

## LITERATURE CITED

- AVILA-PIRES, T. C. S. 1995: Lizards of Brazilian Amazonia (Reptilia: Squamata). Zoologische Verhandlungen 299, Nationaal Natuurhistorisch Museum, Leiden, The Netherlands.
- BROWN, T. W., D. F. MAYRON, M. P. VAN DEN BURG, AND G. L. LONSDALE. 2017. Distribution and natural history notes on *Norops bicaorum* (Squamata: Dactyloidae) endemic to Isla de Utila, Honduras. Mesoamerican Herpetology 4: 493–497.
- D'CRUZE, N. C., AND P. J. STAFFORD. 2006. Resource partitioning of sympatric *Norops* (beta *Anolis*) in a subtropical mainland community. Herpetological Journal 16: 273–280.
- FICKERT, T., AND F. GRÜNINGER. 2010. Floristic zonation, vegetation structure, and plant diversity patterns within a Caribbean mangrove and swamp forest on the Bay Island of Utila (Honduras). Ecotropica 16: 73–92.
- GUTSCHE, A., J. R. MCCRANIE, AND K. E. NICHOLSON. 2004. Field observations on a nesting site of *Norops utilensis* Köhler, 1996. (Reptilia, Squamata), with comments about its conservation status. Salamandra 40: 297–302.
- GUTSCHE, A. 2005. Distribution and Habitat Utilization of *Ctenosaura bakeri* on Utila. Iguana 12: 143–151.
- HALLMEN, M., AND A. HUY. 2012. Natural History Notes. *Norops utilensis* (Utila Anole). Habitat. Herpetological Review 43: 642–643.
- IRSCHICK, D. J., E. CARLISLE, J. ELSTROTT, M. RAMOS, C. BUCKLEY, B. VANHOYDONCK, J. MEYERS, AND HERREL, A. 2005. A comparison of habitat use, morphology, clinging performance and escape behaviour among two divergent Green Anole lizard (*Anolis carolinensis*) populations. Biological Journal of the Linnean Society. 85: 223–234.
- JOHNSON, J. D., V. MATA-SILVA, AND L. D. WILSON. 2015. A conservation reassessment of the Central American herpetofauna based on the EVS measure. Amphibian & Reptile Conservation 9(2) [General Section] 1:94 (e100).
- KÖHLER, G. 1996. A new species of anole of the *Norops pentapleuron* group from Isla de Utila, Honduras (Reptilia: Squamata: Iguanidae). Senckenbergiana Biologica 75: 23–31.
- LEE, J. C. 1996: The Amphibians and Reptiles of the Yucatán Peninsula. Comstock Publishing Associates, Cornell University Press Ithaca, New York, United States.
- LOSOS, J. B., AND D. B. MILES. 1994. Adaptation, constraint, and the comparative method: phylogenetic issues and methods. Pp. 60–98 In P. C. Wainwright and S. M. Reilly (Eds.), Ecological Morphology: Integrative Organismal Biology. The University of Chicago Press, Chicago Illinois, United States.
- MCCRANIE, J. R., AND G. KOHLER. 2015. The Anoles (Reptilia: Squamata: Dactyloidae: *Anolis*: *Norops*) of Honduras: Systematics, Distribution, and Conservation. Bulletin of the Museum of Comparative Zoology, Special Publications Series, No. 1., Cambridge, Massachusetts, United States.
- SAVAGE, J. M. 2002. The Amphibians and Reptiles of Costa Rica: A Herpetofauna between Two Continents, between Two Seas. The University of Chicago Press, Illinois, United States.

TOM W. BROWN<sup>1</sup>, DAISY MARYON<sup>1,2</sup>, AND GEORGE LONSDALE<sup>1,2</sup>

<sup>1</sup>Kanahau Utila Research and Conservation Facility, Isla de Utila, Isla de Bahia, Honduras. E-mail: brownwb@outlook.com (TWB, Corresponding author)

<sup>2</sup>University of South Wales, Pontypridd, United Kingdom.

## Distribution of *Phrynosoma ditmarsii* Stejneger, 1906, with notes on habitat and morphology

The Rock Horned Lizard (Camaleón de Piedra, in Spanish), *Phrynosoma ditmarsii*, is a poorly known Mexican endemic species with a distribution restricted to the state of Sonora. The International Union for Conservation of Nature (IUCN) has categorized this species as Data Deficient (Frost et al., 2007), but using the Environmental Vulnerability measure (EVS) Wilson et al. (2013) assessed this species with a score of 16, placing it in the middle portion of the high vulnerability category; these authors regarded *P. ditmarsii* as highly vulnerable to environmental degradation because of its narrow geographic and ecological distribution. The Secretaría del Medio Ambiente y Recursos Naturales (SEMARNAT) listed this species as threatened (amenazada) in 2002, but in 2010 did not indicate a protected status (SEMARNAT, 2002, 2010).

Initially, this species was collected on the Carl Lumholtz expeditions to Mexico in 1890–91, with the locality recorded as “Sonora.” The type specimens were collected in 1897 “a short distance over the border of Arizona, in

old Mexico, state of Sonora” (Stejneger, 1906: 565), again without an exact locality. The species was named in honor of Raymond L. Ditmars, herpetologist at the New York Zoological Society (later the Bronx Zoo). The type locality was thought to be from an area in Sonora between Naco, Agua Prieta, and Fronteras, based on a study of stomach contents from the holotype and paratype (Lowe et al., 1971, Roth, 1971). The species was not found again for 73 years, when mining engineer Paul Geiger discovered it on Rancho El Alacrán in the Sierra Manzanal (in an area now called the Sierra Alacrán) southeast of Cananea, and on Cerro La Palma east of Baviácora. Charles H. Lowe and his students Michael D. Robinson and C. Wayne Howard studied these populations (Lowe et al., 1971; Lowe and Howard, 1975). Three definitive localities were recorded in the 1970s (Rancho Alacrán, Cerro La Palma, Rancho La Palma), and two more in the 1980s (El Chorro and Tónichi), but see locality 1 below (Lowe et al., 1971; Lowe and Howard, 1975; Perrill, 1983; Sherbrooke et al. 1998). Rorabaugh et al. (2011) reported *P. ditmarsii* from a 2002 observation in Sierra Lampazos, and Burkhardt and Trageser (2015) reported *P. ditmarsii* from near Mina La Caridad in the Sierra Nacozari. Here we clarify two reported localities and summarize 11 new observations from the last 15 years, along with current knowledge about the habitat of this species and suggestions for field identification (Figs. 2, 3).



**Fig. 1.** Photographs of *Phrynosoma ditmarsii* reported from new localities in Sonora, Mexico: (A) Rancho Subitatechi; (B) Rancho Las Tierras de Jimenez; (C) Colonia Aribabi; and (D) Rancho Toribusi.

© Ana Lilia Reina-Guerrero (A), Stephen Minter (B), Hugo Silva-Kurumiya (C), and Michael Wilson (D)



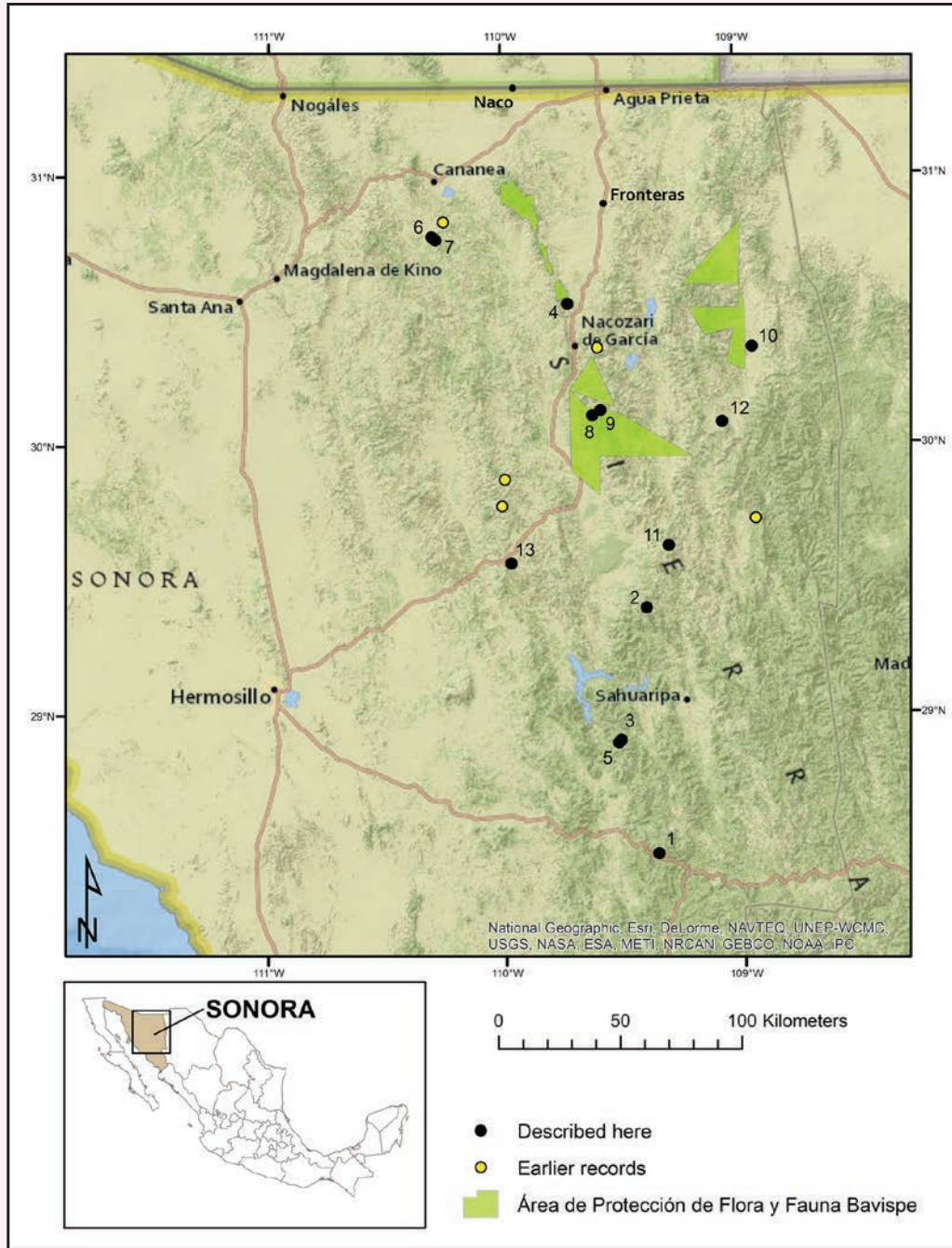



Fig. 2. Known distribution of *Phrynosoma ditmarsii*. Numbered dots refer to the localities described in the text.

Individuals of *P. ditmarsii* have been observed in March and from May to November, with most sightings occurring in July, September, October, and November.

Several of the new records suggest that the previously reported June–July parturition (Lowe and Howard, 1975; Montanucci, 1989) may extend into August, consistent with the summer rainy season in the region. The snout–vent length (SVL) of specimen #8, found 9 August, was consistent with neonate *P. ditmarsii* in captivity (25.5–26.8 mm SVL; Lowe and Howard, 1975).



**Fig. 3.** A comparison of juveniles of *Phrynosoma hernandesi* (left) and *P. ditmarsii* (right) showing the smooth vs. keeled ventral scales (A), and the deeper jaw on *P. ditmarsii* (B).  © Charles Hedgcock

### Distribution and Habitat

New observations include six new municipality records. Two of the new records were found within the boundaries of the Área de Protección de Flora y Fauna Bavispe, and two others were just outside of those boundaries, so the habitat of some populations is under protection.

Among the 18 localities now known, the elevation ranges from 1,004 to 1,679 m. The associated vegetation for 13 of the 18 localities was oak woodland ( $n = 6$ ), or an ecotone of oak woodland with desert grassland ( $n = 4$ ) or foothills thornscrub ( $n = 3$ ). The remaining sites were in desert grassland ( $n = 3$ ), foothills thornscrub ( $n = 1$ ), or tropical deciduous forest ( $n = 1$ ). Many were recorded as occurring on rocky hillsides.

All of the observations were in Sonora, Mexico. We present the geographical coordinates in NAD 1983. Unless stated otherwise, we recorded the observations with photo vouchers, which are available on the Madrean Discovery Expeditions fauna and flora database (MDE; [www.madreandiscovery.org](http://www.madreandiscovery.org)).



(1) Municipio de Ónavas, Rancho la Mula, 29 km SE of Río Yaqui on MEX 16 (28.48583°N, 109.35889°W); elev. 950 m; 14 March 1983. The individual was found in tropical deciduous forest. Perrill (1983: 123) indicated the locality as “ca. 23 km (airline) SE Hwy 16 bridge over the Rio Yaqui near Tónichi, ca. 165 km (airline) SE Hermosillo, Sonora at an elevation of approximately 1050 m.” This locality is confusing, because Tónichi lies 3 km N of the Yaqui River bridge in the municipality of Soyopa, but this is not the collection locality. In an interview with Perrill in 2009, and a subsequent visit to the site by TVD, the locality was refined to the one indicated here.

(2) Municipio de Tepache, Sierra Lampazos, ca. 19.8 km (by air) SE of Tepache, ca. 40.5 km NNW of Sahuaripa (29.39861°N, 109.3975°W); elev. 1,600 m; 30 July 2002; Samia Carrillo-Percástegui and Reyna A. Castillo-Gómez. A juvenile (MDE-18972) was observed on a rocky mountainside, in oak woodland-foothills thornscrub ecotone. Previously, Rorabaugh et al. (2011) cited a vague locality.

(3) Municipio de Bacanora, Rancho Toribusi, Sierra Murrieta, 13.6 km (by air) SW of Bacanora, 14.5 km (by air) ESE of Presa El Novillo (28.90902°N, 109.51040°W); elev. 1,332 m; 7 September 2008; M. F. Wilson and M. Larson. An adult (UAZ 57571-PSV) was observed on a rocky limestone slope in oak woodland, which represents a new municipality record.

(4) Municipio de Nacozari de García, Rancho El Salto, Sierra La Púrica, 16.7 km (by air) NNW of Nacozari de García, Reserva Forestal Nacional & Refugio de Fauna Silvestre Ajos-Bavispe (30.52778°N, 109.71972°W); elev. 1,679 m; aspect 150°SSE, slope 30°; 10 September 2013; C. Roll, D. Turner, and C. Hedgcock. A juvenile female (MDE-18970; SVL = 32 mm, tail length = 5 mm, body mass = 2.2g), was collected on a hillside 20 m from the ridge line, on an abandoned dirt road set within dense grasses and herbaceous plants, along with *Quercus oblongifolia*, *Arctostaphylos pungens*, *Juniperus deppeana*, and *Mimosa dysocarpa*; the habitat consisted of oak woodland/desert grassland ecotone. The specimen was deposited at the Universidad Nacional Autónoma de México, Laboratorio de Ecología-UBIPRO, FES Iztacala UNAM, Estado de México by Julio A. Lemos-Espinal.

(5) Municipio de Bacanora, Rancho Las Tierras de Jimenez, 14.9 km (by air) SW of Bacanora, Sierra de Murrieta (28.89806°N, 109.52083°W); elev. 1,464 m; 1 August 2014; A. L. Reina-G., R. A. Villa, T. R. Van Devender, and S. Jacobs. One adult and one juvenile (MDE-189641) were observed on a rocky slope in oak woodland.

(6) Municipio de Cananea, 23.4 km (by air) S of Cananea, foothills of the Sierra Manzanal (30.77861°N, 110.30028°W); elev. 1,260 m; 13 September 2014; A. L. Reina-G. and T. R. Van Devender. One adult (MDE-18967) was observed on a rocky hillside in desert grassland, in sympatry with *P. solare*.

(7) Municipio de Cananea, Rancho El Chiltepín, 23.9 km (by air) S of Cananea, western foothills of the Sierra Manzanal (30.76755°N, 110.28377°W); elev. 1,246 m; 14 September 2014; C. Hedgcock and K. Hansen. One adult (MDE-18968) was observed in a rocky canyon in desert grassland.

(8) Municipio de Cumpas: Rancho El Mezquite, 16.1 km (by air) ESE of Los Hoyos, Sierra La Madera (30.11333°N, 109.61917°W); elev. 1,297 m; 9 August 2016; Norberto León del Castillo, J. E. Ruelas-C, D. A. Carranza-N., and J. M. Duarte-M. A juvenile (MDE-7963) was observed in oak woodland-desert grassland transition, which represents a new municipality record.

(9) Municipio de Cumpas: Rancho El Prieto, 18.1 km (by air) E of Los Hoyos, Sierra La Madera (30.1325°N, 109.58361°W); elev. 1,260 m; 13 September 2016; Norberto León del Castillo, D. A. Carranza-N., and J. M. Duarte-M. A juvenile (MDE-9295) was observed in oak woodland-grassland mosaic.

(10) Municipio de Bacerac, Bacerac (30.3622200°N, 108.9333300°W); elev. 1,071 m; 10 November 2016; Alfredo Ramirez-G., Hugo Silva-Kurumiya, and G. Yanes-A. An adult (MDE-10201) was observed in desert grassland, and represents a new municipality record. This species often is encountered along the edges of the town; some people keep them as pets.

(11) Municipio de Divisaderos, Rancho Subitatchi, Puerto La Sierrita, 16.8 km (by air) ENE of Divisaderos (29.62833°N, 109.29972°W); elev. 1,325 m; 23 November 2016; M. J. Galaz-G., A. L. Reina-G., and T. R. Van

Devender. An adult male (MDE-10280) was observed at 1110 h in desert grassland-oak woodland mosaic, and represents a new municipality record.

(12) Municipio de Huachinera, 2.9 km (by air) NE of Colonia Aribabi (30.08556°N, 109.06583°W); elev. 1,531 m; 9 September 2017; M. Arvizu-M. and H. Silva-Kurumiya. A juvenile (MDE-21217) was observed in oak woodland, and represents a new municipality record.

(13) Municipio de Moctezuma, Cañada La Carabina, Rancho La Montosa, 38.6 km SW of Moctezuma (29.56639°N, 109.96833°W); elev. 1,150 m; 22 September 2017 Hector Villa-C. and H. Silva-Kurumiya. A juvenile (MDE-21217) was observed in oak woodland-foothills thornscrub transition, and represents a new municipality record.

### Distinguishing *Phrynosoma ditmarsii* from *P. hernandesi*

A possible reason for the scarcity of records for *Phrynosoma ditmarsii* is because of its morphological similarity with the more common and widespread *P. hernandesi*, especially among juveniles of these species. In general, both species are similar in appearance, as their horns are small or absent, although the absence is more pronounced in *P. ditmarsii*.

Three juveniles of *P. hernandesi* were found in Sierra La Púrica on the same day and within 4 km of a juvenile *P. ditmarsii* (#4 above). We compared them for field characteristics that might be useful in distinguishing juveniles of the two species (Table 1, Fig. 3), because most of the diagnostic characteristics are relative and less obvious on small individuals. The strongly keeled ventral scales present on *P. ditmarsii*, especially in the gular region, provided the easiest distinction, in contrast to the smooth granular scales on *P. hernandesi*. Also, the jaw on *P. ditmarsii* is much deeper with the mandibles expanding posteriorly to form a distinct triangle, and the tail on *P. ditmarsii* is much shorter.

**Table 1.** Morphological characteristics of juveniles of *Phrynosoma ditmarsii* and *P. hernandesi* from Sierra la Púrica, Sonora, Mexico.

Character	<i>P. ditmarsii</i>	<i>P. hernandesi</i> #1	<i>P. hernandesi</i> #2	<i>P. hernandesi</i> #3
Sex	Female	Female	Male	Male
Body Mass (g)	2.2	2.3	2.0	1.4
SVL (mm)	32	34	32	29
Tail (mm)	5	13	10	9
Ventral scales	Keeled	Smooth	Smooth	Smooth

**Acknowledgments.**—This study was part of the Madrean Discovery Expedition Program of GreaterGood.org, and its predecessor Madrean Archipelago Biodiversity Assessment program at Sky Island Alliance. Support was provided by GreaterGood.org, Comisión de Áreas Naturales Protegidas (CONANP), and Veolia Environment Foundation. The 2013 specimen was collected under permit SGPA/DGVS/05913/12, with extension SGPA/DGVS/02487/13, issued by the Secretaría de Medio Ambiente de Recursos Naturales (SEMARNAT) to Julio A. Lemos-Espinal. Additional verifications of species identifications were provided by Wade Sherbrooke, James Rorabaugh, and Richard Montanucci.

## LITERATURE CITED

- BURKHARDT, T. R., AND S. TRAGESER. 2015. Geographic Distribution. *Phrynosoma ditmarsii* (Rock Horned Lizard). *Herpetological Review* 46: 60.
- FROST, D. R., HAMMERSON, G. A., GADSDEN, H., AND W. SHERBROOKE. 2007. *Phrynosoma ditmarsii*. The *Phrynosoma ditmarsii*. The IUCN Red List of Threatened Species 2007: e.T64074A12741807. ([www.dx.doi.org/10.2305/IUCN.UK.2007.RLTS.T64074A12741807.en](http://www.dx.doi.org/10.2305/IUCN.UK.2007.RLTS.T64074A12741807.en); accessed 1 October 2017).
- LOWE, C. H., AND C. W. HOWARD. 1975. Viviparity and reproductive pattern in *Phrynosoma ditmarsii* in Sonora, Mexico. *Southwestern Naturalist* 20: 265–270.
- LOWE, C. H., M. D. ROBINSON, V. D. ROTH. 1971. A population of *Phrynosoma ditmarsii* from Sonora, Mexico. *Journal of the Arizona Academy of Science* 6: 275–277.
- MONTANUCCI, R. R. 1989. The reproduction and growth of *Phrynosoma ditmarsii* (Sauria: Iguanidae) in captivity. *Zoo Biology* 8: 139–149.
- PERRILL, R. H. 1983. Geographic Distribution. *Phrynosoma ditmarsii* (Rock Horned Lizard). *Herpetological Review* 14: 123.
- RORABAUGH, J. C., M. A. GÓMEZ-RAMÍREZ, C. E. GUTIÉRREZ-GONZÁLEZ, J. E. WALLACE, AND T. R. VAN DEVENDER. 2011. Amphibians and reptiles of the Northern Jaguar Reserve and vicinity, Sonora, Mexico: a preliminary evaluation. *Sonoran Herpetologist* 24: 123–131.
- ROTH, V. D. 1971. Food habits of Ditmars' Horned Lizard with speculations on its type locality. *Journal of the Arizona Academy of Science* 6: 278–281.
- SEMARNAT (SECRETARÍA DE MEDIO AMBIENTE Y RECURSOS NATURALES). 2001. Norma Oficial Mexicana NOM-059-ECOL-2001, protección ambiental—especies nativas de México de flora y fauna Silvestre—categorías de riesgo y especificaciones para su inclusión, exclusión o cambio—lista de especies en riesgo. *Diario Oficial de la Federación*, Segunda Sección, 6 de marzo de 2002, Ciudad de México, Mexico.
- SEMARNAT (SECRETARÍA DE MEDIO AMBIENTE Y RECURSOS NATURALES). 2010. Norma Oficial Mexicana NOM-059-SEMARNAT-2010, protección ambiental—especies nativas de México de flora y fauna Silvestre—categorías de riesgo y especificaciones para su inclusión, exclusión o cambio—lista de especies en riesgo. *Diario Oficial de la Federación*, Segunda Sección, 30 de diciembre de 2010, Ciudad de México, Mexico.
- SHERBROOKE, W. C., B. E. MARTIN, AND C. H. LOWE. 1998. Geographic Distribution. *Phrynosoma ditmarsii* (Rock Horned Lizard). *Herpetological Review* 29: 110–111.
- STEJNEGER, L. A. 1906. New lizard of the genus *Phrynosoma* from Mexico. *Proceedings of the United States National Museum* 29: 565–567.
- WILSON, L. D., V. MATA-SILVA, AND J. D. JOHNSON. 2013. A conservation reassessment of the reptiles of Mexico based on the EVS measure. *Amphibian & Reptile Conservation* 7: 1–47.

**DALE S. TURNER<sup>1</sup>, THOMAS R. VAN DEVENDER<sup>2</sup>, HUGO SILVA-KURUMIYA<sup>3</sup>, NORBERTO LEÓN DEL CASTILLO<sup>4</sup>, CHARLES HEDGCOCK<sup>5</sup>, CHRIS ROLL<sup>6</sup>, MICHAEL WILSON<sup>7</sup>, AND FRANCISCO ISAIAS OCHOA-GUTIERREZ<sup>8</sup>**

<sup>1</sup>*The Nature Conservancy, 1510 E. Fort Lowell Rd., Tucson, Arizona 85719, United States. E-mail: dturner@tnc.org*

<sup>2</sup>*GreaterGood.org, 6262 N. Swan Rd., Suite 150, Tucson, Arizona 85718, United States. E-mail: yecora4@comcast.net*

<sup>3</sup>*Universidad de la Sierra, Moctezuma, Sonora, Mexico. E-mail: hskurumiya@yahoo.com*

<sup>4</sup>*Programa de Vigilantes Comunitarios, Comisión Nacional de Áreas Naturales Protegidas, Moctezuma, Sonora, Mexico. E-mail: norbertoleon1984@gmail.com*

<sup>5</sup>*5627 East Linden Street, Tucson, Arizona 85712. United States. E-mail: hedgcock@email.arizona.edu*

<sup>6</sup>*11699 E. Highway 181, Willcox, Arizona 85643, United States. E-mail: cmroll@gmail.com*

<sup>7</sup>*Drylands Institute, 2509 N Campbell Ave., PMB 405, Tucson, Arizona 85719, United States. E-mail: millicule@hotmail.com*

<sup>8</sup>*Área de Protección de Flora y Fauna Bavispe, Segunda este final y Av. Sinaloa S/N, C.P. 86120, Cananea, Sonora, Mexico. E-mail: isaias\_8agtz@hotmail.com*