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Front Cover: Plains Hog-Nosed Snake
(Heterodon nasicus) by David Oldham

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ARTICLES

KHS 43rd Annual Meeting

5-6 November 2016

Rockhurst University
1100 Rockhurst Road
Kansas City, Missouri 64110

Auction** to be held @ **Leawood City Hall

Keynote:
Robert Powell, Avilia University, Kansas City, MO
Chasing lizards in paradise: Amphibians and reptiles of the St. Vincent and Grenada Island Banks

The **KHS Nominating Committee** (**Dan Carpenter, Chair**) has put forward the following list of candidates to be voted on by the membership during the business meeting:

for **President** - **Kelly Kluthe and Lynette Seivert**
for **Secretary** - **Kelley Tuel, unopposed**
for **Treasurer** - **Daren Riedle, unopposed**

Visit the KHS webpage to register on-line or secure a presentation time.

NOTES

Spring 2016 KHS Field Trip to Clark County was a Soggy Success

The 121 participants braved torrential rain and treacherous roads around Clark County State Fishing Lake the weekend of 29 April - 1 May 2016, and were rewarded with the opportunity to observe a wide variety of amphibians and reptiles. While the wet weather prevented the participants from reaching many promising sites, the wet weather allowed for the discovery of many secretive species. Overall, 31 species (of the 47 known) were recorded during the trip.

Friday evening was spent near the campsite and driving the KS 94 blacktop east and north of the lake. Saturday and Sunday were spent at various sites on the Denton Ranch (north and west of the lake). Saturday afternoon a group was able to make it south of the lake to the 6M Ranch and were able to record the only Texas Horned Lizard and Western Milk Snake (a county record by Hunter Johnson) discovered.

	FriPM	SatAM	SatPM	6M	SunAM	Total
FROGS (7 of 10 species)						
Great Plains Toad, *Anaxyrus cognatus*	2	0	0	0	0	2
Woodhouse's Toad, *Anaxyrus woodhousii*	2	1	0	0	0	3
Plains Leopard Frog, *Lithobates blairi*	23	1	1	0	0	25
Spotted Chorus Frog, *Pseudacris clarkii*	200+	0	0	0	0	200
Boreal Chorus Frog, *Pseudacris maculata*	0	0	1	0	0	1
Western Narrow-mouthed Toad, *Gastrophryne olivacea*	0	1	2	0	0	3
Plains Spadefoot, *Spea bombifrons*	200+	0	0	0	0	200
SALAMANDERS (1 of 1 possible species)						
Western Tiger Salamander, *Ambystoma mavortium*	23	0	0	0	0	23
LIZARDS (6 of 7 species)						
Eastern Collared Lizard, *Crotaphytus collaris*	2	18	24	16	5	65
Texas Horned Lizard, *Phrynosoma cornutum*	0	0	0	1	0	1
Prairie Lizard, *Sceloporus thayerii*	0	7	10	1	1	19
Great Plains Skink, *Plestiodon obsoletus*	1	5	14	4	3	27
Prairie Skink, *Plestiodon septentrionalis*	0	3	6	1	2	12
Six-lined Racerunner, *Aspidoscelis sexlineata*	1	6	13	1	3	24
SNAKES (16 of 24 species)						
North American Racer, *Coluber constrictor*	0	2	4	0	1	7
Coachwhip, *Coluber flagellum*	0	2	6	1	1	10
Speckled Kingsnake, *Lampropeltis holbrooki*	0	2	4	1	1	8
Western Milksnake, *Lampropeltis gentilis* +	0	0	0	1	0	1
Great Plains Ratsnake, *Pantherophis emoryi*	0	10	9	4	2	25
Long-nosed Snake, *Rhinocheilus lecontei*	0	0	0	1	0	1
Western Groundsnake, *Sonora semiannulata*	5	29	86	42	21	183
Ring-necked Snake, *Diadophis punctatus*	2	48	172	106	21	349
Chihuahuan Night Snake, *Hypsiglena jani*	1	19	69	14	6	109
New Mexico Threadsnake, *Rena dissectus*	2	20	77	41	2	142
Plains Hog-nosed Snake, *Heterodon nasicus*	0	0	2	0	0	2
Plains Black-headed Snake, *Tantilla nigriceps*	0	2	1	0	0	3
Plain-bellied Watersnake, *Nerodia erythrogaster*	0	2	4	0	0	6
Western Ribbonsnake, *Thamnophis proximus*	0	2	2	0	0	4
Common Gartersnake, *Thamnophis sirtalis*	0	3	3	0	0	6
Dekay's Brownsnake, *Storeria dekayi*	0	0	1	0	0	1
TURTLES (1 of 6 species)						
Slider, *Trachemys scripta*	0	1	0	0	0	1

TOTALS Species 31 Individuals 1463

Participants who signed in were Jacob Alexander, Tanner Alexander, Liz Ang, Mary Kate Baldwin, Maria Banuelos, Jacob Basler, Ashmika Behere, Lucresia Bradfield, Melissa Brown, Ken Brunson, Lee Ann Brunson, Cooper Butler, Jeff Calhoun, Zack Cordes, Kypfer Cordts, Walter Couch, Brylee Courkamp, Kristina Crabb, Alberto Cruz, Charlotte Daniel, Charlotte Daniel, Miranda Deblauwe, Emily Denton, Eli Denzer, Denise Dias, Andrew DuBois, Ben Elliott, Gabriella Emanouel, Cody Farra, Colton Farra, Kyle Findley, Victoria Gaa, Erica Gandara, Jonathan Garcia, Junior Garcia, Alejandra Gonzalez Pena, Roxanna Hamidpour, Jeff Haug, Mayah Haug, Chelsea Hawk, Lina Heckert, Becca Henslow, Hanna Henslow, Evelyn Hernandez, Marlene Hernandez, Jordon Hofmeier, Adaira Hutto, Joe Hutto, Katelin Hutto, Paxon Hutto, Sylvie Hutto, Brandon Jacobs, Clayton Jacobs, Trace Jacobs, Cam Johnson, Grant Johnson, Hunter Johnson, Katycie Johnson, Skylar Johnson, Jeanette Marie Kekahbah, Luke Kerns, Eric Kessler, Joey Kippenberger , Katie Kirwan, Kelly Kluthe, Bella Koth, Aidan Lawson, Jacob Lockhart, Alan Maccarone, Alan Maccarone, Leslie Mamahua, Dexter Mardis, Kurtis Meier, Kathy Nicholson, Darian Oakley, Avery Ollig, Chris Ollig, Justin Patterson, Anessa Pecina, Serena Randolph, Daren Riedle, Tamera Riedle, Zach Riedle, Maria Rivas, Daisy Rivera, Carlos Sanchez Jr., Avery Schmidt, Curtis Schmidt, Landon Schmidtberger, Lane Schmidtberger, David Schmitt, Indson Schmitt, Lisa Schmitt, Cameron Schwanke, Elias Silva, Melissa Skelton, Jenny Smith, Macey Steckel, Bruce Taggart, Jess Taggart, Meg Taggart, Travis Taggart, Robert Tenny, Lourdes Tovar, Alicia Trejo, Bennett Tuel, Hadley Tuel, Josh Tuel, Kelley Tuel, Brian Tuplin, James Tuplin, Hayley Urbanek, Kevin Urbanek, Ryan Urbanek, Augustin Vega, Thomas Vitkus, Ben Wakefield, Lisa Wehrly, Lora Wehrly, Jackson Wells, Jon Zuercher.

A special thanks is due to Charles Couch for access to his extensive ranch, and to the 6M ranch and the Denton Ranch for granting us permission to survey their properties. We owe a special debt of gratitude to KDWPT park manager Jon Zuercher for many courtesies before and during our stay.

Travis W. Taggart
KHS Field Trip Chairperson
Hays, Kansas 67601

Ken Brunson and Travis Taggart discuss some the specimens found with Rancher Charles Couch (center) at the campsite. All photos by Kevin Urbanek.

A group of herpetologists gather around a rock to see what was found underneath.

A couple New Mexico Threadsnakes. The wet conditions and warmer temperatures on Saturday and Sunday helped yield 142 of these secretive snakes.

The county record Western Milksnake found by Hunter Johnson. A remarkable find given the number of people that have worked these hillsides in vain.

Results of the KHS Summer Field Trip to the Caney River, Chautauqua County, Kansas

The KHS Summer Field Trip was headquartered at the city park in Elgin, Kansas for the weekend of 29-31 July 2016. The Elgin City Commission generously opened up their air-conditioned community building at the park, which was welcomed by all the participants.

The goal of the field trip was to trap the Caney River (and nearby tributaries) with the hope of capturing one of the 200+ Alligator Snapping Turtles that had been repatriated just downstream in Oklahoma over the past 10 years. When not setting or checking turtle traps, the field trip participants spent their time driving the adjacent roads.

A list of species reported is give below. No Alligator Snapping Turtles were captured. A list of the participants (24+) was never recorded.

FROGS
- American Toad, *Anaxyrus americanus* 2
- Blanchard's Cricket Frog, *Acris blanchardi* .... 40+
- Gray Treefrog complex, *Dryophytes chrysoscelis/versicolor* 4
- Western Narrow-mouthed Toad, *Gastrophryne olivacea* 1
- Plains Leopard Frog, *Lithobates blairi* 3
- American Bullfrog, *Lithobates catesbeianus* .... 20+

TURTLES
- Snapping Turtle, *Chelydra serpentina* 3
- False Map Turtle, *Graptemys pseudogeographica* 2
- Southern Map Turtle, *Graptemys ouachitensis* 16
- River Cooter, *Pseudemys concinna* 1
- Ornate Box Turtle, *Terrapene ornata* 5
- Three-toed Box Turtle, *Terrapene triunguis* 12
- Pond Slider, *Trachemys scripta* .... 20+
- Eastern Musk Turtle, *Sternothorus odoratus* 3
- Spiny Softshell, *Apalone spinifera* 16

LIZARDS
- Slender Glass Lizard, *Ophisaurus attenuatus* 1
- Eastern Collared Lizard, *Crotaphytus collaris* 1
- Common Five-lined Skink, *Plestiodon fasciatus* 1
- Little Brown Skink, *Scincella lateralis* 2
- Six-lined Racerunner, *Aspidoscelis sexlineata* (Linnaeus, 1766) 6

SNAKES
- North American Racer, *Coluber constrictor* 1
- Coachwhip, *Coluber flagellum* 2
- Yellow-bellied Kingsnake, *Lampropeltis calligaster* 1
- Rough Greensnake, *Opheodrys aestivus* 4
- Western Ratsnake, *Pantherophis obsoletus* 5
- Eastern X Broad-banded Copperhead, *Agkistrodon contortrix* X *laticinctus* 13
- Timber Rattlesnake, *Crotalus horridus* 3
- Ring-necked Snake, *Diadophis punctatus* 1
- Flat-headed Snake, *Tantilla gracilis* 1
- Rough Earthsnake, *Haldea striatula* 1
- Plain-bellied Watersnake, *Nerodia erythrogaster* 2
- Diamond-backed Watersnake, *Nerodia rhombifer* 4
- Common Watersnake, *Nerodia sipedon* 1
- Dekay's Brownsnake, *Storeria dekayi* 1
- Western Ribbonsnake, *Thamnophis proximus* 2
- Common Gartersnake, *Thamnophis sirtalis* 6

Travis W. Taggart
KHS Field Trip Chairperson
Hays, Kansas 67601

KHS Campsite @ Elgin City Park. All photos by Rafe Brown.

Clockwise from the lower left, Aaron Short, Luke Welton, Ashley Welton, Meg Taggart, Dexter Mardis, and Theran Lantz w/ a Spiny Softshell.

Luke Welton and John Tollefson with one of the 16 Spiny Softshells collected during the trip.

Ashley Welton showing off an adult Snapping Turtle pulled from one of the traps Saturday afternoon.

Traps were set at six sites on the Caney River and Cedar Creek (pictured).

Field trip participants heading out to check some turtle traps upstream.

Results of the KHS 'Fall' Field Trip to Barber County

Seventy people converged on Barber County State Fishing Lake to attend the 2016 KHS 'Fall' (late Summer) Field Trip over the weekend of 9-11September 2016

As participants staggered in Friday night they were greated with heavy rain followed by cooler temperatures. The preceiptation was welcome, as it made it possible to observe every species of amphibian known from Barber County by simply driving county roads (particularly the blacktop between Sun City and US 160).

Saturday morning Ken Brunson led the caravan to southeast Kiowa County, to an area of abundant flat rocks (Kiowa Shale/Cheyenne Sandstone). A total of 150 specimens of 17 species were discovered.

Saturday afternoon everyone was on their own to explore the Gypsum Hills, resulting in the observation of 121 individuals of 29 species.

Sunday morning Ken led a smaller caravan to a rocky area of the Z-bar Ranch (SW Barber County) where the remaining participants spread out and looked under rocks. and into crevices. The small group managed to turn up 38 specimens of 14 species, including the first Chihuahuan Night Snake of the trip.

Over the course of the field trip, 465 individuals representing 42 species were discovered.

This trip was organized by Ken Brunson, and through his efforts those attending were able to gain access to rugged and spectacular private land. Additinally, the trip provided the opportunity to explore areas consumed by the Anderson Creek wildfire that swept over much of Barber County in March 2016.

The participants that signed in were: Mayah Haug, Maddalyn Lenz, Jacob Alexander, Katie Allen, Elizabeth Ang, Jacob Basler, Ashmika Behere, Mira Bhagat, Moriah Bickle, Madeline Boeck, Cameron Boyd, Nicole Brown, Rafe Brown, Ken Brunson, LeeAnn Brunson, Lauren Burrow, Dan Carpenter, Nathan Carpenter, Maddie Conigliano, Olivia Curry, Gabriella Emanouel, Jaycie Falcon, Melanie Falcon, Treyton Falcon, Sydney Frielaus, Victoria Gaa, Roxanna Hamidpour, Jeff Haug, Hannah Hoetmer, Elliot Horton, Niall Horton, Paxon Hutto, Ian Kanda, Eric Kessler, Katie Kirwan, Caroline Koenig, Aiden Lawson, Keaton Leiker, Dexter Mardis, Elijah McCoy, Jessica Meade, Abigail Millspaugh, Chris Ollig, Chan Kin Onn, Jaclyn Perry, Drake Pitts, Marylee Ramsay, Daren Riedle, Tamera Riedle, Zachary Riedle, Brielle Robinson, Avery Schmidt, Curtis Schmidt, Melissa Skelton, Alexandra Storm, Jess Taggart, Meg Taggart, Travis W. Taggart, Walter Tapondjou, Robert Tenny, Sarah Tomtschick, Jerry Wang, Lora Wehrly, Ashley Welton, Luke Welton, Ethan Westerman, Luke Westerman, Jeff Wienell, Chandler Wihisenhunt, and Jamie Zachary.

Avery Schmidt, Meg Taggart, Keaton Leiker, and Jess Taggart gather around as Ethan Westerman shows off a hatchling Texas Horned Lizard he found.

◄— Treyton Falcon is all smiles, as he holds up a Western Groundsnake he discovered. All photos by Melanie Falcon.

	FriPM	SatAM	SatPM	SunAM	Total
FROGS					
American Bullfrog, *Lithobates catesbeianus*	2	1	2	2	7
Blanchard's Cricket Frog, *Acris blanchardi*	2	7	43	2	54
Boreal Chorus Frog, *Pseudacris maculata*	2	0	0	1	3
Great Plains Toad, *Anaxyrus cognatus*	2	0	0	0	2
Plains Leopard Frog, *Lithobates blairi*	32	7	3	0	42
Plains Spadefoot, *Spea bombifrons*	11	0	0	0	11
Red-spotted Toad, *Anaxyrus punctatus*	8	0	0	0	8
Spotted Chorus Frog, *Pseudacris clarkii*	14	1	0	0	15
Western Narrow-mouthed Toad, *Gastrophryne olivacea*	4	2	5	0	11
Woodhouse's Toad, *Anaxyrus woodhousii*	44	3	3	1	51
SALAMANDERS					
Western Tiger Salamander, *Ambystoma mavortium*	24	2	1	0	27
LIZARDS					
Eastern Collared Lizard, *Crotaphytus collaris*	0	56	2	14	72
Great Plains Skink, *Plestiodon obsoletus*	0	0	1	0	1
Prairie Lizard, *Sceloporus thayerii*	0	0	2	0	2
Six-lined Racerunner, *Aspidoscelis sexlineata*	0	0	2	1	3
Slender Glass Lizard, *Ophisaurus attenuatus*	1	3	5	1	10
Texas Horned Lizard, *Phrynosoma cornutum*	0	12	16	5	33
SNAKES					
Chihuahuan Night Snake, *Hypsiglena jani*	0	0	0	1	1
Coachwhip, *Coluber flagellum*	0	0	0	2	2
Common Gartersnake, *Thamnophis sirtalis*	4	3	1	0	8
Dekay's Brownsnake, *Storeria dekayi*	1	0	1	0	2
Diamond-backed Watersnake, *Nerodia rhombifer*	1	0	1	0	2
Eastern Hog-nosed Snake, *Heterodon platirhinos*	0	0	1	0	1
Gophersnake, *Pituophis catenifer*	0	0	4	1	5
Great Plains Ratsnake, *Pantherophis emoryi*	1	0	1	0	2
Lined Snake, *Tropidoclonion lineatum*	0	2	0	0	2
North American Racer, *Coluber constrictor*	0	2	7	1	10
Prairie Rattlesnake, *Crotalus viridis*	0	1	1	0	2
Speckled Kingsnake, *Lampropeltis holbrooki*	0	2	3	0	5
Western Groundsnake, *Sonora semiannulata*	0	44	0	0	44
Western Massasauga, *Sistrurus tergeminus*	1	0	1	0	2
Western Ratsnake, *Pantherophis obsoletus*	1	0	1	0	2
Western Ribbonsnake, *Thamnophis proximus*	1	2	3	4	10
Yellow-bellied Kingsnake, *Lampropeltis calligaster*	0	0	1	0	1
TURTLES					
Ornate Box Turtle, *Terrapene ornata*	0	0	4	2	6
Pond Slider, *Trachemys scripta*	0	0	3	0	3
Snapping Turtle, *Chelydra serpentina*	0	0	1	0	1
Spiny Softshell, *Apalone spinifera*	0	0	2	0	2
TOTAL	42 species 456 individuals				

Travis W. Taggart
KHS Field Trip Chairperson
Hays, Kansas 67601

ARTICLES

Characterization and Significance of Sexual Dimorphism in Gape Size in *Virginia valeriae* ssp with Comparisons to *V. striatula*

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Abstract ~The availability of a large morphometric data set from over 2,000 specimens of *Virginia* presented the opportunity to examine gape dimorphism in 698 specimens of *V. valeriae* group, and to compare this specialist species with *V. striatula.* As in *V. striatula*, female *V. valeriae* attain a larger snout-to-vent length (SVL). However, the sexual dimorphism in gape demonstrated for *V. striatula* was barely evident within the *valeriae* group collectively. The observed dimorphism in *V. striatula* was hypothesized to allow males to access a wider range of prey (earthworm) sizes at any body size in order to successfully compete with females for the resource, especially during years in which significant drought may limit availability of prey. The potential influence of drought on *Virginia* and other snake genera through the eastern USA is discussed. Taxa within *V. valeriae* show increased specialization for a fossorial niche, and this is hypothesized to have been more intensively selected for suppression of gape size differences between the sexes of *V. v. valeriae*.

INTRODUCTION

The occurrence and hypotheses regarding adaptive significance of sexual dimorphism in head size in snakes has received increasing attention since Shine's (1991) extensive study. Prior to that review, most data on head size were presented as subsets of taxonomic studies, such as Myers' (1982) study of *Imantodes*. Although Shine examined >7,000 specimens, his review of necessity utilized a relatively small number of specimens per species to investigate the broad-scale occurrence of this relationship. For example, Shine (1991) examined 34 specimens (18 male:16 female) of *Virginia valeriae* Baird & Girard, 1853 ssp. Because his results showed no pronounced sexually dimorphic head size (and thus gape) in the species, he did not investigate *V. valeriae* further.

Pisani (2014) used a large data set from over 2,000 specimens of the genus *Virginia* to explore this relationship in *V. striatula* (Linnaeus, 1766). A sex-based ontogenetic divergence in a measure of gape in *V. striatula* existed—trophic morphology dimorphism (TMD per Elgee and Blouin-Demers 2011). It was hypothesized that the observed TMD allows males to utilize a wider range of prey (earthworm) sizes at any post-maturity snout-to-vent length (SVL) in order to successfully [i.e., equally] compete with females within the same trophic niche for the resource, especially during times of prey-scarcity such as drought.

This study uses another subset of those same data to examine the relationship in the three subspecies presently recognized within *V. valeriae*: *V. v. elegans* (Kennicott, 1859), *V. v. pulchra* (Richmond 1954) and *V. v. valeriae* (Baird & Girard, 1853) a related but highly derived (Maaz et al, in press) assemblage specialized for semi-fossorial niches. Data examined here explore in depth the relationships of gape and sex, under selection within this niche.

Pisani (2014) noted that gape has been defined in markedly different ways by various authors (Shine 1991; Hampton 2011; Grudzien, et al. 1992; King 2002; Miller and Mushinsky 1990). Shine (1991) for example used simply mandibular length as a measure of gape; Miller and Mushinsky (abstract) "used the general formula for calculating the circumference of an ellipse whose major and minor axes corresponded to jaw length and jaw width". Irrespective of these differences, the methods validly approximate gape, as definitions generally examine head dimensions and are standardized by SVL. The resulting trends and conclusions thus are comparable.

MATERIALS AND METHODS

Data for 698 (239 male:359 female) *Virginia valeriae* ssp (Appendix 1) were used from the morphometric data set accumulated by examination of museum preserved specimens. Damaged or seemingly distorted (presumably during preservation) head dimensions were not recorded; specimens that were missing data needed for gape computation were excluded from this study. As in Pisani (2014), head metrics (Figure 1) and SVLs were measured in standard fashion (e.g. Grudzien, et al. 1992). My sample again included data from juveniles through adult snakes (70-312mm SVL).

As per Pisani (2014) I defined gape as the distance from the posterior apex of the frontal scale to the anterior-most part of the rostral scale, multiplied by head width as indicated in Figure 1. The fairly short head of *Virginia*, coupled with the fact that some specimens examined were preserved such that mandibular length was difficult to measure accurately, indicated that this was the most repeatable measure of overall head length and width. The considerable cross-correlation of morphometric characters in snakes (Savitzky 1983, Manier 2004) means that little if any accuracy is sacrificed by this method.

Data were natural-log transformed, plotted by sex, and evaluated for homoscedasticity and other regression assumptions, and then examined by linear regression using SPSS21. Residuals were tested against fitted values for normal distribution. Several slight outliers were evenly distributed across sexes; these did not significantly affect random distribution of residuals and cases therefore were not deleted from regression computations.

Taxa within the *V. valeriae* group were initially analyzed by regression separately, and certain results of that are discussed below. However, the slight differences in slopes and y-intercepts were insignificant at $p = 0.05$ (Table 1; Figure 2) and so data subsequently were pooled. Relatively small sample size of *V. v. pulchra* did not allow separate analysis of that morph.

Gapes also were examined by sex non-parametrically within *V. v. valeriae* and *V. v. elegans*.

RESULTS

Pooled regression results for *V. valeriae* are shown in Figure 3 (A and B) and Appendix 2. As with *V. striatula* (Pisani 2014), female *V. valeriae* are at maximum longer (SVL) than are males (Figure 4), and mature females are heavier than males (Todd et al, 2008). R is similar for both sexes (Females= 0.8677, Males= 0.8726), as is r^2 with high ($p < 0.0001$) F-test and Beta significance. Residuals were not significantly ($p > 0.05$) skewed from zero (D-W test).

Unlike *V. striatula*, the sexes of the *V. valeriae* group (pooled) show only slight allometrically dimorphic characteristics in gape. Though male gape is uniformly somewhat larger across the range of SVL, the confidence bands of means (Figure 3B) indicate the difference is not significant at $p > 0.05$).

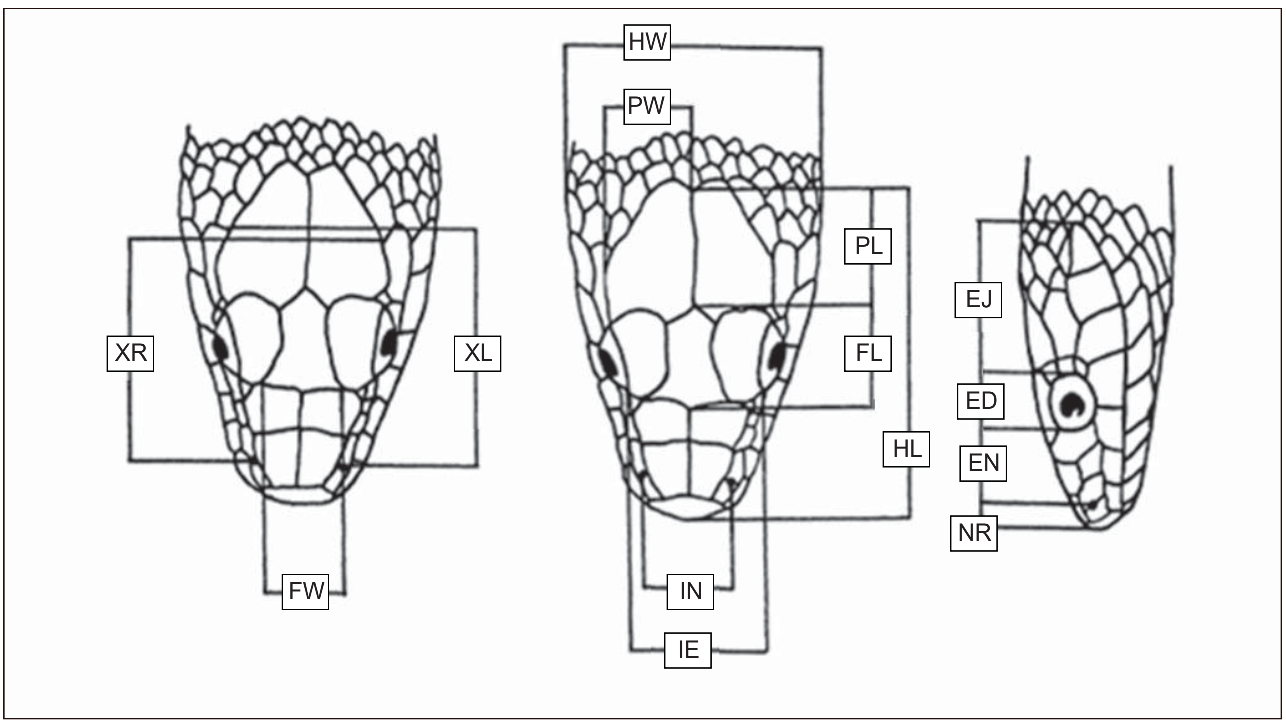
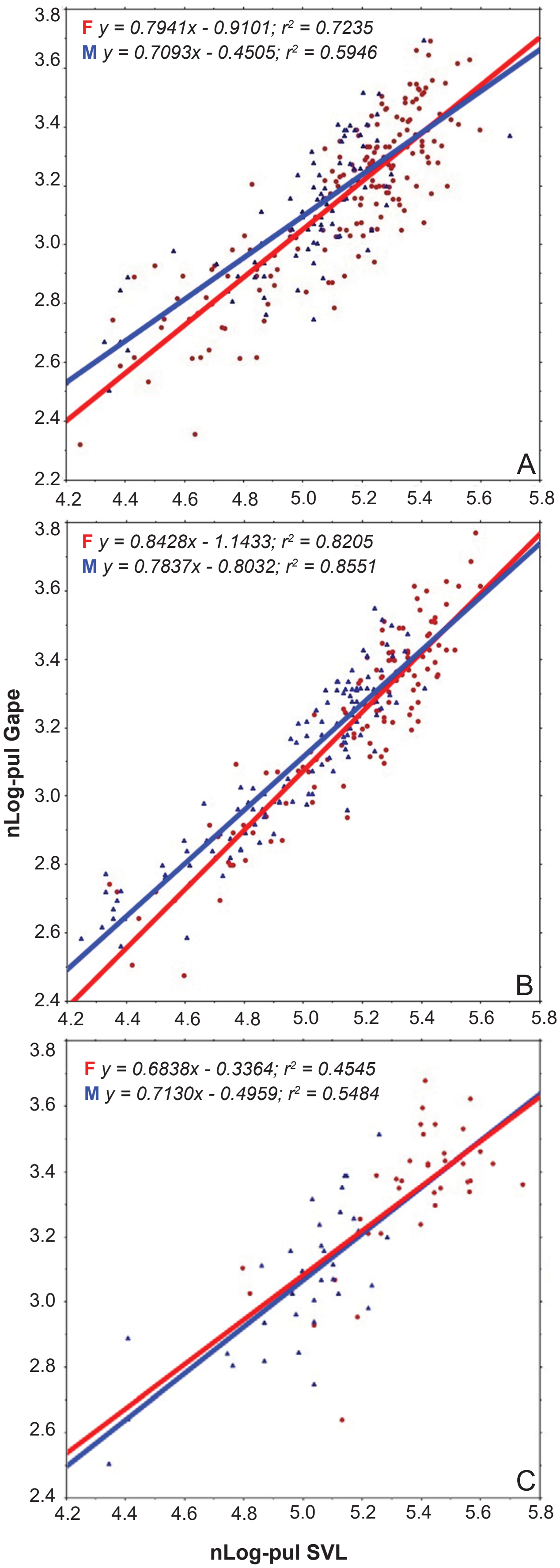


Figure 1. Head dimensions (Adapted from Grudzien et al 1992)



◄— Figure 2. Linear regressions, natural Logs Gape (y-axes) and SVL (x-axes) of males and females within individual taxa in *V. valeriae* group (95% confidence bands not shown). A, *V. v. valeriae* ; B, *V. v. elegans* ; C, *V.v. pulchra*. (●) Females; (▲) Males.

Table 1. Regression equations for separate and grouped *V. valeriae* ssp.

Taxon	Sex (n)	Regression equation	r^2
V. v. elegans	F (148)	y= .8428x- 1.1433	.8205
	M (118)	y= .7837x- .8032	.8551
V. v. valeriae	F (173)	y= .7941x- .9101	.7235
	M (86)	y= .7093x- .4505	.5946
V. v. pulchra	F (38)	y= .6838x- .3364	.4545
	M (35)	y= .713x- .4959	.5484
COMBINED	F (359)	y= .8202x- 1.0437	.7529
	M (239)	y= .7871x- .822	.7614

DISCUSSION

Pisani (2014) reviewed the adaptive value of sexual dimorphism in gape size to a trophically-specialized snake genus like *Virginia*, and also the difficulty of assessing that value when a species feeds solely upon elongate, highly compressible prey such as earthworms.

Selander (1972, cited by Shine 1987) noted that forms of sexual dimorphism involving the feeding apparatus (“trophic apparatus”) may evolve to enable differential niche utilization by the sexes. Although this frequently appears true (see Discussion in Pisani 2014), within the genus *Virginia* there is no indication that the sexes differ trophically, nor do they differ in microhabitat. To that end, both sexes of *V. valeriae* utilize the same habitat and prey exclusively upon earthworms (Pisani 2009, Pisani 2014, Busby and Pisani 2011, Clark and Fleet 1976, Todd et al. 2008, Cervone 1983, Bradford 1973).

Sexual dimorphism in snake head size has also been attributed to (and thus correlated with) the attainment of larger size by one sex, frequently males (see discussion in Shine 1991). However, in *Virginia* as in many natricine genera, mature females reach greater mass and SVL than males (Todd et al. 2008, Clark and Fleet 1976), yet (in *V. striatula*) mature males have relatively larger gape (Pisani 2014).

That this does not seem to be the case in members of the *V. valeriae* group suggests two hypotheses:

- fossorial specialization has been selected for despite potential foraging strategy issues; AND/OR,
- that increased fossoriality (*c.f. striatula*) facilitates worm predation by the *valeriae* group, especially

during periods of environmental stress (primarily drought).

Taxa within *V. valeriae* show increased specialization for a fossorial niche, with *V. v. valeriae* the most derived member of the group in its combination of shortened tail, smooth scales and more compact head (Maaz et al, 2014). Within my results above are additional observations that suggest a lineage of specialization for fossoriality within the *valeriae* group.

For example, when confidence limits in my pooled sample are changed to p = 0.10, males show modestly larger gapes across most SVLs (Figure 4). This difference at 0.10 > p > 0.05 suggests a reduced (cf. *V. striatula*) difference in gape between sexes.

Further investigation of this (Figure 5) indicated that within my sample of *V. v. elegans* Gape and SVL differ between sexes (p = 0.01, Mann-Whitney U and Kruskal-Wallis tests; Brown-Forsythe Test—equality of means), although the relationship between gape and SVL is correlated and does not indicate significant allometry. Within my *V. v. valeriae* sample, gape did not differ, although the SVL relationship between sexes (females larger) was equivalent to that of *V. v. elegans*. This finding was suggestive of gape allometry between sexes in *V. v. valeriae*; however, the differences are not significant (p= 0.10).

Because members of the *valeriae* group are more specialized for fossoriality than is *V. striatula* (Maaz et al, 2014), with *V. v. elegans* seemingly occupying a less-derived position than *V. v. valeriae*, I conclude that the trends noted here reflect increased selection for reduced head dimensions (and thus suppressed gape allometry) as a specialization for increased fossoriality from *elegans* to *valeriae*.

Though several possible environmental forces may operate (individually or collectively) to select for increasing fossoriality in small snakes, extended drought may be an underestimated selective pressure. Many factors affect accurate assessment of drought episodes in the continental US, especially estimates extending prior to 1900 (Knutson et al, 2013). Within the range of the genus *Virginia (striatula and valeriae)*, there has been, over 80+ years, several

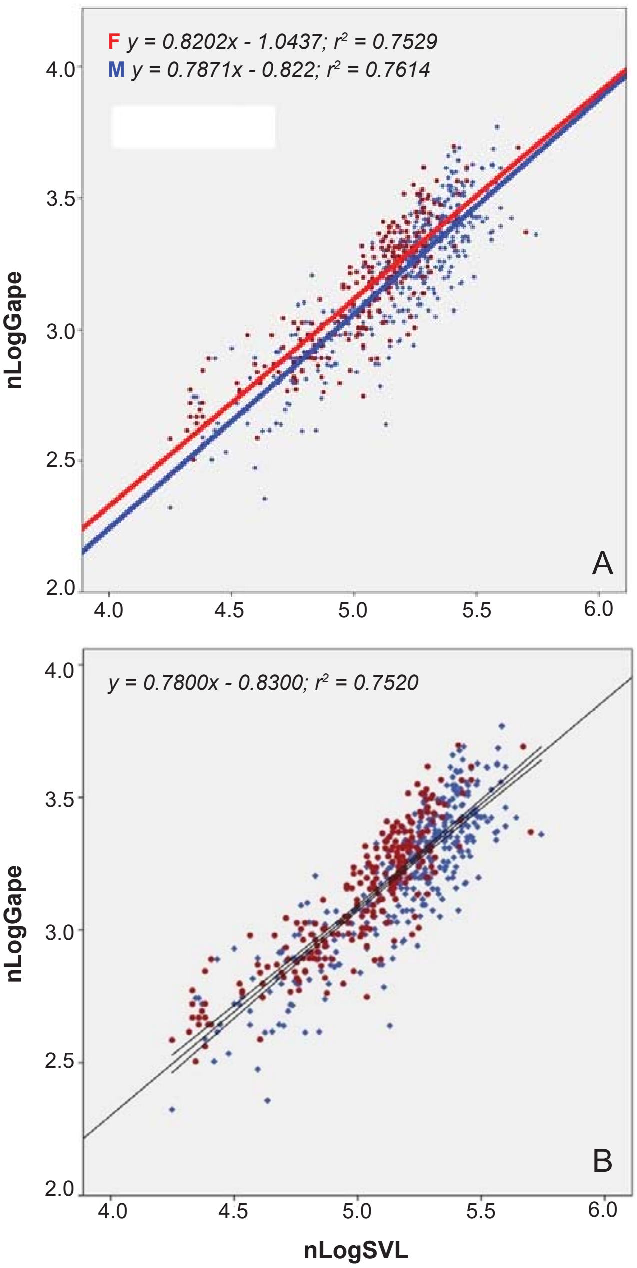


Figure 3. (A) Pooled data, *V. v. valeriae*. (B) Pooled *V. v. valeriae*, common regression line and 95% confidence bands (means). (●) Females; (▲) Males.

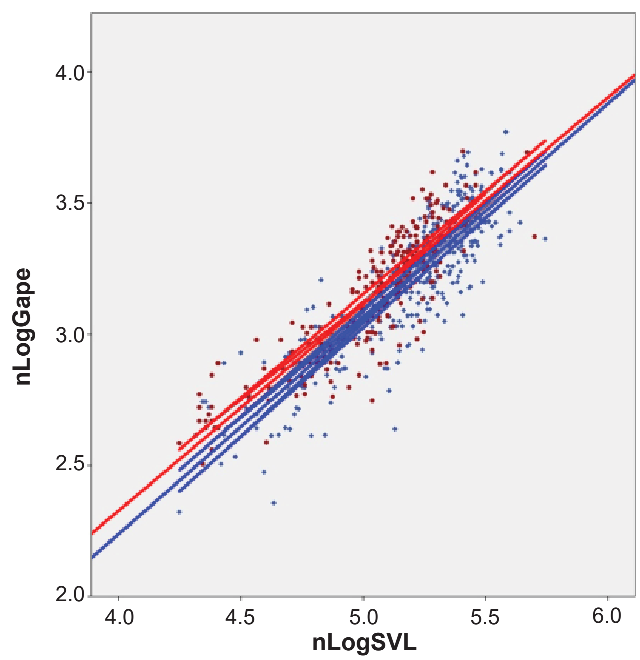


Figure 4. Pooled data, *V. valeriae* males vs females, confidence bands (means) p= 0.10. (●) Females; (▲) Males.

severe drought episodes, some quite prolonged (Andreadis et al. 2005, Cook et al. 2007, Pederson *et al.* 2012). Cook et al (2007) used tree ring data to examine drought patterns back to 951AD. Pederson et al (2012) commented: "Further, the frequency of extreme drought events [in southeastern US] in the first half of the 20th century (and relatively rare until the 1980s) was not anomalous, as similar droughts occurred in the first halves of the 18th and 19th centuries."

These climate studies show that severe drought—and inferred species impacts—have alternated for centuries across present-day ranges of *V. valeriae* group and *striatula*. Although no long-term drought-impact studies on *Virginia* exist, studies of other species suggest this inference is plausible (Seigel, et al. 1995; Winne, et al. 2010; Sperry and Weatherhead 2008). Additional ecological study is required to assess potential between-sex trophic competition in the *valeriae* group during extended drought.

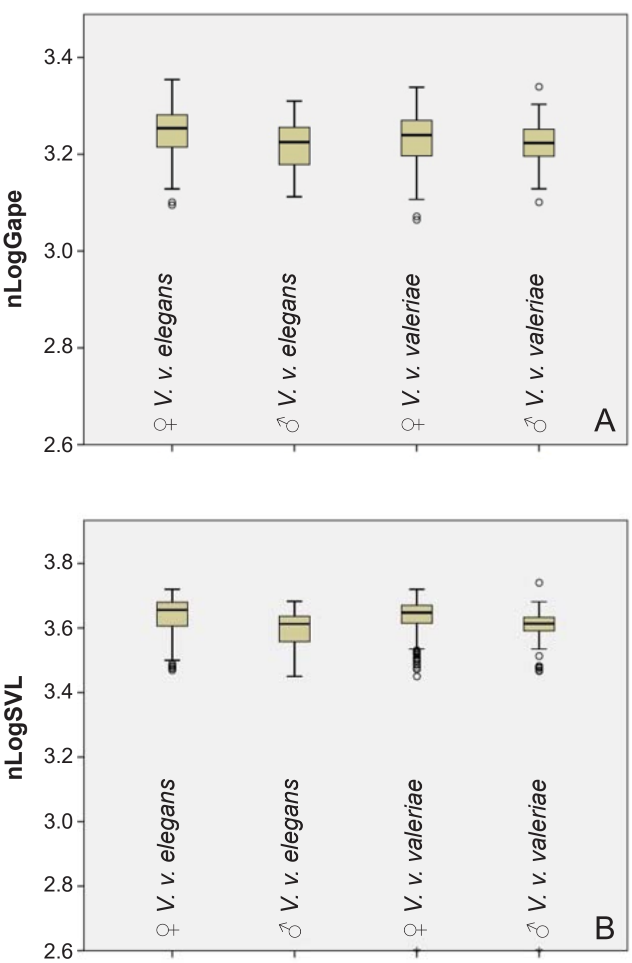


Figure 2. Comparisons of Gape (A) and SVL (B) between *V. v. elegans* and *V. v. valeriae*. Note that male *V. v. valeriae* have gapes equivalent to females despite smaller SVL, whereas in *V. v. elegans* the relationship is the same.

ACKNOWLEDGMENTS

Specimens examined were from many diverse preserved collections, varying from major museum sources through regional ones and well-curated teaching collections. Many curators and collection managers assisted by providing personal access to specimens and unpublished data and by loans of specimens. My sincere thanks to all of these and in particular to W. E. Duellman and J. T. Collins (respectively Curator of Herpetology and former Collection Manager, KU Museum of Natural History) for facilitating loans and providing work space.

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And for sharing his vast knowledge of snake ecology, as well as for field collaboration, I am grateful to Henry S. Fitch (deceased).

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Appendix 1. Specimens examined. Collection acronyms follow Sabaj Pérez (2013) for major USA collections; other collections referenced with their preferred acronyms. Acronyms used are: AMNH (American Museum Natural History, ANSP (Academy Natural Sciences Philadelphia), APSU (Austin Peay State University, Tennessee), AUM (Auburn University Museum), BCB (Bryce C. Brown Collection, Texas), BST (Ball State Univ. Teaching Collection), CA (Chicago Academy Sciences), CM (Carnegie Museum), CNHM (Chicago Natural History Museum), EKU (Eastern Kentucky Univ.), FHSM (Fort Hays State University, Sternberg Museum of Natural History), FMNH (Field Museum Natural History), GRP (George R Pisani field number), JTC (Joseph T Collins field number), JCL (James C List teaching collection), JLC (James L Christiansen Drake University teaching collection), KU (Univ. Kansas Museum Natural History), LSUMZ (Louisiana State University Museum Zoology), MOSU (Morehead State University, Kentucky), MSM (Murray [Kentucky] State Univ. Museum), NLU (Northeast Louisiana University, Monroe), OSM (Ohio State University Museum Zoology), RCB (Richard C Bothner St Bonaventure Univ) field number, UAZ (Univ. of Arizona), SMBU (Baylor Univ. Museum), SUS (Louisiana State Univ., Shreveport), TCWC (Texas Cooperative Wildlife Collection), UF (Univ. of Florida Museum of Natural History), UL (Univ. of Louisville, Kentucky), USA (Univ. of South Alabama), USL (Univ. of Southwestern Louisiana), USNM (National Museum of Natural History), UTM (University of Tennessee, Martin Teaching Collection), WVBS (West Virginia Biological Survey). Acronyms preceded by an asterisk are primarily private collections no longer available.

MALES
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AMNH38315
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* WH-b
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WVBS3961

Appendix 2. Pooled regression results for *V. valeriae.*

FEMALES

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
359	0.8677	0.7529	0.7522	0.1337

Analysis of Variance Table

Source	OF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	19.445	19.445	1087.5363
RESIOUAL	357	6.3831	0.0179	p = 0.0001
TOTAL	358	25.8281		

Beta Coefficient Table

Variable:	Coefficient	Std. Err.:	Std. Coeff.:	t-Value:	Probability;
INTERCEPT	-1.0437				
SLOPE	0.8202	0.0249	0.8677	32.9778	0.0001

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN(X,Y)	3.1926	3.2203	3.1948	3.2181
SLOPE	0.7713	0.8691	0.7792	0.8612

Residual Information Table

SS[e(i)-e(i-1)]:	e • 0:	e < 0:	DW test:
9.6616 1	90	169	1.5136

MALES

Count:	R:	R-Squared:	Adj. R-squared:	RMSResidual:
239	0.8726	0.7614	0.7604	0.1197

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	10.8421 1	0.8421	756.3046
RESIDUAL	237	3.3975	0.0143	p = 0.0001
TOTAL	238	14.2397		

Beta Coefficient Table

Variable:	Coefficient	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	-0.822				
SLOPE	0.7871	0.0286	0.8726	27.501	0.0001

Confidence Intervals Table

Variable:	95% lower:	95% Upper:	90% Lower:	90° Upper:
MEAN (X,Y)	3.1135	3.144	3.116	3.1416
SLOPE	0.7307	0.8434	0.7398	0.8343

Residual Information Table

SS[e(i)-e(i-1)]:	e • 0:	e < 0:	DW test:
5.7196	121	118	1.6834

About the Kansas Herpetological Society

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)

KHS Meetings

The KHS holds an annual meeting in the fall of each year. The meeting is, minimally, a two day event with lectures and presentations by herpetologists. All interested individuals are invited to make presentations. The annual meeting is also the time of the Saturday night social and fund-raising auction.

Field Trips

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.

Editorial Policy

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

Submission of Manuscripts

As space allows, *Collinsorum* publishes all manner of news, notes, and articles. Priority of publishing is given to submissions of Kansas herpetological subjects and by KHS members; however all submissions are welcome. The ultimate decision concerning the publication of a manuscript is at the discretion of the Editor. Manuscripts should be submitted to the Editor in an electronic format whenever possible. Those manuscripts submitted in hard copy may be delayed in date of publication. Manuscripts should be submitted to the Editor no later than the 1st of the month prior to the month of issuance. All manuscripts become the sole possession of the Society, and will not be returned unless arrangements are made with the Editor.

Reprints & Artwork

Collinsorum publishes original peer-reviewed submissions under the Articles and Notes sections. Upon review, acceptance, and publication, Portable Document File (PDF) copies are provided gratis to the author on request. Figures and photographs submitted with manuscripts are welcome, but must be sized appropriately by authors for this journal's column sizes (i.e., 19.5 or 39 picas wide). Particular attention should be paid to reduction of text on the figures.

Societal Awards, Grants, and Recognitions

Distinguished Life Members

Individuals selected as Distinguished Life Members are chosen by the KHS Executive Council based on their distinguished published research papers on Kansas herpetology.

Bronze Salamander Award

Established in 1987, this Award is presented to those individuals whose efforts and dedication to the Kansas Herpetological Society go far beyond the normal bounds. The recipients of this Award have given exemplary service to the KHS, and are presented with an elegant bronze sculpture of a Barred Tiger Salamander.

The Howard K. Gloyd - Edward H. Taylor Scholarship

Established in 1993, The Gloyd-Taylor Scholarship is presented annually by the Kansas Herpetological Society to an outstanding herpetology student. The scholarship is a minimum of $300.00 and is awarded on the basis of potential for contributing to the science of herpetology. Students from grade school through university are eligible.

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.

The Henry S. Fitch - Dwight R. Platt Award for Excellence in Field Herpetology

KHS members only are eligible to apply for The Henry S. Fitch - Dwight R. Platt Award for Excellence in Field Herpetology, which was established in 2010. The recipient of the grant will be selected by the KHS Awards Committee. The award will be given annually when sufficient funds have been raised to establish a trust.

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 lifelong 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.

The Suzanne L. & Joseph T. Collins Award for Excellence in Kansas Herpetology

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.

Kansas Herpetological Society
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