture rates varied with the choice of model. The best-fitting models, as selected on the basis of the deviance information criterion, predicted a large effect on recapture rate (14–17% reduction when removing three toes) and a negligible effect on survival rate (0–2% reduction when removing three toes). Whether toe clipping reduced survival and recapture rates was unclear when the best models were selected on the basis of Bayesian P-values. The reduction in return rate was consistent with that previously observed for anurans. However, the analysis was not able to identify clearly whether the effect was caused by a reduction in survival, a reduction in recapture rate, or both.

PARASITE OUTBREAKS IN YELLOW-LEGGED FROGS

S. J. Kupferberg et al. [2009, *Copeia* 2009(3):529-537] present data supporting a link between periods of unusually warm summer water temperatures during 2006 and 2008 in a northern California river, outbreaks of the parasitic copepod *Lernaea cyprinacea*, and malformations in tadpoles and young of the year foothill yellow-legged frogs (*Rana boylei*). Relative to baseline data gathered since 1989, both 2006 and 2008 had significantly longer periods when daily mean water temperatures exceeded 20°C compared to years without copepod outbreaks. Infestation varied spatially in the watershed, as prevalence increased concomitantly with temperature along a 5.2 km longitudinal transect. At breeding sites of *R. boylei* with copepods in 2006, infestation ranged from 2.9% of individuals upstream to 58.3% downstream. In 2008, copepods were absent from the most upstream sites and infested up to 28.6% of individuals sampled at downstream locations. Copepods most frequently embedded near a hind limb or the cloaca. Among individuals with parasites in 2006, 26.5% had morphological abnormalities compared to 1.1% of un-infested individuals. In 2008 when the infestation peak occurred late in development (post Gosner stage 39), abnormalities were not associated with copepod infestation. In both years, recently metamorphosed frogs with copepods were, on average, slightly smaller than those not infested. These occurrences represent a sudden increase in local prevalence atypical for this river ecosystem. Previously the authors had only once seen copepods on amphibians (on non-native bullfrogs, *Rana catesbeiana*), six km further downstream. Pacific chorus frogs, *Pseudacris regilla*, which co-occur with *R. boylei* in shallow near shore habitats were not used as hosts. The data suggest that increasing summer water temperatures, decreased daily discharge, or both, promote outbreaks of this non-native

parasite on an indigenous host, and could present a threat to the long-term conservation of *R. boylei* under the flow regime scenarios predicted by climate change models.

LAKE ERIE WATERSNAKES AND INVASIVE GOBIES

P. C. Jones et al. [2009, *Copeia* 2009(3):437-445] report on potential impacts of a native predator, the Lake Erie watersnake (*Nerodia sipedon insularum*) on an invasive fish, the round goby (*Apollonia melanostomus*). Round gobies have increased exponentially in the Great Lakes and now constitute >90% of prey consumed by Lake Erie watersnakes. The authors investigated the effects this shift may have on round goby populations by estimating total prey consumption by Lake Erie watersnakes. Digestive rate trials and maximum voluntary prey consumption trials indicate that gastric digestion is rapid (digestion was 90% complete after just 16.4 hours at 30°C and 20.1 hours at 25°C) and voluntary prey consumption is high (from 30.0% of adult female body mass to 117% of neonate body mass in five days). Based on palpation of wild-caught snakes, prey were detected more frequently in adult females than adult males, but no such difference was observed in subadults. The proportion of snakes containing prey varied over time with season-long averages of 11.6% for adult females, 6.9% for adult males, and 22.4% for subadults. Systematic surveys by boat indicate that nearly 90% of foraging occurs <150 m from shore. Projected annual consumption, based on gastric digestion rate, maximum voluntary prey consumption, feeding frequency of free-ranging snakes, and published energetic data and a population size of 12,000 adult watersnakes, ranges from 200,000 to 3,300,000 round gobies (4,455–56,178 kg) per year. Although impressive, this rate of prey consumption is unlikely to have more than local effects on round goby populations.

SURVIVAL OF LEOPARD FROG TADPOLES

J. A. Sosa et al. [2009, *J. Herpetology* 43(3):460-468] note that tadpoles can generally increase their probability of survival in the presence of known predators by reducing their foraging activities or modifying their tail shape to increase swimming speed or lure attacks away from the head. However, it is unknown to what extent tadpoles can induce such behavioral and morphological plasticity in response to introduced predators. Lowland leopard frogs (*Rana yavapaiensis*) are native to Arizona and are currently declining because of a variety of factors including introduced predators such as the green sunfish (*Lepomis cyanellus*). The authors reared lowland leopard frog tadpoles in the presence of tadpole-fed green sunfish or in control tanks and tested whether lowland leopard frog tadpoles alter their behaviors or body shape in response to the visual and chemical cues of this predator. Tadpoles reared in the presence of green sunfish were 90% less active and had significantly different body shapes (including 5% deeper tail fins, 3% larger tail muscle height, and 3% smaller tail muscle area) than tadpoles reared in control tanks. In a subsequent survival experiment with sunfish predators, however, survival rates did not differ between the two groups of tadpoles. Results suggest that lowland leopard frog tadpoles perceive green sunfish as potential predators, but the induced morphological changes and the experience of prior exposure do not confer a survival advantage.

Unofficial Minutes of the CHS Board Meeting, October 16, 2009

The meeting was called to order at 7:40 P.M. at the Schaumburg Public Library. Board members Dan Bavirsha, Deb Krohn, Brad Trost and Jenny Vollman were absent.

John Archer took a few moments at the start of the meeting to thank everyone involved in working on the Midwest Herpetological Symposium, specifically Jason Hood, the Hoppenrath family and Deb Krohn.

Officers' Reports

Recording Secretary: Cindy Rampacek read the minutes of the September 18 board meeting and minor corrections were made.

Treasurer: Andy Malawy presented the financials and they were accepted with no questions. Tentative totals from the MHS are in and it appears we did manage to make a profit.

Membership Secretary: Mike Dloogatch informed the board that membership increased slightly and then proceeded to share the expiring memberships.

Publications Secretary: Aaron has added a note on how to use PayPal for multi-year renewals. He has completed the MHS page. Jason thanked him for the wonderful job he had done on the website. Mike suggested a PayPal option for things such as old *Bulletins*. Aaron explained an easier way to do it on a case by case basis.

Sergeant-at-arms: In Dan Bavirsha's absence it was reported that there were 48 people at the September meeting.

Committee Reports

Shows:

- Notebaert, November 1, needs a large snake.
- SEWERFest, November 1
- Snake Day, Milwaukee Public Museum, November 7.
- Emily Oaks Nature Center, November 15.
- Great Lakes Pet Expo, Saturday, February 6, 2010

Old Business

Postion Paper on Imports: Is this needed? Bring suggestions to the next board meeting if you are interested.

New Business

Eric Thiss has acquired a set of bound copies of the CHS *Bulletin* from the first issue to present. He will give us a chance to purchase them. It was suggested to see what amount he is looking at. Mike Dloogatch emailed Eric that we are interested, so we will wait until the price offer is made to move forward. Our only drawback is the fact that our storage space is limited.

Back Issues on CDs: Is there any interest to create and maintain these? Would it be better to keep them on CD for sale or offer free website as a digital library?

Library Staffer: We may have a person who will enter the library into a data base for us. A member from Wisconsin has volunteered. John will follow up.

Selling Stuff at Meetings: A past member wishes to start selling items at the CHS general meeting. Jason moved that we allow sales at the general meetings by CHS members only who wish to sell items limited to frozen rodents, live insects and dry goods. Cindy Rampacek seconded the motion. A lively discussion ensued. Cindy Rampacek, Aaron LaForge, Rick Hoppenrath, Andy Malawy and Jason Hood voted in favor. Mike Dloogatch voted against. Linda Malawy abstained. Rick Hoppenrath and Aaron LaForge will have rules drafted and in place for the October general meeting.

Grants for 2010: Grants committee is in place. Linda Malawy, Steve Sullivan, Amy Sullivan, Deb Krohn, Mike Dloogatch and Jason Hood will work on the committee. We decided to keep the same rules in place.

Speakers: Jason shared the list of potential speakers that he is passing on to the next VP.

Reimburse NARBC: Members who staffed the table at NARBC will be reimbursed if they were charged admission.

Logo: Aaron suggested getting a professional to redo the logo. We need a higher resolution digital version. Aaron has someone who can do it and so does Rick. Mike Dloogatch suggested that Don might do a complete new original which could then be scanned.

Round Table

Mike praised Dave Williams for his outstanding work as auctioneer, and thanked Andy Malawy and Ralf Ganswindt for handling the bookkeeping at the MHS Auction.

Jason thanked Sammy Cordova from TMB for name tag design; Printing Plus for doing wonderful job on the snake bags; Mary Hoppenrath and her mom for the bag sewing.

Jim Foster shared the Nominating Committee's slate with the group.

Dick Buchholz mentioned that he has arranged several donations as well as several possible vendors for 'Fest.

Nick D'Andrea shared that Ghann's gave several donations.

Respectfully submitted by recording secretary Cindy Rampacek



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For sale: Rats—live or frozen. I breed rats for my collection of boas so only top quality lab chow and care will do, I'm now offering surplus animals for sale. Located in far south suburbs of Chicago. Only orders of 20 or more please, no large rats will be available. For current availability and prices, please e-mail Steve at smuys@sbcglobal.net.

For sale: books. All books in excellent condition unless otherwise indicated. Gilbert Whitley, C. F. Brodie, M. K. Morcombe and J. R. Kinghorn, *Animals of the World—Australia*, 1968, 125 pp., over 160 photos, 50 in color, natural history of birds, mammals, reptiles (26 pp.) and fishes, small slit in DJ, (h), \$12; Marie Appleton and Wayne Miles, *Australia's Northern Territory*, 1988, 154 pp., over 200 outstanding color photos of landscapes, flora and fauna including some herps such as crocs and full-page and double page photos of frill-necked lizards, DJ, (h), \$16; Michael Bright, *Hunters of the Wild*, 1993, 192 pp., 200 superb color photos, DJ, hunting strategies of many animals including herps, a most interesting book, (h), \$12; Mohamed Amin, Duncan Willetts and Brian Tetley, *The Beautiful Animals of Kenya*, 1989, 128 pp., 80 excellent color photos, published in Kenya; (s), \$10. Books make good holiday presents. All books in excellent condition except as noted. Orders for \$25 or more sent postpaid in the U.S.; \$3.00 postage and handling in the U.S. for orders under \$25. William R. Turner, 7395 S. Downing Circle W., Centennial, CO 80122; telephone (303) 795-5128; e-mail: toursbyturner@aol.com.

For sale: Trophy quality jungle carpet, diamond-jungle, and jaguar carpet pythons. Website: moreliapython.googlepages.com E-mail: junglejohn@tds.net

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UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, November 25, at the Peggy Notebaert Nature Museum, Cannon Drive and Fullerton Parkway, in Chicago. This meeting will include the annual election of officers and members-at-large of the CHS Board of Directors. And we'll have an interesting program as well. **Carl Koch**, a CHS member from Milwaukee, will be speaking about his amazing experiences with hog-nosed snakes in Wisconsin. In the last couple of years he has documented many natural history events. His observations on their nest building were featured in the February 2009 CHS *Bulletin*.

The December 30 meeting will be a holiday party. The CHS will provide soft drinks and snacks. If you would like to bring something edible to share with the group, you are invited to do so. If you would like to bring an animal to show off to the group, you are encouraged to do that as well. This will be a chance to socialize all evening and get to know your fellow members a little better.

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

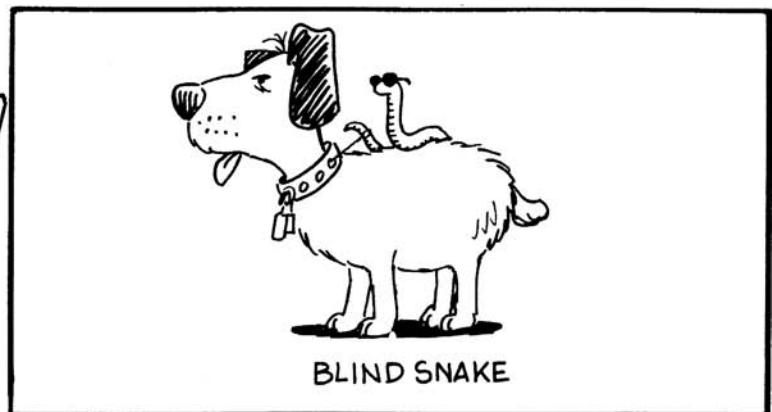
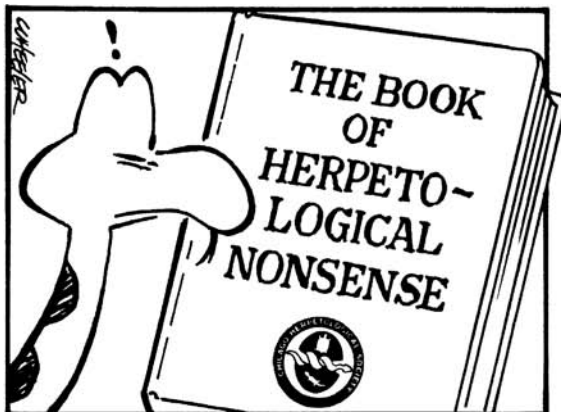
Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? If so, mark your calendar for the next board meeting, to be held at 7:30 P.M., December 18, in the adult meeting room on the second floor of the Schaumburg Township District Library, 130 S. Roselle Road, Schaumburg.

The Chicago Turtle Club

The monthly meetings of the Chicago Turtle Club are informal; questions, children and animals are welcome. Meetings normally take place at the North Park Village Nature Center, 5801 N. Pulaski, in Chicago. Parking is free. For more info visit the CTC website: <http://www.geocities.com/~chicagoturtle>.

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