

ISSN 1540-773X

# ***JOURNAL OF* KANSAS HERPETOLOGY**

NUMBER 29 MARCH 2009



*Published by the Kansas Herpetological Society*



[www.cnah.org/khs](http://www.cnah.org/khs)

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*Front Cover: An adult Smooth Earth Snake (Virginia valeriae) from Jefferson County, Kansas. Photograph by Suzanne L. Collins, Lawrence, Kansas.*

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## KHS BUSINESS

### KHS 2009 SPRING FIELD TRIP

The 2009 Spring KHS Field Trip will be held at Bloody Creek Ranch in Chase County, Kansas. KHS members will gather as early as Friday evening (24 April 2009) at Bloody Creek Ranch at the location displaying a large KHS sign. To get to Bloody Creek Ranch, take Route 50 to Chase/Lyon county line, then go 3 miles south on Road A, then 5.2 miles west on Road 140, then 5.3 miles south on Bloody Creek Road all the way to the end.

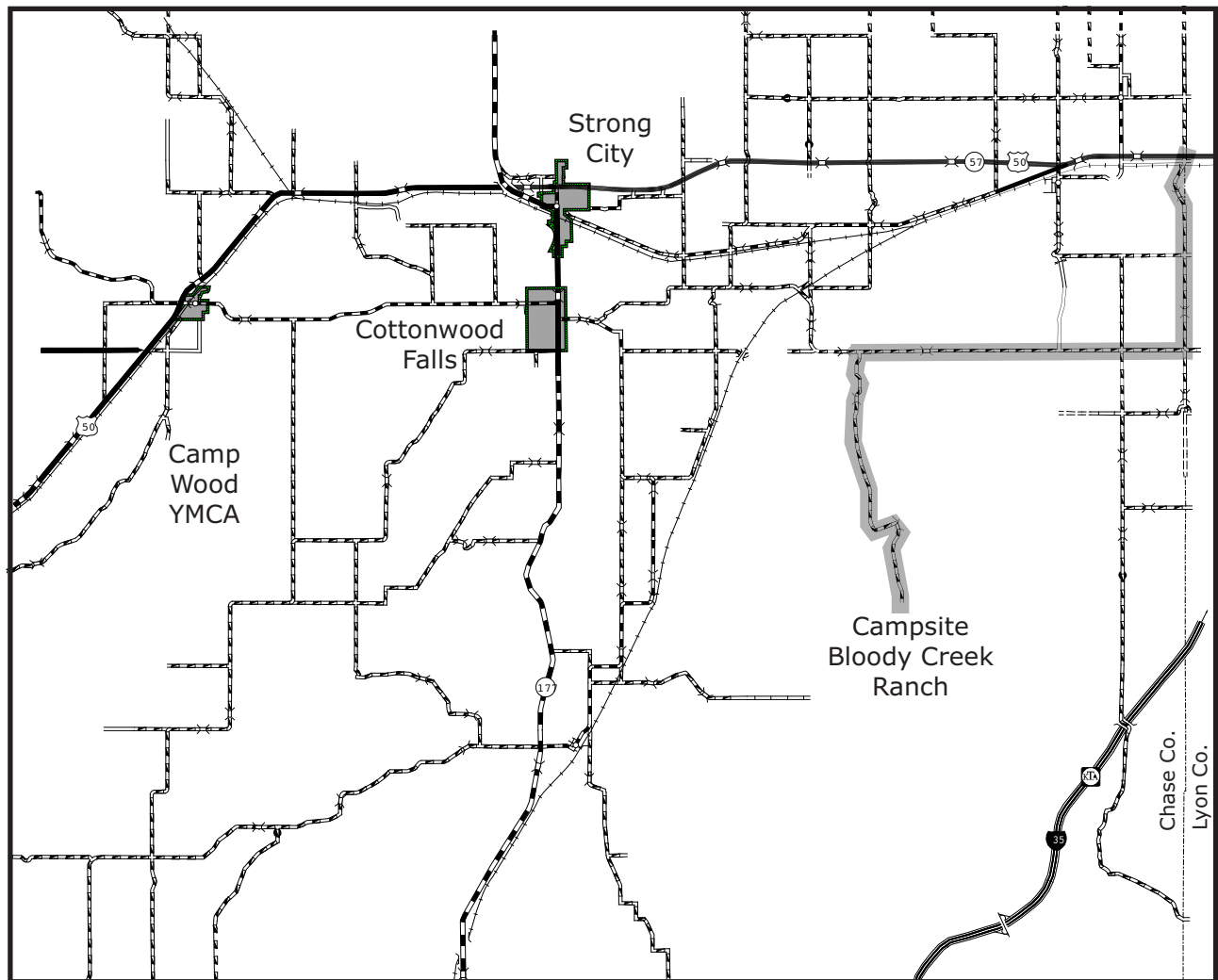
Restaurants and motels are available in nearby Cottonwood Falls (see the KHS web site for a list). Maps and other information will be available at the campsite

each day at 9:00 am.

Facilities at Bloody Creek Ranch consist of three restrooms and three showers; all are in ranch buildings (no charge).

KHS herpetofaunal counts will officially take place from 9:00 am to 5:00 pm on Saturday (25 April 2009) and on Sunday (26 April 2009) from 9:00 am to noon. Individuals wishing to participate should meet at the KHS sign at Bloody Creek Ranch on both dates at 9:00 am.

Herpetofaunal opportunities abound at Bloody Creek Ranch and in the surrounding vicinity. The area is largely unexplored, herpetologically, and offers the



Map of Chase County, Kansas. The bold KHS at the end of the arrow indicates the location of Bloody Creek Ranch, site of the Society's 2009 Spring Field Trip.

chance to produce several significant additions to our understanding of amphibian, reptilian, and chelonian distributions and natural history in this area of Kansas.

Dan Murrow has several activities planned, and will be directing us to several sites that offer prime herping habitat. Several turtle traps will be set at strategic locations and participants will assist in setting them up.

KHS Field Trips are an excellent opportunity for both students and adults to observe and learn field techniques by watching experienced herpetologists actively search for amphibians, turtles, and reptiles. Dan Murrow, Mary Kate Baldwin, Mark Ellis, Dan Johnson, Eric Kessler, Dan Carpenter, Derek Schmidt, Larry L. Miller, Curtis J. Schmidt, Travis W. Taggart, Joseph T. Collins and many others have engaged in herpetological field work in Kansas for decades; most of them will be present at these KHS fields trips to assist people. In addition, well-known herpetological photographers such as Larry L. Miller, Suzanne L. Collins, and Ginny Weatherman are

usually present at KHS field trips; they can supply you with tips and advice on how to photograph many of the creatures discovered on a KHS field trip. Further, film-makers Dan Krull of SmallScale Productions as well as Andy Durbin and Tag Oldham will be taping the field trip for three separate projects, so be careful where you put your fingers.

If you plan to attend the KHS Spring Field Trip, be prepared. You should minimally have heavy gloves, hiking boots, and a flashlight. In addition, it is useful to have a field notebook and pen or pencil. Field notes are very important and provide much additional information about your field activities, information that you might need to resource in the future. Other field items that will improve your KHS experience are bottled water and snacks; remember, you are often not near any grocery stores or fast-food outlets. Maps, such as the one accompanying this article are an important adjunct to any field trip. If you don't want to bring this issue of the *Journal of Kansas Herpetology* with you, make a copy of these pages and don't forget them.

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A list of amphibians, reptiles, and turtles not yet recorded from Chase county, but with records in adjacent counties based on data in the *Kansas Herpetofaunal Atlas*.

Smallmouth Salamander  
Plains Spadefoot  
Slider  
Six-lined Racerunner  
Coachwhip  
Diamondback Water Snake  
Graham's Crayfish Snake  
Plains Garter Snake

A list of amphibians, reptiles, and turtles already recorded from Chase County based on data in the *Kansas Herpetofaunal Atlas*.

AMPHIBIANS  
Barred Tiger Salamander  
Red River Mudpuppy  
American Toad  
Great Plains Toad  
Woodhouse's Toad  
Blanchard's Cricket Frog  
Gray Treefrog complex  
Boreal Chorus Frog  
Great Plains Narrowmouth Toad  
Crawfish Frog  
Plains Leopard Frog  
Bullfrog

TURTLES  
Common Snapping Turtle  
Northern Painted Turtle  
False Map Turtle

Eastern River Cooter  
Ornate Box Turtle  
Spiny Softshell

REPTILES  
Western Slender Glass Lizard  
Eastern Collared Lizard  
Lesser Earless Lizard  
Texas Horned Lizard  
Great Plains Skink  
Northern Prairie Skink

Eastern Glossy Snake  
Eastern Racer  
Prairie Kingsnake  
Common Kingsnake  
Milk Snake  
Great Plains Rat Snake  
Gopher Snake  
Western Rat Snake  
Flathead Snake  
Western Worm Snake  
Ringneck Snake  
Plainbelly Water Snake  
Northern Water Snake  
Brown Snake  
Western Ribbon Snake  
Common Garter Snake  
Lined Snake  
Copperhead  
Massasauga

Daniel Murrow, KHS Field Trip Chairperson



Kansas Herpetological Society  
*Minutes of the Executive Council Meeting*  
22 February 2009  
Dan Johnson Residence, Overland Park, Kansas

KHS Executive Council members present: Mary Kate Baldwin (also holding proxy for Eric Kessler), Joe Collins (holding proxy for Travis Taggart), Suzanne Collins, Kathy Ellis, and Dan Johnson presiding. A voting quorum of six out of seven Executive Council members was present. KHS Committee Chairpersons present were Joe Collins, Dan Murrow, and Robin Oldham. Invited guest present: Dan Krull.

Call to order: KHS President Dan Johnson called the meeting to order at 2:00 pm.

*KHS Financial Report for 2008*

KHS Secretary Mary Kate Baldwin submitted a treasurer's report showing an end-of-year balance of \$19,236.09 (including the *Kamb Grant* and *Gloyd-Taylor Scholarship* trust funds). The balance reflects an increase of \$570.68 (after all invoices were paid) over last year. In 2008, there were 209 members.

One of the missions of the Executive Council is to increase grant awards given annually. Funds from the treasury were added to the grant funds, increasing their net worth. A portion of the interest earned from these investments will be reinvested and a portion will be awarded. The grant funds were increased as follows:

*Alan H. Kamb Grant*  
from \$7,400.00 to \$7,600.00

*Howard K. Gloyd–Edward H. Taylor Scholarship*  
from \$7,000.00 to \$7,200.00

An unexpected expense occurred in 2008. The credit card machine had to be replaced at a cost of \$459.00. The charge to KHS to use credit card services is \$33 per month. Services are normally used only during the KHS annual meeting. Kathy Ellis asked if a seasonal plan could be arranged. She will talk to Eric Kessler to see if anything is available that would cut costs.

It was moved and seconded (S.Collins/Ellis) to approve the 2008 KHS Treasurer's Report as submitted. Motion passed unanimously.

*Summary of KHS 2008 Annual Meeting Expenses*

KHS Secretary Mary Kate Baldwin reported that all expenses from the KHS 2008 annual meeting in Wichita have been paid. The cost of the meeting was approximately \$1,500.00. Some of the meeting expenses were paid from a private donor. Joe Collins raised \$1,557.00 at the auction.

*Budget Request by JKH Editor*

Joe Collins (JKH Associate Editor) requested an allocation for 2009 of \$2,400.00 to cover the cost of publishing four issues of the *Journal of Kansas Herpetology* (this does not include postage costs for mailing JKH). There was some discussion about adding a color cover to the *Journal of Kansas Herpetology*. The Council received the budget request and delayed taking any action on a color cover at this time.

*Budget Request and Report on the 2009 Meeting*

KHS President Dan Johnson met with personnel from MidAmerica Nazarene University. They offered use at no charge of several rooms including a lecture hall for the 2009 KHS Annual Meeting. However, they do require a liability insurance policy. Dan and Joe did some research and found that a policy would cost \$200.00–400.00 depending on the amount of coverage. Dan will purchase the mandatory policy from his annual meeting budget. He will also get agreement from MidAmerica Nazarene University for use of the facilities before purchasing the insurance. The Council received a budget request for \$1000.00 plus a contingency fund of \$400.00.

Dan made arrangements with the Hampton Inn near MidAmerica Nazarene University for a special rate of \$85.00 per night. The auction will also be held there. There is an award winning BBQ restaurant across the street called Oklahoma Joe's. Dan will also make arrangements at a nearby bar/restaurant for a Friday night social. Unlike the past, the KHS Friday night social in 2009 will be Dutch treat.

The keynote speaker for the annual meeting will be R. Alexander Pyron from the College of Staten Island, City University of New York. The subject of his talk will be Common Kingsnakes.

Robin offered to organize The Collins Award photography competition. She will also set up the KHS People's Choice contest so the voting process is easier and submissions are marked appropriately. It was moved and seconded (Ellis/Baldwin) to allow paid participants to vote for a People's Choice photograph (after the selection by the KHS Awards Committee of a recipient for *The Collins Award*; the KHS People's Choice winner will not be the same as the recipient of *The Collins Award*); an award of \$100.00 was proposed for the KHS People's Choice winner. Motion to have the People's Choice photography competition passed unanimously.

As in the past, Eric Thiss will bring his books for dis-

play and purchase by attendees. Dan Krull will organize a live exhibit display at MidAmerica Nazarene University. Dan Krull, Dan Johnson and Joe Collins will work together to identify possible sponsors for the meeting.

*The George Toland Award*

Joe Collins, representing *The Center for North American Herpetology*, announced that *The George Toland Award*, given at the end of the KHS Annual Meeting, would increase to \$200.00 in 2009. A private donor contributed funds to increase the award.

*Critique of the KHS 2008 Annual Meeting*

It was decided that the Friday night KHS Social prior to the annual meeting be in a smaller, more intimate venue. The Social should be Dutch treat so members can eat and drink what they want.

KHS Secretary Mary Kate Baldwin noted that the Society must have a more easily accessible dedicated phone line for credit card charges at the Saturday night auction and for meeting registration on Saturday and Sunday. She and KHS Treasurer Eric Kessler encountered difficulty in finding such lines at the meeting in Wichita.

Although many have missed the slide show on Friday night, it has become very difficult to get appropriate technology that works for everyone. It was decided to let the slide show slide.

*Critique of 2008 Field Trips and 2009 Budget Request*

KHS Field Trip Chairperson Dan Murrow has planned the KHS 2009 Spring Field Trip for Chase County. Camping facilities will be made available on private land at the KHS field site. Details are on the KHS website. Dan will provide Joe Collins with a list of new records possible for Chase County.

Dan Johnson offered to investigate the possibility of producing a T-shirt for the KHS Spring Field Trip. All profits would be donated to KHS. He also visited with personnel from Camp Wood, a Boy Scout camp, in Chase County. Camp Wood will allow us to help on their property, but only two Copperheads can be collected for research. The area is the northwestern border of the range for Copperheads in North America. Sightings have been reported but no specimens have yet been taken. Camp Wood also offered to prepare a dinner for KHS on Saturday night. A menu of chicken, baked potato, vegetable, and peach cobbler would cost \$7.50. The Council agreed it would be convenient since there are few restaurants in the area. Dan Johnson will collect reservations and money from campers as they arrive on Friday night and Saturday morning. Robin will include information in the next KHS news release and Joe will add it to the

KHS website.

The KHS Fall Field Trip will be at Ness City State Fishing Lake in Ness County. Dan Murrow will make a recon trip to identify facilities and available land.

Robin will write KHS field trip press releases and Joe will submit the final field trip herpetofaunal count for publication in the Journal.

It was moved and seconded (Ellis/Johnson) to reimburse Dan \$250.00 for travel expenses incurred in 2008. It was moved and seconded (S.Collins/Ellis) to reimburse Dan \$200.00 for travel expenses in 2009. Dan will keep receipts to document his expenses. The 2008 reimbursement motion passed unanimously; the request for \$200.00 for 2009 reimbursement was received favorably.

*Report of the KHS Historian*

KHS Historian Suzanne Collins continues to collect and organize materials received. She asked that any articles mentioning KHS be sent to her. She also asked that photos could be sent via email or on CDs provided they are JPEGs or TIFFS. A general request will be made at the upcoming KHS annual meeting.

*Report of the KHS Media and Publicity Chairperson*

Robin Oldham will continue to provide press releases about field trips, the annual meeting, and other KHS news to Joe Collins for distribution to media and educational outlets.

*Report of the KHS Nominating Committee Chairperson*

Joe Collins reported that the KHS Nominating Committee has not yet met. He was pleased to announce that Eric Kessler and Mary Kate Baldwin will both stand for reelection for 2010.

*Report of the KHS Awards Committee Chairperson*

Joe Collins reported for Dan Fogell. Dan asked that an effort be made to get more applications for the Alan H. Kamb Grant and Gloyd-Taylor Scholarship. Robin offered to prepare press announcements about the awards for Joe to send to the media.

*KHS Budget Commitments for 2009*

|                                       |           |
|---------------------------------------|-----------|
| Journal of Kansas Herpetology .....   | \$2400.00 |
| Annual Meeting.....                   | \$1000.00 |
| Annual Meeting Contingency Fund ..... | \$400.00  |
| Field Trip Expenses .....             | \$200.00  |
| Peoples Choice Award .....            | \$100.00  |
| Total.....                            | \$4100.00 |

It was moved and second (S.Collins/J.Collins) to approve the KHS 2009 budget commitments as proposed. Motion passed unanimously.

*New Business*

KHS member Dan Krull wishes to make a short documentary film about the KHS and its programs. He has a non-profit company that prepares educational documentaries. The KHS film would be 5-10 minutes in length and would consist of interviews with KHS members on Society-sponsored field trips. The goal of the film would be to introduce KHS to a larger audience and let them know who we are, what we do, and our educational goals. The film could be linked to the KHS website and other venues. Dan could also show it at the KHS Annual Meeting.

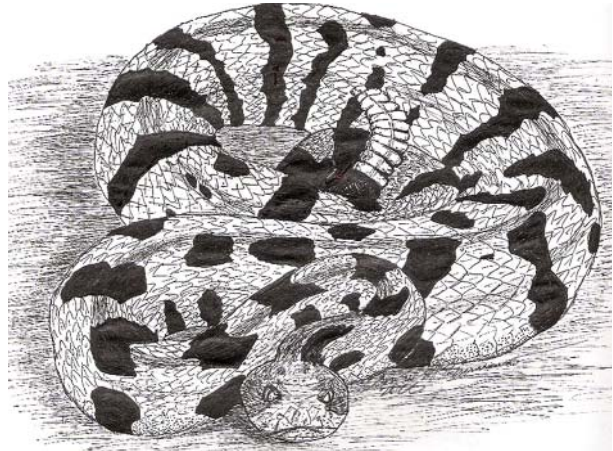
Joe Collins indicated that KHS member Andy Durbin wants to make a longer film about the KHS. Dan Krull stated he will share his film with Andy. KHS member Tag Oldham is also preparing a short film about the Society for a science project. Dan Krull will interview him.

It was moved and seconded (Ellis/J.Collins) to endorse Dan Krull's film proposal. Motion approved unanimously.

The next KHS Executive Council meeting will be the first weekend in October at the Society Fall Field Trip.

Meeting was adjourned at 4:20 pm.

*Respectfully submitted,*  
Suzanne Collins  
23 February 2009



Dan Murrow

KANSAS HERPETOLOGICAL SOCIETY  
*Annual Financial Report 2008*

|                                     |            |
|-------------------------------------|------------|
| Bank Statement 1 January 2008 ..... | \$4,265.41 |
| <u>Income</u>                       |            |
| Membership Dues                     |            |
| <i>Regular</i> .....                | \$1,710.00 |
| <i>Contributing</i> .....           | \$700.00   |
| Total.....                          | \$2,410.00 |
| Annual Meeting                      |            |
| <i>Registration</i> .....           | \$915.00   |
| <i>Auction</i> .....                | \$1,557.00 |
| <i>Sponsors</i> .....               | \$600.00   |
| Total.....                          | \$3,072.00 |
| Sale of KHS Snake Bags.....         | \$410.00   |
| Donations .....                     | \$90.00    |
| Interest from Endowed Funds .....   | \$720.74   |
| Total Income .....                  | \$6,702.74 |

Expenses

|                              |            |
|------------------------------|------------|
| Annual Meeting.....          | \$1,494.00 |
| Cost of KHS Snake Bags ..... | \$500.00   |

|   |            |
|---|------------|
| The Alan H. Kamb Grant.....               | \$300.00   |
| The Gloyd/Taylor Scholarship.....         | \$275.00   |
| Office of the Secretary/Treasurer .....   | \$715.05   |
| Journal of Ks Herpetology (4 issues)..... | \$1,899.00 |
| Office of the Editor (JKH Postage).....   | \$740.00   |
| Field Trip Chairperson .....              | \$100.00   |
| KHS Award Expenses .....                  | \$109.01   |
| Additions to The Kamb Grant .....         | \$200.00   |
| Additions to The G/T Scholarship.....     | \$200.00   |
| Total Expenses .....                      | \$6,532.06 |

Bank Statement 31 December 2008 .....\$4,436.09

Endowed Funds

|                               |             |
|-------------------------------|-------------|
| Alan H. Kamb Grant .....      | \$7,600.00  |
| Gloyd/Taylor Scholarship..... | \$7,200.00  |
| Total in Endowed Funds .....  | \$14,800.00 |

Total Assets.....\$19,236.09

*Respectfully submitted,*  
Mary Kate Baldwin, Secretary  
Eric Kessler, Treasurer



## GEOGRAPHIC DISTRIBUTION

**AMBYSTOMA OPACUM** (Marbled Salamander). Pennsylvania: Dauphin Co: Ned Smith Center for Nature and Art, 176 Water Company Road, Millersburg. 8 October 2008. Walter E. Meshaka, Jr. State Museum of Pennsylvania (SMP-H3242). Verified by Pablo Delis (Shippensburg University). Distribution of this salamander in Pennsylvania is spotty and not continuous (Hulse et al., 2001. *Amphibians and Reptiles of Pennsylvania and the Northeast*. Cornell Univ. Press, Ithaca, New York. 419 pp.) and the species tends to occur east of the Allegheny Front (McCoy, 1982. *Spec. Publ. Carnegie Mus. Nat. Hist.* 6: 1-91). The juvenile specimen (44 mm SVL) was found in mixed deciduous forest under a rock behind the center and across the Wiconisco Creek, represents a new county record, and increases to 17 the number of Pennsylvania counties in which this species is known to occur.

Submitted by **WALTER E. MESHAKA, JR.**, Section of Zoology and Botany, State Museum of Pennsylvania, 300 North Street, Harrisburg, Pennsylvania 17120.

**HOLBROOKIA MACULATA** (Lesser Earless Lizard). Kansas: Smith Co: 39.67486°N, 98.98105°W. 4 October 2008. Eric Kessler. MHP 14196. Verified by Joseph T. Collins. New county record (Collins and Collins, 1993. *Amphibians and Reptiles in Kansas*. Third Edition. University Press of Kansas, Lawrence. xx + 397 pp.).

Submitted by **TRAVIS W. TAGGART**, Sternberg Museum of Natural History, Fort Hays State University, Hays, Kansas 67601.

**PHRYNOSOMA CORNUTUM** (Texas Horned Lizard). Kansas: Smith Co: 39.67486°N, 98.98105°W. 4 October 2008. Travis W. Taggart & Charlie Stieben. MHP 14196. Verified by Curtis J. Schmidt. New county record (Taggart, Collins and Schmidt. 1999–2008 et seq. *Kansas Herpetofaunal Atlas: An On-line Reference*. Electronic Database accessible at <http://webcat.fhsu.edu/ksfauna/herps>. Sternberg Museum of Natural History, Fort Hays State University, Hays, Kansas).

Submitted by **SUZANNE L. COLLINS**, The Center for North American Herpetology, 1502 Medinah Circle, Lawrence, Kansas 66047.

**LAMPROPELTIS GETULA** (Common Kingsnake). Kansas: Smith Co: 39.612189°N, 98.844947°W. 4 October 2008. Chad Whitney. MHP 14201 (see photograph below). Verified by Curtis J. Schmidt. New county record (Collins and Collins, 1993. *Amphibians and Reptiles in Kansas*. Third Edition. University Press of Kansas, Lawrence. xx + 397 pp.).

Submitted by **CHAD WHITNEY**, Sternberg Museum of Natural History, Fort Hays State University, Hays, Kansas 67601.

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An adult specimen (MHP 14201) of the Common Kingsnake (*Lampropeltis getula*) from Smith county, Kansas, collected during the KHS Fall Field Trip on 4 October 2008 by Chad Whitney. Photograph by Suzanne L. Collins.



## NOTES

### NEW RECORDS OF AMPHIBIANS, REPTILES, AND TURTLES IN KANSAS FOR 2008

Joseph T. Collins

Herpetologist  
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*2021 Constant Avenue*  
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Adjunct Curator of Herpetology  
*Sternberg Museum of Natural History*  
*Fort Hays State University*  
*Hays, Kansas 67601*

The nine new county records listed below are those accumulated or brought to my attention since the publication of records for 2007 (Collins, 2008). Publication of these new records permits me to give credit and express my appreciation to the many individuals who collected or obtained specimens and donated them to me for deposition in an institutional collection. Further, recipients of this list are permitted an opportunity to update the range maps and size maxima sections in *Amphibians and Reptiles in Kansas Third Edition* (Collins and Collins, 1993). Finally, these new records represent information that greatly increases our knowledge of the distribution and physical proportions of these creatures in Kansas, and thus gives us a better understanding of their biology. This report is my 34th in a series that has appeared annually since 1976, and the data contained herein eventually will be incorporated into a new forthcoming book, *Amphibians, Reptiles, and Turtles in Kansas*.

The Kansas specimens listed below represent the first records for the given county based on a preserved, cataloged voucher specimen in an institutional collection, or represent size maxima larger than those listed in Collins and Collins (1993). Any information of this nature not backed by a voucher specimen is an unverifiable observation. All new records listed here are presented in the following standardized format: standard common and current scientific name, county, specific locality, date of collection, collector(s), and place of deposition and catalog number. New size maxima are presented with the size limits expressed in both metric and English units. Common names are those now standardized for North America, as compiled by Collins & Taggart (2002), and are given at the species level only.

The records listed below are deposited in the herpetological collection of the Sternberg Museum of Natural History, Fort Hays State University, Hays, Kansas (MHP). I am most grateful to the members of the Kansas Herpetological Society, and to the staff of the Kansas Department of Wildlife and Parks and the Kansas Biological Survey, who spent many hours in search of some of the specimens reported herein. Some of the records contained herein resulted from field studies sponsored by funds from the Kansas Department of Wildlife and Parks' Chickadee Check-off Program. Travis W. Taggart and Curtis Schmidt, Sternberg Museum of Natural History, Fort Hays State University, diligently assigned catalog numbers to most of the specimens listed below, and to them I am most indebted.

#### NEW COUNTY RECORDS

***SPEA BOMBIFRONS*** (Plains Spadefoot). KANSAS: Rawlins Co: 39.83997°N, 100.9759°W. 26 June 2008 at 12:56 am. Curtis J. Schmidt, Kendra L. Phelps, and Zachary J. Schwenke. MHP 13963. Verified by Travis W. Taggart. Reported by Schmidt (2008a).

***ANAXYRUS COGNATUS*** (Great Plains Toad). KANSAS: Rawlins Co: 39.82205°N, 100.99972°W. 26 June 2008 at 12:47 am. Curtis J. Schmidt, Kendra L. Phelps, and Zachary J. Schwenke. MHP 13964. Verified by Travis W. Taggart. Reported by Schmidt (2008b).

***GASTROPHRYNE OLIVACEA*** (Great Plains Narrow-mouth Toad). KANSAS: Neosho Co: N°37.558260, W°95.33179. 28 April 2008. Brandon Low and Judy

Low. MHP 13850. Verified by Travis W. Taggart. Reported by Low (2008).

**GASTROPHRYNE OLIVACEA** (Great Plains Narrowmouth Toad) KANSAS: Osage Co: N°38.669944, W°95.618917. 13 May 2008, Nicholas Gomez. MHP 13903. Verified by Travis W. Taggart. Reported by Gomez (2008a).

**LITHOBATES AREOLATUS** (Crawfish Frog) KANSAS: Osage Co: N°38.46151, W°95.87917. 24 March 2007. Travis W. Taggart. MHP 13400–13409. Verified by Joseph T. Collins. Reported by Taggart (2008).

**LITHOBATES CATESBEIANUS** (Bullfrog). KANSAS: Phillips Co: 39.66124°N, 99.12205°W. 17 July 2008. Zachary J. Schwenke. MHP 13970. Verified by Curtis J. Schmidt. Reported by Schwenke (2008).

**PLESTIODON OBSOLETUS** (Great Plains Skink). KANSAS: Rush Co: 6 mi S & 4.5 mi W Albert. N°38.36218, W°99.07357. 16 May 2008. Zachary Mayers. MHP 13830. Verified by Brian C. Bartels and Curtis J. Schmidt. Reported by Mayers (2008).

**THAMNOPHIS PROXIMUS** (Western Ribbon Snake). KANSAS: Jackson Co: N°39.226167, W°95.998444. 21 May 2008. Nicholas Gomez. MHP 13904. Verified by Curtis J. Schmidt. Reported by Gomez (2008b).

**TERRAPENE ORNATA** (Ornate Box Turtle). KANSAS: Neosho Co: N°37.70331, W°95.30188. 28 April 2008. Paul Ingram and Tom Beaver. MHP 13901. Verified by Daniel Murrow. Reported by Beaver and Ingram (2008).

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## EARLY ACTIVITY OF *STORERIA DEKAYI* IN JEFFERSON COUNTY, KANSAS

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Records of snakes emerging early from hibernation are useful for establishing species' potential activity seasons. In discussing the habits of *Storeria dekayi*, Fitch (1999) attributed to this cold-tolerant species an activity season from "as early as mid-March and . . . as late as mid-November."

On 10 February 2009 at 1400hrs CST, we collected 9 *Storeria dekayi* (6 adult, m:f=4:2; and, 3 juvenile m:f=2:1) from beneath an artificial shelter tin covering an ant nest (*Formica subsericea*) on the Jefferson County tract described by Pisani 2005. An additional adult escaped. A juvenile male *Thamnophis sirtalis* (257mm SVL) was also collected. Three of the adult male *S. dekayi* were recaptures, having been marked at the same site in late October 2008 by GRP. The nest, which is active, is used as a hibernaculum by several small snake species and at least one juvenile of a moderate-sized one—*T. sirtalis* (Pisani 2009).

The shelter station is part of a series of transects of shelters, and is located in regrown woods 10m from the edge of an extensive CRP grass tract. The snakes were released at site of capture as part of ongoing study of *Virginia valeriae* and sympatric species. A search of neighboring shelter stations 10m south, 20m east and west, as well as 20m, 40m, and 60m north revealed no other reptiles. Nor were any observed under plywood at any of the stations. Air temperatures for the preceding two days had been unseasonably warm, with highs ca. 20°C and lows of ca 4°C. The tin, located as it is in deciduous woodland, receives direct sunlight during mid-day and typically is warmer than ambient; this doubtless is a factor in the early activity observed at the ant nest hibernaculum.

Taggart et al. (2008) include for completeness a very early record of 11 January 1928 for *S. dekayi*

based upon two specimens collected by H.K. Gloyd (MVZ 14884, 14885) from Manhattan (Riley County) Kansas, approximately the latitude of the present study. However, Gloyd's accompanying data indicate that these snakes were "Dug up by construction crew." The snakes we describe here were undisturbed emergents.

Two of the adult *Storeria dekayi* described here eliminated uric acid crystals during handling. No defecations were noted, and no earthworms or other suitable early prey were noted beneath any of the shelters checked. As in previous seasons, ants remained dormant at this time. During the 2007 typical field season, the earliest *S. dekayi* collections were 8 March, and the earliest defecations recorded were 17 March.

*Acknowledgments:* We express thanks to Travis W. Taggart, Sternberg Museum of Natural History, Fort Hays State University, for providing Gloyd's collecting data and for maintaining (with Joseph T. Collins and Curtis J. Schmidt) the Kansas Herpetofaunal Atlas. James Trager (Missouri Botanical Gardens) and Brian Fisher (California Academy of Sciences) provided positive identification of, and information about, the ants during the 2008 field season. For ongoing support and access to KBS/KSR lands and facilities, I thank Ed Martinko (Director) and Jerry Denoyelles (Assistant Director) of KBS/KSR. Ongoing financial support for this work from Kansas Department of Wildlife and Parks Non-Game Program (Ken Brunson, Coordinator) is gratefully acknowledged. Additional funding, directly or indirectly, from the Kansas Biological Survey and Kansas Herpetological Society also is most gratefully acknowledged. R. W. McColl and family graciously donated major funding toward purchase of the site as part of the Suzanne Ecke McColl Nature Reserve (now part of KBS/KSR lands).

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### A NEW MAXIMUM SIZE RECORD FOR *CROTALUS MOLOSSUS* (BAIRD & GIRARD, 1853)

The Blacktail Rattlesnake, *Crotalus molossus*, is a medium-sized serpent, with adults typically measuring 800 to 900 mm in total length (TL) (Price, 1998). The maximum TL of *C. molossus* reportedly ranges from 1257 to 1370 mm (Tennant, 1984; Stebbins, 2003; Boundy, 1995; Hardy and Greene, 1995; Price, 1998; Dixon and Werler, 2005). On 14 June 2008, Dallas and Doug Backer collected a Blacktail Rattlesnake that exceeded the previously reported size maxima for this species. This snake was collected on a private ranch (29°31'20.8"N, 103°23'33.2"W; Musgrave Road, ca. 16 km east of Highway 118) in Brewster County, Texas. The elevation of the collection site is approximately 1020 meters and the vegetation similar to the Lechuguilla-Creosotebush-Cactus Association described by Wauer (1971). The TL of the snake measured 1524 mm, exceeding the previously reported maximum size record (1370 mm) by 154 mm. A voucher photograph (SRSU 6752) of this snake is deposited in the James F. Scudday Vertebrate Collection at Sul Ross State University, Alpine, Texas.

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### ARBOREAL ECDYSIS IN THE EASTERN GARTER SNAKE (*THAMNOPHIS SIRTALIS SIRTALIS*)

Shed skins of *Thamnophis sirtalis sirtalis* are most often found beneath debris or on the ground in open situations (Gray, 2005. The serpent's cast: A guide to the Identification of shed skins from snakes of the Northeast and Mid-Atlantic States. The Center for North American Herpetology Monograph Series Number 1). Herein I report evidence of ecdysis by a *T. s. sirtalis* in an arboreal situation.

On 24 June 2008, at a site in Erie County, Pennsylvania (42.09252°N 80.14201°W [WGS 84]), I found a *T. s. sirtalis* shed skin ca. 31 cm above the ground in a grape vine (*Vitis* sp.). The tail portion of the shed skin was "pointing" upward, indicating that the snake crawled up into the vines during ecdysis. Because the shed skin was not torn, and in a

near complete condition, it is unlikely to have been pulled into the vines by a bird or mammal. *Thamnophis s. sirtalis* is known to be a good climber (Ernst and Ernst, 2003. Snakes of the United States and Canada. Smithsonian Books, Washington, D.C.). However, to my knowledge, this is the first report of this species shedding in an arboreal situation. Mounted sections of the shed skin (BG 532) are in my personal collection; unmounted material has been sent to the Sternberg Museum of Natural History, Fort Hays State University, Hays, Kansas 67601.

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## ARTICLES

### SEASONAL ACTIVITY, REPRODUCTIVE CYCLES, AND GROWTH OF THE BRONZE FROG (*LITHOBATES CLAMITANS CLAMITANS*) IN NORTHERN LOUISIANA: THE LONG AND SHORT OF IT

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*Abstract:* We examined the seasonal activity, reproduction, and growth of the Bronze Frog (*Lithobates clamitans clamitans*) from northern Louisiana using 404 museum specimens, calling data, and mark-recapture data. We found longer activity and breeding seasons and earlier ages to sexual maturity than have been reported for northern populations of the Green Frog (*L. c. melanotus*). We also found smaller body sizes at larval transformation and among sexually mature individuals than northern populations, which corroborated earlier findings of this southern form. Our findings underscored the importance of region-specific life history data for species management and also identified biologically meaningful differences in this southern form of a geographically widespread polytypic species.

#### Introduction

The Bronze Frog, *Lithobates clamitans clamitans* (Latreille, 1801), is one of two recognized subspecies of the eastern North American Bronze Frog, *L. clamitans* (Latreille, 1801). Occurring in the Southeast, the Bronze Frog intergrades with the Green Frog, *L. c. melanotus* (Rafinesque, 1820) along the fall line in Georgia and Alabama. The Green Frog, in turn, replaces the Bronze Frog northward to southeastern Canada (Conant and Collins, 1998; Pauley and Lannoo, 2005). Less attention has been paid to the Bronze Frog in the literature than its nearest relative despite the ubiquity of this species in generally lentic aquatic systems in the South. We undertook this study to test earlier findings of small body size

of metamorphoslings (Wright and Wright, 1949) and adults (Wright and Wright, 1949; Mecham, 1954) of the Bronze Frog and to compare activity, reproduction, and growth of this form with northern populations of *L. c. melanotus*, whose seasonal activity is curtailed by the constraints of a north temperate climate.

#### Materials and Methods

Specimens (n = 404) of Bronze Frogs (*Lithobates clamitans clamitans*) collected during 1925-2001 from northern Louisiana (Figure 1) were examined from the holdings of the Carnegie Museum of Natural History, Illinois Natural History Survey, Louisiana State University, Northwestern State University, Tulane University, University of Colorado, Field Museum of Natural Histo-

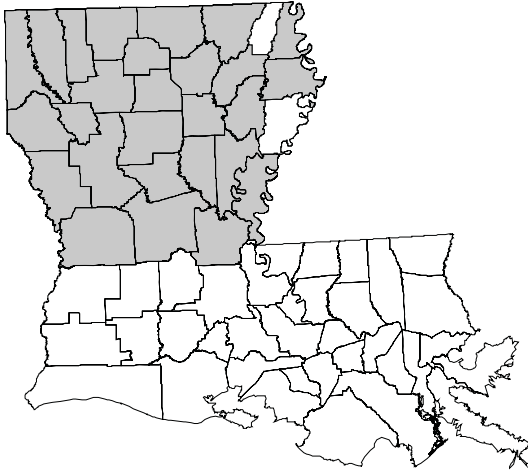


Figure 1. Louisiana parishes from which museum specimens of Bronze Frogs (*Lithobates c. clamitans*) were examined in this study.

ry, University of Kansas, and University of Oklahoma. Body lengths of all size-classes and of tadpoles were measured in mm snout-vent length (mm SVL).

Sexual maturity was determined in males using a slightly modified version of the technique by Martof (1956a), whereby the ratio of tympanum diameter: body size corresponded to enlarged testis, which signified sexual maturity. Martof (1956a) noted that the tympana generally were “nearly or quite round.” For most frogs, Martof (1956a) measured the antero-posterior diameter of the left tympanum. If irregular in shape, the right tympanum was measured. If both were misshapen, Martof (1956a) took the average of the antero-posterior and dorso-ventral measurements. Irregularly shaped tympana from our sample were greater in length than in height. For consistency, we measured the dorso-ventral diameter of the left tympanum and used the right tympanum only if the left one appeared to have been damaged in some way. As per Martof (1956a), sex index = body length/ tympanum diameter. The sex index was generally below 10 for sexually mature males (Martof, 1956a).

Another secondary sexual characteristic, enlarged thumbs, was not easily ascertained. The yellow throat of mature males, which easily fades to varying degrees in preservative, was not apparent. The length and width of the left testis as a percent of the body size was used to measure seasonal differences in testis dimensions.

Sexually mature females were associated with one of four ovarian stages. In the first ovarian stage oviducts were thin and just beginning to coil, and the ovaries are somewhat opaque. In the second ovarian stage, the oviducts were larger and more coiled, and the ovaries contained some pigmented oocytes. In

the third ovarian stage, oviducts were thick and heavily coiled, and the ovaries were in various stages of clutch development. In the fourth ovarian stage, oviducts were thick and heavily coiled, and the ovaries were full of polarized ova with few non-polarized ova, signifying a fully ripened clutch or gravid female (Meshaka, 2001). Fat body development was scored as absent, intermediate in volume in the body cavity, or extensive development that extended antero-posteriorly in the body cavity. The latter amount was used as an estimation of the monthly incidence of adult females containing extensive fat reserves. A subset of females was examined for clutch characteristics. Clutches were removed, patted on paper towel to remove excess moisture, a subset of ova was weighed on an electronic scale, and that mass was extrapolated to estimate clutch size. From each clutch, the diameters of 10 ova were measured using an ocular micrometer; the largest ovum was used in comparative relationships with clutch size and female body size.

Tadpoles were scored as per Gosner (1960). For practical purposes, tadpoles were in categories of having poorly developed hind legs (less than Gosner stage 37) or well-developed hind legs (Gosner stage of at least 37). Metamorphosing were distinguished from tadpoles by the presence of forelimbs (Gosner stage 42) and distinguished from juveniles by the presence of a tail. Means were followed by +2 standard deviations, and significance was recognized at  $P < 0.05$ .

Data from the Louisiana Amphibian Monitoring Program at Cotton Valley route, Webster Parish, during 1998–2008 and the Koran route, Bossier Parish, during 1998–2006 were used to determine calling season in the northwestern region of Louisiana. The NAAMP protocols dictate three runs per year during three sampling windows of six weeks each. The north Louisiana windows began on 27 January and ended 7 July. Unpublished data were collected on movements of Bronze Frogs to, from, and within a breeding pond at the Walter B. Jacobs Memorial Nature Park in Caddo Parish during November 1979–August 1984. Methodology, detailed by Raymond and Hardy (1990) in their demographic study of the Mole Salamander (*Ambystoma talpoideum*), made use of funnel traps along a drift fence that encircled the pond to capture incoming and outgoing frogs as well as movements within the pond using minnow traps located in the pond itself. We used those data to determine the extent of the egg-laying season.

## Results

Seasonal activity.— Bronze Frogs from northern Louisiana were collected in every month of the year

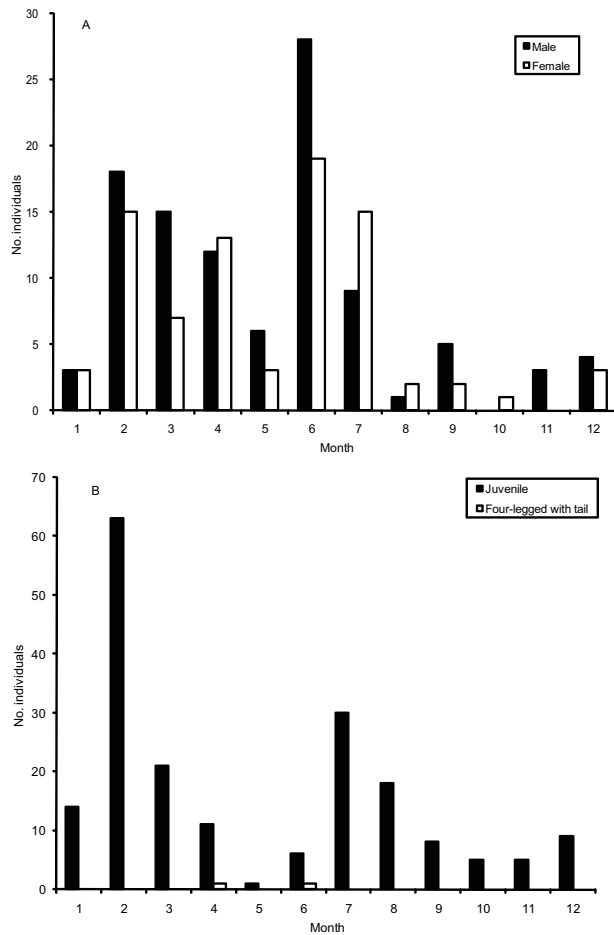


Figure 2. Seasonal incidence of captures of 380 Bronze Frogs (*Lithobates c. clamitans*) from northern Louisiana. A = adults, B = juveniles and metamorphoslings.

(Figure 2). The highest incidence of captures occurred during February–July and was followed by a rapid decline thereafter (Figure 2). However, within the February–July interval, a noticeable decrease occurred in captures of adults (Figure 2A). In the case of juveniles, February and July peaks in captures were followed by decreases thereafter (Figure 2B), perhaps relating to winter-spring emergence of overwintering tadpoles followed by summer-fall emergence of young produced from that same year’s clutches.

Movements of adult Bronze Frogs to and from a breeding pond were monitored for five years at the Walter B. Jacobs Memorial Nature Park in Caddo Parish of northwestern Louisiana. During this period, movements to the pond occurred during 12 April–3 September, with most movements during May–July. In turn, movements from the pond occurred during 3 May–18 September. Bronze Frogs were captured in minnow traps during 10 May–8 September.

Seasonal changes in testis size.— Measured as a percentage of male Bronze Frog body size, both

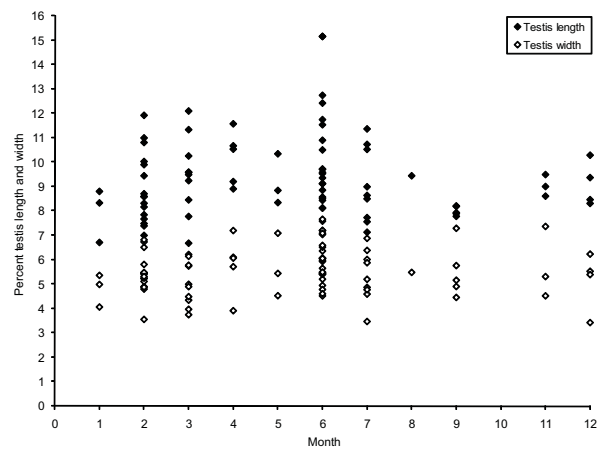


Figure 3. Monthly distribution of testis size of 82 Bronze Frogs (*Lithobates c. clamitans*) from northern Louisiana.

testis length and width were largest in June (Figure 3). More noticeable in the testis length, testis size decreased rapidly thereafter until fall at which time testis size began to increase once again into the following summer (Figure 3).

Calling.— Systematic calling surveys for Bronze Frogs were conducted from 27 January–7 July in Bossier Parish (1998–2006) and in the adjoining Webster Parish (1998–2008) in extreme northwestern Louisiana. At both sites, calling was heard during April–July (Figure 4). However, in Bossier Parish, three calling records were from March (Figure 4), the earliest of which was 2 March 2005.

Ovarian cycle.— Gravid (stage 4) or yolking-nearly gravid (stage 3) female Bronze Frogs were evident during February–September (Figure 5). During this period, the incidence of quiescent (stage 1) females decreased concomitant with an increase in the inci-

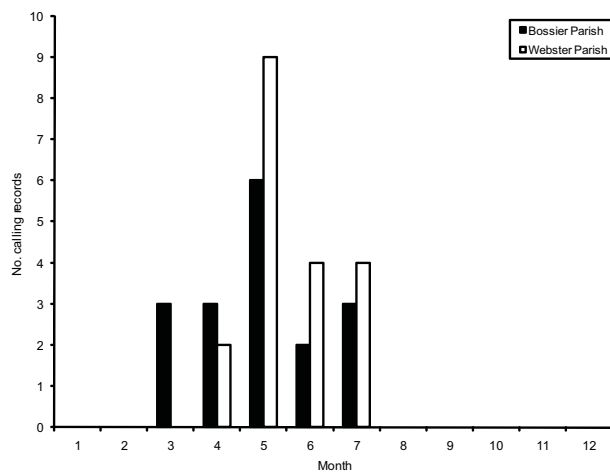


Figure 4. Monthly distribution of calls of male Bronze Frogs (*Lithobates c. clamitans*) from two sites in northwestern Louisiana.

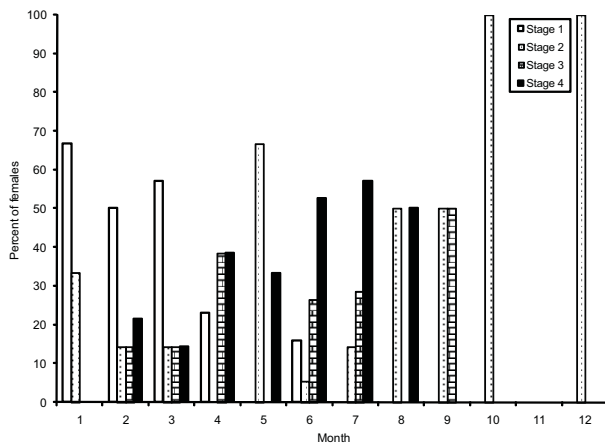


Figure 5. The annual ovarian cycle of 81 Bronze Frogs (*Lithobates c. clamitans*) from northern Louisiana.

dence of gravid females, with the highest incidence of gravid females having been found during June–August (Figure 5). Too few females were available in October ( $n = 1$ ), November ( $n = 0$ ), December ( $n = 3$ ), and January ( $n = 3$ ) to determine the full extent of the gravid season, although in light of the ovarian stages in September, it seemed likely that gravid females would have been present in September. Stage II females were present in each of the 11 months for which we had captures (Figure 5).

Female fat cycle and the presence of food.— The extent to which fat bodies were well-developed in female Bronze Frogs varied across the months, whereby winter stores of fat were gradually depleted in early summer (Figure 6). It was during this time that the highest numbers of gravid females began to appear (Figure 5). In turn, more gravid females were

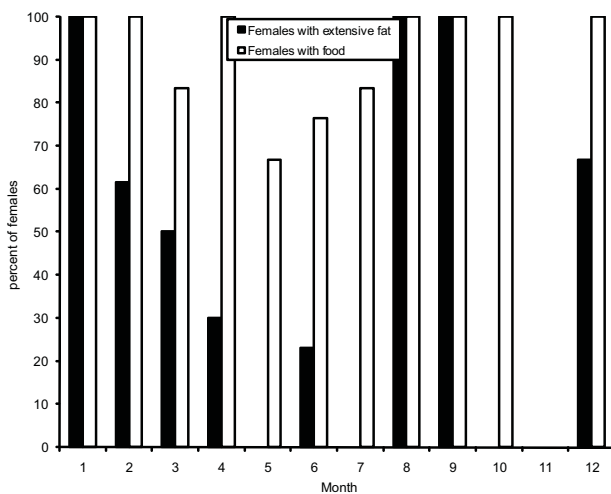


Figure 6. Monthly frequency of extensive fat ( $n = 65$ ) and the presence of food ( $n = 61$ ) in female Bronze Frogs (*Lithobates c. clamitans*) from northern Louisiana.

depleted of their fat compared to their non-gravid counterparts (Figure 7).

The incidence of Bronze Frog females containing food in their stomachs was relatively high through the year (Figure 6). May and June showed the lowest incidence of female stomachs containing food, perhaps having been a response to the enormity of body cavity space taken up by clutches. In that regard, the lowest incidence of stomachs containing food among females occurred in gravid individuals (Figure 7).

Clutch characteristics.— Mean clutch size of the Bronze Frog from northern Louisiana was estimated

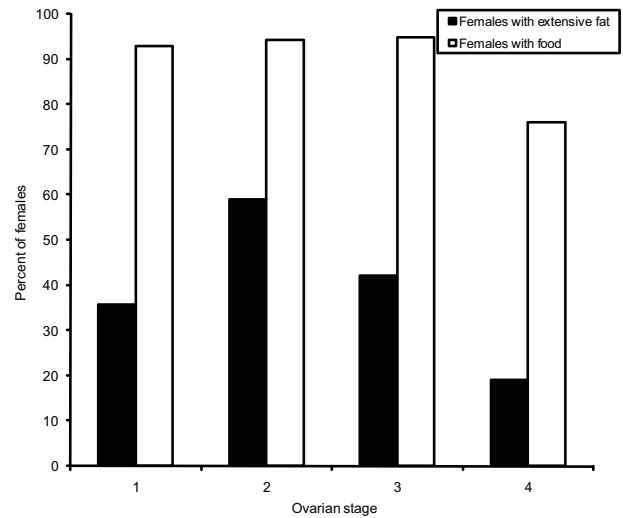


Figure 7. Frequency of extensive fat ( $n = 71$ ) and the presence of food ( $n = 75$ ) in each of the four ovarian stages of female Bronze Frogs (*Lithobates c. clamitans*) from northern Louisiana.

to be  $2550 \pm 873$  eggs (range = 1600–4200;  $n = 9$ ). Mean ovum diameter from these clutches measured  $1.68 \pm 0.15$ ; range = 1.3–2.0;  $n = 90$ ). In northern Louisiana, clutch size positively co-varied with female body size (mean =  $76.0 \pm 4.7$  mm SVL; range = 66.7–82.1;  $n = 9$ ; Figure 8); however, no significant association ( $P > 0.05$ ) was detected between ovum diameter and female body size or with clutch size.

Growth and sexual maturity.— The length of the larval period for Bronze Frogs in northern Louisiana could only be estimated for summer by examination of size class-distributions of the tadpoles in July and August (Figure 9). We assumed that the smallest individual (4 mm SVL) captured on 27 July had hatched that month. The four individuals captured on 4 August (8.9–14.2 mm SVL) were thought to represent the next month's growth. The largest tadpole of that month measured 21.4 mm SVL and had well-developed hind legs. It was also captured on 4 August and probably represented a separate size-class, such that

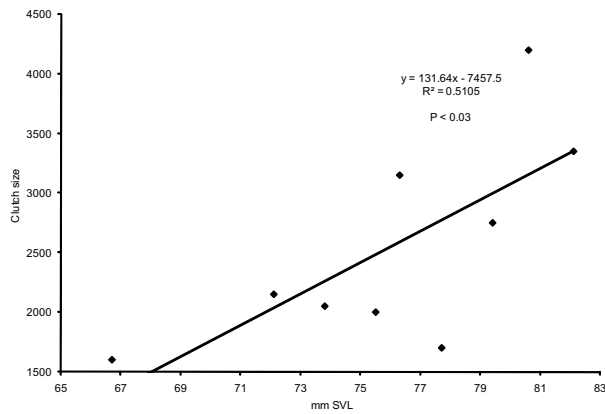


Figure 8. The relationship between clutch size and body size in mm SVL of nine female Bronze Frogs (*Lithobates c. clamitans*) from northern Louisiana.

a tadpole born in late July would have transformed sometime in September.

The monthly distribution of Bronze Frog body sizes from northern Louisiana was indicative of an extended, if not continuous, annual production of metamorphoslings (Figure 9). Captures of metamorphoslings from the pond at the Walter B. Jacobs Memorial Nature Park occurred during 23 May 1980–1 November 1981. A very small juvenile was also trapped on 20 November 1982.

Bronze Frog body size at transformation was small. Two metamorphoslings with tails measured 21.2 and 32.4 mm SVL, and the smallest juvenile measured 19.0 mm SVL (Figure 9). For 104 individuals with 19.0–32.4 mm SVL, mean body size was  $27.3 \pm 3.07$  mm SVL. From these data, growth trajectories from the monthly distribution of body size indicated that male Bronze Frogs reached sexual maturity in three months of post-metamorphic age at 40.7 mm SVL (Figure 9). Five months beyond reaching sexual maturity, males attained their mean body size of  $61.0 \pm 10.1$

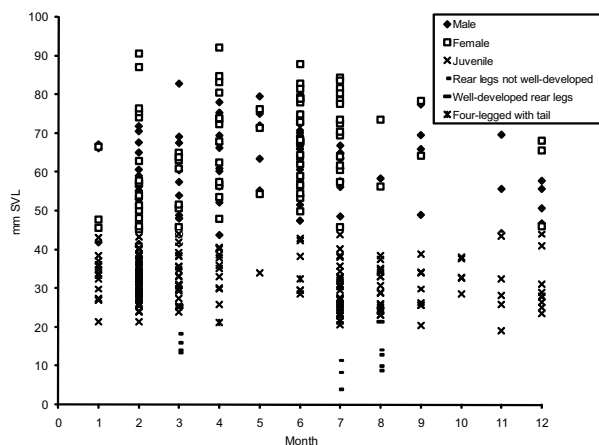


Figure 9. Monthly distribution of body sizes of 404 Bronze Frogs (*Lithobates c. clamitans*) from northern Louisiana.

mm SVL (range = 40.7–82.8;  $n = 106$ ).

Mean sex index (body length/tympanum) for 106 male Bronze Frogs was  $7.8 \pm 0.97$  mm (range = 6.1–10.4). Values exceeding 10 were found in two males: 47.0 mm SVL (10.4), 59 mm SVL (10.2). The sex index negatively co-varied with male body size (Figure 10) because tympanum diameter, which co-varied with the body size of adult males (Figure 11), was relatively larger in large males.

Female Bronze Frogs from northern Louisiana

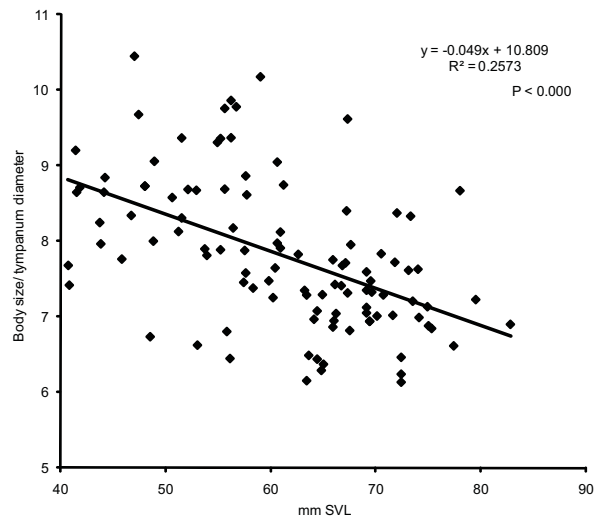


Figure 10. The relationship between sex index and body size of 106 male Bronze Frogs (*Lithobates c. clamitans*) from northern Louisiana.

reached sexual maturity in as few as four months after metamorphosis at 45.5 mm SVL ( $n = 21$ ; ovarian stage I) or 45.2 mm SVL ( $n = 17$ ; ovarian stage II; Figure 9). The smallest females bearing substantial clutch development (ovarian stage III) reached sexual maturity at seven months after metamorphosis at 56.7 mm SVL ( $n = 20$ ; Figure 9). The smallest gravid females (ovarian stage IV) reached sexual maturity at eight months after metamorphosis at 60.1 mm SVL ( $n = 20$ ; Figure 9). Mean body size for all sexually mature females was reached at approximately 10 months after metamorphosis at  $66.4 \pm 12.3$  mm SVL ( $n = 87$ ) and was significantly larger than that of males ( $F = 0.668$ ;  $P < 0.02$ ;  $T = -3.276$ ;  $df = 165$ ;  $P < 0.001$ ). Gravid females ( $77.4 \pm 7.3$  mm SVL; range = 60.6–87.9;  $n = 29$ ) were significantly larger ( $F = 0.325$ ;  $P < 0.001$ ;  $T = 4.825$ ;  $df = 83$ ;  $P < 0.000$ ) than all other females of a combined sample ( $62.9 \pm 12.9$  mm SVL; range = 45.2–92.2;  $n = 58$ ).

## Discussion

The Bronze Frog is a geographically variable species within which two subspecies are recognized; the



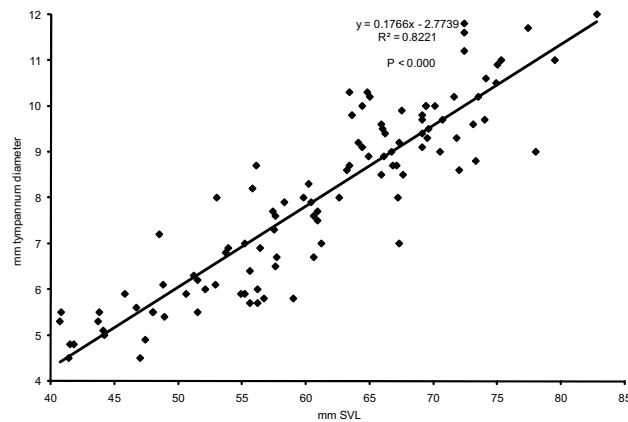


Figure 11. The relationship between tympanum diameter and body size of 106 male Bronze Frogs (*Lithobates c. clamitans*) from northern Louisiana.

Bronze Frog and the Green Frog (Conant and Collins, 1998). Besides differences in color pattern (Mecham, 1954), body size differences are apparent between the two forms with the southern nominate form being smaller in body size than its larger northern relative (Wright and Wright, 1949; Mecham, 1954). Body size at transformation was also shown to be smaller in southern populations (Wright and Wright, 1949).

Our study provided life history data on the lesser studied southern subspecies (*Lithobates clamitans clamitans*) in comparison to the northern race (*L. c. melanotus*). Compared to the northern race, the activity versus maturation and body sizes of our southern sample (from north Louisiana) provided the long and short of it, respectively (Table 1, 2). Continuous activity of the southern sample contrasted with shorter active seasons of the northern sample (Table 1). In the north, *L. c. melanotus* was reported to breed from the end of May to mid-August, whereas southern populations were described as late breeders (Wright and Wright, 1949). Pauley and Lannoo (2005) corroborated the presence of latitudinal differences in an otherwise extended breeding season in *L. c. melanotus*. To that end, breeding seasons were shorter in the north than in the south (Table 2). In Louisiana, calling was heard during mid-March–early September (Table 1; Dundee and Rossman, 1989), and eggs and/or tadpoles were to be expected throughout the year (Dundee and Rossman, 1989). Enlarged testes as early as February and the presence of gravid females for at least seven months, and probably eight months, having peaked during April–August, were both suggestive of a longer opportunity to reproduce than northern populations. In northwestern Louisiana, males were heard calling during March–July, and movements by adults to the Caddo Parish pond began in April and all subsequent movements ended in September. These two measures of reproductive

activity were indicative of a March–September breeding season, which was longer than those reported for northern populations (Table 2).

Data on clutch characteristics are rare for both the Bronze Frog and Green Frog. The mean and maximum values clutch size estimates from northern Louisiana were smaller than the 4924 eggs (73.8 mm SVL) and 5730 eggs (72.7 mm SVL) reported for this form from Arkansas (Trauth et al., 2004). Our conclusions are limited on this matter; however, the mean value of female body size from which we calculated clutch size was large, and females of similar body sizes than those measured by Trauth et al. (2004) contained much smaller clutches. In Michigan, Martof (1956b) estimated clutch size (3800, 4100, 4300 eggs) for three females of unreported body size. Thus, it remains unknown if per unit body size Bronze Frogs from northern Louisiana produced smaller clutches than northern populations of the Green Frog. However, the strong relationship between clutch size and female body size and overall smaller female body size of our sample are suggestive of clutch size reduction in the southern population. We also do not know if seasonal differences in clutch size were apparent in our sample, whose first clutches would have had the benefit of being produced in large part from fat reserve.

Table 2. Geographic variation in breeding seasons of the Bronze Frog (*Lithobates c. clamitans*) in the United States arranged from the south (top) to the north (bottom).

| Location  | Breeding Season     |
|---|---------------------|
| Florida (Carr, 1940) .....                          | April–August        |
| Northern Louisiana (this study).....                | March–September     |
| Louisiana (Dundee and Rossman, 1989).....           | March–September     |
| Alabama (Mount, 1975).....                          | April–September     |
| Georgia (Wright, 1931) .....                        | April–August (call) |
| Georgia (Wright, 1931) .....                        | June–August (eggs)  |
| Kansas (Collins, 1993) .....                        | April–June          |
| Missouri (Johnson, 1987) .....                      | April–August        |
| Kentucky (Barbour, 1971).....                       | May–August          |
| West Virginia, south (Pauley and Barron, 1995)..... | April–July          |
| West Virginia, north (Rogers, 1999) .....           | June–August         |
| Maryland (Lee, 1973) .....                          | May–July            |
| Delaware (Lee, 1973).....                           | May–July            |
| Illinois (Smith, 1961).....                         | May–September       |
| Indiana (Minton, 2001).....                         | May–July            |
| Ohio (Walker, 1946).....                            | May–July            |
| Pennsylvania (Hulse et al., 2001).....              | April–August        |
| Michigan (Martof, 1956b).....                       | May–August          |
| Minnesota (Breckenridge, 1944) .....                | May–August          |
| Southern New England (Klemens, 1993) .....          | May–July            |
| Maine (Hunter et al., 1992, 1999).....              | May–August          |

Table 1. Geographic variation in life history traits of the Bronze Frog (*Lithobates c. clamitans*) in the United States.

| Parameters  | Northern La<br>(this study) | Louisiana<br>Dundee &<br>Rossman 1989 | Georgia<br>Wright<br>1931            | S. New England<br>Klemens<br>1993 | Indiana<br>Minton<br>2001 | Michigan<br>Martof<br>1956a,b  | Penn<br>Hulse<br>et al. 2001 |
|---|-----------------------------|---------------------------------------|--------------------------------------|-----------------------------------|---------------------------|--------------------------------|------------------------------|
| Active season   | Continuous                  |                                       | Apr (?)<br>–Sept (?)                 | Mar–Nov                           | 6 Mar<br>–2 Dec           | last wk Mar–<br>first half Nov | Mar–Oct/<br>early Nov        |
| Breeding season                                       | Feb–Sep                     | mid-Mar<br>–early Sep                 | Apr–Aug call<br>2 Jun–10 Aug<br>eggs | May–Jul                           | mid-May<br>–most of Jul   | mid-May<br>–mid-Jul            | Apr–Aug                      |
| Male age at sexual maturity since metamorphosis       | 3 months                    | –                                     | 2 years                              | –                                 | –                         | 1 year                         | 1 year                       |
| Female age at sexual maturity since metamorphosis     | 4 months                    | –                                     | 2 years                              | –                                 | –                         | 1 year                         | 1 year                       |
| Meta-morphosing mean and range of body size in mm SVL | 27.3<br>(19.0–32.4)         | –                                     | 25<br>(20–23)                        | –                                 | –                         | 32.6<br>(28.4–36.3)            | –                            |
| Male mean and range of adult body size in mm SVL      | 61.0<br>(40.7–82.8)         | –                                     | 52–72                                | 68.8<br>(52–84)                   | 72<br>(60.0–84.5)         | 79.8<br>(60–103)               | 86.1<br>(60–95)              |
| Female mean and range of adult body size in mm SVL    | 66.4<br>(45.4–92.2)         | –                                     | 58–75                                | 64.8<br>(52–94)                   | 76.3<br>(64–88)           | 80.3<br>(65.7–105)             | 85.5<br>(70–94)              |

The length of the larval period of north Louisiana Bronze Frogs could only be roughly estimated from our data. The smallest size-class in July followed by two separate and larger size classes in August were suggestive of a summer larval period that barely extended beyond two months. This estimation is near the lower end of a 70–85 day larval period of tadpoles of early-breeding Green Frogs in a Michigan population (Martof, 1956a). Dundee and Rossman (1989) considered that range to be plausible in Louisiana and also thought that tadpoles might over-winter. We do not know if Bronze Frog tadpoles over-wintered in northern Louisiana. One explanation of the initial movements to the pond (12 April 1980) and the first metamorphosing juvenile captured at the pond (23 May 1980) is that larval periods could actually have been as short as 41 days. Alternatively, this metamor-

phosing juvenile could have been the product of the previous year's clutch at least as late as September, which would yield an eight month larval period, shorter than the 335–360 larval period experienced by tadpoles of late-breeding Green Frogs in Michigan (Martof, 1956a). The capture of a small individual with no tail on 20 November 1982 could have been produced from a September clutch or one earlier than that. Mark-recapture will be needed to discern if the ca. 21 mm SVL juveniles and metamorphoslings collected during winter-spring represented delayed emergence (over-wintering) or simply less growth after the larval period.

Regardless of whether or not Bronze Frogs in northern Louisiana over-winter as tadpoles, larval transformation of the Bronze Frog in this region occurred during more months of the year than in north-

ern populations of the Green Frog. For example, in northern Louisiana, metamorphosing juveniles were apparent throughout the year and captured during May–November, and in the Okefinokee Swamp of southeastern Georgia larval transformation occurred during April–September (Wright, 1931). In Michigan, early clutches produced metamorphosing juveniles during 3 August–28 September, whereas clutches laid after about 25 June–10 July did not transform until the following dates of 5 June–12 July (Martof, 1956a)

Body sizes of metamorphosing Bronze Frog juveniles, like those from southeastern Georgia, were smaller than those from Michigan (Table 1). Likewise, the post-metamorphic age at which northern Louisiana Bronze Frogs reached sexual maturity was shorter than northern populations (Table 1). Excluding winter, both sexes of Michigan Green Frogs required nearly nine growing months to reach sexual maturity as compared to the three (males) and four (females) months necessary for continuously active northern Louisiana Bronze Frogs. Recently-matured Bronze Frogs from northern Louisiana could have then begun breeding within the same season, whereas Green Frogs from Michigan generally became sexually active the following year (Martof, 1956a). In Ithaca, New York, Green Frogs that transformed by late June at ca. 31 mm SVL or larger were capable of breeding one year later, whereas those transforming after late June or at smaller body sizes were sexually mature one year later but had to wait until the season after that for an opportunity to reproduce (Ryan, 1953).

Interestingly, the time needed for the Bronze Frog to reach sexual maturity in southeastern Georgia was twice that of Michigan (Table 1). In light of the other similarities between Wright's (1931) finding and ours, we wonder if perhaps a larger sample from the Okefinokee would provide a sufficient test of what appears to be an unusually long delay to maturity.

For both sexes of the Bronze Frog in northern Louisiana, small metamorphosing juveniles quickly grew to reach sexual maturity at body sizes that were smaller than those of northern populations (Table 1). Among females, this finding held true even in comparing the smallest yolking female and gravid female from northern Louisiana to the smallest gravid female (65.7 mm SVL) in Michigan (Martof, 1956a). Martof (1956a) thought that females probably reached sexual maturity at sizes similar to males (58.6 mm SVL) but required more time for their gametes to ripen. Exceptionally, the smallest adult female examined by Wright (1931) was larger than that of a southern New England sample measured by Klemens (1993) (Table 1).

Subsequent growth of either sex of Bronze Frogs from northern Louisiana occurred quickly to mean

body sizes that were smaller than those of northern populations. In all but one case, the maximum body size attained in northern Louisiana was smaller than that reported in northern populations (Table 1). Maximum values reported for southeastern Georgia were smaller than for all other reported values (Table 1).

Between sexes of adults from northern Louisiana, male Bronze Frogs were smaller in minimum, maximum, and mean body size than females. Elsewhere, males were also sexually mature at smaller body sizes than females, but, with the exception of southern New England (Klemens, 1993), mean and adult body sizes were similar between the sexes (Table 1). Across sites, females tended to reach larger maximum body sizes than males (Table 1).

As in a Michigan population (Martof, 1956a), adult male Bronze Frogs from northern Louisiana could be identified by a sex index (male body size/male tympanum diameter) value that was generally below 10. In Michigan, the mean sex index was 8.3 (range = 6.7–10.2) for all males, and was 7.7 for males at breeding ponds (Martof, 1956a). The sex index from our sample closely approximated that of Martof's (1956a) value for breeding pond males. Also, like Martof (1956a), we found that although tympanum size increased with male body size, it did so at a rate that was disproportionate to the body size of the male. Consequently, the sex index was smallest among the largest males because the tympanum was relatively larger in large males than in small males.

The similarity of sex indices between our sample and that from Michigan (Martof, 1956a), was likely due either to a disproportional number of large males in our series or a significant difference in the y-intercepts of the tympanum diameter-body size relationship between northern Louisiana and Michigan.

Our results corroborated observed trends of a later (Wright and Wright, 1949) and longer (Dundee and Rossman, 1989) breeding season and in reduced body size of adults (Wright and Wright, 1949; Mecham, 1954) and metamorphosings (Wright and Wright, 1949) in the southern form. To these findings we add longer activity and larval transformation seasons, and shorter age to sexual maturity and first breeding. Such is the long and short of it. These biologically meaningful differences in life history traits are useful in species management plans with respect to productivity and are useful in evaluating the variation associated with geographically widespread species which, in this case, is a regionally distinct form with distinctive life history traits.

*Acknowledgments:* This study would not have been possible without the commitment of the aforementioned institutions to collect and preserve amphib-

ians, turtles, and reptiles or without the willingness and time taken by institutional staff to pack and ship these specimens for study. To that end, we wish to especially extend our gratitude to Harold A. Dundee for his single-handed efforts in packing and shipping an enormous lot of Bronze Frogs from the Tulane University collection.

In addition, on 8 July 2004 one of the authors (WEM) made the first email research request ever sent out by *The Center for North American Herpetology*. It asked for information on the life history traits of *Lithobates clamitans*. The response was overwhelming and because of the tremendous amount of data received through that CNAH request, this paper is the first of hopefully many that will address the biology of this fascinating frog.

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