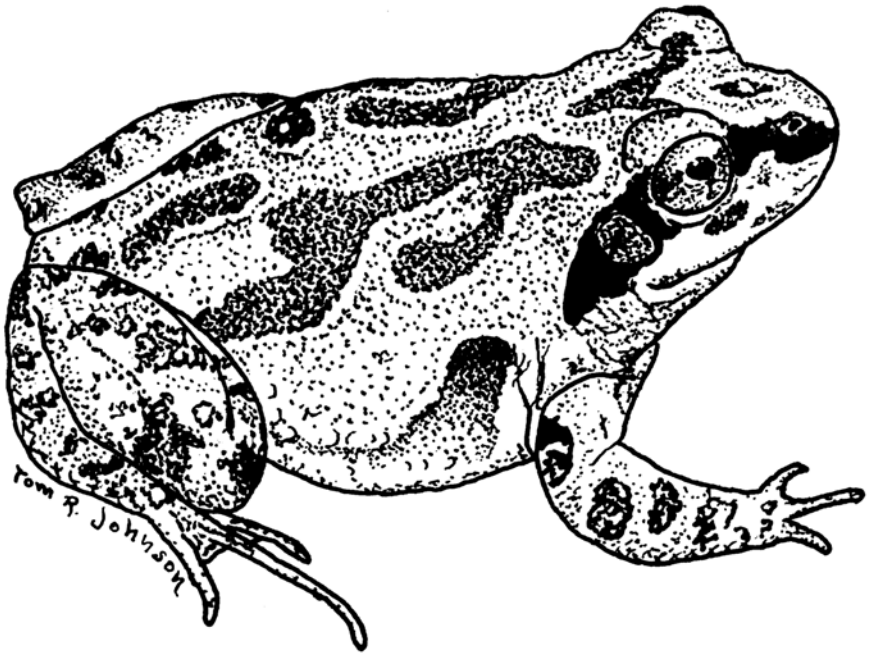
Missouri Herpetological Association



Newsletter

Number 16

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MISSOURI HERPETOLOGICAL ASSOCIATION NEWSLETTER NO. 16

Contents

Cover art: *Pseudacris streckeri illinoensis* by Tom Johnson. The Illinois Chorus Frog is found in seven counties in extreme southeast Missouri. Based on the limited distribution and loss of habitat it is listed as a species of conservation concern by the Missouri Department of Conservation.

INTRODUCTION

The Sixteenth Annual Meeting of the **Missouri Herpetological Association** was held 27-28 September 2003 at the Reis Biological Station in Crawford County, Missouri. This organization is designed to provide herpetologists in Missouri and surrounding states with an opportunity to meet and exchange ideas regarding current efforts in research and other professional activities. High on the list of priorities is to provide students, involved in research at either the graduate or undergraduate level, (1) the chance to interact with senior herpetologists, and (2) an outlet to present, in a semi-formal setting, the results of their labors.

This newsletter is the result of a decision made at the inaugural meeting to provide a means of publicly acknowledging papers presented at this and subsequent Annual Meetings. Further, the Newsletter will inform the herpetological community of new distribution records of Missouri's herpetofauna, additions to the bibliography dealing with the state herpetofauna and provide an outlet for the publication of short notes dealing with the natural history of Missouri amphibians and reptiles.

ANNOUNCEMENTS

17th Annual Meeting of the Missouri Herpetological Association

The 17th Annual Meeting of the **Missouri Herpetological Association** will be held on 25-26 September 2004 at the **Squaw Creek National Wildlife Refuge** near Mound City, Holt County, Missouri. A "call for papers" and registration materials will be sent in mid-July. For more information please contact **Jeff Briggler** at:

Missouri Department of Conservation
P.O.Box 180
Jefferson City, MO 65102-0180
(573) 751-4115
E-mail: briggj@mdc.mo.gov

Wanted

We still need artwork for future cover illustrations. Any species native to the state is acceptable; but, species described from Missouri type specimens are particularly desirable. They are: *Typhlotriton spelaeus*, *Eurycea longicauda melanopleura*, *Scincella lateralis*, *Nerodia fasciata confluens*, *Carphophis vermis*. Anyone wishing to contribute drawings for future issues can send submissions to **Richard Daniel** at:

Division of Biological Sciences
114 Lefevre Hall
University of Missouri
Columbia, MO 65211
E-mail: danielr@missouri.edu

MHA on the Net

The Association has an official site on the Internet. Point your browser to http://www.moherp.org to find copies of current and past publications (…/pubs/publications.htm). Also, be sure to establish and keep your information current in the member listing (…/org/member_contact_form.htm). Send ideas, suggestions, comments, and content to the Webmaster (webmaster@moherp.org).

Abstracts of Posters and Papers Presented at the 16th Annual Meeting of the Missouri Herpetological Association

Reis Biological Station
27-28 September 2003

TAIL AUTOTOMY IN SIX SPECIES OF *Amphisbaena* (AMPHISBAENIA, REPTILIA) FROM THE ANTILLES

Hugo Alamillo
Department of Biological Sciences, University of Missouri, Rolla, MO 65409

Relative to other groups of reptiles, little is known about the biology of the amphisbaenids, presumably because they are difficult to collect and encountered infrequently. Though many published works of C. Gans and others document some aspects of the biology of amphisbaenids, the caudal region has been studied superficially. This is surprising because tail autotomy structures in the amphisbaenids seem to be different from other squamates. Herein, I describe the morphology of the fracture plane involved in caudal autotomy in six amphisbaenids (*Amphisbaena caeca, A. fenestrata, A. gonavensis, A. manni, A. schmidti, A. xera*) cleared and double stained, radiographed and serial sectioned specimens to discribe the relationships between caudal vertebrae and associated muscles that are responsible for tail autotomy. Interspecific variation in the morphology of the plane is discussed.

COURTSHIP, MATING, AND PHEROMONE COMMUNICATION IN THE WATERSNAKE, *Nerodia sipedon*, IN THE WILD

Robert D. Aldridge and Angelo P. Bufalino
Department of Biology, St. Louis University, St. Louis, MO

The mating season in the northern watersnake (*Nerodia sipedon*) occurs in the spring concomitant with vitellogenesis. Mating occurs primarily in trees and bushes that overhang the water. Watersnakes access these basking/mating sites from the water, thus, the terrestrial trailing of a female, typical of most of the snakes studied, cannot occur. Field observations indicate that males systematically search for females from the water. We suggest that watersnake pheromones are heavy, volatile compounds that accumulate along the surface of the water and that males climb branches that are in the vicinity of pheromone concentrations. In field experiments, males are able to locate caged (hidden) attractive females that were placed in trees, over the water or on the shore next to water, without use of trails. On any given day, with appropriate temperatures, the majority of females are not attractive, indicating the females do not produce the attractant continuously during vitellogenesis. Our data suggest that less than 10 percent of the reproductive females are attractive on any one day. In addition to pheromones, males use other cues to locate females including systematic searching of bushes and movement towards moving snakes. Courtship may last from minutes to over one hour and most courtships occurring late in the mating season do not result in mating.

(POSTER) AMPHIBIAN POND SELECTION: AN INQUIRY BASED STUDY - I. INTRODUCTION

R. D. Aldridge[1], D. A. Kangas[2], and J. M. Jones[3].
[1]Department of Biology, St. Louis University, St. Louis, MO; [2]Science Division, Truman State University, Kirksville, MO 63501; [3]Department of Biology, Culver-Stockton College, Canton, MO 63435

The primary goal of this research is to determine if amphibians choose to lay eggs in ponds that have fewer competitors and predators than in adjacent ponds that have neither. Our initial hypothesis is that given a choice, amphibians will choose ponds that have fewer competitors and predators. In August 2002, we constructed 9 small ponds in a field along a tree line at Saint Louis University's Lay Center located in Pike County, Missouri. The ponds are 4 x 4 m and approximately 0.7 m deep and are lined with a rubber pond liner. The ponds received one of three treatments in a randomized order. Three of the ponds were stocked with 125 bullfrog tadpoles (*Rana catesbeiana*), three of the ponds were stocked with 25 goldfish (*Carassius auratus*), and three ponds served as controls. The ponds were stocked with tadpoles on 8 March 2003, and with goldfish on 23 March 2003. Several goldfish had died in the fish ponds so on 19 May 2003 we stocked the fish ponds with bluegill sunfish (*Lepomis macrochirus*). One goal of this research is to provide several Pike County high school biology classes with an inquiry-based learning opportunity. We provide the high school teachers and students with expertise of university professors to assist them with the design and implementation of research projects, and also, to provide a field site where these, and future, biology classes can conduct inquiry-based projects.

PRELIMINARY ANALYSES OF CRANIAL DEVELOPMENT IN SPADEFOOT TOADS

Barbara L. Banbury, Kayla Buchholz and Anne Maglia
Department of Biological Sciences, University of Missouri, Rolla, MO 65409

The developmental osteology of spadefoot toads (Anura: Pelobatidae) has been the subject of several studies. Despite this, little is known about the cause of the extreme variation of adult cranial ossification within the group. *Pelodytes* and *Spea* are poorly ossified frogs, whereas *Pelobates* and *Scaphiopus* are hyperossified. Because *Scaphiopus* and *Spea* are sistertaxa, this suggests that hyperossification has either evolved twice in the group, or has been lost at least once. Herein we provide preliminary data on cranial ossification of four pelobatid species (one representing each genus) and comment on the potential implications regarding cranial development and degree of variation in the group.

THE EFFECT OF TEMPERATURE AND DIGESTION ON METABOLISM IN THE RAT SNAKE *Elaphe obsoleta*.

April M. Brennan, Brian Greene, Tom Tomasi, and Alicia Mathis
Biology Department, Southwest Missouri State University, Springfield, MO 65804

Metabolic rate of reptiles is affected by numerous environmental and physiological variables. Measures of metabolism and its variation have not been investigated for many species. This research focused on the effect of temperature on the intraspecific variation in metabolism of the rat snake, *Elaphe obsoleta*. Thermal influences on resting metabolic rate were estimated for snakes of all size classes by measuring oxygen consumption at 20°C, 25°C, and 30°C using an oxygen analyzer. There were significant differences among temperature, mass, and the temperature by mass interaction at all three temperatures.

THE EFFECTS OF PRE-BURN MOWING AND SUMMER BURNING ON EASTERN MASSASAUGA RATTLESNAKES

Frank Durbian
U.S. Fish and Wildlife Service, Squaw Creek National Wildlife Refuge, Mound City, MO 64470

Summer burning effectively controls woody encroachment on prairie habitats, however prescribed fire during this time of the year results in the direct mortality of eastern massasaugas. In an effort to understand if preburn mowing can effectively reduce fire induced mortality, a study evaluating the effects of this practice was conducted on Squaw Creek NWR during the summer of 2003. Data on radio instrumented snakes indicates that mowing to a height of 10 inches approximately two weeks prior to a summer burn does not reduce mortality to an acceptable level of $\leq$ 10%. In order to preserve the prairie habitat that this species is dependent on, alternative management practices need to be evaluated.

SEASONAL ACTIVITY PATTERNS OF SELECT SNAKE SPECIES ON SQUAW CREEK NWR

Frank Durbian and Leonard Hanway
U.S. Fish and Wildlife Service, Squaw Creek National Wildlife Refuge, Mound City, MO 64470

Activity patterns of select snake species on Squaw Creek NWR were evaluated utilizing drift fences in 2002 and 2003. Trap data indicates that optimal trapping periods occur from approximately April 1 through June 15 and August 15 through October 30. Knowledge of snake activity patterns will enable scientists to maximize trapping efficiency.

(POSTER) AMPHIBIAN POND SELECTION: AN INQUIRY BASED STUDY - III. ADULT FROG AND PHYSICAL DATA

K. Kallash[1], J. Niemeyer[1], R. Niemeyer[1], D. Norton, J. Werenski[1], J. D. Wilson[1], M. Graves[1], R. D. Aldridge[2], D. A. Kangas[3], and J. M. Jones[4]
[1]Bowling Green High School, Bowling Green MO 63334; [2]Department of Biology, St. Louis University, St. Louis, MO; [3]Science Division, Truman State University, Kirksville, MO 63501; [4]Department of Biology, Culver-Stockton College, Canton, MO 63435

The purpose of this part of the project is to determine if there are significant differences in the number of adult frogs, pond pH, temperature, and turbidity in the three pond treatments. The distribution of adult frogs was not significantly different between the pond treatments on any of the sampling days. The pH of all of the ponds was 6.0 to 7.0. The pH did not differ over the sampling period. Several temperature probes were destroyed by animals. The temperature of the ponds that we have data from are similar. Since all of the ponds had the same sun and wind exposure, the temperatures of the ponds were probably very similar over the sampling period. The turbidity of the ponds was not different by pond treatment up to and including samples taken on 19 May, 2003. In most of the ponds, the Secchi disk was visible to the bottom of the pond. Following the measurements taken on 19 May, bluegill sunfish (*Lepomis macrochirus*) were introduced into the fish treatment ponds. On 16 June and all the following samples, the fish treatment ponds were very turbid, with Secchi disk measurements of 7.5 to 15 cm. Control and tadpole ponds had readings of 20 + cm, and most were clear to the bottom. We conclude, 1) adult frogs and breeding toads do not avoid ponds that have tadpoles (potential competitors) or fish (potential predators), compared to control ponds, 2) presence of bluegill fish increased pond turbidity and, 3) pond pH and pond temperature were not affected by pond treatment. Our observation that adult amphibians do not discriminate between ponds with and without fish is consistent with the results obtained by Sexton, O. J., C. A. Phillips, and Eric Routman. (1994. Behaviour 130:113-121), who found that breeding spotted salamanders (*Ambystoma maculatum*) do not discriminate between ponds with and without fish.

SEED DISPERSAL BY THE COMMON SNAPPING TURTLE AND THE RED-EARED SLIDER

J. Kimmons and D. Moll
Biology Department, Southwest Missouri State University, Springfield, MO 65804

Seed dispersal was investigated for two omnivorous aquatic turtles, the common snapping turtle (*Chelydra serpentina*) and the red-eared slider (*Trachemys scripta*), in a southwest Missouri farm pond. Seeds were obtained, identified and counted from fecal samples with the aid of a dissecting scope. Large numbers of mulberry (*Morus* spp.), barnyard grass (*Echinochloa crus-galli*) and curly dock (*Rumex crispus*) seeds were observed in the feces of these two turtles. Feeding trials were conducted to determine if seeds were being damaged as they passed through the digestive tracts of snappers (n =10) and sliders (n = 10). The amount of damaged seeds passed was low for two of the three feeding trials, but a larger amount of damaged barnyard grass seeds were passed (median = 31% damaged seeds). Another part of my research was to determine if passage through the turtle's digestive track aided in germination of the seeds. Seeds removed from fecal material in the feeding trial and control seeds, removed from mulberry fruit or directly from the plant in the case of wind dispersed seeds, were placed in an environmental chamber. Percent germination and time of radicle emergence were recorded for all seeds. Results from a chi-square test showed that there was no significant difference between the turtle-passed seeds and the control for the mulberry seeds ($p = 0.617$), but there was a significant difference between the turtle-passed seeds and the control for the barnyard and curly dock seeds ($p < 0.001$), with the control seeds having a greater percent germination. Although digestion by these turtles does not increase germination of the seeds, these turtles were passing seeds that did germinate, so they are capable of dispersing mulberry, barnyard grass, and curly dock seeds.

BIODIVERSITY AT BRAY CONSERVATION AREA: A COLLABORATIVE APPROACH TO TEACHING BIOINFORMATICS

Trini King[1], Anne Maglia[1], and Jennifer Leopold[2]
[1]Department of Biological Sciences and [2]Department of Computer Sciences, University of Missouri, Rolla, MO 65409

Bioinformatics, the field devoted to applying computational methods to biological problems, is one of the fastest growing subfields of biology. One challenge to educating the next generation of bioinformaticians is to generate student interest in both biology and computer science. Herein, we describe a collaborative approach to teaching bioinformatics in which computer science and biology students are teamed together to address biological problems that require both the collection of biological data and the development of computational solutions. A prototypical problem in which students examine amphibian biodiversity at a local conservation site will be discussed. The collaborative exercises result in open communication among students in diverse fields and increase student interest in both subjects. It is hoped that these experiences will lead to more students pursuing a career in bioinformatics.

HABITAT AND SPATIAL ANALYSIS OF BLANDING'S TURTLE AT SQUAW CREEK NATIONAL WILDLIFE REFUGE

Lisa Lehnhoff
Department of Biology, Southwest Missouri State University, Springfield, MO 65804

Blanding's turtles (*Emydoidea blandingii*) are known from only three populations in northern Missouri where it is listed as an endangered species. We are currently gathering information on habitat use, spatial ecology, and seasonal activity patterns of an *E. blandingii* population at Squaw Creek National Wildlife Refuge to aid biologist in designing management guidelines. Eight turtles (4 males and 4 females)

were telemetrically monitored in 2002 and 2003. Individual home range sizes, determined by the Adaptive Kernel estimator, ranged from 52.1 to 2,789 hectares. Males occupied significantly larger home ranges than females and occasionally made long-distance movements between distant core activity areas. All monitored individuals exhibited a preference for shallow, vegetated aquatic area. Home range sizes of Squaw Creek *E. blandingii* were considerably larger than those reported for other populations and in some cases exceeded the refuge boundaries, suggesting that spatial requirements may be an important management consideration for this population.

THE INVASIVE POTENTIAL OF THE AFRICAN CLAWED FROG (*Xenopus laevis*) IN NORTH AMERICA AND ITS CONSEQUENCES FOR AMPHIBIAN DECLINES

ANNE MAGLIA
Department of Biological Sciences, University of Missouri, Rolla, MO 65409

Given the rapid loss of amphibian populations, it is crucial that we be able to identify, monitor, and predict any factors that may pose a threat to the native amphibian populations. One such threat is the establishment and expansion of invasive African clawed frog (*Xenopus laevis*) populations. Herein, I discuss ecological niche models to predict the potential invasive distribution of this species in North America. Results indicate that a large area, which includes most of the central and eastern United States, is suitable for the species to inhabit. Given that clawed frogs are particularly successful invaders, and have been shown to decimate local fauna (including endangered species), it poses a primary threat to native amphibian populations. And because its popularity in research laboratories and the pet trade continues, further legislation regulating the possession of this species, particularly in the central and eastern United States, should be pursued.

STATUS OF *Aspidoscelis neomexicana* (SQUAMATA: TEIIDAE) AT FT. SUMNER, DE BACCA CO., NEW MEXICO

Glenn J. Manning and J.M. Walker
Department of Biological Sciences, University of Arkansas, Fayetteville, AR 72701

Aspidoscelis neomexicana (New Mexican whiptail) was first discovered in the city limits of Ft. Sumner, De Bacca Co., New Mexico by Harry Taylor in 2002. My objective was to perform an intensive survey of the area to determine the distribution and relative abundance. Nearly 50 hours of collection time were logged. This was done over the dates of the 12th to the 14th July 2002, the 20th to the 23rd June 2003 and the 12th to the 17th August 2003. One hundred and forty-four *A. neomexicana* were observed and of these, 23 were collected. In addition, *A. tesselata* E and *A. sexlineata* were observed and collected. It is my belief that this demonstrates a well-established population of *A. neomexicana*. Six of the collected *A. neomexicana* had abnormal color pattern, incomplete circumorbital scale series and enlarged mesoptychial scales. Principal components and cononical variate analysis were performed using eight meristic characters. These analyses demonstrate that these individuals appear to be hybrids between *A. neomexicana* and *A. sexlineata*.

EFFECTS OF GEOGRAPHIC DISTANCE AND DISPERSAL BARRIERS ON AMPHIBIAN POLYMORPHISM

Adam Martin
Department of Biological Sciences, University of Missouri, Rolla, MO 65409

Understanding the natural history of a species is critical to developing sound management practices. This is especially true for indicator species such as amphibians that play a large role in our understanding of an ecosystem's general health. While much is considered common knowledge about

amphibians (such as their reliance on water) some information may be misinterpreted or incorrectly used in conservation plans. For example, the inability of frogs to disperse and interbreed over a geographic barrier, such as a large river, may pose many lethal deterrents to movement, and thus effectively isolate amphibian populations in very close proximity. In an effort to determine what effect such a phenomenon may have on amphibians I am studying several populations of Blanchard's Cricket Frog (*Acris crepitans blanchardi*) on either side of the Mississippi River. Methods will include molecular data (e.g. AFLP's) and color pattern variation, the combination of which will allow for comparison of variation within and among populations as well as supporting the development of a novel mark/recapture technique for frogs with high variation in color pattern.

CHORUSING BEHAVIOR OF THE BIRD-VOICED TREEFROG (*Hyla avivoca*)

Carlos César Martínez Rivera
Division of Biological Sciences, University of Missouri, Columbia, MO 65211

The Bird-voiced treefrog is a small frog that inhabits forested swamps and wooded wetlands throughout Southern US. Its advertisement call is a whistle like pulse train composed of 15 to 20 pulses of about 50 ms each. Each pulse is followed by a period of silence or interpulse intervals (IPI) of varied length (90ms ± 60 ms at 22ºC). Most of the energy of the call concentrates at around 2.2 kHz. Each call is repeated at irregular intervals during a chorusing night. The frog also produces an aggressive call, which is a single, deeply pulsed note of about 250 ms with frequencies similar to the advertisement call. Analysis of call recording, show that when calling in groups, males frequently overlap their calls with their neighbors and that they increase and often match the number of pulses in the calls in response to others. When overlapping occurs, the pulses within each call often alternate, due to the lengthening of the IPI of the calls of one or both males. The IPI often extends from 70 ms to 120ms, and accounts for the high variability in overall IPI. Males interacting with playbacks of synthesized advertisement calls overlapped with the playback and often matched the number of pulses of the calls. If the stimulus persisted for extended period or if it was presented over a certain intensity threshold, males often produced aggressive calls. These behaviors allow males to maintain the acoustic integrity of their calls, and possibly to compete with close neighbors by means of endurance rivalry, which might be important for female choice. At the same time this behavior may reduce the need for aggressive calling as a mechanism for male spacing.

REPRODUCTIVE ECOLOGY OF AN URBAN POPULATION OF SMALL-MOUTHED SALAMANDERS (*Ambystoma texanum*): YEAR TWO

Teffany N. Sample[1, 2] and Mark S. Mills[1]

[1]Division of Math and Science, Missouri Valley College, Marshall, MO 65340 and [2]Department of Biological Sciences, Arkansas State University, Jonesboro, AR 72467 (Current address)

This is the second year of our study of the reproductive ecology of the small-mouthed salamander, *Ambystoma texanum*. We completely enclosed a small, ephemeral, man-made pond on the campus of Missouri Valley College with a drift fence and pit-fall traps in early February of 2002 and continued to monitor the fence through the 2003 breeding season. The following is a brief comparison of the 2002 and 2003 field seasons (all data listed 2002 first, then 2003). The first salamanders were collected on 20 February and 12 March, which was prior to the pond filling with water on 20 April and 17 April. We continued to collect incoming individuals until 25 May and 20 May, with the last reproductive females entering the pond on 8 May and 21 May. All individuals were measured, weighed, and given a cohort mark (*i.e.*, toe-clipped). Sex ratio was highly male-biased in both years (1.8:1; 3.0:1), with male numbers remaining nearly identical (N=86 & 88) and females decreasing in numbers between the two years (N= 47 & 29). In 2002 salamander larvae were relatively abundant, but only 5 juveniles were documented leaving the pond before the pond dried on 3 July. In 2003 salamanders laid eggs, but larvae were never observed and no juveniles emerged before the pond dried on 27 June. Although we do not have numbers, we know that hundreds (thousands?) of larvae were present in the pond in 2001, and the pond still had water in early

August. However, the spring and summer of both 2002 and 2003 were dry, with July 2003 being the driest on record for this area. This caused the pond to dry early and created a lack of recruitment to this population for the last two years. Perhaps of equal or greater impact on the breeding success is the time at which the pond fills. In 2001 the pond held water all winter, whereas in 2002 and 2003 the pond did not fill until mid-April.

(POSTER) AMPHIBIAN POND SELECTION: AN INQUIRY BASED STUDY - II. TADPOLE DATA

K. Smith[1], B. Docker[1], L. McGuire[1], R. D. Aldridge[2], D. A. Kangas[3], and J. M. Jones[4].
[1]Clopton High School, Clarksville, MO 63336; [2]Department of Biology, St. Louis University, St. Louis, MO; [3]Science Division, Truman State University, Kirksville, MO 63501; [4]Department of Biology, Culver-Stockton College, Canton, MO 63435

The purpose of this part of the project is to determine if there are significant differences in the number of tadpoles in the three pond treatments. The first amphibians to use the ponds for breeding were American toads (*Bufo americanus*). Tadpoles of this species were first observed in the sample taken May 9, 2003. On this date, the number of toad tadpoles in the three pond treatments was not statistically different. On the May 19 sample the number of toad tadpoles was much greater that the May 9 sample, however, the number of tadpoles was not statistically different in the three treatments. In the June 16 sample American toad and gray treefrog (*Hyla versicolor*) tadpoles were present. Many of the American toad tadpoles had well developed hind legs. In the July 25 sample, the vast majority of the tadpoles were treefrogs of the *Hyla versicolor* complex. Cricket frogs (*Acris crepitans*) tadpoles were also present. The distribution of these tadpoles was statistically different by treatment. In most of the samples *Hyla and Acris* tadpoles were absent from the fish treatment ponds. The difference in the number of tadpoles in the fish ponds in the May samples compared to the later samples may be due to the type of fish present in the ponds. By mid-June, the number of goldfish had diminished, so on June 16, we stocked the fish ponds with bluegill sunfish (*Lepomis macrochirus*) obtained from a nearby pond. The bluegill may be more effective predators on the tadpoles and thus the differences seen in the pond treatments for the bufonid tadpoles compared to the hylid tadpoles may be due to predation on the tadpoles rather than pond selection by adults.

THE INFLUENCE OF LOW-LEVEL PESTICIDE EXPOSURE ON SURVIVORSHIP IN LARVAL AMPHIBIANS

Sara I. Storrs
Division of Biological Sciences, University of Missouri, Columbia, MO 65211

A variety of causes have been implicated for global amphibian decline, however the importance of pesticide exposure remains unclear. Wetlands used by amphibians as breeding sites can receive agricultural runoff causing high-level pulses in pesticide levels. For example, atrazine, the most widely used pesticide in North America, can be present at several parts per million in agricultural runoff. However, pesticide levels are likely to remain low for long periods of time. Nevertheless, most studies designed to examine the impacts of contaminants are limited to short-term (~4 days) tests conducted with relatively high concentrations. To investigate long-term (~30 days) exposure of amphibians to low pesticide levels, we exposed four species of frogs: spring peepers (*Pseudacris crucifer*), Amercian toads (*Bufo americanus*), green frogs (*Rana clamitans*), and wood frogs (*Rana sylvatica*) at early (Gosner 25-27) and late developmental stages (Gosner 29-36) to low levels of atrazine (3, 30, or 100 parts per billion (ppb); 3 ppb is the EPA drinking-water standard). Experiments ran for approximately 30 days in a laboratory setting using a fully factorial design. We found counterintuitive patterns in rate of survivorship, however, these patterns varied with stage. Rate of survivorship was significantly higher for animals exposed to 3 ppb for both the early and late stages for *P. crucifer* and *R. clamitans* and only the early stages of *B. americanus*. However, overall mortality was significantly higher for *R. sylvatica* exposed to 3 ppb at

late stages. These counterintuitive survival patterns highlight the importance of investigation the impacts of contaminant with realistic exposures and at multiple developmental stages. This may be particularly important for compounds that produce greater mortality at lower doses than at higher doses, a characteristic of many endocrine disruptors.

THE LARVAL ENVIRONMENT: IMPACTS OF CANOPY COVER AND SUBSTRATE.

Bethany K. Williams and Tracy A. G. Rittenhouse
Division of Biological Sciences, University of Missouri, Columbia, MO 65211

Hydroperiod has long been considered the primary factor regulating amphibian populations. Recently, the amount of forest canopy over a breeding pond has been proposed as an important factor in the regulation of populations. Remarkably, open canopy ponds appear to support more forest-associated species than closed canopy ponds. We experimentally tested the relationship between amount of shade and larval performance (i.e. survival, growth, and development) to 1) ensure that light, as opposed to another factor correlated with light, is affecting larval performance and 2) to examine potential mechanisms (e.g. differences in temperature, phytoplankton, or periphyton) driving the previously observed patterns of occurrence. In addition, we tested the effects of substrate type, because closed canopy ponds often possess a leaf litter bottom, while open canopy ponds often contain grass. Cattle tanks were stocked with 40 *Pseudacris crucifer* or 40 *Rana sphenocephala* tadpoles and randomly assigned a shade (i.e. low-27%, medium-52%, high-77%) and substrate (i.e. leaves, grass) treatment. Survival decreased in the high shade treatments ($P = 0.0328$), but survival was not affected by substrate type ($P = 0.6694$). Shade and substrate affected both time to metamorphosis ($P = 0.0213$, $P < 0.0001$, respectively) and size at metamorphosis ($P = 0.0430$, $P < 0.0001$, respectively). Time to metamorphosis was faster in ponds with grass compared to leaves and increased as shade increased. Size at metamorphosis was greater in ponds with grass compared to leaves, but largest at the medium shade level. Therefore, we suggest that shade may be influencing the presence or absence of a species at a breeding site by affecting survival, while substrate may be a greater influence than shade on the fitness of metamorphs entering the adult population.

SIZE-DEPENDENT BEHAVIORAL AND METABOLIC RESPONSES OF THE SOUTHERN RED-BACKED SALAMANDER (*Plethodon serratus*) TO PREDATORY STIMULI—PRELIMINARY FINDINGS

Nathan Windel, Alicia Mathis, and Laura Sanders.
Department of Biology, Southwest Missouri State University, Springfield, MO 65804

In its natural habitat, visual cues are often limited for *Plethodon serratus*, so chemoreception is probably important for detection of predators. We are conducting experiments examining the effect of chemical stimuli from predatory ring-necked snakes on the foraging behavior and metabolic rates of *P. serratus*, and we present our preliminary findings here. In both studies, individual salamanders were exposed to stimuli from ring-necked snakes, five-lined skinks (non-predator control), and dechlorinated water (blank control). In the foraging study, foraging success was measured by the number of fruit flies consumed in 5 minutes after exposure to the stimulus. In the metabolic study, metabolic rates were calculated using % oxygen consumed, measured by constant volume respirometry, before and after exposure to the stimuli. Smaller salamanders (SVL<30mm) tended to reduce foraging activity and increase metabolic rates when exposed to predatory stimuli. Larger individuals (SVL 36-40mm) showed no difference in foraging activity among treatments, but tended to decrease metabolic rates in the presence of the snake stimulus. Our preliminary findings suggest that size may play an important role in anti-predator responses of *P. serratus*, possibly because large salamanders may be less vulnerable to gape-limited predators. Large salamanders also may be reluctant to flee in the face of predation because they are likely to be territory owners and loss of territories might have serious fitness consequences.

NEW AND PREVIOUSLY UNREPORTED HERPETOLOGICAL RECORDS FROM MISSOURI FOR 2003

Richard E. Daniel[1], Brian S. Edmond[2] and Jeffrey T. Briggler[3]

[1]Division of Biological Sciences, University of Missouri, Columbia, MO 65211

[2] Computer Services, Southwest Missouri State University, Springfield, MO 65804

[3]Missouri Department of Conservation, P.O. Box 180, Jefferson City, MO 65102

The following list represents new county records accumulated or brought to our attention since the publication of Johnson (2000), Daniel and Edmond (2000, 2001) and Daniel *et al*. (2002). Publication of these records extends our knowledge of the amphibians and reptiles native to Missouri. In addition, recipients of this list have the opportunity to update checklists and range maps. Finally, the publication of this list allows us to acknowledge the contributions of the many individuals who have provided information or specimens.

The specimens listed below represent the first reported occurrence of the species within a given county and are based on catalogued voucher specimens or photographs deposited in a public institution. Distribution records are presented in the standardized format of Collins (1989): common and scientific name, county, specific locality (unless withheld for species of special concern), legal description of locality, date of collection, collector(s), institution and catalogue number where the specimen is deposited.

All records included in this list have been deposited in the Dean E. Metter Memorial Collection, University of Missouri, Columbia, MO. Unless otherwise indicated, all of the distribution records are documented by post-metamorphic/hatching fluid preserved specimens.

We would like to extend our appreciation to S. Altnether and B. Schuette for generously providing information or specimens included in this note.

AMPHIBIA: URODELA

Ambystomatidae

SPOTTED SALAMANDER
Ambystoma maculatum
Dent Co.: Indian Trail Conservation Area (S28 T35N R4W); 9 September 2003; J. Briggler, A. Forbes (larva, UMC 7556).

MARBLED SALAMANDER
Ambystoma opacum
Texas Co.: Elder Springs Rd., 0.3 mi. E Jct. Long Hollow Rd. (S2 T33N R11W); 19 October 2003; B. Edmond (eggs, UMC 7606; color print UMC 565P).

SMALL-MOUTHED SALAMANDER
Ambystoma texanum
Scotland Co.: Indian Hills Conservation Area (S21 T64N R12W); 12 June 2003; R. Daniel (larvae, UMC 7510).

Plethodontidae

GROTTO SALAMANDER
Typhlotriton spelaeus
Lawrence Co.: FR 1212, 0.5 mi. S Jct. FR 2108 (S29 T28N R25W); 26 May 2003; B. Edmond (larva, UMC 7532).

Salamandridae

CENTRAL NEWT
Notophthalmus viridescens
Bates Co.: S of Amoret (S6 T39N R33W); 11 May 2003; B. Edmond (UMC 7524).

AMPHIBIA: ANURA

Bufonidae

AMERICAN TOAD
Bufo americanus
Caldwell Co.: MO 13, 0.3 mi. S Jct. Rt. F (S4 T55N R28W); 9 May 2003; B. Edmond (UMC 7520).
Douglas Co.: Mark Twain National Forest, 11.8 airmi. W Vanzant (S25 T27N R11W); 25 April 2003; J. Briggler, R. Rimer, B. Summers (UMC 7550).

FOWLERS TOAD
Bufo fowleri
Madison Co.: Fredericktown (S7 T33N R7E); 19 June 2003; J. Rathert (color print, UMC 525P).

Putnam Co.: Chariton River, Rebels Cove Conservation Area (S4 T66N R16W); 9 August 2003; R. Daniel (UMC 7500).

Hylidae
EASTERN GRAY TREEFROG
Hyla versicolor
Dallas Co.: Fort Niangua Resort (S35 T35N R18W); 13 June 2003, B. Edmond, J. Edmond, A. Edmond (verified by call, UMC 7539).
Pike Co.: 4 mi. NNW Curryville (S33 T54N R4W); 29 June 2003; B. Edmond, J. Blackwell (verified by call, UMC 7542).

SPRING PEEPER
Pseudacris crucifer
Crawford Co.: Woodson Woods Conservation Area (S8 T37N R5W); 21 March 2003; J. Briggler, G. Manning (UMC 7513-7514).
Howell Co.: White Ranch Conservation Area (S29 T22N R8W); 26 March 2003; J. Briggler, B. Gragg (UMC 7512).
Madison Co.: Amidon Conservation Area (S10 T33N R8E); 20 April 2003; A. Bockhorst, C. Gutherie, R. Daniel (UMC 7454).
Texas Co.: Paddy Creek Rec. Area, Mark Twain National Forest (S21 T33N R10W); 19 October 2003; B. Edmond (UMC 7600).

WESTERN CHORUS FROG
Pseudacris triseriata
Gasconade Co.: MO 100 at Jct. CR 208 (S2 T45N R5W); 15 March 2003; J. Briggler, R. Rimer (color slide, UMC 518P).
Linn Co.: Pershing State Park (S15 T57N R21W); 7 May 2003; J. Briggler, T. Nagel, M. Sappington (UMC 7549).

Ranidae
NORTHERN CRAWFISH FROG
Rana areolata
Macon Co.: Rt. PP, ≃ 4.0 mi. E Jct. US 63 (S30 T57N R13W); 6 May 2003; J. Briggler, T. Nagle, M. Sappington (color slide, UMC 519P).

PLAINS LEOPARD FROG
Rana blairi
Knox Co.: Rt. A, 0.55 mi. S Locust Hill (S7 T60N R12W); 4 October 2003; R. Daniel (UMC 7571).
Scotland Co.: 3.2 airmi. SW Bible Grove (S35 T64N R13W); 4 October 2003; R. Daniel (UMC 7576).

GREEN FROG
Rana clamitans
Linn Co.: Mussel Fork Conservation Area (S24 T57N R18W); 7 May 2003; J. Briggler, T. Nagel, M. Sappington (UMC 7548).
Madison Co.: CR 208 X Castor River, Amidon Conservation Area (S10 T33N R8E); 6 September 2003; R. Daniel (UMC 7506).

REPTILIA: SQUAMATA: IGUANIA
Iguanidae
EASTERN COLLARED LIZARD
Crotaphytus collaris
Dent Co.: Indian Trail Conservation Area (S32 T35N R4W); 3 July 2003; J. Briggler, B. Heatherly, B. Elliott, M. Fiani, M. Stubbs (UMC 7546) [MDC introduced population].
Douglas Co.: Shannon Ranch Conservation Area (S7 T26N R12W); 18 September 2003; J. Briggler, T. Stanton, C.D. Scott (color slide, UMC 539P) [MDC introduced population].
Wright Co.: Cedar Gap Conservation Area (S22 T28N R16W); 11 September 2003; J. Briggler, M. Skinner (color print, UMC 528P) [MDC introduced population].

EASTERN FENCE LIZARD
Sceloporus undulatus
Polk Co.: Pleasant Hope Conservation Area (S1 T31N R22W); 9 May 2003; J. Briggler, K. Kramer (UMC 7552).

REPTILIA: SQUAMATA: SCLERO-GLOSSA
Scincidae
SOUTHERN COAL SKINK
Eumeces anthracinus
Crawford Co.: Rt. N, ≃ 6.0 mi. SE Jct. Rt. JJ (S7 T39N R2W); 2 October 2003; B. Guenhe (UMC 7588).

FIVE-LINED SKINK
Eumeces fasciatus
Linn Co.: Mussel Fork Conservation Area (S24 T57N R18W); 7 May 2003; J. Briggler, T. Nagel, M. Sappington (UMC 7547).

BROADHEADED SKINK
Eumeces laticeps
Lawrence Co.: FR 1131, 2.5 mi N Jct. FR 2187 (S31 T27N R26W); 26 May 2003; B. Edmond (UMC 7534).
Randolph Co.: Rudolf Bennitt Conservation Area (S35 T52N R14W); 23 May 2003; R. Daniel (color slide, UMC 473P).

Warren Co.: Daniel Boone Conservation Area (S5 T46N R4W); 6 September 2003; S. Altnether (UMC 7508).

GROUND SKINK
Scincella lateralis
Warren Co.: Daniel Boone Conservation Area (S8 T46N R4W); 26 April 2003; R. Bisch, R. Mank, E. Guenther, R. Daniel (UMC 7453).

REPTILIA: SQUAMATA: "SERPENTES"
Colubridae
WESTERN WORM SNAKE
Carphophis vermis
Warren Co.: Daniel Boone Conservation Area (S8 T46N R4W); 24 September 2003; T. Rittenhouse, S. Altnether (UMC 7565).

YELLOWBELLY RACER
Coluber constrictor
Schuyler Co.: Rt. J, 0.8 mi. E Jct. US 63 (S11 T64N R15W); 4 October 2003; R. Daniel (UMC 7577).
Scotland Co.: 3.45 airmi. SSE South Gorin (S33 T64N R10W); 4 October 2003; R. Daniel (UMC 7574).

PRAIRIE RINGNECK SNAKE
Diadophis punctatus
Howell Co.: ~4.6 airmi. WSW Willow Springs (S32 T27N R10W); 25 May 2003; D. Budd, B. Wake (color photo, UMC 521P).

GREAT PLAINS RATSNAKE
Elaphe emoryi
Dent Co.: Indian Trails Conservation Area (S28 T35N R4W); 28 September 2003; J. Briggler, G. Manning (color print, UMC 540P).

WESTERN RAT SNAKE
Elaphe obsoleta
Wright Co.: Rt. M, 1.0 mi. E Webster Co. (S27 T31N R16W); 19 October 2003; B. Edmond (color print, UMC 568P).

EASTERN HOGNOSE SNAKE
Heterodon platirhinos
Texas Co.: Slabtown Rd., 0.85 mi. E Jct. Paddy Creek Rd. (S17 T33N R10W); 19 October 2003; B. Edmond (UMC 7605).

PRAIRIE KINGSNAKE
Lampropeltis calligaster
Linn Co.: Mussel Fork Conservation Area (S24 T57N R18W); 3 April 2003; T. Nagel (color slide, UMC 523P).
Madison Co: Rt. J, 3.4 mi. E Jct. MO 72 (S8 T33N R8E); 20 April 2003; B. Edmond, R. Daniel, Herpetology Class (UMC 7629).
Scotland Co.: 3.45 airmi. SSE South Gorin (S33 T64N R10W); 4 October 2003; R. Daniel (UMC 7580).

SPECKLED KINGSNAKE
Lampropeltis getula
Lawrence Co.: FR 1212, 0.5 mi. S Jct. FR 2108 (S23 T26N R25W); 26 May 2003; B. Edmond (color slide, UMC 507P).

RED MILK SNAKE
Lampropeltis triangulum
Butler Co.: Rt. KK, 3.0 mi. E Jct. Rt. W (S18 T26N R7E); 19 April 2003; R. Daniel, B. Edmond, D. Clark, A. Edwards (color print, UMC 486P).
Douglas Co.: Shannon Ranch Conservation Area (S7 T26N R12W); 18 September 2003; J. Briggler, T. Stanton, C.D. Scott (color slide, UMC 542P).

MIDLAND BROWN SNAKE
Storeria dekayi
Knox Co.: CR 84 X Middle Fabius River (S35 T63N R10W); 4 October 2003; R. Daniel (UMC 7569).
Maries Co.: CR 513, 7.95 airmi. WSW Vichy (S27 T39N R9W); 2 November 2003; R. Daniel (UMC 7585).
Schuyler Co.: Fairview Rd, 0.35 mi. NE South Fabius River (S4 T64N R14W); 4 October 2003; R. Daniel (UMC 7579).

NORTHERN REDBELLY SNAKE
Storeria occipitomaculata
Howell Co.: Dean Davis Conservation Area (S27 T26N R9W); 13 November 2002; D. Budd (color photo, UMC 522P).
Texas Co.: Rt. M, 0.45 mi. W Jct. Rt. AE (S18 T31N R11W); 1 November 2003; B. Edmond (UMC 7615).

FLAT HEADED SNAKE
Tantilla gracilis
Dent Co.: Indian Trails Conservation Area (S28 T35N R4W); 11 June 2003; J. Briggler, K. Van Patten (UMC 7553).

RED-SIDED GARTER SNAKE
Thamnophis sirtalis
Madison Co.: Amidon Conservation Area (S10 T33N R8E); 20 April 2003; V. Marshall, R. Daniel (UMC 7463).

WESTERN EARTH SNAKE
Virginia valeriae
Howard Co.: CR 117, 0.3 mi. SW Jct. CR 146 (S26 T51N R14W); 3 April 2003; R. Daniel (UMC 7445).
Montgomery Co.: Danville Conservation Area (S5 T47N R5W); 26 April 2003; R. Daniel, B. Edmond, Herpetology Class (UMC 7448).
Warren Co.: Daniel Boone Conservation Area (S4 T46N R4W); 28 September 2003; J. Briggler, G. Manning (color print, UMC 541P).

Viperidae
OSAGE COPPERHEAD
Agkistrodon contortrix
St. Charles Co.: Rt. T, 3.0 mi. NW Augusta (S4 T44N R1E); 5 September 1999; P. Taylor (color photo, UMC 520P).

WESTERN COTTONMOUTH
Agkistrodon piscivorus
Washington Co.: Mineral Fork Creek, ~2.0 mi. NE Jct. Rt. F (S4 T38N R2E); 26 March 1984; S.A. Kemp (color photo, UMC 547P).

TIMBER RATTLESNAKE
Crotalus horridus
Laclede Co:. CR WW-962, 4.15 airmi. SSW Prosperine (S34 T35N R17W); October 2002; B. Scruby (UMC 7637).
St. Charles Co.: Weldon Spring Conservation Area (legal description unavailable); 30 April 2003; M. Staloch (color print, UMC 538P).
Washington Co.: Mark Twain National Forest (S30 T38N R1W); 12 August 2003; coll. unknown (color print, UMC 544P).

REPTILIA: TESTUDINES
Chelydridae
COMMON SNAPPING TURTLE
Chelydra serpentina
Wright Co.: (S4 T31N R13W); 9 October 2003; J. Briggler, B. Heatherly, S. Faith (color slide, UMC 569P).

ALLIGATOR SNAPPING TURTLE
Macrochelys temminckii
Ozark Co.: Bull Shoals, Pond Fork Arm (S18 T22N R15W); 24 May 2003; R. Wallis (color photo, UMC 527P).

Kinosternidae
COMMON MUSK TURTLE
Sternotherus odoratus
Shannon Co.: Presley's Landing MDC (S1 T30N R5W); 12 April 2003; M. Figg, D. Figg (UMC 7479).
Madison Co.: CR 208 X Castor River, Amidon Conservation Area (S10 T33N R8E); 6 September 2003; R. Daniel (UMC 7507); Nim's Lake, ~5.9 airmi. NNW Junction City (S23 T34N R6E); 25 June 2003; D. Figg (shell, UMC 7554).

Emydidae
WESTERN PAINTED TURTLE
Chrysemys picta
Scotland Co.: Rt. M, 1.95 mi. E Jct. MO 15 (S30 T65N R11W); 4 October 2003; R. Daniel (UMC 7575).

RIVER COOTER
Pseudemys concinna
Dallas Co.: Niangua River, base of Sturgeon Bluff (S24 T35N R18E); 16 June 2003, B. Edmond, J. Edmond, A. Edmond (UMC 7540).
Madison Co.: St. Francis River at Rt. D (S13 T33N R5E); 19 June 2003; J. Rathert (color print, UMC 524P).

ORNATE BOX TURTLE
Terrapene ornata
Howard Co.: Rt. Y, 3.25 mi. N Jct. MO 124 (S27 T51N R14W); 9 May 2003; R. Daniel (UMC 7480).

RED-EARED TURTLE
Trachemys scripta
Shannon Co.: Sunklands Conservation Area (S1 T30N R5W: 13 May 2003; J. Briggler, J. Low (color slide, UMC 526P).
Shelby Co.: Pin Oak Conservation Area (S5 T57N R11W); 16 May 2003; R. Daniel, B. Edmond (color slide, UMC 485P).

Trionychidae
MIDLAND SMOOTH SOFTSHELL
Apalone mutica
Lincoln Co.: Mississippi River, just SE Elsberry (legal description unavailable); 4 May 1985; B. Schuette (color slide, UMC 531P).

WESTERN SPINY SOFTSHELL
Apalone spinifera
Lincoln Co.: Mississippi River, just SE Elsberry (legal description unavailable); 4 May 1985; B. Schuette (color slide, UMC 532P).
Madison Co.: Castor River, Amidon Conservation Area (S10 T33N R8E); 20 April 2003; R. Daniel, Herpetology Class (UMC 7481).

Erratum: The Cope's Gray Treefrog record reported in MHA Newsl. (15): 10 should read:
COPE'S GRAY TREE FROG
Hyla chrysoscelis
St. Charles Co: Cuivre Island Field Station (T48N R3E): 13 September 1989; M. Morris (SIUC 6664).

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NATURAL HISTORY NOTES

SUBTERRANEAN OVIPOSITION IN THE WORM SNAKE, *Carphophis vermis*.

Scott Altnether
School of Natural Resources, University of Missouri, Columbia, MO 65211

Little information is available on the oviposition of *Carphophis vermis* in Missouri. Clark (1970), in a study conducted in northeast Kansas, found a mean clutch size of 2.5 ± 0.15 (n= 34). Nesting sites are reported to be depressions under flat rocks, inside rotten stumps and logs, old sawdust piles and possibly mammal burrows (Dloogatch 1978, Ernst and Ernst 2003). Anderson (1965) reports that clutch size in Missouri ranges from 1-6, but didn't mention oviposition sites. Smith and Powell (1993) report two eggs found under a limestone rock in Jackson County.

On 24 September 2003 three hatchling *C. vermis,* along with their eggshells, were discovered on the Daniel Boone Conservation Area, Warren County, Missouri. The hatchlings were excavated from a depth of ~ 20 cm while digging a trench approximately 3.7 m from the edge of a pond to place a drift fence. The disturbance caused by the excavation made it impossible to determine if the eggs had been deposited in a burrow. No additional specimens could be located after extensive digging in the area. The pond is located adjacent to area road #1224 (SWNE S8 T46N R4W) and is surrounded by oak-hickory forest.

This represents the first known report of the species in Warren County. One specimen was inadvertently killed during the excavation and has been deposited at the University of Missouri-Columbia (UMC 7565) to document the new county record.

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OBSERVATION OF SHRIKE PREDATION ON A WESTERN CHORUS FROG

Brian S. Edmond
Computer Services, Southwest Missouri State University, Springfield, MO 65804

On 2 April 2003 in Barry County Missouri, I observed an adult Western Chorus Frog (*Pseudacris triseriata*) impaled on a strand of barbed wire, presumably by a Loggerhead Shrike (*Lanius ludovicianus*). The frog was completely mummified and it was photographed as it was found (Fig. 1). It was then removed to confirm its identity. No other impaled prey items were observed nearby nor could the presence of shrikes be verified since the site was visited at night.

The location, approximately 1 mi E and 2 mi N of Pulaskifield, (Sec 4, T25N, R28W; N36° 54' 07.10" W93° 59' 28.72") is adjacent to a small marsh near an unnamed tributary to Capps Creek. Land use in the area is mostly pasture. At the time of the observation, the anuran chorus in the marsh was dominated by Western Chorus Frogs (*P. triseriata*) and American Toads (*Bufo americanus*), but Spring Peepers (*P. crucifer*) and Southern Leopard Frogs (*Rana sphenocephala*) were heard in small numbers.

Small vertebrates, mainly reptiles and mammals, comprise the bulk of the diet in many shrike populations (Yosef 1996). Because of their secretive nature, amphibians would seem an uncommon food source for shrikes. However, Burton (1990) reported 2% of prey items in an Indiana population were anurans and Yosef and Grubb (1993) reported that 6-10% of prey items in a Florida population were anurans, mainly Green Treefrogs (*Hyla cinerea*). Anuran species documented as shrike prey include Northern Cricket Frog (*Acris crepitans*), Plains Leopard Frog (*R. blairi*) (Tyler 1991); Eastern Narrowmouth Toad (*Gastrophryne carolinensis*) (Yosef and Grubb 1993; Yosef and Whitman 1992); Green treefrog (*H. cinerea*), Squirrel Treefrog (*H. squirella*), Southern Leopard Frog (*R. sphenocephala*) (Yosef and Grubb 1993).

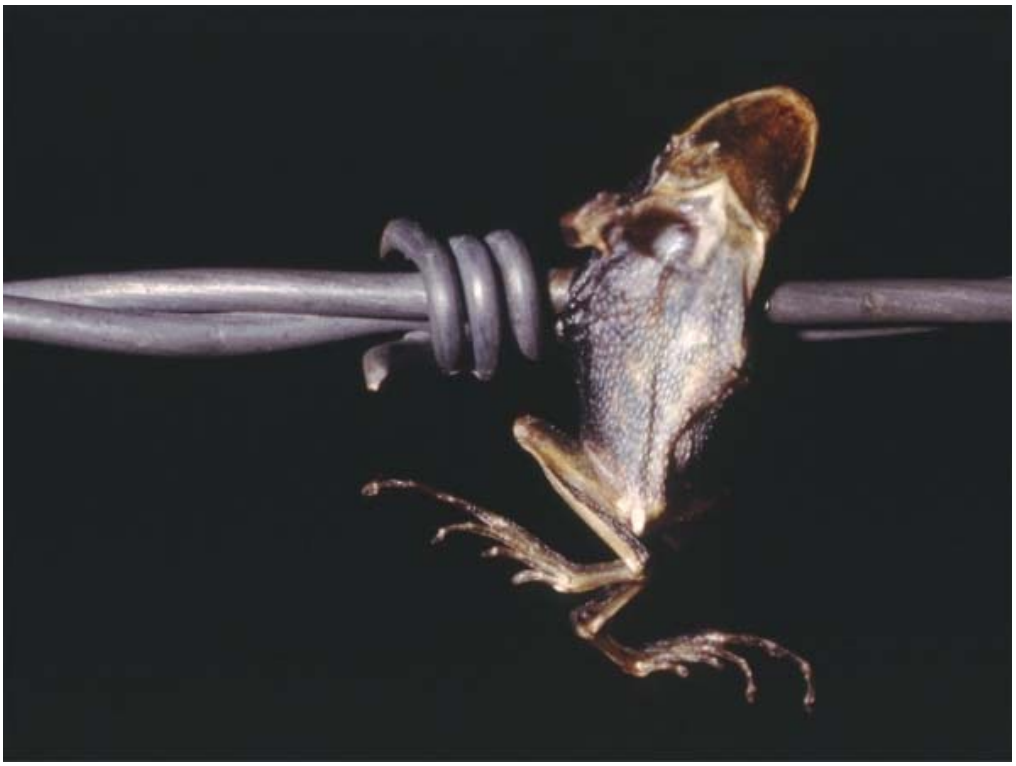

Figure 1. Impaled *Pseudacris triseriata*. Voucher photographs have been deposited in the Dean E. Metter Memorial Collection, University of Missouri, Columbia (UMC 488P).

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ALBINISTIC (XANTHOMORPHIC) *Virginia valeriae* FROM LEWIS COUNTY, MISSOURI

Submitted by

Tim Pettinelli
Missouri Department of Conservation, Northeast Region

This adult male (SVL= 20.9 cm, TL= 26.3 cm) was collected in Lewis County. In the most recent compilation of albino amphibians and reptiles, Dyrkacz (1981, SSAR Herpetol. Circ. no. 11) did not report any instances of albinism in this species. The specimen has been deposited in the Dean E. Metter Memorial Collection, University of Missouri-Columbia (UMC 7638). Photographs by Jim Rathert (MDC).

ADDITIONS TO THE BIBLIOGRAPHY OF REFERENCES ON THE HERPETOFAUNA OF MISSOURI

Compiled by

Richard E. Daniel
Division of Biological Sciences, University of Missouri, Columbia, MO 65211

The following is a list of references dealing with the biology of amphibians and reptiles from Missouri that have been brought to my attention since the publication of Daniel (2001, 2002), Johnson (2000) and Powell and Daniel (2000). Readers are requested to notify the author of any additional references that should be included in future compilations.

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ADDENDUM: HERPETOLOGICAL THESES AND DISSERTATIONS AT ST. LOUIS UNIVERSITY

Compiled by

ROBERT D. ALDRIDGE
Department of Biology, Saint Louis University, St. Louis, MO 63103

Khayyat, P. A. 2001. Male courtship behavior and female attractiveness in the African brown house snake *Lamprophis fuliginosus*. MS thesis. Advisor: R.D. Aldridge

Krohmer, R. W. 1980. The reproductive biology of the lined snake *Tropidoclonion lineatum*. MS thesis. Advisor: R.D. Aldridge.

Krohmer, R. W. 1985. Influence of hormones on secondary sexual characters in water snakes. Ph.D. dissertation. Advisor: R.D. Aldridge.

Minesky, J. J. 1985. The reproductive biology of the queen snake *Regina septemvittata* in western Pennsylvania. MS thesis. Advisor: R.D. Aldridge.

Reeves, A. A. 1996. Pheromone communication in snakes. MS thesis. Advisor: R.D. Aldridge.

Weil, M. R. 1976. The effect of temperature on the male reproductive system of the common water snake (*Natrix sipedon*). MS thesis. Advisor: R.D. Aldridge.

Weil, M. R. 1980. Seasonal androgenesis in the male water snake, *Natrix sipedon*. Ph.D. dissertation. Advisor: R.D. Aldridge.

16th Annual Missouri Herpetological Association Meeting
27-28 September 2003
Reis Biological Station

Front row: Kristen Kallash (BGHS), April Brennan (SMSU), Matt Graves (BGHS), Jessica Wilson (BGHS), Tracy Rittenhouse (UMC), Brett Dockery (CHS), Mike Jones (CSC), Jack Werenski (BGHS), Kenny Smith (CHS), Drew Norton (BGHS), Lynette McGuire (CHS).

Second row: Lisa Lehnhoff (SMSU), Bethany Williams (UMC), Jarrett Johnson (UMC), Sara Storrs (UMC), Elizabeth Harper (UMC), Trini King (UMR), Barb Banbury (UMR), Roy King (SMSU), Ralph Axtell (SIUE), Robert Aldridge (SLU), Sara Acosta (USGS), Carol Bryant (SIUE).

Third row: Carlos Martinez Rivera (UMC), Richard Daniel (UMC), Alicia Mathis (SMSU), Jeff Briggler (MDC), Adam Crane (SMSU), William Ray (SMSU), Nathan Windel (SMSU), Anne Maglia (UMR), Hugo Alamillo (UMR), Leonard Hanway (USFWS), Jeff Kimmons (SMSU), Brian Greene (SMSU).

Fourth row: Pete Sullivan (USFWS), Paul Frese (NRCS), Frank Durbian (USFWS), Chad Rittenhouse (UMC), Kenton Lohrafs (FLW), Adam Martin (UMR), Glenn Manning (UAF), Mark Mills (MVC), Don Kangas (TSU), Nate Nelson (SMSU), Angelo Bufalino (SLU).

Not pictured: Brian Edmond (SMSU).

Key: BGHS=Bowling Green High School, CHS=Clopton High School, CSC=Culver-Stockton College, FLW=Fort Leonard Wood, MDC=Missouri Department of Conservation, MVC=Missouri Valley College, NRCS=Natural Resources Conservation Service, SIUE=Southern Illinois University at Edwardsville, SMSU=Southwest Missouri State University, SLU=Saint Louis University, TSU=Truman State University, UAF=University of Arkansas at Fayetteville, UMC=University of Missouri at Columbia, UMR=University of Missouri at Rolla, USFWS=US Fish and Wildlife Service, USGS=United States Geological Survey

MISSOURI HERPETOLOGICAL ASSOCIATION

Richard E. Daniel
Division of Biological Sciences
105 Lefevre Hall
University of Missouri
Columbia, MO 65211