A conservation checklist of the amphibians and reptiles of Sonora, Mexico, with updated species lists

Julio A. Lemos-Espinal¹, Geoffrey R. Smith², James C. Rorabaugh³

¹ Laboratorio de Ecología-UBIPRO, FES Iztacala UNAM, Avenida los Barrios 1, Los Reyes Iztacala, Tlalnepantla, edo. de Mexico, 54090, Mexico ² Department of Biology, Denison University, Granville, Ohio 43023, USA ³ P.O. Box 31, Saint David, Arizona 85630, USA

Corresponding author: Julio A. Lemos-Espinal (lemos@unam.mx)

Abstract

Sonora has a rich natural diversity, including reptiles and amphibians. Sonora’s location on the United States-Mexico border creates some unique conservation challenges for its wildlife. We compiled a list of the amphibian and reptile species currently known for Sonora, summarized the conservation status of these species, and compared our list of species with known species lists for adjacent states. The herpetofauna of Sonora comprises 200 species of amphibians and reptiles (38 amphibians and 162 reptiles). Overall, Sonora shares the most species with Chihuahua, Sinaloa, and Arizona. Approximately 11% of the amphibian and reptile species are IUCN listed, but 35.5% are placed in a protected category by SEMARNAT, and 32.6% are categorized as high risk by the Environmental Vulnerability Score.

Keywords

United States-Mexico border states, ecoregions, herpetofauna, IUCN Red List, shared species

Introduction

Sonora is a state that, due to its geographic location near the U.S. states of Arizona and California and the extraordinary natural diversity those states host, has attracted the attention of specialists and amateurs in the study of its flora and fauna. Therefore, Sonora’s biodiversity is perhaps the best known among the states of northern Mexico.
Sonora’s varied topography and climate (Figs 1, 2); with altitudes ranging from sea level to 2,625 m, broad plains in the west, high mountains in the east, islands in the Gulf of California, and more than 1,200 km of coastline; have resulted in high levels of biodiversity. Sonora is also home to relatively unique habitats, such as the peat moss habitat found in the Ciénega de Camilo in eastern Sonora (Van Devender et al. 2003), and the spring-fed wetlands or ciénegas of the Apache Highlands of Arizona and Sonora (Minckley et al. 2013). Sonora is also part of the main “hot spot” of tropical dry forests; however, climate change is likely to result in degradation of these forests as is deforestation and increased clearing for agriculture (Prieto-Torres et al. 2016).

Given its physiographic and topographic diversity, Sonora is home to high levels of biodiversity, including its herpetofauna (see Lemos-Espinal and Rorabaugh 2015). In particular, Sonora has several areas that are important with respect to herpetofaunal diversity. The desert shrubland in Sonora supports a high diversity of lizards due to the abundance of microhabitats it provides (García and Whalen 2003). Sonora is the location of the southern range limits of several arid adapted reptiles and amphibians (Bezy et al. 2017), but also the location of the northern limits of Neotropical species (Lavín-Murcio and Lazcano 2010). The Northern Jaguar Reserve in Sonora houses a mixture of amphibians and reptiles from a variety of macrohabitat and biogeographic regions (Rorabaugh et al. 2011). The Pacific Lowlands, including areas of Sonora, are one of the more critical areas of endemism for reptiles and amphibians in Mexico (Johnson et al. 2017).

The location of Sonora along the United States-Mexico border creates some unique issues for the conservation of its wildlife. Environmental quality and ecosystem services on the Mexican side of the Sonora-Arizona border are declining (Norman et al. 2012b). One challenge confronting Sonora’s environment is human population growth and urbanization. This is particularly important along the U.S.-Mexico border as the human population of Nogales, Mexico is rapidly increasing (Norman et al. 2009, 2012a), which is consistent with a general trend in the border region (Anderson 2003). There has also been an increase in economic growth in Sonora, especially agriculture and ranching (Magaña and Conde 2000). Grazing by cattle can result in the loss of important native vegetation and alteration of Sonoran habitats (Morales-Romero et al. 2012). Such development will potentially result in major losses in habitats, such as riparian woodlands and semi-desert grasslands in the region (Villarreal et al. 2013). Other conservation concerns include non-native species (Bogan et al. 2014, Drake et al. 2017), habitat fragmentation that reduces demographic and genetic connectivity (e.g., across the international border due to construction of walls and other infrastructure on the U.S. side; Peters et al. 2018), and climate change resulting in changes in temperature and precipitation (Stahlschmidt et al. 2011, Flesch et al. 2017, Griffis-Kyle et al. 2018).

Another challenge to Sonora’s environment is related to water usage. Watersheds in the region are subject to increasing urbanization, ranching, and losses due to irrigation (Steiner et al. 2000). Increased human populations in Sonora will also drain freshwater for domestic uses and for power generation (Magaña and Conde 2000, Scott et al. 2012). Also, some freshwater systems in Sonora are subject to salinization due to intrusion of saltwater into freshwater aquifers as a result of pumping of water from the aqui-
The factors mentioned above are likely to affect several taxonomic groups, but the herpetofauna is a group of particular concern. Rorabaugh (2008) found that 40% of the Sonoran herpetofauna were given some conservation status by the Mexican government (SEMARNAT) or the IUCN Red List. Although there have been several recent works that report lists of species of reptiles and amphibians in Sonora (Rorabaugh 2008, Enderson et al. 2009, 2010, Lemos-Espíñal and Smith 2009, Lemos-Espíñal and Rorabaugh 2015, Lemos-Espíñal et al. 2015, Rorabaugh and Lemos-Espíñal 2016), species additions and accelerating taxonomic changes merit a new analysis of the current list for Sonora, especially with respect to the conservation status of the species listed. Here,
we report the list of species currently known for the state of Sonora, focusing on the conservation status reported for each species, analyzing it by taxonomic groups and ecoregions, and comparing our list of species with known lists for adjacent states.

**Methods**

We only included species in the checklist for which we could confirm the record in Sonora, either by direct observation or through documented museum records or vouchers. We follow Frost (2018) or AmphibiaWeb (2018) for amphibian names and Uetz and Hošek (2018) for reptile names (for a summary of recent taxonomic changes see Table 1). We compiled the list of amphibians and reptiles of the state of Sonora from
A conservation checklist of the amphibians and reptiles of Sonora, Mexico, with...  

We recognize six herpetological ecoregions in Sonora (Eastern Mountains, High Northeastern Valleys, Western Mainland Deserts, Subtropical Lowlands and Foothills of the Sierra Madre Occidental, Islands, and Marine), each of which supports distinctive amphibian and reptile assemblages (Fig. 3). These ecoregions are further defined by geography, elevational range, topography, and vegetation communities (see Lemos-Espinal and Rorabaugh 2015; Lemos-Espinal et al. 2015; Rorabaugh and Lemos-Espinal 2016 for a description of these ecoregions). As a result, boundaries of ecoregions bear some resemblance to those of physiographic units (Fig. 4) and vegetation communities (Fig. 5).

We recorded the conservation status of each species based on 1) the IUCN Red List 2018-2; 2) Environmental Viability Scores from Wilson et al. (2013a, b); and 3) listing in
Figure 3. Map of the ecoregions of the state of Sonora, Mexico (created by J Rorabaugh using the base topographic map of INEGI 2009).

SEMARNAT (2010). The number of overlapping species with the five neighboring states of Sonora was determined using recent state lists (Arizona, Brennan and Babb [2015]; Baja California, Hollingsworth et al. [2015]; Sinaloa, Enderson et al. [2009]; Chihuahua, Lemos-Espinal et al. [2017]; and New Mexico, Painter and Stuart [2015]). Lists were updated for Arizona (adding *Lampropeltis californiae* [Blainville] and *L. nigrita* Zweifel & Norris, and substituting *Lampropeltis splendida* [Baird & Girard] for *L. getula* Linnaeus [Krysko et al. 2017]); Baja California (substituting *Lampropeltis californiae* [Blainville] for *L. getula* Linnaeus [Krysko et al. 2017]); Sinaloa (adding *Crocodylus acutus* Cuvier [Natural History Museum of Los Angeles County. LACM Vertebrate Collection. Record ID: D411FDF6-C9FA-471B-BC83-B1FC044E54C3. Source: http://ipt.vertebrate.org:8080/ipt/resource.do?r=lacm_verts [accessed on 2018-03-13]], *Leptodeira splendida*...
Figure 4. Topographical map with physiographic provinces of the state of Sonora, Mexico. Map modified from Cervantes-Zamora et al. (1990).

Günther [Natural History Museum of Los Angeles County. LACM Vertebrate Collection. Record ID: 6CD2EBCD-71BA-426B-A9A2-9DF8FE3222B5. Source: http://ipt.vertnet.org:8080/ipt/resource.do?r=lacm_verts (accessed on 2018-03-13)], and *Gopherus evgoodei*, Edwards et al. 2016, and substituting *Lampropeltis nigrita* Zweifel & Norris for *L. getula* Linnaeus [Krysko et al. 2017]); Chihuahua (substituting *Sceloporus coulesi* Lowe & Norris for *S. consobrinus* Baird & Girard [A Leaché, pers. comm., April 2017]); and New Mexico (adding *Lampropeltis holbrooki* Stejneger, and substituting *Lampropeltis splendida* [Baird & Girard] for *L. getula* Linnaeus [Krysko et al. 2017]).

We created species accumulation curves for the total herpetofauna, amphibians, and reptiles using the year of the first recorded observation for each species. Such species accumulation curves are likely to be reasonable estimates of the species richness of amphibians and reptiles (see Raxworthy et al. 2012).
Results and discussion

Sonora hosts a total of 200 (seven of them introduced) species of amphibians and reptiles. This is an increase of four species from the list compiled by Rorabaugh and Lemos-Espinal (2016), and 13 species from the list compiled by Enderson et al. (2009). Thirty-eight are amphibians (35 anurans [two introduced], and three salamanders) and 162 reptiles (one crocodile, 69 lizards [three introduced], 75 snakes [one introduced], and 17 turtles [one introduced]) (Tables 2, 3). These represent 38 families: ten amphibians (eight anurans, one salamanders), and 28 reptiles (one crocodile, 12 lizards [one introduced], eight snakes [one introduced], and seven turtles [one introduced]). Sonora has 91 genera: 17 amphibians (15 anurans, two salamanders), and 74 reptiles (one crocodile, 22 lizards [one introduced], 40 snakes [one introduced], and eleven turtles [one

Figure 5. Vegetation type map of the state of Sonora, Mexico (modified from Dirección General de Geografía – INEGI 2005).
A conservation checklist of the amphibians and reptiles of Sonora, Mexico, with twelve of the 193 native species are only found in islands in Sonora, those are: Isla San Esteban Spiny-tailed Iguana (*Ctenosaura conspicuosa*), Isla San Pedro Nolasco Spiny-tailed Iguana (*C. nolascensis*), Piebald Chuckwalla (*Sauromalus varius*), Isla San Pedro Nolasco Lizard (*Uta nolascensis*), Isla San Pedro Mártir Side-blotched Lizard (*U. palmeri*), Peninsular Leaf-toed Gecko (*Phyllocaucus nocticolus*), San Pedro Nolasco Gecko (*P. nolascensis*), San Pedro Nolasco Whiptail (*Aspidoscelis bacatus*), San Esteban Whiptail (*A. estebanensis*), San Pedro Martir Whiptail (*A. martyris*), Isla San Esteban Whipsnake (*Masticophis slevini*), and Isla San Esteban Black-tailed Rattlesnake (*Crotalus estebanensis*). Another seven are marine species: American Crocodile (*Crocodylus acutus*), Yellow-bellied Seasnake (*Hydrophis platurus*), Loggerhead Sea Turtle (*Caretta caretta*), Green Sea Turtle (*Chelonia mydas*), Hawksbill Sea Turtle (*Eretmochelys imbricata*), Olive Ridley Sea Turtle (*Lepidochelys olivacea*), and Leatherback Sea Turtle (*Dermochelys coriacea*). The introduced species are: Rio Grande Leopard Frog (*Rana berlandieri*), American Bullfrog (*R. catesbeiana*), Common House Gecko (*Hemidactylus frenatus*), Mediterranean House Gecko (*H. turcicus*), Spiny Chuckwalla (*Sauromalus hispidus*), Brahminy Blindsnake (*Indotyphlops braminus*), and Spiny Softshell (*Apalone spinifera*).

The species accumulation curves for all species, amphibians only, and reptiles only suggest that the current list of species likely underestimates the species richness for Sonora (Fig. 6). These curves show a rapid increase in species during the first half of the 20th century with a steady, almost linear, increase in the number of species recorded in Sonora. Following a brief period of little additional accumulation of new species recorded in Sonora in the late 1900’s, there has been a recent increase in the number of species added to the Sonoran herpetofauna. This increase includes recent documentation of non-native species (*Apalone spinifera*, *Hemidactylus frenatus*, and *H. turcicus*), as well as recent taxonomic changes (see Table 1).

We compiled a list of 17 species (three amphibians, 14 reptiles) potentially occurring in Sonora (Table 4) based on species for which undocumented observations in Sonora exist but for which museum or other records are not available, and on species that have not been recorded or observed in the state, but whose distributional ranges come close to the borders of Sonora. We did not include these species in our analyses and summaries.

**General distribution**

Fourteen of the 38 species of amphibians that inhabit Sonora are endemic to Mexico, one of which is restricted to small areas in the Sierra Madre Occidental in eastern Sonora and western Chihuahua (Table 2). Four more are distributed in the Sierra Madre Occidental mainly in the states of Chihuahua, Durango, Sinaloa, and Sonora (Table 2). Another six species are distributed along the Pacific coast, and three more along the Pacific coast extending eastward through the Balsas depression, with one of these three even reaching the state of Veracruz (Table 2). Of the 24 amphibian species not endemic to Mexico that inhabit Sonora, two are introduced species, 17 more are found in the US and Mexico, and the remaining five species have a wide distribution.
Table 2. Amphibians and reptiles of Sonora with distributional and conservation status. Ecoregion (1 = Western mainland deserts; 2 = High northeastern valleys; 3 = Eastern mountains; 4 = Subtropical lowlands and foothills; 5 = Marine; 6 = Islands); IUCN Status (DD = Data Deficient; LC = Least Concern, VU = Vulnerable, NT = Near Threatened; EN = Endangered; CE = Critically Endangered; NE = not Evaluated) according to the IUCN Red List (The IUCN Red List of Threatened Species, Version 2018-1; www.iucnredlist.org; accessed 14 September 2018), conservation status in Mexico according to SEMARNAT (2010) (P = in danger of extinction, A = threatened; Pr = subject to special protection, NL – not listed), and Environmental Vulnerability Score (EVS – the higher the score the greater the vulnerability: low (L) vulnerability species (EVS of 3–9); medium (M) vulnerability species (EVS of 10–13); and high (H) vulnerability species (EVS of 14–20) from Wilson et al. (2013a,b) and Johnson et al. (2015). Global Distribution (GD): 0 = Endemic to Sonora; 1 = Endemic to Mexico; 2 = Shared between the US and Mexico; 3 = widely distributed from Canada or the US to Central or South America; 4 = widely distributed from Mexico to Central America; 5 = circumglobal distribution; 6 = Pacific and Indian Oceans; IN = Introduced to Sonora. Source of first record (year in parentheses) is the voucher specimen (see Appendix 1 for abbreviations) or paper associated with the first documentation of a species in Sonora.

| Class          | Order       | Family        | Species                                              | IUCN  | EVS  | SEMARNAT | Ecoregions | GD    | Source of first record |
|----------------|-------------|---------------|------------------------------------------------------|-------|------|----------|------------|-------|------------------------|
| Class Amphibia | Order Anura | Bufonidae     | *Anaxyrus cognatus* (Say, 1823)                      | LC    | L (8)| NL       | 1, 2       | 2     | UAZ 08894 (1957)       |
|               |             |               | *Anaxyrus debilis* (Girard, 1854)                    | LC    | L (7)| Pr       | 2          | 2     | UAZ 40063 (1974)       |
|               |             |               | *Anaxyrus kelloggi* (Taylor, 1938)                   | LC    | H (14)| NL       | 1, 4       | 1     | UTEP H-14419 (1955)    |
|               |             |               | *Anaxyrus mexicanus* (Broccio, 1879)                | NT    | M (13)| NL       | 3          | 1     | UAZ 15045 (1953)       |
|               |             |               | *Anaxyrus punctatus* (Baird & Girard, 1852)         | LC    | L (5)| 1, 2, 3, 4, 6 | 2  | UAZ 16973 (1905)       |
|               |             |               | *Anaxyrus retiformis* (Sanders & Smith, 1951)       | LC    | M (12)| Pr       | 1          | 2     | MCZ A-48217 (1700)     |
|               |             |               | *Anaxyrus woodhousii* (Girard, 1854)                | LC    | M (10)| NL       | 1, 2       | 2     | USNM 2536 (1855)       |
|               |             |               | *Incilius alvarius* (Girard, 1859)                  | LC    | M (11)| NL       | 1, 2, 3, 4 | 2   | USNM 21063 (1893)      |
|               |             |               | *Incilius marmoreus* (Wiegmann, 1833)               | LC    | M (11)| NL       | 4          | 1     | UAZ 57334-PSV (2011)   |
|               |             |               | *Incilius mazatlanensis* (Taylor, 1940)             | LC    | M (12)| NL       | 1, 2, 3, 4 | 1   | UAZ 11817 (1953)       |
|               |             |               | *Incilius mccoyi* Santos-Barrera & Flores-Villela, 2011 | NE    | H (14)| NL       | 3          | 1     | UAZ 28229 (1964)       |
|               |             |               | *Rhinella borrikilis* (Wiegmann, 1833)              | NE    | NE   | NL       | 1, 4       | 3     | USNM 47243 (1898)      |
|               |             | Craugastoridae | *Craugastor augusti* (Dugès, 1879)                  | LC    | M (8)| NL       | 3, 4       | 2     | USNM311989 (1921)      |
|               |             |               | *Craugastor occidentalis* (Taylor, 1941)            | DD    | M (13)| NL       | 3, 4       | 1     | AMNH A-84437 (1970)    |
|               |             | Eleutherodactylidae | *Eleutherodactylus interorbitalis* (Langebartel & Shannon, 1956) | DD    | H (15)| Pr       | 3, 4       | 1     | UAZ 56549-PSV (2005)   |
|               |             | Eleutherodactylidae | *Eleutherodactylus interorbitalis* (Langebartel & Shannon, 1956) | DD    | H (15)| Pr       | 3, 4       | 1     | UAZ 56549-PSV (2005)   |
|               |             | Hylidae       | *Agalychnis dacnicolor* (Cope, 1864)                | LC    | M (13)| NL       | 3, 4       | 1     | LACM 90158 (1960)      |
|               |             |               | *Dryophytes arenicolor* Cope, 1886                   | LC    | L (7)| NL       | 2, 3, 4     | 2     | MVZ 28776 (1939)       |
|               |             |               | *Dryophytes worthouri* (Taylor, 1939)               | LC    | L (9)| NL       | 2, 3        | 2     | BYU 34818 (1979)       |
|               |             |               | *Smilisca baudini* Duméril & Bibron, 1841           | LC    | L (5)| NL       | 4          | 3     | MVZ 50460 (1950)       |
|               |             |               | *Smilisca fodiens* (Boulenger, 1882)                | LC    | L (8)| NL       | 1, 4        | 2     | UMMZ 72186 (1932)      |
|               |             |               | *Talinobryta smithii* (Boulenger, 1902)             | LC    | M (11)| NL       | 1, 4        | 1     | UAZ 16066 (1956)       |
|               |             | Leptodactylidae | *Leptodactylus melanomorpha* (Hallowell, 1861)      | LC    | L (6)| NL       | 1, 2, 4     | 4     | MVZ 26066 (1938)       |
|               |             | Microhyidae   | *Gastrophrynus mazatlanensis* (Taylor, 1943)        | NE    | L (8)| NL       | 1, 3, 4     | 2     | UMMZ 72177 (1932)      |
|               |             | Ranidae       | *Hypopachus variolus* (Cope, 1866)                  | LC    | L (4)| NL       | 4          | 3     | UAZ 47259 (1938)       |
|               |             | *Rana berlandieri* Baird, 1859                      | N/A   | N/A  | N/A      | N/A        | IN    | ASU HP-00020-21 (2006) |
| Species                                      | IUCN  | EVS   | SEMARNAT | Ecoregions | GD   | Source of first record |
|---------------------------------------------|-------|-------|----------|------------|------|------------------------|
| Rana catesbeiana Shaw, 1802                 | N/A   | N/A   | N/A      | N/A        | IN   | CAS SUA 202273 (1955)  |
| Rana chiricahuensis Platz & Mecham, 1979    | VU    | M (11)| A        | 2, 3       | 2    | LACM 91589 (1965)      |
| Rana forreri Boulenger, 1883                | LC    | L (3) | Pr       | 1, 4       | 4    | KUH 37904 (1954)       |
| Rana magnaculis Frost & Bagnara, 1976       | LC    | M (12)| NL       | 1, 2, 3, 4 | 1    | CAS SUA 15580 (1955)  |
| Rana pastososa Boulenger, 1883              | LC    | L (3) | Pr       | 4          | 1    | ASNHC 13774 (1969)     |
| Rana tarahumarae Boulenger, 1917            | VU    | M (8) | NL       | 3          | 2    | UMMZ 154302 (1935)     |
| Rana yavapaiensis Platz & Frost, 1984       | LC    | M (12)| Pr       | 1, 3, 4    | 2    | CAS SUA 10295 (1950)  |
| Scaphiopodidae                              |       |       |          |            |      |                        |
| Scaphiopus couchi Baird, 1854               | LC    | L (3) | NL       | 1, 2, 3, 4 | 2    | Allen, 1933 (1932)     |
| Spea multiplicata (Cope, 1863)              | LC    | L (6) | NL       | 1, 2, 3    | 2    | USNM 21801 (1894)      |
| Order Caudata                               |       |       |          |            |      |                        |
| Ambystomatidae                              |       |       |          |            |      |                        |
| Ambystoma marvortium Baird, 1850            | LC    | M (10)| NL       | 1, 2       | 2    | UMMZ 78353 (1935)      |
| Ambystoma rosaceum Taylor, 1941             | LC    | H (14)| Pr       | 3          | 1    | USNM 17352 (1891)      |
| Plethodontidae                              |       |       |          |            |      |                        |
| Isthmura sierraoccidentalis (Lowe, Jones, &| NE    | NE    | NL       | 3          | 1    | LACM 39200 (1964)      |
| Wright, 1968)                               |       |       |          |            |      |                        |
| Class Reptilia                              |       |       |          |            |      |                        |
| Order Crocodylia                            |       |       |          |            |      |                        |
| Crocodylidae                                |       |       |          |            |      |                        |
| Crocodylus acutus Cuvier, 1807              | VU    | H (14)| Pr       | 5          | 3    | PBDB 20495 (1764)      |
| Order Squamata                              |       |       |          |            |      |                        |
| Suborder Lacertilia                         |       |       |          |            |      |                        |
| Anguidae                                    |       |       |          |            |      |                        |
| Elgaria kingii Gray, 1838                   | LC    | M (10)| Pr       | 2, 3       | 2    | UAZ 07265 (1905)       |
| Crotophytidae                               |       |       |          |            |      |                        |
| Crotophytus collaris (Say, 1823)            | LC    | M (13)| A        | 2, 3       | 2    | CAS HERP 3411 (1892)   |
| Crotophytus dickersonae Schmidt, 1922       | LC    | H (16)| NL       | 1, 6       | 0    | CAS HERP 53264 (1921)  |
| Crotophytus nebris Axtell & Montanucci, 1977| LC    | M (12)| NL       | 1, 3       | 2    | MVZ 10164 (1926)       |
| Gambelia wislizenii (Baird & Girard, 1852)  | LC    | M (13)| Pr       | 1, 2       | 2    | USNM 43183 (1910)      |
| Dactyloidae                                 |       |       |          |            |      |                        |
| Anolis nebulosus (Wiegmann, 1834)           | LC    | M (13)| NL       | 3, 4       | 1    | MVZ 84691 (1818)       |
| Eublepharidae                               |       |       |          |            |      |                        |
| Coleonyx fasciatus (Boulenger, 1885)         | LC    | H (17)| NL       | 3, 4       | 1    | UAZ 01186 (1958)       |
| Coleonyx variegatus (Baird, 1858)           | LC    | M (11)| Pr       | 1, 2, 4    | 2    | UCM 58228 (1800)       |
| Gekkonidae (Introduced)                     |       |       |          |            |      |                        |
| Hemidactylus frenatus Schlegel, 1836        | N/A   | N/A   | N/A      | N/A        | IN   | UABC 1728 (2007)       |
| Hemidactylus turcicus (Linnaeus, 1758)      | N/A   | N/A   | N/A      | N/A        | IN   | UAZ 56726-PSV (2007)   |
| Helodermatidae                              |       |       |          |            |      |                        |
| Heloderma exasperatum Bogert and Martin del| NE    | NE    | NL       | 3, 4       | 1    | LACM 62549 (1942)      |
| Campo, 1856                                 |       |       |          |            |      |                        |
| Heloderma suspectum Cope, 1869              | NT    | H (15)| A        | 1, 2, 3, 4 | 2    | USNM 20998 (1893)      |
| Iguanidae                                   |       |       |          |            |      |                        |
| Ctenosaura conspicuosa Dickerson, 1919      | NE    | H (16)| NL       | 6          | 0    | CAS HERP 55034 (1912)  |
| Ctenosaura macrolopha Smith, 1972           | NE    | H (19)| NL       | 1, 3, 4    | 1    | SDNHM 3859 (1930)      |
| Ctenosaura notacensis Smith, 1972           | VU    | H (17)| NL       | 6          | 0    | CAS HERP 50562 (1921)  |
| Diposaurus doratii (Baird & Girard, 1852)   | LC    | M (11)| NL       | 1          | 2    | MVZ 20843 (1936)       |
| Sauromalus ater Dumeril, 1856               | LC    | M (13)| Pr       | 1          | 2    | USNM 13483 (1883)      |
| Sauromalus hispidus Stejneger, 1891         | N/A   | N/A   | N/A      | N/A        | IN   | CAS HERP 104443 (1967) |
| Sauromalus varius Dickerson, 1919           | NE    | H (16)| A        | 6          | 10   | USNM 64441 (1911)      |
| Phrynosomatidae                             |       |       |          |            |      |                        |
| Callisaurus draconoides Blainville, 1835    | LC    | M (12)| A        | 1, 4       | 2    | CAS HERP 55037 (1911)  |
| Cophosaurus texanus Troschel, 1852          | LC    | H (14)| A        | 1, 2, 3    | 2    | CAS SUR 9882 (1942)    |
| Holbrookia approximatus Baird, 1859         | NE    | H (14)| NL       | 1          | 1    | UCM 58250 (1800)       |
| Holbrookia elegans Bocourt, 1874            | LC    | M (13)| NL       | 1, 2, 3, 4 | 2    | MCZ R-641 (1859)       |
| Phrynosoma cornutum (Harlan, 1825)          | LC    | M (11)| NL       | 2          | 2    | MVZ 38192 (1818)       |
| Phrynosomaditmarsi Stejneger, 1906          | DD    | H (16)| NL       | 3          | 0    | USNM 36013 (1897)      |
| Species | IUCN | EVS | SEMARNAT | Ecoregions | GD | Source of first record |
|---------|------|-----|-----------|------------|----|-----------------------|
| Phrynosoma goddi Stejneger, 1893 | NE | M (13) | NL | 1 | 2 | CM 54812 (1928) |
| Phrynosoma bernardae Girard, 1858 | LC | M (13) | NL | 2, 3 | 2 | USNM 21022 (1893) |
| Phrynosoma mcallii (Hallowell, 1852) | NT | H (15) | A | 1 | 2 | USNM 21841 (1894) |
| Phrynosoma modestum Girard, 1852 | LC | M (12) | NL | 2 | 2 | USNM 21021 (1893) |
| Phrynosoma orbiculare (Linnaeus, 1766) | LC | M (12) | A | 3 | 1 | MCZ R-169820 (1700) |
| Phrynosoma solare Gray, 1845 | LC | H (14) | NL | 1, 2, 3, 4, 6 | 2 | UAZ 02189 (1905) |
| Sceloporus albilatens Smith, 1939 | NE | H (16) | NL | 3, 4 | 1 | BYU 21179 (1961) |
| Sceloporus clarkii Baird & Girard, 1852 | LC | M (10) | NL | 1, 2, 3, 4, 6 | 2 | CAS HERP 50516 (1921) |
| Sceloporus coulesi Lowe & Norris, 1956 | NE | M (13) | NL | 2 | 2 | UAZ 36545 (1973) |
| Sceloporus jarrovi Cope, 1875 | NE | M (11) | NL | 3 | 2 | USNM 17252 (1891) |
| Sceloporus lemoespinali Lara-Góngora, 2004 | DD | H (16) | NL | 3 | 1 | UAZ 16588 (1966) |
| Sceloporus magister Hallowell, 1854 | LC | L (9) | NL | 1 | 2 | CAS HERP 53359 (1921) |
| Sceloporus neloni Cochran, 1923 | LC | M (13) | NL | 3, 4 | 1 | MVZ 28914 (1939) |
| Sceloporus poinetii Baird & Girard, 1852 | LC | M (12) | NL | 3 | 2 | USNM 315440 (1921) |
| Sceloporus levini Smith, 1937 | LC | M (11) | NL | 2, 3 | 2 | UAZ 02914 (1953) |
| Sceloporus virgatus Smith, 1938 | LC | H (15) | NL | 3 | 2 | MCZ R-46625 (1933) |
| Uma rufopunctata Cope, 1895 | NT | H (16) | NL | 1 | 2 | CAS HERP 53368 (1921) |
| Urosaurus bicarinatus (Duméril, 1856) | LC | M (12) | NL | 4 | 1 | MVZ 28889 (1939) |
| Urosaurus gracilis Hallowell, 1854 | LC | H (14) | NL | 1 | 2 | MVZ 10160 (1926) |
| Urosaurus ornatus (Baird & Girard, 1852) | LC | M (10) | NL | 1, 2, 3, 4, 6 | 2 | CAS HERP 53257 (1921) |
| Uta nolascensis Van Denburgh & Slevin, 1921 | LC | H (17) | A | 6 | 0 | CAS HERP 50539 (1921) |
| Uta palmeri Stejneger, 1890 | LU | H (17) | A | 6 | 0 | CAS HERP 50580 (1921) |
| Uta stanifuriana Baird & Girard, 1852 | LC | M (11) | A | 1, 6 | 2 | CAS HERP 50705 (1921) |

**Phylodactylidae**

| Species | IUCN | EVS | SEMARNAT | Ecoregions | GD | Source of first record |
|---------|------|-----|-----------|------------|----|-----------------------|
| Phylodactylus homolepidus Smith, 1935 | LC | H (15) | Pr | 1, 4 | 1 | CMNH 13022 (1932) |
| Phylodactylus notriolus Dixon, 1964 | NE | M (10) | NL | 6 | 2 | CAS HERP 50798 (1921) |
| Phylodactylus solanoensis Dixon, 1964 | NE | NE | NL | 6 | 0 | CAS HERP 50550 (1921) |
| Phylodactylus tuberculoss Wiegmann, 1835 | LC | L (8) | NL | 4 | 4 | KUH 24117 (1948) |

**Scinidae**

| Species | IUCN | EVS | SEMARNAT | Ecoregions | GD | Source of first record |
|---------|------|-----|-----------|------------|----|-----------------------|
| Plestiodon callicephalus (Bocourt, 1879) | LC | M (12) | NL | 3 | 2 | UAZ 03469 (1905) |
| Plestiodon ohiodus (Baird & Girard, 1852) | LC | M (11) | NL | 1, 3 | 2 | UAZ 35168 (1972) |
| Plestiodon parvianiscus (Taylor, 1933) | DD | H (15) | Pr | 3, 4 | 1 | USNM 47536 (1899) |

**Teiidae**

| Species | IUCN | EVS | SEMARNAT | Ecoregions | GD | Source of first record |
|---------|------|-----|-----------|------------|----|-----------------------|
| Aspidoscelis bacatus (Van Denburgh & Slevin, 1921) | LC | H (17) | Pr | 6 | 0 | Van Denburgh and Slevin 1921 (1921) |
| Aspidoscelis burti (Taylor, 1938) | LC | H (15) | NL | 1 | 0 | CAS HERP 53425 (1921) |
| Aspidoscelis curvatus (Cope, 1878) | NE | M (11) | Pr | 1, 3, 4 | 1 | MVZ 28921 (1939) |
| Aspidoscelis estebanensis (Dickerson, 1919) | NE | NE | Pr | 6 | 0 | Dickerson, 1919 (1919) |
| Aspidoscelis esanguis (Lowe, 1956) | LC | H (14) | NL | 3 | 2 | MVZ 21018 (1936) |
| Aspidoscelis martyri (Stejneger, 1891) | VU | H (17) | Pr | 6 | 0 | Stejneger, 1891 (1891) |
| Aspidoscelis opate (Wright, 1967) | DD | H (16) | NL | 3 | 0 | UAZ 09228 (1963) |
| Aspidoscelis sonorae (Lowe & Wright, 1964) | LC | M (13) | NL | 1, 2, 3 | 2 | UAZ 05045 (1905) |
| Aspidoscelis stictogrammus (Burger, 1950) | NE | H (14) | NL | 1, 3 | 2 | USNM 15752 (1889) |
| Aspidoscelis tigris (Baird & Girard, 1852) | LC | L (8) | NL | 1 | 2 | CAS HERP 49152 (1921) |
| Aspidoscelis uniparens (Wright & Lowe, 1965) | LC | H (15) | NL | 2 | 2 | UAZ 05125 (1905) |
| Aspidoscelis xantitronus (Duellman & Lowe, 1953) | NE | H (14) | NL | 1 | 2 | Rosen and Quijada-Mascareñas 2009 (2009) |

**Xantusidae**

| Species | IUCN | EVS | SEMARNAT | Ecoregions | GD | Source of first record |
|---------|------|-----|-----------|------------|----|-----------------------|
| Xantusia jaycopoli Bezy, Bezy, & Bollies, 2009 | NE | H (16) | NL | 1 | 0 | UAZ 10760 (1964) |
| Xantusia vigilis Baird, 1859 | LC | NE | NL | 1 | 2 | CAS HERP 84144 (1949) |

**Suborder Serpentes**

**Boidae**

| Species | IUCN | EVS | SEMARNAT | Ecoregions | GD | Source of first record |
|---------|------|-----|-----------|------------|----|-----------------------|
| Boa sigma Smith, 1943 | NE | NE | NL | 1, 3, 4 | 1 | USNM 61956 (1887) |
| Lichanura triungulata Cope, 1861 | LC | M (10) | A | 1 | 2 | SDNHM 10793 (1833) |
## Colubridae

| Species                                                                 | IUCN | EVS | SEMARATN | Ecoregions | GD | Source of first record |
|------------------------------------------------------------------------|------|-----|----------|------------|----|------------------------|
| Arizona elegans Kennicott, 1859                                       | LC   | L (5) | NL       | 1          | 2  | SDNHM 16479 (1934)     |
| Chilomeniscus stramineus Cope, 1860                                   | LC   | L (8) | Pr       | 1, 6       | 2  | UAZ 23194 (1958)       |
| Chionactis annulata (Baird, 1858)                                     | LC   | M (12) | NL     | 1          | 2  | CUMV 1243 (1930)       |
| Chionactis palerstri (Klauber, 1937)                                   | LC   | M (13) | NL     | 1          | 2  | MCZ R-36890 (1932)     |
| Drymarchon melanurus (Duméry, Bibron & Duméré, 1854)                  | LC   | L (6) | NL      | 1, 3, 4    | 3  |                       |
| Drynobius margarites (Schlegel, 1837)                                 | NE   | L (6) | NL      | 4          | 3  | MVZ 28930 (1939)       |
| Gyalopion canum Cope, 1861                                            | LC   | L (9) | NL      | 2, 3       | 2  | UAZ 20736 (1954)       |
| Gyalopion quadrandrariae (Günther, 1893)                              | LC   | M (11) | Pr     | 1, 4       | 2  | KUH 24113 (1948)       |
| Lampropeltis californieae (Blainville, 1835)                          | NE   | M (10) | NL     | 1          | 2  | UAZ 25105 (1905)       |
| Lampropeltis knoebli Taylor, 1940                                     | NE   | M (10) | NL     | 3          | 2  | SDNHM 41106 (1950)     |
| Lampropeltis nigra Zweifel & Norris, 1955                             | NE   | NE    | NL      | 1, 2, 3, 6 | 4  | USNM 21720 (1894)      |
| Lampropeltis polynoza Cope, 1860                                     | NE   | L (7) | NL      | 3, 4       | 1  | MVZ 50813 (1950)       |
| Lampropeltis splendida (Baird & Girard, 1853)                         | NE   | M (12) | NL     | 2, 3       | 2  | Baird and Girard 1853  |
| Leptophis diplotropis (Günther, 1872)                                 | LC   | H (14) | A      | 3, 4       | 1  | SDHM 18176 (1947)      |
| Masticophis bilineatus Jan, 1863                                      | LC   | M (11) | NL     | 1, 2, 3, 4 | 6  | USNM 15880 (1889)      |
| Masticophis flagellum Shaw, 1802                                      | LC   | L (8)  | A      | 1, 2, 3, 4 | 6  | USNM 56759 (1902)      |
| Masticophis mendozarius (Duméry, Bibron & Duméré, 1854)               | LC   | L (6)  | A      | 3, 4       | 4  | SDNHM 18183 (1947)     |
| Masticophis slevini Lane & Norris, 1955                               | LC   | H (17) | NL     | 6          | 0  | SDNHM 3826 (1930)      |
| Mastigodryas cliftoni (Hardy, 1964)                                   | NE   | H (14) | NL     | 4          | 1  | UAZ 42231 (1975)       |
| Oxybelis aeneus (Wagler, 1824)                                        | NE   | L (5)  | NL     | 1, 3, 4    | 3  | SDHM 18189 (1947)      |
| Phyllorhynchus browni Stejneger, 1890                                 | LC   | M (13) | Pr     | 1, 4       | 2  | MVZ 50740 (1950)       |
| Phyllorhynchus decurtatus (Cope, 1868)                                | LC   | M (11) | NL     | 1          | 2  | MVZ 10170 (1926)       |
| Pituophis catenifer (Blainville, 1835)                                | LC   | L (9)  | NL     | 1, 2, 3, 4 | 6  | MVZ 5886 (1915)        |
| Pituophis deppei (Duméry, 1853)                                       | LC   | H (14) | A      | 3          | 1  | T.R. Van Devender (son-ter-5147) (1997) |
| Pseudocnemias frontalis (Cope, 1864)                                  | LC   | M (13) | NL     | 4          | 1  | UAZ 21338 (1967)       |
| Rhiocodina lecontei Baird & Girard, 1853                              | LC   | L (8)  | NL     | 1, 2, 3, 4 | 2  | UMMZ 75636 (1933)      |
| Salvadora bairdi Jan & Sordelli, 1860                                 | LC   | H (15) | Pr     | 3          | 1  | AMNH 102194 (1968)     |
| Salvadora deserticola Schmidt, 1940                                   | NE   | H (14) | NL     | 1, 2, 3    | 3  | MVZ 21029 (1936)       |
| Salvadora grahamiae Baird & Girard, 1853                              | LC   | M (10) | NL     | 2, 3       | 2  | UAZ 26182 (1952)       |
| Salvadora helenae (Cope, 1867)                                        | LC   | M (10) | NL     | 1          | 2  | UAZ 26300 (1905)       |
| Sentiscolis triaspis (Cope, 1866)                                     | LC   | L (6)  | NL     | 1, 3, 4    | 3  | CAS HERP 63101 (1928)  |
| Sonora aemula (Cope, 1879)                                            | NT   | H (16) | Pr     | 3, 4       | 1  | PPM H 6448 (1900)      |
| Sonora seminulata Baird & Girard, 1853                                | LC   | L (5)  | NL     | 1, 2       | 2  | UAZ 26340 (1953)       |
| Sympholis lippa Cope, 1862                                            | NE   | H (14) | NL     | 4          | 1  | MVZ 76333 (1963)       |
| Tanilla bembemibib Taylor, 1936                                      | LC   | M (11) | NL     | 1, 2, 3    | 2  | LACM 20473 (1950)      |
| Tanilla wilcoxi Stejneger, 1902                                       | LC   | M (10) | NL     | 3          | 2  | UAZ 28201 (1964)       |
| Tanilla yuqua Smith, 1942                                            | LC   | M (10) | NL     | 1, 3, 4    | 2  | SDHN 18190 (1947)      |
| Trimorphodon lambdi Cope, 1886                                       | NE   | M (13) | NL     | 1, 3, 4, 6 | 2  | USNM 56321 91902       |
| Trimorphodon tau Cope, 1870                                          | LC   | M (13) | NL     | 3, 4       | 1  | UAZ 27070 (1905)       |

## Dipodidae

| Species                                                                 | IUCN | EVS | SEMARATN | Ecoregions | GD | Source of first record |
|------------------------------------------------------------------------|------|-----|----------|------------|----|------------------------|
| Coniophanes lateritius Cope, 1862                                      | DD   | M (13) | NL     | 4          | 1  | Ambia Molina 1969 (1969) |
| Diadophis punctatus (Linnaeus, 1766)                                   | LC   | L (4)  | NL     | 1, 2, 3    | 2  | UAZ 24162 (1905)       |
| Geophis dugesi Bocourt, 1883                                           | LC   | M (13) | NL     | 3          | 1  | Enderson and Bezy 2007 (2007) |
| Heterodon kennelli Kennicott, 1860                                     | NE   | M (11) | Pr     | 2          | 2  | USNM 1253 (1855)       |
| Hypiglena chlorophaga Cope, 1860                                      | NE   | L (8)  | NL     | 1, 2, 3, 4 | 6  | Allen 1933 (1932)      |
| Imanodes gemmistratus (Cope, 1861)                                    | NE   | L (6)  | Pr     | 4          | 4  | UAZ 50923 (1905)       |
| Leptodeira punctata (Peters, 1866)                                    | LC   | H (17) | NL     | 4          | 1  | CAS HERP 93855 (1962)  |
| Leptodeira splendida Günther, 1895                                    | LC   | H (14) | NL     | 3, 4       | 1  | MVZ 50835 (1950)       |
| Tropidodipsas repleta Smith, Lemos-Espinal, Hartman & Chiszar, 2005  | DD   | H (17) | NL     | 3, 4       | 1  | UCM 65700 (2003)       |
| Elapidae | IUCN | Evans | SEMARNAT | Ecoregions | GDF | Source of first record |
|---------|------|-------|----------|------------|-----|-----------------------|
| Hydrophius platyrus (Linnaeus, 1766) | LC | NE | NL | 5 | 6 | USNM 39726 (1962) |
| Micruroides ursus (Kennicott, 1860) | LC | H (15) | A | 1, 3, 4, 6 | 2 | UMMZ 71943 (1935) |
| Micruroides wrighti (Kennicott, 1860) | LC | H (14) | Pr | 3, 4 | 4 | MVZ 28933 (1950) |

| Leptotyphlopidae | |
|------------------|------|-------|----------|------------|-----|-----------------------|
| Rana marinae Baird & Girard, 1853 | LC | L (8) | NL | 1, 3, 4 | 2 | USNM 141978 (1957) |

| Natricidae | |
|-----------|------|-------|----------|------------|-----|-----------------------|
| Storeria ursinaeidae (Cope, 1865) | LC | M (11) | NL | 3 | 1 | UAZ 28125 (1964) |
| Thamnophis cyrtaspis (Kennicott, 1860) | LC | L (7) | A | 1, 2, 3, 4 | 3 | UMMZ 21056 (1893) |
| Thamnophis eques (Reuss, 1834) | LC | L (8) | A | 1, 2, 3, 4, 2 | | MCZ R-5891 (1700) |
| Thamnophis marcellus (Baird & Girard, 1853) | LC | M (10) | A | 1, 2, 3 | 3 | USNM 21822 (1894) |
| Thamnophis melanogaster (Peters, 1864) | EN | H (15) | A | 3 | 1 | BYU 13505 (1956) |
| Thamnophis unilatialis (Tanner, 1985) | NE | NE | NL | 3 | 1 | USNM 21055 (1893) |
| Thamnophis validus (Kennicott, 1860) | NE | M (12) | NL | 4 | 1 | KUH 47567 (1959) |

| Typhlopidae | |
|------------|------|-------|----------|------------|-----|-----------------------|
| Indotyphlops biformis (Daudin, 1803) | N/A | N/A | N/A | N/A | IN | MZFC 6147 (1991) |

| Viperidae | |
|-----------|------|-------|----------|------------|-----|-----------------------|
| Agkistrodon bilineatus (Günther, 1863) | NT | M (11) | Pr | 4 | 4 | SDNHM 40270 (1949) |
| Crotalus atrox Baird & Girard, 1853 | LC | L (9) | Pr | 1, 2, 3, 6 | 2 | USNM 21045 (1893) |
| Crotalus basiliscus (Cope, 1864) | LC | H (16) | Pr | 1, 4 | 1 | SDNHM 18181 (1947) |
| Crotalus cerastes Hallowell, 1854 | LC | H (16) | Pr | 1 | 2 | CAS HERP 81515 (1947) |
| Crotalus eusthenes (Klauber, 1949) | LC | H (19) | NL | 6 | 0 | USNM 64586 (1911) |
| Crotalus lepidus (Kennicott, 1861) | LC | M (12) | Pr | 3 | 2 | SDNHM 42906 (1952) |
| Crotalus molossus Baird & Girard, 1853 | LC | L (8) | Pr | 1, 2, 3, 4, 6 | 2 | SDNHM 3445 (1932) |
| Crotalus pricei Van Denburgh, 1895 | LC | H (14) | Pr | 3 | 2 | UMMZ 78475 (1935) |
| Crotalus pyrrhus (Cope, 1866) | NE | NE | NL | 1 | 2 | UAZ 27600 (1964) |
| Crotalus scutulatus (Kennicott, 1861) | LC | L (11) | Pr | 1, 2 | 2 | UAZ 27355 (1930) |
| Crotalus tigris Kennicott, 1859 | LC | H (16) | Pr | 1, 3, 4, 6 | 2 | SDNHM 3237 (1930) |
| Crotalus viridis (Rafinesque, 1818) | LC | M (12) | Pr | 2 | 2 | USNM 61955 (1887) |
| Crotalus willardi Meek, 1905 | LC | M (13) | Pr | 3 | 2 | UMMZ 78449 (1935) |

| Order Testudines | |
|------------------|------|-------|----------|------------|-----|-----------------------|
| Chelonia | |
| Careta caretta (Linnaeus, 1758) | VU | NE | P | 5 | 5 | USZ 36495 (1954) |
| Chelonia mydas (Linnaeus, 1758) | EN | NE | P | 5 | 5 | USNM 21818 (1894) |
| Eretmochelys imbricata (Linnaeus, 1766) | NE | NE | P | 5 | 5 | Grismer, 2002 (2002) |
| Lepidochelys olivacea (Echscholtz, 1829) | VU | NE | NE | P | 5 | SDNHM 49849 (1961) |

| Dermochelyidae | |
|----------------|------|-------|----------|------------|-----|-----------------------|
| Dermochelys coriacea (Vandelli, 1761) | VU | NE | L (8) | NL | 4 | 4 | MZV 50913 (1950) |

| Emydidae | |
|---------|------|-------|----------|------------|-----|-----------------------|
| Terrapene veloni Stejneger, 1925 | DD | H (18) | Pr | 3, 4 | 1 | SDNHM 42411 (1930) |
| Terrapene ornata (Agassiz, 1857) | NT | H (15) | Pr | 3, 3 | 3 | USNM 20993 (1893) |
| Trachemys nelsoni (Van Denburgh, 1895) | NE | H (18) | NL | 4 | 1 | UMNH 3823 (1961) |
| Trachemys scripta (Legler & Webb, 1970) | VU | H (19) | NL | 1, 3, 4, 0 | | UMNH 12449 (1963) |

| Geoemydidae | |
|-------------|------|-------|----------|------------|-----|-----------------------|
| Rhinoclemmys pulcherrima (Gray, 1855) | NE | L (8) | NL | 4 | 4 | MZV 50913 (1950) |

| Kinosternidae | |
|---------------|------|-------|----------|------------|-----|-----------------------|
| Kinosternon alaminum Berry & Legler, 1980 | DD | H (14) | Pr | 1, 4 | 1 | MVZ 50907 (1950) |
| Kinosternon arizonense Gilmore, 1922 | LC | H (15) | NL | 1 | 2 | UMMZ 72234 (1950) |
| Kinosternon integrum Stejneger, 1925 | LC | M (11) | Pr | 1, 3, 4 | 1 | UMMZ 79514 (1935) |
| Kinosternon sumatrense Le Conte, 1854 | NT | H (14) | P | 1, 2, 3 | 2 | USNM 20984 (1893) |

| Family Testudinidae | |
|---------------------|------|-------|----------|------------|-----|-----------------------|
| Gopherus agassizii Edwards, Karl, Vaughn, Rosen, Meléndez-Torres, & Murphy, 2016 | NE | NE | NL | 3, 4 | 1 | ROM 53301 (1942) |
| Gopherus morafkai Murphy, Berry, Edwards, Leviton, Lathrop, & Riedle, 2011 | NE | H (15) | NL | 1, 3, 6 | 2 | USNM 21159 (1894) |

| Triungulidae | |
|-------------|------|-------|----------|------------|-----|-----------------------|
| Apatelone spinifer (Le Sueur, 1827) | N/A | N/A | N/A | N/A | IN | UAZ 56727-PSV (2007) |
Table 3. Summary of native species present in Sonora by family, order or suborder, and class. Status summary indicates the number of species found in each IUCN conservation status in the order DD, LC, VU, NT, EN, CE (see Table 2 for abbreviations; in some cases species have not been assigned a status by the IUCN and therefore these may not add up to the total number of species in a taxon) and conservation status in Mexico according to SEMARNAT (2010) in the order NL, Pr, A, and P (see Table 1 for abbreviations). Mean EVS is the mean Environmental Vulnerability Score, scores ≥ 14 are considered high vulnerability (Wilson et al. 2013a, b).

| Scientific Name | Genera | Species | IUCN | EVS | SEMARNAT |
|-----------------|--------|---------|------|-----|----------|
| **Class Amphibia** |        |         |      |     |          |
| Order Anura     | 15     | 33      | 2.24 | 9.3 | 25.7, 1.0 |
| Bufonidae       | 3      | 12      | 0.9  | 10.6| 10.2, 0.0 |
| Craugastoridae  | 1      | 3       | 1.1  | 12.7| 2.1, 0.0  |
| Eleutherodactylidae | 1 | 1 | 1.0  | 15  | 0.1, 0.0  |
| Hylidae         | 4      | 6       | 0.6  | 8.5 | 6.0, 0.0  |
| Leptodactylidae | 1      | 1       | 0.1  | 6   | 1.0, 0.0  |
| MICROHYLIDAE    | 2      | 2       | 0.2  | 4.5 | 2.0, 0.0  |
| **Order Caudata** | 2      | 3       | 0.2  | 12  | 2.1, 0.0  |
| Ambystomatidae  | 1      | 2       | 0.2  | 12  | 1.1, 0.0  |
| Plethodontidae  | 1      | 1       | 0.0  | 1.0 | 1.0, 0.0  |
| **Subtotal**    | 17     | 36      | 2.26 | 9.4 | 27.8, 1.0 |
| **Class Reptilia** |    |         |      |     |          |
| Order Crocodylia| 1      | 1       | 0.0  | 14  | 0.1, 0.0  |
| Crocodylidae    | 1      | 1       | 0.0  | 14  | 0.1, 0.0  |
| Order Squamata  | 60     | 140     | 6.90 | 12.2| 91.29, 20.0 |
| **Suborder Lacertilia** | 21 | 66 | 4.40 | 13.5| 46.10, 10.0 |
| Anguidae        | 1      | 1       | 0.1  | 10  | 0.1, 0.0  |
| Crotaphytidae   | 2      | 4       | 0.4  | 13.5| 2.1, 1.0  |
| Dactyliidae     | 1      | 1       | 0.1  | 13  | 1.0, 0.0  |
| Eublepharidae   | 1      | 2       | 0.2  | 14  | 1.1, 0.0  |
| Helodermatidae  | 1      | 2       | 0.0  | 15  | 1.0, 1.0  |
| Iguanidae       | 3      | 6       | 0.2  | 15.3| 4.1, 1.0  |
| Phrynosomatidae | 8      | 29      | 2.19 | 13.2| 22.0, 7.0  |
| Phyllodactylidae| 1      | 4       | 0.2  | 11  | 3.1, 0.0  |
| Scincidae       | 1      | 3       | 1.2  | 12.7| 2.1, 0.0  |
| Teiidae         | 1      | 12      | 1.6  | 14  | 8.4, 0.0  |
| Xantusiidae     | 1      | 2       | 0.1  | 16  | 2.0, 0.0  |
| **Suborder Serpentes** | 39 | 74 | 2.51 | 11.1| 45.19, 10.0 |
| Boidae          | 2      | 2       | 0.1  | 10  | 1.0, 1.0  |
| Colubridae      | 21     | 39      | 0.27 | 10.5| 30.5, 4.0  |
| Dipsadidae      | 8      | 9       | 2.4  | 11.4| 7.2, 0.0  |
| Elapidae        | 3      | 3       | 0.3  | 14.5| 1.1, 1.0  |
| Leptotyphlopidae| 1      | 1       | 0.1  | 8   | 1.0, 0.0  |
| Natricidae      | 2      | 7       | 0.4  | 10.5| 3.0, 4.0  |
| Viperidae       | 2      | 13      | 0.11 | 13.1| 2.1, 1.0  |
| **Order Testudines** | 10 | 16 | 2.24 | 14.7| 6.4, 0.6  |
| Cheloniiidae    | 4      | 4       | 0.0  | 10.5| 0.0, 4.0  |
| Dermochelyidae  | 1      | 1       | 0.0  | 0.0 | 0.0, 1.0  |
| Emydidae        | 2      | 2       | 1.0  | 17.5| 2.2, 0.0  |
| Geoemydidae     | 1      | 1       | 0.0  | 8   | 1.0, 0.0  |
| Kinosternidae   | 1      | 4       | 1.2  | 13.5| 1.2, 0.1  |
| Testudinidae    | 1      | 2       | 0.0  | 15  | 2.0, 0.0  |
| **Subtotal**    | 71     | 157     | 8.93 | 12.4| 97.34, 20.6 |
| **Total**       | 88     | 193     | 10.11| 11.9| 124.42, 21.6 |
from Canada to Central America, from the US to Central or South America, or from Mexico to Central or South America (Table 2).

The American Crocodile (*Crocodylus acutus*) is widely distributed from the eastern US to South America. One of the seventeen species of turtles that inhabit the state is endemic to Sonora (Table 2). Five more are endemic to Mexico. Of the eleven species of turtles not endemic to Mexico that occur in Sonora, one is introduced. Four more are distributed from the US to Mexico, one more is found from Mexico to Central America, and the remaining five species have a circumtropical or circumglobal distribution (Table 2). Fourteen of the 69 species of lizards that occur in the state are endemic to Sonora, nine of them to islands of the Gulf of California. Thirteen more are endemic to Mexico (Table 2). Of the 42 lizard species not endemic to Mexico that inhabit Sonora, three are introduced, 38 more are found in the US and Mexico, and the remaining species have a wide distribution that includes Mexico and South America (*Phyllodactylus tuberculosus*) (Table 2). Two of the 75 species of snakes that inhabit the state are endemic to Sonoran islands of the Gulf of California (Table 2). Another 21 snake species that are found in Sonora are endemic to Mexico. Of the 52 snake species not endemic to Mexico that occur in Sonora, one is introduced, 41 more are distributed from the US to Mexico, six more range from the US or Canada to Central or even South America, and three more are found from Mexico to Central or South America (Table 2).
Ecoregions

The most diverse Sonora ecoregions in terms of the herpetofauna are the Eastern mountains (54% of the total number of amphibian and reptile species for the state) represented by the Sierra Madre Occidental and associated mountains, and the Western Mainland Desert (49%) represented mainly by the Sonoran Desert (Fig. 4). The Island (16%) and Marine (4%) are the least occupied ecoregions (Table 5). In general, the highest richness of amphibian species is observed in the Subtropical Lowlands and Foothills of the Sierra Madre Occidental with 61% of the total number of species, followed by the Eastern Mountains (58%), the Western Mainland Deserts (50%), and the High Northeastern Valleys (39%). Amphibians are almost absent in the Island ecoregion with only two species recorded (6%) and due to their limitations to inhabit saline environments they are absent in the Marine ecoregion (Table 5). The Subtropical Lowlands and Foothills of the Sierra Madre Occidental had 67% of the anuran species in Sonora, whereas caudate amphibians are absent in this ecoregion showing their highest percentage of presence in the Eastern Mountains with two (67%) of the three species occurring in this ecoregion. In reptiles, the highest species richness is found in the Eastern Mountains (53%) ecoregion. This is the ecoregion with the highest number of snake (61%) and turtle (44%) species, although the same number of turtle species is found in the Subtropical Lowlands and Foothills of the Sierra Madre Occidental. Snakes are also diverse in the Western Mainland Deserts and the Subtropical Lowlands and Foothills of the Sierra Madre Occidental; each of these ecoregions hosts 38 snake species (51% of the total number of snake species recorded in Sonora). On the other hand, due to their conspicuousness and adaptations for arid environments, lizards have their highest diversity in the Western Mainland Deserts (48%) followed by the Eastern Mountains (47%), and they are the most diverse taxonomic group in the Island ecoregion, which is represented by dry environments, with 15 species (23%). Snakes are also diverse in the Island ecoregion with 13 species (18%). This is explained in part by the high vagility, adaptations to dry environments, and speciation rates of these two squamate suborders. Testudines is the taxonomic group with the highest percentage of species (5 = 31% of the total number of turtles in Sonora) in the Marine ecoregion, followed by snakes and crocodilians, both groups with one species representing 1 and 100% of the total number of species in their groups respectively. Five of the species that occur in the Marine ecoregion have a circumglobal or circumtropical distribution (five turtles). The other two species occurring in the Marine ecoregion are a crocodile that was thought until recently to be extirpated from Sonora but may be staging a comeback on the southern coast (Rorabaugh 2017), and a sea snake distributed across the Pacific and Indo-Pacific Oceans. The general reptile pattern of diversity is driven by lizards and snakes, except in the Marine ecoregions which is dominated by sea turtles of the families Cheloniidae and Dermochelyidae (Table 5).
### Table 4. List of amphibians and reptiles that could potentially occur in Sonora.

| Class Amphibia |  |
|----------------|---|
| **Order Anura** |  |
| Craugastoridae |  |
| *Craugastor vocalis* (Taylor, 1940) | Likely to occur in tropical deciduous forest and montane woodlands in the Río Fuerte drainage of extreme southeastern Sonora. |
| **Ranidae** |  |
| *Rana blairi* (Mecham, Littlejohn, Oldham, Brown, & Brown, 1973) | Likely to occur in Chihuahuan Desert or semi-desert grassland of northeastern Sonora, along the US-Mexico border east of Naco. |
| **Scaphiopodidae** |  |
| *Spea bombifrons* (Cope, 1863) | Likely to occur in Chihuahua desertscrub east and plains grassland of northeastern Sonora. |
| **Class Reptilia** |  |
| **Order Squamata** |  |
| **Suborder Amphisbaenia** |  |
| *Bipes biporus* (Cope, 1894) | This species has been observed in the San Carlos Bay, municipality of Guaymas (Ballinger pers. comm., May 2009), but no museum record or voucher exist to support its presence in Sonora. |
| **Suborder Lacertilia** |  |
| **Anguidae** |  |
| *Barisia levicolis* (Smith, 1942) | Likely to occur in woodlands of the Sierra Madre Occidental of eastern and northeastern Sonora. |
| **Phrynosomatidae** |  |
| *Sceloporus bimaculosus* Phelan & Brattstrom, 1955 | Expected in Chihuahuan desertscrub and semi-desert grassland valleys as well as the lower slopes of the mountains along the US - Mexico border from the Río San Pedro valley east to the Sierra San Luis, and potentially in Plains grassland in the southern Animas Valley (northeastern Sonora). |
| **Scincidae** |  |
| *Platysoma multilineatum* (Tanner, 1957) | Likely to occur in woodland of the Sierra Madre Occidental of eastern and northeastern Sonora. |
| **Suborder Serpentes** |  |
| **Boidae** |  |
| *Lichanura orcutti* Stejneger, 1889 | Has been found within a few km of the Sonora border in the Tí尼亚as Altas Mountains of Yuma County, Arizona. |
| **Colubridae** |  |
| *Lampropeltis gentilis* (Baird & Girard, 1853) | Occurs in southeastern Cochise County, Arizona. |
| *Tantilla nigricelps* Kennicott, 1860 | Likely occurs in northeastern Sonora in Chihuahuan desertscrub or semi-desert grassland from Agua Prieta east to the Sierra San Luis and possibly in Plains grassland in the southern Animas Valley. |
| **Dipsadidae** |  |
| *Hypsiglena jani* Duges, 1865 | Likely to occur in tropical deciduous forest and scrubland of southeastern Sonora. |
| *Hypsiglena torquata* ( Günther, 1860) | Likely to occur in tropical deciduous forest and scrubland of southeastern Sonora. Mulcahy et al. (2014) suggested the snakes in this area might be an undescribed species of *Hypsiglena*. |
| *Rhadinatam laurata* ( Günther, 1868) | Likely to occur in woodlands of the Sierra Madre Occidental of eastern and northeastern Sonora. |
| **Leptotyphlopidae** |  |
| *Rena dissecta* (Cope, 1896) | Expected in Chihuahuan desertscrub, semi-desert grasslands, and into the lower slopes of adjacent mountains along the United States - Mexico border from the Río San Pedro Valley east to the Sierra San Luis, and also in Plains grassland in the southern Animas Valley. |
| **Natricidae** |  |
| *Thamnophis elegans* (Baird & Girard, 1853) | This species might occur in the Sierras Huachinera and Bacadehuachi and possibly elsewhere in the eastern mountains of Sonora near the Chihuahua border. |
| **Viperidae** |  |
| *Sistrurus tergeminus* (Say, 1823) | Could potentially be found in grasslands along the US – Mexico border from the Río San Pedro Valley east to the Sierra San Luis. |
| **Order Testudines** |  |
| **Emydidae** |  |
| *Trachemys scripta* (Thunberg, 1792) | This aquatic turtle occurs sparingly as an introduced species in the Colorado River near Yuma, Arizona and in the San Pedro River Valley of Arizona. It could be present along wetted reaches of the Río Colorado in Sonora or in agricultural canals and ditches in that region, and in the Río San Pedro of Sonora near the border with Arizona. |
Table 5. Summary of the number of native species (% of total number of species of taxonomic group in Sonora in parentheses) in different taxonomic groups found in the ecoregions of Sonora, Mexico (see text for description of the ecoregion types).

| Taxonomic Group | Western mainland deserts | High northeastern valleys | Eastern mountains | Subtropical lowlands and foothills | Marine | Island |
|-----------------|--------------------------|---------------------------|-------------------|-----------------------------------|--------|--------|
| Amphibia        | 18 (50)                  | 14 (39)                   | 21 (58)           | 22 (61)                           | 0 (0)  | 2 (6)  |
| Anura           | 17 (52)                  | 13 (39)                   | 19 (58)           | 22 (67)                           | 0 (0)  | 2 (6)  |
| Caudata         | 1 (33)                   | 1 (33)                    | 2 (67)            | 0 (0)                             | 0 (0)  | 0 (0)  |
| Reptilia        | 76 (48)                  | 40 (31)                   | 83 (53)           | 61 (39)                           | 7 (4)  | 29 (18) |
| Crocodylia      | 0 (0)                    | 0 (0)                     | 0 (0)             | 0 (0)                             | 1 (100)| 0 (0)  |
| Squamata        | 70 (50)                  | 38 (27)                   | 76 (54)           | 54 (39)                           | 1 (0.07)|28 (20) |
| Lacertilia      | 32 (48)                  | 17 (26)                   | 31 (47)           | 16 (24)                           | 0 (0)  | 15 (23) |
| Serpentes       | 38 (51)                  | 21 (28)                   | 45 (61)           | 38 (51)                           | 1 (1)  | 13 (18) |
| Testudines      | 6 (40)                   | 2 (13)                    | 7 (44)            | 7 (44)                            | 5 (31) | 1 (6)  |
| Total           | **94 (49)**              | **54 (28)**               | **104 (54)**      | **83 (43)**                       | **7 (4)**|**30 (16)** |

Comparisons with neighboring states

Overall, Sonora shares the most species with Chihuahua, Sinaloa, and Arizona (Table 6). For amphibians, Sonora shares the most species with Chihuahua and Sinaloa. For reptiles, Sonora shares about half its species with Chihuahua, Sinaloa, and Arizona (Table 6). Previous comparisons of shared herpetofaunal species among neighboring states in the US-Mexico border region found high levels of similarity between Sonora and Chihuahua (Enderson et al. 2009, Smith and Lemos-Espinal 2015, Lemos-Espinal et al. 2017). However, an analysis based on “biogeographic affinity” resulted in Sonora being closest or most similar to Sinaloa (Enderson et al. 2009, Lavín-Murcio and Lazcano 2010). There is some variation, though, in these affinities depending on which specific herpetofaunal taxa are being examined (Enderson et al. 2009). Such a pattern probably reflects the fact that Sonora, Chihuahua, Arizona, and Sinaloa all have extensive tracts of arid habitats. Shared habitats and vegetation types likely lead to similarities in species among Sonora and neighboring states (see also Smith and Lemos-Espinal 2015, Lemos-Espinal and Smith 2016, Lemos-Espinal et al. 2017). The similarity in herpetofauna among three Mexican states and Arizona highlights the necessity for interstate and international approaches to conserving and managing habitats and species (e.g., Grigione et al. 2009, Wiederholt et al. 2013).

Conservation status

A total of 21 (= 10.9%) species of amphibians and reptiles is IUCN listed (i.e., Vulnerable, Near Threatened, Endangered, or Critically Endangered), but 69 species (= 35.0%) are placed in a protected category by SEMARNAT and 63 species (= 32.6%) are categorized as high risk by the EVS (Tables 3, 5). For amphibians, 11.1% are IUCN
**Table 6.** Summary of the numbers of species shared between Sonora and neighboring Mexican states (not including introduced species). The percent of species from Sonora shared by a neighboring state are given in parentheses. Key: – indicates neighboring state has no species in the taxonomic group, thus no value for shared species is provided.

| Class          | Sonora | Arizona | Baja California | Sinaloa | Chihuahua | New Mexico |
|----------------|--------|---------|-----------------|---------|-----------|------------|
| Order Caudata  | 3      | 1 (33)  | 1 (33)          | 3 (100) | 1 (33)    |            |
| Ambystomatidae | 2      | 1 (50)  | –               | 1 (50)  | 2 (100)   | 1 (50)     |
| Plethodontidae | 1      | 0 (0)   | 0 (0)           | –       | 1 (100)   | 0 (0)      |
| Order Anura    | 33     | 15 (45) | 6 (18)          | 24 (73) | 27 (82)   | 12 (36)    |
| Bufonidae      | 12     | 6 (50)  | 4 (33)          | 8 (67)  | 9 (75)    | 5 (42)     |
| Craugastoridae | 3      | 1 (33)  | –               | 2 (67)  | 2 (67)    | 1 (33)     |
| Eleutherodactylidae | 1 | –       | –               | 1 (100) | 1 (100)   | –          |
| Hyliidae       | 6      | 3 (50)  | 0 (0)           | 5 (83)  | 5 (83)    | 2 (33)     |
| Leptodactylidae| 1      | –       | –               | 1 (100) | –         | –          |
| Microhylidae   | 2      | 0 (0)   | –               | 2 (100) | 2 (100)   | 0 (0)      |
| Ranidae        | 6      | 3 (50)  | 1 (17)          | 4 (67)  | 6 (100)   | 2 (33)     |
| Scaphiopodidae | 2      | 2 (100) | 1 (50)          | 1 (50)  | 2 (100)   | 2 (100)    |
| Class Reptilia | 158    | 88 (56) | 36 (23)         | 85 (54) | 94 (59)   | 61 (39)    |
| Order Crocodylia| 1    | –       | –               | 1 (100) | –         | –          |
| Order Testudines| 16   | 4 (25)  | 5 (31)          | 12 (75) | 6 (38)    | 2 (12)     |
| Anguidae       | 4      | –       | 4 (100)         | 4 (100) | –         | –          |
| Dermochelyidae | 1      | –       | 1 (100)         | 1 (100) | –         | –          |
| Emydidae       | 4      | 1 (25)  | 0 (0)           | 2 (50)  | 2 (50)    | 1 (25)     |
| Geoemydidae    | 1      | –       | –               | 1 (100) | 1 (100)   | –          |
| Kinosternidae  | 4      | 2 (50)  | –               | 2 (50)  | 2 (50)    | 1 (25)     |
| Testudinidae   | 2      | 1 (50)  | –               | 2 (100) | 1 (50)    | –          |
| Order Squamata | 141    | 84 (60) | 31 (22)         | 72 (51) | 88 (62)   | 59 (42)    |
| Suborder Lacertilia | 66 | 37 (56) | 12 (18)        | 25 (38) | 32 (48)   | 29 (44)    |
| Anguidae       | 1      | 1 (100) | 0 (0)          | 1 (100) | 1 (100)   | 1 (100)    |
| Crotaphytidae  | 4      | 3 (75)  | 1 (25)         | –       | 2 (50)    | 2 (50)     |
| Dactyloidae    | 1      | –       | –               | 1 (100) | 1 (100)   | –          |
| Eublepharidae  | 2      | 1 (50)  | 1 (50)         | 1 (50)  | 0 (0)     | 1 (50)     |
| Helodermatidae | 2      | 1 (50)  | –              | 2 (100) | 1 (50)    | 1 (50)     |
| Iguanidae      | 6      | 2 (33)  | 2 (33)         | 2 (33)  | 1 (17)    | –          |
| Phrynosomatidae| 29     | 20 (69) | 6 (21)         | 12 (41) | 18 (62)   | 17 (59)    |
| Phylodactylidae| 4      | –       | 1 (25)         | 2 (50)  | 1 (25)    | –          |
| Scincidae      | 3      | 2 (67)  | 0 (0)          | 2 (67)  | 3 (100)   | 2 (67)     |
| Teiidae        | 12     | 6 (50)  | 1 (8)          | 2 (17)  | 4 (33)    | 5 (42)     |
| Xantusidae     | 2      | 1 (50)  | 0 (0)          | –       | –         | –          |
| Suborder Serpentes | 75 | 47 (63) | 19 (25)        | 47 (63) | 56 (75)   | 30 (40)    |
| Boidae         | 2      | 1 (50)  | 1 (50)        | 1 (50)  | 1 (50)    | –          |
| Colubridae     | 40     | 28 (70) | 10 (25)       | 26 (65) | 29 (72)   | 17 (42)    |
| Dipsadidae     | 9      | 3 (33)  | 2 (22)        | 7 (78)  | 7 (78)    | 3 (33)     |
| Elapidae       | 3      | 1 (33)  | 1 (33)        | 3 (100) | 2 (66)    | 1 (33)     |
| Leptotyphlopidae| 1   | 1 (100) | 1 (100)       | 1 (100) | 1 (100)   | 0 (0)      |
| Natricidae     | 7      | 3 (43)  | 1 (14)        | 3 (43)  | 7 (100)   | 3 (43)     |
| Viperidae      | 13     | 10 (77) | 3 (23)        | 6 (46)  | 9 (69)    | 6 (46)     |
| Total          | 194    | 104 (53) | 42 (22)     | 110 (57) | 124 (64) | 74 (38)    |
listed, 25.0% are protected by SEMARNAT, and 13.8% are at high risk according to the EVS (Tables 3, 5). For reptiles, 10.8% are listed by the IUCN, 38.2% are protected by SEMARNAT, and 36.3% are at high risk according to the EVS (Tables 3, 5). These results suggest that the herpetofauna, especially the reptiles, of Sonora is considered to be of relatively low conservation concern at a global scale, but there is much greater conservation concern at a national level. Indeed, more local assessments (SEMARNAT and EVS) are based on information specific to Mexico and thus are more likely to reflect the conservation needs of the Sonoran herpetofauna (see Lemos-Espinal et al. 2018a,b for a similar assessment for other Mexican states). There are several taxa that, based on their IUCN listing, SEMARNAT category or their EVS, are of conservation concern. Families that include species of particular conservation concern include Bufonidae, Craugastoridae, Eleutherodactylidae, Ranidae, Ambystomidae, Crocodylidae, Helodermatidae, Iguanidae, Phrynosomatidae, Phyllodactylidae, Teiidae, Xantusidae, Colubridae, Dipsadidae, Elapidae, Natricidae, Viperidae, Cheloniidae, Dermochelyidae, Emydidae, Kinosternidae, and Testudinidae (Tables 3, 5). Because the IUCN, SEMARNAT, and EVS categories are based on global or country-level assessments, there are likely amphibians and reptiles whose conservation status in Sonora is not accurately assessed by these measures. Additional assessments at the state level in Sonora, and other Mexican states, are needed to establish conservation or management needs for particular states, or even regions. As an example, frogs in the family Ranidae in Sonora, some of which are considered of conservation concern, are at risk from habitat loss, disease (chytridiomycosis), and predation by introduced species (Rorabaugh and Lemos-Espinal 2016).

To help determine which ecoregions within Sonora support species of particular conservation concern, we summarized the conservation status of reptile and amphibian taxa in each ecoregion found in Sonora (Tables 2, 3). In regard to IUCN categories, none of the amphibians in the Western Mainland Deserts, Subtropical Lowlands and Foothills of the Sierra Madre Occidental, and Island ecoregions are listed; however, one species (2.8%) in the High Northeastern Valleys, and three (8.3%) in the Eastern Mountains ecoregions are included. For SEMARNAT categories, 16.7% of amphibians in the Western Mainland Deserts ecoregion, 14.3% in the High Northeastern Valleys ecoregion, 28.6% in the Eastern Mountains ecoregion, and 18.2% in the Subtropical Lowlands and Foothills of the Sierra Madre Occidental ecoregion are listed. For EVS, 44.4% of the amphibians in the Western Mainland Deserts ecoregion were in the low and medium categories, and 5.6%, represented by only one species, was in the high category; the remaining 5.6% are represented by a species not evaluated. More than half (57.1%) of the amphibians in the High Northeastern Valleys ecoregion are in the low category, and 42.9% are in the medium category; no species in this ecoregion is in the high category. In the Eastern Mountains ecoregion, 38.1% of amphibian species are in the low and medium categories, 19.0% in the high, and the remaining 4.8% are represented by a species not evaluated. For the Subtropical Lowlands and Foothills of the Sierra Madre Occidental ecoregion, 50.0% are in the low category, 36.4% are in the medium category, and 9.1% are in the high category; the remaining 4.5% are represented by a species not evaluated. For the Island ecoregion, the two species occurring in this ecoregion are in the low category.
For the IUCN listings, all ecoregions, except the Marine ecoregion, have relatively few species of reptiles in the protected categories (Western Mainland Deserts \(5 = 6.6\%)\), High Northeastern Valleys \(3 = 7.5\%\), Eastern Mountains \(6 = 7.2\%\), Subtropical Lowlands and Foothills of the Sierra Madre Occidental \(4 = 6.6\%\), and Island \(3 = 10.5\%\)). Nearly all of the reptiles in the Marine ecoregion \(6 = 85.7\%\) are in the protected categories. However, for the IUCN listing a total of 38 reptile species have not been evaluated, most of them are species recently described or not recognized by the IUCN as populations that deserve species status, but all of them are species with a narrow distribution, which increases their vulnerability. On the other hand, 36.8\% of reptiles in the Western Mainland Deserts region, 42.5\% from the High Northeastern Valleys ecoregion, 35.4\% from the Eastern Mountains ecoregion, 37.1\% from the Subtropical Lowlands and Foothills of the Sierra Madre Occidental ecoregion, 85.7\% of the Marine ecoregion, and 41.4\% from the Island ecoregion are in the protected SEMARNAT categories. For the Western Mainland Deserts ecoregion, 26.3\% of the reptiles are in the low EVS category, 36.8\% in the medium, and 32.9\% in the high; the remaining 3.9\% are represented by three species not evaluated. In the High Northeastern Valleys ecoregion, 27.5\% of the reptiles are in the low, 47.5\% in the medium, and 22.5\% in the high category; the remaining 2.5\% are represented by a species not evaluated. Of the reptiles in the Eastern Mountains ecoregion, 19.5\% are in the low, 39.0\% in the medium, and 35.4\% in the high category; the remaining 6.1\% are represented by five species not evaluated. For the Subtropical Lowlands and Foothills of the Sierra Madre Occidental, 27.4\% are in the low EVS category, 32.3\% in the medium, and 33.9\% in the high; the remaining 6.5\% are represented by four species not evaluated. Of the seven reptile species that occur in the Marine ecoregion, only one (14.3\%) is in the high category; the other six species (85.7\%) are species that have not been evaluated. In the Island ecoregion, 17.2\% are in the low EVS category, 24.1\% in the medium, and 48.3\% in the high; the remaining 10.3\% are represented by three species not evaluated. Thus, the reptiles in the Marine ecoregion are clearly the most threatened of the Sonoran herpetofauna.

**Acknowledgments**

We thank J. Murphy, J. Sigala, and an anonymous reviewer for their helpful comments on the manuscript. Support for this study was provided by Dirección General de Asuntos del Personal Académico, Programa de Apoyo a Proyectos de Investigación e Innovación Tecnológica (DGAPA-PAPIIT) through the Project IN215418. We are grateful to Alejandra Núñez Merchard from the National Commission for the Understanding and Use of Biodiversity (CONABIO) for kindly creating and providing the topographic, physiographic, climate, and vegetation maps used in this publication.
A conservation checklist of the amphibians and reptiles of Sonora, Mexico, with...

References

Acevedo AA, Lampo M, Cipriani R (2016) The Cane or Marine Toad, Rhinella marina (Anura: Bufonidae): two genetically and morphologically distinct species. Zootaxa 4103: 574–586. https://doi.org/10.11646/zootaxa.4103.6.7

Allen RJ (1933) Report on a collection of amphibians and reptiles from Sonora, Mexico, with the description of a new lizard. Occasional Papers of the Museum of Zoology 259: 2–15.

Ambía Molina V (1969) Lista de reptiles. In: Sonora: Principales Especies Faunísticas. Dirección General de la Fauna Silvestre, México. Distrito Federal, Mexico, 26 pp.

AmphibiaWeb (2018) AmphibiaWeb. University of California, Berkeley. http://amphibiaweb.org [Accessed 17 September 2018]

Anderson JB (2003) The U.S.–Mexico border: a half century of change. Social Science Journal 40: 535–554. https://doi.org/10.1016/S0362-3319(03)00067-3

Baird SF, Girard CL (1853) Catalogue of North American Reptiles in the Museum of the Smithsonian Institution, Part 1– Serpents. Smithsonian Institution, Washington, DC, 172 pp.

Bezy RL, Rosen PC, Van Devender TR, Enderson EF (2017) Southern distributional limits of the Sonoran Desert herpetofauna along the mainland coast of northwestern Mexico. Mesoamerican Herpetology 4: 138–167.

Bogan MT, Noriega-Felix N, Vidal-Aguilar SL, Findlay LT, Lytle DA, Gutiérrez-Ruacho OG, Alvarado-Castro JA, Varela-Romero A (2014) Biogeography and conservation of aquatic fauna in spring-fed tropical canyons of the southern Sonoran Desert. Mexico. Biodiversity and Conservation 23: 2705–2748. https://doi.org/10.1007/s10531-014-0745-z

Brennan TC, Babb RD (2015) Herpetofauna of Arizona. In: Lemos-Espinal JA (Ed.) Amphibians and Reptiles of the US – Mexico Border States / Anfibios y reptiles de los estados de la frontera México – Estados Unidos. Texas A and M University Press (No. 52 WL Moody Jr Natural History Series), 144–163.

Card DC, Schield DR, Adams RH, Corbin AB, Perry BW, Andrew AL, Pasquesi GIM, Smith EN, Jezkova T, Boback SM, Booth W, Castoe TA (2016) Phylogeographic and population genetic analyses reveal multiple species of Boa and independent origins of insular dwarfism. Molecular Phylogenetics and Evolution 102: 104–116. https://doi.org/10.1016/j.ympev.2016.05.034

Cervantes-Zamora Y, Cornejo-Olgín SL, Lucero-Márquez R, Espinoza-Rodríguez JM, Miranda-Viquez E, Pineda-Velázquez A (1990) Provincias Fisiográficas de México. Extraído de Clasificación de Regiones Naturales de México II, IV.10.2. Atlas Nacional de México. Vol. II. Escala 1:4000000. Instituto de Geografía, UNAM, México.

CONABIO [Comisión Nacional para el Conocimiento y Uso de la Biodiversidad] (2008) División Política Estatal. Versión 2. Scale 1:250,000. Modified from the vectorial data set and toponymy of the topographic chart. Series III. Instituto Nacional de Estadística, Geografía e Informática (2003–2004). Marco Geoesadístico Municipal, Instituto Nacional de Estadística, Geografía e Informática (2005). Scale 1:250,000. México.

Contreras-B S, Lozano-V ML (1994) Water, endangered fishes, and development perspectives in arid lands of Mexico. Conservation Biology 8: 379–387. https://doi.org/10.1046/j.1523-1739.1994.08020379.x
Cox CL, Davis Rabosky AR, Holmes IA, Reyes-Velasco J, Roelke CE, Smith EN, Flores-Villela O, McGuire JA (2018) Synopsis and taxonomic revision of three genera in the snake tribe Sonorini. Journal of Natural History 52: 945–988. https://doi.org/10.1080/00222933.2018.1449912
Dickerson MC (1919) Diagnoses of twenty-three new species and a new genus of lizards from Lower California. Bulletin of the American Museum of Natural History 41: 461–477.
Dirección General de Geografía – INEGI (2005) Conjunto de Datos Vectoriales de la Carta de Uso del Suelo y Vegetación. Scale 1: 250,000, Series III (CONTINUO NACIONAL). Instituto Nacional de Estadística, Geografía e Informática (INEGI). Aguascalientes, México. http://www.inegi.org.mx/geo/contenidos/recnat/usosuelo/Default.aspx
Drake JC, Griffis-Kyle KL, McIntyre NE (2017) Graph theory as an invasive species management tool: case study in the Sonoran Desert. Landscape Ecology 32: 1739–1752. https://doi.org/10.1007/s10980-017-0539-2
Duellman WE, Marion AB, Hedges SB (2016) Phylogenetics, classification, and biogeography of the treefrogs (Amphibia: Anura: Arboranae). Zootaxa 4104: 1–109. https://doi.org/10.11646/zootaxa.4104.1.1
Enderson EF, Bezy RL (2007) Geophis dugesii aquilonaris. Herpetological Review 38: 103.
Enderson EF, Quijada-Mascarenas A, Turner DS, Rosen PC, Bezy RL (2009) The Herpetofauna of Sonora, Mexico, with Comparisons to Adjoining States. Check List 5: 632–672. https://doi.org/10.15560/5.3.632
Enderson EF, Quijada-Mascarenas A, Turner DS, Bezy RL, Rosen PC (2010) Una sinopsis de la herpetofauna con comentarios sobre las prioridades en investigación y conservación. In: Molina-Freaner FE, Van Devender TR (Eds) Diversidad biológica de Sonora. UNAM, México, 357–383.
Flesch AD, Rosen PC, Holm P (2017) Long-term changes in abundances of Sonoran Desert lizards reveal complex responses to climate variation. Global Change Biology 23: 5492–5508. https://doi.org/10.1111/gcb.13813
Frost DR (2018) Amphibian Species of the World: an Online Reference. Version 6.0. American Museum of Natural History, New York. http://research.amnh.org/herpetology/amphibia/index.html [Accessed on 17 September, 2018]
Frost DR, Grant T, Faivovich J, Bain RH, Hass A, Haddad CFB, de Sá RO, Channing A, Wilkinson M, Donnellan SC, Raxworthy CJ, Campbell JA, Blotto BL, Moler PE, Drewes RC, Nussbaum RA, Lynch JD, Green DM, Wheeler WC (2006) The amphibian tree of life. Bulletin of the American Museum of Natural History 297: 1–370. https://doi.org/10.1206/0003-0090(2006)297[0001:TATOL]2.0.CO;2
García A, Whalen DM (2003) Lizard community response to a desert shrubland-intertidal transition zone on the coast of Sonora, Mexico. Journal of Herpetology 37: 378–382. https://doi.org/10.1670/0003-0090(2003)037[0378:LCRTAD]2.0.CO;2
García E – CONABIO [Comisión Nacional para el Conocimiento y Uso de la Biodiversidad] (1998) Climas (Clasificación de Köppen, modificado por García). Scale 1:1,000,000. Secretaría de Educación Pública, CONABIO, México.
Griffis-Kyle KL, Mougey K, Vanlandeghem M, Swain S, Drake JC (2018) Comparison of climate vulnerability among desert herpetofauna. Biological Conservation 225: 164–175. https://doi.org/10.1016/j.biocon.2018.06.009
Lemos-Espinal JA, Smith GR, Woolrich-Piña GA (2018b) Amphibians and reptiles of the state of San Luis Potosí, Mexico, with comparisons with adjoining states. ZooKeys 753: 83–106. https://doi.org/10.3897/zookeys.753.21094

Lemos-Espinal JA, Smith GR, Woolrich-Piña G, Cruz A (2017) Amphibians and reptiles of the state of Chihuahua, Mexico, with comparisons with adjoining states. ZooKeys 658: 105–130. https://doi.org/10.3897/zookeys.658.10665

Lemos-Espinal JA, Smith HM, Dixon JR, Cruz A (2015) Anfibios y reptiles de Sonora, Chihuahua y Coahuila, México / Amphibians and reptiles of Sonora, Chihuahua, and Coahuila, Mexico. CONABIO, 714 pp. [vol. 1], 668 pp. [vol. 2].

Lowe CH, Jones CJ, Wright JW (1968) A new plethodontid salamander from Sonora, Mexico. Contributions in Science. Natural History Museum of Los Angeles County 140: 1–11.

Magaña VO, Conde C (2000) Climate and freshwater resources in northern Mexico: Sonora, a case study. Environmental Monitoring and Assessment 61: 167–185. https://doi.org/10.1023/A:1006399025537

Meik JM, Streicher JW, Lawing AM, Flores-Villela O, Fujita MK (2015) Limitations of Climatic Data for Inferring Species Boundaries: Insights from Speckled Rattlesnakes. PLoS ONE 10(6): e0131435. https://doi.org/10.1371/journal.pone.0131435

Minckley TA, Turner DS, Weinstein SR (2013) The relevance of wetland conservation in arid regions: A re-examination of vanishing communities in the American Southwest. Journal of Arid Environments 88: 213–221. https://doi.org/10.1016/j.jaridenv.2012.09.001

Morales-Romero D, Godínez-Álvarez H, Campo-Alves J, Molina-Freaner F (2012) Effects of land conversion on the regeneration of *Pachycereus pectin-aboriginum* and its consequences on the population dynamics in northwestern Mexico. Journal of Arid Environments 77: 123–129. https://doi.org/10.1016/j.jaridenv.2011.09.005

Mulcahy DG, Martínez-Gómez JE, Aguirre-León G, Cervantes-Pasqualli JA, Zug GR (2014) Rediscovery of an endemic vertebrate from the remote Islas Revillagigedo in the Eastern Pacific Ocean: The Clarión Nightsnake lost and found. PLoS ONE 9(5): e97682. https://doi.org/10.1371/journal.pone.0097682

Norman LM, Feller M, Guertin DP (2009) Forecasting urban growth across the United States-Mexico border. Computers, Environment and Urban Systems 33: 150–159. https://doi.org/10.1016/j.compenvurbsys.2008.10.003

Norman LM, Feller M, Villarreal ML (2012a) Developing spatially explicit footprints of plausible land-use scenarios in the Santa Cruz Watershed, Arizona and Sonora. Landscape and Urban Planning 107: 225–235. https://doi.org/10.1016/j.landurbplan.2012.06.015

Norman LM, Villarreal ML, Lara-Valencia F, Yuan Y, Nie W, Wilson S, Amaya G, Sleeter R (2012b) Mapping socio-environmentally vulnerable populations access and exposure to ecosystem services at the U.S. – Mexico borderlands. Applied Geography 34: 413–424. https://doi.org/10.1016/j.apgeog.2012.01.006

Painter CW, Stuart JN (2015) Herpetofauna of New Mexico. In: Lemos-Espinal JA (Ed.) Amphibians and Reptiles of the US – Mexico Border States / Anfibios y reptiles de los estados de la frontera México – Estados Unidos. Texas A and M University Press (No. 52 WL Moody Jr Natural History Series), 164–180.
Peters R, Ripple WJ, Wolf C, Moskwik M, Carreón-Arroyo G, Ceballos G, Córdova A, Dirzo R, Ehrlich PR, Flesch AD, List R, Lovejoy TE, Noss RF, Pacheco J, Sarukhán JK, Soulé ME, Wilson EO, Miller JRB et al. (2018) Nature divided, scientists united: US – Mexico border wall threatens biodiversity and binational conservation. BioScience 68: 740–743. https://doi.org/10.1093/biosci/biy063

Prieto-Torres DA, Navarro-Sigüenza AG, Santiago-Alarcon D, Rojas-Soto OR (2016) Response of the endangered tropical dry forests to climate change and the role of Mexican Protected areas for their conservation. Global Change Biology 22: 364–379. https://doi.org/10.1111/gcb.13090

Raxworthy CJ, Ananjeva N, Orlov NC (2012) Complete species inventories. In: McDiarmid RW, Foster MS, Guyer C, Gibbons JW, Chernoff N (Eds) Reptile Biodiversity: Standard Methods for Inventory and Monitoring. University of California Press, Berkeley, 209–215.

Rorabaugh JC (2008) An introduction to the herpetofauna of mainland Sonora, México, with comments on conservation and management. Journal of the Arizona-Nevada Academy of Science 40: 20–65. https://doi.org/10.2181/1533-6085(2008)40[20:AITTHO]2.0.CO;2

Rorabaugh JC (2017) Crocodiles spotted in southern Sonora waters for the first time since 1973. Sonoran Herpetologist 30(4): 68–69.

Rorabaugh JC, Gómez-Ramírez MA, Gutiérrez-González CE, Wallace JE, Van Devender TR (2011) Amphibians and reptiles of the Northern Jaguar Reserve and vicinity, Sonora, México: A preliminary evaluation. Sonoran Herpetologist 24: 123–131.

Rorabaugh JC, Lemos-Espinal JA (2016) A Field Guide to the Amphibians and Reptiles of Sonora, Mexico. ECO Herpetological Publishing and Distribution, Rodeo, NM, 688 pp.

Rosen PC, Quijada-Mascareñas A (2009) *Aspidoscelis xanthonota*. Herpetological Review 40: 237.

Rovito SM, Vázquez-Almazán CR, Papenfuss TJ, Parra-Olea G, Wake DB (2015) Biogeography and evolution of Central American cloud forest salamanders (Caudata: Plethodontidae: *Cryptotriton*), with the description of a new species. Zoological Journal of the Linnean Society 175: 150–166. https://doi.org/10.1111/zooj.12268

Scott CA, Megdal S, Oroz LA, Callegary J, Vandervoet P (2012) Effects of climate change and population growth on the transboundary Santa Cruz aquifer. Climate Research 51: 159–170. https://doi.org/10.3354/cr01061

SEMARNAT [Secretaría de Medio Ambiente y Recursos Naturales] (2010) Norma Oficial Mexicana NOM-059-Ecol-2010. Protección ambiental-Especies nativas de México de flora y fauna silvestres-Categorías de riesgo y especificaciones para su inclusión, exclusión o cambio-Lista de especies en riesgo. Diario oficial (Segunda Sección, 30-dic), 77 pp.

Smith GR, Lemos-Espinal JA (2015) Herpetofaunal Diversity of the United States-Mexico Border States, with comparison among the states. In: Lemos-Espinal (Ed.) Amphibians and Reptiles of the US-Mexico Border States. Texas A&M University Press, College Station, 196–205.

Stahlschmidt ZR, DeNardo DF, Holland JN, Kotler BP, Kruse-Peeples M (2011) Tolerance mechanisms in North American deserts: Biological and societal approaches to climate change. Journal of Arid Environments 75: 681–687. https://doi.org/10.1016/j.jaridenv.2011.03.006
Steiner F, Blair J, McSherry L, Guhathakurta S, Marruffo J, Holm M (2000) A watershed at a watershed: the potential for environmentally sensitive area protection in the upper San Pedro Drainage Basin (Mexico and USA). Landscape and Urban Planning 49: 129–148. https://doi.org/10.1016/S0169-2046(00)00062-1

Steyneger L (1891) Description of a new species of lizard from the Island San Pedro Martir, Gulf of California. Proceedings of the United States National Museum 14(864): 407–408. https://doi.org/10.5479/si.00963801.863.407

Steyskal GC (1971) On the grammar of names formed with -scelus, -sceles, -scelis, etc. Proceedings Biological Society of Washington 84: 7–12.

Tucker DB, Colli GR, Giugliano LG, Hedges SB, Hendry CR, Lemmon EM, Lemmon AR, Sites Jr JW, Pyron RA (2016) Methodological congruence in phylogenomic analyses with morphological support for teiid lizards (Sauria: Teiidae). Molecular Phylogenetics and Evolution 103: 75–84. https://doi.org/10.1016/j.ympev.2016.07.002

Uetz P, Hošek J (2018) The Reptile Database. http://www.reptile-database.org [Accessed on 17 September 2018]

Van Denburgh J, Slevin JR (1921) Preliminary diagnoses of new species of reptiles from islands in the Gulf of California, Mexico. Proceedings of the California Academy of Science 11: 95–98.

Van Devender TR, Reina G AL, Peñalba G MC, Ortega RCI (2003) The Ciénega de Camilo: A threatened habitat in the Sierra Madre Occidental of eastern Sonora, Mexico. Madroño 50: 187–195.

Villareal ML, Norman LM, Boykin KG, Wallace CSA (2013) Biodiversity losses and conservation trade-offs: assessing future urban growth scenarios for a North American trade corridor. International Journal of Biodiversity Science, Ecosystem Services and Management 9: 90–103. https://doi.org/10.1080/21513732.2013.770800

Wiederholt R, López-Hoffman L, Cline J, Medellín RA, Cryan P, Russell A, McCracken G, Diffendorfer J, Semmens D (2013) Moving across the border: modeling migratory bat populations. Ecosphere 4(9): 114. https://doi.org/10.1890/ES13-00023.1

Wilson LD, Johnson JD, Mata-Silva V (2013a) A conservation reassessment of the amphibians of Mexico based on the EVS measure. Amphibian & Reptile Conservation 7(1): 97–127.

Wilson LD, Mata-Silva V, Johnson JD (2013b) A conservation reassessment of the reptiles of Mexico based on the EVS measure. Amphibian & Reptile Conservation 7(1): 1–47.

Wood DA, Fisher RN, Vandergast AG (2014) Fuzzy boundaries: Color and gene flow patterns among parapatric lineages of the Western Shovel-Nosed Snake and taxonomic implications. PLoS ONE 9(5): e97494. https://doi.org/10.1371/journal.pone.0097494

Ye L, Grimm NB (2013) Modelling potential impacts of climat change on water and nitrate export from a mid-sized, semiarid watershed in the US Southwest. Climatic Change 120: 419–431. https://doi.org/10.1007/s10584-013-0827-z

Yuan ZY, Zhou WW, Chen X, Poyarkov NA, Chen HM, Jang-Liaw NH, Chou WH, Matzke NJ, Lizuka K, Min MS, Kuzmin SL, Zhang YP, Cannatella DC, Hillis DM, Che J (2016) Spatiotemporal diversification of the true frogs (genus Rana): A historical framework for a widely studied group of model organisms. Systematic Biology 65(5): 824–842. https://doi.org/10.1093/sysbio/syw055
### Appendix I

Museum collections included in the CONABIO database examined for records of Sonoran amphibians and reptiles or that house specimens of the first record of a species in Sonora.

| Abbreviation | Institution Name |
|--------------|------------------|
| AMNH         | Collection of Herpetology, Herpetology Department, American Museum of Natural History |
| ANSP         | Collection of Herpetology, Herpetology Department, Academy of Natural Sciences of Philadelphia |
| ASNHC        | Herpetology Collection, Angelo State Natural History Collections, Angelo State University |
| ASU          | Arizona State University |
| NHMUK        | Collection of Herpetology, Zoology Department, The Natural History Museum, London, UK |
| BYU          | Monte L. Bean Life Science Museum, Brigham Young University, Provo, Utah |
| CAS          | Collection of Herpetology, Herpetology Department, California Academy of Sciences |
| CMNH         | Collection of Herpetology, Amphibian and Reptile Section, Carnegie Museum of Natural History, Pittsburgh |
| CNAR         | Colección Nacional de Anfibios y Reptiles, Instituto de Biología UNAM |
| CUMV         | Amphibian and Reptile Collection, Cornell University Museum of Vertebrates |
| ENCB         | Colección Herpetológica, Departamento de Zoología, Escuela Nacional de Ciencias Biológicas |
| FMNH         | Division of Amphibians and Reptiles, Field Museum of Natural History |
| FSM-UF       | Collection of Herpetology, Florida State Museum, University of Florida |
| LACM         | Collection of Herpetology, Herpetology Section, Natural History Museum of Los Angeles County |
| LEUBIPRO     | Laboratorio de Biología UBIPRO |
| LSUMZ        | Collection of Herpetology, Museum of Zoology, Biological Science Division, Louisiana State University |
| MCZ          | Collection of Herpetology, Museum of Comparative Zoology, Harvard University Cambridge |
| MNHUK        | Museum of Natural History, Division of Herpetology, University of Kansas |
| MPM          | Herpetology, Milwaukee Public Museum |
| MVZ          | Collection of Herpetology, Museum of Vertebrate Zoology, Division of Biological Sciences, University of California Berkeley |
| Institution          | Location/Description                                      |
|----------------------|-----------------------------------------------------------|
| MZFC-UNAM            | Colección Herpetológica, Museo de Zoología “Alfonso L. Herrera”, Facultad de Ciencias UNAM |
| PBDB                 | Paleobiology Database, Paleobiology Database Chordates   |
| ROM                  | Department of Herpetology, Royal Ontario Museum, Toronto, Ontario, Canada |
| SDNHM                | Collection of Herpetology, Herpetology Department, San Diego Natural History Museum |
| TCWC                 | Collection of Herpetology, Texas Cooperative Wildlife Collection, Texas A&M University |
| TNHC                 | Collection of Herpetology, Texas Natural History Collection, University of Texas Austin |
| TU                   | Collection of Herpetology, Biology Department, Tulane University, New Orleans |
| UABC                 | Colección Herpetológica, Universidad Autónoma de Baja California |
| UAZ                  | Amphibians and Reptiles Collections, University of Arizona |
| UCM                  | Collection of Herpetology, University of Colorado Museum |
| UIMNH                | Collection of Herpetology, University of Illinois Museum of Natural History |
| UIUC                 | Collection of Herpetology, Museum of Natural History, University of Illinois at Urbana-Champaign |
| UMMZ                 | Collection of Herpetology, Museum of Zoology, University of Michigan Ann Arbor |
| UMNH                 | Reptiles and Amphibians Collection, Natural History Museum of Utah |
| USNM                 | Collection of Herpetology, Department of Vertebrate Zoology, National Museum of Natural History, Smithsonian Institution |
| UTAMM                | Merriam Museum, University of Texas Arlington |
| UTEP                 | Collection of Herpetology, Laboratory of Environmental Biology, Biological Science Department, University of Texas – El Paso |