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Front Cover: The eggs of an Eastern Narrowmouth Toad (*Gastrophryne carolinensis*) from Cherokee County, Kansas. Photograph by Suzanne L. Collins, Lawrence, Kansas.

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KHS BUSINESS

REPORT ON THE KANSAS HERPETOLOGICAL SOCIETY 35th ANNUAL MEETING

The Kansas Herpetological Society held its 35th Annual Meeting in William Penn Hall at Friends University, Wichita, Kansas, on 8–9 November 2008. Over 100 participants attended six scientific paper sessions to listen to 28 talks on amphibians, reptiles, and turtles by scientists and students from across the nation.

During its business meeting, the KHS elected a new slate of officers. Kathy Ellis (Wakarusa, Kansas) was voted president-elect for 2009, Eric Kessler (Blue Valley North High School) was voted treasurer, and Mary Kate Baldwin (Topeka Collegiate School) was voted secretary. Dan Johnson (Overland Park) currently is president-elect and takes office as president on 1 January 2009. Dan Carpenter (Friends University) served as president during 2008, hosted the meeting this year, and will serve on the KHS Executive Council in 2009 as past-president.

At the start of the Saturday night KHS auction, Dan Fogell (KHS Awards Committee Chairperson) announced that Ashley Inslee of Fort Hays State University was this year's recipient of the Howard K. Gloyd-Edward H. Taylor Scholarship. The scholarship of \$275.00 honors the memory of two great herpetologists (and KHS Distinguished Life Members) with strong ties to Kansas. Gloyd was born in Ottawa, Kansas, and attended both Kansas State University and the University of Kansas, and Taylor graduated from Garnett (Kansas) High School and was a faculty member for decades at the University of Kansas. Next, Fogell presented the Alan H. Kamb Grant for Research on Kansas Snakes to Page Klug of Kansas State University. The \$300.00 grant honors the memory of longtime KHS member Al Kamb of Lawrence.

The KHS Saturday night award ceremony continued with Dustin Wilgers, University of Nebraska at Lincoln, becoming the eleventh recipient of *The Suzanne L. and Joseph T. Collins Award for Excellence in Kansas Herpetology*. Dustin was selected for this honor by the KHS Awards Committee, which judged his published research, *Effects of Different Burn Regimes on Tallgrass Prairie Herpetofaunal Species Diversity and Community Composition in the Flint Hills, Kansas* (co-authored with Eva A. Horne and published in the *Journal of Herpetology* in 2006). For his excellent research paper, Dustin was given a commemorative plaque and a check for \$1,000.00 by KHS President Dan Carpenter. *The Collins Award* is the largest biological award given annually in the state of Kansas, and the largest annual presentation made nationally for research (even-numbered years) or photography (odd-numbered years) of amphibians, reptiles, and turtles. The KHS Awards Committee for 2008 consisted of Daniel D. Fogell (University of Nebraska, Omaha), Travis W. Taggart

(Sternberg Museum of Natural History, Fort Hays State University, Hays), and Walter E. Meshaka, Jr. (State Museum of Pennsylvania, Harrisburg).

After welcomes by Dan Carpenter (KHS President), and Patrick Mathews (Friends University), George Potts introduced the Society's keynote speaker at the two-day event, Dr. Ronald M. Bonett (University of Tulsa, Oklahoma). Ron spoke about *Evolution versus Paedomorphosis in Salamanders* and his talk was very well received and generated much interest about these creatures, three species of which are found in southeastern Kansas.

Other speakers for the scientific paper sessions on Saturday morning included (in order of presentation): Rachel Spruance & Richard T. Kazmaier on *Snakes of the Matador Wildlife Management Area: Habitat Selection and Notes on Diet*, Joseph T. Collins on *Mintonius, Pituophis, Pantherophis and Scotophis*, Bruce Rothschild, Hans-Peter Schultze & Rod Pellegrini on *Review of Macroscopic Crocodile and Lizard Skeletal Pathology and Creation of an Annotated Herpetological Bibliography*, David Chiszar, Bryon Shipley, Kevin Fitzgerald & Hobart M. Smith on *Straightness of Path during and after the Vernal Migration in Prairie Rattlesnakes, Crotalus viridis viridis, in Eastern Colorado*, Samantha Parker, Hillary Bernhardt & Shireen Usman on *Eastern Newts near Gloyd's fabled Pigeon Lake*, and Dwight R. Platt on *Reproductive Strategies of Sympatric Populations of *Thamnophis sirtalis* and *T. radix* in Harvey County, Kansas*.

Speakers for the scientific paper sessions on Saturday afternoon included George R. Pisani on *Utilization of an Active Ant Nest (*Formica subsericea*) as a Hibernaculum by Small Snake Species*, Michael Rochford on *The Diet of the Indian Python (*Python molurus*) in Southern Florida*, Curtis J. Schmidt, Joseph T. Collins & Travis W. Taggart on *The Graptemys pseudogeographica complex in Kansas: History, Problems, and a Request*, Mark J. Lange & Richard T. Kazmaier on *Variations in Aquatic Turtle Communities on Three Study Sites in the Texas Panhandle*, Page Klug on *The Spatial Ecology of Two Predatory Snakes in the Tallgrass Prairie and the Impact on Avian Nesting*, Dan Krull on *Reptiles and Amphibians as Educational Tools*, Dan P. Walker & Richard T. Kazmaier on *Responses of Herpetofauna to Prescribed Fire in a Mixed-grass Prairie*, Mindy L. Walker, Rebecca J. Benjamin, William Donovan, Jennifer A. Dorr & George R. Pisani on *Successful Relocation of a Threatened Suburban Kansas Population of Timber Rattlesnakes (*Crotalus horridus*)*, J. Daren Riedle, Richard T. Kazmaier, Trey B. Barron & Wes B. Littrell on *Assessing Habitat Associations of an Eastern Texas Aquatic Turtle Community*, and Angela M. Fornell on *Foraging Site Selection in*



Some of the over 100 participants at the KHS Annual Meeting at Friends University, Wichita, Kansas, on 8 November 2008. Photograph courtesy of Kansas Heritage Photography.

Prairie Kingsnakes (Lampropeltis c. calligaster): An Experimental Approach.

Speakers for the scientific paper sessions on Sunday included Steve D. Grant, Richard T. Kazmaier, Mike W. Janis & Abby Lubbers on *Spatial Ecology of Ornate Box Turtles in a Sand-sage Prairie Ecosystem*, Emilie Throop on *Habitat Occupancy of Eastern Collared Lizards in the Flint Hills of Kansas*, Trey B. Barron, Richard T. Kazmaier & Wes B. Littrell on *Diet and Habitat Use by an Inland American Alligator Population*, Jacobo Reyes Velasco on *New State Herpetofaunal Records for Colima, Mexico*, Matthew D. Broxson & Richard T. Kazmaier on *Assessing Diet in an Eastern Texas Snake Community*, Ginny Weatherman on *Museum Field Collecting Techniques for Herpetofauna, with Comments on Recent Work in Mexico*, Chip Cochran on *African Snakes*, Mark S. Mills, Teffany N. Sample, Jennifer L. Godfrey, Sandra Mosquera, Mariah L. Carter, Matthew C. Klein & Kathleen M. Novicky on *Reproductive Ecology of a Suburban Population of Smallmouth Salamanders (Ambystoma texanum): An Seven-Year Study*, Ashley A. Inslee & Chad Stinson on *Recovery Program for the Kemp's Ridley (Lepidochelys kempii) on Matagorda Island, Texas*, and Ashley A. Inslee & William J. Stark on *Habitat Preference of the Texas Horned Lizard (Phrynosoma cornutum) on Matagorda Island, Texas*.

At the conclusion of the Sunday presentations, the first annual *George Toland Award*, for the best paper presented at the meeting by a student on the ecology of North American amphibians, reptiles, turtles, and/or crocodilians was given by S. Ross McNearney, representing the *McPherson Family Trust*, to Steve D. Grant, West Texas A&M University at Canyon. Steve received a commemorative certificate and a check for \$100.00.

The Saturday evening KHS auction garnered \$1,470.00 for the Society treasury, spurred once again in part by the extraordinary offering of original artwork by Eva Horne, excellent donations of herpetological books by Suzanne L. Collins (CNAH) and Eric Thiss (Zoo Book Sales), original artwork by John Lokke, herpetological color photographs by Larry L. Miller (Kansas Heritage Photography), and T-Shirts from Touchstone Energy, and also by the hard work of auction assistants Laura Acuff, Hillary Bernhardt, Morgan Ferraro, Grace Anne Johnson, Samantha Parker, Erica Peterson, and Shireen Usman, who so diligently assisted KHS auctioneers Joe Collins, Dan Fogell, and Chad Whitney.

Meeting Chairperson and KHS President Dan Carpenter deserves the generous thanks and appreciation of the KHS membership for putting together a memorable meeting. Dan was aided in his task by a local committee consisting of himself, James H.

Marlett, Patrick Mathews, Suzanne L. Collins, and Joseph T. Collins. To them all we owe our enthusiastic kudos. And, of course, we must recognize the stalwart and sterling efforts of Mary Kate Baldwin (KHS Secretary) and Eric Kessler (KHS Treasurer); both kept us financially sound and stable through their sterling work.

And, of course, thanks to our sponsors, Friends University, The McPherson Family Trust, Touchstone Energy, Sedgwick County Zoo, Zoo Book Sales, and CNAH. Without their support, financial and otherwise,

the meeting would have been less.

In 2009, the Society will meet in the Overland Park area (talks, donuts, and coffee, free beer and auction) under the auspices of Dan Johnson, who will serve as KHS President during that year. For more precise information on the 36th Annual Meeting of the KHS in November 2009, bookmark and regularly check the KHS meeting web site (updated constantly as new information becomes available) at

<http://www.cnah.org/khs/AnnualMeetingInfo.html>

Images of the Kansas Herpetological Society 35th Annual Meeting Friends University, Wichita, Kansas, 7–9 November 2008



KHS President Dan Carpenter greets the assembled horde. Photograph courtesy of Kansas Heritage Photography.



KHS Awards Chairperson Dan Fogell (R) presents *The Collins Award* to Dustin Wilgers, University of Nebraska, Lincoln. Dustin received a plaque and a check for \$1000.00. Photograph courtesy of Kansas Heritage Photography.



Dan Fogell presents the *Gloyd-Taylor Scholarship* for \$275.00 to Ashley Inslee, Fort Hays State University. Photograph courtesy of Kansas Heritage Photography.



Dan Fogell presents the *Alan H. Kamb Grant* for \$300.00 to Page Klug, Kansas State University. Photograph courtesy of Kansas Heritage Photography.



Dr. Ronald Bonett (L), the KHS Keynote Speaker, shown here with Joe Collins. He took us down where the near-eyeless *Eurycea* evolve. Photograph by Suzanne L. Collins.



Former KHS President and well-known artist John Lokke was featured at the meeting with a display of his exquisite renderings. Photograph by Suzanne L. Collins.



Ross McNearney (L), representing the McPherson Family Trust and CNAH, presents the first *George Toland Award* to Steve D. Grant, West Texas A&M University, Canyon. Steve received a certificate and a check for \$100.00. Photograph by Suzanne L. Collins.



KHS Distinguished Life Members (L-R) Joe Collins, Henry Fitch, and Dwight Platt swap stories of meetings attended, past and present. Dwight and Joe both presented papers; Henry critiqued them. Dwight got an A; Joe got a low C. Photograph by David Oldham.



KHS President-elect Kathy Ellis will host the annual meeting in 2010 in Topeka, Kansas. Photograph by Kansas Heritage Photography.



David Chiszar from the University of Colorado spoke at the meeting, and passionately regaled the participants with the saga of Howard Gloyd, Hobart Smith, and the historic handgun. Photograph courtesy of Kansas Heritage Photography.



As always, KHS Treasurer Eric Kessler and KHS Secretary Mary Kate Baldwin made sure the money matched. Photograph courtesy of Kansas Heritage Photography.



As daughter Grace Anne looks on in wonderment, Dan Johnson dons the traditional President-elect crown, transferred eagerly to him by KHS President Dan Carpenter in a somber ceremony at the meeting. Photograph courtesy of Kansas Heritage Photography.



L-R. Robin Oldham, Chad Whitney, Ryan Shofner, and Don Becker hang out at the live exhibit. Photograph by David Oldham.



Samantha Parker and Laura Acuff wowed the auction audience with their offerings. Photograph courtesy of Kansas Heritage Photography.



The KHS auction was once again a sterling success, thanks to the efforts of (L-R) Erica Peterson, Chad Whitney, Morgan Ferraro, Samantha Parker, Hillary Bernhardt, Shireen Usman, Joe Collins, and Dan Fogell. Laura Acuff and Grace Anne Johnson also helped a lot, but were off somewhere drinking orange juice. Photograph courtesy of Kansas Heritage Photography.

REPORT ON THE KHS FALL FIELD TRIP TO SMITH COUNTY, KANSAS

The Kansas Herpetological Society Fall Field Trip for 2008, held on 4-6 October in Smith County, was a great success. Slightly over fifty participants conducted a successful herpetofaunal count, recording twenty-two species of amphibians, turtles, and reptiles and about 600 specimens during the weekend event.

The field trip began on Friday, with campers arriving at Glen Elder State Park to set up tents, cook the evening meal, and check the nearby habitat for critters. On Saturday morning, the group assembled at 9:00 am to receive instructions from KHS Field Trip Chairperson Daniel Murrow about the herpetofaunal survey to be done by them on the hillsides of a pre-selected site in Smith County. The seventeen car caravan arrived at the rugged habitat and it occupied the participants for much of the day. The Sunday portion of the Society field trip was cancelled due to a combination of impending rain, wind and a dirt road surface, a messy mix guaranteed to put every car in a roadside ditch. Saturday night consisted of the usual revelry around the campfires, snakes stories and dancing and singing offkey, followed by a night's slumber. The KHS extends its thanks to Bob Levine, for generously showing a large band of herpetologists how to roam the terrain and experience the beauty of the land.

Participants were: Keith Arkenberg, Mary Kate

Baldwin, Laura Baldwin, Henry Bishop, Miles Bishop, Dan Carpenter, Nathan Carpenter, Shelbi Carpenter, Keith Coleman, Joseph T. Collins, Suzanne L. Collins, Andrew S. Durbin, Mark Ellis, Ewin James Gubanyi, Julian Gubanyi, Spencer Hobson-Gutierrez, Dylan Howes, David Humenczuk, Eric Kessler, Owen Kessler, Crystal Klaichang, Bob Levin, Emmy Lieser, Jill Lokke, John Lokke, Brandon Low, Judy Low, Brock Mark, S. Ross McNearny, Larry L. Miller, Suzanne Miller, Jacob Mirocke, Daniel Murrow, Ben Myers, David Oldham, Robin Oldham, Tag Oldham, Brett Schmidt, Derek Schmidt, Garrett Shropshik, Charlie Stieben, Travis W. Taggart, Jeremiah Teller, Danny Umschied, Kristin Umscheid, Chad Whitney, Victor Wilkinson, Claire Williams, and Brant Yeoman.

The following species were observed:

Amphibians

Barred Tiger Salamander	1
Woodhouse's Toad	2
Blanchard's Cricket Frog	±397
Boreal Chorus Frog	3
Plains Leopard Frog	±102
Bullfrog	1
Great Plains Narrowmouth Toad	1



Some of the more than fifty participants at the KHS Fall Field Trip to Smith County, Kansas, on 5 October 2008. Photograph by Kansas Heritage Photography.

Reptiles

Lesser Earless Lizard	2
Texas Horned Lizard.....	3
Great Plains Skink	1
Six-lined Racerunner	3
Eastern Racer.....	9
Common Kingsnake	1
Milk Snake	6
Great Plains Rat Snake	7
Gopher Snake (aka Bullsnake).....	6
Ringneck Snake	±40
Brown Snake	1
Common Garter Snake.....	8
Lined Snake.....	2

Turtles

Northern Painted Turtle	2
Ornate Box Turtle	2

Field Trip Totals

22 Species.....	±600 Specimens
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DANIEL G. MURROW, KHS Field Trip Chairperson, 8129 Perry Street #37, Overland Park, Kansas 66204.



The hunt is on at the KHS Fall Field Trip in Smith County. Photograph by Kansas Heritage Photography.



KHS president Dan Carpenter surveys his subjects at the KHS Fall Field Trip to Smith County, Kansas, on 5 October 2008. Photograph by Kansas Heritage Photography.



Shelbi Carpenter (left) and Crystal Klaichang rock at the top of the big rock. Photograph by Ks Heritage Photography.



Daniel Murrow, the ever resourceful KHS Field Trip Chairperson, secures wood for the Saturday night campfire. Photograph by Kansas Heritage Photography.



Chad Whitney shows Laura Baldwin the correct way to hold a big Bullsnake. Six of these serpents were found in Smith County. Photograph by Ks Heritage Photography.



John and Jill went up the hill . . . to look for reptiles. The Lokke's enjoyed yet another excursion into the wilds of Kansas. Photograph by Kansas Heritage Photography.



Shown here is one of the seven Great Plains Rat Snakes (*Pantherophis emoryi*) found during the Smith County KHS Field Trip. Photograph by Kansas Heritage Photography.



Spencer Hobson-Gutierrez, one of Eric Kessler's students from Blue Valley North High School, admires his Smith County Milk Snake. Photograph by Ks Heritage Photography.

PAY YOUR 2009 DUES

If you have not already done so, send your calendar 2009 dues (\$15.00 regular, \$20.00 contributing) to:

Mary Kate Baldwin
KHS Secretary
 5438 SW 12th Terrace Apt. 4
 Topeka, Kansas 66604

Your attention to this matter will ensure that delivery of the *Journal of Kansas Herpetology* will be uninterrupted.

KHS 2009 SPRING FIELD TRIP

The KHS 2009 spring field trip will be to Chase County. For information as it is posted, be sure to check the KHS web site regularly at:

<http://www.cnah.org/khs/FieldTripSpringInfo.html>

For immediate information, contact:

Daniel G. Murrow
KHS Field Trip Chairperson

(see inside front cover of this issue)

RETROSPECTIVE

RICHARD LATTIS

The First Secretary of the Kansas Herpetological Society

In the late fall of 1974 (at the end of my term as KHS Secretary), I left the University of Kansas and took a job with the New York Zoological Society (now called the Wildlife Conservation Society) headquartered at the Bronx Zoo. It was an opportunity to teach, work with animals all around me, and live in the woods. Yes, believe it or not, Westchester County, just north of New York City, is filled with wildlife and forests. I remember finding lots of snakes and Eastern Box Turtles on the property when I built my house.

I started as the Assistant Curator of Education at the Bronx Zoo. My tasks were to run the Children's Zoo and the animal rides, as well as oversee the school programs. Later I became the Curator of Education and it was during this period that I discovered I really had taken the correct step in my career. I was given the chance to re-design the Bronx Zoo children's zoo.

My opportunity to design interactive animal exhibits for children to learn about animals had begun. By the way, the first exhibit where children looked through plastic domes at prairie dogs was a product of that project.

After that, I was lucky enough to be made the Director of City Zoos, a title created for the job of renovating and operating the Prospect Park Zoo in Brooklyn, Central Park Zoo in Manhattan, and the Queens Zoo. All three were previously operated by the City of New York, but the New York Zoological Society was asked to assume operations in 1980. I led the effort to create these new zoos for the Society. Two (Prospect Park and Central Park) were demolished and re-built, while the one in Queens was drastically remodeled, with a few of the old

buildings retained. Once the renovated zoos were reopened, I directed all three zoos from my office on Fifth Avenue in Central Park.

Ten years later I moved back to the Bronx Zoo to add the title of Assistant Director of the Bronx Zoo to my other duties. Soon after that I was promoted to Vice-President and General Director, Zoos and Aquariums. My job was to direct all operations of the Wildlife Conservation Society's four zoos and its aquarium on Brooklyn's Coney Island. During that time I led the creation of many new zoo exhibits in all the facilities and began the process of "greening" the zoos and aquarium as well. We had opened a new waterless restroom in the Bronx Zoo, just before I left.

In addition to my experiences with the Wildlife Conservation Society, I was elected President of the Association of Zoos and Aquariums in 1999 and served on its Board of Directors for seven years. While President, I started its program for animal welfare. I was also a member of the World Zoo and Aquarium Association. For two years, in the mid-seventies, I had a short piece on New York City's NBC News program every Friday night. It was filmed in the Bronx Zoo and called "Who's Who in the Zoo?"

I retired on 1 July 2007, after thirty-three years of working for the Society, and I still live in Westchester County. Working for the Society was a marvelous experience filled with regular trips overseas to see animals, design projects to create new animal exhibits with a conservation theme, and so many opportunities to meet people whose names were known worldwide – scientists, politicians, philanthropists, actors, and the like. The Wildlife Conservation Society's conservation activities are known worldwide and I am proud to have been a part of that.

My wife, Sharon, and I celebrated our 40th wedding anniversary last June. She, too, loved Kansas, as well as New York. Our three children, all males aged 31, 29, and 24, live in Brooklyn. None followed their father into biology, but instead pursued finance, music, and graphic design.

One of my last tasks before retiring was to replace the Curator of Reptiles position at the Bronx Zoo. My long-time friend and former reptile curator, John Behler, had died. Having appointed a new director of the Bronx Zoo, prior to my retiring, I asked him to lead a search for a replacement for John. Today our new Curator of Reptiles at the Bronx Zoo is Dr. Jennifer Pramuk, a graduate of the University of Kansas. Another herpetologist from Kansas does well in the big city!

Editor's Note: Richard Lattis served as the first Secretary of the Kansas Herpetological Society in 1974.



Richard Lattis, shown here at his residence in Westchester County, New York, served during 1974 as the first Secretary of the Kansas Herpetological Society. His humor was legendary.

OF INTEREST

MOLECULAR INSIGHTS INTO THE SYSTEMATICS OF THE SNAPPING TURTLES (CHELYDRIDAE)

2008. H. Bradley Shaffer, David E. Starkey & Matthew K. Fujita. Pp. 44-49. In *Biology of the [Common] Snapping Turtle (Chelydra serpentina)*. A. G. Steyermark, M. S. Finkler, and R. J. Brooks (editors). Johns Hopkins Univ. Press, Baltimore. x + 225 pp.

Taken from the text on page 49: Based on currently available molecular evidence, we favor recognizing a monotypic, widespread *C[helydra] serpentina* across the continental United States and southern Canada, and abandoning *C[helydra] s. osceola* as an evolutionary entity . . . available molecular data do not indicate any substantial differentiation between these [*C. s. serpentina* and *C. s. osceola*] taxa.

DEMOGRAPHIC AND PHYLOGEOGRAPHIC HISTORIES OF TWO VENOMOUS NORTH AMERICAN SNAKES OF THE GENUS AGKISTRODON

2008. Timothy J. Guiher and Frank T. Burbrink. *Molecular Phylogenetics and Evolution* 48(2): 543-553.

Abstract: Many studies have revealed that lineages currently inhabiting formerly glaciated areas were pushed into southern glacial refugia and have expanded into their modern range since the last glacial maximum. There have been few studies that compare the effects of glacial cycles on lineage diversification and historical demography in closely related species with overlapping ranges. In this study we compare phylogeographic structure, historical demography, and approximate lineage age in two closely related and broadly co-occurring venomous snakes in eastern North America, the Cottonmouth (*Agkistrodon piscivorus*) and Copperhead (*A. contortrix*), using sequences from the mtDNA gene cytochrome b. We inferred three geographic lineages of *A. contortrix* and two of *A. piscivorus* with no common geographic or temporal pattern of lineage diversification identified for these species. Lineage diversification occurred in the Late Pliocene for *A. piscivorus* (2.5 mya) and in the Early Pleistocene for *A. contortrix* (1.5 mya). Demographic estimates revealed population expansion following the last glacial maximum (20,000 years ago) in two lineages of *A. contortrix* (the Central clade and Eastern clade) and one lineage of *A. piscivorus* (the Continental clade). The Florida clade of *A. piscivorus* is the only lineage for which constant population size through time was inferred, possibly due to stable populations

persisting in areas unaffected by glacial advances. Our data suggest that unique habitat preferences may have shaped both the phylogeographic and demographic histories of each species.

A gratis PDF of this article is available from the CNAH PDF Library at

http://www.cnah.org/cnah_pdf.asp

Associate Editor's Note: Using mtDNA, Guiher & Burbrink (2008) identified three evolutionary lineages of *Agkistrodon contortrix* and two evolutionary lineages of *Agkistrodon piscivorus* in this excellent paper, but did not name them as distinct species, instead awaiting future results of analysis of nucleic DNA evidence. However, based on known type localities (as they appear in Gloyd & Conant, 1990, and Schmidt, 1953) for already described, published, and available names, the following distinct species might be recognized in the future:

Agkistrodon contortrix Linnaeus, 1766 (Eastern lineage of Guiher & Burbrink 2008)
Type locality: Charleston, South Carolina
Standard common name: Eastern Copperhead
Synonym: *Agkistrodon contortrix mokasen* Palisot de Beauvois, 1799

Agkistrodon austrinus Gloyd & Conant, 1943 (Central lineage of Guiher & Burbrink 2008)
Type locality: Orleans Parish, Louisiana
Standard common name: Midland Copperhead
Synonyms: none

Agkistrodon laticinctus Gloyd & Conant, 1934 (Western lineage of Guiher & Burbrink 2008)
Type locality: Bexar County, Texas
Standard common name: Western Copperhead
Synonyms: *Agkistrodon contortrix phaeogaster* Gloyd, 1969; *Agkistrodon contortrix pictigaster* Gloyd & Conant, 1943

Agkistrodon piscivorus Lacépède, 1789 (Continental lineage of Guiher & Burbrink 2008)
Type locality: Charleston, South Carolina
Standard common name: Northern Cottonmouth
Synonyms: *Agkistrodon piscivorus leucostoma* Troost, 1836; *Toxicophis pugnax* Baird & Girard, 1853

Agkistrodon conanti Gloyd, 1969 (Florida lineage of Guiher & Burbrink 2008)
Type locality: Alachua County, Florida
Standard common name: Southern Cottonmouth
Synonyms: none

The above list of name combinations is presented here merely as advance information of possible future changes in the taxonomy of two polytypic species of the North American genus *Agkistrodon*. Under no circumstances should the above list be adopted as a taxonomy for the group. Additional work on the systematics of these serpents is in progress.

References

Gloyd, Howard K. and Roger Conant. 1990. Snakes of the *Agkistrodon* Complex. A Monographic Review. SSAR Contribution to Herpetology 6: vi + 614 pp.
Schmidt, Karl P. 1953. A check list of North American amphibians and reptiles. Sixth Ed. Publ. American Soc. Ich. Herp., viii + 280 pp.

INCONGRUENCE IN THE PATTERN AND TIMING OF INTRA-SPECIFIC DIVERSIFICATION IN BRONZE FROGS AND BULLFROGS (RANIDAE)

2008. James D. Austin & Kelly R. Zamudio. Molecular Phylogenetics and Evolution 48: 1041–1053.

Abstract: We compare patterns of lineage divergence in mitochondrial DNA (mtDNA) sequences of two proteinencoding mitochondrial genes (cyt b and ND2) in two ecologically similar, co-distributed, and closely related ranid frogs (*Rana clamitans* and *Rana catesbeiana*), that are geographically widespread, and frequently syntopic. We identified three lineages in *R. clamitans*, separated by 0.5% to 2.1% net corrected sequence divergence, comparable to two *R. catesbeiana* lineages separated by 0.6%. The geographic pattern of lineage distribution differed notably between the two species. In *R. clamitans*, we found a Coastal Plain-Appalachian (CPA) lineage restricted to south and east of the Appalachian Mountains and a widespread lineage that encompassing nearly all the sampled range. A third distinct and divergent lineage was detected in one location in the southwest portion of the range (Louisiana). This pattern contrasts with the east-west pattern in *R. catesbeiana*, and reflects possible differences in refugial dynamics and patterns of range expansion. Although both species have undergone range expansion and population growth, coalescent reconstruction of Ne reflects larger lineages but more recent divergence in *R. clamitans* relative to *R. catesbeiana*, reflecting significant differences in population history or divergent patterns of molecular evolution at mtDNA.

A pdf of this article is available from the CNAH PDF Library at

http://www.cnah.org/cnah_pdf.asp

Associate Editor's Note: Using mtDNA, Austin

and Zamudio (2008) identified three evolutionary lineages of *Lithobates clamitans* and two evolutionary lineages of *Lithobates catesbeianus* in this excellent paper, but did not name them as distinct species, presumably awaiting future results of an analysis that includes nucleic DNA. However, based on known type localities (as they appear in Schmidt, 1953) for already described, published, and available names, the following distinct species might be recognized in the future:

Lithobates catesbeianus (Shaw, 1802) (Eastern lineage of Austin & Zamudio 2008)
Type locality: Charleston, South Carolina
Standard common name would become: Eastern Bullfrog
Synonyms: *Lithobates mugiens* (Merrem, 1820); *Lithobates scapularis* (Le Conte, 1825); *Lithobates conspersus* (Le Conte, 1855)

Lithobates new species (Western lineage of Austin & Zamudio 2008)
Type locality: should data warrant, to be designated and published
Standard common name would become: Western Bullfrog

Lithobates clamitans (Latreille, 1801) (ACP lineage of Austin & Zamudio 2008)
Type locality: Charleston, South Carolina
Standard common name would become: Bronze Frog or Southern Bronze Frog
Synonym: none found

Lithobates melanotus (Rafinesque, 1820) (Widespread of Austin & Zamudio 2008)
Type locality: Lake Champlain and Lake George, Vermont & New York
Standard common name would become: Green Frog or Northern Bronze Frog
Synonyms: *Lithobates fontinalis* (Le Conte, 1825); *Lithobates flaviviridis* (Harlan, 1825); *Lithobates horiconensis* (Holbrook, 1838); *Lithobates nigricans* (Agassiz, 1850)

Lithobates new species (Louisiana lineage of Austin & Zamudio 2008)
Type locality: should data warrant, to be designated and published
Standard common name would become: Louisiana or Cajun Bronze Frog

The above arrangement is presented here merely as advance information of possible future changes in the taxonomy of two wide-ranging species of the North American genus *Lithobates*. Under no circumstances should the above list be adopted as a taxonomy for the group. Additional work on the systematics of these anurans is in progress.

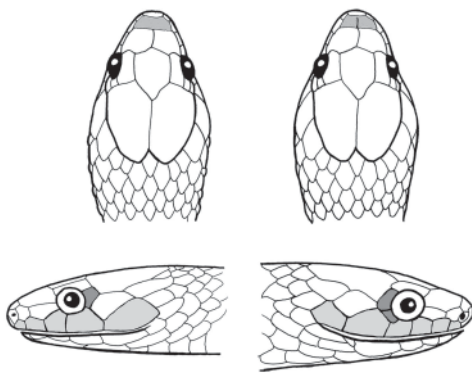
The status of *Lithobates okaloosae* (Moler, 1985) remains uncertain and awaits resolution as to

whether it is a distinct species or a synonym of *L. clamitans* (sensu lato).

Of more immediate interest to many north American herpetologists, the authors synonymized the subspecies *Lithobates clamitans melanotus* (Rafinesque, 1820) with *L. c. clamitans* (Latreille, 1801). *L. c. melanotus* has heretofore been called the Green Frog and the nominate subspecies has been called the Bronze Frog. CNAH will now adopt the standard common name Bronze Frog for the species because it better reflects the skin color of this frog -- most herpetologists know that, throughout the southern two-thirds of its range, *Lithobates clamitans* has little if any green skin color. While "bronze" may not be as precise as some would desire, it is better than a color the amphibian normally doesn't possess throughout the majority of its range. An alternative would be to call *L. clamitans* the Bronze Frog and retain Green Frog for *L. melanotus* if it proves to be a distinct species.

References

Schmidt, Karl P. 1953. A check list of North American amphibians and reptiles. Sixth Ed. Publ. American Soc. Ich. Herp., viii + 280 pp.



Line drawing of heads of snakes of the genus *Virginia*.

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NOTES

EGG MASS FIDELITY SUGGESTS OOPHAGY IN THE ILLINOIS CHORUS FROG (*PSEUDACRIS STRECKERI ILLINOENSIS*)

Many species of larval anurans engage in oophagy by feeding on conspecific eggs or egg remnants within their clutch. (Crump, 1983. *American Nat.* 121: 281-287). On 24 February 2000, three amplexant pairs of *Pseudacris streckeri illinoensis* were collected from a breeding chorus located in Clay County, Arkansas. The three pairs were housed communally in a 15x30x15 cm plastic box with about 4 cm of dechlorinated tap water. The following morning (25 February 2000), several small clutches of eggs were present. A total of 170 eggs was laid averaging 57 eggs per female. The eggs were incubated at 20°C in the same boxes where they were laid. For seven days following hatching, the tadpoles were allowed to remain with their egg masses. The first free-swimming *P. s. illinoensis* larvae were observed 1 March 2000. By 4 March 2000, 112 larvae were free-swimming. Nearly all larvae remained with the egg masses for at least six days (7 March) despite appearing fully capable of dispersing. On 7 March, the tadpoles began dispersing about the rearing container and by 8 March they were nearly evenly distributed throughout this chamber. Since the yolk appeared to be absorbed by 4 March 2000, the tadpoles may have been feeding on the remnants of the egg mass. Such behavior is highly adaptive because the remaining egg materials are undoubtedly highly nutritious. Utilization of egg components by larvae might further offset the costs of egg production by the female. If the offspring of a female feed on the remains of her egg mass, her parental investment in those tadpoles may be increased without additional resource allocation on her part. The female must provide the resources eaten by the tadpoles anyway. Behaviors such as these, that improve offspring survivorship without additional parental resource partitioning to reproduction, should quickly spread throughout populations due to intraspecific competition between strategists and non-strategists (Clutton-Brock, 1991. *The Evolution of Parental Care*. Princeton Univ. Press, New Jersey, 368 pp.). Foraging strategies that reduce foraging efforts resulting in lowered energy expenditures and reduced exposure to predators are highly adaptive (Stephens and Krebs, 1987. *Foraging Theory*. Princeton Univ. Press, New Jersey, 262 pp.). Since oophagic larvae aren't required to search for food, they may improve marginal gains in energy allocation. Since they are not traveling between foraging sites, they may also experience increased survivorship due to reduced predator exposure. The lack of necessary traveling for foraging may lower the larvae's likelihood of contacting predators (Stephens and Krebs, 1987 op.

cit.). Improved survivorship through lowered larval energy expenditures and reduced exposure to predators while foraging translates into higher returns to the parent in actual reproductive output (Clutton-Brock, 1991 op. cit.). Considering the advantages of oophagy combined with the extended fidelity for the egg mass, it seems probably that the tadpoles were utilizing the egg mass as a food source. While these observations were observed in captivity, the nature of oophagy combined with its common occurrence in other hylid species provide further evidence that this behavior is a natural phenomenon and not an artifact of captive rearing.

Submitted by MALCOLM L. McCALLUM, Biological Sciences Program, Texas A&M University at Texarkana, Texarkana, Texas 75501 (malcolm.mccallum@herpconbio.org) and STANLEY E. TRAUTH, P. O. Box 599, Department of Biological Sciences, Arkansas State University, State University, Arkansas 72467 (strauth@astate.edu).

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

The Blacktail Rattlesnake, *Crotalus molossus*, is a medium-sized rattlesnake, 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 1331 mm (Tennant, 1984; Stebbins, 1985; 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. The snake was collected on a private ranch (29°31'20.8"N, 103°23'33.2"W; Musgrave Road, ca. 16 km east of Rt. 118) in Brewster County, Texas. The elevation of the collection site was ca. 1020 meters and the vegetation was similar to the Lechuguilla-Creosotebush-Cactus Association described by Wauer (1971). The TL of the snake measured 1524 mm (60 inches), exceeding the previously reported maximum size record (1331 mm) by 193 mm. A voucher photograph (SRSU 6752) of this snake was deposited in the James F. Scudday Vertebrate Collection at Sul Ross State University, Alpine, Texas.

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Submitted by STEVEN G. PLATT, Department of Biological Sciences, P. O. Box C-64, Sul Ross State University, Alpine, Texas 79832, (splatt@sulross.edu) and THOMAS R. RAINWATER, 619 Palmetto Street, Mount Pleasant, South Carolina 29464.

MORTALITY OF BULLFROGS (*RANA CATESBEIANA*) FROM AN IN-GROUND SWIMMING POOL

Little is known regarding the impact of in-ground swimming pools on herpetofaunal mortality. These structures may be a significant source of mortality to urban populations of amphibians and reptiles. Here we describe a mortality event at a single in-ground swimming pool (8 x 15 m, 1-2 m deep) located in the apartment complex immediately north and adjacent to the Louisiana State University in Shreveport campus (UTM 43,691,86X 3,589,040,30Y [Zone 15]) and speculate regarding its implications.

On 24 September 2004 a band of rain associated with Tropical Storm Ivan hit Shreveport, Louisiana. This event occurred after a two-month drought. Precipitation stimulated movements of many species of anurans. We observed 3-4 juvenile *Rana catesbeiana* (SVL = 2.5-4.5 cm) trapped in the pool the night of 24 September 2004. By 27 August 2004, over 20 juvenile *R. catesbeiana* were observed in the pool. Unknown numbers were removed from the pool by apartment staff during this period. Among these, 14 frogs were recovered, still alive, from the pool. All but six died by 30 September 2004 (mortality >70%). Whether their inability to escape from the pool, the chlorine and other chemicals used to treat the pool water, or an interaction between these factors ultimately led to the frog's demise is unknown. The fact that entrapped frogs died as long as three days after being removed from the pool suggests that even if devices to facilitate escape are provided, mortality may still be significant.

This observation begs to question how large this mortality event could have been at the landscape level. Swimming pools are very popular in the Shreveport area. On one block I counted 6/10 of houses with pools of which one was in-ground. If 1/10 homes has an in-ground pool we can extrapolate that, among 171,826 housing units located in Shreveport, Louisiana (US Census Bureau 2003) there could be as many as 17,183 in-ground

swimming pools. Assuming all pools were affected similarly to our pool, as many as 343,660 frogs may have succumbed. Compound this for each rain event during the year and the amphibian deaths become astronomical. MLM is frequently informed of the dozens of treefrogs fished from filter baskets in home swimming pools during the summer in Shreveport. It is well known that frogs mobilize after heavy rains. The ability of a pool, whether in-ground or above ground, to entrap organisms is an important urban wildlife issue receiving relatively little attention. This observation and associated speculation provides additional evidence that further research is needed to determine what impact swimming pools have on urban wildlife and what methods can be contrived to prevent future mortality events.

Submitted by MALCOLM L. MCCALLUM, Biological Sciences Program, Texas A&M University at Texarkana, 2600 Robison Road, Texarkana, Texas 75501 (malcolm.mccallum@herpconbio.org), and VIC BOGOSIAN III and ERIC WALSH, Department of Biological Sciences, Louisiana State University at Shreveport, One University Place, Shreveport, Louisiana 71115.

ARBOREAL BEHAVIOR IN THE NORTHERN CURLYTAIL LIZARD

Northern Curlytail Lizards (*Leiocephalus carinatus armouri*) are a spreading invader in southern Florida (Weigl et al. 1969. Copeia 1969: 841-842; Smith et al. 2004. Internat. Biodeter. Biodegrad. 54: 261-264; Meshaka et al. 2005. Southeast. Nat. 4(3): 521-526; Meshaka et al. 2006. Journ. Kansas Herpetol. 17: 6). This lizard species joined the herpetofauna of Florida Atlantic University's MacArthur Campus in Jupiter, Florida, in late 2005 (Moore pers. obs.). It has displaced Brown Anoles (*Anolis sagrei*) as a dominant terrestrial lizard in certain portions of the campus. In the presence of Northern Curlytail Lizards, Brown Anoles have declined in numbers and altered their behaviors by changing timing of basking to later in the day (after Northern Curlytail Lizards have gone into their burrows) and selecting more elevated basking sites (Jameson 2007. Niche adjustment of the Brown Anoles after introduction of the Northern Curlytail lizard. Unpublished senior thesis, Wilkes Honors College, Florida Atlantic University, Jupiter; Moore pers. obs.), similar to behaviors documented in the Bahamas (Schoener et al. 2002. Ecol. Monogr. 72(3): 383-407; Losos et al. 2004. Nature 432: 505-508). The selection of elevated basking sites is an indication that Northern Curlytail Lizards less frequently climb into the vegetation and are mainly ground-dwelling lizards.

However, I report here on unusual arboreal behavior observed in Northern Curlytail Lizards at a particular site. The site is a pair of buildings on the northern boundary of the MacArthur Campus, the

Hibel Arts and Hibel Museum buildings. These two separate buildings each feature a covered exterior walkway with a sloped tile roof. The lower edge of the roof is 3.4 meters above the ground. The sloped tile roof meets the exterior wall of the building at about 4.6 meters height above ground. Various ornamental trees and shrubs are planted around the walkways.

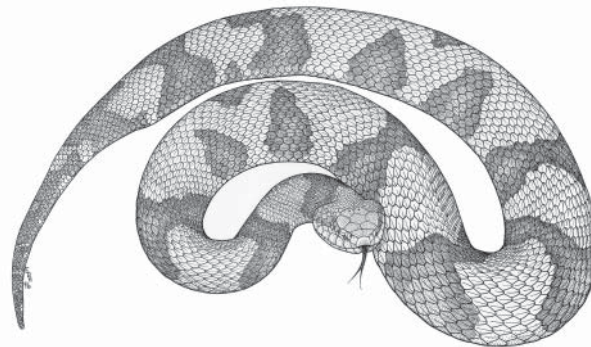
On 3 Oct 2007 at ca. 1400 hours, a large Northern Curlytail Lizard (SVL ~9 cm) was observed climbing a silver Buttonwood Tree (*Conocarpus erectus* var. *sericeus*) next to the covered walkway. At about 3.7 m above ground, it leapt onto the walkway roof of the Hibel Arts building from a branch across a gap of about 15–20 cm. I watched the lizard climb up the roof slope and disappear under a loose tile. On subsequent days in October 2007, I observed a single Northern Curlytail Lizard living in an opening where the sloped tile roof meets the exterior wall of the building. The flashing there has separated from the wall in several places and a Northern Curlytail Lizard was often seen extending its head and forelegs from one of those openings. Over the next several weeks, a single individual of this species was seen basking on the tile roof in the morning hours, typically between 8:30–10:30 hours.

On 7 April 2008 ca. 1200–1300 hours, three Northern Curlytail Lizards were observed on the Hibel Arts walkway roof, two larger specimens (~8–10 cm SVL) and a smaller lizard (~6 cm SVL). The two larger lizards chased each other and the smaller one across the roof. The smaller lizard eventually went to the edge of the roof and leapt across a gap of 28 cm onto a branch of Silver Buttonwood Tree (a dif-

ferent tree from the one used by the lizard seen in October). This smaller lizard then proceeded down the branches and trunk to ground level where it moved into the cover of leaf litter under the shrubbery. This same individual was seen basking on the adjacent sidewalk an hour later.

The presence of multiple individuals on the roof of Hibel Arts building may represent imitative learning among the Northern Curlytail Lizards, with multiple individuals learning the method of accessing the roof from the initial individual. Access is gained using different individual trees of the same species, even though many other trees (Sabal Palms) are planted in the same area and are tall enough and close enough to provide similar access. On 18 April 2008, a Northern Curlytail Lizard was observed basking on the walkway roof of the nearby Hibel Museum building, which has similar plantings of Silver Buttonwood Trees in close proximity to the edge of the roof. Thus, this method of gaining access to the walkway roof has also been applied to a similar situation at a second separate building. These rooftop refuges not only provide sunny and relatively safe areas for uninterrupted basking (as opposed to sidewalks below where passing students cause Northern Curlytail Lizards to frequently scuttle into their burrows), but may also come with a ready food resource in the form of Tropical Geckos (*Hemidactylus mabouia*) that populate the same rooftop and wall areas of these buildings.

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Line drawing of a Copperhead by Errol D. Hooper, Jr.

ARTICLES

SEASONAL ACTIVITY, REPRODUCTION, AND GROWTH OF THE RINGNECK SNAKE (*DIADOPHIS PUNCTATUS*) IN PENNSYLVANIA

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Abstract: We examined 712 museum specimens of the Ringneck Snake from 59 of 67 counties in Pennsylvania to determine the seasonal activity, reproductive cycles, and growth of this geographically widespread species in the United States. Testis length was greatest in June. Oviducal eggs were present in females during May–August, and the highest frequency occurred in June with nearly all females having been found spent in July. Clutch size co-varied positively with female body size. Estimates of mean clutch size ranged from 3.6 eggs (oviducal and shelled eggs) to 4.6 eggs (ovarian follicles). Seasonal distribution of body sizes suggested that sexual maturity was reached in about 11 months in males and 12 months in females. Minimum, mean, and maximum adult body sizes were larger in females. Our data largely conform to a relatively inflexible pattern with respect to several life history aspects of the Ringneck Snake in northern latitudes. However, regional differences were apparent in growth rates, and geographic trends were apparent with respect to length and peak of activity season, testicular cycle, and clutch size.

Introduction

The Ringneck Snake, *Diadophis punctatus* (Linnaeus, 1766), is a geographically widespread species in the eastern United States (Conant and Collins, 1998). The Northern Ringneck Snake, *D. p. edwardsii* (Merrem, 1820) is the most widespread form of this species in the northeast and mid-Atlantic regions. Seasonal activity and the ovarian cycle were discussed, and clutch characteristics were presented for the Northern Ringneck Snake across Pennsylvania (Hulse et al., 2001). In nearby New Jersey, testis size reached its maximum in June (Prieto, 1975), overlapping the abbreviated egg-laying season of this species in Pennsylvania (Hulse et al., 2001). Using a large series of specimens we examined patterns in seasonal activity, reproduction, and growth of this species from 59 of the 67 Pennsylvania counties to enhance the understanding of these aspects of its ecology in Pennsylvania and its relation to geographic variation in life history traits of this species in eastern North America.

Materials and Methods

Museum specimens from the Carnegie Museum of Natural History and the State Museum of Pennsylvania were examined to determine sex, body size and reproductive condition. Body lengths were measured as snout-vent length (SVL). Length of the right testis was measured with calipers. The lengths of the largest follicles were measured with calipers, and counts were made to esti-

mate clutch sizes. Collection dates were summarized to determine seasonal activity based upon monthly collections of this species during 1896–2008 from 59 of the 67 counties in Pennsylvania. Statistical tests (i.e., T-tests) were two-tailed, and significance was recognized at an alpha level of 0.05. Common names follow Collins and Taggart (2002).

Results

Seasonal activity.—Surface movements during the period 1896–2008 of 676 Ringneck Snakes occurred during April–October, with the highest number of captures in May (Figure 1). Number of captures decreased steadily thereafter. A single individual captured in January was excavated from more than 1 meter underground. Seasonal activity patterns were unimodal for males, females, and juveniles. Very few individuals were captured in April; however, males and juveniles were captured most often during May–June, and females were captured most often in June (Figure 1).

Testicular size.—The testes rapidly increased in size in spring and reached their maximum length in June (Figure 2). Testis length decreased thereafter and was at its minimum size by September (Figure 2).

Ovarian cycle.—Follicular growth and vitellogenesis were apparent in April, and 51.6% of females collected in May contained shelled eggs (Figure 3), the earliest of which was 4 May. The incidence of gravid females reached its peak in June when 82.2% of the females contained shelled eggs. Most

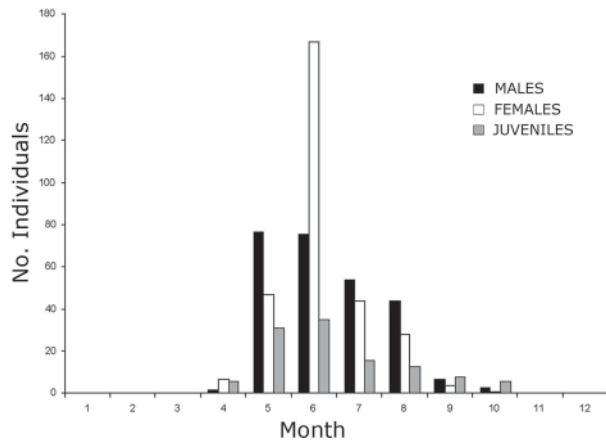


Figure 1. Seasonal incidence of captures of 676 Ring-neck Snakes (*Diadophis punctatus*) during 1896–2008 in Pennsylvania.

females lacked oviducal eggs in their reproductive tracts in the months afterwards as shown by the low incidence of gravid females in July (5.7%) and August (6.2%).

Clutch characteristics.—Mean clutch size was estimated by counts of yolked ovarian follicles (4.56 + 1.82; range = 2–7; $n = 16$), oviducal eggs (3.62 + 1.41; range = 1–10; $n = 159$), and shelled eggs (3.56 + 1.41; range = 1–11; $n = 144$). No significant difference ($P > 0.05$) was detected in the mean values of the latter two estimations. Counts of ovarian follicles > 2.0 mm provided a mean estimated clutch size that was significantly larger than that of oviducal eggs ($t = 2.47$; $df = 173$; $P < 0.02$) and shelled eggs ($t = 2.63$; $df = 158$; $P < 0.009$). Number of shelled eggs (Figure 4), but not maximum length of shelled eggs, co-varied significantly with female body size.

Body size.—Among adults, males were smaller than females. The smallest sexually mature male measured 17.1 cm SVL, and the smallest sexually

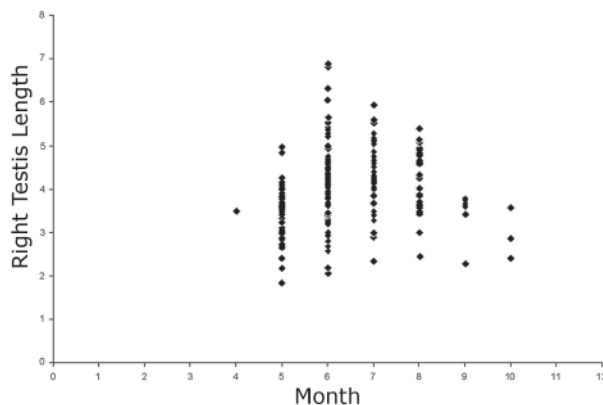


Figure 2. Monthly distribution of right testis lengths of 193 male Ring-neck Snakes (*Diadophis punctatus*) from Pennsylvania.

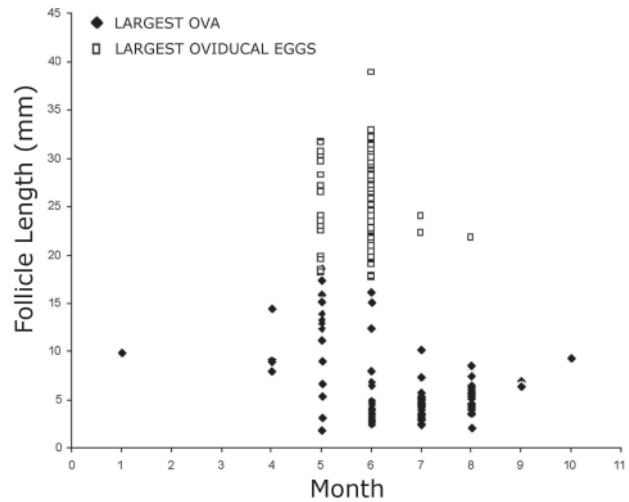


Figure 3. The ovarian cycle of 176 female Ring-neck Snakes (*Diadophis punctatus*) from Pennsylvania.

mature female measured 20.1 cm SVL (Table 1). Likewise, the largest sexually mature male (36.8 cm SVL) was smaller than the largest sexually mature female (43.3 cm SVL) (Table 1). The variances were significantly different between the sexes ($F = 0.64$; $df = 276$; $P < 0.001$), and the mean body sizes of males (26.5 + 3.61; $n = 277$) and females (28.4 + 4.39; $n = 305$) (Table 1) were also significantly different from one another ($t = -5.92$; $df = 572$; $P < 0.000$). Juveniles ($n = 130$) ranged 8–20 cm SVL.

Growth and maturity.—Eggs that were laid between 30 June and 1 July 1983 by a female caught on 21 June 1983 from Clinton County later hatched during 8–10 August 1983. Thus, a maximum incubation time of 41 days was possible from this clutch. In light of the distribution of shelled eggs in May, a few eggs deposited in early and mid-May could have hatched in June; however, most hatchlings would have appeared during July–August (Figure 5). Hatchlings collected during July–October (8.0–9.6 cm SVL) appeared as the smallest individuals during April–June (Figure 5). From the seasonal distribution of body sizes, males would reach sexual maturity at 11 months of age, followed by females one month later (Figure 5). Consequently, Ring-neck Snakes hatched in July 2008 would have reproduced the following spring 2009. Those individuals that hatched late (October 2008) would have mated the following fall (2009) or spring 2010, and laid eggs for first time in the summer of 2010.

Discussion

The Ring-neck Snake of Pennsylvania, like many others of this species elsewhere in the eastern and central United States, adhered closely to relatively inflexible patterns with respect to aspects of activity, reproduction, and growth that were examined in this study. However, geographic variation was evident in some of its life history traits. For example,

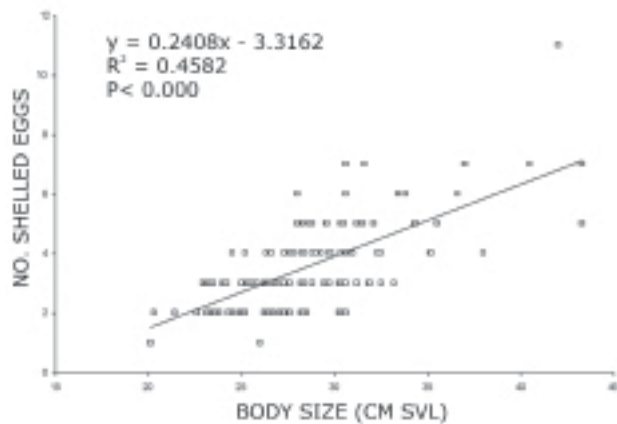


Figure 4. The relationship between clutch size and female body size of 143 Ringneck Snakes (*Diadophis punctatus*) from Pennsylvania.

in April–October activity season in Pennsylvania (Hulse et al., 2001; this study) was similar to that of other populations in northern latitudes: May–October in southern New England (Klemens, 1993), April–October in Kansas, Indiana, New York, and Virginia (Wright and Wright, 1957; Mitchell, 1994; Fitch, 1999; Minton, 2001). However, farther south, seasonal activity occurred during February–December in North Carolina (Palmer and Braswell, 1995) and year-round in southern Florida (Dalrymple et al., 1991).

Although seasonal activity was thought to be strongly bimodal in Pennsylvania (Hulse et al., 2001), we found that it was quite strongly unimodal. Unimodal seasonal activity was also exhibited by Ringneck Snakes in South Carolina (Gibbons and Semlitsch, 1987) and the southern Everglades (Dalrymple et al. 1991). Differences also occurred in the timing of peak activity. Although June was the most active month for this species in Pennsylvania (this study) and South Carolina (Gibbons and Semlitsch 1987), peak activity was greatest during spring and least during summer in Florida (Myers, 1965) and

Table 1. SVL body size means followed by ranges (cm) of the Ringneck Snake (*Diadophis punctatus*) from selected sites.

Location	Male	Female
Connecticut (Klemens, 1993)	25.3	27.2
Pennsylvania (Hulse et al. 2001)	27.2; 21.0–32.5	28.6; 21.7–43.3
Pennsylvania (this study)	26.5; 17.1–36.8	28.4; 20.1–43.3
Virginia (Mitchell, 1994)	26.2; 18.3–35.8	30.0; 21.9–40.0
Indiana (Minton, 2001)	24.0; 21.1–30.6	27.2; 22.0–32.8
Kansas (Fitch, 1999)	25.4; 17.3–39.6	28.8; 22.5–38.2

was greatest during June–July in the southern Everglades (Dalrymple et al. 1991). The latter pattern was explained by a June peak in male activity and a July peak in female activity.

The seasonal variation in testicular size of Pennsylvania populations was similar to that of adjoining New Jersey (Prieto, 1975); however, testis size in Florida reached its maximum in August, two months later than we found in Pennsylvania. Among females in Pennsylvania generally, egg-laying by the Ringneck Snake was found to have occurred from the end of June through very early July (Hulse et al. 2001) or from mid-June to August (Surface (1906). Our findings suggested that some females could oviposit during May but that nearly all egg-laying ended in July. Similarly, in Maryland (Clark et al., 1997) and New Jersey (Prieto, 1975) egg-laying occurred from mid-June to mid-July, late June and early July in Kentucky (Barbour, 1950), and late June through July in Michigan (Blanchard, 1937). In North Carolina, most gravid Ringneck Snakes were found in June and none thereafter (Palmer and Braswell 1995), and in northeastern Kansas eggs were laid in July (Fitch 1999). On the other hand, eggs were laid during May–August (Myers, 1965), into September in Florida (Iverson, 1978), and during June–August in the southern Everglades (Dalrymple et al. 1991). Although the extent to which later breeding occurred in Florida is unknown, a June and/or July pulse in egg-laying was evident among populations in the eastern and central United States.

Our estimation of Ringneck Snake clutch size (3.6 eggs) was in close agreement with that of Hulse et al. (2001) (3.8 eggs). Elsewhere in the north clutch sizes were small: 3.5 eggs in Michigan (Blanchard, 1937), 3.4 eggs in Kansas (Fitch, 1999), and 3.6 eggs in Maryland (Clark et al., 1997). Farther south, larger clutch sizes averaged 4.2 eggs in Virginia (Mitchell, 1994), 3.8 and 4.0 eggs in Arkansas (Trauth et al., 2004), 4.1 eggs in North Carolina (Palmer and Braswell, 1995), and 4–5 eggs in Alabama (Mount, 1975). Clutch sizes were largest in Florida, where they averaged 5.2 eggs (Myers, 1965), and a 32.4 cm SVL female from northern Florida laid a clutch of 6 eggs (Iverson, 1978). To that end, our data and those in the literature collected since Myers' (1965) study corroborate Myers' (1965) findings of increased clutch size in southern latitudes in this species.

A positive relationship between clutch size and female body size was found in populations in Pennsylvania (Hulse et al., 2001; this study), Maryland (Clark et al., 1970), Michigan (Blanchard, 1937), and Florida (Myers, 1965). Neither Hulse et al. (2001) nor we found a significant relationship between largest egg length and female body size in the Ringneck Snake.

Ringneck Snake body size appeared to be the least flexible of the traits we measured. Across the range, minimum, mean and maximum body size is larger in females (Table 1). Minimum body size at

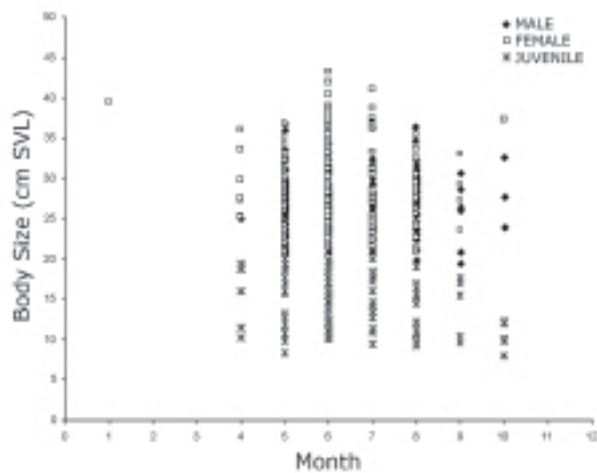


Figure 5. Monthly distribution of body sizes of 676 Ringneck Snakes (*Diadophis punctatus*) from Pennsylvania.

sexual maturity varied the most among sites; however, mean body sizes within each sex were similar among sites, and females were always the larger sex (Table 1).

Appearance of Ringneck Snake hatchlings into late summer–fall was typical of the species (e.g., Blanchard, 1926; Wright and Wright, 1957; this study). The time necessary to reach sexual maturity varied among populations. We estimated approximately one year from hatching. In Kansas, sexual maturity was reached by males in their 2nd year and by females in their 3rd year (Fitch, 1999). Both sexes were sexually mature during their second spring of life in Florida (Myers, 1965).

Our findings conform to a relatively inflexible pattern with respect to several life history aspects of the Ringneck Snake in northern latitudes. Growth rates differed among sites but not enough studies exist to adequately test for a geographic component. Regional differences were apparent southward with respect to the length and peak of the activity season, its testicular cycle, and its clutch size.

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