A conservation checklist of the amphibians and reptiles of the State of Mexico, Mexico with comparisons with adjoining states

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Abstract

The State of Mexico has a unique combination of geographic characteristics and topography that promotes a high biodiversity. Unfortunately, continued human population growth of the metropolitan areas of Mexico City and Toluca have degraded the environment of the State of Mexico, which threatened its wildlife. An updated checklist of the amphibians and reptiles of the State of Mexico is provided and their conservation status summarized. The State of Mexico has 49 species of amphibians and 101 species of reptiles. The majority of the amphibians (73.5%) and reptiles (70.3%) found in the State of Mexico are endemic to Mexico. Of the amphibian and reptile species in the State of Mexico, 20.1% are IUCN listed (i.e., Vulnerable, Near Threatened, or Endangered), 18.4% are placed in a protected category by SEMARNAT (excluding NL and Pr, this last category is equivalent to the LC category of IUCN), and 34.9% are categorized as high risk by the EVS. The importance of forested habitats for the protected amphibians and reptiles in the State of Mexico suggest that management of these habitats to maintain or expand them needs to be considered.

Keywords

checklist, crocodilians, frogs, herpetofauna, lizards, salamanders, snakes, turtles
Introduction

Although relatively small, the State of Mexico bears unique geographic characteristics that combined with its topography create conditions that promote a high level of biodiversity. Unfortunately, these same conditions along with the continued human population growth of the metropolitan area of Mexico City and the city of Toluca have created high water and air pollution levels, deforestation, habitat fragmentation, and low water availability, which threaten the wildlife of this state (Rodríguez Romero et al. 2008; Flores-Villela et al. 2010). For example, atmospheric water in the Valley of Mexico contains heavy metals that are detectable and exceed regulatory limits when condensed (Bautista-Olivas et al. 2014). This is especially important for amphibians and reptiles, which are represented in the State of Mexico by a unique assortment of species. Central Mexico, including the State of Mexico, contains several areas of high endemcity for the herpetofauna of Mexico and as such is very important to the conservation of the Mexican herpetofauna (Flores-Villela et al. 2010).

Here, we provide an updated checklist of the amphibians and reptiles documented in the State of Mexico. We also summarize the conservation status of these species with the goal of determining if there are particular taxa of conservative concern in the State of Mexico. In addition, we consider the overlap in species between the State of Mexico and its neighboring states.

Physiographic characteristics of the state

The State of Mexico is the most populous, as well as the most densely populated state in Mexico. It is located in south-central Mexico, in the highest part of the Mexican Altiplano, between 18°22’0.84”N and 20°17’9.24”N, and 100°36’46.8”W and 98°35’48.84”W (Fig. 1). It is bordered by the states of Querétaro and Hidalgo to the north, Morelos and Guerrero to the south, Michoacán to the west, Tlaxcala and Puebla to the east, and surrounds Mexico City on three sides (west, north, and east). The state is relatively small (22,351 km²) and is the seventh smallest Mexican state, representing 1% of the total surface territory of Mexico (modified from Wikipedia – https://en.wikipedia.org/wiki/State_of_Mexico – accessed 21 November 2019).

The topography of the state is highly variable, with the highest mountains in the extreme eastern part of the state along the border with Puebla (Popocatépetl 5,380 m altitude, Iztaccíhuatl 5,203 m, Monte Tláloc 4,120 m), and in the central part of the state (Nevado de Toluca 4,643 m), as well as rugged intermontane valleys, hills and plains, with altitudes ranging from 300 m near the border with Guerrero to 5,380 m on the top of the Popocatépetl Volcano (Fig. 2). The State of Mexico contains two physiographic provinces: a) Eje Neovolcánico, and b) Sierra Madre del Sur (Fig. 3; modified from INEGI 2017). The Eje Neovolcánico comprises most of the state, occupying the central, northern and eastern portions of the state. This province is divided into three sub-provinces: a) Lagos y Volcanes de Anáhuac, which occupies most of the central, north, and east portions of the state, and includes the northern part of the
Herpetofauna of the State of Mexico

Figure 1. Map of Mexico with the State of Mexico shown in red (modified from INEGI, 2018a).

Metropolitan Zone of Mexico and the city of Toluca. b) Mil Cumbres, a thin strip running from north to south and lying between the sub-provinces of Lagos y Volcanes de Anáhuac and Depresión del Balsas, and eastern Michoacán. c) Planicies y Sierras de Querétaro e Hidalgo, a small portion at the northern end of the state that borders Querétaro and Hidalgo. The Sierra Madre del Sur comprises the southwestern corner of the state along its border with Guerrero and western-northwestern Morelos, and is divided into two sub-provinces: a) Depresión del Balsas, which is bordered by northern Guerrero, and b) Sierras y Valles Guerrerenses, which is a small area bordering northern Guerrero and western-northwestern Morelos (Fig. 3).

The State of Mexico has a variety of vegetation types (Fig. 4; modified from INEGI 2017). Agricultural Areas that occupy 54.61% of the state's surface area, and are found mainly in the central, northern, and eastern parts of the state, occupying most of the province of the Eje Neovolcánico. Woodlands cover 27.22% of the state's surface area, and are scattered at the higher elevations of the Eje Neovolcánico province, especially the western foothills of the Popocatépetl and Iztaccíhuatl volcanoes, the Sierra de las Cruces – Sierra del Ajusco complex, the area surrounding the Nevado de Toluca Volcano, and most of the Mil Cumbres Subprovince. Woodlands include Oak Forests which are distributed between 1,600 and 2,400 meters above sea level; Pine-Oak Forest, which develops above 2,400 meters altitude; and Pine Forest, which develops in the highest elevations of the state's mountains. At the highest elevations, this forest is surrounded by padded grasses including *Mühlbergia rigida*, *Stipa ichu*, and *Bouteloa gracilis* among others. Grasslands, covering 12.15% of state's surface area, occur in
isolated areas in the northern, central, and southwestern parts of the state and they intermingle with Tropical Forests, which are limited to some scattered spots in the Sub-provinces of the Sierra Madre del Sur. Tropical Forest, comprising 5.34% of the state’s surface area, is represented by Tropical Deciduous Forest, also called Tropical Dry Forest, that develops between 1,500 and 1,600 m altitude. These forests, although lush, lose their leaves during the dry season (winter-spring), and have dense foliage during the rainy season (summer). Scrubland covers only 0.2% of the state’s surface area. The remaining 0.41% is represented by scattered areas lacking vegetation (Fig. 4).

Given the geographical location and diversity of the natural regions in the state, there are several climates in the State of Mexico (Fig. 5; modified from López-Cano et al. 2009; INEGI 2017). A warm sub-humid climate with summer rains and semi-humid with summer rains is found in the Balsas Basin in the extreme southwestern part of the state, covering 20.8% of the state area. The temperate sub-humid with summer rains is found over most of the Lerma Basin and Valley of Mexico, covering most of the state (61.7% of the state). The wet semi-cold climate with abundant rains in summer and sub-humid semi-cold with summer rains is present in the highest mountains of
**Figure 3.** Physiographic provinces of the State of Mexico, Mexico (modified from Cervantes-Zamora et al. 1990).

**Figure 4.** Vegetation map of the State of Mexico, Mexico (modified from Dirección General de Geografía – INEGI 2016).
the state (Nevado de Toluca, Sierra Nevada, Sierra las Cruces, Sierra del Ajusco, etc.), covering 11.6% of the state surface. The temperate semi-dry climate is found in the northeast corner of the state, in a strip that runs from the central eastern part of the state, on the northeastern limit of Mexico City to northeastern State of Mexico on the border with Hidalgo, covering 5.7% of the state surface. A Cold climate present on the summits of the Nevado de Toluca, Popocatépetl, and Iztaccíhuatl volcanoes, covering 0.2% of the state’s area.

**Materials and methods**

We compiled our list of amphibians and reptiles of the State of Mexico from our field work over several years, especially within the past 5–10 years, a thorough examination of available literature on amphibians and reptiles in the state, amphibian and reptile records for the State of Mexico in VertNet.org, and amphibian and reptile records for the State of Mexico in Servicio de Descarga de Ejemplares del Sistema Nacional de Información sobre Biodiversidad (SNIB-CONABIO), data bases Amphibians State of Mexico and Reptiles State of Mexico. Amphibian names follow Frost (2019) and AmphibiaWeb (2019) (http://amphibiaweb.org) and reptile names follow Uetz and Hošek.
Herpetofauna of the State of Mexico (2019). We included species in the list only if we could confirm records by either direct observation or documented museum records or vouchers.

We made species accumulation curves for the total herpetofauna, and amphibians and reptiles separately using the year of the first recorded observation for each species. These curves can estimate the potential species richness of amphibians and reptiles (see Raxworthy et al. 2012). For each species, we recorded conservation status based on the IUCN Red List 2019-2, listing in SEMARNAT (2019), and Environmental Vulnerability Scores (Wilson et al. 2013a, b; Johnson et al. 2015). We determined the number of species found in the State of Mexico that overlapped with neighboring states and Mexico City using recent state lists (Michoacán, Alvarado-Díaz et al. 2013; Hidalgo, Lemos-Espinal and Smith 2015; Puebla, Woolrich-Piña et al. 2017; Guerrero, Palacios-Aguilar and Flores-Villela 2018; Mexico City, Lemos-Espinal and Smith in press; Morelos, Lemos-Espinal and Smith 2020; and Querétaro, Cruz-Elizalde et al. 2019). We did not include the state of Tlaxcala since no comprehensive check list of the amphibians and reptiles of this state currently exists. We generated border lengths with the INEGI state division map for the year 2018 using ArcMap 10.7.1 neighboring polygon tool (June 2019).

Results and discussion

The State of Mexico is home to 150 species of amphibians and reptiles representing 31 families (two introduced: Gekkonidae and Typhlopidae) and 65 genera (two introduced: Hemidactylus and Indotyphlops) (Table 1; Fig. 6). The herpetofauna of the State of Mexico includes 49 species of amphibians (33 anurans [one introduced], and 16 salamanders), and 101 reptiles (40 lizards [one introduced], 57 snakes [one introduced], and four turtles). The three introduced species are the American Bullfrog (Rana catesbeiana), the Common House Gecko (Hemidactylus frenatus), and the Brahminy Blindsnake (Indotyphlops braminus). Five of the 147 native species of the State of Mexico are endemic to the state: the Delicate-skinned Salamander (Ambystoma bombypellum), the Granular Salamander (Ambystoma granulosum), the Lake Lerma Salamander (Ambystoma lermaense), Roberts’ False Brook Salamander (Pseudoeurycea robertsi), and the Herrera Alligator Lizard (Barisia herrerae). The most species rich families of amphibians in the State of Mexico are Hylidae, Ambystomatidae, and Plethodontidae, whereas the most species rich families of reptiles are Phrynosomatidae and Colubridae (Table 1).

The species accumulation curves for the total herpetofauna, reptiles, and amphibians all show a steep increase in the number of species documented in the State of Mexico in the second half of the 20th century, and that trend appears to be continuing, albeit at a somewhat slower rate in the 21st century (Fig. 7). This suggests that the overall number of amphibians and reptiles in the State of Mexico is likely to increase over time. Indeed, we compiled a list of 21 species (two amphibians, 19 reptiles: Table 2) that potentially occur in the State of Mexico (Table 2). These potential species are distributed mainly along the border with Guerrero (extreme southwest-
Table 1. Amphibians and reptiles of the State of Mexico with distributional and conservation status. Vegetation Type: (1 = Oak Forest; 2 = Pine-oak Forest; 3 = Pine Forest; 4 = Tropical Deciduous Forest; 5 = Grassland; 6 = Scrubland); IUCN Status: (DD = Data Deficient; LC = Least Concern, VU = Vulnerable, NT = Near Threatened; EN = Endangered; CR = Critically Endangered; NE = not Evaluated) according to the IUCN Red List (IUCN 2019); 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) (Wilson et al. 2013a,b; Johnson et al. 2015); conservation status in Mexico according to SEMARNAT (2019): (P = in danger of extinction, A = threatened, Pr = subject to special protection, NL – not listed). Global Distribution: 0 = Endemic to the State of Mexico; 1 = Endemic to Mexico; 2 = Shared between the US and Mexico; 3 = widely distributed from Mexico to Central or South America; 4 = widely distributed from the US to Central or South America; IN = Introduced to State of Mexico. Date in which the first record appeared; and Source of the first record.

| CLASS AMPHIBIA ORDER ANURA |
|-----------------------------------------------|
| FAMILY BUFONIDAE (5) |
| Anaxyrus compactilis (Wiegmann, 1833) | 1,2,5,6 | LC | NL | H (14) | 1 | 1888 | Dugès 1888 |
| Incilius marmorov (Wiegmann, 1833) | 4 | LC | NL | M (13) | 1 | 1930 | MCZ-A 17755 |
| Incilius occidentalis (Camerano, 1879) | 1,2,3,6 | LC | NL | M (11) | 1 | 1941 | TCWC 6365 |
| Incilius perplexus (Taylor, 1943) | 4 | EN | NL | M (11) | 1 | 1983 | Camarillo-Rangel 1983 |
| Rhinella borrhilds (Wiegmann, 1833) | 4 | LC | NL | L (3) | 4 | 1941 | UIMNH 25155 |
| FAMILY CRAUGASTORIDAE (4) |
| Craugastor auguri (Dugès, 1879) | 2,6 | LC | NL | L (8) | 2 | 1942 | Taylor 1942 |
| Craugastor hobarrosmithi (Taylor, 1937) | 2 | EN | NL | H (15) | 1 | 1936 | UIMNH 18301 |
| Craugastor pugmaru (Taylor, 1937) | 1,2,3 | VU | NL | L (9) | 3 | 1992 | Camarillo-Rangel and Smith 1992 |
| Craugastor rugulosus (Cope, 1870) | 3 | LC | NL | M (13) | 3 | 1968 | UTEP Herp:7475 |
| FAMILY ELEUTHERODACTYLIDAE (4) |
| Eleutherodactylus angustidigitorum (Taylor, 1940) | 1,2,3,6 | VU | Pr | H (17) | 1 | 1954 | TCWC 11158 |
| Eleutherodactylus manrus Hedges, 1989 | 1,2,3,6 | DD | Pr | H (17) | 1 | 1954 | TCWC 11259 |
| Eleutherodactylus nitidus (Peters, 1870) | 1,2,3 | LC | NL | M(12) | 1 | 1951 | AMNH A-55227 |
| Eleutherodactylus pijplanos (Taylor, 1940) | 4 | LC | NL | M (11) | 3 | 1979 | MZFC 3764 |
| FAMILY HYLIIDAE (9) |
| Dryophytes arenicolor (Cope, 1886) | 1,2,3,4,5,6 | LC | NL | L (7) | 2 | 1921 | MCZ-A 8367 |
| Dryophytes eximius (Baird, 1854) | 1,2,3,6 | LC | NL | M (10) | 1 | 1919 | AMNH A 13256 |
| Dryophytes plicatus (Brocchi, 1877) | 1,2,3,6 | LC | A | M (11) | 1 | 1912 | MCZ-A 25699 |
| Exerodonta smaragdina (Taylor, 1940) | 4 | LC | Pr | M (12) | 1 | 1992 | Camarillo-Rangel and Smith 1992 |
| Sarcohyla bistincta (Cope, 1877) | 1,2,3 | LC | Pr | L (9) | 1 | 1938 | UIMNH 17903 |
| Sarcohyla pentithet (Adler, 1965) | 4 | EN | NL | M (13) | 1 | 2009 | Aguilar-Miguel et al. 2009 |
| Smilisca baudinii (Duméril & Bibron, 1841) | 1,2,4,6 | LC | NL | L (3) | 4 | 1982 | CNAR 3912 |
| Smilisca fodiens (Boulenger, 1882) | 4 | LC | NL | L (8) | 2 | 1968 | UTEP H 8448 |
| Tlalocohyla smithii (Boulenger, 1902) | 4 | LC | NL | M (11) | 1 | 1968 | UTEP H 7713 |
| FAMILY LEPTODACTYLIDAE (1) |
| Leptodactylus metanotus (Hallowell, 1861) | 4 | LC | NL | L (6) | 3 | 1965 | ENCB 7687 |
| FAMILY MICROHYLIDAE (1) |
| Hypopachus variolosus (Cope, 1886) | 4 | LC | NL | L (4) | 4 | 1941 | ENCB 2905 |
| FAMILY PHYLLOMEDUSIDAE (1) |
| Agalychnis dacnicolor (Cope, 1864) | 4 | LC | NL | M (13) | 1 | 1983 | Camarillo-Rangel 1983 |
| FAMILY RANDIDAE (7) |
| Rana catesbeiana Shaw, 1802 | IN | IN | IN | IN | IN | 1982 | CNAR 17313 |
| Rana forreri Bouletger, 1883 | 4 | LC | Pr | L (3) | 3 | 1940 | CNAR 620 |
| Rana montezumae Baird, 1854 | 1,2,3,5,6 | LC | Pr | M (13) | 1 | 1888 | Dugès 1888 |
| Rana neovolcanica Hillis & Frost, 1985 | 1,2,3 | NT | A | M (13) | 1 | 2009 | MZFC 23392 |
| Rana spectabilis Hillis & Frost, 1985 | 1,2,3,5,6 | LC | NL | M (12) | 1 | 1936 | FMNH 110654 |
| Rana tlabec Hillis & Frost, 1985 | 1,2,5,6 | CR | P | H (15) | 1 | 1979 | ENCB 10567 |
### Herpetofauna of the State of Mexico

#### FAMILY SCAPHIOPODIDAE (1)

| Species                  | Year of first record | Global distribution | IUCN status | SEMARNAT EVS Global |
|--------------------------|----------------------|---------------------|-------------|----------------------|
| Rana zweifeli            | 1982                 | 1                   | EN          | NL M (11) 1 1982 ENCB 11912 |

#### ORDER CAUDATA

#### FAMILY AMBYSTOMATIDAE (8)

| Species                  | Year of first record | Global distribution | IUCN status | SEMARNAT EVS Global |
|--------------------------|----------------------|---------------------|-------------|----------------------|
| Ambystoma altamirani     | 1895                 | 1                   | CR A H (13) | 1 1943 Taylor 1943   |
| Ambystoma bombylepis     | 1940                 | 2                   | CR A H (15) | 1 1940 Taylor 1940a  |
| Ambystoma granulosum     | 1944                 | 0                   | CR A H (15) | 1 1944 Taylor 1944   |
| Ambystoma leorae         | 1943                 | 1                   | CR A H (15) | 1 1943 Taylor 1943   |
| Ambystoma lermanae       | 1940                 | 0                   | CR A H (15) | 1 1940 Taylor 1940a  |
| Ambystoma ordinarium     | 2004a                | 1                   | DD A M (13) | 1 1940 Taylor 1940b  |
| Ambystoma rivulare       | 1982                 | 1                   | LC Pr H (13) | 1 1982 ENCB 11912     |

#### FAMILY PLETHODONTIDAE (8)

| Species                  | Year of first record | Global distribution | IUCN status | SEMARNAT EVS Global |
|--------------------------|----------------------|---------------------|-------------|----------------------|
| Aquileuinycya cephalica  | 1938                 | 1                   | LC Pr H (14) | 1 1938 UIMNH 30898   |
| Ceratobatrachus orculus  | 1951                 | 1                   | LC Pr H (17) | 1 1951 MVZ 54646     |
| Echinomura bellii        | 1938                 | 1                   | LC Pr H (17) | 1 1938 UIMNH 30881   |

#### CLASS REPTILIA

#### SUBORDER ACERTILIA

#### FAMILY ANGUIIDAE (5)

| Species                  | Year of first record | Global distribution | IUCN status | SEMARNAT EVS Global |
|--------------------------|----------------------|---------------------|-------------|----------------------|
| Abronia deppii           | 1979                 | 1                   | EN A H (16) | 1 1979 MZFC 6294     |
| Barisia herreztii        | 2002                 | 0                   | EN A H (16) | 1 1979 MZFC 6294     |

#### FAMILY DACTYLOIDAE (1)

| Species                  | Year of first record | Global distribution | IUCN status | SEMARNAT EVS Global |
|--------------------------|----------------------|---------------------|-------------|----------------------|
| Anolis nebulosus         | 1998                 | 1                   | LC NL M (13) | 1 1998 Casas-Andreu et al. 1998 |

#### FAMILY GECKONIDAE (1)

| Species                  | Year of first record | Global distribution | IUCN status | SEMARNAT EVS Global |
|--------------------------|----------------------|---------------------|-------------|----------------------|
| Hemidactylus frenatus    | 1998                 | 1                   | LC Pr H (13) | 1 1998 Casas-Andreu et al. 1998 |

#### FAMILY HELODERMATIDAE (1)

| Species                  | Year of first record | Global distribution | IUCN status | SEMARNAT EVS Global |
|--------------------------|----------------------|---------------------|-------------|----------------------|
| Anolis nebulous          | 1940                 | 1                   | LC NL M (13) | 1 1940 UCM 46440     |

#### FAMILY IGUANIDAE (1)

| Species                  | Year of first record | Global distribution | IUCN status | SEMARNAT EVS Global |
|--------------------------|----------------------|---------------------|-------------|----------------------|
| Ctenosaura pectinata     | 1933                 | 1                   | NE A H (15) | 1 1933 UIMNH 46440   |

#### FAMILY PHRYNOSOMATIDAE (19)

| Species                  | Year of first record | Global distribution | IUCN status | SEMARNAT EVS Global |
|--------------------------|----------------------|---------------------|-------------|----------------------|
| Phrynosoma orbiculare    | 1888                 | 1                   | LC A M (12) | 1 1888 Dugès 1888    |

#### FAMILY SCHELTOPHILA (1)

| Species                  | Year of first record | Global distribution | IUCN status | SEMARNAT EVS Global |
|--------------------------|----------------------|---------------------|-------------|----------------------|
| Sceloporus occidentalis   | 1888                 | 1                   | LC A M (12) | 1 1888 Dugès 1888    |
| Species                             | Year of first record | Source          |
|-------------------------------------|----------------------|-----------------|
| Sceloporus spinosus Wiegmann, 1828  | 1922                 | MVZ 8851        |
| Sceloporus sagittatus Smith, 1942   | 1999                 | SEMARNAT        |
| Sceloporus torquatus Wiegmann, 1828 | 1888                 | Dugès 1888      |
| Urosaurus bicarinatus (Duméril, 1856)| 1930                 | MCZ R-33686     |
| Sceloporus sugillatus Smith, 1942   |                      |                 |
| Sceloporus torquatus Wiegmann, 1828 |                      |                 |
| Urosaurus bicarinatus (Duméril, 1856)|                      |                 |

**Vegetation type**

- IUCN status
- SEMARNAT
- EVS
- Global distribution
- Year of first record
- Source

**Family Phylodactylidae (1)**

- *Phylodactylus lutescens* Smith, 1955

**Family Scincidae (6)**

- *Marisonia brachypoda* (Taylor, 1956)
- *Plestiodon brevirostris* (Günther, 1860)
- *Plestiodon copei* (Taylor, 1933)
- *Plestiodon dugesi* (Thorington, 1883)
- *Plestiodon indubitatus* (Taylor, 1933)
- *Plestiodon lyncae* (Wiegmann, 1834)

**Family Teiidae (5)**

- *Phylloctites carinatus* (Cope, 1878)
- *Aspidoscelis cinctatus* (Cope, 1878)
- *Aspidoscelis deppei* (Wiegmann, 1834)
- *Aspidoscelis galera* (Baird & Girard, 1852)
- *Aspidoscelis sackii* (Wiegmann, 1834)

**Family Boiidae (1)**

- *Boa sigma* Smith, 1943

**Family Colubridae (21)**

- *Conopsis biserialis* (Taylor & Smith, 1942)
- *Conopsis lineata* (Kernicott, 1859)
- *Conopsis nasus* (Günther, 1858)
- *Drymarchon melanurus* (Duméril, Bibron & Duméril, 1854)
- *Drymobius margaritiferus* (Schlegel, 1837)
- *Lampropeltis polyzona* Cope, 1860
- *Leptophis diplotropis* (Günther, 1872)
- *Masticophis mentovarius* (Duméril, Bibron & Duméril, 1854)
- *Oxybelis aeneus* (Wagler, 1824)
- *Pituophis deppei* (Dumeril, 1853)
- *Pituophis lineaticollis* (Cope, 1861)
- *Pseudoficimia frontalis* Cope, 1864
- *Salvadora bairdi* Jan & Sordelli, 1860
- *Salvadora mexicana* (Duméril, Bibron & Duméril, 1854)
- *Senticolis triaspis* (Cope, 1866)
- *Tantilla boconati* (Günther, 1895)
- *Tantilla calaminarum* Cope, 1866
- *Tantilla deppei* (Bocourt, 1883)
- *Tantilla rubra* Cope, 1875
- *Trimorphodon bicucullatus* (Duméril, Bibron & Duméril, 1854)
- *Trimorphodon tau* Cope, 1870

**Family Dipsadidae (12)**

- *Conophis vittatus* Peters, 1860
- *Diadophis punctatus* (Linnaeus, 1766)
- *Enulius flavitorques* (Cope, 1868)
- *Geophis bicolor* Günther, 1868
- *Geophis riebecki* (Jan, 1862)
- *Imantodes gemmistratus* (Cope, 1861)
- *Leptodeira maculata* (Hallowell, 1861)
| Species                                    | Vegetation type | IUCN status | SEMARNAT status | EVS | Global distribution | Year of first record | Source                           |
|--------------------------------------------|-----------------|-------------|-----------------|-----|---------------------|----------------------|----------------------------------|
| Leptodeira septentrionalis (Kennicott, 1859) | 4 LC            | NL          | L (8)           | 4   | 1992                | Camarillo-Rangel and Smith 1992 |
| Leptodeira splendida Günther, 1895         | 4 LC            | NL          | H (14)          | 1   | 1976                | CNAR 3770            |
| Blandinaeus hopperi Bailey, 1940           | 4 LC            | Pr          | M (10)          | 1   | 1973                | ENCB 7829            |
| Blandinaeus laevis (Günther, 1868)         | 1,2,3 LC        | NL          | M (12)          | 1   | 1952                | KUNHM 39966          |
| Blandinaeus tarsatus (Peters, 1863)        | 1,2 LC          | NL          | M (13)          | 1   | 1979                | CNAR 3543            |
| **FAMILY ELAPIDAE (3)**                    |                 |             |                 |     |                     |                      |                                  |
| Micruro browni Schmidt & Smith, 1943       | 1,2,3 LC        | Pr          | L (8)           | 3   | 1954                | KUNHM 50701          |
| Micruro latidorsis Peters, 1870            | 4 LC            | Pr          | H (14)          | 1   | 1986                | ENCB 12924           |
| Micruro tener Baird & Girard, 1953         | 1,4 LC          | NL          | M (11)          | 2   | 1943                | ENCB 2204            |
| **FAMILY LEPTOTYPHLOPIDAE (2)**            |                 |             |                 |     |                     |                      |                                  |
| Epictia bakewelli (Oliver, 1937)           | 4 NE            | NL          | NE              | 1   | 1985                | Camarillo-Rangel et al. 1985 |
| *Rena maxima* (Leveridge, 1932)            | 4 LC            | NL          | M (11)          | 1   | 1960                | KUNHM 67639          |
| **FAMILY NATRICIDAE (7)**                  |                 |             |                 |     |                     |                      |                                  |
| *Soweria storeriodes* (Cope, 1866)         | 1,2,3 LC        | NL          | M (11)          | 1   | 1938                | UIMNH 18771          |
| Thermobius cyrticus (Kennicott, 1860)       | 1,2,3,4,6 LC    | A            | L (7)           | 4   | 1892                | USNM 19903           |
| Thermobius eques (Reuss, 1834)             | 1,2,3,4,6 LC    | A            | L (8)           | 2   | 1904                | USNM 46599           |
| Thermobius melanogaster (Wiegmann, 1830)    | 1,2,3,6 EN      | A            | H (15)          | 1   | 1888                | Dugès 1888           |
| Thermobius pulchritatus (Cope, 1885)       | 1,2,3,4 LC      | NL          | H (15)          | 1   | 1888                | Dugès 1888           |
| Thermobius scalaris (Cope, 1861)           | 1,2,3,5 LC      | A            | H (14)          | 1   | 1888                | Dugès 1888           |
| Thermobius scalaris (Jan, 1863)            | 1,2,3,5,6 VU    | A            | H (15)          | 1   | 1939                | UMMZ 85367           |
| **FAMILY TYPHLOPIDAE (1)**                 |                 |             |                 |     |                     |                      |                                  |
| Indotyphlops braminus (Duellin, 1803)       | IN              | IN          | IN              | IN  | 1997                | CNAR 11307           |
| **FAMILY VIPERIDAE (10)**                  |                 |             |                 |     |                     |                      |                                  |
| Contusus aquilus Klauber, 1952              | 1,2,3,4,6 LC    | Pr           | H (16)          | 1   | 1982                | CNAR 4246            |
| Contusus atrum Baird & Girard, 1853        | 5 LC            | Pr           | L (9)           | 2   | 2004                | Marias-Ferrer and Murillo 2004b |
| Contusus culminatus Klauber, 1952           | 4 NE            | NL          | H (15)          | 1   | 1888                | Dugès 1888           |
| Contusus molossus Baird and Girard, 1853    | 1,2,3,6 LC      | Pr           | L (8)           | 2   | 1888                | Dugès 1888           |
| Contusus polyticus (Cope, 1865)            | 1,2,3,4 LC      | Pr           | H (16)          | 1   | 1888                | Dugès 1888           |
| Contusus quercus Cope, 1865                | 1,2,3,4,6 LC    | A            | H (14)          | 1   | 1938                | UIMNH 19186          |
| Contusus crusatoides (Kennicott, 1861)      | 5 LC            | Pr           | M (11)          | 2   | 1967                | ENCB 3853            |
| Contusus tigris Bryson, Linkem, Dorcas, Larhno, Jones, Alvarado-Dias, Grünwald & Murphy, 2014 | 1,2,3,4 NE    | NL          | H (16)          | 1   | 2014                | Bryson et al. 2014 |
| Contusus transversus Taylor, 1944          | 2,3 LC          | P            | H (17)          | 1   | 1975                | KUNHM 159362         |
| Contusus tigris (Wagler, 1830)              | 1,2,3,4,6 LC    | NL          | H (16)          | 1   | 1940                | MVZ 36745            |
| **ORDER TESTUDINES**                       |                 |             |                 |     |                     |                      |                                  |
| Emydidae (1)                               |                 |             |                 |     |                     |                      |                                  |
| Trachemys venusta (Gray, 1855)             | 4 NE            | NL          | M (13)          | 3   | 1939                | MCZ R-45542          |
| **FAMILY GEOEMYDIDAE (1)**                 |                 |             |                 |     |                     |                      |                                  |
| Rhinoclemmys ruhida (Cope, 1870)            | 4 NT            | Pr           | H (14)          | 1   | 1983                | Camarillo-Rangel 1983 |
| **FAMILY KINOSTERNIDAE (2)**               |                 |             |                 |     |                     |                      |                                  |
| Kinosternon hirtipes (Wagler, 1830)         | 1,4,5,6 LC      | Pr           | M (10)          | 2   | 1888                | Dugès 1888           |
| Kinosternon integrum LeConte, 1854         | 4 LC            | Pr           | M (11)          | 1   | 1888                | Dugès 1888           |

ern State of Mexico), Hidalgo and Querétaro (northern State of Mexico), Morelos (southern State of Mexico), and Puebla (eastern State of Mexico), and are based on distributional records appearing in Vertnet.org, the Sistema Nacional de Información sobre Biodiversidad (SNIB-CONABIO) for all six neighboring states and Mexico City, Dixon and Lemos-Espinal (2010) for Querétaro; and Lemos-Espinal and Dixon (2016) for Hidalgo. We are convinced that as more herpetological work is done in the areas near the borders between the State of Mexico and its neighboring states, these potential species will likely be documented in the State of Mexico.
General distribution

Thirty-six of the 49 species of amphibians found in the State of Mexico are endemic to Mexico, four of them to the State of Mexico (*Ambystoma bombypellum*, *A. granulosum*, *A. lermaense*, and *Pseudoeurycea robertsi*); twelve are species found mainly along the Eje Neovolcánico of central Mexico; seven are species typical of the Pacific Coast, including the Balsas Depression; three are species characteristics of the Mexican Plateau; seven more are species with a widely distributional patterns in the Mexican Plateau, the Sierra Madre Occidental, Sierra Madre Oriental, Sierra Madre del Sur, and Eje Neovolcánico; and the remaining three are represented by scattered populations in the Mexican Plateau, Sierras Madres, and Eje Neovolcánico (Table 1). Of the 13 amphibian species not endemic to Mexico, four are found in the United States and Mexico,
Figure 7. Species accumulation curves for total herpetofauna, amphibians, and reptiles of the State of Mexico, Mexico.

Five range from Mexico to Central or even South America, three more are found from southern United States to Central or South America, and one is introduced (Table 1). Thirty-three of the 40 species of lizards that occur in the state are endemic to Mexico; one is endemic to the State of Mexico (*Barisia herrenae*); six are restricted to localities in central Mexico in the State of Mexico, Morelos, Puebla, and Mexico City; ten are typical of the Mexican Pacific Coast; two are limited to the Eje Neovolcánico of central Mexico; six are limited to the central-south part of Mexico, in the Eje Neovolcánico and Sierra Madre del Sur; two are typical of the Mexican Plateau, occurring also in the Eje Neovolcánico or the Sierra Madre del Sur; and six occur in both the Sierra Madre Occidental and Sierra Madre Oriental, and in the Eje Neovolcánico. Of the seven species of lizards found in the State of Mexico but that are not endemic to Mexico, one is found in the United States and Mexico, four are distributed from Mexico to Central America, one is distributed from the United States to Central America, and one is introduced (Table 1). Thirty-six of the 57 species of snakes that inhabit the State of Mexico are endemic to Mexico. Of the 21 snake species not endemic to Mexico that are found in the State of Mexico, six are found in the United States and Mexico, ten range from Mexico to Central or even South America, four are found from central or southern United States to Central or South America, and one is introduced (Table 1). Two of the four species of turtles found in the State of Mexico are endemic to Mexico, one is a species found in the United States and Mexico, and one is distributed from Mexico to Central America (Table 1).
Table 2. List of amphibian and reptile species that potentially occur in the State of Mexico.

| CLASS AMPHIBIA                  | Region in the State of Mexico where it likely occurs |
|--------------------------------|----------------------------------------------------|
| ORDER ANURA                    |                                                    |
| Family Craugastoridae          |                                                    |
| Craugastor rhodopus (Cope, 1867)| southern                                          |
| Family Hylidae                 |                                                    |
| Scinax staufferi (Cope, 1865)  | southern                                          |
| CLASS REPTILIA                 |                                                    |
| ORDER SQUAMATA                 |                                                    |
| SUBORDER AMPHISBAENIA          |                                                    |
| Family Bipedidae               |                                                    |
| Bipes canaliculatus Latreille, 1801 | extreme southwestern                          |
| SUBORDER LACERTILIA            |                                                    |
| Family Anguidae                |                                                    |
| Gerrhonotus ophiurus Cope, 1867 | eastern and southern                             |
| Family Eublepharidae           |                                                    |
| Coleonyx elegans Gray, 1845    | extreme southwestern                              |
| Family Phrynosomatidae         |                                                    |
| Phrynosoma asio Cope, 1864     | extreme southwestern                              |
| Sceloporus minor Cope, 1885    | northern                                          |
| Sceloporus siniferus Cope, 1870| extreme southwestern                              |
| Sceloporus utformis Cope, 1864 | extreme southwestern                              |
| Family Phyllodactylidae        |                                                    |
| Phyllodactylus bordai Taylor, 1942 | extreme southwestern                          |
| Phyllodactylus tuberculatus Wiegmann, 1834 | extreme southwestern                          |
| Family Teiidae                 |                                                    |
| Holcosus sinister (Wiegmann, 1834) | extreme southwestern                          |
| SUBORDER SERPENTES             |                                                    |
| Family Colubridae              |                                                    |
| Ficimia pubia (Cope, 1866)     | extreme southwestern                              |
| Lampropeltis ruthveni Blanchard, 1920 | northern                                         |
| Mastigodryas melanolomus (Cope, 1868) | extreme southwestern                          |
| Sonora michoacanensi (Dugès, 1884) | western and southwestern                         |
| Family Dipsadidae              |                                                    |
| Pseudoleptodeira latifasciata ( Günther, 1894) | extreme southwestern                          |
| Tropidodipsa zweifeli (Liner & Wilson, 1970) | extreme southwestern                          |
| Family Loxocemidae             |                                                    |
| Loxocemus bicolor Cope, 1861   | extreme southwestern                              |
| Family Viperidae               |                                                    |
| Agkistrodon bilineatus Günther, 1863 | extreme southwestern                          |
| ORDER TESTUDINES               |                                                    |
| Family Kinosternidae           |                                                    |
| Kinosternon scorpoides (Linnaeus, 1766) | western and southwestern                         |

**Habitat types**

In the State of Mexico, the percentage of herpetofaunal species found in the Oak (51.7%), Pine-oak (55.8%), Pine (44.9%), and Tropical Deciduous Forest (51.7%) vegetation types are relatively equal (Table 1). However, the Grassland (29.9%) and Scrubland (23.8%) vegetation types have relatively fewer species. This pattern of the observed percentage of species in each habitat type is the same for amphibians and reptiles individually in the Oak, Pine-oak, and Pine Forests; and in the Scrubland. However, the Tropical Deciduous Forest contains a higher percentage of reptiles (80.3%)
than for amphibians (19.7%), which might be due to the dry conditions of this vegetation type. The percentage of species found in the Grassland is the same for amphibians as for reptiles (50.0% for both), perhaps due to the high altitude grasslands that intermingle with Pine Forest in the State of Mexico, and these grasslands often traverse streams which host important populations of hylids, ranids, ambystomatids, anguids, phrynosomatids, colubrids, and vipers in the State of Mexico.

**Conservation status**

Of the amphibian and reptile species in the State of Mexico, 20.1% are IUCN listed (i.e., Vulnerable, Near Threatened, or Endangered), 18.4% are placed in a protected category by SEMARNAT (excluding NL and Pr, this last category is equivalent to the LC category of IUCN), and 34.9% are categorized as high risk by the EVS (Table 3; Fig. 8). For amphibians, 41.7% are IUCN listed, 20.8% are protected by SEMARNAT, and 33.3% are at high risk according to the EVS (Table 3; Fig. 8). For reptiles, 8.8% are listed by the IUCN, 17.2% are protected by SEMARNAT, and 35.7% are at high risk according to the EVS (Table 3; Fig. 8). These results suggest that many amphibians found in the State of Mexico are at risk and of relatively high conservation concern at both the global and national scale. However, the reptiles found in the State of Mexico are less at risk according to the global and national assessments of the IUCN and SEMARNAT, respectively; but the EVS suggests they may be at higher risk than the IUCN and SEMARNAT assessments suggest. Based on our review of the conservation statuses of the herpetofauna found in the State of Mexico, we have identified several families that include species of particular conservation concern. These families include Craugastoridae, Eleutherodactylidae, Ambystomatidae, Plethodontidae, Helodermatidae, Iguanidae, Phrynosomatidae, Colubridae, Natricidae, and Viperidae (Table 3). Because the conservation statuses we reviewed are developed and applied at a species wide level, we believe that the conservation status of specific taxa in the State of Mexico may not be accurately reflected by these measures. Additional state level assessments are needed, especially for species in the families we have identified as being at a particularly high level of risk.

We summarized the conservation status of amphibian and reptile taxa in each vegetation type found in the State of Mexico to determine the vegetation types that support species of particular conservation concern (Table 1). For IUCN listings, 43.3% of amphibian species in the Oak Forest are listed in a protected category; 48.5% in the Pine-oak Forest; 50.0% in the Pine Forest; 13.3% in the Tropical Deciduous Forest; 59.1% in the Grassland; and 16.7% in the Scrubland. For SEMARNAT listings of amphibian species, 30.0% in the Oak Forest are listed in a protected category; 30.3% in the Pine-oak Forest; 34.6% in the Pine Forest; 0% in the Tropical Deciduous Forest; 36.4% in the Grassland; and 16.7% in the Scrubland. For EVS, 40.0% of amphibian species in the Oak Forest of the State of Mexico were in the high category, 45.5% in the Pine-oak Forest, 42.3% in the Pine Forest, 0% in the Tropical Deciduous Forest, 54.5% in the Grassland, and 25.0% in the Scrubland. For IUCN listings, 8.9% of reptile species in
Table 3. Summary of native species present in the State of Mexico 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, CR (see Table 1 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). Mean EVS is the mean Environmental Vulnerability Score; scores ≥ 14 are considered high vulnerability (Wilson et al. 2013a, b) and conservation status in Mexico according to SEMARNAT (2019) in the order NL, Pr, A, P (see Table 1 for abbreviations).

| Scientific name | Genera | Species | IUCN | % EVS | SEMARNAT |
|-----------------|--------|---------|------|-------|----------|
|                 |        |         | DD, LC, VU, NT, EN, CR |       | NL, Pr, A, P |
| CLASS AMPHIBIA  |        |         |     |       |          |
| ORDER ANURA     | 15     | 32      | 1,24,2,1,3,1 | 10.3  | 20,9,2,1 |
| Bufonidae       | 3      | 5       | 0,4,0,0,1,0  | 10.4  | 5,0,0,0  |
| Craugastoridae  | 1      | 4       | 0,2,1,0,1,0  | 11.25 | 4,0,0,0  |
| Eleutherodactylidae | 1 | 4     | 1,2,1,0,0,0  | 14.3  | 2,2,0,0  |
| Hylidae         | 5      | 9       | 0,8,0,0,1,0  | 9.3   | 6,2,1,0  |
| Leptodactylidae | 1      | 1       | 0,1,0,0,0,0  | 4     | 0,1,0,0  |
| Microhylidae    | 1      | 1       | 0,1,0,0,0,0  | 1     | 0,1,0,0  |
| Phyllomedusidae | 1      | 1       | 0,1,0,0,0,0  | 13    | 0,1,0,0  |
| Ranidae         | 1      | 6       | 0,4,0,1,0,1  | 11.2  | 2,2,1,1  |
| Scaphiopodidae  | 1      | 1       | 0,1,0,0,0,0  | 3     | 1,0,0,0  |
| ORDER CAUDATA   | 5      | 16      | 1,2,2,1,5,5  | 14.8  | 2,7,7,0  |
| Ambystomatidae  | 1      | 8       | 1,1,0,0,2,4  | 13.5  | 0,5,3,0  |
| Plethodontidae  | 4      | 8       | 0,1,2,1,3,1  | 16.1  | 2,2,4,0  |
| SUBTOTAL        | 20     | 48      | 2,26,4,2,8,6 | 11.8  | 22,16,9,1 |
| CLASS REPTILIA  |        |         |     |       |          |
| ORDER SQUAMATA  | 40     | 95      | 2,79,3,0,4,0 | 11.5  | 53,25,15,2 |
| SUBORDER LACERTILIA | 13 | 39      | 0,32,2,0,3,0 | 12.4  | 25,9,4,1  |
| Anguidae        | 3      | 5       | 0,2,0,0,3,0  | 13.2  | 1,2,1,1  |
| Dactyliidae     | 1      | 1       | 0,1,0,0,0,0  | 13    | 1,0,0,0  |
| Helodermatidae  | 1      | 1       | 0,1,0,0,0,0  | 11    | 0,0,1,0  |
| Iguanidae       | 1      | 1       | 0,0,0,0,0,0  | 15    | 0,0,1,0  |
| Phrynopsomatidae| 3      | 19      | 0,18,1,0,0,0 | 12.4  | 16,2,1,0  |
| Phylloactylidae | 1      | 1       | 0,1,0,0,0,0  | 15    | 1,0,0,0  |
| Scincidae       | 2      | 6       | 0,4,1,0,0,0  | 12    | 3,3,0,0  |
| Teiidae         | 1      | 5       | 0,5,0,0,0,0  | 11.2  | 3,2,0,0  |
| SUBORDER SERPENTES | 27 | 56      | 2,47,1,0,1,0  | 11    | 28,16,11,1 |
| Boidae          | 1      | 1       | 0,0,0,0,0,0  | 15    | 1,0,0,0  |
| Colubridae      | 13     | 21      | 0,20,0,0,0,0 | 10    | 12,4,5,0  |
| Dipsadidae      | 7      | 12      | 2,10,0,0,0,0 | 9.8   | 7,5,0,0  |
| Elapidae        | 1      | 3       | 0,3,0,0,0,0  | 11    | 1,2,0,0  |
| Leptotyphlopidae| 2      | 2       | 0,1,0,0,0,0  | 11    | 2,0,0,0  |
| Natrixidae      | 2      | 7       | 0,5,1,0,1,0  | 11.5  | 2,0,5,0  |
| Viperidae       | 1      | 10      | 0,8,0,0,0,0  | 13.8  | 5,5,1,1  |
| ORDER TESTUDINES| 3      | 4       | 0,2,0,1,0,0  | 12    | 1,3,0,0  |
| Emydidae        | 1      | 1       | 0,0,0,0,0,0  | 13    | 1,0,0,0  |
| Geemydidae      | 1      | 1       | 0,0,0,1,0,0  | 14    | 0,1,0,0  |
| Kinosternidae   | 1      | 2       | 0,2,0,0,0,0  | 10.5  | 0,2,0,0  |
| SUBTOTAL        | 43     | 99      | 2,81,3,1,4,0 | 11.6  | 54,28,15,2 |
| TOTAL           | 63     | 147     | 410,7,3,12,6 | 11.7  | 76,44,24,3 |

the Oak Forest are listed in a protected category; 12.5% in the Pine-oak Forest; 12.5% in the Pine Forest; 3.8% in the Tropical Deciduous Forest; 9.1% in the Grassland; and 8.7% in the Scrubland. For SEMARNAT listings of reptile species, 22.2% in the Oak Forest are listed in a protected category; 25.0% in the Pine-oak Forest; 25.6% in the Pine Forest; 15.0% in the Tropical Deciduous Forest; 18.2% in the Grassland; and 34.8% in the Scrubland. For EVS, 42.2% of reptile species in the Oak Forest of the State of Mexico were in the high category, 45.8% in the Pine-oak Forest, 53.8% in the Pine Forest, 35.0% in the Tropical Deciduous Forest, 22.7% in the Grassland, and
34.8% in the Scrubland. Given the apparent importance of forested habitats in terms of protected amphibian and reptile species in the State of Mexico, efforts to maintain or expand such habitats, perhaps by reforestation, is a management strategy that needs to be considered. Indeed, Sánchez-Jasso et al. (2013) found that reforested woodlands in the State of Mexico supported a relatively high richness of vertebrates.

**Comparison with neighboring states**

Overall, the State of Mexico shares the most species (76.9%) with Michoacán (Table 4). The State of Mexico also shares the most amphibian species with Michoacán (72.9%), including 87.5% of its anuran species, and 43.8% of its salamander species. These two states are especially important for salamanders in the family Ambystomatidae and contribute 11 of the 14 species of the regional pool, only lacking *A. mexicanum* (endemic to Mexico City), *A. taylori* (endemic to Puebla), and *A. subsalsum*. For reptiles, the State of Mexico shares 78.8% of its reptile species with Michoacán. The similarity between these two states is due to the long border between them (241 km, INEGI 2018) and the fact that the larger Michoacán contains essentially all of the vegetation types present in the State of Mexico. In contrast, the state that shares the second highest number of species with the State of Mexico is the small state of Morelos. Morelos, along with the State of Mexico and Mexico City,
Table 4. Summary of the numbers of species shared between the State of Mexico and neighboring Mexican states (not including introduced species). The percent of the State of Mexico species shared by a neighboring state are given in parentheses. – indicates either the State of Mexico or the neighboring state has no species in the taxonomic group, or none of that specific taxon is shared between the states, thus no value for shared species is provided.

| Taxon          | State of Mexico | Michoacán | Morelos  | Puebla | Guerrero | Hidalgo | Querétaro | Mexico City |
|----------------|-----------------|-----------|----------|--------|----------|---------|-----------|-------------|
| CLASS AMPHIBIA | 48              | 35 (72.9) | 33 (68.8)| 27 (56.3)| 26 (55.3)| 20 (41.7)| 16 (33.3)| 16 (33.3)   |
| ORDER ANURA    | 32              | 28 (87.5)| 26 (81.3)| 23 (71.9)| 23 (71.9)| 16 (50.0)| 13 (40.6)| 8 (25.0)    |
| Bufonidae      | 5               | 5 (100)   | 5 (100)  | 5 (100) | 4 (80.0) | 3 (60.0) | 3 (60.0)  | 1 (20.0)    |
| Craugastoridae | 4               | 3 (75.0)  | 4 (100)  | 3 (75.0)| 4 (100)  | 1 (25.0) | 1 (25.0)  | 1 (25.0)    |
| Eleutherodactylidae | 4 | 3 (75.0)  | 3 (75.0) | 1 (25.0)| 2 (50.0) | 1 (25.0) | 1 (25.0)  | –           |
| Hylidae        | 9               | 8 (88.9)  | 7 (77.8) | 7 (77.8)| 7 (77.8) | 5 (55.6) | 3 (33.3)  | 3 (33.3)    |
| Leptodactylidae| 1               | 1 (100)   | 0        | 1 (100) | 1 (100)  | 1 (100) | –         | –           |
| Microhylidae   | 1               | 1 (100)   | 1 (100)  | 1 (100) | 1 (100)  | 1 (100) | 1 (100)  | –           |
| Phyllomedusidae| 1               | 1 (100)   | 1 (100)  | 1 (100) | 1 (100)  | –       | –         | –           |
| Ranidae        | 6               | 5 (83.3)  | 4 (66.7) | 3 (50.0)| 2 (33.3) | 3 (50.0) | 3 (50.0)  | 2 (33.3)    |
| Scaphiopodidae | 1               | 1 (100)   | 0        | 1 (100) | 1 (100)  | 1 (100) | 1 (100)  | 1 (100)     |
| ORDER CAUDATA  | 16              | 7 (43.8)  | 7 (43.8) | 4 (25.0)| 3 (18.8) | 4 (25.0) | 3 (18.8) | 8 (50.0)    |
| Ambystomatidae | 8               | 4 (50.0)  | 1 (12.5)| 1 (12.5)| 1 (12.5) | 1 (12.5) | 1 (12.5) | 2 (25.0)    |
| Plethodontidae | 8               | 3 (37.5)  | 6 (75.0) | 3 (37.5)| 2 (25.0) | 3 (37.5) | 2 (25.0) | 6 (75.0)    |
| CLASS REPTILIA | 99              | 78 (78.8)| 73 (71.8)| 71 (71.7)| 65 (65.7)| 47 (47.5)| 45 (45.5)| 43 (43.4)   |
| ORDER SQUAMATA| 95              | 75 (78.9)| 71 (74.7)| 69 (72.6)| 63 (66.3)| 44 (46.3)| 43 (45.3)| 41 (43.2)   |
| SUBORDER LACERTILIA | 39 | 28 (71.8)| 29 (74.4)| 26 (66.7)| 26 (66.7)| 12 (30.8)| 10 (25.6)| 14 (35.9)   |
| Anguidae       | 5               | 3 (60.0)  | 4 (80.0) | 2 (40.0)| 3 (60.0) | 1 (20.0) | 1 (20.0) | 1 (20.0)    |
| Dactyloidae    | 1               | 1 (100)   | 1 (100)  | –       | 1 (100)  | –       | –         | –           |
| Helodermatidae | 1               | 1 (100)   | 1 (100)  | 1 (100) | 1 (100)  | –       | –         | –           |
| Iguanidae      | 1               | 1 (100)   | 1 (100)  | 1 (100) | 1 (100)  | –       | –         | –           |
| Phrynosomatidae| 19              | 12 (63.2)| 14 (73.7)| 15 (78.9)| 12 (63.2)| 9 (47.4)| 7 (36.8) | 10 (52.6)   |
| Phylodactylidae| 1               | 1 (100)   | –        | 1 (100) | –       | –       | –         | –           |
| Scincidae      | 6               | 4 (66.7)  | 4 (66.7)| 4 (66.7)| 3 (50.0) | 1 (16.7)| 1 (16.7) | 2 (33.3)    |
| Teiidae        | 5               | 5 (100)   | 4 (80.0)| 3 (60.0)| 4 (80.0) | 1 (20.0)| 1 (20.0)| 1 (20.0)    |
| SUBORDER SERPENTES | 56 | 47 (83.9)| 42 (75.0)| 43 (76.8)| 37 (66.1)| 32 (57.1)| 33 (58.9)| 27 (48.2)   |
| Boidae         | 1               | 1 (100)   | 1 (100)  | 1 (100) | 1 (100)  | –       | –         | –           |
| Colubridae     | 21              | 19 (90.5) | 19 (90.5)| 20 (95.2)| 18 (85.7)| 13 (61.9)| 14 (66.7)| 9 (42.9)    |
| Dipsadidae     | 12              | 11 (91.7)| 8 (66.7)| 7 (58.3)| 8 (66.6) | 5 (41.7)| 4 (33.3)| 4 (33.3)    |
| Elapidae       | 3               | 2 (66.7)  | 2 (66.7)| 2 (66.7)| 2 (66.6) | 1 (33.3)| 1 (33.3)| 1 (33.3)    |
| Leptotyphlopidae| 2 | 2 (100)  | 1 (50.0)| 1 (50.0)| 2 (100)  | 1 (50.0)| 1 (50.0)| –           |
| Natricidae     | 7               | 7 (100)   | 4 (57.1)| 6 (85.7)| 3 (42.9)| 6 (85.7)| 6 (85.7)| 7 (100)     |
| Viperidae      | 10              | 5 (50.0)  | 7 (70.0)| 6 (60.0)| 3 (30.0)| 6 (60.0)| 7 (70.0)| 6 (60.0)    |
| ORDER TESTUDINES| 4 | 3 (75.0)| 2 (50.0)| 2 (50.0)| 2 (50.0)| 3 (75.0)| 2 (50.0)| 2 (50.0)    |
| Emydidae       | 1               | –        | –        | 1 (100) | –        | 1 (100) | –        | –           |
| Geoemydidae    | 1               | 1 (100)   | –        | 1 (100) | –        | –        | –         | –           |
| Kinosternidae  | 2               | 2 (100)   | 2 (100) | 1 (50.0)| 1 (50.0)| 2 (100) | 2 (100)  | 2 (100)     |
| TOTAL          | 147             | 113 (76.9)| 106 (72.1)| 98 (66.7)| 91 (61.9)| 67 (45.6)| 61 (41.5)| 59 (40.1)   |

share parts of the Corredor Biológico Chichinautzin, which includes the Lagunas de Zempoala National Park, that hosts a unique assortment of amphibians and reptiles. Moreover, Morelos shares part of the Tropical Deciduous Forest with the southern part of the State of Mexico. Puebla and Guerrero also share a large number of species with the State of Mexico. Hidalgo, Querétaro, and Mexico City share fewer amphibian and reptile species with the State of Mexico. Hidalgo and Querétaro are states whose dominant species are from the Mexican Altiplano and the Sierra Madre Oriental, whereas the dominant species for the State of Mexico are a combination of
species of the Eje Neovolcánico and the Sierra Madre del Sur. The lower number of shared species among these states may also reflect the inherent species richness of the shared habitat types. In addition, the border of Querétaro with the State of Mexico is quite short (95.3 km, INEGI 2018), and although the border of Hidalgo with the State of Mexico is the longest of the other neighboring states (422.3 km, INEGI 2018), most of this border is confined to the subprovince of Llanuras and Sierras de Querétaro e Hidalgo, with a sole contribution of species typical of the Mexican Altiplano. On the other hand, although Mexico City is nearly surrounded by the State of Mexico, its small size (1,485 km²) along with its large urbanized area, results in a small number of species of amphibians and reptiles (63: Lemos-Espinal and Smith, in press), which also results in an equally small number of species shared between Mexico City and the State of Mexico (59). However, 93.7% of the total number of species recorded for Mexico City is shared with the State of Mexico.

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References

Aguilar Miguel X, Casas Andreu G, Cárdenas Ramos PJ, Cantellano de Rosas E (2009) Análisis espacial y conservación de los anfibios y reptiles del Estado de México. Ciencia Ergo Sum 16: 171–180.

Alvarado-Díaz J, Suazo-Ortuño I, Wilson LD, Medina-Aguilar O (2013) Patterns of physiographic distribution and conservation status of the herpetofauna of Michoacán, México. Amphibian & Reptile Conservation 7(1): 128–170.
AmphibiaWeb (2019) AmphibiaWeb. University of California, Berkeley. https://amphibiaweb.org [accessed 29 November 2019]

Bautista-Olivas AL, Tovar-Salinas JL, Mancilla-Villa OR, Flores-Magdaleno H, Ramírez-Ayala C, Arteaga-Ramírez R, Vázquez-Peña M (2014) Concentración de metales traza en el agua condensada de humedad atmosférica en el Valle de México. Interciencia 39(4): 234–240.

Bryson RW, Linkem CW, Dorcas ME, Lathrop A, Jones JM, Alvarado-Díaz J, Grünwald CI, Murphy RW (2014) Multilocus species delimitation in the Crotalus triseriatus species group (Serpentes: Viperidae: Crotalinae), with the description of two new species. Zootaxa 3826(3): 475–496. https://doi.org/10.11646/zootaxa.3826.3.3

Camarillo-Rangel JL (1983) New herpetological records from the state of México. Bulletin of the Maryland Herpetological Society 19(2): 39–46.

Camarillo-Rangel JL, Aguilar-Cortes R, González-Ruiz A (1985) Distributional records of amphibians and reptiles from the state of México. Herpetological Review 16(3): 1–85.

Camarillo-Rangel JL, Smith HM (1992) A handlist of the amphibians and reptiles of the State of Mexico, Mexico. In: Strimple PD, Strimple JL (Eds) Contributions in Herpetology. Greater Cincinnati Herpetological Society, Cincinnati, 111 pp.

Casas-Andreu G, Barrios-Quiroz G, Cruz-Avina R (1998) Hemidactylus frenatus. México: México. Herpetological Review 29(1): 1–51.

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) (1997) “Modelo Digital del Terreno”. Escala 1:250 000. México.

CONABIO (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad) (2018) Sistema Nacional de Información sobre Biodiversidad. Registros de ejemplares. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. Registros Curatoriales Anfibios, Reptiles para el estado de México. Ciudad de México, México.

Cruz-Elizalde R, Ramírez-Bautista A, Hernández-Salinas U, Berriozabal-Islas C, Wilson LD (2019) An updated checklist of the herpetofauna of Querétaro, México: species richness, diversity, and conservation status. Zootaxa 4638(2): 273–290. https://doi.org/10.11646/zootaxa.4638.2.7

Dixon JR, Lemos-Espinal JA (2010) Anfibios y Reptiles del Estado de Querétaro, México / Amphibians and Reptiles of the State of Querétaro, México. CONABIO, México, 428 pp.

Duellman WE (1960) A taxonomic study of the Middle American Snake, Pituophis deppei. University of Kansas Publications. Museum of Natural History 10(10): 599–610.

Dugès AAD (1888) Erpetología del Valle de México. La Naturaleza. Serie 2. México 1: 97–146.

Dugès AAD (1895) Description d’un Axolotl des Montagnes de las Cruces (Amblystoma altamariní, A. Dugès). Institut Médico-Nacional, Imprimérie du Ministère de Fomento, México, 64 pp.

Duméril AMC (1853) Prodrome de la classification des reptiles ophidiens. Mémoires de l’Académie de Sciences, de l’Institut de France, Paris 23: 399–536. https://doi.org/10.5962/bhl.title.60463
Flores-Villela O, Canseco-Márquez L, Ochoa-Ochoa LM (2010) Geographic distribution and conservation of the Mexican Central Highlands herpetofauna. In: Wilson LD, Townsend JH, Johnson JD (Eds) Conservation of Mesoamerican Amphibians and Reptiles. Eagle Mountain Publishing, Eagle Mountain, 303–321.

Frost DR (2019) 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 29 November 2019]

García E, Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO) (1998). “Climas (Clasificación de Köppen, modificado por García)”. Escala 1:1 000 000. México.

INEGI (2016) Conjunto de Datos Vectoriales de Uso de Suelo y Vegetación. Escala 1:250 000. Serie VI (Capa Unión), escala: 1:250 000. edición: 1. Instituto Nacional de Estadística y Geografía. Aguascalientes, México.

INEGI (2017) Anuario estadístico y geográfico del estado de México 2017 / Instituto Nacional de Estadística y Geografía. México: INEGI.

INEGI (2018) Áreas Geostadísticas Estatales’, escala: 1:250000. edición: 1. Instituto Nacional de Estadística y Geografía. Aguascalientes, México.

IUCN (2019) IUCN Red List of Threatened Species, Version 2019.2. [Downloaded on 19 November 2019]

Johnson JD, Mata-Silva V, Wilson LD (2015) A conservation reassessment of the Central American herpetofauna based on the EVS measure. Amphibian & Reptile Conservation 9: 1–94.

Kennicott R (1859) Reptiles of the Boundary (Vol. 2, pt. 2.), United States and Mexican Boundary Survey. U.S. 34th Congress, 1st Session, Executive Document (108). 23, plate 21, Figure 2.

Lara-Góngora G (2003) A new cryptic species of *Pseudoeurycea* (Amphibia: Caudata: Plethodontidae) of the *leprosa* group from central México. Bulletin of the Maryland Herpetological Society 39: 21–52.

Lemos-Espinal JA, Dixon JR (2016) Anfibios y Reptiles de Hidalgo / Amphibians and Reptiles of Hidalgo. CONABIO, México, 63 pp. https://doi.org/10.3897/zookeys.594.8289

Lemos-Espinal JA, Smith GR (2015) Amphibians and Reptiles of the State of Hidalgo, México. Check List 11(3): 1–1642. https://doi.org/10.15560/11.3.1642

Lemos-Espinal JA, Smith GR (2020) A conservation checklist of the herpetofauna of Morelos, with comparisons with adjoining states. ZooKeys 941: 121–144. https://doi.org/10.3897/zookeys.941.52011

Lemos-Espinal JA, Smith GR (in press) A conservation checklist of the amphibians and reptiles of Mexico City, with comparisons with adjoining states. Zookeys.

López-Cano R, Becerril-Zepeda G, Benítez C, Cuevas-Solórzano S (2009) El Medio Físico, Biológico y Social. En: Gobierno del Estado de México (Ed.) La Diversidad Biológica del Estado de México. Estudio de Estado. Biblioteca Mexiquense del Estado, Colección Mayor. Gobierno del Estado de México, 49–61.

Lynch JF, Wake DB, Yang S-Y (1983) Genic and morphological differentiation in Mexican *Pseudoeurycea* (Caudata: Plethodontidae). Copeia 1983: 884–894. https://doi.org/10.2307/1445090

Matías-Ferrer N, Murillo S (2004a) *Ambystoma ordinarium*. Herpetological Review 35: 182–183.
Matias-Ferrer N, Murillo S (2004b) *Crotalus atrox*. Herpetological Review 35: 1–190.
Matias-Ferrer N, Murillo S (2004c) *Conophis vittatus*. Herpetological Review 35: 1–190.
Palacios-Aguilar RI, Flores-Villela O (2018) An updated checklist of the herpetofauna from Guerrero, Mexico. Zootaxa 4422(1): 1–24. https://doi.org/10.11646/zootaxa.4422.1.1
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.
Rodríguez Romero L, Pacheco L, Zavala Hurtado JA (2008) Pteridifitas indicadoras de alteración ambiental en el bosque templado de San Jeronimo Amanalco, Texcoco, México. Revista de Biología Tropical 56: 641–656. https://doi.org/10.15517/rbt.v56i2.5614
Sánchez-Jasso M, Aguilar-Miguel X, Medina-Castro JP, Sierra-Domínguez G (2013) Riqueza específica de vertebrados en un bosque reforestado del Parque Nacional Nevado de Toluca, México. Revista Mexicana de Biodiversidad 84: 360–373. https://doi.org/10.7550/rmb.29473
SEMARNAT [Secretaría de Medio Ambiente y Recursos Naturales] (2019) Modificación al anexo normativo III, lista de especies en riesgo de la 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, publicado el 30 de diciembre del 2010. [14 noviembre 2019] https://www.dof.gob.mx/nota_detalle.php?codigo=5578808&fecha=14/11/2019
Taylor EH (1939) Concerning Mexican salamanders. University of Kansas Science Bulletin 25: 259–313. https://doi.org/10.5962/bhl.part.1703
Taylor EH (1940a) New salamanders from México, with a discussion of certain known forms. University of Kansas Science Bulletin 26: 407–430.
Taylor EH (1940b) A new *Rhyacosiredon* (Caudata) from western México. Herpetologica 1: 171–176.
Taylor EH (1943) Herpetological novelties from México. University of Kansas Science Bulletin 29: 343–361.
Taylor EH (1944) A new ambystomid salamander from the Plateau Region of México. University of Kansas Science Bulletin 30: 57–61. https://doi.org/10.5962/bhl.part.6502
Taylor EH, Smith HM (1942) The snake genera *Conopsis* and *Toluca*. University of Kansas Science Bulletin 28(15): 325–363.
Uetz P, Hošek J (2019) The Reptile Database. http://www.reptile-database.org [accessed 19 November, 2019]
Wiegmann AFA (1828) Beyträge zur Amphibienkunde. Isis von Oken 21(4): 364–383.
Wilson LD, Johnson JD, Mata-Silva V (2013a) A conservation reassessment of the amphibians of México 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 México based on the EVS measure. Amphibian & Reptile Conservation 7(1): 1–47.
Woolrich-Piña GA, García-Padilla E, DeSantis DL, Johnson JD, Mata-Silva V, Wilson LD (2017) The herpetofauna of Puebla, México: composition, distribution, and conservation status. Mesoamerican Herpetology 4(4): 791–884.
Zaldívar-Riverón A, Nieto-Montes de Oca A (2002) Variation in the rare lizard *Barisia rudicollis* (Wiegmann) (Anguidae) with description of a new species from Central México. Herpetologica 58(3): 313–326. https://doi.org/10.1655/0018-0831(2002)058[0313:VITTRLB]2.0.CO;2
Appendix 1

Museum collections included in the VertNet.org database records of the State of Mexico amphibians and reptiles that house specimens of the first record of a species in the State of Mexico.

AMNH  Collection of Herpetology, Herpetology Department, American Museum of Natural History;
CNAR  Colección Nacional de Anfibios y Reptiles, Instituto de Biología, Universidad Nacional Autónoma de México;
ENCB  Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional;
FMNH  Division of Amphibians and Reptiles, Field Museum of Natural History;
MCZ   Collection of Herpetology, Museum of Comparative Zoology, Harvard University Cambridge;
KUNHM Museum of Natural History, Division of Herpetology, University of Kansas;
MVZ   Museum of Vertebrate Zoology at Berkeley, Herpetological Collection;
MZFC  Museo de Zoología Alfonso L. Herrera, Facultad de Ciencias, UNAM. Colección Herpetológica;
NHM   Natural History Museum, London, Zoological Collection;
TCWC  Collection of Herpetology, Texas Cooperative Wildlife Collection, Texas A&M University;
UCM   Collection of Herpetology, University of Colorado Museum;
UIMNH University of Illinois Museum of Natural History Amphibian and Reptile Collection;
UMMZ Collection of Herpetology, Museum of Zoology, University of Michigan Ann Arbor;
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.