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THIS MONTH'S PROGRAM

Photographic Potpourri, Potluck, and Business Meeting

6:00 PM; Monday, 17 December 2018

Ward 3 Office Conference Room, 1510 E Grant Rd, Tucson, AZ

Gear up for another fun-filled December meeting that will include a photographic potpourri, potluck, and business meeting. Here is an opportunity to display some of your favorite digital images. These images could simply be your best from 2018, your favorites of all time, they might tell a story, or they might take the form of a short powerpoint presentation that you'll share with the other members on the big screen. It's all up to you. Just make sure what you bring takes about 5 minutes or less to show so others have time to display their images, too. Bring your images on a flash drive. If they are not in a powerpoint format, remember they will be displayed in numerical/alphabetical order in File Explorer. So if the order of your pictures matters, number your image file names.

We'll also have a potluck! Bring something to share—main dishes, side dishes, finger food, beverages, chips and salsa, desserts, whatever. Bring an appetite, too! Then alongside all of this we will be electing officers for 2019 and planning for future field trips. Note that for this meeting we have a novel start time and day of the month—Monday the 17th at 6 pm. Contact your Program Chair, Jim Rorabaugh, at *jrorabaugh@hotmail.com* with any questions.

Great Plains Toad (*Anaxyrus cognatus*) on the western bajada of the Dragoon Mountains, AZ. Photo by Jim Rorabaugh.

FUTURE SPEAKERS

16 January 2019—John Murphy: Giant Snakes, as Human Predators, Invasive Species, and Living Works of Art

20 February 2019—John Kraft: An Overview of Amphibian and Reptile Management on the Coronado National Forest, Sierra Vista Ranger District

RESEARCH ARTICLES

BOOK REVIEWS

RESEARCH ARTICLE

Notes on Reproduction of the Arizona Treefrog, *Dryophytes wrightorum* (Anura: Hylidae) from Arizona

Stephen R. Goldberg, Whittier College, Department of Biology, Whittier, CA; *sgoldberg@whittier.edu*

Dryophytes wrightorum (Taylor, 1939) (as *Hyla wrightorum*) (Fig. 1) occurs in the mountains of central Arizona and western New Mexico south in the Sierra Madre Occidental to Guerrero, Mexico (Stebbins 2003). The biology of *D. wrightorum* is summarized in Gergus et al. (2005). Reproduction of *D. wrightorum* (as *H. eximia*) in Arizona and New Mexico occurs during the summer rainy season in temporary and permanent ponds (Degenhardt et al. 1996, Brennan and Holycross 2009). Chapel (1939) reported that *D. wrightorum* (as *Hyla wrightorum*) reproduction extended from June to August in Arizona but was dependent on summer rains which delimited the breeding season. Duellman (2001) reported *D. wrightorum* (as *Hyla wrightorum*) reproduction occurred in late June and July. *Dryophytes wrightorum* metamorphs occur in September and October (Murphy 2018). In this paper I present data from a histological examination of *D. wrightorum* gonadal material from Arizona. Utilization of museum collections for obtaining reproductive data avoids removing additional animals from the wild.

A sample of 45 *D. wrightorum* collected 1962 to 1994 from Arizona (Appendix) consisting of 40 adult males (mean snout-vent length, SVL = 36.9 mm ± 2.25 SD, range = 31–41 mm) and five adult females (mean SVL = 40.0 mm ± 3.4 SD, range = 36–44 mm) was examined from the herpetology collections of Arizona State University, Natural History Collections (ASU), Tempe, Arizona, USA and the Natural History Museum of Los Angeles County (LACM), Los Angeles, California, USA (Appendix). An unpaired *t*-test was used to test for differences between mean 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 ASU and LACM.

The testicular morphology of *D. wrightorum* is similar to that of other anurans as described in Ogielska and Bartmanska (2009a). Within the seminiferous tubules, spermiogenesis 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 Bartmanska 2009a). Lumina of the seminiferous tubules contained either clusters of sperm or an intertwined sperm mass. The inner periphery of each seminiferous tubule contained a ring of germinal cell cysts in various stages of development. All *D. wrightorum* males were undergoing spermiogenesis: June (n = 1), July (n = 31), August (n = 8). The smallest mature male (sperm in lumina of seminiferous tubules) measured 31 mm SVL (ASU 16910) and was

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Figure 1. *Dryophytes wrightorum*. photo by USDA Forest Service, Coconino National Forest.

from August. Adult males of *D. wrightorum* are 24–44 mm SVL (Wright and Wright 1949).

The mean body size of females was significantly larger than that of males (t = 2.8, df = 43, P = 0.008). The ovaries of *D. wrightorum* are typical of other anurans in being paired organs lying on the ventral sides of the kidneys which are filled with diplotene oocytes in various stages of development in adults (Ogielska and Bartmanska 2009b). Mature oocytes are filled with yolk droplets; the layer of surrounding follicular cells is thinly stretched. All five females, three from July (LACM 123250, 123254, 141122) and two from August (ASU 16917, 16927) were in spawning condition. One female from August (ASU 16927), in addition to mature oocytes, also contained postovulatory follicles, evidence of a recent spawning. Postovulatory follicles form when the ruptured follicle collapses after ovulation; the follicle 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 oocytes with concurrent postovulatory follicles indicates females of *D. wrightorum* may spawn more than once in the same reproductive season. It is not surprising that the female with postovulatory follicles was from August (late in the *D. wrightorum* spawning season) suggesting that the initial spawning may have occurred in July. The number of times a *D. wrightorum* female may spawn is not known. However, the presence of postovulatory follicles along with abundant mature oocytes constitute a reliable indication that some *D. wrightorum* females will spawn more than once during the same reproductive season. The smallest mature *D. wrightorum* female (spawning condition) measured 36 mm SVL (ASU 16927) and was from August. Adult *D. wrightorum* females are 24–48 mm SVL (Wright and Wright 1949).

Gravid *D. wrightorum* (as *H. eximia*) females were reported from 5 May to 2 August in San Luis Potosí and Hidalgo, Mexico (Lemos-Espinal and Dixon 2013, 2016) indicating reproduction begins earlier in southern populations than in Arizona and New Mexico.

Acknowledgments—I thank Charlotte Johnston (ASU) and Gregory B. Pauly (LACM) for permission to examine *D. wrightorum*.

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Appendix: *Dryophytes wrightorum* examined by county from Arizona borrowed from the herpetology collections of Arizona State University (ASU), Tempe, Arizona, USA and the Natural History Museum of Los Angeles County (LACM), Los Angeles, California, USA.

Apache ASU 17257, 17262, 17265, 17272, 17281, 17284, 17285; LACM 75244; **Coconino** ASU 16907, 16909, 16910, 16913, 16917, 16927, 16941, 16961, 17007, 17312, 17315, 17317, 17500, 17568, 17577, 17579, 17580, 17588; LACM 141122; **Greenlee** ASU 17134, 17143, 17172, 17175, 17176, 17197, 17201, 17202, 17230, 17291, 17293, 17295, 17298, 17299, 17303, 17305; LACM 123250, 123254.

RESEARCH ARTICLE

In the Heat of the Night: Assessing Nocturnal Activity of the Desert Iguana (*Dipsosaurus dorsalis*)

Brian R. Blais and Corey J. Shaw, University of Arizona, School of Natural Resources and the Environment, 1064 E. Lowell St., Tucson, AZ 85721; *opheodrys1@gmail.com*

The Desert Iguana, *Dipsosaurus dorsalis*, is a well-studied denizen of the desert Southwest (Bezy 2010), with a distribution largely congruent with creosote bush (*Larrea tridentata*; Norris 1953; Lemm 2009), a plant species that is tetraploid in the Sonoran Desert and hexaploid in Mohave Desert (Hunter et al. 2001). The range of *D. dorsalis* is largely encompassed by the precipitation patterns of the North American Monsoon (Mitchell et al. 2002; Guido 2008). The typical active season for *D. dorsalis* extends from March to September (sometimes as early as February and late as October) with daily peaks occurring between mid-morning and early-afternoon depending on the season (Howland 1988). This unimodal activity pattern is less common among Sonoran lizards (Bezy 2010). Remarkably, this continuous, mid-day activity period enables *D. dorsalis* to possess one of the greatest thermal maximum thresholds of any reptile, often over 105 °C (see review in Bezy 2010). This threshold equates to frequent encounters on roads (Norris 1953), albeit the road ecology of *D. dorsalis* is relatively unknown.

The diurnal activity pattern of *Dipsosaurus* is thought to be a predator-avoidance strategy (Pianka and Vitt 2003), as they may sleep less during times when saurophagous predators such as *Crotalus cerastes* are present (Revell and Hayes 2009) or that they might utilize their high thermal maximum to forage during times when other potential predators cannot (Norris 1953). Interestingly, Revell and Hayes (2009) observed desert iguanas asleep between 2000–0700 h during their *ex situ* experiment, even when a predator was introduced during night hours. Albeit infrequent, there are some instances of *D. dorsalis* activity detection at night. Klauber (1939) encountered four individuals on roads between 2105–2250 h, with T_a ranging 31.1–33.3 °C, and Norris (1953) notes two additional instances of nighttime road detection.

While road-cruising (see Rosen and Lowe 1994) on 16 August 2018 at 2145 h, we found a *D. dorsalis* motionless approximately 2 m from the edge of a paved portion of W. Silverbell Road (32.46523°N, -111.3303°W ±4 m, datum = WGS84; elev. 580 m) near Marana, Arizona. This locality is consistent with the near-easternmost distribution of the species (Bezy 2010). Initially, we thought this desert iguana was roadkill due to its stationary posture as we drove slowly past it; dead-on-road occurrences are not unheard of for *D. dorsalis*. However, as we came upon it by foot, the lizard bolted quickly to the nearest cover, a patch of creosote bushes about 4 m away (Fig. 1). Interestingly, Lemm (2009) reported this behavior trend in that *D. dorsalis* seem to ignore cars but scurry once approached by foot. This particular lizard seemed intent on avoiding us by either remaining motionless in the center and thickest part of the creosote or by bolting to the next adjacent bush. We were able to record a few photographs before it escaped us. Weather data at the time of observation was T_a = 29.2 °C; rH = 59.5%; Pb = 949.5 hPa; wind = 0.9 m/s. There were scattered clouds overhead and although it was not raining, a monsoonal

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Figure 1. Nocturnally active Desert Iguana (*Dipsosaurus dorsalis*) that had been displaying thermoregulatory behavior on a paved road, only to scurry to cover as we approached.

thunderstorm was approaching from the east. It should be noted that during the same road-cruise we also observed active crotalids nearby, including *C. cerastes* and immature *C. atrox*. It is plausible that this individual *D. dorsalis* was exhibiting nocturnal activity due to arousal from a threat, however, the motionless posture on the road was more suggestive of thermoregulatory behavior (i.e., conductive basking). Using a laser thermometer, we found *in situ* asphalt temperature (T_g = 33.9 °C) to be warmer than ambient temperature by nearly 5 degrees Celsius. We were unable to detect whether the lizard's eyes were open (hence alertness) or closed (i.e., sleeping) upon our first pass before it darted away (see Revell and Hayes 2009).

This seemingly unusual nocturnal observation inspired us to investigate into the nocturnal ecology of *D. dorsalis* and if certain abiotic factors (e.g., time, season) influence such surface activity (i.e., surface observable presence). Due to a contemporary trend toward inclusive, citizen-science initiatives and corresponding data accessibility and the growing datasets therein, we examined *Dipsosaurus dorsalis* observations through two prominent citizen-science platforms. First, we explored the taxonomically-broad *iNaturalist* (inaturalist.org), an increasingly popular citizen-science platform with approximately 382,000 users contributing nearly 13.8 million observations across over 181,000 species (at the time of writing). We then compared data generated from *HerpMapper* (2018), a citizen-science platform specifically for global biodiversity tracking of herpetofauna, complete with over 7,500 users contributing more than 237,000 records. There is a growing list of benefits stemming from citizen-science platforms, but some sampling biases across space and/or time must be carefully considered (Tiago et al. 2017). Congruent with literature and findings by Klauber (1939) and Norris (1953), we predicted that night observations of *D. dorsalis* would constitute merely a small proportion of daily observations. Because it has been noted that *D. dorsalis* surface activity does not appear to shift during the onset of the early stages of the monsoon and only briefly when young emerge on the landscape (Norris 1953; Lemm 2009), we did not expect to find differences between seasons in *D. dorsalis* surface detections.

Methods

To examine occurrences of nocturnal behavioral ecology in *D. dorsalis*, we analyzed observational record metadata from *iNaturalist*, between 5 March 2005 and 16 August 2018 as well as records from *HerpMapper*, from 6 April 2008 to 18 August 2018. Because age class and sex of are often not recorded or easily determinable by citizen-scientist observations, we included records without assuming sex or life stage. Further, we took several measures to reduce any temporal biases associated with these observational datasets. First, we

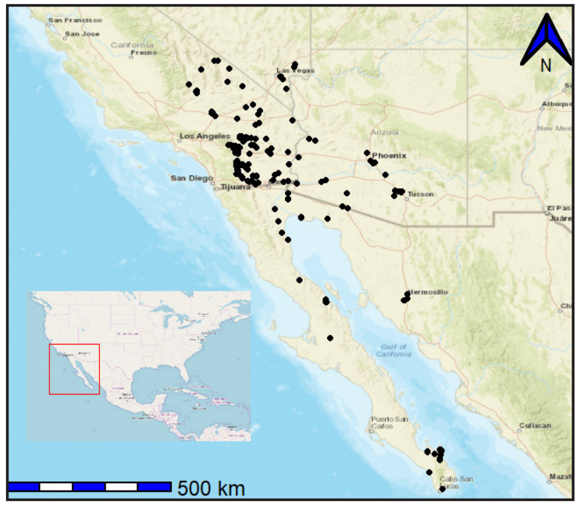

Figure 2. Sub-sampling map of *Dipsosaurus dorsalis* detections with geocoordinate accuracy ≤100 m (n = 321). Citizen-science data from *iNaturalist*.

limited observations to only those with specified observation times and recorded in spatially-accurate time zones consistent with the species range (e.g., Pacific; see Fig. 2). For instance, we removed any data with Eastern Time Zone because *D. dorsalis* does not range where that zone occurs or if precise time could not be determined. We then corrected for UTC factor across all time zones and sorted records into categorical 3 h bins (e.g., 0000–0300 = midnight to 2:59:59 AM, …, 2100–2400 = 9:00:00 to 11:59:59 PM). We also verified or corrected each putative night observation (i.e., from 2100–0600 h) for timestamp accuracy. For instance, some observations were recorded at 2300 h but upon inspection of photographic vouchers, overhead sunlight was obvious, and the entry was likely an electronic timestamp error for 1100 h, or at least during a diurnal period. We also omitted night observations of deceased individuals as true time of death is unlikely to be determined. Finally, we sub-partitioned records that occurred actively during the North American Monsoon (15 June – 30 September; see Guido 2008) versus those occurring outside that period. Because the North American Monsoon has a substantial influence across the range of *D. dorsalis*, we used this variable as an indicator of "season" (i.e., active monsoon periods vs. outside of monsoon). Because these citizen-science observations/data are typically derived without systematic scrutiny (and meant to be more inclusive to non-scientists), we caution there may be missed discrepancies (e.g., data entry error) and/or sampling bias (e.g., localities predominantly along roads/trails).

We used custom MS Excel scripts to generate descriptive statistics for the resulting data bins. To test whether time bin frequencies differed between periods of active versus inactive monsoon (i.e., daily activity across season), we used Pearson's chi-square test (χ^2) for a 2 × 8 contingency table analysis. The null hypothesis is that there is no difference in time bin frequency during or outside of monsoon season. Some biostat-

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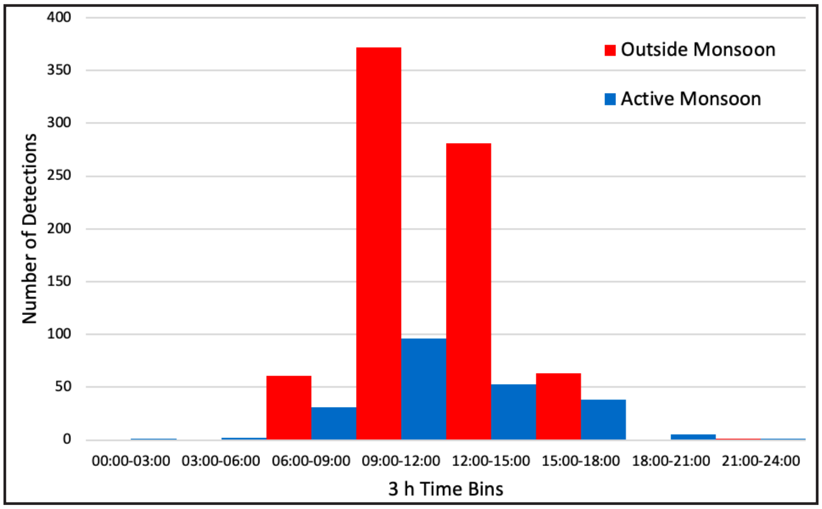

Figure 3. Histogram of 3 h time-bin windows for desert iguana *Dipsosaurus dorsalis* detections (i.e., observations) from *iNaturalist* between 5 March 2005 and 16 August 2018. Blue values represent records during the active North American Monsoon period (June 15–September 30); red values indicate detections outside of the monsoon window.

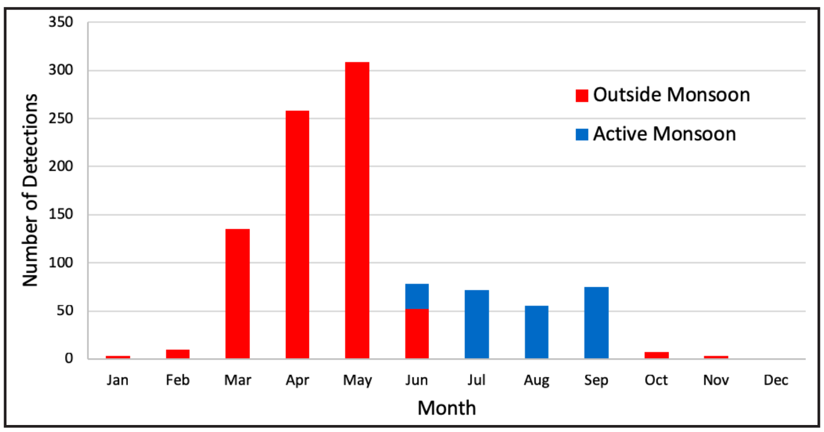

Figure 4. Monthly distribution of *D. dorsalis* observations in *iNaturalist* from March 2005 to August 2018. Red bars indicate times outside of North American Monsoon, whereas blue bars indicate active monsoon periods.

isticians urge caution when dealing with insufficient (i.e., small) expected frequencies in chi-square analyses (Zar 1999). Zar (1999) noted that the *G*-test of independence may overcome issues to potential sample bias in chi-square fit tests, albeit the conclusions are often congruent. To investigate test congruence and categorical sampling bias, we also ran the *G*-test of independence. To further test independence between day versus night activity and between active and inactive monsoon seasons, we concatenated both citizen-science datasets and ran a 2 × 2 chi-square contingency table. We used R software (R Core Team 2013) to compute chi-square and *G* tests.

Results

For all literature credibility, *D. dorsalis* is undoubtedly a diurnal species. Congruent with most authors, *D. dorsalis* is most frequently encountered between 0900–1500 h. (Fig. 3). Our *iNaturalist* results show that across the *D. dorsalis* range, only 7 of 1005 (< 1%) observations were recorded at night, including our own (*iNaturalist* #15569050). Six of seven nocturnal records depicted the animal on paved road and the remaining record's geocoordinates place it adjacent a road. Although daily activity patterns are unimodal regardless of season, there was a significant difference (χ^2 = 57.6, df = 7, $P < 0.001$) in time bin frequencies between non-monsoonal times and active monsoonal periods (Table 1). There was no difference between conclusions drawn from chi-square and *G* tests. More overall detections occurred outside of monsoonal periods. Norris (1953) reported sexual activity peaking in May and by mid-June (i.e., onset of monsoon) most gravid females have retreated underground. We found similar activity trends from the *iNaturalist* dataset as most *D. dorsalis* detections occurred in the spring months (March–May) before drastically tapering off in June onwards (Fig. 4). Of interest, all but one nocturnal detection occurred within the monsoonal period. There were also a few *iNaturalist* records of *D. dorsalis* diurnal activity as early as 12 January and late as 11 November, extending the known active season capacity for this species – albeit those dates should be confirmed with respective observers.

Congruently, our *HerpMapper* findings produced

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Table 1. Chi-square results of daily time bin observations (obs) and uncertainty (residuals) for active and inactive monsoon periods between 5 March 2005 and 16 August 2018 [date span]. Active North American Monsoon period is from June 15–September 30, whereas inactive monsoon is outside of that time window. Data from *iNaturalist*.

	Monsoon inactive		Monsoon active		
Time-bins	**obs**	**residuals**	**obs**	**residuals**	**obs total**
00:00-03:00	0	-0.88	1	1.629	1
03:00-06:00	0	-1.244	2	2.304	2
06:00-09:00	61	-1.211	31	2.242	92
09:00-12:00	372	0.51	96	-0.944	468
12:00-15:00	281	1.396	53	-2.584	334
15:00-18:00	63	-1.718	38	3.18	101
18:00-21:00	0	-1.967	5	3.642	5
21:00-24:00	1	-0.441	1	0.816	2
Total	**778**		**227**		**1005**
$\chi^2 = 57.6$, df = 7, $P < 0.001$					

a similarly small ratio of nocturnal records, merely 16 out of 439 (3.6%) during our temporal scan. Our concatenated tests revealed significant differences (χ^2 = 38.8, df = 1, $P < 0.001$) between day versus night surface presence and active vs. inactive monsoon period (Table 2). Table 3 categorizes nocturnal records from *HerpMapper* including time bins, age-class, and substrate type. Most of these night observations occurred on paved roads, and multiple observers reported that they found individuals sleeping on the road, only to bolt at the last instance. Night detection times were evenly distributed between after-sunset (e.g. 1800–2400 h) and pre-dawn (e.g. 0000–0600 h), although all early morning sightings occurred during monsoonal periods whereas night detections outside of the monsoon only occurred between dusk to midnight. Adults were more likely to be detected than juveniles by a 3:1 ratio and all *HerpMapper* observations ranged between the 32nd and 35th latitudes (southern California and southwest Arizona), but that may be the result of observer bias. Per *HerpMapper* records, the earliest seasonal night detection occurred on 30 March (2206 h; rock) and the latest on 1 November (2230 h; sand).

Discussion

We provide evidence for the benefits and usefulness of citizen-science data. Although caution must be taken during any analyses of non-systematically recorded observations, we believe the benefits outweigh the costs. The sheer number of people involved over space and time are not likely to be replicated in a scientific protocol due to logistical and resource demands. Further, encouraging citizen-science participation facilitates public sector involvement in scientific endeavors. We find this to be an invaluable link to bridging communication channels between scientists and public stakeholders.

Our analyses support several known characteristics about *Dipsosaurus dorsalis* life history. This species is most active during daylight hours and can be detected during the hottest part of the year (e.g., late June). Although some authors note a decrease of (adult) *D. dorsalis* surface activity once young appear (i.e., July–August; Lemm 2009), we found that records of surface-active *D. dorsalis*, regardless of age class, are drastically reduced during the May–June transition. Admittedly, this could be due to *in situ* sampling bias (e.g., observers may be less active during these times), albeit our datasets comprise over 1,400 observations across nearly 10 years. It would be of interest to resample localities where prior authors noted that adult activity is high until young are present. It is important to examine abiotic factors such as precipitation and temperature at these localities to compare their impact on both adult and juvenile activity.

Regardless of time of year or season, we support Howland (1988) in that *D. dorsalis* is predominantly found during late mornings and early afternoons, specifically between 0900–1500 h. We found substantially more records of surface activity in times outside of the active monsoonal period (ratio 4.38:1), specifically before its onset (i.e., May to early June). Outside of monsoon, activity is largely nonexistent after 1800 h and does not pick up again until the morning daylight hours (e.g., 0600–0900 h). Activity within the monsoonal period seems to follow a similar trend. Night detections were sparse regardless of season.

We also present some evidence that *D. dorsalis* occasionally employs opportunistic nocturnal behaviors. This might include strategies to thermoregu-

Table 2. Chi-square analysis of activity intervals between active (Mon1) and inactive (Mon0) monsoon periods. Data are concatenated between *iNaturalist* and *HerpMapper* datasets.

	Intervals of Activity		
Monsoon	**Day**	**Night**	**obs total**
Mon0	1081	6	1087
Mon1	337	20	357
Total	**1418**	**26**	**1444**
$\chi^2 = 38.8$, df = 1, $P < 0.001$			

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Table 3. Descriptive statistics for nocturnal *D. dorsalis* records from *HerpMapper*. Data is divided into 3 h *time-bins*, beginning at midnight; n = total number of observations per bin; *mon-ratio* = ratio of detections during inactive monsoon (left fraction) versus active monsoon (right fraction); *age-ratio* is the distribution of adult (A; left fraction) versus juvenile (J; right fraction); *road*, *rock*, and *sand* refer to the substrate type which the detection occurred on. *two substrate types from the 2100-2400 bin records were undeterminable.

Time-bins	*n*	mon-ratio	age-ratio	road	rock	sand
0000-0300	4	0/4	3A/1J	4	0	0
0300-0600	4	0/4	2A/2J	4	0	0
1800-2100	1	0/1	1A/0J	0	0	1
2100-2400	7*	5/2	6A/1J	2	2	1
Total	**16**	**5/11**	**12A/4J**	**10**	**2**	**2**

late on paved roads that likely maintain temperatures above ambient, especially during the North American Monsoon season. In the southwestern desert habitats, some of the hottest periods of the year occur after mid-June and during subsequent, intermittent precipitation events. *Dipsosaurus* might be employing a novel strategy to avoid the most extreme heat of the day by extending thermoregulatory behavior into cooler hours. More research into a potential thermoregulatory behavior transition is warranted, especially during contemporary warming and drying climate trends that impact processes of the North American Monsoon (Cook and Seager 2012). It is unknown if *Dipsosaurus* is at the cusp of extending thermoregulatory processes into nocturnal times more regularly as a result of a changing climate. Research has shown that some lizard species have no choice and must rapidly adapt to environments changing quicker than species can tolerate (Sinervo et al. 2010). Over the last 10 years, both the *iNaturalist* and *HerpMapper* datasets reveal several observations extending annual seasonality for *D. dorsalis* in both directions —albeit from a small number of individuals and not yet reflective of the species as a whole. Could this be an early indicator that this lizard might be trending towards making use of an extension of a hotter and drier climate in the American Southwest? Regardless, we caution these uncommon night encounters are still likely the exception and not the norm as records remain infrequent in both literature and citizen science observations.

A nighttime, road basking strategy may come with both natural costs, such as exposure to nocturnal predators (Sperry et al. 2013) and anthropogenic risks such as road mortality since small herpetofauna are hard to detect, especially at night (Rosen and Lowe 1994). We note that despite the seemingly light traffic volume where we detected our nocturnal observation, that area does produce moderate amphibian and reptile roadkill (Blais et al. unpublished data). Klauber (1939) noted that *D. dorsalis* "...are rather inquisitive and curious; they often stop in the road to observe an oncoming car with fatal results [*sic*]".

Dipsosaurus might be employing a novel strategy to avoid the most extreme heat of the day by extending thermoregulatory behavior into cooler hours. More research into a potential thermoregulatory behavior transition is warranted, especially during contemporary warming and drying climate trends that impact processes of the North American Monsoon (Cook and Seager 2012).

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GEOGRAPHIC DISTRIBUTION NOTE

New record of the Milky Pepper Treefrog (*Trachycephalus typhonius*; Hylidae, Amphibia) in the Natural Protected Area of Reserva de la Biosfera de Marismas Nacionales, in the municipality Tecuala, Nayarit

Jesús A. Loc-Barragán, Biodiversa Comité Nacional para la Conservación de Ecosistemas Mexicanos A.C. Ajijic, Jalisco, Mexico. Asociación para la Investigación y la Conservación de los Anfibios y Reptiles (AICAR) A.C., Región Noroeste. Tepic, Nayarit, Mexico; *biolocbarragán@gmail.com*

César Barrio-Amorós, DocFrog Expeditions, Uvita, Costa Ballena, Costa Rica

The Milky Pepper Treefrog (*Trachycephalus typhonius*) is a native hylid of México, Central, and South America (Amphibiaweb 2018). La Marca et al. (2010) mention that the species is found in different disturbed habitats including human dwellings, as well as in open or moist to dry forested situations. Duellman (1970) documented that the species occurs within the Pacific states of Mexico south of Sinaloa. Luja et al. (2014) reported its occurrence within the state of Nayarit. Woolrich-Piña et al. (2016) documented its distribution in the following biogeographic regions: Coastal Plain and Trans-Mexican Volcanic Belt adjacent to Nayarit. Its conservation status is category L (4) = Low vulnerability species, proposed by Wilson et al. (2013), category LC = Least Concern, proposed by IUCN (2018), and category NS = no status, proposed by NOM-059-SEMARNAT (2010).

On August 22, 2018, at 11:30 PM, we observed the first record of the species in the Natural Protected Area Reserve of the National Marsh Biosphere (22.408032 °N; 105.666774 °W; WGS 84; elevation 7 m). The frog had the following morphological characteristics: SVL = 74 mm; tibia length = 29 mm, head width = 17 mm (Fig. 1). It was found on the paved road in ejido Novillero to ejido of San Cayetano, between croplands and cattle pastures. It was observed during the night in a light rain, but before our observation a heavy rain occurred during sunset. Photo voucher of this individual is deposited at the Autonomous University of Nuevo Leon, Faculty of Biological Sciences, Herpetological Collection (UANL-8309). This voucher represents a new municipality record, with the nearest locality reported ca. 33.6 km to the east of “Highway 15, El Llorón, Acaponeta, Nayarit” (based on a specimen deposited in the Herpetology Collection, Biodiversity Institute, University of Kansas, KUBI 73879, Brown 2017).

Figure 1. Milky Pepper Treefrog (*Trachycephalus typhonius*; photo voucher = UANL 8309), found on a paved road between ejido Novillero and ejido San Cayetano, in Natural Protected Area of the Reserva de la Biosfera de Marismas Nacionales adjacent to the Municipality of Tecuala. Photo by: César Barrio-Amorós.

One point of interest is that the Brown (2017) record was reported in 1962, in the municipality Acaponeta, 56 years prior to our report from municipality Tecuala, and H.W. Campbell previously documented the most recent record for the state in 1972, 46 years ago in municipality San Blas (Feeney 2016); our record is now the 11th report for Nayarit (Enciclovida 2018). This shows its scarcity in the area. The specimen was released *in situ* the next day after recording its morphological data and taking a photograph.

The Milky Pepper Treefrog (*Trachycephalus typhonius*) is a native hylid of México, Central, and South America (Amphibiaweb 2018). La Marca et al. (2010) mention that the species is found in different disturbed habitats including human dwellings, as well as in open or moist to dry forested situations.

Acknowledgments—We thank David Lazcano for providing the photo voucher number.

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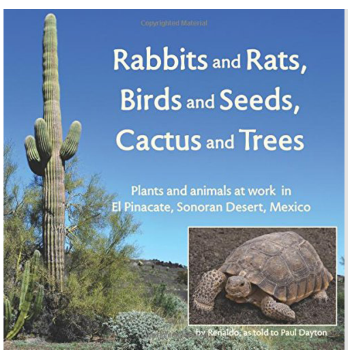
BOOK REVIEW

Rabbits and Rats, Birds and Seeds, Cactus and Trees: Plants and animals at work in El Pinacate, Sonoran Desert

Howard O. Clark, Jr., CWB®, Senior Scientist, Colibri Ecological Consulting, LLC, Fresno, CA; *hclark@colibri-ecology.com*



Rabbits and Rats, Birds and Seeds, Cactus and Trees: Plants and animals at work in El Pinacate, Sonoran Desert

Paul Dayton

Paperback: 32 pages
Publisher: Dayton Publishing; 1st edition (July 17, 2017)
Language: English
ISBN-10: 0997003219
ISBN-13: 978-0997003215
Product Dimensions: 8.5 x 0.1 x 8.5 inches

Book cover and details.

Paul Dayton has produced a delightful book about the wildlife dynamics within the Sonoran Desert. The book is geared for young readers, from about 10 to early teens. Rather than writing a lengthy comprehensive book about the entire Sonoran Desert, the author carefully picked a few interactions that would have the highest interest impact on a young reader. The idea, I surmise, was to capture the child's attention quickly, allowing them to turn the pages with curiosity and anticipation. The book is not written in the author's point of view, however, but rather in the point of view of a Desert Tortoise, named Renaldo.

The main focus of the book is to explore the idea that nature doesn't exist in a vacuum. Plants and animals depend on each other to survive, sometimes at the eventual demise of one of the species. The table of contents outlines which natural interactions are discussed, to wit: (1) Rain; (2) Cholla and Rain; (3) Cholla, Rain and Packrats; (4) Ocotillo, Jackrabbits and Cholla; (5) Saguaros and "Nurse Trees"; (6) Saguaros, Nurse Trees and Mistletoe; (7) Saguaros, Nurse Trees, Packrats and Infection; and (8) Jackrabbits, Saguaros and Rain. As you can tell by this list of topics, each chapter builds on itself, introducing ecological ideas which are applied in later sections. Rain is an incredibly important abiotic factor in desert ecology, and the author via Renaldo the Desert Tortoise, explores it well.

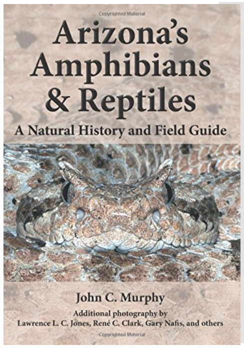
The book is packed with great photos and diagrams that complement the writing, providing a visual stimulus that enhances the reading adventure. I highly recommend the book to anyone planning on visiting the El Pinacate or having a general interest in the ecology of the Sonoran Desert.

The book is packed with great photos and diagrams that complement the writing, providing a visual stimulus that enhances the reading adventure.

BOOK REVIEW

Reptiles and Amphibians of Arizona, A Natural History and Field Guide

Jason A. Fantuzzi, Herpetological Associates, Inc., 405 Magnolia Rd., Pemberton, NJ 08068; *j.fantuzzi462@gmail.com*



Reptiles and Amphibians of Arizona, A Natural History and Field Guide

John C. Murphy

2018

Book Services Publishing Co., *www.BookServices.us*
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Book cover and details.

Since the late 1970s we have enjoyed a burgeoning procession of herpetological field guides. A few, more recent examples, include such volumes as the third edition of Stebbins' *Field Guide to Western Reptiles and Amphibians* (2003) and *Lizards of the American Southwest* by Lawrence Jones and Robert Lovich (2009). Besides the larger regions covered in these geographically macroscopic guides, there are more localized resources available. There is currently a field guide for almost every state in the US and if not, one can otherwise find their state grouped with another (e.g., *The Reptiles and Amphibians of Delmarva* by James F. White, 2002/2009 or *The Reptiles and Amphibians of the Carolinas and Virginia* by Jeffrey C. Beane, et al. 2010). For the past several years, the preferred guide of mine and many others has been the highly comprehensive, yet basic *Amphibians and Reptiles of Arizona* by Thomas Brennan and Andrew Holycross (2006).

Arizona has welcomed a multitude of reptile and amphibian "herpers" running the gamut from amateur enthusiasts to academic herpetologists, particularly from July to September. This summertime pilgrimage often involves extensive camera gear and notebooks but would not be complete without at least one field guide in every vehicle covering any visited regions. The most recent of these volumes is *Reptiles and Amphibians of Arizona, A Natural History and Field Guide* by John C. Murphy released March 2018. At a standard 7.5 × 25 cm and a portable 730 g, this book is perfect to stow in a hiking pack while exploring Arizona, as well as for casual reading and referencing. While thumbing through the species accounts (pp. 16-289) the reader will appreciate the large, bold text, truly a benefit when reading by headtorch to identify a newly "road-cruised" snake. The content table section of this book, pages viii-x, are written in a typical format, though smaller font than the bulk of the book and include the original describing author's name, as any interested student of herpetology should expect. One of the few publishing errors found in this book are the lack of bolding for the binomials *Aspidoscelis xanthonota*, *Sceloporus cowlesi*, and *S. tristichus*; truly a minor oversight in this outstanding volume.

One of the most salient features of this book, before one even opens the cover, is revealed in the title: "…A Natural History AND Field Guide". I am a proponent of "guide books" which make the best effort to cover not only the identification of reptiles and amphibians afield but also a meticulous delve into the natural history and behavioral ecology of those taxa being observed. It is in that aspect where this book truly excels, the author clearly having put an extraordinary amount of time into the composition of this tome. The information provided in the species accounts section, covering 184 species and subspecies of 30 families (as per this volume) is truly remarkable. The accounts in many other guides are mostly relegated to short paragraphs of information often resulting in a degree of redundancy. Rather than fragmented sentences, e.g., "…Mates in April", or "Lays between 4 to 6 eggs", it is appreciable to read more elaborate descriptions such as the multi-page accounts of this book, while maintaining a practical size for field use. Insufficient data notwithstanding, there must be some better resources in the literature than what is sometimes listed, and many of those much more basic field guides do not cite literature for morphometrics or reproductive biology. Given the number of references cited in this volume (nearly 250) it is evident that the author utilized a much wider breadth of samples to provide this book with its size ranges, etc. Unfortunately, I did not find the reference for the mention within of *Latrodectus* (Widow Spiders) as predators of *Micruroides euryxanthus*, an interesting record indeed. As a herpetologist specializing in cladistics, it comes with no surprise that Mr. Murphy offers the most currently accepted taxonomy and nomenclature on each species covered in this volume. I was pleased to see the mention of such systematics as the relations of *Salvadora* using the most recent phylogenies. To that point, I was interested to learn (as an admitted "ophidiophile") that bufonids are sister taxa to the Hylidae, a relation that many "anuraphiles" likely learned well before me.

The range maps, overlain with dot localities represented by voucher specimens (mostly via museum databases) which the reader will find representing each species are excellent. Those who have enjoyed Braswell and Palmer's compendium, *Reptiles of North Carolina* (1995) will appreciate that feature of this volume as well. There is no distinction between dot localities (literature vs. museum vouchers) as in the former; nevertheless, the latter has avoided the "gray areas" produced by using shading

Arizona has welcomed a multitude of reptile and amphibian "herpers" running the gamut from amateur enthusiasts to academic herpetologists, particularly from July to September. This summertime pilgrimage often involves extensive camera gear and notebooks but would not be complete without at least one field guide in every vehicle covering any visited regions.

to delineate the distribution of a particular reptile or amphibian. Additionally, county boundaries are provided to offer a basic sense of spatial location whenever a reptile or amphibian is observed afield. As with most GIS-produced maps, the utilization of darker or lighter areas as well as shadowing has illuminated the terrain creating a topographic dimension. Interestingly, this aspect often correlates with geographic barriers such as the Madrean Line and Mogollon Rim corroborating contemporary research and effectively relating that to the reader. These and other such barriers and evolutionary filters are discussed with geologic timescales in the section titled, “Geologic Events, Barriers, and Speciation”, pp. 3-5. These are not necessarily to be confused with biotic communities, as highlighted in *A Field Guide to Amphibians and Reptiles of Arizona* (Brennan and Holycross 2006). Although specific biotic communities are not mentioned in this volume, pages 8 and 10 offer first a wide view of many of the ecoregions found not only in Arizona but much of the western US, then followed by a precipitation map for those interested in this largely xeric state.

As in every field guide, photographs are provided for the proper identification of a reptile or amphibian in hand and nearly 250 photographs grace the pages of this book. Generally, there are from one to three images in the accounts section for each species covered. The species account for *Bufo* (= *Anaxyrus*) *punctatus* is particularly impressive and includes four images comprising all of the toad’s life stages. Though there are no identifying characters highlighted in the image as in many other bona fide field guides, such characters can be found noted in each species account nonetheless. I was disappointed at the lack of images of ontogenetic shift in phenotype as in the genera *Coluber* and *Masticophis*. One example that did attempt to elucidate such a shift was not quite as evident as it could have been: in the species account for *Elgaria kingii* whereby juveniles possess such a distinctive pattern of wide, boldly contrasted bands that they may well be confused with certain Galliwasp lizards (*Diploglossus* spp.) of Latin America much further south rather than conspecifics of *E. kingii*. The photo provided was a subadult specimen at most, with much of the adulthood pattern already having coalesced. One image that I felt should have been given more time was that of *Crotalus obscurus*. One can readily see a mulch substrate and a metallic frame, evidence of a photograph taken under *ex-situ* settings. While the author was certainly not attempting to fool readers into believing it an *in-situ* photo, it left me desiring to see an image that was. This book is published on a newsprint type paper unlike the glossy pages of more traditional field guides. Although this feature undoubtedly lends itself to cost-effectiveness, it also seems to have affected a poor resolution on many of the images within. This is disappointing because I know John Murphy and his colleagues produce exemplary images of the reptiles and amphibians with which they work. Notwithstanding, there are some beautiful, well-composed images to be found. Among some of the more striking images are the *Crotalus molossus* (pp. 275-276) by Lawrence Jones and René Clark respectively, the *Chionactis annulata klauberi* (p. 199) by Daren Riedle, and the author’s own image of the *Sceloporus jarrovii* pair (p. 73), arguably Arizona’s most beautiful phrynosomatid lizard.

Appendices 1-6 (pp. 294-299) feature commonly used morphometrics for each order and suborder of reptile and amphibian covered within. Appendix 5 provides exceptional illustrations highlighting the cephalic morphology of the seven indigenous Arizonan *Phrynosoma* spp., including the newly elevated, *Phrynosoma goodei*, formerly a subspecies of *P. platyrhinos* (Mulcahy et al. 2006). A reader will find these illustrations a significant resource given the amount of distributional overlap and abundance within the genus, particularly in Cochise County.

In keeping with the “notes from the field” format of many field guides, Mr. Murphy has included a small number of anecdotal accounts of himself and his colleagues; just enough to provide the reader with an entertaining view into “herping” the state of Arizona. In my opinion, excessive anecdotes and author’s accounts should fill the pages of neither field guides nor natural history books and, while often highly entertaining, are rather best left for autobiographies and more casual publications (or at least offered sparingly as here). The reader will also find several historical facts about the original descriptions and discoveries of certain taxa native to Arizona within each species account. I found the record of the first Arizonan *Craugastor augusti* and the brevity of the original description of *Crotalus viridis* (Rafinesque 1818) quite interesting, as well as mention of the ambivalent presence or absence of plethodontid salamanders in the state. Although readers will find the pages within this volume nearly typographically flawless, there was one grammatical error that was slightly difficult to move past fluidly: in the section “A Note on Frog Calls”, the first sentence of the second paragraph reads, “…The advertisement call, may be a simple one note call or a more complex composed of…”. Later, on p. 223 in the account of *Senticolis triaspsis*, the genus name *Panthera* (a category of “big cats”) is mistakenly printed rather than the word *Pantherophis* for the North American ratsnakes. Another much more blatant typo which is difficult to overlook occurs on p. 246, the introduction to the Thamnophiini including the invasive *Nerodia fasciata*: the abbreviated version of the subfamily Natricinae is here erroneously spelled “Natracines”, then “Natracidae” (using the prefix”-idae” to infer family status), and finally, “Natrids” all within five opening sentences. Additionally, for some reason usage of the word Colubrines is the heading to the “typical snakes”, those exclusive of the elapids, viperids, boids, and the scolecophidians represented in Arizona. Colubrids or Colubridae would have been a better heading, especially given the inclusion of another subfamily, the natricines, within this section. Murphy recognizes the distinction and familial status of the Dipsadidae (Benavides et al. 2012), itself more frequently relegated to subfamily (Zheng and Wiens 2016, Figueroa et

As in every field guide, photographs are provided for the proper identification of a reptile or amphibian in hand and nearly 250 photographs grace the pages of this book. Generally, there are from one to three images in the accounts section for each species covered.

al. 2016). However, recognized here as full family status, I felt it should have followed the "watersnakes" rather than been placed between two subfamilies. Perhaps the author wished to recognize the morphological and ecological similarities between the Colubrinae and Dipsadidae, highlighting the character traits of those keeled-scaled, aquatic natricines afterward. All considered, I was pleased to find a very few additional and minor typos throughout the pages.

Overall, I was extremely impressed with this volume and delighted to see it out and available in both hard and soft cover editions. Readers will be entertained and enlightened by John Murphy's writing style, and no field excursion to Arizona during those visits to the state would be complete without a copy of *Arizona's Amphibians and Reptiles: A Natural History and Field Guide* on hand. Ironic that a book written about amphibians has itself an amphibious use, enjoying a "dual life" of equal time on fancy, glass-fronted book cases in home libraries of herpetologists as well as being jostled around in a field vehicle driving through lightning-blazed nights of monsoonal showers and wandering frogs, snakes, and lizards.

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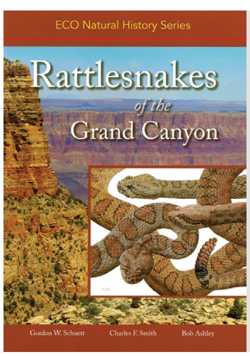
Overall, I was extremely impressed with this volume and delighted to see it out and available in both hard and soft cover editions.

BOOK REVIEW

Rattlesnakes of the Grand Canyon

Robert L. Bezy, Natural History Museum of Los Angeles County; *robertbezy@gmail.com*

This is a wonderful book on Arizona's crown jewels, the Grand Canyon and rattlesnakes. I ordered it thinking I would just glance through it, not anticipating doing much more. I often purchase books on the herpetofauna of the West just to see what the authors have produced and how they go about the topic. I am frequently disappointed, thinking that if the authors had an original idea or produced a creative sentence they might die of shock.



Rattlesnakes of the Grand Canyon

Gordon W. Schuett, Charles F. Smith, and Bob Ashley

2018

ECO Natural History Series | ECOUNIVERSE
www.ecouniverse.com/product/455/
Soft cover, 131 pages
$12.95

ISBN-10: 1938850580
ISBN-13: 978-1938850585

Book cover and details.

But here is a book that does not disappoint. The authors cover the topic thoroughly with a lively writing style relaying what is known about the eight species found in the region. They have a knack for providing details without boring or talking down to the reader. I particularly enjoyed the maps and discussions of distributions in and near the Canyon. Unlike most books of this nature, there are abundant in-text citations of key references for the interested reader to pursue.

Tell Hicks' art is magnificent and his rendering of *Crotalus abyssus* on the edge of the Canyon is nothing short of exquisite. The many photographs of the snakes and their habitats are sharp and beautiful, printed in excellent color with pleasing layout on glossy paper. I enjoyed every page and recommend this very affordable book to all.

The authors cover the topic thoroughly with a lively writing style relaying what is known about the eight species found in the region.

JOURNAL RESOURCE

Bibliography of the *Sonoran Herpetologist*: Volume 31, Issues 1-4

Howard O. Clark, Jr., CWB®, Editor, Tucson Herpetological Society, Tucson, AZ; *editor.sonoran.herp@gmail.com*

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Information for Contributors

Authors should submit original articles, notes, book reviews to the editor, either via email using an attached word processed manuscript or by mail to the Society's address. The manuscript style should follow that of *Journal of Herpetology* and other publications of the Society for the Study of Amphibians and Reptiles. For further information, please contact the editor, at *editor.sonoran.herp@gmail.com*

Remember the THS in Your Will

Including the THS in your will is an excellent way to support the value of this organization and the conservation of the herpetofauna of the Sonoran Desert. We would like to recognize and thank anyone who has included the THS in their will. Please contact us so we can express our appreciation. For information about designating the THS in your will, please contact Margaret Fusari, Treasurer, at *maggiefusari@gmail.com*.

MEETING MINUTES

BOD minutes can be found here:
http://bit.ly/2m9tXiI

MEMBERSHIP

Membership Information

Individual	$20	Sustaining	$30
Family	$25	Contributing	$50
Student	$14	Life	$500

The Tucson Herpetological Society would like to thank existing members and new members for renewing their membership. We appreciate your support and are always looking for members to actively participate in THS activities and volunteer opportunities. It is a great way to be involved with the conservation of amphibians and reptiles in the Sonoran Desert.

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Time to Renew Your THS membership?

Thank you for your membership in the Tucson Herpetological Society. Renewal reminders for upcoming membership expiration will be emailed at the beginning of the month that your membership expires. If you have any questions about your membership or would like to be in touch with a THS member you do not know how to reach, please contact our Membership Coordinator, Robert Villa, by email: cascabel1985@gmail.com.

Tucson Herpetological Society
P.O. Box 709, Tucson, Arizona 85702-0709
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The THS newsletter, the *Sonoran Herpetologist*, is delivered online only. Please indicate the email address you would like to receive the newsletter if you are not currently receiving the newsletter at your preferred address. If you are unable to receive the newsletter online, please contact Robert Villa at **cascabel1985@gmail.com**. If not already done, please indicate if you want your email added to the THS directory and/or the Monthly meeting announcement (circle one or both). Please return this form with your check to the address above.

Email address ____

Sonoran Herpetologist Natural History Observations

The Tucson Herpetological Society invites your contributions to our Natural History Notes section. We are particularly interested in photographs and descriptions of amphibians and reptiles involved in noteworthy or unusual behaviors in the field. Notes can feature information such as diet, predation, community structure, interspecific behavior, or unusual locations or habitat use. Please submit your observations to Howard Clark, *editor.sonoran.herp@gmail.com*. Submissions should be brief and in electronic form.

Local Research News

The *Sonoran Herpetologist* welcomes short reports for our Local Research News, a regular feature in our journal. We are interested in articles that can update our readers on research about amphibians and reptiles in the Sonoran Desert region. These articles need be only a few paragraphs long and do not need to include data, specific localities, or other details. The emphasis should be on how science is being applied to herpetological questions. Please submit your materials to Howard Clark, *editor.sonoran.herp@gmail.com*. Submissions should be brief and in electronic form.

SONORAN HERPETOLOGIST©
Newsletter-Journal of the Tucson Herpetological Society

Sonoran Herpetologist (ISSN 2333-8075 [online] 2577-9370 [print]) is the newsletter-journal of the Tucson Herpetological Society, and is Contents are indexed in Zoological Record. A complete set of back issues are available in the Special Collections area of the University of Arizona library. They are accompanied by a copy of *The Collected Papers of the Tucson Herpetological Society, 1988-1991*.

Information for Contributors

Authors should submit original articles, notes, book reviews to the Editor, either via email using an attached word processed manuscript or by mail to the Society's address. The manuscript style should follow that of *Journal of Herpetology* and other publications of the Society for the Study of Amphibians and Reptiles. For further information, please contact the editor, at editor.sonoran.herp@gmail.com.

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Deadline for *Sonoran Herpetologist*: 15th of Feb, May, Aug, and Nov (based on the quarterly schedule)

The Tucson Herpetological Society is dedicated to conservation, education, and research concerning the amphibians and reptiles of Arizona and Mexico.

Tucson Herpetological Society is a registered 501(c)(3) non-profit organization

TUCSON HERPETOLOGICAL SOCIETY
TucsonHerpSociety.org
P.O. Box 709 Tucson, AZ 85702-0709

Society Activities

Monthly Members Meeting
Jim Rorabaugh, Program Chair
jrorabaugh@hotmail.com
3rd Wednesday, 7:15 PM

Board of Directors Meeting
Last Wednesday of each month (except December), 7:00 PM

Speakers Bureau (scheduled presentations)
Robert Villa

Conservation Committee
Dennis Caldwell

Herpetological Information Hotline
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Publications:
Sonoran Herpetologist, Backyard Ponds brochure,
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THS Herp Coloring Book, THS Collected Papers, 1988-1991

THS Webpage
http://tucsonherpsociety.org
Heidi Flugstad, Webmaster, heidi_flugstad@hotmail.com

For more information about the THS and the reptiles and amphibians of the Tucson area visit
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