BULLETIN
of the
Chicago Herpetological Society

Volume 53, Number 10
October 2018

BULLETIN OF THE CHICAGO HERPETOLOGICAL SOCIETY
Volume 53, Number 10
October 2018

Cover: Sinaloa toad, *Incilius mazatlanensis*, from the municipality of Compostela, Nayarit, Mexico. Photograph by Guillermo A. Woolrich-Piña.

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The *Bulletin of the Chicago Herpetological Society* (ISSN 0009-3564) is published monthly by the Chicago Herpetological Society, 2430 N. Cannon Drive, Chicago IL 60614. Periodicals postage paid at Chicago IL. **Postmaster:** Send address changes to: Chicago Herpetological Society, Membership Secretary, 2430 N. Cannon Drive, Chicago IL 60614.

Notes on the Herpetofauna of Nayarit, Mexico 2: Amphibians and Reptiles of the Municipality of Compostela

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(all photographs depict specimens and habitat found in the municipality of Compostela)

Abstract

With the objective of increasing our knowledge on the herpetological composition of the municipality of Compostela, we performed surveys in different types of vegetation during the period from 2013 to 2016. This is our second survey for a particular municipality of the state. Based on the information obtained, we here report our findings of 71 species (21 amphibians and 50 reptiles) in four orders, 29 families and 54 genera. The most diverse family is the Colubridae, with 13 species.

Resumen

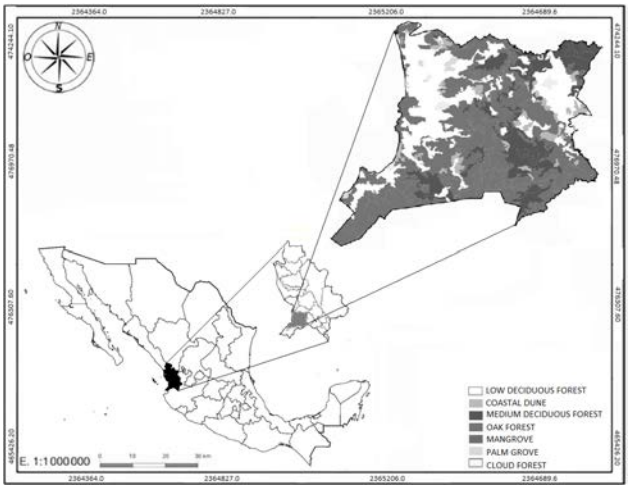
Con el objetivo de dar a conocer la composición de anfibios y reptiles del municipio de Compostela, del 2013 al 2016 fueron realizados muestreos en diferentes tipos de vegetación. Este es el segundo inventario sobre el estado que se demuestra la presencia actual de las especies, base a los muestreos realizados se encontraron 71 especies de herpetofauna; de estos 21 fueron anfibios y 50 reptiles, en cuatro órdenes, 29 familias y 54 géneros. El género Colubridae es el más diverso, con 13 especies.

Introduction and Background

Previous studies of herpetofauna in the Mexican state of Nayarit have documented the herpetological composition of species found in the state (Luja et al., 2014; Loc-Barragán et al., 2015; Woolrich-Piña et al., in press). These documents form the basis of future work, such as the recent study on composition, distribution and conservation of the herpetofauna of this state (Woolrich-Piña et al., 2016). Research on amphibians and reptiles in the state has received great impulse; however, existing studies have not dealt with vegetation types or municipalities. The objective of our research was to provide regional accounts of herpetofauna for the state and the second summary list of amphibians and reptiles for a municipality of Nayarit, in this case, Compostela. The principal intention of this field work was to obtain a reliable list of herpetofauna. This information would improve management strategies of flora and fauna in this municipality that has been affected by quick growth in development for tourism and other anthropogenic activity (cattle raising and paved road construction).

Study site (Biogeography)

Nayarit is located at the junction of three prominent physiographic segments of Mexico: (1) the Coastal Plain—17% of its surface area, (2) the Sierra Madre Occidental—53.2%; (3) the Trans-Mexican Volcanic Belt 28.7% (Woolrich-Piña et al., 2016). The municipality of Compostela is located in the southern region of Nayarit, it has an area of 1848 km^2, is located between 20°51' and 21°23' N latitude, and between 104°47' and 105°23' W longitude; with an altitude gradient between 0 and 1700 m. It is bordered to the north by the municipalities of San Blas and Xalisco; to the south by the municipality of Bahia de Banderas and the state of Jalisco; to the east by the municipalities of Santa María de el Oro and San Pedro Lagunillas, and by the state of Jalisco; and to the west by the Pacific Ocean. It occupies 6.82% of the surface area of the state. One of the seven natural protected areas of Nayarit is in this municipality: "Sierra de Vallejo" (SEMARNAT and CONANP, 2005). Compostela presents a diversity of landscapes and vegetation: Cloud Forest and Oak Forest, representing around 17.66% of the municipality's surface; Medium Deciduous Forest and Low Deciduous Forest with 50.58%; Mangrove 0.51%; Coastal Dune 0.7%; Palm Grove 0.30% and Agricultural 30.25% (INEGI, 2009).



The location of the municipality of Compostela, Nayarit, Mexico.

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Incilius mazatlanensis observed in Medium Deciduous Forest, on the road to Alta Vista, Compostela. Photograph by Guillermo A. Woolrich-Piña.

Craugastor occidentalis observed in Medium Deciduous Forest in Alta Vista, Compostela. Photograph by Jesús Loc-Barragán.

Craugastor pygmaeus observed in Oak Forest. Locality: Mazatán, Compostela. Photograph by Jesús A. Loc-Barragán.

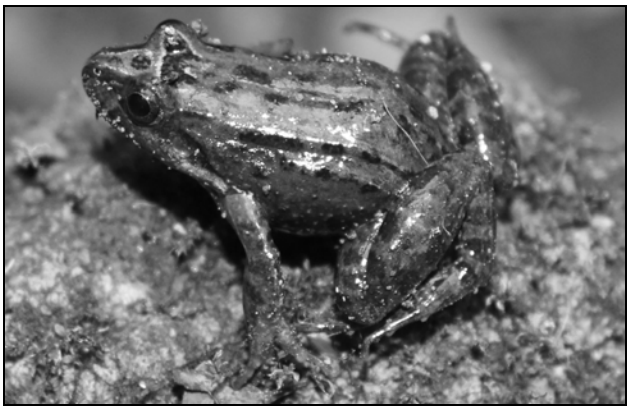
Eleutherodactylus nitidus observed in Medium Deciduous Forest. Locality: Cumbres de Huicicila, Compostela. Photograph by Jesús Loc-Barragán.

Eleutherodactylus pallidus observed in Cloud Forest. Locality: Rancho Pajaritos, Sierra Vallejo, Compostela. Photograph by Jesús A. Loc-Barragán.

Diaglena spatulata observed in Medium Deciduous Forest on the road to Alta Vista, Compostela. Photograph by Guillermo A. Woolrich-Piña.

Tlalocohyla smithii observed in Low Deciduous Forest. Locality: Rancho Agua Sarca, on the Compostela-Mazatán road, Compostela. Photograph by Jesús A. Loc-Barragán.

Agalychnis dacnicolor observed in Medium Deciduous Forest on the road to Alta Vista, Compostela. Photograph by Guillermo A. Woolrich-Piña.



Leptodactylus melanonotus observed in Low Deciduous Forest. Locality: Calexico, Compostela. Photograph by Jesús Loc-Barragán.

Lithobates forreri observed in Low Deciduous Forest on the Compostela-Mazatán road, Compostela. Photograph by Jesús A. Loc-Barragán.

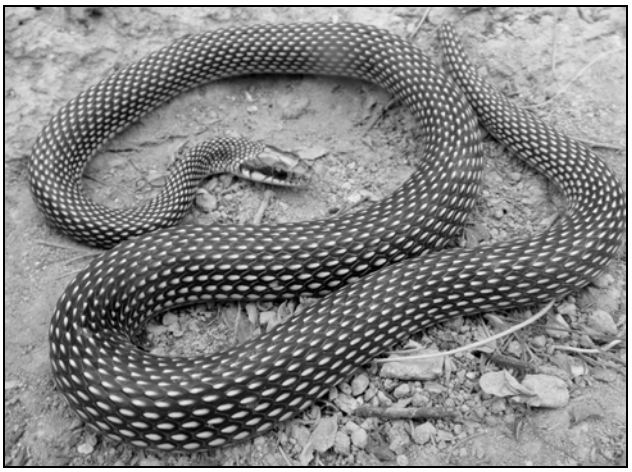
Lithobates magnaocularis observed in Low Deciduous Forest on the Compostela-Mazatán road. Photograph by Jesús A. Loc-Barragán.

Gerrhonotus liocephalus observed in Low Deciduous Forest. Locality: Rancho Agua Sarca, on the Compostela-Mazatán road. Photograph by Jesús A. Loc-Barragán.

Heloderma horridum observed in Low Deciduous Forest. Locality: Carrillo Puerto, Compostela. Photograph by Jesús A. Loc-Barragán.

Ctenosaura pectinata observed in Low Deciduous Forest. Locality: Rancho Agua Sarca, on the Compostela-Mazatán road. Photograph by Jesús A. Loc-Barragán.

Holcosus sinister observed in Medium Deciduous Forest. Locality: Alta Vista, Compostela. Photograph by Guillermo A. Woolrich-Piña.



Drymobius margaritiferus observed in Low Deciduous Forest. Locality: Rancho Agua Sarca on the Compostela-Mazatán road. Photograph by Jesús A. Loc-Barragán.

Lampropeltis polyzona observed in Low Deciduous Forest. Locality: Mazatán, Compostela. Photograph by Jesús A. Loc-Barragán.

Leptodeira maculata observed in Low Deciduous Forest along the Compostela-Mazatán road. Photograph by Jesús A. Loc-Barragán.

Crotalus basiliscus observed in Oak Forest. Locality: Mazatán, Compostela. Photograph by Jesús A. Loc-Barragán.

Kinosternon integrum observed in Low Deciduous Forest. Locality: Rancho Agua Sarca, on the Compostela-Mazatán road. Photograph by Jesús A. Loc-Barragán.

Material and Methods

Field trips were conducted from September 2013 to December 2016, with approximately 40 sampling visits lasting five to 10 days each for different study sites within the municipality. Sampling effort was flexible, depending on conditions and vegetation types. We conducted daytime (0900–1200 h) and nocturnal (2100–2300 h) surveys; our main searching activity was focused on direct observation and rock lifting, trying our best not to disturb the habitat (Goode et al., 2004, 2005), using equipment such as hooks, bags and lanterns. Specimens were bagged, transported to the lab for photography and released the next day at the locality where they were collected.

Results

We documented the presence of 71 species, of which 21 are amphibians and 50 are reptiles (Table 1). The 21 amphibian species are grouped into one order, eight families and 12 genera. SEMARNAT (2010) lists 12 of these species as endemic to Mexico and five as protected (*Eleutherodactylus pallidus*, *E. teretistes*, *Hypopachus ustus*, *Lithobates forreri* and *L. pustulosus*). IUCN (2018) lists one species as Vulnerable (*Craugastor pygmaeus*) and three as Data Deficient (*C. occidentalis*, *E. pallidus* and *E. teretistes*). Based on the environmental vulnerability score (EVS), nine species are at low vulnerability, nine at medium vulnerability and two (*E. pallidus* and *E. teretistes*) at high vulnerability.

The 50 reptile species occur in three orders, 21 families and 42 genera. SEMARNAT (2010) categorizes 27 of these species as endemic to Mexico, one species as introduced (*Hemidactylus frenatus*), 16 as protected, five as threatened (*Heloderma horridum*, *Ctenosaura pectinata*, *Leptophis diplotrophis*, *Masticophis mentovarius* and *Rhinoclemmys pulcherrima)* and four as being in danger of extinction (*Chelonia mydas, Eretmochelys imbricata*, *Lepidochelys olivacea* and *Dermochelys coriacea*). IUCN (2018) lists one species as Critically Endangered (*E. imbricata*), one as Endangered (*C. mydas*), four as Vulnerable (*Crocodylus acutus*, *L. olivacea*, *D. coriacea* and *Trachemys ornata*), one as Near Threatened (*Agkistrodon bilineatus*), and two as Data Deficient (*Plestiodon parvulus* and *Coniophanes lateritius*); 10 species are not evaluated. Based on the environmental vulnerability score (EVS), 15 species are at low vulnerability, 14 at medium vulnerability and 15 at high vulnerability. The amphibian family with the most species was Hylidae with five. The reptile family with the most species was Colubridae with 13. Differences were observed in species richness among the seven plant communities. Nine species of amphibians and reptiles were observed in Cloud Forest, 13 in the Oak Forest, 37 in Medium Deciduous Forest, 46 in Low Deciduous Forest, six in Mangrove, eight in Palm Grove, and nine in Coastal Dunes vegetation (Tables 1 and 2). Some of our records represent extensions of distribution, and new records for the municipality of Compostela.

Discussion and Conclusions

The herpetofauna of Nayarit comprises 154 species: 36 amphibians of which 21 are endemic to Mexico and 118 reptiles of which 67 are endemic for the country (Woolrich-Piña et al., 2016). Our survey numbers for the municipality of Compostela represent 55.5% and 73.1% respectively of the amphibian and reptile richness of the state. The number of species found in this study is an important factor when considering conservation alternatives for the different vegetation types, for the municipality and the state. This is the second study of this type we have performed for a particular municipality of Nayarit; our first was Tecuala (Loc-Barragán and Lazcano, 2018). López-Solís and Luja (2014) reported on their fieldwork on the herpetofauna of the municipality of Tepic, Nayarit, showing a preliminary result of 33 species (14 amphibians and 19 reptiles). Table 2 compares

Oak Forest at Sierra Vallejo, Compostela. Photograph by Jesús A. Loc-Barragán.

Micrurus proximans observed in Low Deciduous Forest. Locality: Rancho Agua Sarca on the Compostela-Mazatán road. Photograph by Jesús A. Loc-Barragán.

Salvadora mexicana observed in Medium Deciduous Forest. Locality: road to Alta Vista, Compostela. Photograph by Guillermo A. Woolrich-Piña.

results for the three municipalities.

Acknowledgments

We thank PROMEP ("Los vertebrados de la Sierra de Vallejo" Project) for financial support to for scholarship (UAN-CA-261) obtained to JALB, and CONACyT (Grant no. 290805) for the Postdoctoral fellowship to GAWP in 2013–2014. We thank Fausto R. Mendez de la Cruz for obtaining our collecting permit from SEMARNAT OFICIO NÚM (SGPA/DGVS/01629/16), and Dr. Larry David Wilson for reviewing the manuscript. We thank all the people of the *ejidos* of Alta Vista, El Moteón, La Peñita de Jaltemba, Zacualpan, El Capomo, Carrillo Puerto, Calexico and Mazatán for their hospitality and support for these field trips.

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Table 1. Distributional and conservation status of the herpetofauna of Compostela, Nayarit, Mexico. **END** = endemism: E = endemic to Mexico; N = not endemic to Mexico; I = Introduced. **NOM** = protection status under NOM-ECOL-059-2010 (SEMARNAT, 2010): P = En Peligro de Extinción (Endangered); Pr = Protección Especial (Special Protection); A = Amenazada (threatened). IUCN Categorization: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; and NE = Not Evaluated. Environmental Vulnerability Score, low (L) vulnerability species (EVS of 3–9); medium (M) vulnerability species (EVS of 10–13); and high (H) vulnerability species (EVS of 14–20) (Wilson et al. 2013; Woolrich-Piña et al., 2016). .Vegetation: CF = Cloud Forest; OF = Oak Forest; MDF; Medium Deciduous Forest; LDF = Low Deciduous Forest; M = Mangrove; PG = Palm Grove CD = Coastal Dune. Nomenclature from Wilson et al., 2013a and 2013b.

Family	Species	END	NOM	IUCN	EVS	Vegetation
Bufonidae	*Incilius marmoreus*	E	—	LC	M(11)	MDF, LDF
	Incilius mazatlanensis	E	—	LC	M(12)	CF, MDF, LDF, CD
	Rhinella horribilis	N	—	LC	L (3)	CF, MDF, LDF, CD
Craugastoridae	*Craugastor augusti*	N	—	LC	L (8)	CF, OF
	Craugastor occidentalis	E	—	DD	M(13)	OF, CF, MDF
	Craugastor pygmaeus	E	—	VU	L(9)	OF, CF, MDF
	Craugastor vocalis	E	—	LC	M(13)	MDF
Eleutherodactylidae	*Eleutherodactylus nitidus*	E	—	LC	M(12)	OF, CF
	Eleutherodactylus pallidus	E	Pr	DD	H (17)	CF, MDF, LDF
	Eleutherodactylus teretistes	E	Pr	DD	H (16)	CF,OF
Hylidae	*Diaglena spatulata*	E	—	LC	M(13)	MDF, LDF
	Dryophytes eximius	E	—	LC	M(10)	MDF, LDF
	Smilisca baudinii	N	—	LC	L (3)	MDF, LDF, PG
	Smilisca fodiens	N	—	LC	L(8)	LDF
	Tlalocohyla smithii	N	—	LC	L (8)	OF, MDF, LDF
Phyllomedusidae	*Agalychnis dacnicolor*	E	—	LC	M(13)	CF, MDF, LDF, PG, CD
Leptodactylidae	*Leptodactylus melanonotus*	N	—	LC	L (6)	MDF, LDF, PG
Microhylidae	*Hypopachus ustus*	N	Pr	LC	L (7)	LDF, PG
Ranidae	*Lithobates forreri*	N	Pr	LC	L (3)	LDF
	Lithobates magnaocularis	E	—	LC	M(12)	OF. MDF
	Lithobates pustulosus	E	Pr	LC	L (9)	CF, MDF
Crocodylidae	*Crocodylus acutus*	N	Pr	VU	H (14)	MS, CD
Anguidae	*Gerrhonotus liocephalus*	N	Pr	LC	L (6)	MDF, LDF
Dactyloidae	*Norops nebulosus*	E	—	LC	M(13)	OF, MDF, LDF, PG, CD
Gekkonidae	*Hemidactylus frenatus*	I	—	—	—	MDF
Helodermatidae	*Heloderma horridum*	E	A	LC	H (14)	MDF
Iguanidae	*Ctenosaura pectinata*	E	A	NE	H (15)	MDF, LDF, M, CD
	Iguana iguana	N	Pr	LC	M(12)	MS
Phrynosomatidae	*Sceloporus albiventris*	E	—	NE	H(16)	LDF
	Sceloporus clarkii	N	—	LC	M(10)	LDF
	Sceloporus melanorhinus	N	—	LC	L (9)	LDF
	Sceloporus utiformis	E	—	LC	H (15)	OF, MDF, LDF
	Urosaurus bicarinatus	E	—	LC	M(12)	LDF, M
Phyllodactylidae	*Phyllodactylus lanei*	E	—	LC	H (15)	MDF
	Phyllodactylus tuberculosus	N	—	LC	L (8)	CF, MDF
Scincidae	*Plestiodon parvulus*	E	—	DD	H (15)	OF, MDF, LDF, PG
Teiidae	*Aspidoscelis costata*	E	Pr	NE	M(11)	OF, MDF, LDF
	Aspidoscelis lineattissima	E	Pr	LC	H (14)	MDF, LDF, M
	Holcosus sinister	E	—	NE	M(13)	MDF, LDF

Table 1. (cont'd)

Family	Species	EN	NOM	UICN	EVS	Vegetation
Boidae	*Boa sigma*	E	—	NE	H (15)	CF, MDF, LDF, M
Colubridae	*Drymarchon melanurus*	N	—	LC	L (6)	LDF
	Drymobius margaritiferus	N	—	NE	L (6)	MDF, LDF
	Lampropeltis polyzona	E	—	NE	M(11)	LDF
	Leptophis diplotropis	E	A	LC	H (14)	LDF, PG
	Masticophis mentovarius	E	A	LC	L (6)	LDF
	Mastigodryas melanolomus	N	—	LC	L (6)	OF
	Oxybelis aeneus	N	—	NE	L (5)	LDF
	Salvadora mexicana	E	Pr	LC	H (15)	MDF
	Senticolis triaspis	N	—	LC	L (6)	LDF
	Trimorphodon paucimaculatus	E	—	NE	H (15)	LDF
	Coniophanes lateritius	E	—	DD	M(13)	MDF
	Hypsiglena torquata	E	Pr	LC	L (8)	MDF
	Imantodes gemmistratus	N	Pr	LC	L (6)	LDF
Dipsadidae	*Leptodeira maculata*	N	Pr	LC	L (7)	MDF, LDF
	Leptodeira septentrionalis	N	—	LC	L (8)	LDF
	Leptodeira splendida	E	—	LC	H (14)	LDF
	Manolepis putnami	E	—	LC	M(13)	OF
	Rhadinaea hesperia	E	Pr	LC	M(10)	LDF
	Tropidodipsas annulifera	E	Pr	LC	M(13)	LDF
	Tropidodipsas philippiI	E	Pr	LC	M(14)	LDF
Elapidae	*Micrurus proximans*	N	—	LC	—	LDF
Leptotyphlopidae	*Rena humilis*	N	—	LC	L (8)	OF
Viperidae	*Agkistrodon bilineatus*	N	Pr	NT	M(11)	LDF, PG
	Crotalus basiliscus	E	Pr	LC	H (16)	OF, MDF, LDF, PG
Cheloniidae	*Chelonia mydas*	N	P	EN	—	CD
	Eretmochelys imbricata	N	P	CR	—	CD
	Lepidochelys olivacea	N	P	VU	—	CD
Dermochelyidae	*Dermochelys coriacea*	N	P	VU	—	CD
Emydidae	*Trachemys ornata*	E	Pr	VU	H (19)	MDF, LDF, M
Geoemydidae	*Rhinoclemmys pulcherrima*	N	A	NE	L (8)	OF, MDF, LDF
Kinosternidae	*Kinosternon integrum*	E	Pr	LC	M(11)	MDF, LDF

Table 2. Composition of the herpetofauna reported for each of three Nayarit municipalities. Vegetation communities: LTS = Low Thorny Scrub, LDF = Low Deciduous Forest, MDF = Medium Deciduous Forest, OF = Oak Forest, CF = Cloud Forest, RV = Riparian Vegetation, CD = Coastal Dunes, M = Mangrove, HV = Halophyte Vegetation, PG = Palm Grove.

Municipality	Number of herpetofauna species for each vegetation community										Numbers of species of herpetofauna reported		Source
	LTS	LDF	MDF	OF	CF	RV	CD	M	HV	PG	Amphibians	Reptiles	
Tepic	–	–	–	–	–	–	–	–	–	–	14	19	Lopez-Solís and Luja (2014)
Tecuala	30	25	–	–	–	16	12	9	7	–	17	34	Loc-Barragán and Lazcano (2018)
Compostela	–	46	37	13	9	–	9	6	–	8	21	50	This study

Of Rats and Snakes

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This author has had many conversations with fellow snake geeks on the topic of the rodents that we feed our charges. Many times, from many directions, I have heard it said that if whoever runs the afterlife looks like a mouse or rat, our goose is going to be cooked. At times, necessity dictates a final solution type of decision for the rodents that fall into our hands. If any prospective reader of this column has *not* kept snakes, I advise you to stop reading this piece here. Should you choose to read on, be advised that things get rough for awhile. But in the end, it is my hope that the respect that I feel for the White-throated Wood Rat (*Neotoma albigula*) will shine through. Another common name for this species is "Packrat." That is *mostly* what they will be called throughout this column. (Although the words "filthy rat" and other disrespectful terms of endearment *do* appear here and there). While some might break Packrat into two words, I will combine them in much the same fashion that some herpetologists will combine snake names, such as "Gartersnake," or "Gophersnake." As a small measure of the respect that I now have for Packrats, I will capitalize the P on their moniker throughout this piece (Figure 1).

The date of 10 August 1996 will always be burned in the brain of this author for two reasons. The first is that this is the day that we almost killed Allison. That's the end of *that* story. There was a gang of four us who gathered this day to assail the Summer Canyon loop. Said gang was composed of Allison Titcomb, who was to one day assume the presidency of the Tucson Herpetological Society. Did I mention that we almost killed her? Patti Mahaney, who was then employed as a keeper in the herpetology department of the Arizona Sonora Desert Museum, was also along. Kent Jacobs, who was a retired rich guy with a high-clearance herpmobile, also attended. Kent drove us close enough to the beginning of the ensuing death march to save Allison's life on the return trip. Last and always least, the field trip was the really dumb brainchild of the author. If that idiot had not been there, neither would have anybody else. And certainly, without the presence of the scribe and guide, anything that happened that day would never have appeared in print. Herpetologically speaking, the butt crack of dawn beginning of the hike to the raging hot o'clock conclusion was considered only a modest success story. (These days, the same kind of numbers would be pronounced an enormous success. Times have changed with the numbers of herp encounters per effort, and not for the better). But as is sometimes the case, whether the totals are awesome or meager, one big event occurred that carried the day.

Figure 1. A White-throated Woodrat (*Neotoma albigula*), aka "Packrat." Pinal County, Arizona. Image by Martin J. Feldner.

Said big event occurred at 0835, while we were immersed in the depths of a steep and rather narrow arroyo. We had named this cut "Summer Canyon," due to its propensity to deliver prodigious numbers of herps during the hot summer months. A 1.5-meter-long, lanky Sonoran Gophersnake (*Pituophis catenifer*) was viewed crawling into the entrance of a formidable Packrat mound (also called "Packrat house" or "Packrat midden"). This mound bristled with spiny plants of all manner, intricately woven with sticks, chunks of cowpies, tortoise turds, and anything else that was *not* sugar, spice and everything nice. We watched that large and hungry Gophersnake cautiously enter the house until it disappeared completely. There next ensued a single loud "squeak," followed by quite a ruckus that outwardly shook the house to its rafters. We looked at each other, and Patti said: "Score one for the Gophersnake." Within seconds of that happening, a hefty mother Packrat came scurrying out of one of the many exit holes. The reason I know that she was a mother is because two young Packrats—each well over half the size of mamma—were clinging to her teats. (Yehaw—huh? Try clamping a hundred-pound child to each boobie and go jogging across some uneven terrain some time! That was the situation here.) Mamma was actually trying to flee uphill during this process. She got about 5 meters upslope, and paused to look back. It was probably at this point that she noticed the four of us, each well over two hundred times her mass and size, staring back at her. Talk about a bad day! She has just lost a son or daughter, and has saved what she could by running for her miserable little ratty life. While doing this, she has elongated two of her lactating rat boobies beyond all hopes of maintaining her sexy profile—and *now* there are these big bipeds looming large above her! In response to this new threat, she squatted on her ratty haunches, bent her head downward, and began applying her chisel-like incisors to the area near the closest offspring's snout. This inspired Patti to start a commentary on the process. She in essence assumed the role of mamma speaking abruptly to her children. "Let go of me, for I *must* make good my escape. It's every rat for himself now. Run away now—hurry! If necessary, I *must* sacrifice one or both of you to these enormous apes. If you do *not* let go, I will chew your little ratty snouts off!" The process took only seconds, but in the end, both young rats dropped off and scattered, and mamma jetted straight up the embankment and out of sight. Two narrow trails of blood were left in her wake as she scurried up that hill. This inspired me to correct Patti's narrative: "No Patti! She *didn't* bite them on the snout. Dude-ess! *She chewed her tits off*!"

It's too bad that nobody thought to photograph this moment. It would have made a *great* Mother's Day card!

§ § § § §

"Oh, **NO**! Ouch, G-A-A-A-A-A-A! *Get off me*! Let go of me—you *filthy* little ***slut***! YOU SUCK!" While the abrasive language may offend some of the more delicate members of the CHS, perhaps the story of *why* the strong talk ensued will invoke some understanding, if not sympathy. The words were mine, and they were directed at a large female Packrat who had just sunk her *filthy* upper incisors deep into my left thumb. The incident all started when astronomer Dr. Richard "Dick" Joyce delivered the nasty little ball of vermin to my office at work. She resided inside a wire live trap when she was delivered, and the good Dr. Joyce wanted that trap back so that it could be utilized to capture more of her kind. There was a new development going down near his neighborhood, which in turn forced a mass exodus of Packrats from that area. It seemed that many of the refugee Packrats found the good astronomer's yard, house and vehicles to be fair game in their resettlement process. Dr. Joyce had at one point been feeding the Packrats he had been catching to his dog, but upon my expressing the need for such things, he enthusiastically began bringing them to me. Prior to this he had brought me many, which were dispatched in a most humane and efficacious manner. In the machine shop that I supervised, we used liquid nitrogen (LN_2) to stress-relieve the aluminum and stainless steel that in turn went into the cryogenic vessels that we built and maintained. I learned that LN_2—which maintains an average temperature of negative 210°C—was also quite good at stress-relieving Packrats. One squeak, and there was no more stress. However, this particular Packrat was delivered to me *after* the project that required the daily use of LN_2 was completed. This dictated a more conventional approach to the problem of a live rat in a trap.

Many of you who keep snakes may be familiar with the art of "thumping" mice and rats. These days, rats and mice are purchased frozen in baggies from any number of sources. Yup! The dirty work has already been done for you. You plunk down 20 bucks, and walk away with a bag full of rodents, each wearing a frozen face of death at one end, and a little turd half-hanging out of the other. Yup! Rats in a baggie—another dirty job performed by the Man from Glad. These days, we got it easy, and I have no doubt that there is now an entire generation of *prissy* snake-lovers who have *never* thumped a mouse or rat. The art form of thumping is yet another skill set that is not being passed from the older generations to the young. It is a skill that can *only* be learned from experience of the trial-and-error type. In my earlier days, many experimental thumping experiences eventually led me to the two best methods. Both methods are also good for developing a throwing arm for the sport of baseball. Indeed, I learned the form of both my favored thumping styles from two Major League Baseball pitchers. Both forms require that one stand a certain distance from any given solid, vertical structure, and hurl the hapless creature to be thumped at great velocity against it. My first thumping method involves what I call the side-armed, "Catfish Hunter" style of delivery. This is effective for mice, but when the game gets a little bigger, I go with the overhead delivery of "Goose Gossage." In using either style, how the animal is held is also important. Until the moment about to described, I always held the tail of the animal-to-be-thumped while bringing my arm forward. This allows for a little more leverage just prior to release, and creates a greater impact force. And with the Goose Gossage delivery, one also utilizes gravity by raising the arm far above one's head, and swinging the arm downward prior to release.

The Packrat in the trap this day was a big one. She was by far the biggest rat that I had ever tried to dispatch. I later learned that she carried a mass of 200 grams, which is one ounce shy of half a pound. She was roughly 150 mm (~6 inches) long from snout to vent, with a handle, er uh, tail being roughly the same length. It was determined that the Goose Gossage method of thumping would be required for this particular beast. As a safety precaution, I pulled out my trusty pair of elk-skin welders' gloves. I sometimes used these to handle red hot metal, and thought *surely* these would be thick enough to stop the penetration of a Packrat bite. (Wrong!) These gloves had also been used many times over to handle smaller venomous snakes, and had thwarted nearly every attempt on their part to punch through. (Except one—and that is a *different* story). I placed the left glove on my left hand, somehow making the correct decision of which glove was which in the process. I next thrust my gloved left hand into the deep, tunnel-like recesses of the live trap, grabbed the filthy rat by the throat, and hauled her out. While I was quickly bringing my bare right hand around to grab her by the tail, she utilized her own Goose Gossage method of applying bite force by raising her head high above my gloved left thumb. Her nasty piehole swung open wide, revealing yellow fangs that oozed every form of plague and pestilence known to mankind. Her incisors swung outward, and she drove her head downward. Her half-inch-long upper canines punched their way through the glove as though it were paper thin. And then, she began shaking her head like a nasty little fox terrier, trying to burrow her ratty fangs deeper into my thumb. It is at this point we could easily insert the abrasive sentence that we pushed off the dock with at the start of this section. We instead use the ending "YOU SUCK," and take it from there. While overcoming a powerful urge to just drop dead from an overdose of overwhelming disgust, I stripped the glove, rat and all, off my left hand and slammed it all back into the trap. The glove sort of jammed the rat into place while I fumbled with the door, which seemed to take days to figure out. That being done, I gave pause to admire the little jet-streams of blood that ebbed and flowed with each beat of my heart. It was also noted with no small measure of dissatisfaction that my pain sensors were all functioning efficiently, especially those that resided a half-inch deep in the meaty part of my thumb. The nerve lines leading to that portion of the brain that man the floodgates to the "freak out **NOW**" portion of the brain also performed admirably well. Thoughts of rabies shots, hantavirus, safety officers, and heaven only knows what else caused an adrenaline surge that set my feet to dancing with fear and rage. And while hopping about like a kid who has to pee, I was shouting at—and pointing my index finger at—that rat. In lurid detail, I harshly explained every foul deed that I was going to inflict on the verminous rodent. (The bite actually had no bearing on this. That rat could have sung sweet love sonnets while kissing my work boots, and the outcome would have been

the same.) And profanity? Yehaw! Words that don't even exist were created in the vile and colorful soliloquy that followed. Minutes later, the freak-out phase was behind me, and I took note of my office floor. A river that looked not unlike the feeder stream of the Red Sea was flowing under the closed door of my office. I needed to get both the bite, and the mess, cleaned up as quickly as possible. None of my crew asked any questions when I headed for the shop first aid kit. We were often slashing and gashing ourselves as part of our metal-cutting duties for science. Our only regret was *always* that we had but one life to give to the science of astronomy.

About an hour later, I've managed to quietly get the floor to my office cleaned up without anybody asking any questions. (Had the bloody floor been noticed, some well-meaning jerk would have notified our safety officer of the incident, and we would have been shut down. The building would have been evacuated, and a hazmat team would have been called in to clean up my blood. I would have found myself in the emergency ward of the nearby U of A hospital, followed by a visit to the Human Resources Department. Later, a visit to the unemployment office would have likely ensued). My thumb has now been cleaned, deeply disinfected, and neatly bandaged. I have taken a walk to my truck, and returned with my trusty Whitney snake tongs. Despite a strong urge to get medieval with this filthy *bitch* of a rat, I am sticking with the plan of the Goose Gossage quick thump. The live trap is pulled out from under my desk, and placed on the table. The door is opened to the trap, the tongs slide in and deftly snag the rat by the neck. Out slides the squeaky little monstrosity, who is barring her filthy little fangs at me in protest. As soon as she is out of the trap, the tongs are raised high, and my right hand clamps on the tail. The rat is released from the tongs, and is held suspended above my head for less than an instant while I go up on my toes, and rapidly deliver the downward motion of a high velocity pitch. What happened next was everything about to be described at once, in the span of less than two seconds.

It was first noted that the load seemed pretty light when I brought my arm forward. It felt like I was throwing air. And there was supposed to be the sickening sound of a skull-smashing thump at the other end of this action. There was no thump. *What happened to the thump*? The lack of a thump indicated that indeed I had just thrown air at the wall. A glance into my right palm indicated that I now held a six-inch-long, hairy little tube sock of sorts in my hand. Said tube sock was similar to a scabbard that might sheath an ice pick. A FILTHY . . . DISGUSTING . . . HAIRY . . . tail sheath was now in my right hand! It was at this moment that I had an epiphany. Packrats *must* have a sheath over their tail, which can be discarded in times of peril to allow escape. How cool is that? At the same time the discovery of a detachable tail sheath was made, I felt little footsteps on top of my head. These same nasty little footsteps began to descend down the back of my head, and into the opening of the collar of my collared boss shirt. Now the footsteps become the dragging of claw marks, as the rat is trying to stop her rapid descent to the small of my back by digging in with all four sets of claws. The attempt to stop is unsuccessful, and she slides downward to the point where my belt clamps against the bottom of my shirt. That's right—I now have a *filthy*, half-pound rat squirming about inside my shirt! Once again, the nerves send their messages to the brain's freakout flood gates, and I scream: "**G-A-A-A-A-A-A-A-A-A! Help!**"

The filthy rat is now turning around, and trying to run uphill to get out of the situation that she finds herself in. As she does so, her nasty little rat claws begin puncturing mini-divots into my back. That's right—those nasty little toenails are poking little parallel holes upward along my spine! While this is developing, I am all sorts of gyrating in place, spinning circles, trying to pull my shirt out of my tightly-belted waist, all the while shouting and cussing in an all out panic attack. I finally get my shirt out of my pants, but the rat suddenly decides that she likes it inside my shirt, and won't be dislodged. Now I am dancing around while flapping my shirt like a man on fire. The rat finally comes spewing out, and drops to the floor. It scrambles a distance of about 2 meters, jets out the open door of my office, and enters our machine shop. I can only watch in helpless fashion as she heads for the pile of junk that huddles under one of our work benches across the aisle from my office door. And suddenly, the six-foot-tall hulking figure of a guardian angel steps into my view. Up rises his size 12 work boot, and "stomp" goes that boot. It scores a direct hit on the head of that rat, and, well, let's just say that said stomp was the abrupt end of that particular rat. The enormity of what has just happens hits my guardian angel, and with his boot still on the head of that rat, his blue eyes open wide, and meet mine.

"Did I do good, boss?" He asks.

"Yes, Ron," comes my weak response, "you did good!"

I've said it before, and I'll say it again. Having understanding coworkers is paramount to any avocational herpetological career.

That was the last rat, and rodent in general, to ever suffer death in any form at my hands. I no longer keep snakes, and my radio-tracking days are over. Upon returning the trap to its owner, I told Dr. Joyce that I no longer wanted any more of his Packrats. I hope his dog was hungry!

Meanwhile, a detachable tail sheath on Packrats? Brilliant! Who'd have thunk it?

§ § § § §

Back in March of 1998, the good editor of the *Bulletin* took a chance, and saw fit to run an article written by an upstart by the name of Roger Repp. The *ponderous* title of the article began with "Wintertime Observations on Five Species of Reptiles in the Tucson Area." While most of what was written was general knowledge to a few good local field herpetologists, those people had never bothered to put their knowledge into print. Hence, this article was the first of its kind to appear *anywhere*. The citation of this work has appeared in so many places that the author doesn't even know where it has landed. The subject matters that were discussed are no longer new, or fresh, but are now widely accepted as fact in circles much higher than mine. But through the 20 years that have followed this article, nobody has really ever taken the ball and ran with the subject of Packrats and Rattlesnakes overwintering together. Similar studies have been done between ground squirrels, rock squirrels, and prairie dogs

Figure 2. A Western Diamond-backed Rattlesnake (*Crotalus atrox*) consuming a pre-killed Packrat under staged circumstances. The author suggests that such events likely occur in the wild, but they are *far* from routine. See text for details. Image by John Cancalosi.

Figure 3. Did he eat himself—and others—out of house and home? This author thinks so! This image, taken 20 February 1999, is of a *Crotalus atrox* with a food bolus that looks suspiciously like a Packrat. From January 1993 through the date of this image, the aggregate den that this snake occupied routinely held numbers of *C. atrox* during the over-wintering time periods. Following this feeding event, the *atrox* left and did not return. Image by the author.

all doing similar acts with various species of rattlers, but nothing to date has been done with Packrats and *atrox*. (If the good Dr. Gordon Schuett gets wind of these words, my phone will start ringing off the hook. "Roger! I *told you* we need to start writing this stuff up!"). I will quote one paragraph from this 1998 article (page 53, bottom right), as it serves to nicely segue with the rest of this column: "I have many observations of strange interactions between pack rats and *atrox* during the colder months. For example, on November 25, 1995, a group of six of us saw a pack rat resting with one of its paws against the flank of a very large *atrox*. One week later, on a solo jaunt, I saw what appeared to be the same rat snuggled against the flanks of the same snake. The rat was sleeping when first viewed, and only lazily opened one eye when my light hit it in the face. It does not surprise me that the snakes do not appear to eat the rats during the colder months. What does surprise me is the fact that the rats seem to know they are safe."

At the same time that article was being written (summer of 1997), I was making the circuit with presentations to various groups. One such group was the Tucson Herpetological Society (THS). (A similar program occurred at the Chicago Herpetological Society on 27 August 1997. A through accounting of that program, written by Gary Kostka, can be found in the October 1997 issue of the *Bulletin*.) At the end of the THS presentation, Janice Johnson hooked me and relayed an account of something that she had witnessed between a Packrat and an *atrox*. Janice is no longer with us, as cancer recently claimed her life. She was one of the more stalwart staff members of the Arizona Sonoran Desert Museum Herpetology Department. Moving along to the topic of our discussion this evening, Jan was working independently with a film company who wanted to film a feeding sequence of an *atrox* killing and eating a Packrat. The stage was set, and the *atrox* did his best to please. In all, he bit that Packrat over 50 times. The rat was so saturated by snake venom that it was literally drenched with it, but it was otherwise none the worse for the wear. In the end, the sequence was pronounced a failure, the Packrat was released, and the *atrox* was denied his movie star fame. (Compare this failed feeding attempt to that of the *Crotalus molossus* feeding episode described on page 209 in the November 2015 *Bulletin* article "Seeking Cool." In that case, there were two bites: Snake bites rat, rat bites dust—just like that!) A whole lot of research will one day be required to separate the fly shit from the pepper where the relationships of venoms of various snakes to their various prey items can be adequately explained. But for now, "different snakes/different rat/different venom" sums it all up nicely. The evolutionary arms race between predator and prey appears to be an ever-evolving phenomenon.

Fifteen years ago, the stomach contents of 101 preserved specimens of *Crotalus atrox* with food boluses were analyzed (see Spencer [2003], and Schuett, Feldner et al. [2016]). Not a single *Neotoma albigula* (Packrat) was discovered inside these 101 *atrox*. There was nearly everything else *but* Packrats inside them. Nor did our 15-year-plus radiotelemetry study in the Suizo Mountains reveal *proof* that *atrox* kill and eat them. We *did* on occasion offer dead Packrats (from the trapped Packrats provided by Dr. Dick Joyce of NOAO—and his little dog too) to our subjects. On two occasions that I remember for sure, two different *atrox* did eat them. But they did not kill them on their own. We did *that* for them. I also offer the photograph in Figure 2 for an example of an *atrox* eating one. But once again, the Packrat being devoured was dead before being offered to the snake.

I won't state here or anywhere else that *atrox* don't kill and eat Packrats, but I will say that such events seem to be rare. Certainly, such feeding events are rare when compared to the *huge* number of opportunities that they have to eat them. That being said, I have twice observed (and photographed) an *atrox* with a distended food bolus that appeared to be a Packrat. The snake in Figure 3 is one of these, and the back story to it is one that holds great interest for this author. From January of 1993 until the winter of 1999, the den *always* had numbers of *atrox* visible within it. We called the den "Dan's Den," after Daniel M. Bell, the person who discovered it. Before February of 1999, Dan's Den showed the signs of being an active Packrat hangout as well. And then, the author photographed the snake in Figure 3. There have been multiple visits from that day forward, and not a single snake has been seen there since. Did that hungry snake eat himself, and others, out of house and home? This author

thinks so! How important is the presence of a Packrat in the gash dens of *atrox*? This author thinks they are paramount to the successful aggregate occupation of a winter gash den by *atrox*.

Up until this point in the column, we have only discussed Packrats and *atrox* hanging out together during the fall/winter/early spring months. The fact is, the Packrats and *atrox* hang together in all seasons. The Schuett/Repp Suizo Mountain study was as much a study of Packrat houses as it was about the herps that used them. We took great interest in the developments at each Packrat house that our subjects occupied, often indicating whether or not the house, or midden, reflected the presence of a Packrat. If a Packrat was viewed at a particular midden our subjects were habituating, that midden was called active. Sometimes, the Packrat would not be visible, but fresh scat and recently-gathered plant parts would appear on the mound or in the entranceways. This would also indicate an active midden. If all the detritus piled on the house was old, and there was no scat apparent, the house was declared inactive. With countless observations, we are convinced that the snakes arrived at these houses *before* the Packrats did! (A lone Packrat occupies many different houses throughout the course of any given year). At times, houses reported as "inactive" became "active" shortly after the arrival of the snake! This was especially true with the female *atrox* under our watch that nested and gave birth in Packrat houses. In short: I am convinced that, at times, ***the Packrats were following the snakes!*** That doesn't seem to make sense, but there could be many reasons why this happens. Until we humans learn to read the minds of our subjects, explanations of the why of things will always remain only speculation.

This author is now facing a deadline, as well as his own self-imposed word limit, with this column. Contained within a stack of three-ring binders that stands nearly three feet tall is an overwhelming glut of information on the phenomenon of Packrats, four species of rattlesnakes and Gila Monsters gathering together. And within the other set of notes—29 years of herp journals—there are many more. If I live long enough, and do it right, I will get it all down on both spreadsheets and text files. That will make searching by topic a snap. In wrapping this column up, I fished the 2006 binder out of the Suizo Mountain Study pile. This one was grabbed because 2006 is burned in my memory as a banner reproductive year for *atrox*. I zeroed in on August of 2006, and then my heart sank. It didn't sink for want of data, but because there was too much data! A future column of Packrats occupying *atrox* parturition sites during the month of August is in order. For this column, I choose but one "of rats and snakes" event in 2006 to close with.

The subject snake was female *Crotalus atrox* #93, or, Ca93. On 12 August at 0759 h, she was viewed coiled in a hunting posture on open bajada, and was deemed pregnant by both Gordon Schuett and me. I did not check on her again until 19 August at 0755 h. She had moved roughly 200 meters during that one-week time period, and she was no longer pregnant. Later events proved that the place she occupied on this day was her parturition site. She was viewed facing one of the many entrance holes of a Packrat midden roughly 60 cm tall by 2 meters in diameter. The midden was piled in the center stalks of a prickly pear cactus that was 1.5 meters tall by 3 meters in diameter. It was what we designated as an "opuntia/cholla pod *Neotoma* midden" (Figure 4). The data from this day mentions nothing of recent Packrat occupation. But the facts that mamma was facing one of the entrance holes, her leaner-looking flanks, and the observations of everything that followed would indicate that she had given birth prior to this point in time. (We often observed the mother *atrox* just outside their nesting holes, staring straight inside. This watchful behavior was a good indicator that Ca93 was closely monitoring the situation in that hole). On 20 August at 1927 h, (~36 hours later), the Packrat made an appearance at the nest site. Ca93 was not visible under the southwest edge of the midden, and my notes say this about the Packrat: "Large (200 + gram) *Neotoma* viewed entering north-center hole of midden." (Rat and snake were then less than a meter apart). On 22 August, Ca93 was coiled in a hunting posture on open bajada about 2 meters south of the midden/nest. A Kangaroo Rat was viewed perched on top of the midden. Ca 93 was visited again on 24 August, and viewed in roughly the same place as two days pervious. But this time, she spooked and crawled into what I now knew was her nesting hole.

On 26 August at 0605 hours, I am approaching Ca93's nest from the east. I am hoping that the rising sun at my back will impede the vision of any creatures that might be there. My camera is at ready, because if any of Ca93's brood are out, they will flee into the midden at the first sight of me. I do not see mamma or any of her brood, but I do see that Packrat. I am surrounded by silence as I quietly try to sneak up to get a photo of it. It is deathly quiet. I get close that rat, and am just ready to snap the shutter, when the rat notices me, and flees into the same "north-center hole in the midden" that she used to escape from me on 20 August. Unbeknownst to me, good old Ca93 (mamma) is coiled just inside the rat's escape hole. So quiet it is out in paradise that there is a highly audible "thud" when rat and snake collide. Mamma completely freaks out at the collision, and her fierce rattling abruptly fills the air, cutting through the silence—and my nerves—like a rattling foghorn. If anything, the rat is more surprised than I am, and freezes in that entrance hole, while mamma turns around and jets down that hole. Her rattle is singing as she nosedives out of sight. She continues to rattle for my whole

Figure 4. An "opuntia/cholla pod *Neotoma* midden." This is a classic example of our handwritten notations on a certain type of Packrat midden. This image is Site 24 of transmittered female *Crotalus atrox* #93 (Ca93). She gave birth at site 24, and shared the experience with a Packrat, who shared the parturition site with both her and her offspring for seven days. Note that the nurse plant is a prickly pear, and the midden is composed mainly of cholla pods.

Figure 5. The Packrat in this image has just smacked right into Ca93 while attempting to flee from the photographer. He froze while the rattlesnake fled down the hole. Image by the author, 26 August 2006, Pinal County, Arizona

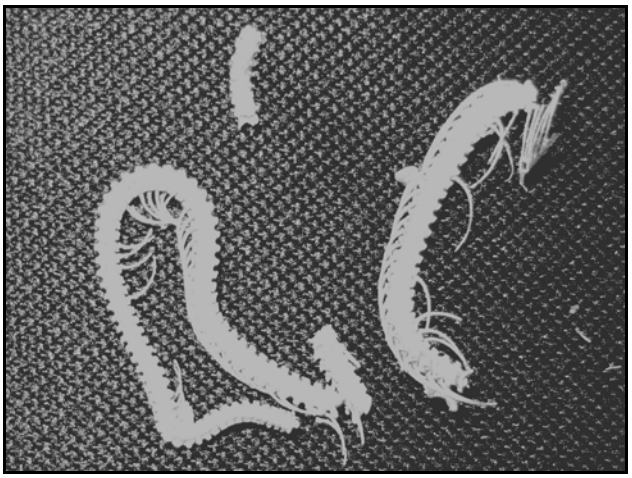

Figure 6. Two sections of vertebrae from neonate *Crotalus atrox* pulled from the nesting hole of Ca93. "Many critters, both great and small, would consider neonate *atrox*, live *or* dead . . . , a feast. Ants come to mind—as do Packrats! There must be a reason the Packrats hang out with pregnant female atrox." Image by the author.

stay here—which is atypical behavior. The rat remains put in that entrance hole, shaking like a whore in church, allowing me *plenty* of time to photograph his backside. (Figure 5). In all, the whole experience completely shook up all three participants!

On this morning, I collected two shed skins of neonate *atrox* from in front of the suspected nesting hole. Said nesting hole was visited again that evening, and I pulled two more little shed skins, as well as the vertebrae of two dead neonates, out of the same. The presence of these four neonate shed skins would indicate that for a minimum of seven days, the Packrat had dwelled with both Ca93 and at least four of her progeny. There was also a Kangaroo Rat inside that hole, as well as a hatchling Banded Gecko (*Coleonyx variegatus*). Did the presence of these critters indicate evidence that momma dropped her kids near a stocked refrigerator? This author thinks so! See also Figure 6, which contains the two sections of vertebrae collected this night, and note that they are picked clean. Many critters, both great and small, would consider neonate *atrox*, live *or* dead (perhaps stillborn), a feast. Ants come to mind—as do Packrats! There *must* be a reason the Packrats hang out with pregnant female *atrox*. Could *not* a potential snack be one of them?

I have a confession to make. I now *love* Packrats. Until they start infesting my yard, or my house, or start eating the wiring out of my vehicles, I have made my peace with them. You won't catch me thumping or gassing them any more to feed snakes. Those days are over. Should I ever start keeping snakes again, I'll do what everybody else does, and apply the Man from Glad frozen food techniques.

A healthy population of Packrats almost always leads to healthy populations of not only the reptiles that feed on them, but almost every other animal that inhabits the environment around them. This is especially true in the Sonoran Desert. The first thing I start looking at—and in—is Packrat middens with any patch of ground that I investigate. One fine day, I will make list of every species of herp that I have observed in or around their middens. That list will prove something to me that I already know: the lowly Packrat is the true indicator of a healthy ecosystem. Remove the Packrats, and nearly *everything* else will vanish with them. The White-throated Woodrat (*Neotoma albigula*) may very well be the number one nurturer of the Sonoran Desert, and all the magnificent wildlife that it contains.

This here is Roger Repp, signing off from Southern Arizona, where the turtles are strong, the snakes are handsome, and the lizards are all above average.

Literature Cited and Suggested Reading

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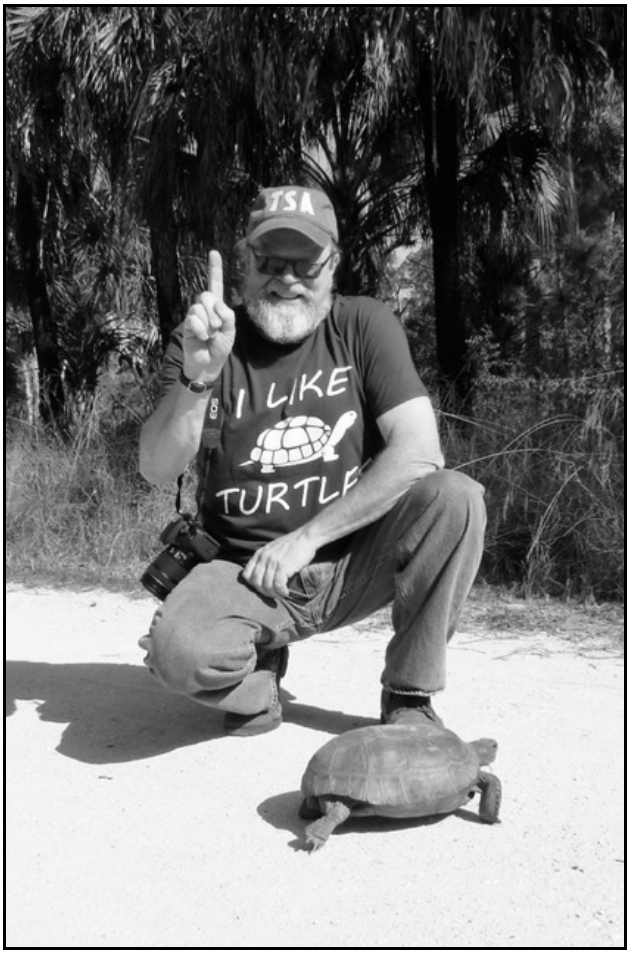
What You Missed at the September Meeting: George Heinrich

John Archer
j-archer@sbcglobal.net

I, like many of you, would really enjoy a year of doing nothing but traveling all over the country looking for herps. Imagine going where you wanted in order to see what you wanted. One full cycle of the earth around the sun to hunt the herps on your bucket list. Trying to see as many as possible in that year. Sounds great! I doubt if any of us could do that, but George Heinrich came as close to that as anyone I know. It wasn't an easy year, but it was enlightening, and most of the time, a lot of fun. Inspired by the movie *The Big Year*, George set out on "The Big Turtle Year."

The Big Year is a movie about competitive birding. Yeah, there really is such a thing. "The Big Turtle Year" is not about competition because a herper thought it up. I don't know any herper who's particularly competitive. At least not about herping. If there is such a thing as competitive herping, please don't tell me about it. Most herpers I know are very willing to share a field experience with another herper provided the other herper is not a total ass. Indeed, trying to find herps in strange country can be difficult to impossible for even a very experienced herper, and local guides are always sought. George, along with his partner and friend Tim Walsh, wanted to see as many species of turtle in the U.S. as they could in one year. He thought it would serve as advertisement for the plight of turtles in the U.S. Through lectures, social media, and a book, George is raising awareness of the dangers threatening not only exotic turtles, but the turtles that are U.S. natives and frequently unappreciated.



And he's off! January 1, 2017, and the start of The Big Turtle Year. Photograph by Andrew Farren.

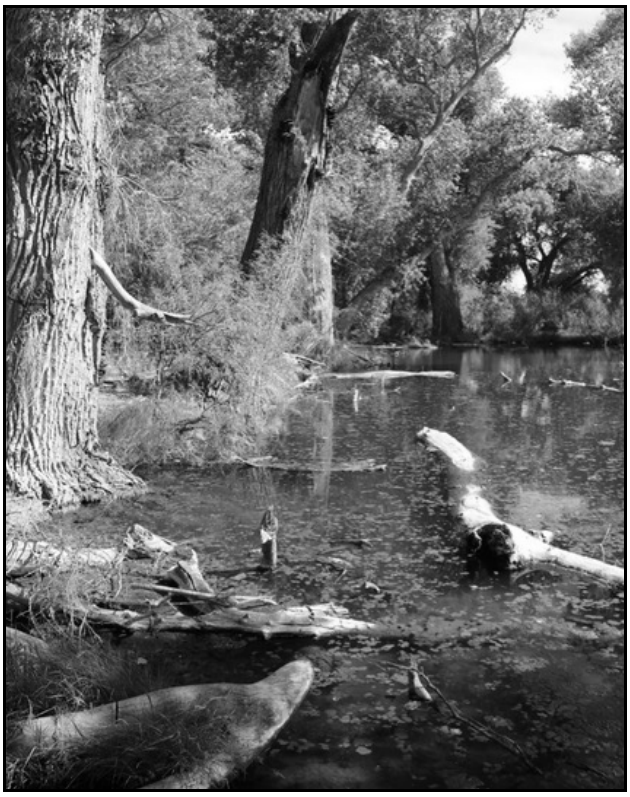
Here's George's biography from our website:

> George L. Heinrich is a field biologist and environmental educator specializing in Florida reptiles. His company, Heinrich Ecological Services, is based in St. Petersburg, Florida, USA and conducts wildlife surveys and research, natural history programming, and nature-based tours. A graduate of Memphis State University, his current work focuses on the ecology and conservation of gopher tortoises (*Gopherus polyphemus*) at Boyd Hill Nature Preserve (St. Petersburg, Florida), anthropogenic threats to diamondback terrapins (*Malaclemys terrapin*), and distributional surveys of the Suwannee cooter (*Pseudemys concinna suwanniensis*) within its southern range. George is an invited member of the IUCN Tortoise and Freshwater Turtle Specialist Group, served twice as co-chair of the Gopher Tortoise Council, and is the executive director of the Florida Turtle Conservation Trust.

George said that while Southeast Asia is the most turtle-rich region in the world, the United States is the most turtle-rich country in the world with 59 species (changed during 2017 to 62). Mexico is not even a particularly close second with 49. The Big Turtle Year (TBTY) had to have rules. He decided that he would have to see each species in the wild in company with at least one other expert to verify what he saw. Photographing each was desired but not always possible and capturing each would be impossible for a number of reasons. He knew that he couldn't accomplish his goal without a lot of help. Fortunately, George is well-known in chelonian circles and has a reputation of being responsible, knowledgeable, and a nice guy. He won't say that it made his hunt easy, but it did make it possible.

One starts a year-long quest on January 1, and on the first of January George ventured out on his home turf and found nine gopher tortoises (*Gopherus polyphemus*) including a yearling he had been monitoring for a couple of months.His next quest was in northern Florida, where he joined a group of researchers with the Turtle Survival Alliance studying river turtles, including Suwannee cooters (*Pseudemys concinna suwanniensis*). He had


The star of the first day, a gopher tortoise (*Gopherus polyphemus*). Photograph by George L. Heinrich.



One of the very few ponds in the U.S. where Big Bend mud turtles (*Kinosternon hirtipes murrayi*) hang out. Photograph by George L. Heinrich.

Naturally this little diamond-backed terrapin (*Malaclemys terrapin*) was relocated to a safer spot. Photograph by Timothy J. Walsh.

Blanding's turtles (*Emydoidea blandingii*) always look happy, even though they're threatened by raccoons and roads. Photograph by George L. Heinrich.

A very pretty southern western pond turtle (*Actinemys pallida*). Before the species was split a couple of years ago it would have just been a western pond turtle (*A. marmorata*). Photograph by George L. Heinrich.

With help, George added the bog turtle (*Glyptemys muhlenbergii*) to his list. Photograph by Timothy J. Walsh.

George celebrating the sighting of his last sea turtle target, the hawksbill (*Eretmochelys imbricata*) in late December 2017. Photograph by Robert Krause.

a nice shot of one of his protégés, Andrew Farren, holding a large cooter. George would refer to former students of his educational camps several times during the presentation. I think that demonstrates not only the importance of education in exposing young people to the natural world, but also George's ability to connect with people.

George then moved us through the year with anecdotes and facts about the various turtles he found. He couldn't expound on every species, so he dipped in to present an overview of a few. Even though he condensed his year, I can't relate all that he covered, so I'll just cover a few of his subjects.

He traveled to the Northeast to find graves (another story) and met a woman who lived in a Revolutionary War-era house who showed him how to find spotted turtles (*Clemmys guttata*) in leaf litter between the rails of an abandoned train track.

He toured Texas with Carl Franklin, another famous turtle man who has spoken to your society. Carl knows "not only good spots to look for turtles, but the good spots to look for every turtle species that lives in Texas." They traveled 2500 miles in seven days and added 12 species to his list. Anyone that knows Carl knows that the trip was fun and intense. They visited County Line BBQ on The Lake in Austin to discover a barbecue restaurant that supports turtle research on the large number of turtles that are attracted to the restaurant because people feed them. They trapped an alligator snapping turtle (*Macrochelys temminckii*) in Buffalo Bayou in the middle of Houston, allowing George to check off one of the three species of alligator snapping turtles he had to find. On the National Butterfly Center in south Texas he found a juvenile Texas tortoise (*Gopherus berlandieri*). Two tortoises down; two to go. In a pretty little clear Del Rio stream fed by a spring they found *Pseudemys gorzugi*, the Rio Grande cooter. George spoke of the problems in conserving species that have very limited ranges such as the Big Bend mud turtle (*Kinosternon hirtipes murrayi*) that lives in only four ponds in the United States.

George tried to arrange his trips so he could get the most species in the least amount of time. A trip to southern California allowed him to find western pond turtles (now *Actinemys pallida*), in Topanga Canyon and the Mohave desert tortoise (*Gopherus agassizii*) at the Desert Tortoise Natural Area. The pond turtles were split into two species recently. George decided to stay with his beginning list for his count, ignoring the inevitable taxonomic changes that happened during the year, but he talked of going to see the other western pond turtle species in the future. Showing a gorgeous scenic picture of the Desert Tortoise Natural Area, he mentioned that most of his scenic pictures were little bits of lies because often, just out of view, the habitat was degraded by trash, off-road vehicles, or even homeless camps. Habitat protection is a must for conservation.

He traveled to New Jersey to find bog turtles (*Glyptemys muhlenbergii*) along with several other species, including a hatchling diamondback terrapin (*Malaclemys terrapin*) rescued from a highway. A major threat to terrapins is drowning in crab traps, an easily preventable death by including a turtle bypass device in the trap. Unfortunately, crab fishermen have been reluctant to install this effective and cheap solution.

Number 57 and the last for The Big Turtle Year, finally a chicken turtle (*Deirochelys reticularia*). Photograph by George L. Heinrich.

He counted five species of turtles in New York City's Central Park. He traveled to Plymouth, Massachusetts, to see a disjunct population of Northern red-bellied cooters (*Pseudemys rubriventris*). We saw a photo of a huge nesting leatherback sea turtle (*Dermochelys coriacea*) on a beach in Florida. *Sternotherus depressus*, the flattened musk turtle, was found in its very limited range in the one river system where it exists. He checked off the ornate box turtle (*Terrapene ornata*) right here in Illinois while accompanied by some CHS members, and saw a little six-week-old Sonoran mud turtle (*Kinosternon sonoriense*) in Organ Pipe Cactus National Monument, where he had to travel with National Park Service personnel. Very late in December he managed to find the remaining two marine turtles he needed, the Kemp's ridley sea turtle (*Lepidochelys kempii*) and the hawksbill (*Eretmochelys imbricata*), and the last turtle he managed to spy was the chicken turtle (*Deirochelys reticularia*). His final count? Fifty-seven of the 59 target species. He failed to see only the Apalachicola alligator snapping turtle (*Macrochelys apalachicolae*) and the yellow mud turtle (*Kinosternon flavescens*). Truly a Big Turtle Year!

George made the year sound interesting, educational and even exciting. He continually referred to all the people that helped him all over the country. He frequently required cooperation with state and national organizations, both nonprofit and government. He relied on monetary support from many different avenues. Throughout his talk he demonstrated not only his tremendous knowledge of turtles, but his obvious passion for these threatened animals. We learned of the threats from the usual habitat destruction to poaching, from crab traps to raccoons. Throughout his talk I felt like I would have loved to do a big turtle year, and throughout the talk I was reminded that I had neither the expertise nor the connections nor the stamina to accomplish what George had done. Of course, he's not done. More talks are in the future. A book is being written, and more importantly, there are turtles to be saved. He may not do another turtle year, but George will keep doing what he has been doing, educating, studying and conserving turtles.

You might want to visit The Big Turtle Year website <thebigturtleyear.org>. It has photos of the turtles, list of partners, links to other organizations you might be interested in knowing about, and a blog about the year.

Herpetology 2018

In this column the editorial staff presents short abstracts of herpetological articles we have found of interest. This is not an attempt to summarize all of the research papers being published; it is an attempt to increase the reader's awareness of what herpetologists have been doing and publishing. The editor assumes full responsibility for any errors or misleading statements.

EFFECTS OF CROWDING IN HEADSTART PENS

J. S. Mack et al. [2018, Chelonian Conservation and Biology 17(1):14-26] note that scientists worldwide have headstarted threatened and endangered reptiles to augment depleted populations. Not all efforts have been successful. For the threatened Agassiz's desert tortoise (*Gopherus agassizii*), one challenge to recovery is poor recruitment of juveniles into adult populations, and this is being addressed through headstart programs. The authors evaluated 8 cohorts of juvenile desert tortoises from 1 to 8 yrs old in a headstart program at Edwards Air Force Base, California, for health, behavior, and growth. They also examined capacities of the headstart pens. Of 148 juveniles evaluated for health, 99.3% were below a prime condition index; 14.9% were lethargic and unresponsive; 59.5% had protruding spinal columns and associated concave scutes; 29.1% had evidence of ant bites; and 14.2% had moderate to severe injuries to limbs or shell. Lifetime growth rates for juveniles 1–8 yrs of age were approximately two times less than growth rates reported for wild populations. Tortoises in older cohorts had higher growth rates, and models indicated that high density in pens and burrow sharing negatively affected growth rates. Densities of tortoises in pens (205–2042/ha) were 350–3500 times higher than the average density recorded in the wild (<1/ha) for tortoises of similar sizes. The predominant forage species available to juveniles were alien annual grasses, which are nutritionally inadequate for growth. The authors conclude that the headstart pens were of inadequate size, likely contained too few shelters, and lacked the necessary biomass of preferred forbs to sustain the existing population. Additional factors to consider for future reptilian headstart pens include vegetative cover, food sources, soil seed banks, and soil composition.

Minutes of the CHS Board Meeting, September 14, 2018

Rich Crowley called the meeting to order at 7:41 P.M. Board members Dan Bavirsha, Lawrence Huddleston, Kim Klisiak and Jessica Wadleigh were absent. Minutes of the August 17 board meeting were read and accepted with changes.

Officers' Reports

Treasurer: John Archer presented the financial reports for August.

Media secretary: Via email Kim Klisiak reports that she is continuing to work on designing our three new websites.

Membership secretary: Mike Dloogatch read the list of expiring memberships.

Sergeant-at-arms: Mike Scott reported 31 people in attendance at the August 29 general meeting.

Committee Reports

Shows: Gail Oomens mentioned a need for help the weekend of October 13–14, when we are scheduled to have tables both at NARBC and the Chicago Pet Show.

ReptileFest: Frank Sladek reported via email that he will be using Mailchimp to get in touch with this year's exhibitors and vendors to solicit comments, questions and concerns, and what they would like to see improved for next year. He asked the board for suggestions on new organizations to invite.

Adoptions: There is a need to build a data base of members looking to adopt and what specific animals they are looking for. We also a need list of members willing to foster animals until a home can be found for them.

Junior Herpers: Frank Sladek reported via email that the last meeting was held at the Little Red Schoolhouse Nature Center. The Junior Herpers helped release 30 common snapping turtle hatchlings into the Long John Slough.

Old Business

Rich Crowley reported that although we do now have liability insurance for our shows there is still some confusion about the policy that needs to be resolved.

Rich Crowley will be attending a workshop / meeting being held by the Pet Industry Joint Advisory Council (PIJAC) toward the end of October.

New Business

John Archer recommended that we encourage our speakers to bring their own computers to ensure that we have a version of their presentation that works as intended.

The meeting adjourned at 9:58 P.M.

Respectfully submitted by recording secretary Gail Oomens

Advertisements

For sale: **highest quality frozen rodents**. I have been raising rodents for over 30 years and can supply you with the highest quality mice available in the U.S. These are always exceptionally clean and healthy with no urine odor or mixed in bedding. I feed these to my own reptile collection exclusively and so make sure they are the best available. All rodents are produced from my personal breeding colony and are fed exceptional high protein, low fat rodent diets; no dog food is ever used. Additionally, all mice are flash frozen and are separate in the bag, not frozen together. I also have ultra low shipping prices to most areas of the U.S. and can beat others shipping prices considerably. I specialize in the smaller mice sizes and currently have the following four sizes available: Small pink mice (1 day old—1 gm) , $25 /100; Large pink mice (4 to 5 days old—2 to 3 gm), $27.50 /100; Small fuzzy mice (7 to 8 days old—5 to 6 gm) , $30/100; Large fuzzy mice / hoppers (10 to 12 days old—8 to 10 gm), $35/100 Contact Kelly Haller at 785-234-3358 or by e-mail at kelhal56@hotmail.com

Free to a good home: Six years (Oct. 2012 – Oct. 2018) of the Chicago Herpetological Society Bulletin, print edition. Boxed and ready to go. Call Rob Streit, 708-383-6830 to arrange pickup.

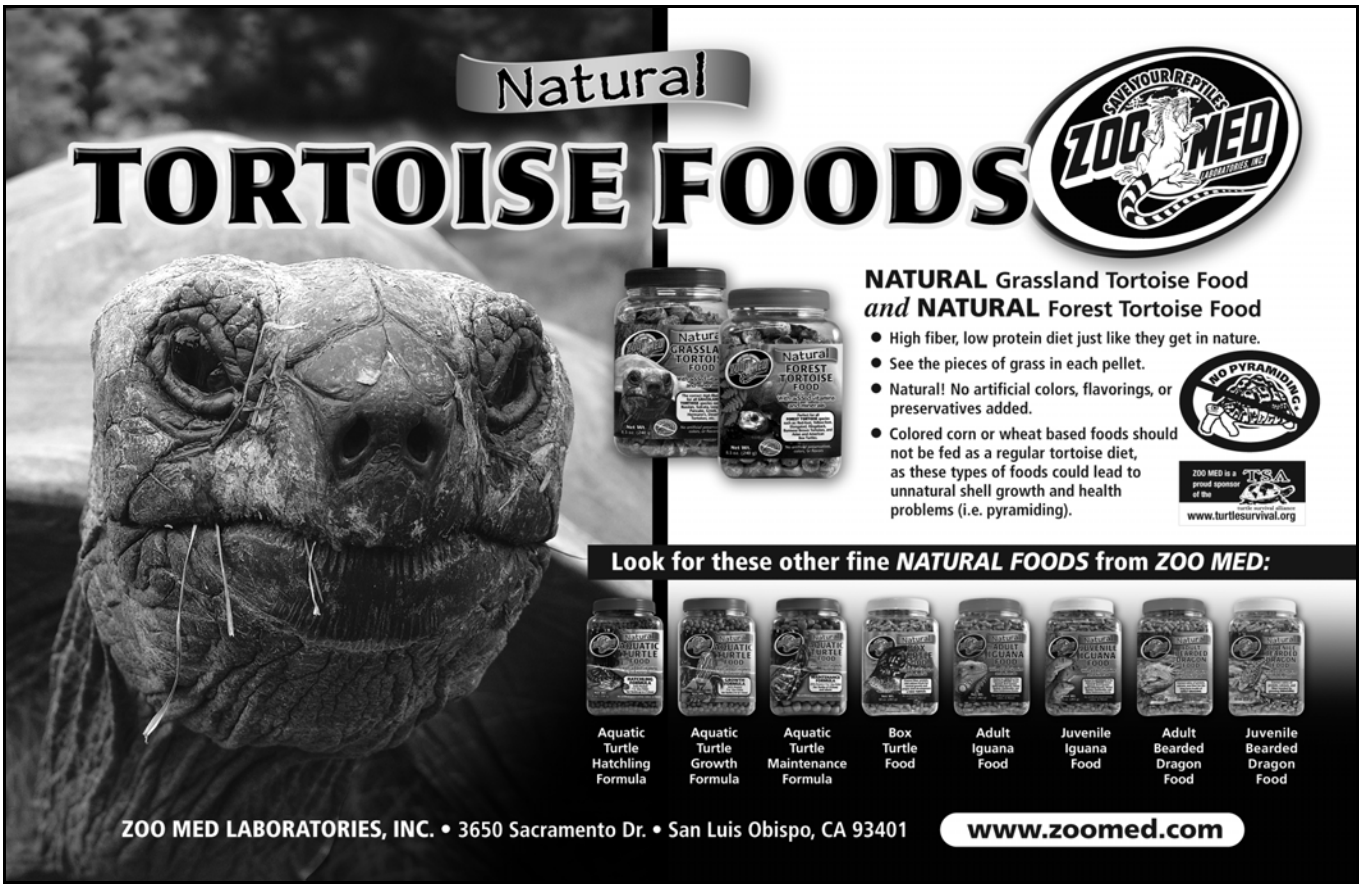
Herp tours: **Costa Rica herping adventures**. Join a small group of fellow herpers for 7 herp-filled days. We find all types of herps, mammals, birds and insects, but our target is snakes. We average 52 per trip, and this is our 10th year doing it. If you would like to enjoy finding herps in the wild and sleep in a bed at night with air-conditioning, hot water and only unpack your suitcase once, instead of daily, then this is the place to do it. Go to our web-site http:// hiss-n-things.com and read the highlights of our trips. Read the statistics of each trip and visit the link showing photos of the 40 different species we have found along the way. E-mail at jim.kavney@gmail.com or call Jim Kavney, 305-664-2881.

Wanted: to the young fellow who recorded "Wild Kingdom" shows for me on a flash drive: Could you please get in touch with me? Thank you! Ray Pawley, raypawley@pvtnetworks.net.

Line ads in this publication are run free for CHS members—$2 per line for nonmembers. Any ad may be refused at the discretion of the Editor. Submit ads to mdloogatch@chicagoherp.org.

NEW CHS MEMBERS THIS MONTH

Sophia Shukin
Joe Goldufsky
Peter Berg
Sara Barnas
Ruta and Mitch Krawczyk



News and Announcements

2019 CHS HERPETOLOGICAL GRANTS PROGRAM

The mission of the Chicago Herpetological Society is education, conservation and the advancement of herpetology. To further this mission, the CHS provides grants of up to $1,000 in the following categories:

1. Illinois Herpetology
2. Graduate Student Research in Herpetology
3. Undergraduate Research in Herpetology
4. Conservation
5. Captive Management, Husbandry and Propagation

The number of grants awarded in each category will depend on the grant applications received; it is possible that not all categories will receive awards and some categories may receive more than one award. The Grants Committee reserves the right to reassign the category under which a given proposal is submitted.

To qualify for a grant, the applicant must be a member of the Chicago Herpetological Society as of December 31, 2018. In accepting a grant, the recipient agrees to acknowledge the Chicago Herpetological Society in any publications or public presentations of research funded by this grant. Further, the recipient agrees to abide by all state and federal laws.

Recipients must submit a short report of their research findings to the CHS within 6 months of their anticipated completion date. The report should be written for a general audience and be suitable for publication in the CHS *Bulletin* or on the CHS webpage. This requirement may be waived if results will be published in a peer-reviewed journal within a year. Recipients may be invited to present a program at a CHS general meeting.

Applications must include the following:

1. Project title
2. Applicant's name, address, phone and email
3. Submission category
4. Introduction—Provide background for the proposed work. Include a clear statement of the objectives of the proposed work.
5. Materials and methods—Describe the study site and the materials and methods (in non-technical terms) that will be used to accomplish the objectives of the proposed research. Attach plans, diagrams and maps as necessary. Indicate whether you have an approved Animal Care (IACUC) protocol covering the proposed methods or whether you will be submitting such a protocol.
6. Applicability and broader implications—How does this work apply to conservation, education and the advancement of herpetology?
7. Budget—Indicate the budget for the entire project and make clear what portion the CHS grant money would fund.
8. Anticipated completion date for the research
9. Applicant curriculum vitae
10. Letters of support—Student applicants must include a letter of support from a faculty advisor. For non-academic individual and institutional applicants, letters of support from collaborating partners or institutions are strongly encouraged. Letter(s) of support may be emailed and should include an address and phone number at which the writer can be contacted. Letter(s) of support may also be sent by postal mail.

Proposals should be submitted as email attachments. Attachments should include the applicant's name in the file name. Proposal text should not exceed five double-spaced pages (excluding literature cited, applicant's CV, and letters of support) and should be typed using a common font (e.g., Arial, Times, Courier) no smaller than 10 pt. Applications must be received by December 31, 2018, and awards will be announced by February 15, 2019.

Proposals or questions should be emailed to grants@chicagoherp.org

UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, October 31, at the Peggy Notebaert Nature Museum, Cannon Drive and Fullerton Parkway, in Chicago. **Roger Carter** of the Hoosier Herpetological Society will speak about "Searching for Hidden Herps." Roger has been using an inspection camera to look for herps in hollow logs, rock crevices and other hard-to-access places.

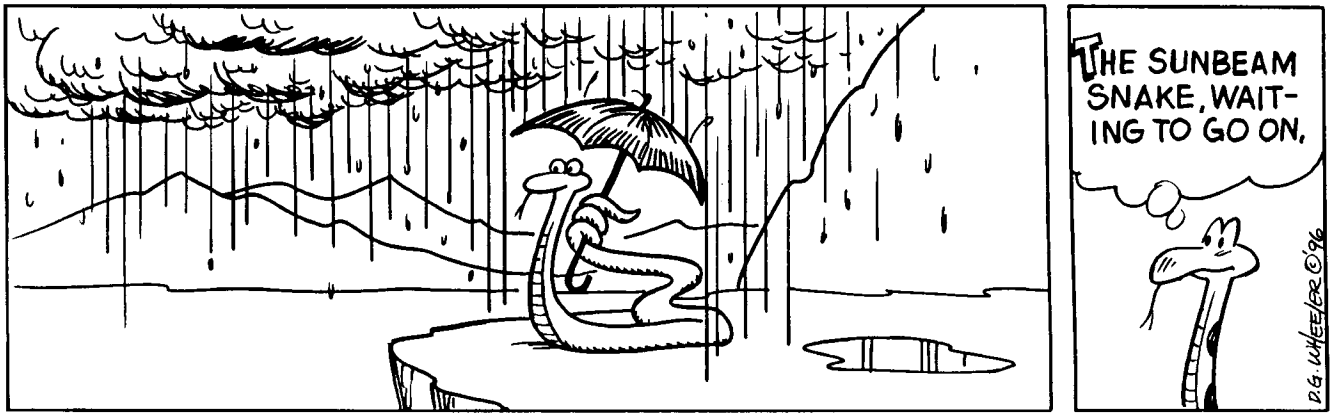
The November 28 meeting will include the annual election of officers and members-at-large of the CHS Board of Directors. **Maggie Solum**, a keeper at the Fort Worth Zoo, will speak about "Crocodilian Cognition and Learning."

The regular monthly meetings of the Chicago Herpetological Society take place at Chicago's newest museum—the **Peggy Notebaert Nature Museum**. This beautiful building is at Fullerton Parkway and Cannon Drive, directly across Fullerton from the Lincoln Park Zoo. Meetings are held the last Wednesday of each month, from 7:30 P.M. through 9:30 P.M. Parking is free on Cannon Drive. A plethora of CTA buses stop nearby.

Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? If so, mark your calendar for the next board meeting, to take place on November 16, 2018. The venue is as yet uncertain, so if you wish to attend please email mdloogatch@chicagoherp.org.

THE ADVENTURES OF SPOT



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