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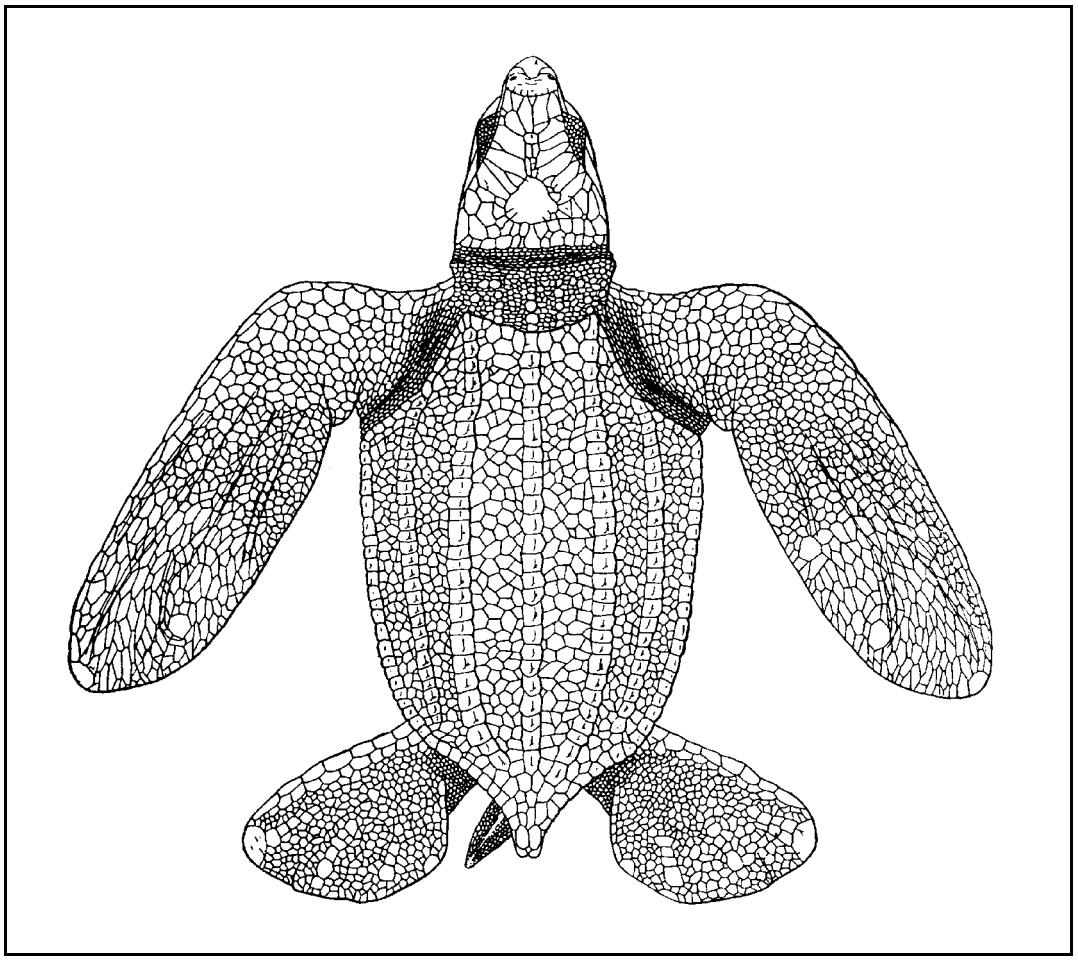

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Cover: Young leatherback sea turtle, *Dermochelys coriacea*. Drawing from "Herpetology of Japan and Adjacent Territory" by Leonhard Stejneger, 1907, United States National Museum Bulletin 58.

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Dietary Vitamin D_3 and UV-B Exposure Effects on Green Iguana Growth Rate: Is Full-spectrum Lighting Necessary?

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Abstract

The effects of dietary vitamin D_3 and exposure to ultraviolet light on growth of juvenile green iguanas (*Iguana iguana*) was investigated. Thirty-two iguanas (2–3 weeks old) were randomly assigned to one of four groups corresponding to four experimental testing protocols. The findings give a current perspective on the best vitamin D_3 acquisition method by green iguanas in a husbandry situation.

Green iguanas (*Iguana iguana*) are large, herbivorous, arboreal lizards indigenous to Central and South American tropical rainforests. Because of their unique, "exotic" nature and ubiquitous availability, iguanas are one of the most popular reptilian pets. Most iguana owners acquire their new pet when it is small, usually no more than 0.3 m (1 ft) in total length with most of that being tail. Unfortunately, most new iguana owners do not realize that their new exotic pet can reach lengths exceeding 1.8 m (6 ft). It is for this reason that green iguanas are now being called Giant Green Iguanas, a trend that began on the internet. Sadly, many iguana owners decide against keeping the iguana when it grows to adulthood. Animal shelters are full of iguanas; in fact, iguanas are the most common reptile up for adoption in programs such as that of the Chicago Herpetological Society. There are entire organizations dedicated to saving these reptiles such as the *Iguana iguana* Sanctuary, Inc., of Pennsylvania and the Northwest Green Iguana Rehabilitation Center in Oregon.

Numerous books and publications are dedicated to the care of green iguanas in captivity. Most of them discuss the role of ultraviolet (UV) or "full-spectrum" lighting in the health of iguanas. The term "full-spectrum" was coined by a light bulb manufacturer and implies a simulation of the spectral output of the sun. Within this full-spectrum light, it is the UV bandwidth that is necessary for the synthesis of vitamin D_3 in the skin of reptiles. Like mammals, reptiles manufacture vitamin D_3 in their skin (Holick, 1989). The UV stimulates a cutaneous vitamin D_3 precursor that goes through a series of biochemical reactions resulting in activated cholecalciferol or vitamin D_3. Vitamin D_3 is an essential part of calcium absorption. Therefore, without a source of vitamin D_3 calcium is not absorbed from the intestinal tract no matter how much calcium is present in the diet. This UV – vitamin D_3 link is the reason why vitamin D_3 is often called the "sunshine vitamin".

When an iguana is calcium or vitamin D_3 deficient, a condition known as Metabolic Bone Disease (MBD) develops (Boyer, 1996). MBD is actually a general term for a number of conditions relating to atrophy of bone tissue caused by either a deficiency in calcium itself or a deficiency in vitamin D_3 thus preventing calcium from being absorbed. The basis of MBD is the mobilization to the bloodstream of calcium from the bones, the largest reservoir of calcium in an animal's body (Boyer, 1996). Common manifestations of MBD in iguanas include nutritional secondary hyperparathyroidism (dietary-induced MBD), fibrous osteodystrophy (fibrous connective tissue replaces atrophied bone), and osteomalacia/rickets (failure of bone calcification and decrease in bone density) (Fowler, 1978; Boyer, 1996). MBD is one of the most commonly diagnosed health problems in iguanas (Wissman and Parsons, 1994; Allen et al., 1995; Mader, 1997).

Most iguana "care in captivity" publications discuss the requirement of "full-spectrum" lighting for the reptile's health. Although direct sunlight is always the best, in a husbandry situation this is not always possible, so iguana owners turn to the so-called full-spectrum fluorescent light bulbs available on the pet market. These bulbs are said to produce the UV that iguanas need for vitamin D_3 synthesis. Unfortunately, their efficacy of supporting vitamin D_3 synthesis has yet to be determined by scientifically-controlled animal studies. In addition, Gehrmann (1996) has examined a number of bulbs common on the pet market and has found that while they do produce UV, they have a peak output outside the known peak wavelength for vitamin D_3 synthesis.

While UV-induced vitamin D_3 synthesis is the natural source of vitamin D_3 for iguanas, diet-supplemented vitamin D_3 is absorbed into the bloodstream and thought to be assimilated and utilized in the same matter (Holick, 1989), although the metabolism of dietary forms of vitamin D_3 in reptiles is not fully understood. If exposure to natural sunlight is not an option for captive iguanas and artificial light sources produce only very small quantities of D_3-synthesizing UV at best, dietary sources of vitamin D_3 are the only other alternative.

Most of the aforementioned iguana "care in captivity" publications rarely if ever mention dietary forms of vitamin D_3 as a potentially important alternative to UV-induced vitamin D_3 synthesis. A two-part iguana study at the National Zoo in Washington, D.C. (Allen, 1988; Allen et al., 1989; Allen et al., 1995; Bernard et al., 1991; Bernard, 1995), concluded that either iguanas need extremely high doses of dietary vitamin D_3 or they cannot utilize it at all. This study is cited quite commonly in the iguana literature as evidence that iguanas cannot use dietary vitamin D_3 and therefore must have a source of UV

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for vitamin D_3 synthesis.

With over 4.8 million live green iguanas imported to the U.S. from 1991 to 2002 (no data for 1997) (USFWS, 1997, 2003) and with MBD cited as one of the largest threats to iguana health, understanding the metabolism of dietary vitamin D_3 and its role in green iguana health is crucial. The main objective of this study was to delineate the best vitamin D_3 acquisition method (dietary or UV-induced synthesis) in green iguanas by looking at rates of growth in juveniles. If direct sunlight is not possible in a husbandry situation, is the use of these expensive, scientifically unsubstantiated full-spectrum lights the only other option iguana owners have?

Materials and Methods

A sample of 32 juvenile (3–4 weeks old) green iguanas was obtained from Fluker Laboratories, Baton Rouge, Louisiana. The captive iguanas hatch under the sun in a multi-acre outside enclosure at Fluker's iguana farm in El Salvador. After about 10 days in El Salvador, the iguanas are shipped to Fluker's facilities in Louisiana where they are housed in an indoor enclosure for 2–3 weeks before shipment to customers. The iguanas are fed Fluker's Iguana Diet® supplemented with Fluker's Repta Vitamin® supplement during these first few weeks of their lives. Fluker's Repta-Sun® artificial lights are provided for the iguanas as well as a spotlight for heat while they are in the indoor enclosure at the Louisiana facilities.

Iguanas were randomly assigned to one of four treatment groups using a 2 × 2 factorial research design. The treatment groups were as follows:

Group 1: UV light, dietary vitamin D_3
Group 2: UV light, no dietary vitamin D_3
Group 3: Fluorescent light, no dietary vitamin D_3
Group 4: Fluorescent light, dietary vitamin D_3

Each animal was assigned an individual number, and claws were so-marked with nail polish. Philips F40UVB® (TL40W/12/RS) bulbs (Philips Lighting Co., Somerset, New Jersey) provided the UV light and Philips Econ-o-watt Cool-White® F40CW/RS/EW-II bulbs provided the fluorescent (FL) light.

Four modular housing units were built to accommodate 8 separately-housed iguanas each (Figure 1). Each individual iguana cage measured 60.96 cm wide × 60.96 cm high × 60.96 cm long. The 121.9 cm (4 ft) UV or FL bulb (depending on group) extended down the middle of each unit giving each iguana cage access to the light via the inside corner. Window glass covered this inside corner in the FL groups and 1.27 cm (½ in) galvanized hardware cloth covered the inside corner in the UV groups. Window glass was used in the FL groups because glass would filter out any tiny amounts of UV that might irradiate from the FL bulbs, and the hardware cloth was used in the UV groups to allow for maximum flux of the UV light into the cages while preventing the escape of the iguanas. Each cage was carpeted with green indoor/outdoor carpeting and was equipped with a carpeted ramp that extended from midway up the back wall, across the inside corner, and ended on the floor.

The UV or FL light was turned on for 15 minutes per day

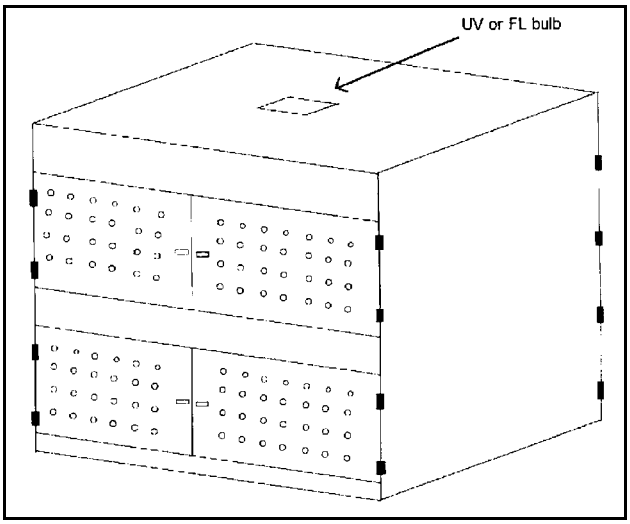

Figure 1. A modular housing unit containing eight iguana cages. Only four cages are showing; the other four face the back. A hole extending down the center accommodates either the UV or FL bulb.

(2 min at noon, 3 min at 1 P.M., 2 min at 2 P.M. etc. for six periods), 5 days a week. Each cage was heated by a 100-watt Pearlco® ceramic heating element (RAM Network, Encino, California) and was kept at ~30°C during the day and ~24°C at night using thermostats. A 12 hr light/12 hr dark photoperiod was set up using 40-watt G.E. SoftWhite® 40A/W (General Electric Co., Cleveland, Ohio) incandescent bulbs.

The 6-month study was conducted from June through December 1996. Iguanas were housed in a laboratory on Central Michigan University's Biological Station (CMUBS) located on Beaver Island, Michigan, from June through August. At the conclusion of the summer, the iguanas were moved to the main Central Michigan University (CMU) campus and housed in a biology laboratory for the remainder of the study period. At no time, from the arrival of the iguanas from Louisiana in June until the conclusion of the study in December, were the iguanas exposed to sunlight. Overhead (room) lighting in the CMUBS lab came from 150-watt G.E.® incandescent bulbs, while overhead lighting in the CMU biology lab came from Philips Econ-o-watt Cool-White® F40CW/RS/EW-II fluorescent bulbs.

Ultraviolet output of the Philips UV bulbs was measured at the beginning of the study in June and at the conclusion of the study in December using a Spectroline® DM-300X digital radiometer (Spectronics Corp., Westbury, New York) sensitive to a 280 – 320 nm bandwidth with peak sensitivity at 300 nm. The irradiance of the Philips bulb was found to be 50 microwatts per cm^2 ($\mu W/cm^2$) at 30 cm below the bulb and 20 $\mu W/cm^2$ at 61 cm below the bulb. As a comparison, the Sylvania 2096 UV bulb used in Allen and Bernard's work was found to have an irradiance of 50.9 $\mu W/cm^2$ at 61 cm below the bulb (Bernard, 1995) and all of the full-spectrum bulbs Gehrmann (1996) analyzed had an irradiance of less than 10 $\mu W/cm^2$ at 30 cm below the bulb. It was also confirmed that the window glass-filtered fluorescent lights (of the FL light groups) and overhead G.E. incandescent bulbs emitted no detectable amounts of UV.

Fresh water was available ad libitum in a large bowl, and all iguanas were misted with water regularly to maintain a humid environment. Diet was an essential part of this study and consisted of a "salad-type" diet using nutritionally balanced fruits and vegetables. Iguanas were fed daily for most of the study period but occasionally time restraints required the skipping of a day. The diet for any particular day was picked based on protein content and calcium phosphorus (Ca:P) ratios. A calcium phosphorus ratio of 2:1 is the ideal ratio for the nutritional requirements of green iguanas (Burgmann et al., 1993; Boyer, 1996; Mader, 1997). Calcium-rich leafy greens (e.g., collard greens, mustard greens, kale, turnip greens) made up at least 50% of each daily diet. At every feeding time, each food item was weighed out separately on an electronic balance to ensure that each iguana was given the same amount of each food item. The mean total amount of food (as fed basis) offered to the iguanas each day ranged from 8 g in June to 25 g in December in accordance to their growth. The cages were cleaned and vacuumed as needed.

The dietary vitamin D_3 was provided by Rep-Cal™ multivitamin supplements (Rep-Cal Research Labs, Los Gatos, California). This vitamin supplement is a two-part supplement consisting of Herptivite™ containing numerous vitamins, amino acids and minerals, and Calcium with Vitamin D_3™ containing only calcium and vitamin D_3. These two parts are mixed in equal proportions when used. A special lot of Calcium with Vitamin D_3™ was ordered that was free of vitamin D_3. The vitamin supplement was also weighed out daily on an electronic balance for each iguana and lightly dusted on top of the food. A mean of 1245 I.U. vitamin D_3 per kg of diet (as fed basis) was given over the entire study period. Because plants do not naturally contain vitamin D_3 (Norman, 1979), the only vitamin D_3 the iguanas received was from the supplement.

Both versions of the Rep-Cal Calcium with Vitamin D_3™ supplement were analyzed by Dr. James Ball of Ford Motor Company, Dearborn, Michigan, using gas chromatograph/mass spectrograph (GC/MS) and high performance liquid chromatography (HPLC) techniques. The vitamin D_3 supplement was found to contain 671 I.U. vitamin D_3 per gram of supplement and the vitamin D_3-free supplement was found to be free of any vitamin D_3.

Initially and every two weeks throughout the study, five growth parameters were measured and general health and behavior were noted. The five growth parameters measured were mass, snout-to-vent length, vent-to-tail tip length, head width, and base-of-tail width. Mass was determined by placing each iguana into a large plastic container on an electronic balance. Snout-to-vent and vent-to-tail tip lengths were both determined by carefully placing each iguana adjacent to a meter stick taped to a countertop. Head width was determined by carefully measuring the width of the head between the eye sockets (the widest part of the head) using vernier calipers. Base-of-tail width was determined by measuring the width of the tail just posterior to the pelvic girdle using vernier calipers. At select times throughout the study, all iguanas were photographed to illustrate general morphological changes.

Although five growth parameters were measured during the study, only mass and snout-to-vent length were analyzed because these two factors give the best indication of overall growth. Mass and snout-to-vent length were analyzed by linear regression analysis with the regression coefficients (slope of the regression line = rate of growth) being analyzed with a one-way ANOVA with Tukey's multiple comparison.

Results

The Philips F40UVB® bulb used in this study was chosen because of its high UV output. To my knowledge, this bulb has never been used in a study involving green iguanas, although a very similar bulb has been used in a panther chameleon (*Chamaeleo pardalis*) study (Ferguson et al., 1996). Because of the Philips F40UVB bulb's lack of use in reptilian husbandry and because little is known about the quantity of ultraviolet light needed by reptiles, UV exposure times and distances could only be inferred. Using the Ferguson et al. (1996) study as a base, the cages were designed so that the iguanas could be as close as 10.16 cm to the UV/FL bulb or as far away as 71.12 cm. An exposure time of 1 hour per day (10 min at noon, 10 min at 1 P.M., etc. for six periods) was initially used.

After about a week into the study, a darkening of the iguanas' skin pigmentation in groups 1 and 2 (UV groups) was observed. Consequently, these two groups were watched closely for signs of overexposure to ultraviolet radiation. Two weeks after the beginning of the study, a very lethargic iguana from group 1 died. Although no further signs of overexposure to UV were evident (other than dark skin pigmentation), the UV/FL exposure times were decreased from 1 hr to ½ hr per day (5 min at noon, 5 min at 1 P.M., etc.). Unfortunately, over the next week-and-a-half, two additional iguanas from group 1 and one iguana from group 2 had died, all very lethargic before death.

During the first week of July, the iguanas from groups 1 and 2 were observed to sit motionless with their eyes closed during the day indicating possible eye irritation caused by the UV. On 10 July, one additional iguana from group 1 had died with the same symptoms as the other four. After consultation with an authority on UV lighting (Gehrmann, pers. com.), the UV/FL exposure times were decreased to that listed previously in the Materials and Methods section of this manuscript (from 30 to 15 min per day). The UV/FL exposure times remained at this level throughout the remainder of the study.

The death of these five iguanas was most likely due to overexposure to ultraviolet light. No signs of MBD were observed in any of these iguanas at any time. As to why four iguanas from group 1 died but only one iguana from group 2 can only be speculated, but one possible explanation is that group 1 iguanas also received dietary vitamin D_3 supplementation suggesting possible vitamin D_3 toxicity in this group brought about by high amounts of UV light in addition to the vitamin D_3 supplement. Necropsies of these iguanas were not performed.

The results reported here are based on the remaining sample sizes for the four groups: Group 1: n = 4, Group 2: n = 7,

Group 3: n = 8, and Group 4: n = 8.

As mentioned previously, only mass and snout-to-vent length (SVL) were analyzed because these two factors give the best indication of overall growth. Figure 2 shows a growth curve for mass of the four groups over the entire study period. Each time growth data were taken (every two weeks), mass values for each iguana were averaged to give one value per group. Figure 3 shows a growth curve for SVL of the four groups over the entire study period. Again, each time growth data were taken, SVL values for each iguana were averaged to give one value per group.

Linear regression analysis was performed on the mass and SVL growth curves for each iguana and the results averaged per group. Regression coefficients (slopes of the regression line, equal to the rate of growth) for both mass and SVL were analyzed with a one-way ANOVA with Tukey's multiple comparison. Results of the analysis of mass regression coefficients (Table 1) indicated a significant difference between group 1 (mean = .3946, SEM ±0.043) and group 3 (mean = .1470, SEM ±0.025) and between group 3 and group 4 (mean = .3796, SEM ±0.046). Results of the analysis of SVL regression coefficients (Table 2) indicated a significant difference between group 1 (mean = .0295, SEM ±0.003) and group 3 (mean = .0102, SEM ±0.002) and between group 3 and group 4 (mean = .0269, SEM ±0.003).

Discussion

Despite the death of five iguanas from groups 1 and 2 early on in the study, the most important comparison is between groups 3 (no UV, no D_3) and 4 (no UV, D_3) because this comparison directly addresses the question of the efficacy of dietary vitamin D_3 supplements in supporting the vitamin D_3 needs of green iguanas.

The growth curves for both mass and SVL (Figures 2 and 3 respectively), indicate groups 1, 2 and 4 grew throughout the study while group 3 did not. Interestingly, groups 1 and 4 (the groups receiving dietary vitamin D_3) grew the most. It appears that dietary vitamin D_3 elicited a growth advantage to groups 1 and 4 compared to that of groups 2 and 3. The significant differences between regression coefficients for groups 3 and 4 clearly indicates dietary vitamin D_3 utilization by group 4.

Unfortunately, scientifically-controlled research on the UV and vitamin D_3 requirements of the green iguana is greatly lacking. Thus far, the only extensive work in this area has been that of Allen and Bernard (Allen, 1988; Allen et al., 1989; Allen et al., 1995; Bernard, 1995; Bernard et al., 1991) who concluded that either green iguanas need extremely high levels of dietary vitamin D_3 (> 3000 I.U./kg diet) or that the iguanas cannot utilize dietary vitamin D_3 at all and therefore must rely on a source of UV light for synthesis. This conclusion would have a significant impact on iguana husbandry: The use of so-called full-spectrum light bulbs could dramatically increase with devastating consequences. First, it is commonly thought that if iguanas cannot use dietary vitamin D_3 from vitamin supplements, then there is no need to give the vitamin supplement to the iguanas. This is dangerous because the other vitamins and minerals found in the supplement (e.g., vitamin A, vitamin B, calcium) are needed by the iguana. Second, and

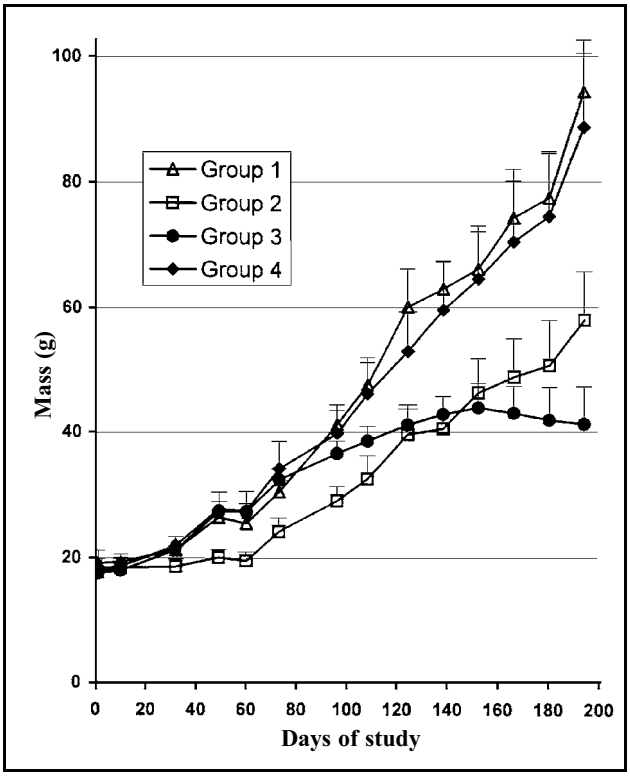

Figure 2. Growth curves for mean mass per group throughout the study. Sample sizes were: Group 1, n = 4; Group 2, n = 7; Group 3, n = 8; Group 4, n = 8. Error bars depict + 1 SE.

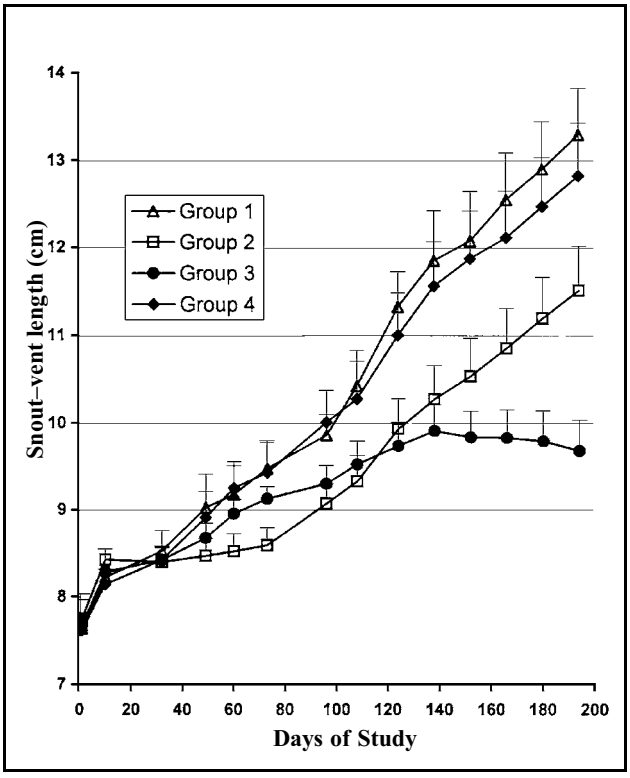

Figure 3. Growth curves for mean snout–vent length per group throughout the study. Sample sizes were: Group 1, n = 4; Group 2, n = 7; Group 3, n = 8; Group 4, n = 8. Error bars depict + 1 SE.

Table 1. Linear regression lines and slopes (= rates of growth) for mass of the four groups. Note groups with same letters indicate significant differences in slope values (one-way ANOVA, $F(3,23) = 3.129$, $p < 0.001$, with Tukey's multiple comparison).

	Regression line	Slope ± SEM (g/day)
Group 1[a]	mass = 8.41 + .3946 × days	.3946 ± 0.043
Group 2[c]	mass = 11.24 + .2210 × days	.2210 ± 0.041
Group 3[ab]	mass = 19.34 + .1470 × days	.1470 ± 0.025
Group 4[b]	mass = 10.65 + .3796 × days	.3796 ± 0.046

Table 1. Linear regression lines and slopes (= rates of growth) for SVL of the four groups. Note groups with same letters indicate significant differences in slope values (one-way ANOVA, $F(3,23) = 10.990$, $p < 0.001$, with Tukey's multiple comparison).

	Regression line	Slope ± SEM (g/day)
Group 1[a]	SVL = 7.53 + .0295 × days	.0295 ± 0.003
Group 2[c]	SVL = 7.63 + .0188 × days	.0188 ± 0.003
Group 3[ab]	SVL = 8.20 + .0102 × days	.0102 ± 0.002
Group 4[b]	SVL = 7.63 + .0269 × days	.0269 ± 0.003

most important to this study, it is thought that if vitamin D_3 can not be supplied via dietary supplements, then a "full spectrum" light bulb must be used to stimulate the synthesis of vitamin D_3. As previously stated, the problem with these "full spectrum" bulbs is that their output is questionable with regards to their support of vitamin D_3 synthesis.

The results of this study clearly indicate dietary vitamin D_3 utilization by green iguanas. Consistently throughout the study, groups 1 and 4 were found to be the healthiest groups. Although group 1 received both UV light and dietary vitamin D_3, group 4 received only dietary vitamin D_3 indicating clearly dietary vitamin D_3 utilization by group 4. As mentioned earlier, the most important group comparison is that between groups 3 (no UV, no D_3) and group 4 (no UV, dietary D_3). The significant differences between groups 3 and 4 clearly indicate that dietary vitamin D_3 supplementation is an effective option for vitamin D_3 acquisition in green iguanas, at least for the first six months of their life.

While an argument could be made about the short time period of this study (six months), this is the best time frame to do this kind of work because young, rapidly growing juvenile iguanas have one of the greatest demands for calcium in their lifetime during this period, hence the high potential for calcium deficiency problems (i.e., MBD) (Mader, 1997).

Is full spectrum lighting absolutely necessary for the husbandry of green iguanas? Since green iguanas are obligate herbivores and therefore do not receive dietary vitamin D_3 in the wild, UV-induced vitamin D_3 synthesis is the "natural" source of vitamin D_3 for iguanas and therefore the preferred acquisition method. Because of the potential for dietary vitamin D_3 toxicity, the use of a safe, proven effective light source would be the best acquisition method of vitamin D_3 in captivity. Unfortunately, an effective light source is not currently available. The present research indicates that until there is such a light source available to the general public that has been thoroughly tested in controlled scientific studies, dietary vitamin D_3 can and should be used as an effective vitamin D_3 source. Full-spectrum lighting is not a necessity.

Research results looking at other growth and development factors such as general morphology and radiographic anatomy, serum vitamin D_3 and calcium levels, and bone ash analyses will be published at a later date. Further research is greatly needed to test the effectiveness of the various so-called "full spectrum" light bulbs at vitamin D_3 synthesis. Research is also needed to delineate just how much vitamin D_3 is needed by green iguanas in captivity.

Acknowledgments

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Book Review: *Introduction to Horned Lizards of North America* by Wade C. Sherbrooke 2003. xiii + 171 pp. University of California Press. ISBN: 0-520-22827-8. Paperback $16.95*

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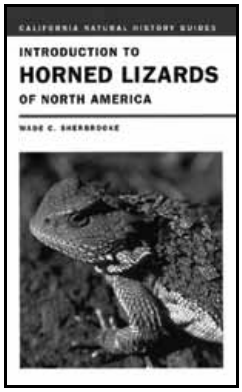

Lizards that squirt blood from their eyes? Toads with horns on them? Despite the taxonomic fallacy of the horned lizards being called "toads," the mystique of this unique group of lizards has long captured the interest and imagination of Southwesterners. These lizards are an established part of Southwestern culture and also serve an important role in the ecosystems they inhabit. Wade Sherbrooke has studied horned lizards since the 1970s, and has helped contribute to our knowledge of these lizards, and Southwestern natural history as a whole. Sherbrooke's latest contribution to horned lizard biology is the *Introduction to Horned Lizards of North America*. This pocket-sized and information-rich book provides a wealth of knowledge of horned lizard biology for its size. Published by University of California Press as one of a series of titles in the "California Natural History Guide," it represents the second edition of this book. The author's first edition, *Horned Lizards: Unique Reptiles of North America* (Sherbrooke, 1981) was published 23 years earlier by the Southwest Parks and Monuments Association. The latest edition is similar to the first in that it contains much of the original information, but has been richly expanded in information and decidedly downsized to a more convenient field guide.

The book's layout is typical of a field guide and includes a list of all horned lizard species with a darkened relief of head shapes on the inside and reverse covers of the book to aid in identification. Structurally, the binding is paperback, but flexible and plastic coated so as to withstand the rigors of field travel. At 7½ by 5 inches in size, it can fit into a large pocket or be carried easily in a day pack. In his preface the author describes the "evolution" of the second edition from the first edition, and his logic in the book layout and overall coverage. The acknowledgments follow the preface, and read like a who's who of Southwestern herpetology as related to horned lizard research. The most significant difference between the first and second editions is the coverage. Overall coverage of the horned lizards is greatly enhanced in the second edition. Although much smaller in overall size, the second edition is xiii + 178 pages in length, whereas the first edition was only 48 pages.

The introduction spans 24 pages, and provides a key for identification as well as a wealth of information to familiarize the reader with horned lizard origin and evolution, past and present distribution, and diversity of forms. The introduction is written at a level understandable by the layperson, but with enough depth to be of utility and interest to the professional herpetologist.

Following the introduction are the species accounts, which are broken along geopolitical lines into two main sections. The first covers the eight species of horned lizards found in the United States, Canada and Mexico. The second section covers the five species found only in Mexico. While the first edition stopped in its coverage at the U.S.–Mexico border, the second edition is comprehensive in its treatment of these lizards. Since horned lizards do not recognize geopolitical boundaries, equal coverage on all species gives the reader a more accurate depiction of their whole biology. Each account includes a section entitled "Identifying Characteristics," within which the author includes information on identification, etymology of the scientific name, history of the species, abbreviated biology of the species, distributional information, and present status/conservation needs of the species. A nice addition to the species accounts section ends with a short (4-page) section detailing the convergence between the moloch (*Moloch horridus*) and horned lizards in general. While the species accounts are well written, they are also fairly short, as expected for a field guide.

The last major section of the book text is "Natural History." This is further divided into four subsections: "Cycles and Activities," "Enemies and Defense," "Coming of Generations," and "Of Humans and Lizards." Each of these subsections is very well-written and informative. The text here is mostly descriptive, and comes both from the published literature and from the observations and findings of a lifetime of horned lizard work by the author himself. At 89 pages in length, the "Natural History" section makes up the bulk of the text, and the author's years of experience with these lizards is clearly shown.

Rounding out the book are the "Selected References," "Additional Captions," and an index. The references have been greatly expanded from the first edition, and acquaint the reader with the most recent and/or seminal literature on these lizards. The first edition contained relatively few references, and the author did well to take advantage of the additional information that has been produced on horned lizards since 1981 by including many more references. There were seven "Related Readings" in the first edition, compared to 91 "Selected References" in this edition. However, although there are

more references in the second edition than the first, the references are not cited in the text, thus the reader is left to sift through the selected references to determine which literature forms the basis for some of the information presented. "Additional Captions" provides information on the photos that have no figure caption (i.e., cover photo, flyleaf photo, etc.). This is a nice touch, and allows the reader a better understanding of the significance of each photo and its contribution to the book overall. The five-page index is printed in a small typeface, and is more than adequate for finding particular keywords or topics of interest within the already well-arranged book.

There are more photographs and figures in this second edition, and they are of good quality. Photographs include the lizards, their habitat, color and sexual variation, physiology, and many other topics that give the reader a much greater understanding for the topics considered. Many of the photos depict behaviors that are rarely seen in the wild, or at least not without a great deal of patience or luck. The author obviously spent a great deal of time capturing the representative photographs that relate directly to the topics covered in the text. Figures and their citations are of good quality but are poorly cited in the text, leaving the reader to search through the book to find the appropriate figure reference. Figure citations on pages 11 and 14, for example, send the reader flipping through the book, rather than sending them more directly to the page where the cited figures are shown. Additionally, a few of the author's statements caused me to consider their merit. Examples of this are on page 12 where the author states that "Certainly there were other species of which we have no record." This statement falls a little flat since it left me wondering how we could know we lost something that we have no evidence ever existed. Also, on page 13, the author claims that the range maps show the " . . . historical distribution of a species, including some areas from which it may have been extirpated." This seemed reasonable because there are several horned lizard species that have been extirpated from former parts of their range; however horned lizards are not evenly distributed throughout their "historical range," and the maps would more accurately be described as "circumscribed range maps."

Despite the few criticisms I have voiced for this book, I thoroughly enjoyed it. Reading about horned lizards served to both re-orient me to this group of lizards, and also to educate me with a stimulating "refresher course" of additional information on their habitats in general. The text was easily read and information covered more than simply horned lizards. The author knows Southwestern natural history well, and it shows. You emerge from the book with a greater understanding of the role horned lizards serve in their environment, and a deeper appreciation of their significance. As a final comment, this book also stands out among its peers in the California Natural History Guide Series. It is one of the better books in this series based on quality, content, and coverage. My compliments go out to the author, and anyone who seeks to use this book as a field reference while pursuing "horny toads."

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Bull. Chicago Herp. Soc. 39(8):152-155, 2004

HerPET-POURRI

by Ellin Beltz

Quote of the Month

Reporting on a story where a man attacked his girlfriend with an alligator: "Sober people just don't go after their special someones with a reptile, not even in trailer parks." [Jackson, Mississippi *Clarion-Ledger* August 1, 2004]

Ruling protects desert tortoise habitat

"A federal judge struck down permits issued by the Bush administration that allowed cattle grazing and off-road vehicles in a desert tortoise habitat in California, saying they violated the Endangered Species Act," according to the Associated Press, 8/4. The federal judge, ruling that critical habitat is intended to promote the recovery of endangered and threatened species, said "the Department of Interior hadn't done enough to protect the tortoise on 4.1 million acres set aside for its recovery in the California desert." Conservation organizations said the ruling was "very important" and "upheld the intent of the Endangered Species Act." "In order for the desert tortoise to recover from the brink of extinction, the recovery plan for the tortoise . . . must be fully implemented immediately, including its call for the complete elimination of livestock grazing and drastic reduction of off-road vehicle use on essential tortoise habitat," said Daniel Patterson, an ecologist with the Center for Biological Diversity. [*GREENLines*, August 5, 2004]

Salad toad-go

A 34-year-old woman found a two-inch-long toad in a takeout salad purchased at a Massachusetts McDonald's restaurant on June 16. The town health agent said the toad was shipped to a California-based company which processes McDonald's lettuce. [Eureka *Times-Standard*, July 2, 2004, from Ken Mierzwa]

Dr. Mike's Obit

"Vet followed lifelong love of animals. Dr. Michael J. Miller acquired his first pet when he was about 5 years old. It was a turtle named Pete with a damaged vocal cord that, according to family lore, allowed the animal to talk. . . . A long list of pets followed. Dr. Miller, 54, a veterinarian in the south suburbs for more than three decades and a former breeder of gecko lizards, died of a heart attack Monday, June 21, in his Palos

Hills home." As reported last month in the *Bulletin*, Dr. Miller was a past president of CHS, a recognized gecko expert and a pioneer at breeding them in captivity. [*Chicago Tribune*, June 25, 2004, from Ray Boldt]

Don't lick your kitten

"The Central District Health Department in Idaho reported that six cases of salmonellosis were reported and confirmed in January. Five of the six cases were linked to kittens that came from the Idaho Humane Society in December. The kittens have since been cleaned, and the cat holding area at the shelter has been disinfected." [*Veterinary Practice News* 16:4, April 2004, from S. L. Barten who wrote, "I bet we won't see any proposed legislation to ban the sale of kittens based on this!"]

Wish the pond was as clawed-less

African clawed frogs have taken up residence in a pond in San Francisco. "They are a threat," said David Wake, emeritus professor at UC Berkeley. Originally native to Kenya, clawed frogs can survive just about anything, freezing cold to nearly beachfront brackish water. They also eat just about anything, slurping insects, fish, lizards, frogs and sometimes even birds. Clawed frogs were outlawed as pets in California, but continue to be used in laboratories. The infestation in Golden Gate Park and further south may be due to researchers releasing animals. In a case of bureaucracy in action, workers were within hours of laying pipe to drain the pond to the sewers when they were stopped by budget issues in the California Department of Fish and Game. The department's invasive species coordinator said, "Some of the rehabilitation of the ponds has been slowed and this pond is not on the list." [Eureka *Times-Standard*, May 10, 2004, from Ken Mierzwa]

Not easy being gold-colored either

A distinctive, gold-colored giant frog, *Cardiglossa aureolia*, that hasn't been seen alive in the wild in 40 years was rediscovered in Sierra Leone. It is reported to live mostly in dry areas in rock cavities. Sierra Leone has suffered civil war and a series of military governments, although it was "considered a tourist paradise in the 1970s," according to *Africa Free Press*, July 20, 2004.

Hiss is a real problem

A washer repair man discovered his customer's problem was a dead snake in the machine. He found the pet, missing from a nearby house in Sheffield, when he pulled what looked like a wire. [*Daily Record*, Glasgow UK, July 19, 2004]

Lord Shiva Unpleased

"As a child, rituals can be very exciting. Nag Panchami, for example, was day of huge excitement. As an eight year old, there were two things I knew for sure—this was the day we made it a point to pray to Lord Shiva and this was the day we fed milk to the snakes. And that's how you knew how brave you were. The snakes would turn up everywhere—at traffic signals, street corners, bus stops, railway stations, in the market and even at your door. They would coil in round wicker baskets, slung around their owners' greasy necks or slither around on dirty pieces of colored cloths that doubled as temporary display grounds. The scariest part was when the snake—mostly a cobra—would suddenly, without warning, be thrust under my nose and I would run and hide behind Mummy while she gave the snake man a coin to go away. You also gave the snake owner money to ensure the snake drank some milk. If it did, it was supposed to mean that both the snake, and Lord Shiva, whose matted hair it adorned, was pleased. It was only many years later that I realized the poor snake was much more frightened of me that I was of it. That snakes are not, according to their natural diet, supposed to drink milk—that, in fact, they had probably been starved for days to make sure they did so. That cobras were prodded and hurt so that they would raise their hood. And that, in many terrible cases, their mouths had been sewn up so they wouldn't hurt or scare anyone. I don't think Lord Shiva will be pleased. Gayatri S., Mumbai" [Mumbai, India *ReDiff*, July 19, 2004]

Tortoise Heaven

"Giant Tortoises Bonnie and Clyde live in a £5,000 tortoise-house with underfloor heating and air-conditioning. Their proud mum is garden nursery owner . . . who lives . . . in Surrey. . . . [She] imported the tortoises from Mauritius 14 years ago at a cost of £2,500. . . ." The owner said they are quite costly to keep. In addition to the indoor enclosure, they have an outdoor run and a 52 × 10 foot greenhouse. The woman added, "When we first brought them into the country I was so scared of somebody stealing them, that I kept them in the dining room. I remember sitting down for Christmas lunch with turkey, trimmings, crackers and two giant tortoises walking around. I'll never forget the look on my mother-in-law's face." [*London Daily Mail*, June 15, 2004, from Bill Burnett's Aunt Peggy]

Not a single herp escaped

A 4.1 Richter earthquake woke many CHS members the night of June 28, 2004. "In Chicago and the surrounding suburbs, hundreds contacted the United States Geological Survey to say they had felt the quake, some reporting rumbling that lasted 15 seconds. . . . The quake resulted in little damage. . . . The last significant earthquake in the region was September 7, 1999, when a 3.5 magnitude temblor struck about 31 miles northwest of [this one]." A 4.6 struck LaSalle on June 27, 1881, almost exactly 123 years ago. In 1909 a 5.1 struck Aurora and in 1968 the largest recorded was a 5.2 which was felt in 22 other states besides Illinois. A 3.0 in 1985 and two 4.5 shocks in 1972 and 1912 round out the local earthquake history along the Sandwich Fault and LaSalle Anticline Zone. The *Chicago Tribune* interviewed several people who were scared, frightened, amazed and so on at the earthquake waves. Meanwhile, out here, we've had three 3-ish and a half dozen or so 2-ish quakes in the past week. Click on http://quake.usgs.gov/recenteqs/FaultMaps/124-40.htm for a neat map showing our area and follow the links backwards to where you live. [June 29, 2004, from Mrs. P. L. Beltz]

Kemp's ridleys like Texas

"The world's most endangered sea turtle has returned to nest on Texas beaches in record numbers this year, a hopeful sign for biologists watching the species come back from the brink of extinction. A total of 41 Kemp's ridley nests have been reported in Texas this year, breaking past the previous Texas

record of 38 nests in 2002. . . . In 1985, there were fewer than 350 nesting females reported, and this year that number is approaching 3,000. Hitting the 10,000 mark could downlist the turtles from endangered to threatened under the federal Endangered Species Act. . . . Importantly, the use of Turtle Excluder Devices (TEDs) by the commercial fleet is a major reason the Kemp's ridley and other sea turtle populations are rebounding, since the device allows turtles to escape shrimp trawls." [North Texas E-News, July 20, 2004]

It was a slow news day for sure
Mishawaka actually has news, but on June 29, 2004, the *South Bend Tribune* devoted a quarter page of its edition to a photo of rush hour traffic at a standstill while an officer chased a 12-inch snapping turtle across Indiana 933. [from Garrett M. Kazmierski who writes "It's been slim pickings lately."] On July 3, the same paper reported that a 5-foot-long boa constrictor was discovered after a 911 call reporting that a snake had been hit by a motorcycle. The snake wrangling deputy showed up and said the snake was too badly hurt to save.

Home on my range, thank you
Rattlesnakes relocated by National Park Service workers and USGS wildlife biologists had a larger home range and higher mortality rates than stay at homes, but surprisingly about half of the relocatees returned to their original home ranges. Researchers also found that most rattlesnakes den near or under trails and many snakes have summer ranges near visitor centers and park housing. This is due to higher small mammal and bird abundance around human habitation, so just removing snakes only opens that habitat to a new snake. Curiously, most snakes hanging out near visitor centers or housing were not seen by park workers; only the radio transmitters revealed their location. [*Oregon Herpetological Society Newsletter*, February 4, 2004]

Frog Joke of the Month
Q. What do you call a frog with ice cream?
A. A "Hop-sicle"
MaryBeth Trilling

How low can you go?
"Four people have been arrested and charged in last weekend's theft of exotic snakes and turtles. [The four] were . . . accused of stealing more than $21,000 worth of creatures and more than $3,000 in jewelry. The thieves stole hognose snakes, albino Burmese pythons, wood turtles and hatchling pancake turtles, authorities said. Authorities have recovered some exotic animals, but they are not sure if the creatures were the ones taken from the Lowcountry Reptile and Amphibian Expo in Ladson [South Carolina]. . . . [Two of the alleged thieves] also face charges of unlawful possession of a spotted turtle and unlawful possession of an American alligator skull. [*Beaufort Gazette*, July 28, 2004, from Wes von Papineäu]

Opportunistic feeding in pythons
This is a first. A motorist in upstate New York reported and police officers observed a 6-foot Burmese python in the middle of a road, chowing down on a dead woodchuck. WNBC, which ran this story on July 28, 2004, dryly reported that Burmese pythons are native to Southeast Asia, not New York freeways!

Ancient turtle uncovered
An *Archelon* fossil is being uncovered near Cooperstown, North Dakota. The first bone of this ancient giant sea turtle was the jaw, parts of a flipper have been excavated and more bones are expected over the rest of the summer. [*Grand Forks Herald*, July 24, 2004, from Allen Salzberg]

Finally on the list
California tiger salamanders were listed as threatened under the Endangered Species Act on July 26, 2004. The U.S. Fish and Wildlife Service announced that nearly 400,000 acres in 20 counties will be designated critical habitat. However, cattle ranchers are exempt; their stock ponds are prime salamander breeding habitat. [*GreenLines*, July 28, 2004, and background information from Brad Norman]

Giant turtles off Cape Cod
"Boaters off the coast of Massachusetts have discovered three endangered giant sea turtles since [in the past week] entangled in buoy lines and struggling to survive. . . ." New England Aquarium officials said the three turtles were found entangled last Thursday, Friday and Saturday. Two of the three animals were freed. Leatherback sea turtles, the largest living turtles, are listed as endangered. [*GreenLines*, August 3, 2004, Issue 2162] Details were provided by the *Boston Herald* [August 2, 2004]. Two of the tangled turtles were freed by boaters; the third one was left tangled when the sailboaters trying to help it had to leave due to rough water.

"Sex antics of UK tourists scare turtles to death . . . "
. . . reports the *London Observer* [August 1, 2004], and continues, "They have outlived dinosaurs, surviving 100 million years of climate change and catastrophic asteroid impacts. Yet Europe's largest refuge for the rare loggerhead turtle faces its gravest threat: the drunken British tourist. Record numbers of young UK holidaymakers are invading the nesting grounds of the endangered creatures on the Greek island of Zakynthos, where they are blamed for wreaking havoc among one of the turtle's last havens. Vast stretches of Laganas Beach have already been abandoned by turtles this summer as a record 200,000 Britons head to the lively resort nearby. . . . Each week thousands of Britons arrive on a flight path that sweeps directly above the loggerheads' nesting grounds, the airport being a 10-minute drive from where the turtles try to lay their eggs. However, protesters have forced the authorities to ban night flights throughout the nesting season from May to October. It is a rare concession, lament environmentalists, who point to a controversial decision by the Greek government to close a marine park that protected the nesting ground from intrusion. Laws safeguarding the species are being broken with impunity. . . . Where 24-hour wardens once protected vital nesting grounds, holidaymakers are free to storm the loggerhead's habitat. Cars and motorbikes have been reported careering by moonlight on the nesting areas, smashing soft eggs buried beneath the sand. Pregnant turtles, too petrified by the commotion to wade ashore at night, are being forced to lay their eggs in the sea, where they cannot hatch. Eggs that

are successfully laid face a fresh set of obstacles posed by mass tourism. Hatchlings expecting to be guided by moonlight to the sea are bewildered by the lights and neon-studded bars of the mile-long strip slicing through Laganas. Disorientated, the creatures crawl towards the lights and die in the sand. Volunteers, including several Britons, are attempting to patrol the nesting grounds but remain powerless to stop drunken tourists encroaching on eggs or diving into the sea, ensuring the notoriously nervous loggerheads are deterred from coming ashore. Last year more than 1,200 nests were recorded in Laganas Bay, around half what is thought to have been noted this year. Environmentalists now warn that the turtles could disappear from the area if tourism is not controlled. Underpinning the problem is the natural vulnerability of the species: as few as one in 1,000 hatchlings reaches maturity, while eggs may have to incubate on crowded beaches for up to 70 days."

Letter from India

"Dear Ellin, Our snake book is finally published and ready for sales. Do you think the Chicago Herpetological Society will do a small notice for us? Anything you can do to help will be much appreciated. Details below and in the website. Best, Janaki" The enclosure detailed the first comprehensive color guide to *The Snakes of India* by Romulus Whitaker and Ashok Captain. It has 262 color plates, 500 pages and a limited first edition. The books were printed in India and half the profits are targeted for local herpetological conservation. Order your copy at http://www.snakesofindia.com by clicking on the cute Indian bank paypal button. Or you can write Janaki Lenin/ Rom Whitaker, Draco Films and Books, P.O. Box 21, Chengalpattu 603001 India.

Enter the Brain Zone

A golf resort in Petaling Jaya, Malaysia, denied it was negligent when a suit was brought against the resort by a man who claimed it was the resort's fault that he was bitten by a crocodile while reclaiming his golf ball from the crocodile trap on Hole 7. The man said he did not see the "Beware of Crocodile" sign until after he was bitten and dragged. "The resort claimed that Hong had entered the `Drop Zone' area where the crocodiles were resting to pick his golf ball despite knowing the presence of the reptiles. It said the Drop Zone signboard had been put up to inform golfers to continue their game with a new ball if one enters or falls into the crocodiles' rest area," according to the July 23, 2004, Malaysia *Star*.

Only its length was amazing

"A 16-foot-long Burmese python was captured on a [Vero Beach, Florida] city street after a passing motorist spotted about three feet of it hanging over a curb and called police. The brown-and-yellow snake was wrestled into a body bag and taken to the home of Vero Beach Animal Control Officer . . . [who] said he has picked up dozens of loose Burmese pythons and boa constrictors over the years, but this was the biggest. The snake will likely be euthanized if its owner doesn't come forward, said . . . the Humane Society. "There is such overpopulation, no zoo wants them," she said. [Raleigh, North Carolina *News Observer*, July 23, 2004]

For sale by any other name

The Food and Drug Administration and Wisconsin Dells Police ordered five businesses owned by one company to stop giving away baby turtles, which is a violation of federal law. *Wisconsin Dells Events* (August 2, 2004) reported that "A free baby turtle was being given away with the purchase of a turtle kit that included items like a tank, food and hand sanitizer, according to the police report. . . . The FDA regulates the use of turtles to control communicable diseases. The Center for Disease Control estimates that 70,000 people in the United States get salmonella poisoning each year from contact with reptiles, including turtles, that carry the bacteria in their intestinal tracts. [The local police chief] said that, while the turtles are being given away, the stores are also selling merchandise, and the turtles are being used to `lure people in. To us, that's a form of doing business,' he said."

Tiny little candles and hot tubs?

"A batch of Wyoming toad tadpoles released into Albany County ponds marked the first time artificial fertilization has been used to help an endangered amphibian, according to researchers," and the Billings, Wyoming, *Gazette*. The article continues, "The Wyoming toad is the only toad that lives in the Laramie Basin, and the Laramie Basin is the only place that is home to the toad. The toad was listed as endangered in 1984 and was thought to have gone extinct in 1987. But more toads were found. By 2000, the total population of the toad was about 200 in a captive breeding program plus as few as 62 at reintroduction sites. More than 10,000 toads and tadpoles have been released in Albany County since 1995, but none had been born through artificial fertilization. In early July . . . [they] received a shipment of 1,700 tadpoles from the Memphis Zoo. The tadpoles were shipped in water-filled plastic bags pumped with oxygen inside a cooler inside a cardboard box. The flight took about eight hours and the toads were released on a ranch within 12 hours. . . . The fertilization technique helps maintain genetic diversity because eggs can be fertilized by up to seven different males. Why the toad is imperiled remains unclear. Many of the toads are infected with chytrid fungus, forming a layer on their skin that might prevent water from passing through. Some toads suffer from `short tongue syndrome,' making them unable to catch prey." The fertilization is done by injecting hormones into the parent frogs then catching the sperm and eggs for fertilization. [July 27, 2004]

Thanks to all my contributors this month and to Bradford Norman, Bill Burnett, Marty Marcus, Allen Rigerman, Garrett Kazmierski, Ray Boldt, Ms. G. E. Chow, and Lori King-Nava for all the stuff they've sent that I'm either saving for next month or just enjoyed reading. All the unsourced contributions above are from Wes von Papineäu. You can contribute too! Send me all the cute articles about herps that show up in the papers and magazines you read. Just clip the whole page - there's no need to trim, newspaper is incredibly cheap to mail. Fold and put in the biggest envelopes you feel comfortable using (less folding/unfolding) and mail to me: Ellin Beltz, POB 1125, Ferndale, CA 95536-1125.

Herpetology 2004

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.

EFFECTS OF ROADS ON SNAKE MOVEMENTS

R. Shine et al. [2004, Ecology and Society 9(1): 9. [online] URL: http://www.ecologyandsociety.org/vol9/iss1/art9] postulate that if animals avoid road surfaces or are unable to follow conspecific trails across such surfaces, previously continuous populations may be fragmented. The authors gathered data on the effects of a small (4-m wide) gravel road on the behavior and trail-following abilities of garter snakes (*Thamnophis sirtalis parietalis*) in Manitoba, central Canada. As expected, the road surface had less vegetation cover, a more open canopy and thus, higher incident radiation than did the surrounding grassland. Contrary to expectations, however, substrate temperatures were lower on the road than in its surrounds, because of the higher reflectivity of the road's surface. On a nearby asphalt road, substrate temperatures were relatively high on the road surface only in the evening, as surrounding areas cooled. Focal sampling showed that snakes avoided the gravel road, typically changing direction when they encountered it. If they crossed the road, they did so by the shortest possible route (straight across). Mate-searching male snakes were less able to follow substrate-deposited pheromonal trails left by females if those trails crossed a road than if the trails were entirely within the surrounding grassland. Thus, roads may significantly modify snake movement patterns, as well as the ability of males to locate reproductive females. This study provides the first detailed information on the effects of roads on snake behavior.

BOWSPRIT TORTOISE EGG PRODUCTION

M. D. Hofmeyra [2004, J. Herpetology 38(2):172-179], using ultrasonography, studied the reproductive cycle and egg production of *Chersina angulata* females maintained under natural climate conditions for 29 months. The tortoises initiated egg production in February (late summer) and were gravid through most of the year. A short nongravid period in January indicates a cyclic rather than continuous reproductive pattern. *Chersina angulata* females produced one egg at a time, and clutch frequency ranged from one to six per year. Annual fecundity was influenced by the date of reproductive onset and egg-retention time; early ovulation and a short retention time increased annual fecundity. Egg retention time was highly variable (23– 212 days) and correlated to ambient temperature (inversely) and rainfall (directly). Temperature had no direct effect on oviposition, but rainfall served as an important exogenous cue, perhaps facilitating nesting. Oviposition and ovulation were synchronized and females prepared a new egg immediately after oviposition. This reproductive pattern is highly unusual for chelonians in Mediterranean climates. This pattern might facilitate reproduction in the different environments over the range of *C. angulata*.

REPRODUCTION IN COOTERS AND SLIDERS IN FLORIDA

M. J. Arescoa [2004, J. Herpetology 38(2):249– 256] notes that the cooter, *Pseudemys floridana*, and the pond slider, *Trachemys scripta*, are two abundant freshwater turtles in the southeastern United States, but little is known of their reproductive ecology in northwestern Florida. He studied their nesting phenology and behavior, clutch size and frequency, rates of nest predation, and hatchling overwintering behavior during 2001– 2003 at Lake Jackson, Leon County, Florida. Both species nested from mid-April to mid-July with peaks in May (47% of *P. floridana* and 55% of *T. scripta* nests). All 43 nests of *P. floridana* had a central chamber and two side holes. Nest predation on both species was high and may have been caused by a combination of artificial habitats (road-side and drift fences). Mammalian predators and imported red fire ants (*Solenopsis invicta*) destroyed all or part of 99 nests (98%; *P. floridana*, N = 30; *T. scripta*, N = 69) found at drift fences. Raccoons (*Procyon lotor*) destroyed eggs in all three chambers in 24 of 26 nests of *P. floridana*. Mean clutch size for *P. floridana* was 12.4 eggs and female size and clutch size were positively related. Mean clutch size for *T. scripta* was 6.6 eggs. There was a weak positive relationship between female size and clutch size of *T. scripta*. Some hatchling *P. floridana* and *T. scripta* emerged from mid-July to early October in the year of oviposition, whereas others remained in nests for up to 10 months and emerged from February to May in the following year. A review of published literature reveals that some reproductive traits, such as nesting season, that vary geographically in *P. floridana* do not vary substantially among populations of *T. scripta*. Geographic variation in some reproductive characteristics of *P. floridana* is apparently the result of a gradient in temperature whereas others (e.g., unique behavioral traits) may be adaptations to past or present regional conditions.

ANOLE BEHAVIOR

A. V. Paterson and S. McMann [2004, J. Herpetology 38(2): 288– 291] note that animals in territorial neighborhoods often show differential behavior toward different classes of conspecifics. The authors tested whether males of the lizard *Anolis sagrei* outside of their territorial neighborhoods differed in visual display behavior when matched with neighbors versus with nonneighbors. They captured nine dyads of neighbors and nine dyads of nonneighbors, placed each dyad on an artificial habitat patch in the field, and then observed display behavior for one hour. Dyads of neighbors exhibited a smaller proportion of bobbing headbob displays than did dyads of nonneighbors. The direction of this display difference is consistent with the hypothesis that neighbors were treated less aggressively than nonneighbors.

Unofficial Minutes of the CHS Board Meeting, July 16, 2004

Lori King called the meeting to order at 7:42 P.M. Board members Brian Jones, Ed Rzewnicki and Jenny Vollman were absent.

Officers' Reports

Recording Secretary: Melanie Aspan read the minutes of the June 18 board meeting. Corrections were made and the minutes were accepted.

Treasurer: Jim Hoffman presented the June balance sheet and announced that all ReptileFest expenses have been submitted. Jim reported that the profit on the 2004 ReptileFest is down from the 2003 'Fest.

Vice-President: The Board was reminded that there would be no guest speaker at the August meeting. Instead the membership will vote on the Illinois State Reptile and State Amphibian.

Corresponding Secretary: Steve Spitzer has dispatched a thank-you note to Mark Bardoul who donated a Neodesha to our raffle.

Committee Reports

Shows: Lori King, on behalf of Jenny Vollman, presented the Board with an invoice for the 2005 Arlington Family Pet Show for $712.50. It was discussed that this is an increase in the rate paid for the same booth space in 2004. The issue was tabled until Jenny can report at the August Board Meeting on what negotiations took place and what, if any, special discounts are in effect for the CHS.

Monthly Raffle: Some of the items recently donated by ZooMed were included in the June raffle, which raised $156.

Library: Linda Malawy inquired whether the CHS library has a full set of CHS *Bulletin*s. Steve Sullivan replied that currently the library does not have a set of *Bulletin*s. Linda offered to donate a full set which she had acquired in an auction some years ago. Steve accepted and will bind the set with Library funds to make it more usable.

Adoptions: Linda Malawy announced a combined donation of $240 from the last two months of adoptions. Lori King asked Linda to identify any trends that she has noticed lately. Linda replied that requests to take into custody stray alligators are beginning to come in from other states. This raised concern about the cost that will be presented by this year's relocation efforts. It was decided that Bob Bavirsha should be invited to speak with the Board to give some idea of how many animals will need to make the trip.

General Meetings: Lori King reminded the Board that the Herp of the Month for the July general meeting is iguanids. Matt Campbell will present the Short Presentation on the six-lined racerunner.

Chicago Wilderness: Ron Humbert presented Jim Hoffman with a pre-addressed envelope for the donation to Chicago Wilderness.

Old Business

State Reptile/Amphibian: Ron Humbert reminded the Board that CHS members would be voting on both of these issues at the August general meeting. Ron also updated the top five finalists in each category for the Board. Reptilian finalists: common gartersnake, massasauga, eastern box turtle, painted turtle, and milksnake. Amphibian finalists: gray treefrog, eastern tiger salamander, American toad, western chorus frog, and spotted salamander.

New Business

ReptileFest Committee Chair: Lori King announced that Steve Sullivan has accepted the post for the 2005 ReptileFest. Steve scheduled the year's first Reptile Fest meeting for 7 P.M. on August 27, 2004, at the Humbert's home.

Dangerous Animals Act Comittee Chair: Lori King announced that Steve Barten is stepping down as chair and that Linda Malawy has volunteered to take over.

Round Table

Jim Hoffman inquired whether a Nominating Committee has been put together for this year's election. Lori King responded that this would be on the agenda at the next Board Meeting.

Lori King called attention to the slide show scheduled for 7 P.M. on August 12, 2004, at the North Park Village Nature Center. The slides will feature Shawnee National Forest, Illinois' only National Forest.

The meeting was adjourned at 9:38 P.M.

Respectfully submitted by Melanie Aspan, 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: Two 3' Neodesha cages with glass, brand new and unused, come with matching hide box and bowl, $90 each set. Chicago area only. Jim, (847) 534-4980, or jim@hoffmanz.com.

For sale: herp books. *Eyelids of Morning* by Graham and Beard, 1990, 260 oversize (9 × 12") pp., many color and b&w photos, interesting story of 3 years of research on Nile crocodiles in Kenya's Lake Rudolf, softbound, $23; *The Last of the Ruling Reptiles* by Wilfred T. Neil, 1971, Columbia University Press, 486 pp., 162 figs. (b&w photos, range maps), a comprehensive reference on crocodilians, hardbound, $98; *Natural History of the Hognose Snakes,* Heterodon platyrhinos *and* Heterodon nasicus, by Dwight Platt, 1969, pp. 225-420; 7 b&w plates, tables and figs., a University of Kansas monograph, softbound, $32. All books in excellent condition. Send E-mail address for complete list. Orders for $25 or more sent postpaid; $2.50 postage and handling for orders under $25. William R. Turner, 7395 S. Downing Circle West, Littleton, CO 80122, (303) 795-5128. E-mail: toursbyturner@aol.com.

For sale: 20" c.b. argus monitor, the prettiest of the monitor lizards, healthy, voracious feeder (crickets, pinkies), $225 or may consider best offer. Will deliver in Chicago area. Bill, (708) 799-6697.

For sale: c.b. '03 yellow anacondas, aggressive feeders, perfect health, about 2 ' long, $100 each; also c.b. '04 reticulated pythons; beautiful hatchlings already feeding on adult mice. These guys are tiger siblings and are available for $100/each as well. Personal checks, money orders and Paypal accepted. Out of state shipping available. If you have questions or would like to purchase an animal call Mark Petros, (847) 836-9426 or E-mail ballpython777@yahoo.com.

Herp Tours: Why pay more? Travel with the International Fauna Society, a 501 (c)3 not-for-profit organization, and experience the Costa Rican rainforest! Stay at the beautiful Esquinas Rainforest Lodge in the untouched herpetological paradise that is Piedras Blancas National Park. Meet new friends, relax in the naturally-filtered swimming pool or in the lush, fauna-filled tropical garden. Discounts for IFS and Chicago Herp Society members. For details, visit The International Fauna Society website at www.faunasociety.org or E-mail: info@faunasociety.org.

Herp tours: Adventure trips to **Madagascar**! Journey somewhere truly unique to seek and photograph nature on the world's least-studied mini-continent. For maximum herp fun and discovery, join Bill Love as we go where few people will ever venture in their lives. Let his experience assure a comfortable tour finding the most colorful and bizarre species on the planet! Get all the details at Blue Chameleon Ventures' comprehensive new website: < http://www.bluechameleon.org> , E-mail: bill@bluechameleon.org, or call (239) 728-2390.

Herp tours: Experience the Amazon! Road-ride in Costa Rica! See and photograph herps where they live, have fun doing it, make good friends and contacts, and best of all . . . **relax!** From wildlife tours to adventure travel, **GreenTracks, Inc.** offers the best trips led by internationally acclaimed herpers and naturalists. See our website < http://www.greentracks.com> or call (800) 9-MONKEY. E-mail: greentracks@frontier.net.

Pet Sitting: In-home care for all your pets' needs. Specializing in reptiles, amphibians, birds, fish, dogs, cats. . . . Very passionate in herpetology, experienced vet technician at an exotic animal hospital, aquarium technician for over 10 years. Great references available. Call Lisa Collins to book your special care requests, (847) 644-3681. [Northshore based]

Wanted: Female ball pythons, adults preferred but smaller animals also considered. I am a professional breeder specializing in ball pythons and I can assure you that your animal will be provided with excellent care and optimal living conditions. Mark Petros, (847) 836-9426; ballpython777@yahoo.com.

Wanted: big-headed turtles; mata mata turtles; Mexican giant mud turtles (*Staurotypus triporcatus*); exceptionally large common snappers (45 lbs. & up); large alligator snappers (over 90 lbs.); spectacled caiman from Trinidad, Tobago and Surinam; dwarf caiman; smooth-fronted caiman; albino turtles (except red-eared sliders). Walt Loose, (610) 926-6028, 9:00 A.M. – 1:00 P.M. or after 11:30 P.M. Eastern Time.

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.

News and Announcements

UPDATED WEB AREA FOR USFWS CHICAGO OFFICE

The United States Fish and Wildlife Service's Chicago Illinois Field Office was created by Congressional appropriation in 1991, and has since become established as a leader in local conservation issues. The Chicago Field Office recently launched an updated and expanded web area which replaces an older one-page web area that represented the office since the late 1990s. The new web area includes pages on all of the office's major program areas and regional functions, such as Education and Outreach, Endangered Species, Federal Projects and Permit Reviews, Environmental Contaminants, Habitat Restoration and Watershed Planning. The web site can be accessed at: http://midwest.fws.gov/chicago/ .

Announcing

ReptileFest 2005

April 2–3, 10:00 – 5:00
UIC PE Building, 901 W. Roosevelt Road
$5.00 2-12, $7.00 13 and up

ReptileFest 2005 will be here sooner than you know it!

ReptileFest began back in 1983 under the name HerPETological Weekend. In 2004 'Fest attracted 3,700 visitors, featured over two dozen businesses and non-profit organizations, and over 30 members and their animals. This success of ReptileFest is because of the dedication of Chicago Herpetological Society members like you. Last year it took a volunteer team of 60 Society members and friends to put on the show.

You can help to make ReptileFest 2005 the best 'Fest yet!

There are over 100 jobs that must be completed to make 'Fest run smoothly. Some require weeks of dedicated work, others take only a few hours. You don't need to own or display an animal at ReptileFest to help make 'Fest a success.

Some examples of the jobs that we need help with are:

Buying supplies
Providing muscle during setup
Staffing the doors during setup
Typing
Public speaking
Soliciting donations
Distributing flyers
Staffing CHS booths

There's a job for every member, old or young, new or experienced—and the success of 'Fest depends on all of us.

For more information:

Come to the kick-off meeting on August 27 at 7:00 P.M. at Ron and Dottie Humbert's home, 99 S. Lodge Lane, Lombard

Or call Steve Sullivan at (773) 755-5100, x2042

Or e-mail ChicagoReptileFest@gmail.com

Or watch the website www.ChicagoHerp.org for more meeting dates and announcements.

See you at ReptileFest 2005!

Announcing
the
FALL 2004 CHS ZOO TRIP
to the
National Mississippi River Museum & Aquarium

Saturday, October 2

Prepare to take an entertaining and informative journey on the Mighty Mississippi at the National Mississippi River Museum & Aquarium. Enjoy dynamic aquariums, historical exhibits and a stroll through the wetlands and boatyard. Visitors can get "up close and personal" with live critters, become barge pilots, and control locks and dams. Tour the steamboat William M. Black and watch as a boat is launched into the Mississippi River.

Woodward Wetlands (outdoor exhibit) is the place to explore the natural habitat of the Mississippi, with a boardwalk trail that takes you to natural and living history outposts. See turtles sunning on logs while herons perch nearby. Examine the natural flora of a Mississippi wetlands Meet and hear the stories of Native Americans, fur traders, fishers, clanimers, refuge managers and early pioneers.

The floating dock features houseboats, scientific vessels, and the traveling Audubon Ark. Among the friends you'll meet at the Aquarium are turtles (including spotted, Blanding's, Ouachita map, false map, albino map), cave salamanders, amphiumas and plethodons. Check out this unusual Museum/Aquarium at http://www.mississippirivermuseum.com/main.htm. [To view a short video of the Aquarium under construction, log onto www.mississippirivermuseum.com/MovieMed.RAM.] Over the past 25 years, the museum has successfully raised $54 million to establish and expand its Mississippi River Museum into the National Mississippi River Museum & Aquarium. The Museum & Aquarium is accredited by the American Association of Museums — a distinction held by only nine percent of American Museums — and was named an affiliate of the Smithsonian Institution in August 2002.

Trip Schedule:

7:00 A.M. **SHARP!**	Bus leaves the Peggy Notebaert Museum. Watch a film *en route*. Enjoy Fall colors along the Mississippi River.
11:00 A.M.	Herp hunting on Green Island
12:30 P.M.	Box lunch (or bring your own) **on the bus** *en route* to the Mississippi River Aquarium in Dubuque
1:15 P.M.	Guided tour of the Aquarium with Lee Jackson, Aquarium Director
5:00 P.M.	Dinner in Dubuque (not included in trip fee)
6:00 P.M.	Bus Leaves Dubuque
10:00 P.M.	Return to Peggy Notebaert

Cost: **$40,** includes box lunch, Aquarium admission and round-trip luxury transportation [**or** bring your own lunch and pay only $32]. Seats are limited. To register, contact Bob Herman at **773-667-4095** or email BobHerman@ameritech.net for a registration form. Your reservation is secure *only* when paid up!

UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, August 25, at the Peggy Notebaert Nature Museum, Cannon Drive and Fullerton Parkway, in Chicago. This meeting will be devoted to the upcoming effort to provide the state of Illinois with an official State Reptile and an official State Amphibian. **Ron Humbert** and **Mike Dloogatch** will speak about Illinois herpetofauna in general and provide detailed information about the top five candidate species in each category. Members present at the meeting will be asked to vote for their top choices.

The September 29 meeting will feature a slide program by renowned nature photographer **Karl Switak** on the wonders of South Africa's Kalahari Desert. This program will include scenes from Karl's latest trip to the Kalahari, last October, on which he was accompanied by Lori King and Mike Dloogatch.

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 17 board meeting, to be held at the North Park Village Administration Building, 5801 North Pulaski Road, Chicago. To get there take the Edens Expressway, I-94, and exit at Peterson eastbound. Go a mile east to Pulaski, turn right and go south to the first traffic light. Turn left at the light into the North Park Village complex. At the entrance is a stop sign and a guardhouse. When you come to a second stop sign, the administration building is the large building ahead and to your left. There is a free parking lot.

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.

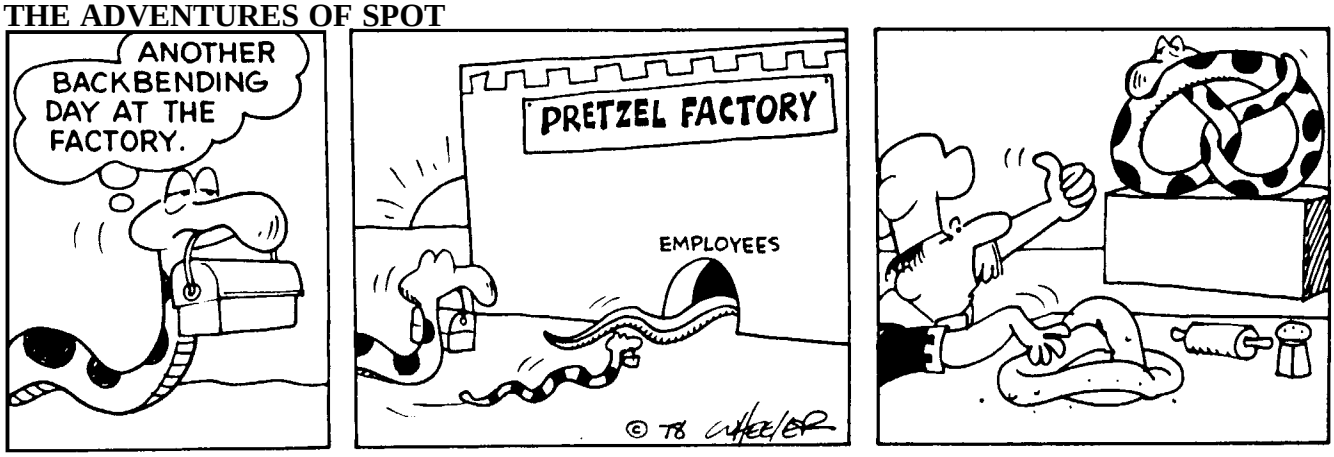
HERP OF THE MONTH

Each monthly meeting will showcase a different herp. CHS members are urged to bring one specimen of the "Herp of the Month" to be judged against the entries from other CHS members. Prizes will be awarded to the top three winners as follows: 1st place—6 raffle tickets at next meeting; 2nd place—4 raffle tickets at next meeting; 3rd place—2 raffle tickets at next meeting. The categories for the next two months are: August—neonates/baby herps; September—ratsnakes.

20TH ANNUAL MIDWEST HERPETOLOGICAL SYMPOSIUM, OCTOBER 15–17, ST. LOUIS

This year's Midwest Herpetological Symposium will be held October 15–17 in St. Louis, Missouri, and will be hosted by the St. Louis Herpetological Society. Events will take place at the Holiday Inn St. Louis Airport North, 4545 N. Lindbergh, Bridgeton MO 63044. Friday night will feature an icebreaker social followed by John Hollister speaking about herping in Texas and giving a herp ID quiz. Saturday all day long will see presentations by distinguished speakers. The Saturday evening banquet will also include a program by former Missouri State Herpetologist Tom Johnson. Sunday will include an auction and a captive-bred animal and dry goods sale (open to the public). The scheduled Saturday speakers and their topics are: Thomas Eimermacher, "Swimming with Cobras, Water Cobras in Lake Tanganyika"; Jonathan Losos, "Studies of Anole Habitat and Adaptation"; Jeff Briggler, "Hellbender Status in Missouri"; Chris Tabaka, "Asian Turtle Crises"; Karl Krumke, "The Husbandry and Breeding of Asian Rat Snakes"; Jay King, "Working with Chicken Frogs"; Richard Bartlett, "Herping the Midwest"; and Dr. Mark Manteufel, "Studying *Sceloporus* in Arizona." For registration information, contact Steve Brown, (636) 942-3131, or David Doyle, (636) 461-2818. Or visit the SLHS web site: www.stlherpsociety.org.

THE ADVENTURES OF SPOT



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