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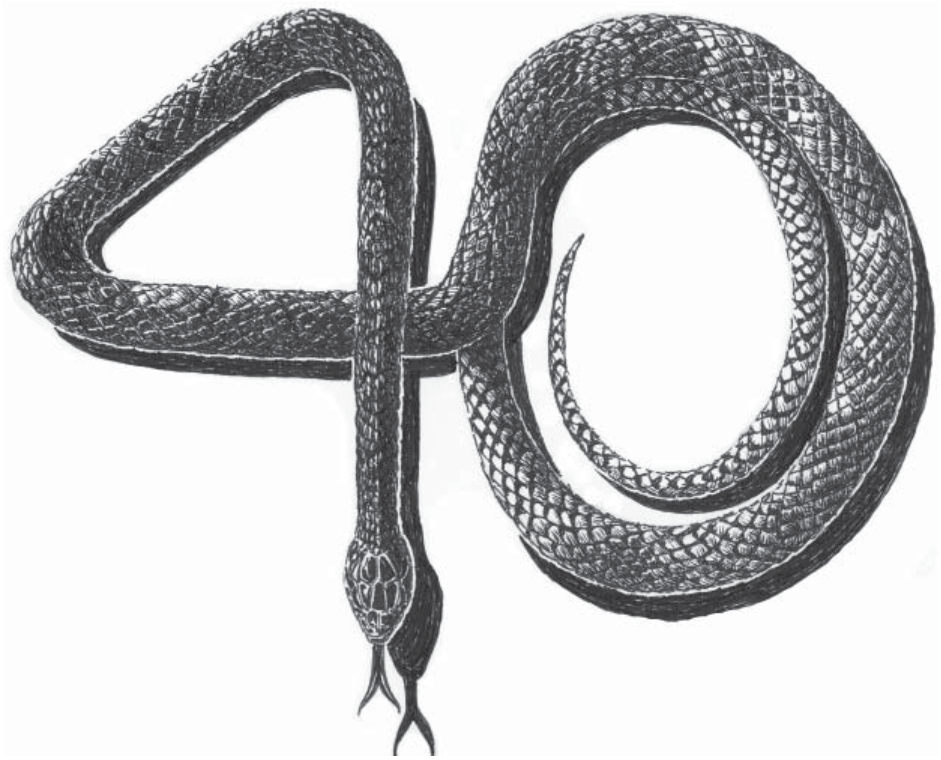
Collinsorum

THE JOURNAL OF KANSAS HERPETOLOGY

Volume 2, Number 1/2 March/June 2013

Celebrating the 40th Anniversary of the Kansas Herpetological Society



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Kansas Herpetological Society

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Front Cover: Original line drawing by John Lokke, Wichita Kansas.

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TABLE OF CONTENTS

LETTER FROM THE EDITOR

Dear KHS Members,

Let me begin by giving my sincerest apologies for the lack of a journal over the last several months. I understand the frustrations felt by many members, as I have been fielding several questions relating to the future of Collinsorum and KHS as a whole. Please allow me to give some explanations for some of the “growing pains” that we are experiencing after the loss of our founder, Associate Editor, and major contributor, Joe Collins.

When Travis Taggart stepped down as Journal Editor, Joe and Travis asked me to become the new Editor. I was rather hesitant because of my inexperience, but in our subsequent discussions, Joe was clear that the publication of the journal was more than a one-man process. He then convinced me to jump on board as Editor, with himself and Travis as Associate Editors to help with the production of the journal. Each of us would have our specific roles, with the hopes that someday I would be proficient and comfortable enough to assume all responsibilities on my own.

When Joe passed away, we lost a major cog in the wheel. We have since had to re-evaluate the duties of the editorial staff and more forward. This transition probably has taken longer than it should have, but we assure you that we are ironing out the kinks and will soon get back to regular publication. However, further compounding the problem is the fact that much of the material in the previous journals was written by Joe, Travis, or myself. This has resulted in a lack of material to fill the space of a quarterly journal.

I ask the KHS membership to continue to have confidence in the maintenance and growth of the society and to be supportive as we move forward. It will take time to get back to the way it used to be, but we will get there. We need everyone’s support and everyone’s contributions. We need manuscript submissions, natural history notes, field reports, herp counts, and much more in order to maintain the publication of a journal. The addition of a Kansas Herpetology Facebook page has been great, but we do not want it to compete with the journal as a means of sharing your experiences.

Thank you for your patience and continued support.

Sincerely,

Curtis Schmidt
KHS Editor

KHS BUSINESS

KHS 39TH ANNUAL MEETING HELD IN HAYS

The 39th Annual Meeting of the Kansas Herpetological Society (KHS) was held from 2-4 November 2012 at the Sternberg Museum of Natural History and Fort Hays State University (FHSU) in Hays, Kansas. Participants heard oral presentations about amphibians, reptiles and turtles from herpetologists and students from Kansas and from across the United States. The meeting this year was dedicated to the memory of KHS Founder and Distinguished Life Member Joseph T. Collins, who passed away unexpectedly in January 2012.

Activities began Friday evening with an informal gathering at the Sternberg Museum of Natural History followed by the dedication of the Joseph T. Collins Natural History Library by Sternberg Director Reese Barrick. Throughout the evening and the remainder of the weekend attendees were free to visit the Museum's "Rattlerssss" exhibit – an interpretive display that includes living specimens of 22 rattlesnake species from across the United States. Additionally, museum collection tours were offered to meeting attendees by past and present FHSU students. Participants were also were given the opportunity to compete in a "specimen identification quiz" during which they would try to identify 50 museum specimens that included live and preserved animals, skulls, road-killed specimens, and shed skins. The person or team with the most correct species identifications would receive a copy of *Amphibians, Reptiles, and Turtles in Kansas* by Joseph T. Collins, Suzanne L. Collins, Travis W. Taggart, and Errol D. Hooper at Saturday's Awards Ceremony.

The meeting officially began Saturday at Fort Hays State University with welcomes by KHS President Travis W. Taggart followed by Elmer Finck, Chair of the Department of Biological Sciences at FHSU. The first speaker was KHS member Larry Miller who, in a talk titled 'Recollections from my first dozen years with JTC', reminisced about his companionship with Joe Collins. The mood was somber as Larry recalled his first meeting with Joe and how their friendship grew over the years.

Other presentations during the Saturday morning session included: Daniel D. Fogell (presenting for David A. Chiszar) – Straightness of path during and after the vernal migration in prairie rattlesnakes (*Crotalus viridis viridis*) in eastern Colorado; George Pisani – Redbelly Snakes in Kansas: Finding needles in haystacks without a metal detector; J. Daren Riedle – Home-range and shelter site selection in Sonoran Desert Tortoises; Tom Mathies – Western Fence Lizard at its range limits in the Pacific Northwest: Climatic niche divergence or conservation?; Eva Gann – Thermal Ecology of overwintering snakes in a cave hibernaculum in Johnson County, Missouri; Jason L. Smith – Facultative learning capability of terrestrial Box Turtles using a visual stimulus; and Cameron Young - Snake Count – Citizen Science for Snake Conservation.

After the obligatory KHS Group Photograph by Larry Miller of Kansas Heritage Photography the meeting broke for lunch. Upon returning, attendees were treated to an afternoon of presentations including: Malcolm McCallum - Amphibians, reptiles, turtles, and all vertebrate biodiversity is crashing, and no one cares; Ivan Monagan – The converse of Bergmann's Rule displayed by male Bunchgrass Lizards, *Sceloporus slevini*; Walter E. Meshaka, Jr. – The Green Frog, *Lithobates clamitans melanota* (Rafinesque, 1820), in Canada: Life along the northern edge; Billy J. Pope – Taxonomic affinity of an isolated western *Pseudemys* population: A molecular approach; Felena King-Cooley – Ecology of an urban box turtle population part I: Home range and movements; Simone Johnson – Ecology of an urban box turtle population part II: Population structure; Kelly J. Irwin – The status of the Ozark Hellbender in Arkansas; Lisa Prowant – Inferring species distributions of herpetofauna in south-central Kansas for conservation planning; Adam Rusk – An analysis of habitat use among four lizards in south-central Kansas; Kasandra Brown – Sexual dimorphism among populations of the Texas Horned Lizard in south-central Kansas; and Kyle Broadfoot – Spatial association of the Texas Horned Lizard and Harvester Ants (*Pogonomyr-*

mex spp.) in south-central Kansas.

The Saturday afternoon oral presentations were followed up by the annual KHS business meeting directed by President Travis Taggart. During the business meeting elections for officers were held. Daniel Fogell of Southeast Community College in Lincoln, Nebraska was elected as the President-Elect for 2014. David Oldham (Pittsburg State University) was elected Treasurer, Eva Horne (Kansas State University) was voted Secretary, and Daniel Murrow (Hutchinson, Kansas) will take over as President on 1 January 2013. Travis Taggart (Fort Hays State University) will remain as a member of the KHS Executive Council as the immediate Past-President. Upon completion of the business meeting attendees had time to relax before proceeding to the Sternberg Museum for an evening full of activities.

Saturday evening's schedule began with a welcome by Sternberg Museum Director Reese Barrick followed by a barbeque-style banquet of pulled pork, brisket, corn, beans, and salad. In addition, there were two different varieties of "orange juice" to choose from and enjoy while activities commenced. While everyone was enjoying their meals, KHS Awards Committee Chair Dan Fogell presented several awards to deserving recipients. The first award presented was the Henry S. Fitch-Dwight R. Platt Award for Field Herpetology, which was awarded to Joseph T. Collins. Suzanne Collins graciously accepted the $200.00 check and commemorative certificate while a standing ovation from an emotional crowd welcomed her to the stage. This year's Howard Kay Gloyd-Edward Harrison Taylor Scholarship was awarded to Andrew Coleman, a student at Emporia State University. Andrew received a commemorative certificate as well as a check for $300.00. Greg Sievert was the recipient of the Alan H. Kamb Grant for Research on Kansas Snakes for 2012. Greg, a professor at Emporia State University, received a commemorative certificate and a check for $300.00. The final official award for the evening was the Suzanne L. & Joseph T. Collins Award for Excellence in Kansas Herpetology. This year's Collins Award was given to William J. House, previously of Emporia State University, for his 2011 paper entitled "Selected aspects of semi-aquatic turtle assemblages in east-central Kansas ponds" which was published in the Transactions of the Kansas Academy of Science. William was awarded a commemorative plaque and a check for $1,000.00 which was accepted by Brent Thomas, William's advisor and a co-author of the publication. One final informal award was presented to the winners of the "species identification quiz" which went to The Family Oldham – consisting of David, Robin, and Tag Oldham of Oswego, Kansas for correctly identifying 46 of the 50 specimens. The Oldhams (who may have had a little help with the quiz) received a copy of *Amphibians, Reptiles, and Turtles in Kansas*.

Once the Awards Ceremony was over, the Society's 2012 keynote speaker, Brian I. Crother of Southeastern Louisiana University took the podium. Brian's talk, titled 'The Bold Hypothesis(es) of Joseph T. Collins', presented an overview of Joe's taxonomic and nomenclatural revisions and discussed how – while at the time they may have seemed slightly extreme – most were eventually accepted into use by the herpetological community. Brian gave an excellent presentation, after which the annual KHS auction commenced. Led by auctioneering trio of Eric Thiss, Walter Meshaka, and Dan Fogell, this year's auction made an astounding $3601.00 for the KHS Treasury. Throughout the auction, KHS member John Lokke – a noted artist – produced on-demand water colors which were instantly auctioned off. The premiere items offered up for bid were a pair of field knives custom made by KHS member Ted Leonard (Omaha, Nebraska). One of the knives had a custom handle made from fossil mammoth ivory and was inscribed "KHS 39th Annual Meeting, Hays, Kansas, November 3-4 2012" on one side and "In Memory of Joseph T. Collins" on the other. This knife alone fetched a bid of $500.00 by Suzanne Collins! The second knife had the same inscription in a handle custom made from the hardwood California Buckeye. As auction items and "orange juice" began to disappear, attendees retired for the evening to prepare for a second day of excellent oral presentations.

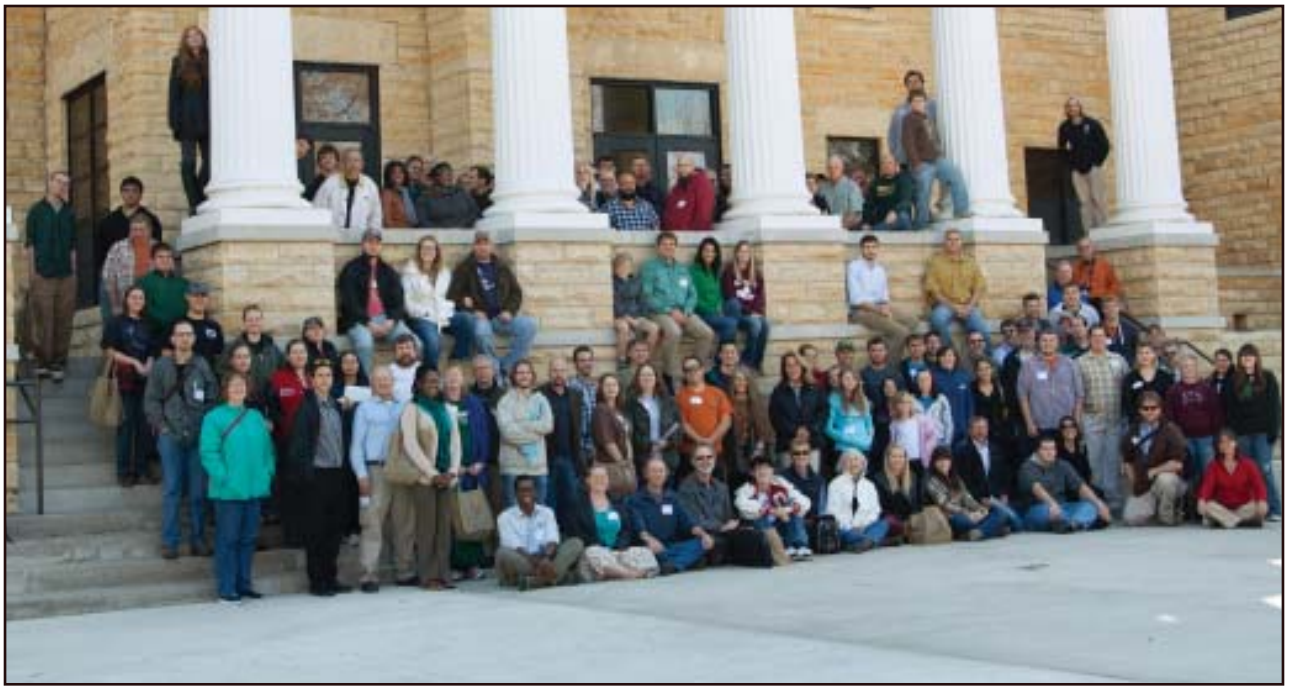
On Sunday, speaker sessions continued at FHSU beginning with James Emerson as he presented on the Ecology of a snake commu-

nity along the Canadian River drainage. Other presentations on Sunday included: Walter E. Meshaka, Jr. – Status and distribution of the Eastern Spadefoot, *Scaphiopus holbrookii* (Harlan, 1835), in Pennsylvania: statewide conservation implications for an imperiled species; Lucas Prater – Food webs and ecotoxicology of an Ozark River: A very preliminary analysis; Alexander J. Anton – Effects of chronic corticosterone increases on the maternal behavior of the Prairie Skink, *Plestiodon septentrionalis*; William (Bill) Pence – Survey of Rare Herpetofauna at the Fort Riley Military Reservation; Andrew Coleman – Efficacy of different artificial cover objects in reptile surveys; AshleE VanderHam – Herpetofauna monitoring to assess wetland restoration success; Anthony E. Bridger – Late seasonal movements and thermoregulation of Garter Snakes in a riparian floodplain; Aric Buerer – Local and regional effects of water resources on the herpetofauna of central Nebraska; and Katie Talbott - Using harmonic radar to monitor movements of Texas Horned Lizard hatchlings on Tinker Air Force Base.

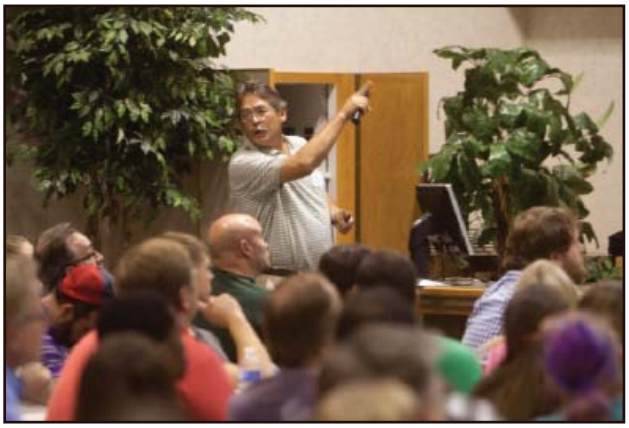
At the conclusion of the paper sessions the final award of the weekend – the George Toland Award – was presented for the best student presentation. This year the Toland Award went to Alexander J. Anton of the University of Nebraska at Omaha for his presentation Effects of chronic corticosterone increases on the maternal behavior of the Prairie Skink, *Plestiodon septentrionalis*. Alexander was presented with a commemorative certificate and a check for $200.00.

After the Toland Award presentation, the 39th Annual Meeting of the Kansas Herpetological Society adjourned. Meeting coordinator and KHS President Travis Taggart deserves many words of thanks for his efforts, as do Curtis Schmidt, Ryan Shofner, and a host of others who made this meeting successful. We hope to see you all in Wichita as President Dan Murrow presides over the 40th Annual Meeting of the Kansas Herpetological Society in November 2013.

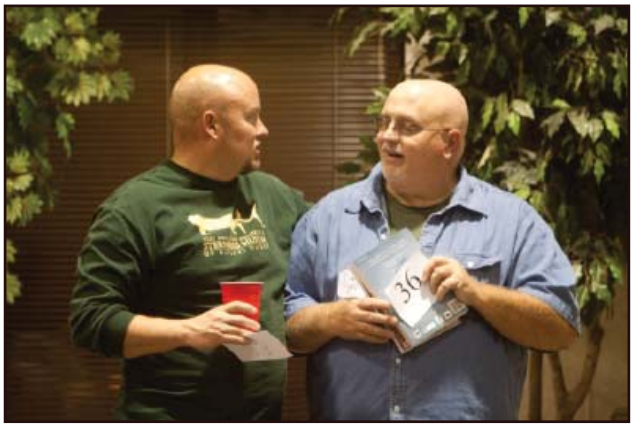
- Dan Fogell, KHS President-Elect, Southeast Community College, Lincoln, Nebraska



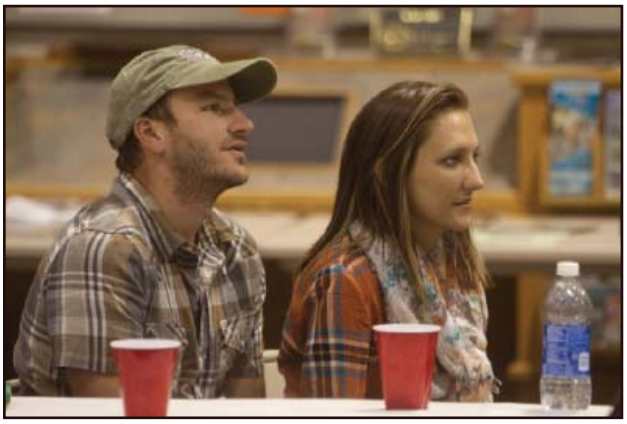
Participants of the KHS 39th Annual Meeting convene behind Picken Hall on the campus of Fort Hays State University in Hays for the group photograph.



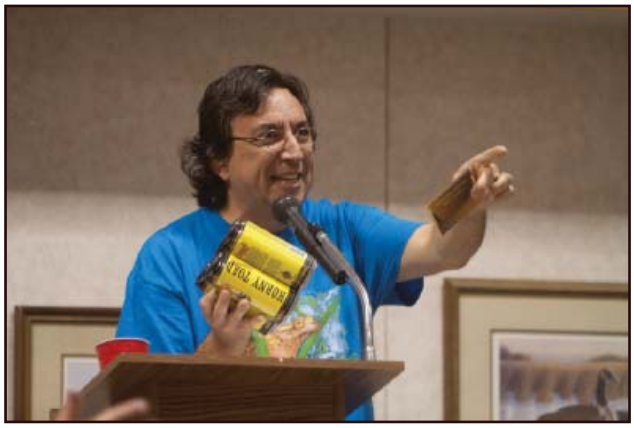
Brian Crother of Southeastern Louisiana University pays homage to the work of KHS founder Joseph T. Collins during his keynote address.



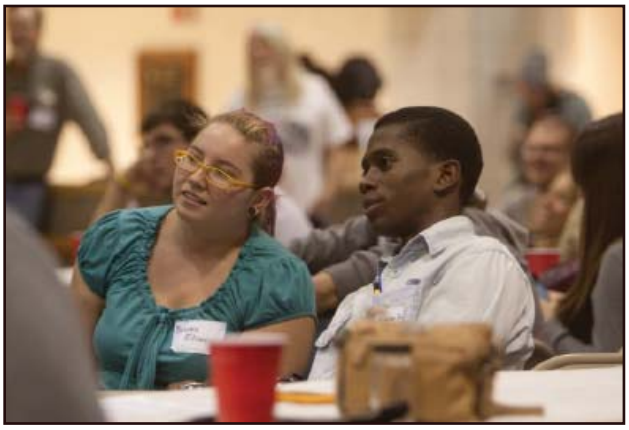
Curtis Schmidt and Dan Fogell discuss the adaptive significance of male pattern baldness.



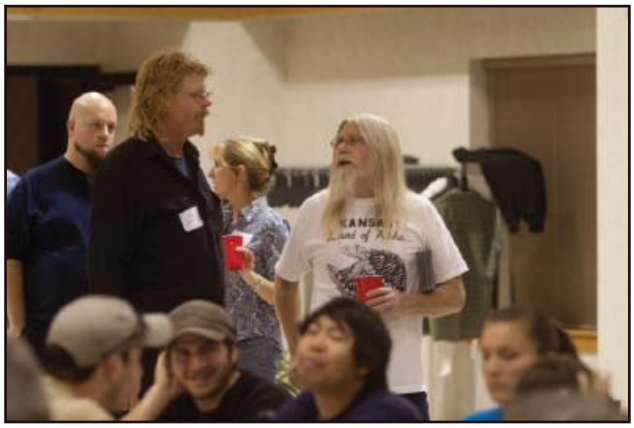
Mike Rochford and the future Mrs. Mike Rochford (Sarah Bruton) remain focussed on their desired auction items. The couple made the trek from southern Florida to attend the meeting.



Walter Meshaka did his best to prevent being outbid for the ever-popular herp beer.

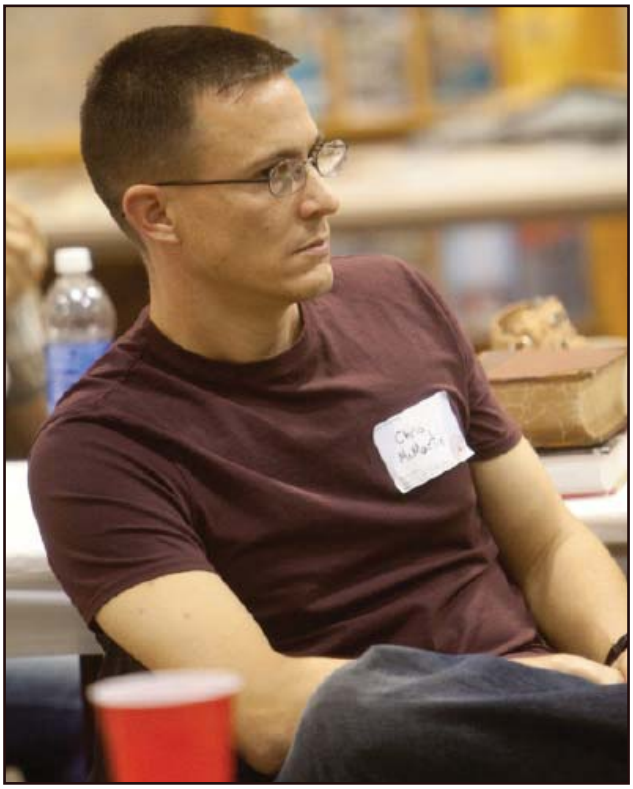


Brooke Ellison and Ivan Managan, Jr., Virginia State University, take in the antics of the KHS auctioneers.

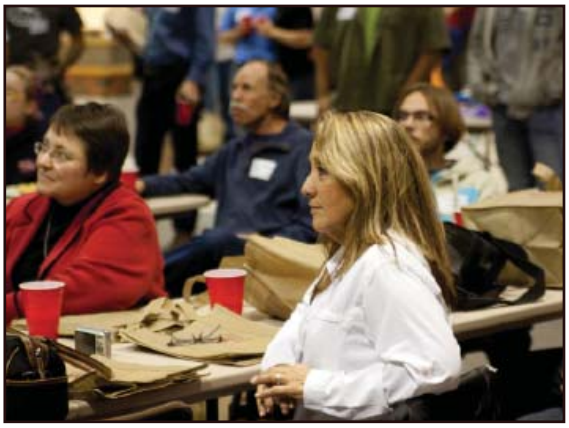


Two long-time KHS members, John Lokke and Mark Ellis, discuss the finer things in life, as President Elect Dan Murrow keeps them under control.

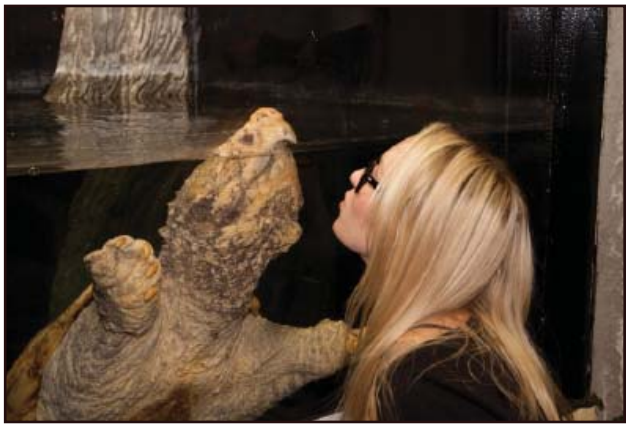
KHS President Travis Taggart “enthusiastically” places a bid, much to enjoyment of his daughter Meg.



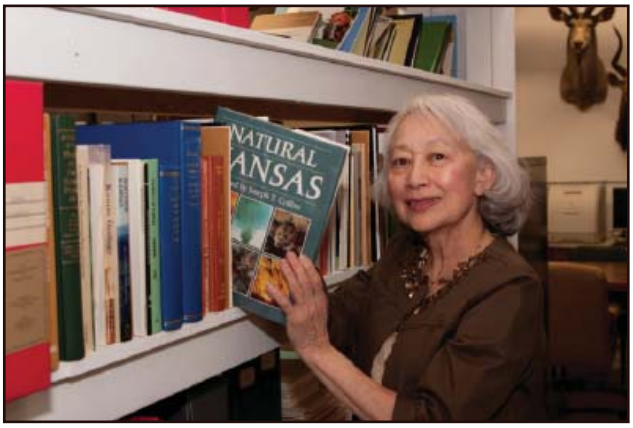
Chris McMartin pays close attention to avoid a missed opportunity to add to his growing herpetological library at the KHS auction.



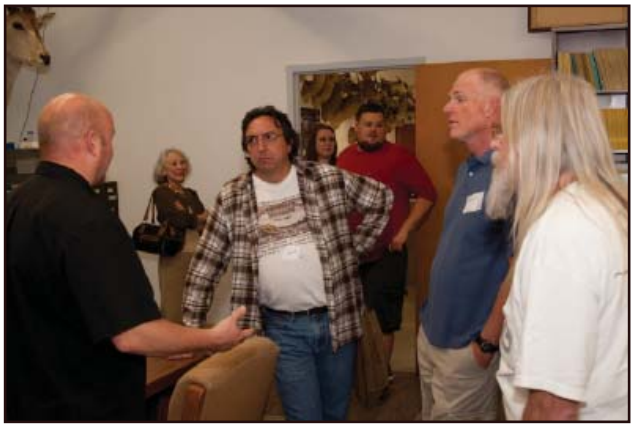
Nancy Weaver, daughter of KHS matriarch Suzanne Collins, made the trip from Arkansas to attend the meeting dedicated to Joe.



Beauty and the Beast! Eva Gann of the University of Central Missouri shares a moment with Levi, the Sternberg Museum’s Alligator Snapping Turtle.

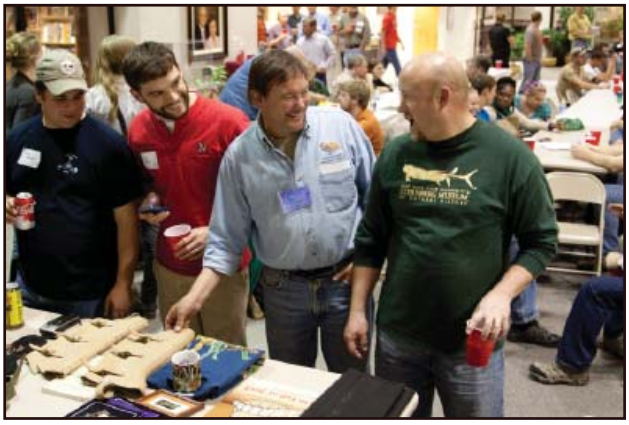


Suzanne Collins poses in the Joseph T. Collins Natural History Library with a copy of *Natural Kansas*.

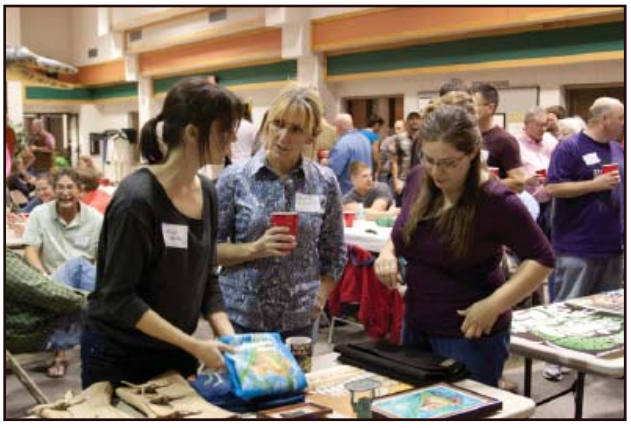


Curtis Schmidt proudly shows off the newly-dedicated Joseph T. Collins Natural History Library to some of Joe's best friends and colleagues.

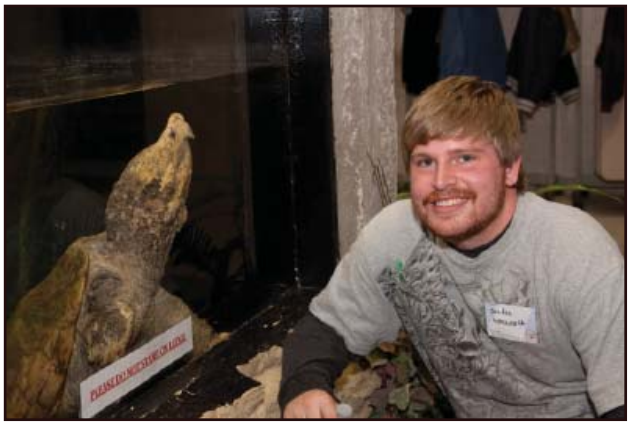
Even the beer tastes better in Kansas! Let the auction begin!



KHS auctioneer Eric Thiss tries to convince Curtis Schmidt to model some of the auction items. Curtis is not amused.



Mindy Walker, Robin Oldham, and Katie Talbott discuss bidding strategies and prepare to arm-wrestle over the high-quality auction items.



Braden Aylesworth, Wichita, sizes up Levi, the Alligator Snapping Turtle, while Levi begs for a handout.

NOTES

A Four-Day Spring Snake Count Across Northern Kansas

From 26 to 29 April 2013 I observed the following:

26 April 2013

142nd street just north of I-70, Bonner Springs, Wyandotte County, Kansas.

Diadophis punctatus	303
Pantherophis obsoletus	1
Carphophis vermis	7
Coluber constrictor	1
Agkistrodon contortrix	1
Lampropeltis triangulum	5
Total snakes:	318

158th and Golden, Bonner Springs, Wyandotte County, Kansas.

Diadophis punctatus	5
Scotophis obsoletus	1
Coluber constrictor	1
Total snakes	7

27 April 2013

I-70 and 177, Manhattan, North Geary County, KS

Diadophis punctatus	177
Tropidoclonion lineatum	2
Pantherophis emoryi	2
Coluber constrictor	1
Pituophis catenifer	1
Lampropeltis triangulum	1
Total snakes:	184

Apache Road, 0.2 miles west of K-14, Lincoln County, Kansas.

Diadophis punctatus	8
Total snakes:	8

Homer Road and 190th, Russell County, KS

Diadophis punctatus	4
Thamnophis sirtalis	1
Storeria dekayi	1
Total snakes:	6

28 April 2013

Highway 281, 12.5 miles north of 40, Russell County, Kansas.

Diadophis punctatus	49
Pantherophis emoryi	2
Lampropeltis triangulum	1
Ophisaurus attenuatus	1
Total snakes:	52

K-18, 2.4 miles west of Luray, Russell County, Kansas.

Diadophis punctatus	6
Lampropeltis triangulum	4
Total snakes:	10

K-18, 2.2 miles west of Luray, Russell County, Kansas.

Diadophis punctatus	3
Pantherophis emoryi	1
Lampropeltis triangulum	2
Total snakes:	6

Waldo Road, 0.2 miles east of K-18, Russell County, Kansas.

Diadophis punctatus	20
Tropidoclonion lineatum	1
Pantherophis emoryi	1
Lampropeltis triangulum	4
Total snakes:	26

Pillsbury Crossing, Riley County, Kansas.

Diadophis punctatus	3
Total snakes:	3

29 April 2013

Carnahan Road and Otter Creek Road, Pottawatomie County, Kansas.

Diadophis punctatus	24
Thamnophis sirtalis	3
Tropidoclonion lineatum	1
Pituophis catenifer	1
Coluber constrictor	1
Storeria dekayi	1
Total snakes:	31

Cedar Point Road, 0.2 miles from 5th street, Alma, Wabaunsee County, Kansas.

Diadophis punctatus	2
Coluber constrictor	2
Total snakes:	4

Grand total snakes: 655

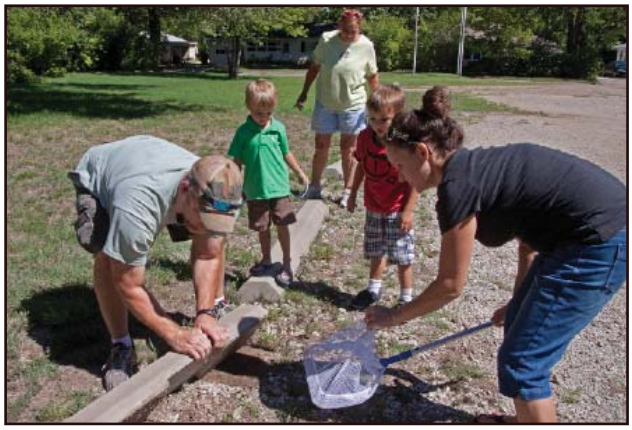
Tom Sinclair
12903 Cloverwood Drive
Cypress, TX 77429-2028

15th Annual Running of the Lizards

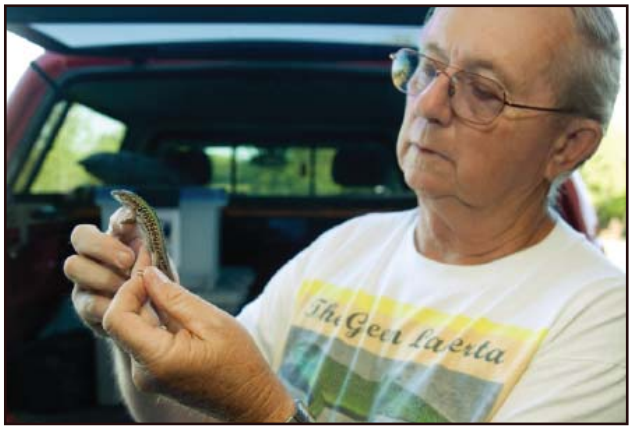
Approximately 20 individuals from Topeka and surrounding areas participated in the 15th Annual Running of the Lizards that was held near the intersection of 21st and Gage Street in Topeka the afternoon of 9 September 2012. The annual event, which was first organized by Joseph T. Collins as a part of his Kansas herpetology class at Washburn University, focused on two species of non-native lizards found in the area. Populations were established during the late 1950's or early 60's when several individuals either escaped or were released from a nearby biological supply house. Each year since Collins organized the event, interested individuals have gotten together during early September to observe and collect specimens. Most of the specimens are set free after being counted, identified, and photographed. Most of the lizards found each year are Italian Wall Lizards (*Podarcis siculus*). However, the much larger Western Green Lacerta (*Lacerta bilineata*) is sometimes encountered. During the 2012 event, 23 wall lizards and no lacertas were discovered.

The 15th Annual Running of the Lizards was held in memory of Jim Gubanyi and Joseph T. Collins. Jim lived in the area and had probably conducted more research on the two species than any other individual. He attended and assisted with most of the herpetological events. Jim passed away during the summer of 2010. Joe, along with his wife Suzanne, hosted the event each September and encouraged participation of herpetologists and others interested in the lizards. Joe passed away in January 2012.

Larry L. Miller
Kansas Heritage Photography
Wakarusa, Kansas



A group of those that participated in the event are shown attempting to surround and capture a large adult wall lizard in a gravel parking lot.



Larry L. Miller talks about one of the adult wall lizards at the conclusion of the annual event. All lizards from the 2012 event were released back to the wild.

The Missouri River Fish and Wildlife Mitigation Project: For the river, for you, and for herps

A recent article in the Journal, "A herpetofaunal survey of Boyer Chute National Wildlife Refuge, Washington County, Nebraska", made me think that Journal readers would be an excellent audience to introduce to the entire Missouri River Fish and Wildlife Mitigation Project (Mitigation Project). As the name implies the Mitigation Project is mitigation for environmental damage caused by the Bank Stabilization and Navigation Project (BSNP) along the Missouri River. This mitigation will eventually encompass 166,750 acres along the banks of the Missouri River from Sioux City, IA to St Louis, MO. Currently there are approximately 59 sites and 60,000 acres in the project. These are lands that, like Boyer Chute, are open to the public for most outdoor pursuits, including herpetological studies and field observations. Below, I will describe the mitigation that is taking place, highlight the mitigation sites in Kansas, a herpetofaunal study that currently is underway, and provide information so you can visit some or all of the mitigation sites.

Historically the Missouri River was a wide shallow river with lots of side channels and frequent seasonal flooding. The river also contained many snags (downed trees and log jams), a seemingly endless supply of constantly shifting sand bars, and a very heavy sediment load. These sediments were used against the river to aid in its channelization.

In 1912, Congress authorized the U.S. Army Corps of Engineers (Corps) to make the river easier to navigate and to protect the banks from flooding, this became the BSNP. Implementation of the BSNP was accomplished using pile dikes, trees driven into the river forming a wall, to slow down the water and let the sediment drop out. This sediment, in just a few years, created new land that, along with wing dikes, directed and constricted the river's flow. Levees were then constructed around these new lands and they were cleared and converted to row

crops.

Over time the impacts of the BSNP resulted in the loss of 522,000 acres of floodplain habitats and 125 river miles. It was this environmental damage that led to the Mitigation Project in 1986 and the types of habitat to be restored. Upland features to be restored include riparian forests, grasslands, and scrub-shrub habitats. Aquatic habitats are both riverine and wetland features. The riverine habitats are focused on shallow water areas along the river edges, side channels, chutes, backwater areas, sandbars, and islands. Different wetland features to be restored or created include scour holes, oxbows, emergent, scrub-shrub, and forested wetlands.

The Corps has partnered with the United States Fish and Wildlife Service and state wildlife agencies for land management on the mitigation sites. Kansas currently has four such sites located in Atchison and Doniphan counties managed by the Kansas Department of Wildlife, Parks, and Tourism. Site descriptions of each are below.

The Benedictine Bottoms mitigation site is the oldest in Kansas, purchased in 1993 and 1994. It is located just northeast of Atchison in Atchison County and consists of 2,111 acres between River Miles 424 and 429, 626 acres are riverward of the levee, the remaining 1,485 acres are levee protected. The site contains a variety of features such as maturing riparian forests, native grasslands, emergent wetlands, food plots, shrubby uplands, ponds and scour holes.

Benedictine Bottoms is managed as a quality hunting location so all access is limited to special permits with a restricted number of people assigned each day during hunting season. Access permits are required at other times of the year also. Permit information can be obtained by contacting KDWP&T at (913) 367-7811. Allow plenty of time for permitting, don't plan on last minute permits or access.

Burr Oak Bottoms is located in Doniphan County and is the newest acquisition in Kansas. Purchases were made on this site beginning in 2009. The area currently consists of 204 acres that are comprised of bottomland timber, a large scour hole, and an old slough from previous flooding. Interim management has begun at the site and will continue until all planning for the site is completed. The site is open to the public and all statewide regulations apply.

Dalbey Bottoms is a 1,602 acre site purchased in 2006. The plan is to restore a side channel, add length and restore sinuosity to the previously straightened Walnut Creek, dig a scour hole, and to breach existing levees to restore floodplain connectivity. This site is currently in construction phase.

The Elwood Bottoms site was purchased in 2006 and is comprised of 1,067 acres. The area is located just south of Elwood, Kansas in Doniphan County. The site has ephemeral and forested wetlands created by the floods of the 1990's, as well as a scour hole, riparian forest, and early successional vegetation. Warm season grass plantings and other vegetation manipulations continue on the site but there are no major construction plans for the site.

All of the above sites except Burr Oak were sampled for calling anurans and turtles during 2010 and again during 2011. There were an additional eight sites surveyed in Missouri, Nebraska, and Iowa. This survey was done to compare the quality of different wetland types on mitigation sites, using anurans and turtles as indicator species.

The results of the 2010 season were seven species of turtles and 13 species of anurans. The turtles species captured were Slider, Smooth Softshell, Spiny Softshell, Western Painted Turtle, Common Snapping Turtle, False Map Turtle, and the Common Musk Turtle. The anuran species encountered were Plains Leopard Frog, Southern Leopard Frog, Bullfrog, Gray Treefrog complex, Boreal Chorus Frog, Blanchard's Cricket Frog, American Toad, Woodhouse's Toad, Great Plains Toad, Plains Spadefoot, and the Great Plains Narrowmouth Toad. Besides anurans two Smallmouth Salamanders also were captured in Kansas.

These areas are not the limestone strewn flint hills, with tons of rocks to flip. So the herping may not be easy, but it can be rewarding. As mitigation sites are restored and features develop and age, these areas will again resemble the original big river floodplains that have been missing in this country for the last 60 or more years.

Additional information on the Missouri River Recovery Program and the Missouri River Mitigation Project can be found at www.moriverrecovery.org. To find exact site locations, navigate to the above website and click on the BiOP/Mit Efforts tab and then the Mitigation tab. Here you will find contact information on the two Corps districts and the partnering agencies that manage the sites. On this webpage, click on the Mitigation Sites link and the new page will have an interactive map as well as two drop down menus that will allow you to navigate to a particular site or to a region of the river. These site pages contain site specific information.

The Missouri River Mitigation Project began 25 years ago and now provides 60,000 acres for a restoration of the Missouri River, both channel and floodplain. These lands are open to you the public for hunting, fishing, herping, and many other outdoor pursuits. Be sure to get out take advantage of these sites. The herpetofauna that inhabit these areas are already taking advantage it.

Neil Bass
US Army Corp of Engineers
Missouri

*Range extension for the Rough Green Snake (*Opheodrys aestivus*) in Kansas*

A live adult specimen of the Rough Green Snake (*Opheodrys aestivus*) was collected by Quinn Ward the morning of 24 April 2012 at the Ward farm located southwest of Drury, Kansas near the Oklahoma line in Sumner County, Kansas.

It was discovered on the ground near farm buildings at the edge of a very wooded area to the north of Bluff Creek and to the west of the Chikaskia River.

The location where the snake was discovered is: N 37.00051, W 097.32755. This specimen represents a range extension to the west of approximately 20 miles (Collins, Joseph T., Suzanne L. Collins, and Travis W. Taggart. 2010. Amphibians, Reptiles, and Turtles, in Kansas. Eagle Mountain Publishing, LC Eagle Mountain, Utah. xvi + 312 pp.).

I would like to thank the Carson Ward Family for their continued efforts in providing useful and important data to the field of Kansas herpetology.

An adult Rough Green Snake collected by Quinn Ward the morning of 25 April 2012.

Larry L. & Suzanne L. Miller
Kansas Heritage Photography
Wakarusa, Kansas

Wellington Lake Herpetological Survey

Below is a table of animals Suzanne and I discovered between 2-4 May 2012 while we were camping at the Wellington Lake in Sumner County, Kansas (37.2178166 N, 97.5287833 W). The lake is located west of Wellington in a very agricultural (mostly wheat fields, but with a few pastures and some wetland areas near the lake) area near Mayfield, Kansas. All of the animals were found (in some cases heard in reference to the frogs and toads) either while we were walking on lake property or driving the roads within a three mile radius of our campsite. Once we were sure we had observed at lest ten different animals of any one species we stopped recording for that species. None of our attempts to find animals involved the turing of rocks or other natural or unnatural ground cover during this count.

Floating logs provided many opportunities to count basking Northern Painted Turtles and Sliders.

We documented a total of 19 species representing more than 70 individuals. Some species such as Sliders were extremely common (as is shown in the photo of a large number on logs near our campsite along with two Painted Turtles) while others were not at all common while we were in the area.

Herpetofaunal Count

Great Plains Toad	1
Blanchard's Cricket Frog	10+
Spotted Chorus Frog (calling)	10+
Cope's Gray Treefrog (calling)	4
Plains Leopard Frog (calling)	10+
American Bullfrog	2
Great Plains Narrowmouth Toad (calling)	4
Snapping Turtle	1
Yellow Mud Turtle	1
Ornate Box Turtle	4
Northern Painted Turtle	3
Slider	10+
Six-lined Racerunner	1
Eastern Racer	1
Prairie Kingsnake	3
Western Rat Snake	4
Plainbelly Water Snake	2
Diamondback Water Snake	1
Common Garter Snake	1

Larry L. Miller
Kansas Heritage Photography
Wakarusa, Kansas

Quivira National Wildlife Refuge Herpetological Outing

A birding adventure in Quivira National Wildlife Refuge in Stafford County, KS turned into a surprise herping trip! On the afternoon of Friday 22 March 2013 Jeremy Birket (Sedgwick County Zoo) and myself arrived at Quivira around 3:30pm for an afternoon of birding. While a multitude of species of waterfowl and raptor as well as deer were evident, I was somewhat surprised to find herps as well. It was a calm, sunny 48 degree day that I suspected would offer little in the way of herpetological excitement; but the warm sunshine bolstered my meager hopes.

Jeremy and I first stopped at the children's fishing pond on the southern edge of the refuge to look at the northern shovelers, mergansers, pintails and various songbirds. Stepping out of the car I noticed several ant dens nearby bustling with excitement that ants always carry with them throughout their duties. Before leaving the pond, I noticed a small *Trachemys scripta* basking upon a log. "Okay," I thought, "water's starting to warm for the season, cool!" Upon scouting the edge of a soggy little marsh further on, I found the skeleton of a rather large *Chelydra serpentina* and a veritable swarm of small spiders dancing throughout the reeded shallows.

Our birding adventure carried on for another hour or so, full of coots, killdeer, more pintails, shovelers and mergansers, raptors, red-winged blackbirds and other songbirds. During a stop to look at a group of what I suspect were dowichers (though I truly haven't a clue past acknowledging they were feathered, brown softballs with long, straight bills) I noticed the smooth arcing shell of a chelonian on the bank. A hop over barbed wire and a small hike down the bank showed me a recently deceased *T. scripta*, probably caught by a cold snap a few days earlier. I continued my walk around the muddied banks of the small pond and discovered several more deceased sliders, as well as two dead *Chrysemys picta*. Looking out over the water's surface also showed the heads of + 25 more *T. scripta*.

Once the chelonian excitement of the pond was finished, I held little hope for anything more that day, herpetologically speaking. The sun was racing toward the western horizon and the time was after 5:00. We had stopped one last time at an overflow for the little salt marsh to watch coots and mergansers for a moment, and I noticed skeletons down in the spillway. Climbing down confirmed more sliders and some catfish composed the skeletal ruins, but I noticed a serpentine body draping over a rock about ten feet away. Truth be told, I thought the snake was dead, its position looked odd, and the skin sagged. As I walked over to it, it came to life, rushing towards the safety of the water with all the furious speed of a cold *Nerodia*. I quickly caught it and once it had fulfilled its obligation of attempting to bite me, it calmed down. I posed it on a rock for Jeremy to photograph, and snapped a few with my cell phone as well. A few moments later, our need for photographs was sated and the snake was back at the water's edge, slithering off to whatever shelter it could find.

While not a terrifically exciting day in regards to either herping or birding, the little surprises made the trip worthwhile and kindled a growing excitement for herping to begin in earnest this year!

Herpetofaunal Count

Common Snapping Turtle	1
Slider	25+
Western Painted Turtle	2
Diamondback Water Snake	1

Dexter Mardis
3801 W 13th St N, Apt. 1001
Wichita, KS 67203

KHS Fall Field Trip
to be held at

Butler County State Lake and Wildlife Area

6-8 September 2013

The
KHS 40th Annual Meething
will be held at

Great Plains Nature Center, Wichita, Kansas

1-3 November 2013

TWO HERPETOFAUNAL SURVEYS IN SOUTHWESTERN MISSOURI

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Abstract: *As part of the ongoing management of natural resources on lands owned by the Missouri Army National Guard, amphibian and reptile inventories were conducted at two training sites in 2011-12. Camp Crowder, Newton County, Missouri was surveyed in 2011 and 14 species of amphibians and 16 species of reptiles were observed. Camp Clark, Vernon County, Missouri was sampled in 2012 and 8 species of amphibians and 15 species of reptiles were observed. Species occurrences at both sites were compared to known amphibian and reptile records for each respective county. At both sites, a high percentage of amphibians known to occur in each county were observed. Reptile observations, particularly snakes, were under-represented most likely due to the short duration of the sampling efforts. Repeated sampling efforts over time will continue to increase species occurrence information for amphibians and reptiles on both training sites.*

INTRODUCTION

Considering the decline in amphibians and reptiles over the last few decades, Gibbons et al. (2000) suggested that herpetofaunal inventories become a standard part of any environmental assessment. Even in areas where species are well known, knowledge gaps exist and often decisions are made on incomplete data (Foster et al., 2012). Understanding distributions, particularly at a local scale, is important when trying to maintain continuity in populations and habitat (McDiarmid, 2012). This is particularly true when one considers that there may be considerable spatial and temporal variability in the occurrences of some amphibian and reptile species (Fitch, 1999; Fisher and Foster, 2012).

Detailed information about natural resources of Missouri Army National Guard (MOARNG) training sites is needed for planning and implementation of management, sustainability, and integration of biodiversity conservation and the MOARNG training mission. Biodiversity surveys (i.e., surveys of fauna, flora, and ecosystems) provide information needed for assessing resiliency and disturbance at training sites, past or potential impacts of training on biodiversity, military and land use impacts, training and testing capacity, and the need for ecological restoration or specific management and conservation.

The Army requires training sites conduct inventories and classify natural resources present on training sites and their status (Army Regulation 200-3). In order to meet this requirement, we conducted amphibian and reptile surveys at Camp Crowder, Newton County, MO in 2011 and Camp Clark in Vernon County, MO in 2012.

MATERIALS AND METHODS

Site Descriptions

Camp Crowder Training Site (1,764 ha) is located in Newton County, south-western Missouri. Situated in the Springfield Plateau of the Ozarks Highlands (Thom and Wilson, 1980; Omernik, 1987), Camp Crowder consists of gently rolling hills intersected by intermittent creeks and permanent streams. At least 15 vernal pools are scattered through the mesic oak-hickory forest, which is the dominant vegetation type at Camp Crowder. Lakes, ponds, wetlands, riparian forest, warm-season, and cool-season grasslands are also present.

Oak (*Quercus* spp.) were the most common trees in dry-mesic forests. Most dry mesic forest sites had dense understories of Hawthorn (*Crataegus* spp.) and Blackberry (*Rubus* spp.). We noted presence of four vine species: Virginia Creeper (*Parthenocissus quinquefolia*), and the invasive Amur Honeysuckle (*Lonicera maackii*) in sunny areas and along roads of dry-mesic forests; Poison Ivy (*Toxicodendron radicans*), and Wild Grape (*Vitis rotundifolia*) in the moister

bottomland and wet-mesic forests. Grassland forbs included Goldenrods (*Solidago* spp.), Spiderwort (*Tradescantia* spp.), Snakeroot (Asarum spp.), Morning Glory (*Convolvulus* spp.), clovers (*Trifolium* spp.) and Ticktrefoil (*Desmodium canadense*). Most common grasses were Tall Fescue (*Festuca arundinacea*), Big Bluestem (*Andropogon gerardii*), and Ryegrass (*Lolium* spp.).

Camp Clark Training Site (521 ha) is situated in the Osage Plains Region (Thom and Wilson, 1980) more specifically described as Wooded Osage Plains and Cherokee Plains (Omerik, 1987) of south-western Missouri near Nevada, MO, in Vernon County. During pre-settlement times, tall grass prairie covered 70% or more of the site, the remainder likely being covered by riparian forest. Currently, Camp Clark contains a mixture of native prairie, cool season grassland, savanna, mesic oak-hickory forest and riparian forest within the undeveloped portions of the site. Approximately 1/3 of Camp Clark is currently covered by grassland.

The common trees in dry-mesic forests were oaks (*Quercus* spp.). Most dry mesic forest sites had dense understories of Hawthorn (*Crataegus* spp.) and Blackberry (*Rubus* spp.). We noted presence of vine species: Virginia Creeper (*Parthenocissus quinquefolia*) and the invasive Amur Honeysuckle (*Lonicera maackii*) in sunny areas and along roads. Poison Ivy (*Toxicodendron radicans*) and Wild Grape (*Vitis rotundifolia*) were common in the moister bottomland and wet-mesic forests. Wet bottomland forests along creeks were dominated by White Oak (*Quercus alba*), Pin Oak (*Quercus palustris*), Black Walnut (*Juglans nigra*), and Sycamore (*Platanus occidentalis*).

The dominant grass was Big Bluestem (*Andropogon gerardii*), but Indian Grass (*Sorghastrum nutans*), Switch Grass (*Panicum virgatum*), and other grasses were also present. Cool season Tall Fescue (*Festuca arundinacea*) was dominant near the western edge of the training area. Most of the native prairie at Camp Clark is invaded (≥20 % ground coverage) by woody shrubs such as Sumac (*Rhus* spp.), oak (*Quercus* spp.), Blackberry (*Rubus* spp.), and Multiflora Rose (*Rosa multiflora*). Some of the more common grassland forbs included Blazing Star (*Liatris spicata*) Goldenrod (*Solidago* spp.), Ragwort (*Senecio* spp.), Spiderwort (*Tradescantia* spp.) various species of Asters (*Aster* spp.), Yellow Coneflowers (*Ratibida* spp.), Purple Coneflowers (*Echinacea* spp.), Morning Glory (*Convolvulus* spp.), and Clovers (*Trifolium* spp) were common. Less common were Milkweeds (*Asclepias* spp.) and Indian Paintbrush (*Castilleja* spp.).

Sampling

Both Camp Crowder and Clark are active training sites for MOARNG. Subsequently, large windows of time were rarely available for sampling. Our approach was to use a broad array of sampling techniques to sample as many species of amphibians and reptiles as possible during the late spring and early summer.

Aquatic sites were sampled via auditory surveys and by seine. During each sampling period we would conduct 5 minute auditory samples at each aquatic site. We used a 4x10 feet (121 x 304 cm) minnow seine with 6 mm mesh to sample amphibian adults, larvae, and eggs in March and April, 2011 and 2012. At each of the aquatic habitats sampled, we dragged the seine on the bottom of the wetland or pond in a semi-circular motion. We sampled approximately 20 linear meters along the bank of each wetland, pond, or lake.

We also set aquatic turtle traps at both training sites. We utilized collapsible box traps purchased from Memphis Net and Twine (www.memphisnet.net). The box traps were 79 cm x 60 cm x 25 cm with a square mesh size of 1 cm, and had a 60-cm horizontal slit funnel on opposite ends of the long axis of the trap. The box traps were used for sampling shallow, heavily vegetated bodies of water. For deeper water bodies we used large hoop nets, also purchased from Memphis Net and Twine. The larger hoop consisted of three 88-cm diameter metal rings and one 31-cm diameter stretchable funnel. Overall trap length was 245 cm, and square mesh size was 2.5 cm. Traps were baited with sardines and checked once every 24 hours.

Terrestrial habitats were sampled utilizing trapping arrays consisting of 4-5 gallon buckets buried at ground level (i.e., pitfalls) joined by 3-6m silt fences staked into the ground. The lower edges of the 90 cm tall drift fences were buried, to force animals to travel along the fences and fall into the pitfalls. The trapping arrays were checked once every 24 hours for 6 consecutive days. Additionally, foot searches, and flipping of rocks and woody debris were conducted throughout each training site. We also road cruised during the late afternoon/early evening hours.

We recorded all species observed or heard during the course of our surveys. We then compared

species observed during the course of our survey to historical species occurrences for each respective county as reported in the Missouri Herpetological Atlas Project (http://atlas.moherp.org/). Camp Clark is located 27-km east of the Bourbon County, Kansas border. Camp Crowder is located 24-km east of the Ottawa County, Oklahoma border. As most herpetological inventories stop at political boundaries, we compared species occurrences during our surveys to known records for adjacent states in order to elucidate range extensions, or possible species of occurrence across state boundaries. Data from Oklahoma was taken from the Oklahoma Biological Survey's Distribution of Oklahoma Amphibian and Reptiles by Recorded Sightings (DOKARRS) (http://www.biosurvey.ou.edu/dokadesc.html) database, and for Kansas we used Collins et al., (2010).

RESULTS

At Camp Crowder we conducted auditory surveys and sampled via seine at 15 aquatic sites (wetlands, ponds, lakes, streams) in March, April, and May 2012. We ran 25 terrestrial sampling arrays between 27 May-2 June 2011. We conducted additional road cruising and foot searches, and turtle trapping between 18-20 June 2011. Total effort for turtle trapping was 12 trap nights with large box traps and 9 trap nights with large hoop traps.

We observed 14 species of amphibians and 16 species of reptiles at Camp Crowder, accounting for 70% of the amphibians and 43% of the reptiles known to occur in Newton County, MO (Table 1). No amphibian or reptile species observed on Camp Crowder represented a new county record for Newton County. There were seven species of amphibians and reptiles that occur in Ottawa County, OK, but not in Newton County, MO (Table 1). Twenty species of amphibians and reptiles have been reported from Newton County, MO that have not been recorded for Ottawa County, OK. (Table 1).

At Camp Clark we conducted auditory surveys and sampled via seine 7 aquatic sites (wetlands, ponds, lakes, and streams) in March, April, and May 2012. Nineteen terrestrial sampling arrays were sampled between 28 May-3 June, 2012. There were 20 net nights utilizing large hoop nets between 29 May-2 June, 2012.

We observed 8 species of amphibians and 15 species of reptiles at Camp Clark, accounting for 72% of the amphibians and 44% of the reptiles known to occur in Vernon County, MO (Table 2). No new county records for Vernon County were observed on site, although the original voucher specimen for the Smallmouth Salamander, *Ambystoma texanum*, was missing for the county. One specimen was collected from this survey as a voucher. There were three species of amphibians and reptiles that have been recorded for Vernon County, MO but not in Bourbon County, KS, and 11 species recorded in Bourbon County, KS but not in Vernon County, MO (Table 2).

DISCUSSION

Short-term herpetofaunal inventories at MOARNG in 2011 and 2012 resulted in the observation of a high percentage of amphibians but only a moderate number of reptile species (Tables 1-2) known to occur in each county. Based on our survey work, perceived absences are most likely due to the short duration of our sampling efforts and/or variation in microhabitat regimes between each individual training site and the surrounding county.

There is one spring-fed limestone cave on Camp Crowder, and two species of cave dwelling salamanders, Long-tailed Salamanders (*Eurycea longicauda*) and Cave Salamanders (*E. lucifuga*) were observed there. Grotto Salamanders, (*E. spelaea)* were not observed, but could occur there. Adult Grotto Salamanders are predominantly troglodytic, although larval individuals can be found in flowing streams at cave mouths (Rudolph, 1978). No larval Grotto Salamanders were observed during the course of both diurnal and nocturnal surveys. A notable anuran absence at Camp Crowder was the Pickerel Frog, *Lithobates palustris*. Although widespread throughout the Ozarks in Missouri (Johnson, 2000), Trauth et al. (2004) noted that their distribution can be quite sporadic. A lack of cool, wet thermal refugia, such as caves and mines on site may be a limiting factor (Heath et al., 1986; Johnson, 2000).

The dearth of snake observations at Camp Crowder may simply be due to the short duration of the survey, and continued survey work would most likely fill out the list of species found on site. The lizard species observed at Camp Crowder were representative of what should be found there based on habitat present. Ongoing glade restoration by MOARNG natural resource personal may result in the future occurrence of Eastern Collared Lizards, *Crotaphytus collaris*. There is evidence that this species is capable of significant dispersals between glades (Hutchison and Templeton, 1999; Templeton et al., 2001).

Table 1. Amphibian and reptile species observed at Camp Crowder, Newton County, MO (2011) (*NOW*) and species historically reported for Newton County, MO (*THEN*), and Ottawa County, OK (*OT,OK*).

Species	NOW	THEN	OT,OK
Caudata			
Central Newt	X	X	X
Grotto Salamander	X	X	X
Long-Tailed Salamander	X	X	X
Cave Salamander	X	X	
Oklahoma Salamander	X	X	X
Ozark Zigzag Salamander			X
Spotted Salamander	X	X	
Smallmouth Salamander			X
Eastern Tiger Salamander	X		
Common Mudpuppy	X		
Western Slimy Salamander	X	X	X
Anura			
American Toad	X	X	
Crawfish Frog	X		X
American Bullfrog	X	X	X
Green Frog	X	X	X
Pickerel Frog	X		
Southern Leopard Frog	X	X	
Blanchard's Cricket Frog	X	X	X
Grey Treefrog (complex)	X	X	X
Northern Spring Peeper	X	X	
Boreal Chorus Frog	X	X	
Eastern Narrowmouth Toad	X	X	X
Serpentes			
Brown Snake	X		X
Northern Red-Bellied Snake	X	X	
Ground Snake			X
Rough Earth Snake	X		
Smooth Earth Snake	X		
Rough Green Snake	X	X	X
Coachwhip	X		X
Eastern Racer	X		X
Prairie Kingsnake	X	X	
Speckled Kingsnake	X	X	
Milk Snake	X		X
Texas Rat Snake	X	X	X
Eastern Hog-Nosed Snake	X		X
Western Worm Snake	X		X
Ring-necked Snake	X	X	X
Flat-headed Snake	X		X
Plain-bellied Water Snake	X		
Northern Water Snake	X		X
Western Ribbon Snake	X	X	
Common Garter Snake	X		
Copperhead	X	X	X
Cottonmouth	X		
Timber Rattlesnake	X		
Chelonia			
Common Snapping Turtle	X	X	X
Alligator Snapping Turtle			X
Common Musk Turtle	X		X
Eastern River Cooter	X		X
Eastern Box Turtle	X	X	X
Ornate Box Turtle	X		X
Slider	X		X
Spiny Softshell Turtle	X		X
Sauria			
Coal Skink	X		X
Five-Lined Skink	X	X	X
Broad-Headed Skink	X	X	
Southern Prairie Skink			X
Great Plains Skink	X		
Ground Skink	X	X	X
Eastern Collared Lizard			X
Texas Horned Lizard			X
Prairie Lizard	X	X	X
Six-Lined Racerunner	X	X	X
Western Slender Glass Lizard	X	X	

Habitat for aquatic turtles on Camp Crowder was limited to man-made ponds, so several species were expected to be absent from the site. It was surprising that no Sliders, (*Trachemys scripta)*, were captured or observed. Additional sampling effort may yet reveal both sliders and the Common Musk Turtle, (*Sternotherus odoratus)*, at Camp Crowder.

Camp Clark is roughly one-third the size of Camp Crowder and subsequently has more intensive anthropomorphic impacts, including higher densities of buildings and roads, and more foot traffic. This high human use and increased fragmentation may be a causal factor for the low numbers of species observed on site. Notable amphibian absences at Camp Clark included the Plains Leopard Frog, (*Lithobates blairi)*, and the Great Plains Narrowmouth Toad, (*Gastrophryne olivacea)*. Habitat for both species is present (Johnson, 2000; Collins et al., 2010) and both may turn up with additional survey work. The Crawfish Frog, (*L. areolatus)* is a grassland species that has experienced declines throughout its range from agricultural and successional conversion of its prairie habitat (Parris and Redmer, 2005). While no individuals of this species were observed during our surveys, Camp Clark has seen considerable grassland restoration work. Grassland restoration sites include wet prairie and abundant populations of Grassland Crayfish, (*Procambarus gracilis)*, whose burrows could be utilized by Crawfish Frogs.

Table 2: Amphibians and reptiles observed at Camp Clark, Vernon County, MO (2012) (NOW) and species reported historically for Vernon County, MO (THEN) and Bourbon County, KS (BB,KS).

Species	NOW	THEN	BB,KS
Caudata			
Central Newt			X
Smallmouth Salamander	X	X	X
Common Mudpuppy			X
Anura			
American Bullfrog	X	X	X
Crawfish Frog		X	X
Blanchard's Cricket Frog	X	X	X
Great Plains Narrowmouth Toad			X
Grey Treefrog (complex)	X	X	X
Plains Leopard Frog		X	X
American Toad	X	X	X
Spring Peeper	X	X	X
Boreal Chorus Frog	X	X	X
Southern Leopard Frog	X	X	X
Fowler's Toad		X	X
Serpentes			
Brown Snake	X	X	X
Lined Snake		X	X
Rough Green Snake		X	X
Common Gartersnake	X	X	X
Western Ribbon Snake		X	X
Plain-bellied Water Snake	X	X	X
Diamond-backed Water Snake		X	X
Northern Water Snake		X	X
Graham's Crayfish Snake			X
Coachwhip		X	X
Eastern Racer		X	X
Great Plains Rat Snake			X
Texas Rat Snake	X	X	X
Prairie Kingsnake		X	X
Speckled Kingsnake		X	X
Milk Snake			X
Gopher Snake		X	X
Eastern Hog-Nosed Snake		X	
Western Worm Snake			X
Ringneck Snake	X	X	X
Flathead Snake		X	X
Copperhead		X	X
Timber Rattlesnake			X
Massasauga			X
Chelonia			
Common Snapping Turtle	X	X	X
Common Musk Turtle	X	X	X
Western Painted Turtle		X	X
Common Map Turtle			X
Eastern River Cooter			X
Eastern Box Turtle	X	X	X
Ornate Box Turtle	X	X	X
Slider	X	X	X
Spiny Softshell Turtle		X	X
Sauria			
Southern Coal Skink	X	X	
Five-Lined Skink	X	X	X
Broad-Headed Skink			X
Great Plains Skink		X	X
Ground Skink	X	X	X
Six-Lined Racerunner	X	X	X
Texas Horned Lizard		X	X
Prairie Lizard	X	X	
Eastern Collared Lizard		X	X
Western Slender Glass Lizard		X	X

Very few snake species were observed on Camp Clark, although the lack of available cover on site (very few rocks, downed woody debris, or old building materials) may have made detection difficult. Several individuals of water snake were observed, but only one species, the Plain-bellied Water Snake (*Nerodia erythrogaster*) has been verified at this time. Turtle species occurrences were representative based on the available habitat on site (man-made ponds) (Table 2). Western Painted Turtles, (*Chrysemys picta)* may eventually be observed at Camp Clark, although the large number of Sliders currently present in the ponds may preclude their occurrence (Dreslik and Phillips, 2005; Dreslik et al, 2005).

Comparison of cross-border records revealed data needs for providing a more complete picture of local species distributions. It was clear when comparing cross-border distributional records that while considerable distributional work on amphibians and reptiles has been done in Kansas and Missouri, more effort is needed in Oklahoma. Missouri has an active herpetological atlas program (http://atlas.moherp.org/), with the most recent update, as of this writing, being 28 August 2012. Kansas has had a long history of herpetological inventories (see Collins et al., 2010), and also has an active online atlas project (http://webcat.fhsu.edu/ksfauna/herps/). Based on information on the home page for the Oklahoma Biological Survey site (http://www.biosurvey.ou.edu/dokadesc.html), no entries have been made since 1998.

Amphibian and reptile inventories at MOARNG training sites in western Missouri, while short in duration, provided important baseline information required for habitat management and restoration. Comparisons between our surveys and historical surveys at the county level show

that much additional work needs to be done at these sites to obtain a more complete picture on amphibian and reptile community composition at each training site. Gunzbuger (2007) found that detection probability of amphibians varied across a range of techniques depending on species and life-stage. An extreme example of temporal variability in species encounters was a 50-yr snake study conducted by Fitch (1999) in Douglas, Jefferson, and Leavenworth counties in northeastern Kansas. During the course of this 50-yr study, the Smooth Earth Snake (*Virginia valeriae*) was only observed 3 times. It is hoped that repeated surveys over time will allow for the growth in our knowledge of the community composition at all MOARNG training sites.

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AN EVALUATION OF TECHNIQUES FOR MEASUREMENTS OF SNAKE LENGTH

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Abstract: *The efficacy of two measurement techniques was evaluated in a laboratory setting for user variation and practicality. A total of 59 snakes (15* Lampropeltis getula floridana*, 16* Pantherophis guttatus*, 12* Epicrates cenchria maurus*, and 16* Thamnophis sauritus*) were measured using traditional soft-tape measurements paired with restraining tubes. The second measurement method evaluated snake length using the digital imaging software Snakemeasurer© by taking a photo parallel to the surface the snake was resting on with a known length object in the photo for measurement reference. Each snake was measured by two designated measurers (one experienced and one recently-trained) using both measurement techniques. Each researcher and technique produced similar measurements. Digital measurements were not significantly different between measurers while soft-tape measures varied with species.*

Key Words: digital measure, snake length, Snakemeasurer©, straight line length

INTRODUCTION

Varying types of size measurements are used in studies on snakes and can provide valuable data (Fitch, 1987). The typical length measure reported for snakes is the snout-to-vent length (SVL) as it is seen as the most important length measurement (Fitch, 1987), but this has not always been the standard (Seigel and Ford, 1988). Seigel and Ford (1988) reported the three most common measurements of snakes to be SVL, total length (TL), and mass. While SVL is the standard length measurement used for snakes today, TL is still occasionally used (Penning and Cairns, 2012). Typically SVL measurements are recorded using the methodologies of Fitch (1987) due to its time and cost effectiveness in the field. A soft or hard tape measure is used and the snake is gently stretched along the tape length. Other methods of measurement that have been used include restraining tubes (Fitch, 1987), press-boxes (Quinn and Jones, 1974; Bertram and Larsen, 2004), anesthesia (Blouin-Demers, 2003), and digital imaging software (Measey et. al., 2002). All of the above mentioned measurement techniques are prone to three types of error: single user-single measurement technique variation; multiple user-single measurement technique variation; and multiple measurement technique variation (Setser, 2007).

Highly precise and repeatable measurements are becoming increasingly important, especially with the newly discovered bidirectional growth phenomenon reported in marine iguanas (Wikelski and Thom, 2000). This phenomenon was investigated in snakes using data from a long-term field study on *Liasis fuscus*, and based on recapture data, 6.42% of the recaptures reported shrinking lengths (Madsen and Shine, 2001). The same phenomenon was reported in Blouin-Demers *et al.* (2002) for *Pantherophis obsoletus*. Both of these observations were reported to be measurement error and not actual shrinking. Contrastingly, measurement error has not always been considered to cause false results in experimental evaluations (Merila and Bjorklund, 1995).

Several investigators have evaluated the accuracy and precision of length measures of elongate vertebrates using various measurement techniques and varying levels of support exist for every measurement type. Quinn and

Jones (1974) found the squeeze-box technique to produce reliable measurements with little variation, while Setser (2007) found the same technique to produce less reliable results than anesthetizing snakes prior to straight measurement. Bertram and Larsen (2004) reported significantly larger measurements to be produced by straight-line measurements when compared to squeeze-box measurements and recommended one tracing in a squeeze-box measured three times to best balance handling time and accuracy. Cross (2000) evaluated squeeze-box and anesthetized measurement techniques and found <1 cm variation between measurements. Measey *et al.* (2002) compared fixed-ruler measurements to flexible measurements using digital imaging software (Wilcox *et al.*, 1997) and found both measures to be reliable with fixed-rulers producing significantly longer measurements. Blouin-Demers (2003) found all three of the investigated measurement forms (soft-tape while awake, soft-tape while anesthetized, and solid-tape while anesthetized) to be effective and concluded with the recommendation for measuring snakes under anesthesia using a solid ruler. Measurements using soft-tape while the snake is awake is a reasonable alternative, a conclusion also supported by Setser (2007).

Using different measurement techniques not only come at varying economical costs (Setser, 2007), but also have potential ecological impacts (Fitch, 1987). The process of measuring snakes awake with a soft-tape in the field has been shown to have negative growth impacts for several weeks after capture in *Crotalus viridis* (Fitch, 1949). Using anesthesia to measure snakes brings the greatest risk (Fitch, 1987) and has been cautioned against its use if only measurement data are to be taken (Measey *et al.*, 2002). Hand measurements have the drawback of being a "one off" measurement with no capability of being checked by an alternate authority (Measey et. al., 2002). Errors in snake measurements are an important problem (Fitch, 1987) that needs to be addressed with minimally invasive handling techniques in mind (sensu Fellers *et al.*, 1994). Measurement error of SVLs have been found to be so variable that its use has occasionally been abandoned (Houston and Shine, 1994), an unfortunate outcome that may be prevented with new software. Snakemeasurer© is digital imaging software designed to measure snakes based on single-frame images with a known measure within the image. It is freely available (http://serpwidgets.com/main/measure) and has been used in prior publications (Pen-

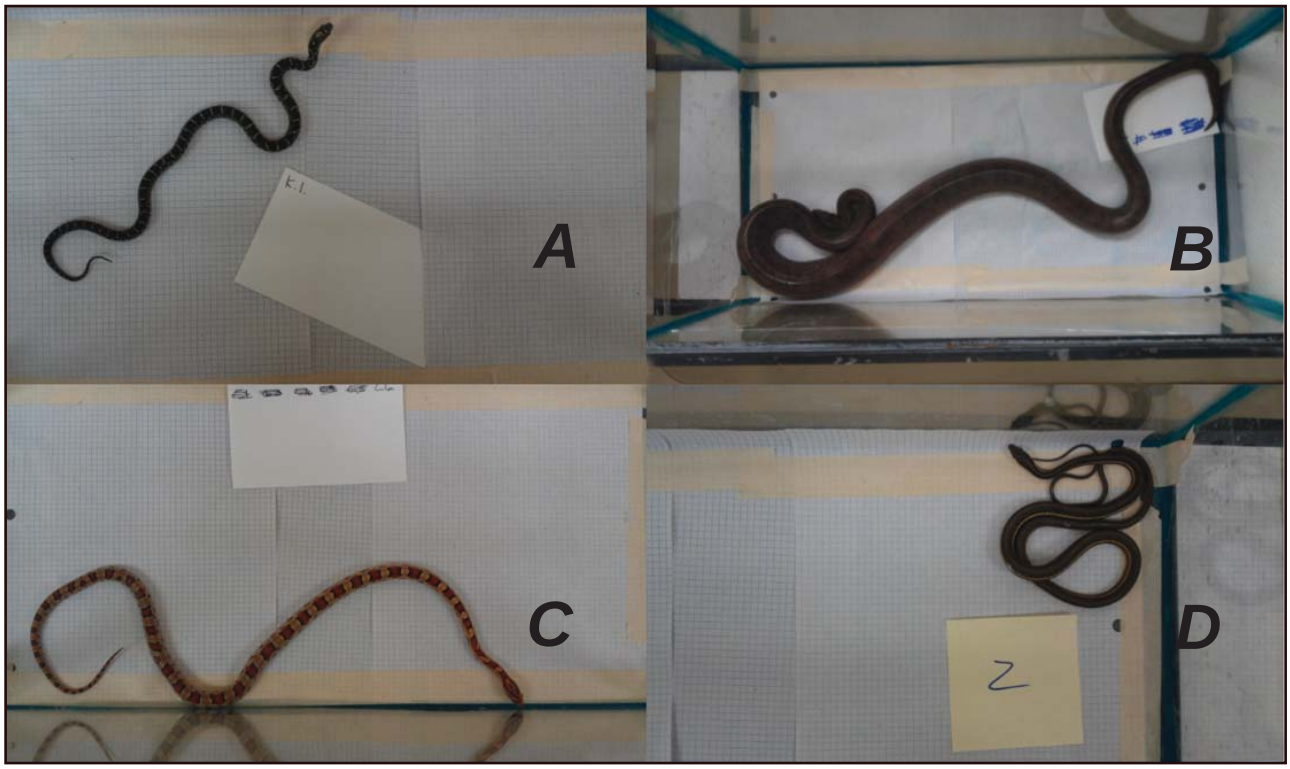

Figure 1. An overhead image of all four snake species [*Lampropeltis getula floridana* (A); *Epicrates cenchria maurus* (B), *Pantherophis guttatus* (C), and *Thamnophis sauritus* (D)] using 0.4 cm graph paper as the measurement reference.

ning and Cairns, 2012). The main objective of our study is to evaluate the effectiveness of Snakemeasurer© for measuring snake length and how it compares to the classic soft-tape measuring technique.

METHODS

Snakes used in this study came from various growth and behavioral studies being performed at the University of Central Missouri during spring 2012. A total of 59 snakes were used for the evaluation of measurement techniques (15 *Lampropeltis getula floridana*, 16 *Pantherophis guttatus*, 12 *Epicrates cenchria maurus*, and 16 *Thamnophis sauritus*). Manual measurements involved the use of a soft-tape measure and various restraining tubes. Snakes were placed in a restraining tube just large enough to accommodate them and were then measured for total length. Total length was used due to the overhead imaging procedures used with the software program. As we are not making any ecological implications based on our length data, total length serves the identical purpose for comparing measures. All snake total lengths were measured twice using soft-tape (once by an experienced researcher and once by a recently-trained researcher) to the nearest 0.1 cm. Snakes were then placed in a 37.8 L aquarium lined with 0.4 cm graph paper where they were free to orient themselves. Snakes were photographed from above with the camera on a parallel plain to the aquarium bottom (Penning and Cairns, 2012). Occasionally snakes were moved gently with a snake hook until an acceptable body position was available for imaging (no overlap or raised body sections). The snake needed to be flat with no portion of the body elevated from the substrate because the imaging software measures only in two dimensions. Both the tip of the snout and tip of the tail needed to be easily viewed within the image. Images were then run through Snakemeasurer© for straight-line length by both researchers using the graph paper as the known measurement length (Fig 1). The experienced researcher remained the same for all measurements but the recently-trained researchers changed between snake species with the exception of *L. g. floridana* and *P. guttatus*.

All statistical analyses were performed on MS EXCEL and MINITAB. Paired t-tests (two-tailed) were performed between measurers of each technique for each species due to the repeated measure design of data collection (McDonald, 2008), as well as its previous use in similar investigations (Measey *et al.*, 2002; Blouin-Demers, 2003). Variables were normally distributed and all tests were considered significant at $p<0.05$.

RESULTS

Implementation

For the experienced user the time to complete the entire procedure was, on average, faster for soft-tape measurements (ca. 2 min). Overall time spent handling snakes was much faster for the digital imaging (<1 min), but required more time for image transfer, downloading, and processing (ca. 3 min).

Reliability

A total of 236 measurements were taken from 59 snakes. For *L. g. floridana*, mean straight line lengths varied only by 1 mm between digital measurers and were not significantly different (paired t-test (15) = -0.453, $p>0.05$), while soft-tape measurements were significantly different with the average varying by 12 mm (paired t-test (15) = -5.467, $p<0.05$). For *P. guttatus*, mean straight line lengths varied by 5 mm between digital measurers and 1 mm between soft-tape measurers and both were not significantly different between measurers (paired t-test (14) = -2.08, $p>0.05$ and paired t-test (14) = -0.4483, $p>0.05$ respectively). For *E. c. maurus*, mean straight line

Table 1. Combined measurement (mean±SD) results from four snake species (a total of 236 measurements). Digital snake measuring using Snakemeasurer© is represented by "Digital Measure", hand measurements using restraining tubes and a soft ruler is represented by "Soft-Tape Measure".

Species	***Digital Measure***	***Soft Tape Measure***	***Paired t-test***
L. g. floridana	511±8.7 mm	478±8.5 mm	t(15) = 15.34, p<0.05
P. guttatus	625±9.14 mm	590±8.32 mm	t(15) = 16.27, p<0.05
E. c. maurus	963±11.08 mm	885±10.23 mm	t(11) = 25.22, p<0.05
T. sauritus	609±4.78 mm	591±5.09 mm	t(15) = 14.44, p<0.05

lengths were not significantly different among digital measurers (paired t-test (11) = 2.128, $p>0.05$) while soft-tape measurers were (paired t-test (11) = -12.749, $p<0.05$). For *T. sauritus*, mean straight line lengths varied by 6 mm and were not significantly different between digital measurers (paired t-test (15) = 1.777, $p>0.05$) while mean straight line length was significantly different between soft-tape measurers (paired t-test (15) = -7.590, $p<0.05$). All combined digital measures were significantly larger than combined soft-tape measures (Table 1).

DISCUSSION

Our results are similar to that of Measey *et al.* (2002) in that one measure consistently produced significantly longer measurements than the other but differ in the longer measure reported. In our study, Snakemeasurer© software reliably produced longer measurements compared to the soft-tape measurements, markedly so in *E. c. maurus*. This species is a notorious resister to manual restraint and the forces at which it can do so have been quantified (Lourdais *et al.*, 2005). All digital measurements were similar when compared between researchers while the soft-tape measures were significantly different between researchers in all but the *P. guttatus* comparison. This supports the notion that measurer variation is higher in hands-on manipulations of snakes and less when using digital imaging software.

Functionally, Snakemeasurer© digital imaging software is similar to anesthetized measures. The snake is not active and time can be taken to measure length carefully with no struggling, resistance, or spinal flexion. Blouin-Demers (2003) found the greatest variation in measurements to be active snakes and the most precise measurements to come from anesthetized snakes. These results support this trend by showing no significant difference between researchers using Snakemeasurer© digital imaging software. When compared between researchers, soft-tape measurements were significantly different in three of the fours species we investigated.

Palmeirim (1998) reported skull measurement variation between different measurers to be 30.7%, almost twice the value of intra-measurer variation. Ecological studies can span several investigators and measurer bias and error has the ability to impact measurement recordings (Madsen and Shine, 2001; Blouin-Demers et al., 2002) even to the extent of rejecting length as a measure in general (Houston and Shine, 1994). With powerful musculature controlling the snake's ability to move and in some cases slightly elongate or compress during handling, gentle stretching procedures used in many measurement investigations could have and have yielded variable results from experimenter manipulation (Houston and Shine, 1994). Coupling measurer and measurement technique variation could have a large impact on the measurements reported. The use of a measuring technique that eliminates as many potential errors balanced with a lessened post-measurement impact on the organism of investigation would be the ideal technique.

In this study, Snakemeasurer© digital imaging software showed the least variation between measurers compared to soft-tape measuring and has added benefits that no other measuring technique can provide. Inter-measurer error can be completely eliminated with this technique even if the length measurer was not the field investigator. Additionally, with the ability to easily store images it is possible to allow additional researchers access to the data allowing for the further elimination of inter-measurer error even in large compiled data sets.

Measey et al. (2002) listed many of the benefits of using digital imaging software, but at the time, warned of its expense and technical complexity. In today's market, digital cameras can be purchased at reasonable prices; the Snakemeasurer© digital imaging software is freely available, and the newly trained researchers in this study had no difficulty using the software. It is a much less expensive alternative to anesthesia and in this study had none of its reported drawbacks (Setser, 2007). Handling time per snake was reduced, although there was a slight increase in total measuring time using the digital software. The expense of added time is a cost to the researcher with the benefit of reduced handling to the snake. The simplest and most cost-effective measuring technique will likely always be soft tape measuring but even this fairly noninvasive technique has been shown to have a negative impact on snake growth (Fitch, 1949). The most precise measurement technique (anesthesia) is the most expensive. Its use requires the most time for the researcher as well as han-

dling time for the snake and can prove to be fatal in some cases (Setser, 2007). When designing future experiments, researchers should design their experiments with all of the above benefits and drawbacks in mind.

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The KHS is a non-profit organization established in 1974 and designed to encourage education and dissemination of scientific information through the facilities of the Society; to encourage conservation of wildlife in general and of the herpetofauna of Kansas in particular; and to achieve closer cooperation and understanding between herpetologists, so that they may work together in common cause. All interested persons are invited to become members of the Society. Membership dues per calendar year are $15.00 (U.S., Regular), $20.00 (outside North America, Regular), and $20.00 (Contributing) payable to the KHS. Send all dues to: KHS Secretary, (address inside the front cover)

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The KHS hosts three field trips each year, one each in the spring, summer, and fall. Field trips are an enjoyable educational experience for everyone, and also serve to broaden our collective understanding of the distribution and abundance of the amphibians, reptiles, and turtles in Kansas. All interested persons are invited to attend.

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Collinsorum, currently issued quarterly (March, June, September, and December), publishes all society business.

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The Alan H. Kamb Grant for Research on Kansas Snakes

KHS members only are eligible to apply for *The Alan H. Kamb Grant for Research on Kansas Snakes,* which was established in 2001. The recipient of the grant will be selected by the KHS Awards Committee. A minimum award of $300 is given annually.

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The George Toland Award for Ecological Research on North American Herpetofauna

This CNAH Award was established in 2008 in recognition of the scientific career of George Fredrick Toland, whose life-long interest in herpetology was passed on to so many of his students. The recipient of this award will be selected by the KHS Awards Committee. A minimum award of $200 is given annually at the end of the KHS meeting.

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This CNAH Award was established by Westar Energy in 1998 in recognition of the achievements of Suzanne L. Collins and Joseph T. Collins. In even years, the Award is bestowed upon an individual who, in the preceding two calendar years, had published a paper of academic excellence on native species of Kansas amphibians, reptiles, and/or turtles, and in odd years, the Award is given to an individual who, in a juried competition, took the best photograph of a Kansas amphibian, reptile, or turtle. *The Collins Award* is minimally $1,000.00, and is neither a grant nor a scholarship. No nominations or applications can be made for it.

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