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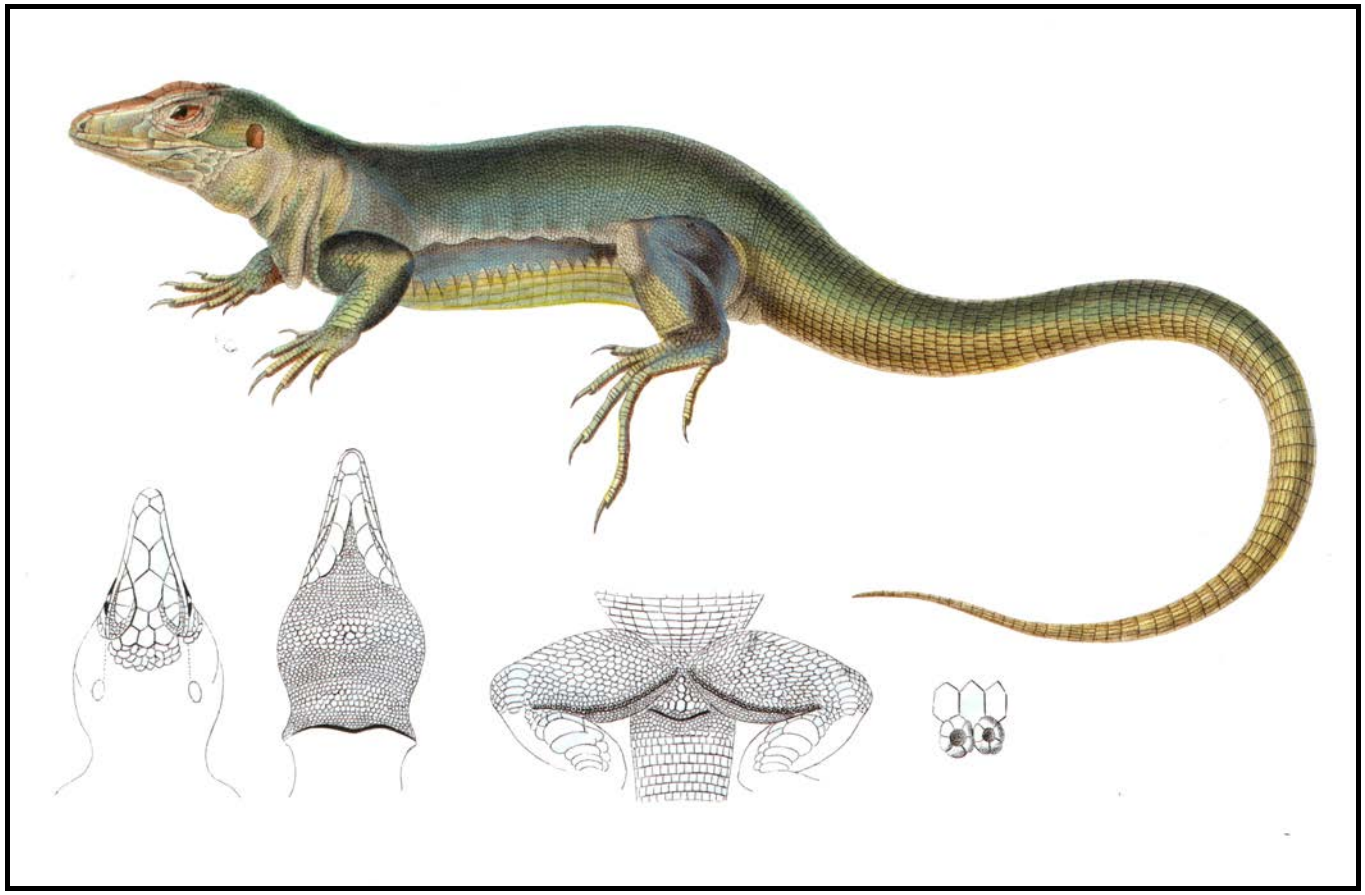

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Cover: Martinique giant ameiva, *Pholidoscelis major* [extinct]. Drawing from *Erpétologie Générale on Histoire Naturelle Complète des Reptiles—Atlas* by A. M. C. Duméril, G. Bibron and A. Duméril, 1854.

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Book Review: *Field Guide to Amphibian Eggs and Larvae of the Western Great Lakes* by Gary S. Casper, Thomas G. Anton and Ryne D. Rutherford 2020. 91 pp. Amphibian and Reptile Conservancy, Inc. Spiralbound $25.00

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The authors developed this field guide "to assist with identifying the eggs and larvae of amphibians found in nine national park units in the western Great Lakes region." The guide covers 14 species of frogs and nine species of salamanders, species that are generally well distributed throughout the Great Lakes basin. As such, the guide's coverage extends beyond the specific park properties and will be useful throughout the watershed.

The spiralbound booklet measures approximately 5½ × 8½" and is printed on a special water-resistant paper making it suitable for field use. It is attractively designed and printed in full color.

Pages 4 and 5 provide a map that locates the National Park units, a list of four-letter acronyms used throughout the book (but not on the map just above the list) to refer to the parks, acknowledgments, and photo credits. Following that is a two-page spread with the table of contents. Then a two-page introduction states the purpose of the guide, again lists the nine park units, very briefly overviews the geological history and landscape setting of the region, and comments on the sources for species distribution information. It concludes by cautioning surveyors about the sensitive nature of some habitats and the importance of following applicable regulations and of cleaning and disinfecting equipment. The placement and order of some of this "front matter" within the guide seems a little peculiar.

A two-page glossary provides definitions for 16 terms and acronyms used in the keys, as well as four line-drawings depicting general characteristics of eggs and larvae. Eleven pages of identification keys follow, mostly arranged in couplets but with some choices ending in triplets or quadruplets. This section would have benefited from the inclusion of additional terms and illustrations depicting the features and orientation of tadpole mouthparts, particularly since some of these are important for species identification and are mentioned in the keys (e.g., "Two (2) upper and 2 or 3 lower labial teeth rows" and "second upper tooth row shorter than first" for chorus frogs; "second upper tooth row longer than first" and "3 lower labial tooth rows, the lowest at least half the length of the one above it" for treefrogs; "gap of second upper tooth row . . . longer than either lateral part" and "submarginal papillae" for several *Lithobates*). I would also have liked to see an illustration of the presence or lack of the "intercellular partition between adjacent eggs" used in separating eggs of the two toad species.

The bulk of the book, the individual species accounts, follows the keys. Each species account occupies two or four pages and begins with a listing of the national park units where the species has been documented. Brief descriptions of breeding habitat, phenology, and the egg and larval stages follow, with distinguishing characteristics highlighted. Anecdotal observations sprinkled throughout the species accounts underscore the authors' appreciation for these animals. For example, they conclude the American toad account with "Hundreds to thousands of fingernail-sized toadlets simultaneously leaving ponds or lakeshores is one of the wonders of the western Great Lakes region for those lucky enough to witness it." I share this sentiment. Other comments reflect the tribulations of field work. For example, "success in finding nests is usually greatest right after mosquitoes emerge from these wetlands (often dissuading the casual observer)" in the four-toed salamander account. I noticed only one minor editorial oversight in the text; on page 24, the algal genus name *Oophila* should have been italicized.

Each species account includes color photographs of the different life stages, including the adults, of the species. The photos are generally sufficiently large, provide *in situ* perspectives, and clearly show helpful diagnostic characteristics. These will certainly facilitate identification of some of the species and the authors should be commended for their inclusion.

Maps depicting the range of each species in the western Great Lakes region accompany the species accounts. Small red, triangle-shaped icons indicate the locations of the nine national park units on each of these maps. These icons seem unnecessary given the inclusion of the map depicting the park locations included in the front of the guide. I also found these icons to be a little distracting; at first glance they suggest locations of the species, particularly for widespread species for which the entire map is shaded (e.g., American toad and northern leopard frog).

The guide concludes with a list of 17 recommended references and "About the Authors" information.

This publication expands the range of Upper Midwest and Northeast states for which identification aids are now available for these life stages and I recommend it as part of the amphibian enthusiast's library. Individuals wishing to purchase the guide can do so at <https://www.wisconsinwetlands.org/field-guide-to-amphibian-eggs-and-larvae-of-the-western-great-lakes/>. Proceeds from sales of the guide benefit the Wisconsin Wetlands Association and Midwest Partners in Amphibian and Reptile Conservation.

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Notes on the Herpetofauna of Western Mexico 25: Predation on a Clouded Anole (*Norops nebulosus*) by a Ferruginous Pygmy-Owl (*Glaucidium brasilianum*) in Dry Oak Forest in Jalisco, Mexico

Santiago Cortés-Vázquez [1], Lizett Carolina Núñez-Carrillo [1], Daniel Cruz-Sáenz [2], Andrés Rodríguez-López [1], David Lazcano [3], Juan Antonio García-Salas [4], Lydia Allison Fucsko [5] and Larry David Wilson [6]

Abstract

We document for the first time predation on a clouded anole (*Norops nebulosus*) by a ferruginous pygmy-owl (*Glaucidium brasilianum*) in a habitat on the outskirts of the city of Guadalajara, Jalisco, Mexico.

Resumen

Aquí documentamos por primera vez la depredación sobre la lagartija anolis del bosque neblinoso (*Norops nebulosus*) por un búho-pigmeo ferruginoso (*Glaucidium brasilianum*) en un hábitat en las afueras de la ciudad de Guadalajara, Jalisco, México.

Introduction

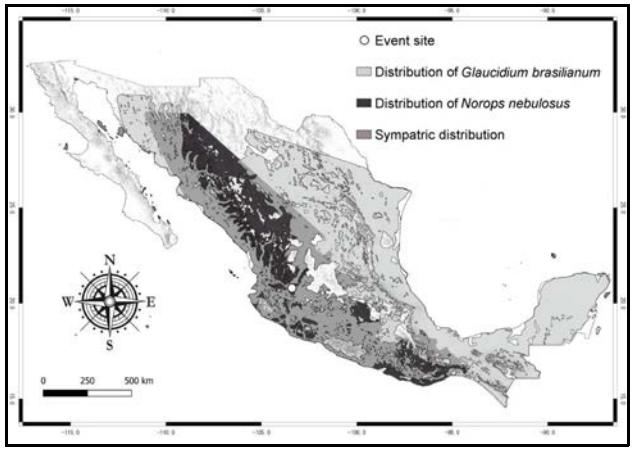
We document predation on the clouded anole (*Norops nebulosus*) by a ferruginous pygmy-owl (*Glaucidium brasilianum*) and discuss some aspects of the biology of these two species that are inhabitants of El Diente, Zapopan, on the outskirts of the city of Guadalajara, Jalisco, Mexico.

Background on *Norops nebulosus* (Wiegmann, 1834)

Norops nebulosus has been documented as follows: it is one of the most widely distributed and common anole species in Mexico, occurring from Chihuahua and Sonora in the north to Guerrero, Morelos, and Puebla to the south (Lemos-Espinal et al., 2013; Köhler et al., 2014). *Norops nebulosus* occurs mainly on the ground (Wilson and McCranie, 1979) and its seasonal, sex, and size variation in the different habitats used by the species have been observed (Jenssen, 1970a; Lister and Garcia Aguayo, 1992; Ramírez-Bautista and Benabib, 2001; Pringle et al., 2019). *Norops nebulosus* feeds primarily on insects, especially termites and orthopterans (Boyd et al., 2007; Hernández-Salinas et al., 2016), and it is preyed on by other lizards, including *Sceloporus melanorhinus* (Siliceo-Cantero and García, 2013). Growth, body size, and morphology from island and mainland populations in Jalisco, Mexico, have been compared (Senczuk et al., 2014; Siliceo-Cantero and García, 2014; Hernández-Salinas and Ramírez-Bautista, 2015). Fitch (1976) found no evidence of sexual size dimorphism in *N. nebulosus*, whereas others have found that males are larger than females (Jenssen, 1970a; Senczuk et al., 2014; Woolrich-Piña et al., 2015). The reproductive cycle of the species has been described from the locality of Chamela, Jalisco, on the Pacific coast of Mexico (Ramirez-Bautista, 1995; Ramírez-Bautista and Vitt, 1997; Hernández-Salinas and Ramirez-Bautista, 2015). In addition, observations on aspects of their natural history, such as body temperature and body displays, have been reported (Jenssen 1970b, 1971; Ramírez-Bautista and Benabib, 2001). Even the presence of internal parasites has been documented in this species (Mayén-Peña and Salgado-Maldonado, 1998).

Background on *Glaucidium brasilianum* (Gmelin, 1788)

This pygmy-owl inhabits deserts with large cacti, open arid,



Distribution of *Norops nebulosus* and *Glaucidium brasilianum* in Mexico. Map by Andrés Rodríguez-López.

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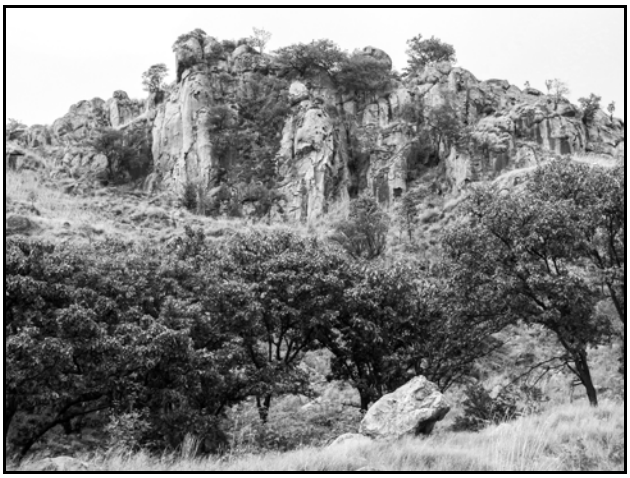
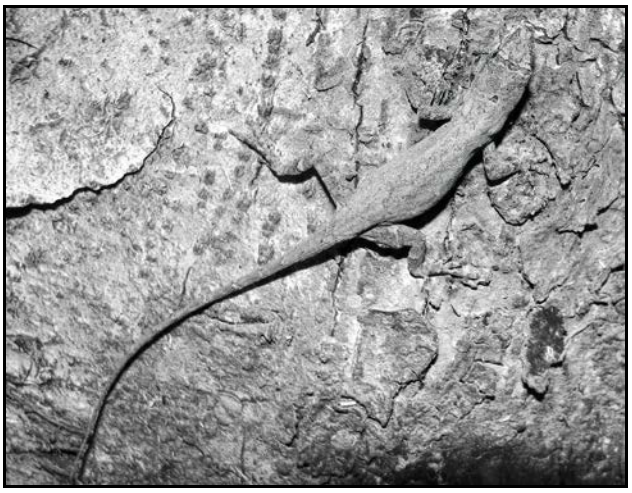


The dry forest at El Diente where the event took place. Photograph by Santiago Cortés-Vázquez.



A clouded anole (*Norops nebulosus*) perching on a tree trunk. Photograph by Santiago Cortés-Vázquez

riparian, and thorny thicket forest. Where it is sympatric with woodpeckers, *Glaucidium brasilianum* may nest in abandoned woodpecker nest cavities.

The diet of *G. brasilianum* varies according to seasons and habitat types (Sarasola and Santillán, 2014). Insects, primarily grasshoppers (Orthoptera), were found to be consumed in large numbers in Texas (Proudfoot and Beasom, 1997); also insects, mainly grasshoppers and crickets (Orthoptera) and some scorpions (Arachnida) have been reported to form part of their diet in Veracruz, Mexico (Lowery and Dalquest, 1951); another article reports that the stomachs of individuals collected in the northeastern states of Mexico had nothing but a traces of insects (Sutton, 1951); Cicadidae were documented to be consumed in Panama (Wetmore, 1968).

Quantitatively, insects contribute significantly to the diet of *Glaucidium brasilianum*. However, because differences in prey biomass can significantly affect the nutritional caloric contributions (Cummins and Wuycheck, 1971; Steenhof, 1983), reptiles, birds, small mammals and amphibians can be qualitatively significant in its diet (Proudfoot and Beasom, 1996). In Texas, five classes of prey were recorded (Amphibia, Aves, Insecta, Mammalia and Reptilia), and in Arizona, three classes are listed as prey (Insecta, Mammalia and Reptilia). Reptile prey includes lizards of the genera *Eumeces* (= *Plestiodon*), *Cnemidophorus* (= *Aspidoscelis*), *Holbrookia*, *Phrynosoma* and *Sceloporus*; mammal prey includes the genera *Mus, Baiomys* and *Dipodomys* (Proudfoot and Beasom, 1997).

The largest prey items that have been recorded in Arizona and Texas were Gambel's quail (*Callipepla gambelii*) and the hispid cotton rat (*Sigmodon hispidus*); the smallest were sphinx moths (family Sphingidae) and lightning bugs (family Lampyridae). Also in Texas *Glaucidium brasilianum* is recorded as consuming the eastern lark (*Sturnella magna*), and even the narrow-mouthed toad (*Gastrophryne olivacea)* (Proudfoot and Beasom, 1997). South American natives reported this species of owl can attack a Jacu hen (*Penelope* sp.), a bird larger than some of the domestic birds that they also attack **(**Proudfoot and Beasom, 1997). In Brazil a variety of insects (orthopterans, beetles, termites of the genus *Nasutitermes*, odonates, ants and cicadas) have been documented in the diet of these owls, as well as a rodent and small reptiles (several lizards, including a gecko [*Gymnodactylus* sp.], and a snake (Schubart et al., 1965).

In a quantitative analysis, insects constituted 58.0% of the remains of identified prey (n = 207) from eight nests, and 62.0 and 89.7% of prey deliveries (n = 75 and 127) from visual observations (105 h) and video image analysis (103 h), respectively; reptiles, 22.5%, 18.2 and 7.1%, respectively; birds, 10.5%, 9.1 and 2.3%; mammals, 8.6%, 10.3 and <1.0% (Proudfoot and Beasom, 1997). In Arizona, reptiles accounted for 47.0%, birds 21.0%, mammals 9.0% and insects 5.0% of the ferruginous pygmy-owl diet (W. Richardson, pers. comm.).

Individuals have been observed catching birds perched in the low canopy; reptiles on the ground, ascending the trunks of trees and perched on tree branches and low vegetation; and insects on the soil and low vegetation. Although the capture was not recorded, this bird was observed perched on a low branch over the water clutching a frog (*Rana* sp.) at the water's edge (Proudfoot et al., 2020). It seems that their feeding habits are similar throughout their distribution; all that changes are the particular species found in the area.

Background of the study site

The Protected Natural Area known as Nixticuil-San Esteban and El Diente Forest has a surface area of about 1,591 hectares and is characterized by a relatively rugged topography with large granite formations that stand out, making it one of the most visited areas near the Metropolitan Area of Guadalajara. The area is used for recreational activities, such as climbing, rappelling and hiking. El Diente in general is composed of the following plant communities: Deciduous Tropical Forest, Oak Forest, Oak Forest with Grassland, Pine Forest, Gallery Forest, Induced Natural Grassland, and Secondary Vegetation. The vegetation of the area consists mainly of oaks dominated by red oak (*Quercus resinosa*); however, there is also the presence of individuals of yellow oak (*Q. magnoliifolia*) and turkey oak (*Q. laeta*). Among the moderate slopes and canyons lie some scattered valleys where it is common to find grasslands with native species like muhly grass (*Muhlenbergia* sp.), three awn grass

Ferruginous pygmy-owl (*Glaucidium brasilianum*) grasping a clouded anole (*Norops nebulosus*). Photograph by Santiago Cortés-Vázquez.

(*Aristida* sp.) and bluegrass (*Bouteloua* sp.), as well as the African species Natal grass (*Melinis repens*). To a lesser extent, individuals of egg-cone pine (*Pinus oocarpa*) can be found and in the most visited areas it is common to find individuals of Aztec pine (*P. teocote*), due to reforestation practices led by local authorities and citizen groups (Cruz-Sáenz et al., 2017).

Method and Results

The area of the El Diente Forest where the encounter between the pygmy-owl and the anole occurred includes various trails that are used by visitors. The plant community consists primarily of an oak forest with scattered egg-cone pines and huizaches (*Vachellia* sp.). The locality is at 20°47'44.14"N, 103°23'50.63"W, 530 masl, approximately one kilometer from the entrance of El Diente. This area falls within both the Central Plateau and Sierra Madre Occidental physiographic areas.

During an ornithological survey trip on 25 July 2020, within the Natural Protected Area, in the section of El Diente at 19:11, we observed a small bird perching under the canopy of an oak (*Quercus* sp.). As we approached the bird, we saw that it was a ferruginous pygmy-owl (*Glaucidium brasilianum*) that held a lizard (*Norops nebulosus*) in its talons. The bird remained watching us for about a minute and then ate the lizard. The event took approximately 6 minutes; after consuming the lizard the bird took flight and entered very dense vegetation, where we lost sight of it.

Discussion and Conclusion

In the state of Jalisco, 554 bird species in 73 families have been documented. Additionally, 22 accidental species, 8 extirpated species, and 3 introduced species are also listed. Of the total, 9% are species that are endemic to Mexico. The birds of Jalisco are primarily Nearctic in origin, although the resident species tend to be of Neotropical origin. One-third of the species of the state are migratory or winter residents, confirming the importance of this region for Nearctic–Neotropical migrants. Of these, there are 37 raptor species that are potential predators of anoles or other reptile species (Palomera-García et al., 2007).

In El Diente, we have observed other birds that might also prey on *N. nebulosus* and other reptiles found in the area (Table 1). We have made numerous field trips to the area for bird observation—approximately every 2 or 3 months during the last 2 years—during which around 80 species have been identified and documented, of which at least 17, in addition to *G. brasilianum,* can be classified as potential predators of *N. nebulosus* and other species of herpetofauna. Some of the bird species that we have recorded in the study area are hawks (Accipitridae), which due to their size might be considered not agile enough to feed on this species; however, multiple records of predation on lizards and snakes by large birds of prey have been documented (Nahuat-Cervera et al., 2020), so we could consider that some species of this group might be occasional predators of *N. nebulosus* in this area.

Waders of the Ardeidae family recorded in the area could also be important occasional predators of this species, since

Table 1. Potential avian predators of *Norops nebulosus* observed in El Diente in addition to *Glaucidium brasilianum*. Likelihood based on habits and sizes of the different species.

Family	Species	Common name	Likelihood of preying on *N. nebulosus*
Accipitridae	*Accipiter cooperii*	Cooper's Hawk	Active
Accipitridae	*Buteo jamaicensis*	Red-tailed Hawk	Occasional
Accipitridae	*Buteo plagiatus*	Gray Hawk	Occasional
Accipitridae	*Circus hudsonius*	Blue Hawk	Occasional
Accipitridae	*Elanus leucurus*	White-tailed Kite	Occasional
Accipitridae	*Geranoaetus albicaudatus*	White-tailed Hawk	Occasional
Ardeidae	*Bubulcus ibis*	Cattle Egret	Occasional
Ardeidae	*Ardea alba*	Great Egret	Occasional
Ardeidae	*Egretta thula*	Snowy Egret	Occasional
Cathartidae	*Cathartes aura*	Turkey Vulture	Occasional
Cathartidae	*Coragyps atratus*	Black Vulture	Occasional
Falconidae	*Caracara cheriway*	Northern Crested Caracara	Occasional
Falconidae	*Falco sparverius*	American Kestrel	Active

waders have a strong affinity for aquatic environments and anoles have been observed there. These wading birds are characterized by having a broad diet (Miranda and Collazo, 1997). Scavenger species of the family Cathartidae within the area, despite their large size and slow flight, have occasionally been documented hunting live prey (e.g., snakes) (Almeida et al., 2010; Severo-Neto et al., 2014).

Finally, we also consider members of the Falconidae, Laniidae, Strigidae (including pygmy-owls) and Tytonidae families (Kittredge et al., 2006; Simpson et al., 2019), to be potentially active predators of *N. nebulosus*, because of their rapacious habits, size, and agility, which facilitate capture of small and elusive prey.

Acknowledgments

We thank all the people who have helped to obtain the list of birds in the area, particularly Marco A. Carrasco-Ortiz, Georgina Ramos-Córdova, Perla Velázquez-Ríos, and the valuable members of the Rio Blanco community who have participated in bird watching walks. In addition, we thank FEMAF, a female organization for the combat of forest fires, and other volunteer brigades for their contribution to the conservation of the area, primarily as forest fire fighters.

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Notes on Reproduction of Pig Frogs, *Lithobates grylio* (Anura: Ranidae), from Texas

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Abstract

I conducted a histological examination of gonads from 13 *Lithobates grylio* from Texas consisting of five adult males and eight adult females. Males contained sperm from all months examined: June, July and December. The smallest mature male (sperm in lumina of seminiferous tubules) measured 92 mm SVL and was from July. Females in spawning condition were found in April, June and December. Two non-spawning females containing previtellogenic oocytes were from December. The smallest mature (spawning) female measured 123 mm SVL and was from December. One gravid female from April (TCWC 70519) contained postovulatory follicles from a recent spawning suggesting *L. grylio* spawns more than once in the same year in Texas.

Lithobates grylio (Stejneger, 1901) occur on the Atlantic Coastal Plain from southern South Carolina, all of Florida and west to southeastern Texas (Dodd, 2013). They have been introduced on Andros and New Providence islands in the Bahamas and Puerto Rico (Green et al., 2013). Suitable habitats include swamps, marshes, lakes and large ponds; most breeding occurs from March to September (Elliott et al., 2009). Lamb (1984) reported females contained mature ova from April through July in Georgia. *Lithobates grylio* are entirely aquatic and mainly nocturnal (Wright, 1932). Weather permitting, they may be active throughout the year (Dodd, 2013). Altig and Lohoefener (1982) summarized the biology of *L. grylio*. In the current paper I present data on the *L. grylio* reproductive cycle from a histological examination of gonadal material from Texas. Utilization of museum collections for obtaining reproductive data avoids removing additional animals from the wild.

I examined a sample of 13 *L. grylio* from Texas collected 1983 to 2016 (Appendix) consisting of five adult males (mean SVL = 112.6 mm ± 12.9 SD, range = 92–127 mm) and eight adult females (mean SVL = 127.5 mm ± 13.3 SD, range = 108–153 mm) from the Biodiversity Research and Teaching Collection (TCWC) of the Department of Wildlife and Fisheries Sciences. Texas A&M University, College Station, Texas, USA (Appendix). An unpaired *t*–test was used to test for differences between adult male and female SVLs (Instat, vers. 3.0b, Graphpad Software, San Diego, CA).

A small incision was made in the lower part of the abdomen and the left testis was removed from males and a piece of the left ovary from females. Gonads were embedded in paraffin, sections were cut at 5 μm and stained with Harris hematoxylin followed by eosin counterstain (Presnell and Schreibman, 1997). Histology slides were deposited at TCWC.

There was no significant difference between mean SVL of adult males versus adult females of *L. grylio* ($t = 1.98$, df = 11, $P = 0.07$). The testicular morphology of *L. grylio* is similar to that of other anurans as described in Ogielska and Bartmañska (2009a). Within the seminiferous tubules, spermatogenesis occurs in cysts which are closed until the late spermatid stage is reached; cysts then open and differentiating sperm reach the lumina of the seminiferous tubules (Ogielska and Bartmañska, 2009a). All five *L. grylio* adult male*s* were undergoing sperm formation (= spermiogenesis) in which clusters of sperm filled the seminiferous tubules. A ring of germinal cysts was located on the inner periphery of each seminiferous tubule. By month, numbers of *L grylio* males exhibiting spermiogenesis were: June ($n = 1$), July ($n = 2$), December ($n = 2$). Lamb (1984) reported testes of *L. grylio* from Georgia contained sperm throughout the year. The smallest mature *L. grylio* male in my study (spermiogenesis) measured 92 mm SVL and was from July (TCWC 86524). Ligas (1960) found sperm in testes of *L. grylio* males between 70 and 75 mm. Wright and Wright (1933) reported adult *L. grylio* males ranged from 82 to 152 mm in body length.

The ovaries of *L. grylio* are typical of other anurans in consisting of paired organs located on the ventral sides of the kidneys; in adults they are filled with diplotene oocytes in various stages of development (Ogielska and Bartmañska, 2009b). Mature oocytes are filled with yolk droplets; the layer of surrounding follicular cells is thinly stretched. Two stages were present in the spawning cycle (Table 1): (1) "Ready to Spawn Condition" in which mature oocytes predominated; (2) "Not in Spawning Condition" in which previtellogenic oocytes predominated. Monthly stages in the spawning cycle of *L. grylio* are in Table 1. The smallest *L. grylio* mature female (ready to spawn) measured 123 mm SVL (TCWC 89817) and was from December. Wright and Wright (1933) reported adult *L. grylio* females ranged from 85 to 161 mm in body length. *Lithobates grylio* females reach maturity near 94 mm SVL (Ugarte et al., 2007). The ovaries of two other *L. grylio* females from December (Table 1) contained only non-vitellogenic oocytes, consistent with previous reports of *L. grylio* spawning earlier in the year and suggesting some seasonality in the female spawning cycle in Texas.

Table 1. Two monthly stages in the spawning cycle of eight adult female *Lithobates grylio* from Texas.

Month	N	Ready to spawn condition	Not in spawning condition
April	2	2	0
June	3	3	0
December	3	1	2

Table 2. Months of breeding for *Lithobates grylio* from different states.

Locality	Breeding period	Source
Alabama	May–June	Mount, 1975
Florida	mainly March to August	Ugarte, 2004
Florida	March–September in south; April–July in north	Krysko et al., 2019
Georgia	May 4 to September 1	Wright, 1932
Georgia	March to September	Jensen et al., 2008
Louisiana	February–August	Dundee and Rossman, 1989
Louisiana	March–August	Boundy and Carr, 2017
no locality	March–September	Wright and Wright, 1933
South Carolina	April–August	Beane et al., 2010
Southeast	most of year	Dorcas and Gibbons, 2008
Texas	March to November	Tipton et al., 2012

Atretic follicles were noted in the ovaries of 13% (one of eight: TCWC 70519) of my *L. grylio* female sample. Atresia is a widespread process occurring in the ovaries of all vertebrates (Uribe Aranzábal, 2009). It is common in the amphibian ovary (Saidapur, 1978) and is the spontaneous digestion of a diplotene oocyte by its own hypertrophied and phagocytic granulosa cells which invade the follicle and eventually degenerate after accumulating dark pigment (Ogielska and Bartmañska, 2009b). See Saidapur and Nadkarni (1973) and Ogielska et al. (2010) for a detailed description of follicular atresia in the frog ovary. Atresia plays an important role in fecundity by influencing numbers of ovulated oocytes (Uribe Aranzábal, 2011). Incidences of follicular atresia increase late in the reproductive period (Saidapur, 1978). Saved energy will be presumably utilized during a subsequent reproduction.

I found histological evidence suggesting that *L. grylio* produces multiple clutches in the same reproductive season in Texas as indicated by the presence of mature follicles (upcoming spawning) and the concurrent presence of postovulatory follicles (from a recent spawning), in the same female (TCWC 70519) (*sensu* Redshaw, 1972). Postovulatory follicles form when the ruptured follicle collapses after ovulation; the follicule lumen disappears and proliferating granulosa cells are surrounded by a fibrous capsule (Redshaw, 1972). Postovulatory follicles are short–lived in most anuran species and are resorbed after a few weeks (Redshaw, 1972). The presence of mature follicles for a subsequent spawning, with concurrent postovulatory follicles from a recent spawning, in the same ovary suggests *L. grylio* may spawn a second time during the same reproductive period in Texas.

Because I lacked *L. grylio* female samples from late summer and autumn, I cannot comment on the duration of female reproduction in Texas although five females from spring ($n = 2$) and early summer ($n = 3$) indicate spawning during those two seasons. My one December female in spawning condition from Texas is one month later than the last month of spawning (November) in Tipton et al. (2012). Times of breeding for *L. grylio* throughout its range are shown in Table 2.

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Appendix

Thirteen *L. grylio* from Texas examined by county from the Division of Herpetology, Biodiversity Research and Teaching Collection (TCWC), Texas A&M University, College Station, Texas. **Jefferson:** 70519, 71567, 82889, 82892, 89811, 89812, 89815-89817, 90470, 90474, 90481; **Orange:** 86524.

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Mud Turtles, Gartersnakes, Froggies, Chytrids, Fires and Drought

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While this author is a stickler for maintaining a field journal, the exact date that the following discussion transpired wasn't documented. If I noted every time that a herper said something off the wall, I'd need to build a storage shed to stow my journals. My best guess is that the conversation I am about to reveal occurred in the spring of 2012. The very fact that it happened at all showed how very little my friend Dr. Hans-Werner Herrmann understood my herpetological focus, in spite of roughly seven years of us constantly herping together. In the event that the name "Hans-Werner Herrmann" isn't any sort of tipoff, we should highlight the fact that he is German. And while his spoken *and* written English is *outstanding*, folk from Germany never fail to pronounce words that begin in V with a W, or a W-word with a V. For example, "vacuum" is pronounced "wacuum," and Hans-Werner is pronounced "Hans-Verner." Our German friends also have trouble with the word "one." This I understand and sympathize with completely, as there is no solid grammatical reason whatsoever why that *beautiful* vowel "o" should *ever* take on the "w" sound. Why don't we spell the number 1 as "w-u-n?" What happened to that "w" when our grammatical genius decided that we were going to spell out the number 1 as "o-n-e?" Did that same genius decide to use the misplaced "w" for the word "two?" Beautiful! So *that's* where that "w" went! And if we look at the spelling for the number 8 (E-i-g-h-t? **C'mon man!**), we wonder how that same jerk got the spelling for "three" correct. Why didn't this idiot throw a "q" into the word "three" while he was screwing things up so mightily? Why not? That makes as much sense to me as the letter combination used to get "eight"!

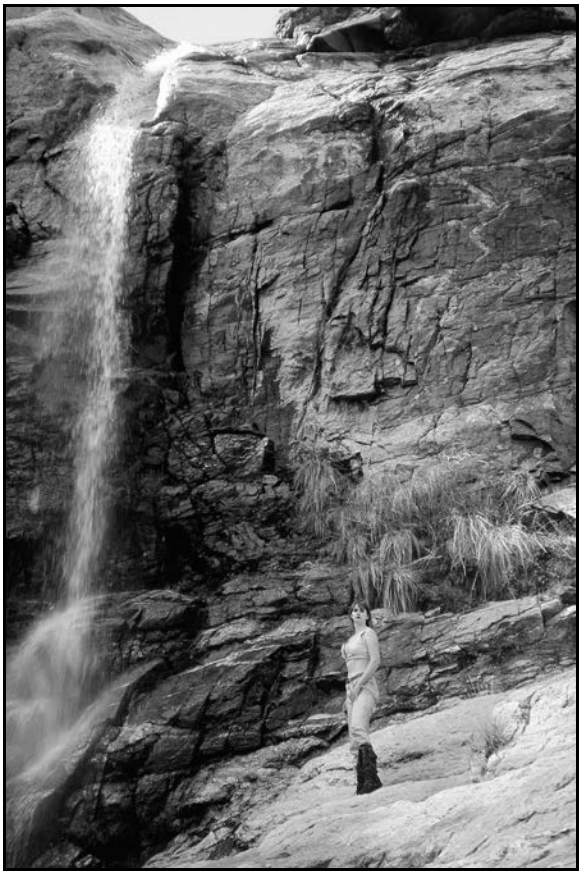


Figure 1. Maiden Falls, resplendent with a maiden, somewhere in the Catalina Mountains near Tucson, Arizona. We only knew the young woman in the image as "Ozark Amy." In this article, the author laments over being too old, both for the maiden *and* for the hike to get to get to the place where she stands. Image by the author, 4 March 1995.

Since I'm just getting started on the idiosyncrasies of the English language, I'll stop—lest we wind up with another 14,000-word column. It's time to get back to my conversation with Herrmann the German. We had just radio-tracked a female Western Diamond-backed Rattlesnake (*Crotalus atrox*) to her location, and I was writing up the data on her. At that point, out of the blue, H-W (or "H-V") offered his opinion:

"Roger!" He exclaimed (which is why the author used the exclamation point thusly): "Vun vord: ***FROGS*!**"

"*Vhat?* I mean, *what*?" I shot back. (I so was befuddled by this "Vun vord frogs" business that I started talking like the dude.) "Vhat do you mean by 'Vun vord: ***FROGS***"? VTF?"

"Schnakes are so ***boring*** man. Look at this schnake dot you are writink up now. Vhut is it doing now dot you must make vith all the vords? Vhy don't you just say it is doing nothink? Dot's vhat is *really* happening! It is doing *nothink*."

"Oh *really*? To me it looks like she is coiled in a hunting posture under a creosote bush, waiting for a rat to come by so that she can nail it. She seems to be doing a fine job of it, for here you are!"

The German breathed a heavy sigh. "No Roger, you don't undershtand. Frogs are interesting, frogs are exciting. Frogs have the coolest behaviors. Did you know dot some carry their young on their backs?"

"Big deal! So do water bugs and scorpions."

"Und some frogs vill dig a trench for their tadpoles to eshcape a dryink puddle und svim into deeper vater."

"Sounds to me like somebody chose the wrong damn puddle to reproduce in. You won't see snakes digging any trenches for *their* young. They drop 'em in the right spot in the first place."

On and on, and back and forth our discussion raged. For whatever reason, my German friend had it in his thick Germanic skull that he could convince me to just pull the plug on my rattlesnake study, and follow him into some form of frog-infested fantasy of his. The discussion got a little heated when I pointed to the Santa Catalina Mountains, and suggested: "The nearest froggie is 30 miles that way. I'll be happy to drive you over there if you promise to stay." When that insult wasn't enough to stop his verbal amphibious assault, a suggestion that Germany also had enough froggies to beckon him back home—where he belonged—was offered. Things got pretty quiet after that. I probably should have just stated the real reason I had

Figure 2. A rare image of the author hiking / herping in Montrose Canyon, which is one of Arizona's fantastic riparian corridors. Image by Don Swann, 14 October 1995.

stayed as far away from frog studies as I could for the previous 13 years. They are damn delicate organisms, and would be quite easy to love to death. But that probably would have brought on a different and much more heated discussion. We will circle back to some of these "loving-them-to-death" thought patterns (which seem to be uniquely mine), as well as more of "Herrmann the German," at the end of this column. He is currently following his bliss, which has nothing to do with snakes *or* frogs. And *man* am I *ever* glad that I didn't walk away from ten years of my own bliss, not to mention ten thousand dollars worth of telemetry gear, to follow him.

Had Hans-Werner abandoned me to study frogs, he would not have been the first herp buddy to do so. Were I able to travel back in time to relive the best five years of my life, the time period I would choose would be the years 1991 through 1995. These were my glory years. Herpetologically speaking, I was hitting on all cylinders, and I was doing it with a solid, like-minded core group. They were outstanding field herpers, highly positive in attitude; powered by passionate motivation; and just plain fun to hang with. To be sure, I have always been blessed to have good people at my side when herping in Arizona. But I will always hold the team of Dennis Caldwell and Don Swann in a special place in my heart. By the end of 1995, I basically lost both of them to frogs. They were no longer interested in being landlocked herpers. Their call of the wild went something like: "Ribbit! Ribbit!" Forever after, if I wanted the pleasure of their company in the field, it could only happen if I went a-froggin' with them. To be sure, some of the places that we went were among the most drop-dead, scenically awesome canyons in the world. I must confess that upon seeking images to share with the readers from my bygone froggie days with these guys, my heart sank considerably. I will never be able to get back to some of these fantastic places (Figure 1). And even if I *could* someday magically find myself in good enough shape to hike to these places, there have been many landscape-altering forest fires roar through the best of them. And I *fear* what the god-awful droughts have done to these magnificent places of late. They are probably *not* the same—and will *never* be the same—at least not in my lifetime. Maybe it's for the best that I remember these places as they once were, and share that glory with my readers (Figure 2).

The approach of Don and Dennis to their froggie sweet spots was much like my own toward my tortoise, Gila Monster, and rattlesnake places. First off, never once did I see them handle a frog. They were content to photograph what they saw as though there was an invisible pane of glass between them and the frogs. And for the most part, be it froggies or the higher life forms, we stayed pretty close to Tucson with most of what we did.

There was a third person who briefly crossed paths with the three of us. He also started as a reptile guy, but quickly moved into the froggie-loving arena. We speak of Erik Enderson. While Don and Dennis stayed comparatively local, Erik was all over the place. Erik got into the ambitious amphibious life-listing mode by going all out to find and photograph every species of amphibian in the state. The uninitiated might think that his mission to do this wouldn't take long. After all, the driest state in the lower 48 could not have all that many amphibians, right? Wrong! Incredibly, within 100 miles of Tucson, nine species of frogs, 12 species of toads, and one type of salamander can be found. I accompanied Erik on a number of his froggie life-listing efforts. The best of these took us to the Huachuca Mountains, where he was able to get some *stellar* images of Mountain Treefrogs (*Hyla wrightorum*) calling and breeding. We also visited the Tohono O'Odham reservation, where the ambitious (and dangerously fearless) young photographer went all out to get images of Narrow-mouthed Toads (*Gastrophryne olivacea*), Lowland Burrowing Treefrogs (*Smilisca fodiens*) and Sonoran Green Toads (*Anaxyrus retiformis*). On 22 August 1999, Erik and I got a taste of Illinois herping right here in Arizona. On this day, we were near the town of Flagstaff, Arizona. One of the stops that we made was at a place named Roger's Lake. At the place where we parked, there were lots of downed wood planks, roughly 1 by 3 inches of varying length, to flip. I don't know how they got there. Perhaps a dude named Roger left them there, was proclaimed a hero, and the lake was named after him? In any case, these were all scattered about a verdant pasture that was roughly 100 meters wide by 200 meters long. Almost immediately, I scored an adult Arizona Tiger Salamander (*Ambystoma mavortium nebulosum*) under one of these planks. As soon as I showed this find to Erik, I had all of Roger's Lake, and all of its mystery planks, to myself. How one can manage to spend over two hours taking a photo of a sitting duck like this salamander is beyond the limits of my patience to understand, but that is exactly what Erik did here. While Erik basically married the poor thing, I flipped every board in that field. I found several Western Chorus Frogs (*Pseudacris triseriata*) while waiting for Erik to consummate his relationship with that salamander. Once herping that pasture was behind us, we snagged Erika Nowak from her moorings at Northern Arizona University, and headed up a dizzying array of jeep trails that eventually led us to some small springs. It was there that we scored three Northern Leopard Frogs (*Rana pipiens*). It is somewhat comical to note that while all three of these species are big juju in Arizona, I could have found all three within a few miles of my back yard in my home town of Crystal Lake, Illinois (Figure 3).

We are going to shift gears a bit here, while temporarily keeping Erik Enderson on the back burner, with what comes next. As I have said often in these columns, upon moving to Arizona, I did not have any friends here who shared my interest

Figure 3. Can the herping in Arizona yield similar results to the herping in Illinois? You bet! (Left): Arizona Tiger Salamander (*Ambystoma mavortium nebulosum*) (Center) Western Chorus Frog (*Pseudacris triseriata*) (Right) Northern Leopard Frog (*Rana pipiens*). All three species were found near Flagstaff, Arizona, on 22 August 1999. Images by Erik F. Enderson.

in reptiles. But I *did* do a lot of hiking. I would often hike with my wife Dianna, our son Tim, and other families with children similar in age to Tim. We would often choose streams to hike along, and hoofed these as far up as we could make it. Often times, we would get cliffed-out on these hikes, usually by some combination of a steep rock wall and a waterfall. That would be the end of that particular hike. The early 1980s were exceptionally wet years. It would rain on an almost weekly basis from November through March, peter out for the spring and foresummer months of April until very early July, and then we would get hammered by fearsome thunderstorms that occurred about every third day through September. From 1981 through 1983—three glorious years in row—we received generous bimodal rain patterns. As a result, every drainage in the larger mountain ranges that surround Tucson flowed year-round. When we weren't walking trails, our hikes were often bushwhacks along riparian corridors that involved as much swimming as hiking. The flowing waters created their own trail system for us. I was always the point man on these family hikes. I would often hike well ahead of the group, occasionally doubling back to make sure that everybody was all right. I am guessing that it was at some point in 1983 that we hiked a place named Montrose Canyon for the first time. This canyon drains the north side of the front range of the Catalina Mountains. The stream flows from east to west through Catalina State Park. On whatever day our Montrose Canyon hike was, I scored a life-list herpetological first. I was well ahead of the six others who accompanied me, when I saw that the canyon was starting to tighten up ahead. I could hear the roar of a waterfall, and got glimpses of it through the canopy of ash, willow trees, wild grapevine and various other vegetative rip rap that come as accessories to our riparian corridors. As I got closer to the falls, I could see that the hike was going to end there. The embankments to either side of the falls were menacingly vertical, and the slide rock that the falls were roaring over was too steep and slippery to ascend. But a major plunge pool had formed at the base of the falls. There was a small sandy beach to one side of the pool, while the opposite side was simply a continuation of the steep embankment. The pool was roughly 90 feet long by 60 feet wide, and well over six feet deep. It was the perfect swimming hole. As I walked on the far side of the beach, hugging the far right side of the canyon, I observed a turtle with perhaps a five-inch-long, dark brown-colored shell, scramble from the beach and plop into the pool. I got a good look at it as it ran more than swam across the sandy bottom of that pool, and slipped out of sight into the deeper waters. I still can visualize the long neck protruding out of the shell, and the legs kicking up mini-swirls of sediment as it hustled away from me. The sight left a clear and lasting memory that I can recall with total clarity. Without realizing what it was, I had just seen my very first Sonora Mud Turtle (*Kinosternon sonoriense*) (Figure 4).

It was not until this day, after having lived in Arizona for over two years, that I learned that there was any kind of aquatic turtle living here! But I was not the only one in this group who was unaware of this fact. When the group finally caught up to me, not a one of them believed my story about seeing it! The conversation was all me relaying what I had just seen, to a chorus of "no ways" coming back. Even the kids were mocking me! The reader had better believe that as soon as I got home, I consulted my 1966 Stebbins. And there it was (and still is) on Plate 14, with the text on Page 82, and the corresponding Map 61. All three of these factors combined to say "Hell yes, this is what you saw, Repp!" And while it was great fun to give everybody the horse laugh after looking it up, it just wasn't the same as reporting it to people who might have been interested in it. What *really* burns me about this experience is that I didn't write the date down anyplace. What burns me even more is knowing that this sort of thing happens on every field trip with most herpers that I know. You see it, you don't write it down, and 38 years later—if you are lucky—you have a razor-sharp imprint on

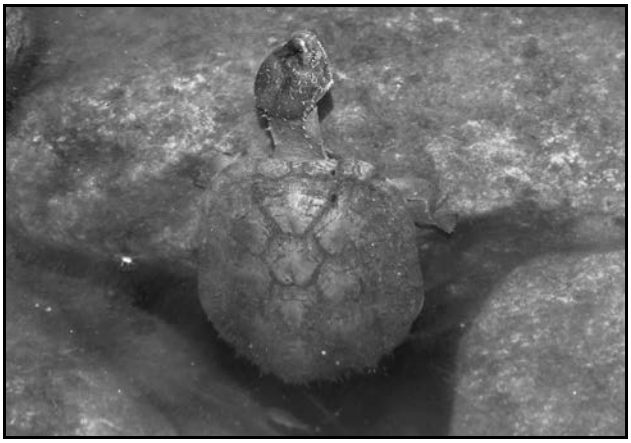


Figure 4. A Sonora Mud Turtle (*Kinosternon sonoriense*) rises to the surface of Sabino Creek for a breath of air. When the author saw his very first one of these in 1983, he was ignorant that Arizona even had any native species of aquatic turtles! See text for details. Image by René C. Clark, Dancing Snake Nature Photography.

your brain that loses all value for want of the ability to spew out a simple date. In essence, by trying to report this most worthy find, I become just another doddering old man who is uncertain of both the year and the season that something important in my life happened. Were somebody to question me about when it happened, the smart answer would be to quickly say "I don't know." But because "I don't know" is not really an acceptable answer, I would probably have a verbal debate with myself for an answer, while whoever asked the question would deeply regret it. Perhaps a few thousand words later, I would come up with "I don't know." And while I mentally fumble with a date this first mud turtle happened, there are ricochets of other things that we saw or didn't see on this hike careening about inside my head. I'm 90% sure that we saw "several" Black-necked Gartersnakes (*Thamnophis cyrtopsis*) this day, as well as 99% sure that we saw "several" Canyon Treefrogs (*Hyla arenicolor*). This information is even *more* worthless than the knowledge of the mud turtle, as it is relayed with far less certainty. But worse yet, the most important memory to relay here would be a simple "yes" or "no" answer to leopard frogs. Either answer, yes *or* no is important, but I can only say that I'm not sure if there were leopard frogs seen this day. I'd like to think that if we saw any, I would remember it. I am pleased to report that where Montrose Canyon is concerned, everything else that I have to say is said with certainty. But notes or not, one other tidbit that occurred this day *can* be relayed with conviction. My wife Dianna got stung twice on the back of the neck by a wasp, and she still occasionally reminds me that she was underwhelmed with her husband being whereabouts unknown when it happened. I guess I was supposed be there to kiss her welts? As good as her memory for my misdeeds can be, I'm surprised that she doesn't know the date and time of this incident by heart!

My next visit to Montrose Canyon occurred on 4 October 1992. Rather than attempting a blow-by-blow description of what went down on this day, we'll just stick with the facts as they appear in my journal. While the way I documented field trips at this time was humble, the minimalist approach serves to demonstrate how simple the process can be. There is no reason for anybody of our ilk *not* doing this sort of thing. We quote, word-for-word, what was stated, and how I stated it:

"1992 Sun. Oct. 4
Location: Frog Canyon
Herps: 3 mud turtles, 2 bn garters, 100s of leopard frogs
1 black Coachwhip
Don back to Maine"

That's it! On the one hand, the technique used here is so primitive as to be embarrassing to share. On the other, if all I ever did was document all of my trips in this simple fashion, I would *still* have the most staggering dataset in all of Arizona today. A few further words of explanation for the notes taken this day are in order. First off, we'll skip a few lines and go for the throat here. Regarding the "100s of leopard frogs," that was not an exaggeration. Hell, there may have been double that, or more. Every step we took, we heard "plip-plip-plip-plop-plip-plip." Some dove deep, some doubled back to look at us, and some sort of skipped across the surface of the crystal clear water like a flat stone hurled with great velocity. Sadly, neither of us

Figure 5. "Plip-plip-plip-plop-plip-plip" all over the place! This image of a grouping of Lowland Leopard Frogs (*Rana yavapaiensis*) is shown *only* to depict how many of these were being seen in Montrose Canyon on our 4 October 1992 field trip there. It almost seemed as if this many, or at times more, were gathered around every pool in the canyon on this day. Image by the author.

had a camera this day. In fact, I did not even start carrying a camera until late 1993. Since I don't have any images to show from this day, I resort to showing a more recent image from a favored canyon of ours (Figure 5). As for the rest of this 4 October notation, to this very day I am not specific when writing down exact locations of places that I go. "Frog Canyon" became my code words for "Montrose Canyon." As ridiculous as that may sound, having the words "Montrose Canyon" reach the eyes and ears of the wrong person might just kill off a good leopard frog population. (And if you don't believe that—keep reading!) Also, if my mental fumbling with what happened in Montrose during the 1980s isn't any sort of tipoff, there is no way in hell I would remember the three mud turtles, the two *Thamnophis cyrtopsis*, the "100s of leopard frogs" *or* the Coachwhip without these notes. I'm also *thinking* that we saw some Canyon Treefrogs this day, but since I didn't write them down, the world will never know. Lastly, the "Don back to Maine" meant exactly that. This was to be my last field trip with Don Swann, and it was highly possible that I would never see him again. He was moving back to Maine, which was a place that he dearly loved. And the promise of field work there, combined with being close to family, would probably keep him there forever. It is indeed fortunate (for me if not him) that Don was able to move back to Tucson in 1993 to pursue his master's degree.

My next outing to Montrose Canyon was on 14 October 1995. Once again, Don was the driving force in my being there. As I'm about to report on yet another trip I made there, we will shorten my recounting of the highlights of this day to a single incident. At one point, I found myself alone, roughly 50 feet above a deep plunge pool. While looking down at this, I was able to witness—at length—the feeding frenzy of a mud turtle that was swimming about in the crystal-clear water of this pool. The turtle was unaware of my presence, which *always* sets up the best scenario in witnessing cool behaviors. The turtle was swimming along the edges of some of the seaweed-like plants that clung to the boulders, roughly two meters under the surface of the pool. As it did so, it was drawing its head back and lunging it forward again, taking large bites out of the plants as it did. On occasion, it would also swim upward, and in similar fashion, pick off insects that were swimming at the surface. In all, I

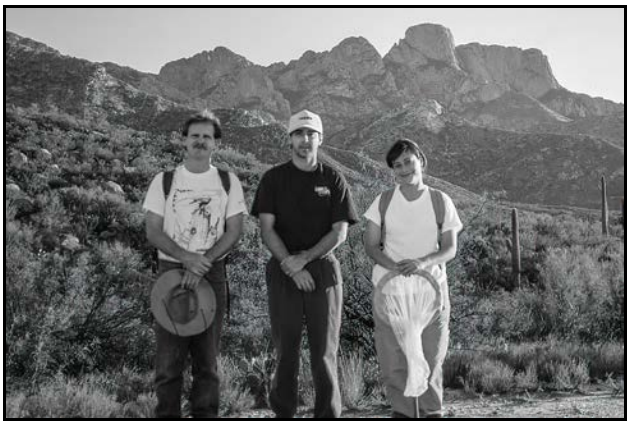


Figure 6. (Left to right): Don Swann, Jeff Moorbeck, and Karen Galindo, toward the end of the Montrose Canyon hike described in the text. Image by author, taken on 24 November 1996. Note the stunning backdrop of this photo, which is the north side of Table Mountain, part of the chain of peaks known as the "front range" of the Santa Catalina Mountains. See also Figure 10, left, for a different and more ominous image of Table Mountain.

watched this spectacle for over ten minutes. While I have never added them up, I would guess there are over 500 mud turtle observations buried in my field notes. Out of all of those, I have never again seen anything like this.

My next and final outing to Montrose Canyon transpired on 24 November 1996. I was joined by Don (of course, it was a frog trip), Jeff Moorbeck, and Karen Galindo (Figure 6). The weather this day was Arizona perfect—70°F and nearly cloudless. As nice as the weather was, the water temperature was *much* too cold to consider taking a swim, but that didn't stop me. On our return trip, our fearless leader chose a route that had us somewhat screwed. The only way to continue onward was to leap our way out. I had just hopped across an expanse of stream that was roughly six feet across, leaping from one boulder to the next. Karen was following me, but as the water was deep and the current swift, she was hesitant to follow. We were in the situation where if she *didn't* jump, we were in for a long and arduous back track. Mr. Smooth here assured her that he was there for her, and hence, she was safe. So, Karen took a few steps back, sprinted forward and went for it. She made it with room to spare, but her momentum would have carried her onward and off the other side of the boulder had I not been there to stop her. During the process of stopping her (which I did), I learned that a five-foot-two panic-stricken flying Cuban woman packs quite a wallop. She knocked me clean off that boulder and into the drink. In essence, I saved her so that I could take the beating myself. (What a hero!) The only thing I remember of the plunge was that I hit the water feet first, and that it took a long time for those same feet to finally hit the bottom of that streambed. That pool was deep, and the water was *very* cold. My three witnesses informed me that my first sputtering utterance upon surfacing was "*This water is cold!*" I managed to quickly scramble back up on the boulder, and thankfully, was only ridiculed by my companions for the rest of my life. On this day, we saw five mud turtles, a few *arenicolor*, one Black-necked Gartersnake (*Thamnophis cyrtopsis*) (Figure 7), one leopard frog, and many tadpoles. The fact that we saw a leopard frog this day means that they were still there. That we saw only one should not be taken as a bad sign—especially in November. Also, any time that tadpoles are observed means a potential bright future for the species in whatever canyon they are observed (Figure 8).

We now pull Erik Enderson off the back burner, and bring him to the forefront of this column again. Seeing how I keep good records of things like this, I can tell the reader that I was on my normal type of herp outing with Erik on 2 January 1999. (I say "normal" as in being a daylight frolic under saguaros, and wallowing in rattlesnakes, tortoises, and Gila Monsters). In casual conversation this day, I happened to mention Montrose Canyon and its leopard frog population. He was very interested in this news, and I told him how to get there. As was the wont of the crazed froggie lover during this time period, he didn't let any grass grow under his feet waiting overly long to visit Montrose Canyon. He went there on 5 January 1999—three days later. When he got there, he observed that I had *not* told him any lies. He saw lots of Lowland Leopard Frogs—over 60 of them! But they were *not* going "plip-plip-plip-plop-plip-plip" all over the place. And they were *not* diving deep, or doubling back to look at him, or skipping across the surface of the crystal clear waters

Figure 7. (Left) A Black-necked Gartersnake (*Thamnophis cyrtopsis*), photographed *in situ* roughly 1.5 meters above ground in the branches of a seepwillow. *Thamnophis cyrtopsis* were the most common snake that we encountered when hiking the riparian corridors near Tucson. Image by the author. (Right) A *T. cyrtopsis* about to convert a Lowland Leopard Frog into snake mass. Image by Mike Ward, Wild Horse Canyon, Saguaro National Park East.

Figure 8. Always a sign of a potential bright future for leopard frogs in any riparian corridor where they are observed. (Left) A group of *Rana yavapaiensis* (RAYA) emerging from eggs. According to expert Dennis Caldwell, RAYA are capable of egg production year round. (Right) An image that more closely depicts the developmental state of the RAYA tadpoles viewed on our 24 November 1996 field trip to Montrose Canyon. Images by Dennis Caldwell.

like a flat stone hurled at high velocity. Nope! Nothing like that! They were instead mostly floating on their backs, the undersides of their calves and thighs were burning bright red, and most were encapsulated with some kind of a fungal cloud as they were undergoing a form of amphibious meltdown. A few were still alive, but these were twitching in dreadful fashion, as if they were all suffering from mutual seizures. He knew that something was horribly wrong, so he hot-footed out of Montrose and contacted me. I sent him to Don Swann, who in turn contacted Mike Sredl (whom we will speak more of shortly), and the three of them returned two days later. They of course collected samples, but what Mike already knew was that he was witnessing the state's most terrible outbreak of chytrids to date. All totaled, they counted 110 dead leopard frogs, and several dead Canyon Treefrogs (Figure 9).

It was at this point in this article that I found myself about to take the perilous plunge into the abyss of another 14,000-word column by going deep with an amphibian-related disease known as chytridiomycosis, which is often shortened to "chytrids" in casual conversation. Chytrids is caused by a non-hyphal zoosporic fungus called *Batrachochytrium dendrobatidis,* which is often abbreviated to *Bd.* These days, chytrids and *Bd* are so commonly used in herpetological circles that we might all think that we came out of our mother's womb familiar with both terms. But truth be told, the heartbreak of chytrids and *Bd* was not described until 1993. I knew less than nothing about it until the January 1999 Erik Enderson incident that I just described. Neither did most other amphibian experts here in Arizona. Only one other minor *Bd* die-off had been documented a few weeks previously, and one shortly after this one. But the Montrose Canyon die-off was the granddaddy of them all, and this event really kicked awareness of the disease into high gear locally.

On 9 April 1999, through an accidental chain of events too lengthy to describe here, I attended a meeting held in Phoenix that centered on the issue of chytrids and native frog populations. It so happened that Erik Enderson and I were in town for a different herpetologically-oriented symposium, when word of this meeting reached our ears. Erik wanted to go, I was his wheels for this particular symposium, so I obligingly took him. While there was no way in hell I would have gone without Erik's urging, to say that this meeting was anything but a life changing event for me would be an understatement. I do not remember much about who was at this meeting, and Don and Dennis remember even less. I only know that the room was packed with not only every local amphibian expert, but many others from across this great nation of ours. (They were all there to participate in the same symposium that Erik and I were attending.) We arrived a few minutes late, and upon our entrance, a previously-discussed gentleman by the name of Mike Sredl, who was the Coordinator of the Ranid Frogs Program for Arizona Game and Fish, was at the podium. As it turned out, Erik and I could not have bought a better time for a dramatic entrance, for Mike was in the middle of saying "and on January 5, a guy named Erik Enderson—why, *here he is now*!" I was happy

Figure 9. A series of images showing the horrific effects of chytridiomycosis (chytrids), a disease caused by the fungus *Batrachochytrium dendrobatidis* (*Bd*). The images at the left and center are the ventral and dorsal sides of two different *Rana yavapaiensis* that have died from the disease. The right side image is a Canyon Treefrog (*Hyla arenicolor*) that suffered the same fate. All three images were taken by Erik F. Enderson on 7 January 1999 in Montrose Canyon, Catalina Mountains, Pima County, Arizona. Erik and his colleagues counted 110 dead leopard frogs that day. See text for further details.

for Erik, for like so many of us, gaining recognition and acceptance from the academic herpetologists meant *everything* to him. As the meeting progressed, I watched many gory images of what happens when *Bd* takes control of a frog population. As I saw these horrible things—these piles of red-legged frogs floating downstream whilst quivering in their spasmodic death throes—I issued a silent promise to myself that ***NEVER*** would I be responsible for such a thing happening on account of anything that I did or didn't do. As if in response to this promise to myself, a young woman performed a demonstration of what is now standard operating procedure for *anybody* doing hands-on research with amphibians worldwide. As visual aides to her demonstration, she had a five-gallon bucket, a scrub brush, a bottle of ISO alcohol, a gallon of bleach, and a dip net. She showed us everything that needed to be done to sterilize each, placing particular emphasis on her boots. By the end of that demonstration, my mind was set. From that day forth, I would be keeping my boots dry, and any admiration or photos of frogs would be kept at a distance. And the simple act of allowing one's boots to dry between visits to riparian corridors *greatly* enhances the odds of a pleasant and non-intrusive hike along a favored watercourse to *be* exactly that: a non-intrusive hike.

My message to all of you readers is this: *Please* do not attempt to handle any frogs or turtles just to get a photo when you are blessed to be in such places. If it was in my power to whop *everybody*—biologists and lay people alike—upside the head with a two-by-four to get their attention, I would do so here. Don and Dennis are pros at their respective duties, and they do not touch the frogs they encounter when in the field. They do and act like any of the rest of us *should* do and act by treating these creatures with the respect that is required. If we *all* pretend that *they* are disease vectors to *us,* the world will be a better place. I will include a document at the conclusion of this article that we should *all*—from greatest to least—be aware of. And if you are not willing to do any of this, please keep your streamside admiration and photography at a distance, and keep your boots dry. Trust me, you don't want to see what happened at Montrose happen to any of your favorite places.

Montrose Canyon Alternate Ending Number 1—Despair

I have not been to Montrose Canyon since the 1996 field trip mentioned above. And I certainly did not go there after that 1999 outbreak. Sadly, the 1999 chytrids outbreak is like kissing a pretty girl compared to other factors that have recently been hurled by nature at this canyon. The next two images of this column deal with Montrose Canyon being ground zero in the tragic Bighorn Fire (Figure 10). A lightning strike occurred on 5 June 2020 on the north side of the front range of the Catalina Mountains—directly above Montrose Canyon. Before that fire was finally extinguished on 23 July 2020, it had consumed 119,978 acres, was the biggest fire ever to hit the Catalina Mountains, and took nearly 1,000 firefighters to bring under control. Going hand in glove with the destructive force of the Bighorn Fire is the worst drought in weather history, which in Tucson, goes back 130 years. *Nobody alive has ever seen such a drought!* It is hard to imagine any of the beautiful water holes of Montrose Canyon being anything but fire-retardant infested, silt-laden holes, and the trees that used to shade this lush canyon as being anything but vertical charcoal briquettes. It *can't* be too good, and will probably not get any better for the remainder of not only my own life, but the lives of those who will follow for generations to come. I just wish there was a way to know for sure. But in my heart, I know the place *must* be toast.

Montrose Canyon Alternate Ending Number 2—Reality and Maybe Even Hope . . .

During the latter phases of preparing this column, Dennis Caldwell mentioned that a wildlife biologist named Ian Murray had been surveying various canyons in the Santa Catalina Mountains, and that Ian might have recently been in Montrose Canyon. This gave my heart a little leap of joy, for I had actually met Ian twice before. He is highly skilled in the field, and a motivated field herpetologist to boot. The first time we met was in May of 2018, and the second was at a Tucson Herp Society meeting in June of that same year. We had several email exchanges after that as well. We tried to hook up to go after the local tortoises, but we could never quite swing an outing together. I was highly impressed with him. As I already had his email contact info, I contacted him via that medium. That happened a scant six days ago. In the exchanges that followed, Ian told me that he had never been to Montrose Canyon, but had worked a different watercourse that was nearby. Incredibly, he

Figure 10. The opening act of the Bighorn Fire, which began as a lightning strike on 5 June 2020, and was not extinguished until 23 July 2020. Montrose Canyon is directly below the bottom limits of both images. See text for further details. Images by John M. Slone, 6 June 2020—the day after the fire started.

Figure 11. It appears that against all odds, Montrose Canyon has survived everything that man and nature have hurled at it. On 26 June 2021, Ian Murray, a wildlife biologist, hiked this canyon specifically for this article, and these images are but a token fragment of what he saw. (Left): Ian saw over 500 Canyon Treefrogs (*Hyla arenicolor*) on his hike. (Right): While the signs of severe drought are apparent in this pool, the treefrogs observed, along with this pool of standing water, show that the canyon is still surviving if not thriving. Ian saw 15 similar pools on his hike. Images by Ian Murray.

offered to go Montrose to take a look. I could not have asked my very best friend in the world to do such an *enormous* favor for me. But I certainly didn't want to send him there without his being sure what this column is all about. I sent him the rough draft, which was finished with the exception of everything that falls under these "alternate ending number 2" paragraphs. As the reader may have noticed, I was basically throwing Montrose Canyon to the dogs with ending number 1 by stating "I know the place *must* be toast."

Well, Ian was as good as his word. He went there just yesterday (26 June 2021). I learned many lessons from all this, but the most important lesson of all is to never count out the resilience of Mother Nature, even when all seems hopeless. Amazingly—probably as a result of the fantastic efforts of our hotshot firefighters—the Bighorn Fire spared the bottom of Montrose Canyon. The fire went up and over the top of the north side of the front range of the Catalinas, and spread eastward from there. The slurry that the reader can see in the right side of Figure 10 certainly played an effective role in keeping the fire out of the canyon. To be sure, parts of the canyon had burned, but the willows, ash trees and other hardwoods in the bottom of the canyon survived unscathed. In all, Ian counted 15 pools still holding water, and saw over 500 *Hyla arenicolor*, as well as their tadpoles. One dead *Kinosternon sonoriense* was found as well. Only one dead mud turtle is actually a good sign. If severe fire damage or drought was affecting the mud turtle populations there, Ian would have been tripping over their corpses. While there were not any *Thamnophis* or *Rana* encountered, that does not necessarily indicate that they are no longer there. The bottom line is that things are *much* better than I could have hoped for in Montrose (Figure 11). Should we receive even a normal monsoon this summer, the place *will* heal. Thanks to a hurricane named Enrique slugging its way northward into the Gulf of California, rain—and a lot of it—is in the near-term forecast. Things *are* looking up!

From snakes to frogs to *what*?

I promised at the beginning of this column to circle back to Dr. Hans-Werner Herrmann. While it's true that he and I went our separate ways shortly after our discussion on potential frog studies, there were other reasons for us parting company. That would all fall under the category of nobody's business but ours. However, I wish him well, and remain grateful for the help he gave us on our telemetry study, as well as the technical help that he continues to give Dr. Gordon Schuett with the DNA and genome aspects of the Suizo Mountain Project. As a goodwill gesture, I initiated a meeting with him several months ago because I wanted to give him something. That something was the August 2020 *Bulletin of the Chicago Herpetological Society*. His image of Tiger Rattlesnakes in courtship graces the cover of that issue, and I wanted him to have it. We of course chatted a bit, and got caught up on things. He has definitely moved on to other pastures with his field studies. Note that I did not say "greener" pastures. We will highlight his *fascinating* new research objects thusly: "One word: Snails." Yes, sirs and madams, he now studies snails. Boy, those are really happening beasts for sure! I hear that they fight with a savagery not equaled in nature—snail slime all over the place. And we are all familiar with their elegant reproductive behaviors. There is nothing like witnessing snail sex in the wild. And when they overpower a leafy vegetable, it is a sight to behold. I forgot to ask him if he ever leads snail safaris. The next time I see him, I'll ask him about it—and sign up for one if he does. I would imagine one must be careful when stalking snails, lest they get riled up and attack. There is nothing quite as terrifying or ruthless as a gang of pissed-off snails! Yes, sirs and madams, it is easy to get all sorts of excited over snails. They are not at all like those *boring* snakes . . .

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.

Acknowledgments

The author is indebted to Dennis Caldwell, Don Swann, and Erik Enderson for many things, not the least of which are my warm memories of the beauty of Arizona's riparian corridors. I

will remain ever-grateful to Ian Murray for his exploration of Montrose Canyon, and his resulting images and written documentation of this fantastic canyon. Ian's extraordinary effort will one day open doors to long term data on a place that has been under watch for nearly three decades. If he is trying to make a name for himself, he just did.

Addendum

As a simple reminder to CHS members about the importance of an abundance of caution when herping along any of our watercourses, the author wants to share this document prepared by the **D**eclining **A**mphibian **P**opulation **T**ask **F**orce (DAPTF). While this "Fieldwork Code of Practice" pertains mainly to hardcore, hands-on research, the dangers of reckless handling, for any reason, of plants or animals of any kind in our wetlands should be apparent. The author and his like-minded, frog-loving friends all encourage you to enjoy our watercourses to the fullest, while keeping any intrusions at a safe distance. Practicing social distancing when photographing herps is the safest way to avoid contamination and possible extinction of the animals that we love.

Fieldwork Code of Practice

A code of practice, prepared by the Declining Amphibian Population Task Force to provide guidelines for use by anyone conducting field work at amphibian breeding sites or in other aquatic habitats. Observations of diseased and parasite-infected amphibians are now being frequently reported from sites all over the world. This has given rise to concerns that releasing amphibians following a period of captivity, during which time they can pick up unapparent infections of novel disease agents, may cause an increased risk of mortality in wild populations. Amphibian pathogens and parasites can also be carried in a variety of ways between habitats on the hands, footwear, or equipment of fieldworkers, which can spread them to novel localities containing species which have had little or no prior contact with such pathogens or parasites. Such occurrences may be implicated in some instances where amphibian populations have declined. Therefore, it is vitally important for those involved in amphibian research (and other wetland/pond studies including those on fish, invertebrates and plants) to take steps to minimize the spread of disease and parasites between study sites.

1. Remove mud, snails, algae, and other debris from nets, traps, boots, vehicle tires and all other surfaces. Rinse cleaned items with sterilized (e.g. boiled or treated) water before leaving each study site.

2. Boots, nets, traps, etc., should then be scrubbed with 70% ethanol solution (or sodium hypochlorite 3 to 6%) and rinsed clean with sterilized water between study sites. Avoid cleaning equipment in the immediate vicinity of a pond or wetland.

3. In remote locations, clean all equipment as described above upon return to the lab or "base camp". Elsewhere, when washing machine facilities are available, remove nets from poles and wash with bleach on a "delicates" cycle, contained in a protective mesh laundry bag.

4. When working at sites with known or suspected disease problems, or when sampling populations of rare or isolates species, wear disposable gloves and change them between handling each animal. Dedicate sets of nets, boots, traps, and other equipment to each site being visited. Clean and store them separately and the end of each field day.

5. When amphibians are collected, ensure the separation of animals from different sites and take great care to avoid indirect contact between them (e.g., via handling, reuse of containers) or with other captive animals. Isolation from un-sterilized plants or soils which have been taken from other sites is also essential. Always use disinfected/disposable husbandry equipment.

6. Examine collected amphibians for the presence of diseases and parasites soon after capture. Prior to their release or the release of any progeny, amphibians should be quarantined for a period and thoroughly screened for the presence of any potential disease agents.

7. Used cleaning materials (liquids, etc.) should be disposed of safely and if necessary taken back to the lab for proper disposal. Used disposable gloves should be retained for safe disposal in sealed bags.

Minutes of the CHS Board Meeting, June 18, 2021

A virtual meeting of the CHS board of directors via Zoom conference video/call was called to order at 7:35 P.M. Board members Rachel Bladow, Rich Crowley, Stephanie Dochterman, John Gutierrez and Kyle Houlihan were absent. Nonmembers of the board in attendance were Zorina Banas and Joan Moore. Minutes of the May 14 board meeting were read and accepted with changes.

Officers' reports

Treasurer: John Archer summarized the May financial report. He asked that thank-you letters be sent to acknowledge two large donations. There was a discussion about putting thank-you notices in the *Bulletin*.

Vice-president: John reported that Rachel had not yet confirmed speakers for July and August.

Membership secretary: Mike Dloogatch read the list of those whose memberships have expired, and reported a small drop this month.

Old business

John Archer has been working on improving the CHS website. He has reached a point where he is going to need Kim Klisiak's help.

Stephanie Dochterman is still working on creating a YouTube channel for the CHS.

We will continue to do without liability insurance until such time as we resume in-person meetings and live animal displays.

The meeting adjourned at 8:19 P.M.

Respectfully submitted by recording secretary Gail Oomens

Bulletin of the Chicago Herpetological Society 56(7):127, 2021

Herpetology 2021

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.

SPRACKLANDUS UPHELD AS AVAILABLE NAME

International Commission on Zoological Nomenclature [2021, Bulletin of Zoological Nomenclature 78:42-45] in Opinion 2468 (Case 3601) finds no basis under the provisions of the Code for regarding the name *Spracklandus* Hoser, 2009 (Reptilia, Serpentes, Elapidae) as unavailable, nor for regarding any of issues 1–24 of *Australasian Journal of Herpetology* as being unpublished in the sense of the Code, but the Commission has declined to use its powers to confirm what is obvious. The Commission is not empowered to take Appendix A of the Code (Code of Ethics) into account in its rulings on this or any other case.

A NOVEL FEEDING STRATEGY FOR A SNAKE

H. Bringsøe et al. [2020, Herpetozoa 33:157-163] describe a hitherto unknown feeding mode among snakes for the colubrid snakes *Oligodon fasciolatus* (small-banded kukri snakes) in northeast Thailand. Three cases are described of *O. fasciolatus* using enlarged posterior maxillary teeth to cut open abdomens of live poisonous toads, *Duttaphrynus melanostictus* (Asian common toads), and eat their organs. The toads fought vigorously, and secreted toxic white liquid on the dorsum and neck. The snakes inserted their heads into the abdomens of the toads, pulled out some of the organs and swallowed them. The snakes and toads were adults. All three cases were documented by extensive photographic material. In a fourth case from central Thailand, an adult *O. fasciolatus* was observed swallowing an entire subadult *D. melanostictus*. The vast majority of all snake species swallow their prey in one piece, but to place their observations in a broader context the authors review exceptions.

REPTILE POACHING IN PAKISTAN

R. Masroor et al. [2020, Herpetozoa 33:67-75] note that southwestern Balochistan Province is a faunal extension of the Iranian Plateau in Pakistan, harboring more than a third of Pakistan's known amphibian and reptile species. The authors carried out field visits in five districts of southwestern Balochistan during 2013–2017 to investigate the scale and hotspots of reptile poaching. They encountered 73 illegal collectors possessing 5,369 live reptiles representing 19 species in ten families. Overall, *Teratoscincus keyserlingii*, *T. microlepis* (both Sphaerodactylidae), *Phrynocephalus maculatus* and *P. luteoguttatus* (both Agamidae) were the most collected lizards, having a relative abundance of 22.4%, 13.5%, 11.9% and 11.3 %, respectively. *Eumeces schneiderii zarudnyi* (Scincidae) was among the least collected lizards. Similarly, *Lytorhynchus maynardi* (Colubridae) and E*ryx tataricus speciosus* (Erycidae) were the most abundant snakes in the total collection (4.4% and 3.0%, respectively). Among the poached reptiles were internationally protected species: *Varanus griseus caspius* (Varanidae; CITES Appendix-I), *E. t. speciosus* (Appendix-II), *Naja oxiana* (Elapidae; Appendix-II), and *Saara asmussi* (Uromastycidae; Appendix-II). The overall trend of illegal reptile poaching steadily decreased during the study period (from 1,724 individuals in 2013 to 633 in 2017). According to collectors, poached reptiles were largely destined for the pet trade, but also targeted other markets including folk medicines and snake charmer shows. One hotspot for collection of reptiles was identified, and should be a focus of law-enforcement activities. This case study partly demonstrates the effectiveness of strict enforcement of recently amended provincial wildlife protection legislation in the less studied regions of Asia.

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 785-224-7291 or by e-mail at kelhal56@hotmail.com

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

Kristi Anderson
Molly Anne Bishop
Carol Hajkowicz
Marcia Rybak
Alyssa Turner
Melissa B. Youngquist

UPCOMING MEETINGS

Until in-person meetings again become possible the Chicago Herpetological Society will be holding monthly general meetings online via Zoom webinar. A notification will be sent by email to all members who have supplied us with an email address. As has been our custom for over 50 years, the meetings will be held on the last Wednesday evening of each month. The speaker for the July 28 webinar will be **Kevin Barrett**, reptile and amphibian collection and conservation manager at the Maryland Zoo in Baltimore. Kevin has worked at the zoo for over 14 years, and has held his present position since 2013. He is also the Association of Zoos and Aquariums Species Survival Plan vice-coordinator and studbook keeper. Kevin will be talking about saving the Panamanian golden frogs: the in-situ breeding center and conservation work, and the successful breeding program here in the US.

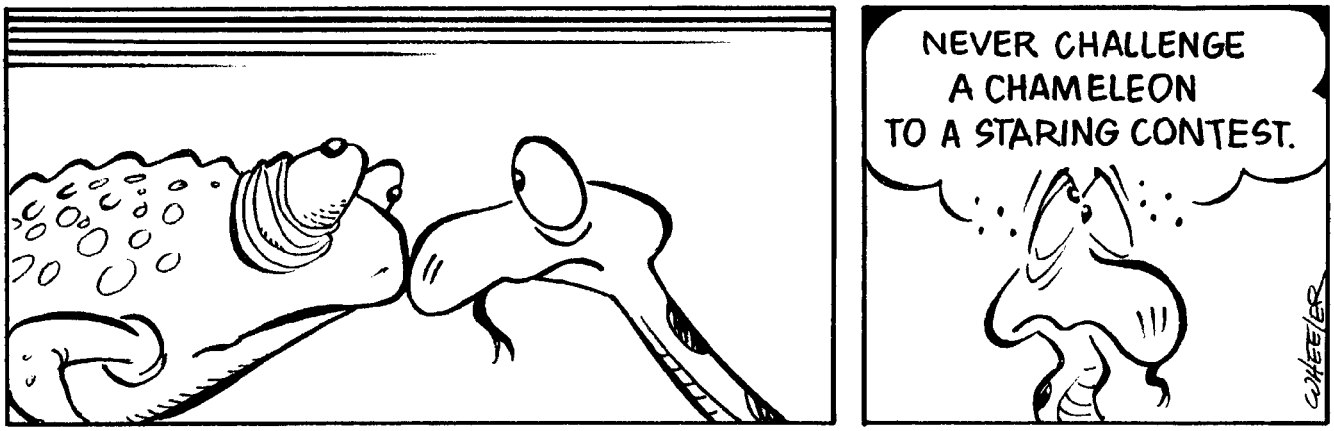
A speaker for the August 25 meeting has not yet been confirmed.

Please check the CHS website or Facebook page each month for information on the program. Information about attending a Zoom webinar can be found here:
<https://support.zoom.us/hc/en-us/articles/115004954946-Joining-and-participating-in-a-webinar-attendee->

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? The next board meeting will be held online. If you wish to take part, please email: mdloogatch@chicagoherp.org.

THE ADVENTURES OF SPOT



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