Introductory Page. *Crotalus mictlantecuhtli* Carbajal-Márquez, Cedeño-Vázquez, Martínez-Arce, Neri-Castro, and Machkour-M'Rabet, 2020. The Veracruz Neotropical Rattlesnake is a cryptic state endemic species in the *Crotalus durissus* species complex, which recently was described. This rattlesnake is distributed in the southern portion of the state of Veracruz, and eventually might be found in northeastern Oaxaca and western Tabasco. This species occurs at elevations from near sea level to 1,200 m. The describers indicated that this rattlesnake "inhabits mostly open dry areas with rocky outcrops in tropical deciduous forest and seasonal rain forest along the Atlantic versant" (Carbajal-Márquez et al. 2020: 465). The conservation status of this species has not been evaluated by the IUCN or by SEMARNAT; however, we calculated its EVS value as 16, placing it in the middle portion of the high vulnerability category. This individual was photographed in the vicinity of La Antigua, in the municipality of the same name. *Photo by Isaac Ajactle-Tequiliquihua.*

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The herpetofauna of Veracruz, Mexico: composition, distribution, and conservation status

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Abstract.*—The herpetofauna of the state of Veracruz, Mexico, currently consists of 359 species, including 76 anurans, 45 caudates, one caecilian, one crocodylian, 217 squamates, and 19 turtles. The distribution of the herpetofaunal species are catalogued here among the four recognized physiographic regions in the state. The total number of species ranges from 179 in the Sierra de Los Tuxtlas to 236 in the Sierra Madre Oriental. The number of species shared among the four physiographic regions ranges from 100 between the Gulf Coastal Lowlands and the Transmexican Volcanic Belt, to 190 between the Sierra Madre Oriental and the Transmexican Volcanic Belt. A similarity dendrogram based on the Unweighted Pair Group Method with Arithmetic Averages (UPGMA) depicts two distinct clusters, one between the Sierra Madre Oriental and the Transmexican Volcanic Belt, and the other between the Gulf Coastal Lowlands and the Sierra de Los Tuxtlas. The former cluster reflects two adjacent regions in highland environments that share a substantial number of herpetofaunal species, and the latter cluster shares a sizeable number of wide-ranging, generalist, lowland species found on the Atlantic and Pacific versants of Mexico and Central America. The level of herpetofaunal endemism is relatively high, with 182 of 359 species either endemic to Mexico or to Veracruz. The distributional categorization of the total herpetofauna is as follows: 169 non-endemic species; 138 country endemic species; 44 state endemic species; and eight non-native species. The 169 non-endemic species are allocated to the following distributional categories: MXCA (89), MXSA (30), MXUS (29), USCA (11), USSA (four), and OCEA (five). The principal environmental threats to the herpetofauna of Veracruz include deforestation, livestock, roads, water pollution, myths and other cultural factors, diseases, invasive species, and illegal commerce. The conservation status of each native species was evaluated using the SEMARNAT, IUCN, and EVS systems, of which the EVS system proved to be the most useful. The Relative Herpetofaunal Priority method was employed to determine the rank order significance of the four regions, and this identified the Sierra Madre Oriental as the region of greatest importance. Only six protected areas exist in Veracruz, most of which are located in the Gulf Coastal Lowlands, the region of least conservation significance. The area of greatest significance, the Sierra Madre Oriental, does not contain any protected areas. A total of 265 species have been recorded within the six protected areas, of which 138 are non-endemics, 89 are country endemics, 31 are state endemics, and seven are non-natives. Finally, we provide a set of conclusions and recommendations to enhance the prospects for the future protection of the herpetofauna of Veracruz.

Keywords: Anurans, caudates, physiographic regions, protected areas, protection recommendations, squamates, turtles

***Resumen*.—La herpetofauna de Veracruz, México, comprende 359 especies, incluidas 76 anuros, 45 caudados, una cecílido, un cocodrílido, 217 escamosos y 19 tortugas. Catalogamos la distribución de las especies de herpetofauna en cuatro regiones fisiográficas reconocidas. El número total de especies varía de 179 en la Sierra de Los Tuxtlas a 236 en la Sierra Madre Oriental. El número de especies compartidas**

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entre las cuatro regiones fisiográficas varía de 100 entre las Tierras Bajas Costeras del Golfo y el Cinturón Volcánico Transmexicano a 190 entre la Sierra Madre Oriental y el Cinturón Volcánico Transmexicano. Un dendrograma de similitud basado en el Método de Grupos de Pares no Ponderados con Promedios Aritméticos (UPGMA) muestra dos grupos distintos, uno entre la Sierra Madre Oriental y el Cinturón Volcánico Transmexicano y el otro entre las Tierras Bajas Costeras del Golfo y la Sierra de Los Tuxtlas. El primer grupo refleja las dos regiones que comparten un número sustancial de especies de herpetofauna de ambientes de tierras altas en áreas adyacentes, y el último grupo comparte un número considerable de especies de tierras bajas generalistas de amplio rango que se encuentran en las vertientes del Atlántico y Pacífico de México y América Central. El nivel de endemismo de la herpetofauna es relativamente alto, de 359, 182 especies son endémicas de México o Veracruz. De la herpetofauna total, la clasificación de distribución es la siguiente: 169 especies no endémicas; 138 especies endémicas al país; 44 especies endémicas al estado; y ocho especies exóticas. Las 169 especies no endémicas se asignan a las siguientes categorías de distribución: MXCA (89); MXSA (30); MXUS (29); USCA (11); USSA (cuatro); y OCEA (cinco). Las principales amenazas ambientales para la herpetofauna de Veracruz incluyen la deforestación, la ganadería, las carreteras, la contaminación del agua, los mitos y otros factores culturales, las enfermedades, las especies invasoras y el comercio ilegal. El estado de conservación de cada especie nativa se evaluó utilizando los sistemas SEMARNAT, IUCN y EVS, de los cuales el sistema EVS resultó más útil. Se utilizó el método de Prioridad Relativa de la Herpetofauna para determinar el orden de importancia de las cuatro regiones, con la mayor importancia asignada a la Sierra Madre Oriental. Solo existen seis áreas protegidas en Veracruz, la mayoría de las cuales están ubicadas en las Tierras Bajas Costeras del Golfo, la región de menor importancia para la conservación. La zona de mayor importancia, la Sierra Madre Oriental, no tiene áreas protegidas dentro de ella. Se registra un total de 265 especies dentro de las seis áreas protegidas, de las cuales 138 son no endémicas, 89 son endémicas del país, 31 son endémicas del estado y siete son no nativas. Finalmente, se brinda un conjunto de conclusiones y recomendaciones para mejorar las perspectivas de protección futura de la herpetofauna de Veracruz.

Palabras Clave: Anuros, caudados, regiones fisiográficas, áreas protegidas, recomendaciones de protección, escamosos, tortugas

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"Nature is the metaphorical goddess of all existence that lies beyond human control. Humanity is blessed to the extent we love her, and her products, from the sweet descent of her sunsets to the tantrums of her thunderstorms, and from the empty vast space beyond her biosphere to the seething diversity within it, of which we ourselves are a recent chance addition."

E. O. Wilson (2020)

Introduction

Veracruz includes 212 municipalities and is a narrow, elongate, crescent-shaped state in Mexico (Fig. 1) that extends 650 km (from north to south) along the southwestern coast of the Gulf of Mexico, and varies in width from 32 to 212 km. The state is situated entirely within the tropics, but at its northernmost extent lies only 160 km south of the Tropic of Cancer at latitude 23.43663° N. The state is bordered to the north by Tamaulipas, to the west by San Luis Potosí, Hidalgo, Puebla, and Oaxaca, to the southeast by Chiapas, and to the east by Tabasco. Its surface area covers 71,826 km^2, which ranks 11th in size among the 32 federal entities or states in Mexico. The population in 2020 was 8,062,597, ranking 3rd in the country, with a population density of 110 people/km^2, which was 10th in the country (http://inegi.org.mx; Accessed: 3 April 2021).

The highest mountain in Mexico is the stratovolcano Pico de Orizaba (or Citlaltépetl), with an elevation of 5,747 m, which lies along the border of Veracruz and neighboring Puebla (Woolrich-Piña et al. 2017), traversing the caldera at the peak (http://maps.google.com; Accessed: 8 June 2020). This imposing volcano lies on the eastern periphery of the Transmexican Volcanic Belt (TVB), a roughly 1,000 km-long volcanic arc in central Mexico that extends from near the Gulf of Mexico to near the Pacific Ocean at latitudes between 18°30'N and 21°30'N.

In addition to the TVB, Veracruz also harbors elements of three other physiographic regions, including the Gulf Coastal Lowlands (GCL), the Sierra Madre Oriental (SMO), and the Sierra de Los Tuxtlas (SLT). The GCL

extends along the entire length of the state and lies between the shore of the Gulf of Mexico and the lower limits of the SMO and the TVB. Herein, the same cut-off point (200 m) for the upper limit of the GCL was used as in Johnson et al. (2010, 2015a) and Cruz-Sáenz et al. (2017) for the Pacific Coastal Plain in Chiapas and Jalisco, respectively.

The SMO is a narrow and elongate mountain range in eastern Mexico that extends from near the Rio Grande along the border of Texas (in the United States) and Coahuila (in Mexico) southward along the eastern periphery of the Central Plateau (= Mesa Central) through Nuevo León, southwestern Tamaulipas, eastern San Luis Potosí, northeastern Querétaro, eastern Hidalgo, and northern Puebla, where it joins the eastern extension of the TVB to the west of the GCL (Lemos-Espinal and Dixon 2013; Ramírez-Bautista et al. 2014; Nevárez-de los Reyes et al. 2016; Woolrich-Piña et al. 2017; Lazcano et al. 2019).

The SLT is an isolated volcanic belt and mountain range in southeastern Veracruz that contains Volcán Santa Marta and Volcán San Martín Tuxtla, both above 1,700 m in elevation. This range is separated from the Transmexican Volcanic Belt to the northwest by about 250 km and from the Central American Volcanic Belt to the southeast by about 330 km (http://www.wikipedia.org; Accessed: 8 June 2020).

Because of its geographic position, Veracruz encompasses the broadest range of elevations of any state in Mexico, from sea level along the eastern coast of the Gulf of Mexico to the peak of Pico de Orizaba at almost 6 km above sea level along its western border.

Materials and Methods

Our Taxonomic Position

In this paper, we maintain the same taxonomic position as explained in previous works on other parts of Mesoamerica (e.g., Johnson et al. 2015a,b; Mata-Silva et al. 2015; Terán-Juárez et al. 2016; Woolrich-Piña et al. 2016, 2017; Nevárez-de los Reyes et al. 2016; Cruz-Sáenz et al. 2017; Gonzalez-Sánchez et al. 2017; Ramírez-Bautista et al. 2020). Consult Johnson (2015b) for a statement of this position, with special reference to the subspecies concept.

System for Determining Distributional Status

We used the same system developed by Alvarado-Díaz et al. (2013) for the herpetofauna of Michoacán to determine the distributional status of members of the herpetofauna of Veracruz. Subsequently, Mata-Silva et al. (2015), Johnson et al. (2015a), Terán-Juárez et al. (2016), Woolrich-Piña et al. (2016, 2017), Nevárez-de los Reyes et al. (2016), Cruz-Sáenz et al. (2017), González-Sánchez et al. (2017), Lazcano et al. (2019), and Ramírez-Bautista et al. (2020) utilized this system, which consists of the following four categories: SE = endemic to state (in this case Veracruz); CE = endemic to Mexico; NE = not endemic to Mexico; and NN = non-native in Mexico.

Systems for Determining Conservation Status

To evaluate the conservation status of the herpetofauna of Veracruz, we employed the same systems (i.e., SEMARNAT, IUCN, and EVS) used by Alvarado-Díaz et al. (2013), Mata-Silva et al. (2015), Johnson et al. (2015a), Terán-Juárez et al. (2016), Woolrich-Piña et al. (2016, 2017), Nevárez-de los Reyes et al. (2016), Cruz-Sáenz et al. (2017), González-Sánchez et al. (2017), Lazcano et al. (2019), and Ramírez-Bautista et al. (2020). Detailed descriptions of these three systems appear in earlier papers in this series (e.g., Alvarado-Díaz et al. 2013; Johnson et al. 2015a; Mata-Silva et al. 2015), and thus are not repeated here.

The Mexican Conservation Series

The Mexican Conservation Series (MCS) was initiated in 2013, with a study on the herpetofauna of Michoacán (Alvarado-Díaz et al. 2013), as part of a set of five papers designated as the Special Mexico Issue published in *Amphibian & Reptile Conservation*. The basic format for entries in the MCS was established in this paper, i.e., an examination of the composition, physiographic distribution, and conservation status of the herpetofauna of a given Mexican state or group of states. Two years later, the MCS resumed with a paper on the herpetofauna of Oaxaca (Mata-Silva et al. 2015), and that same year with a paper on the herpetofauna of Chiapas (Johnson et al. 2015a). Three entries in the MCS appeared in 2016, on Tamaulipas (Terán-Juárez et al. 2016), Nayarit (Woolrich-Piña et al. 2016), and Nuevo León (Nevárez-de los Reyes et al. 2016). Three more entries appeared the following year, on Jalisco (Cruz-Sáenz et al. 2017), the Mexican Yucatán Peninsula (González-Sánchez et al. 2017), and Puebla (Woolrich-Piña et al. 2017), followed by another in 2019, on Coahuila (Lazcano et al. 2019). Finally, one entry appeared in 2020, on Hidalgo (Ramírez-Bautista et al. 2020). Consequently, this paper on the herpetofauna of Veracruz is the 12th entry in this series.

Physiography and Climate

Physiographic Regions (Fig. 1)

The distribution of the herpetofauna of Veracruz was analyzed using the classification system of physiographic regions (= physiographic provinces of INEGI 2000 and CONABIO 2008). According to these sources, the state contains four regions (Fig. 1), as briefly described below. Note that Veracruz falls within the biogeographic area described by Holt et al. (2013) as the "Panamanian Realm" (Tropical Mexico and Central America), which supersedes previous traditional classifications by other biogeographers.

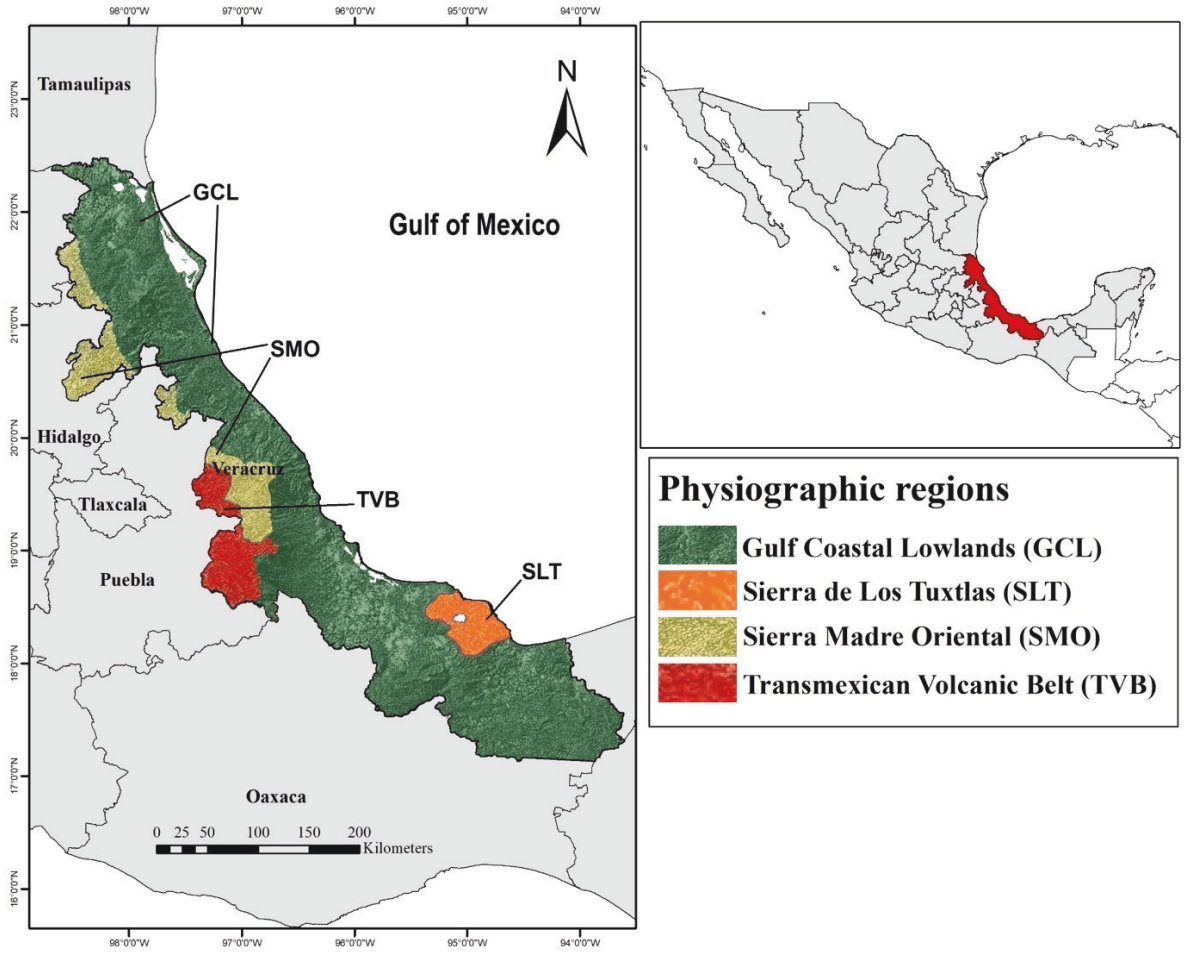

Fig. 1. Location in Mexico and physiographic regions of Veracruz, Mexico. Abbreviations: GCL = Gulf Coastal Lowlands; SLT = Sierra de Los Tuxtlas; SMO = Sierra Madre Oriental; and TVB = Transmexican Volcanic Belt.

Gulf Coastal Lowlands (*GCL*). In Mexico, this region (Figs. 2–3) extends from the Río San Fernando in Tamaulipas southeastward to the Río Candelaria, located on the Yucatán Peninsula (Morrone 2001). This region covers various-sized Atlantic versant portions of the states of Tamaulipas, San Luis Potosí, Veracruz, Hidalgo, Puebla, Oaxaca, Chiapas, Tabasco, Campeche, Yucatán, and Quintana Roo. In Veracruz, the GCL is located between 25°52'17.02"N, -94°04'11.48"W, and 20°55'36.56"N, -90°18'06.7"W, at elevations ranging from about sea level to 200 m (Espinosa et al. 2008). The mean annual precipitation in this region ranges from 1,000–2,000 mm, whereas the average annual temperature is 21.2 °C. Numerically dominant vegetation types include tropical or subtropical evergreen forest, scrub, sub-deciduous forest, and dry forest (CONABIO 2008; Wilson and Johnson 2010), depending on the elevation and amount of rainfall.

Sierra de Los Tuxtlas (*SLT*). In Veracruz, this physiographic region (Fig. 4) is bordered to the north and east by the Gulf of Mexico, to the east and southeast by the Olmec region, and to the west by the Papaloapan region (CONABIO 2008). The SLT (18°42'36" to 18°03'00"N, -95°25'48" to -94°34'12"W) contains four municipalities: Catemaco, Hueyapan de Ocampo, San Andrés Tuxtlas, and Santiago Tuxtla (González-Soriano et al. 1997). This region has a surface area of 3,484.34 km^2 (4.1% of state's territory), and due to their combined size, the municipalities of San Andrés Tuxtlas and Hueyapan de Ocampo comprise 56.6% of its territory. The region is volcanic in origin, and because of its proximity to the Gulf of Mexico it generates a sizable amount of precipitation, making it one of the rainiest regions in Mexico (Table 2). The elevations of the steep-sided volcanic cones range from 200–1,700 m (CONABIO 2008). The climate of the region ranges from humid tropical to humid subtropical, depending on the elevation. The average temperature ranges from 21.5–27.3 °C, and the annual rainfall is over 4,500 mm. Even though rainfall is frequent throughout the year, there is a recognized "rainy season" from May to February, and a "dry season" from March to May (CONABIO 2008). The driest month generally is May, and wettest months are either August, September, October, or November. The region contains such lush vegetation as tropical and subtropical evergreen forest, but it has been subjected to intense agricultural exploitation since pre-Hispanic times (González-Soriano et al. 1997). The most important agricultural products are corn, beans, sugar cane, and tobacco. Fishing and raising

Fig. 2. *Gulf Coastal Lowlands.* Vegetation in the vicinity of El Salmoral, municipality of La Antigua. *Photo by Isaac Ajactle-Tequiliquihua.*

Fig. 3. *Gulf Coastal Lowlands.* Mangrove forest during the dry season in the vicinity of Tumilco, municipality of Túxpam. *Photo by Uriel Hernández-Salinas.*

Fig. 4. *Sierra de Los Tuxtlas.* Cloud forest at the top of Volcán San Martín. *Photo by Elí García-Padilla.*

Fig. 5. *Sierra Madre Oriental.* Montane cloud forest in the municipality of Tatatila. *Photo by Fidel López Guzmán.*

Fig. 6. *Transmexican Volcanic Belt.* Vegetation on the "roof of Mexico," Volcán Pico de Orizaba or "Citlatépetl." *Photo by Jorge González Sánchez.*

livestock are common in areas that have been transformed into grassland, in addition to industrial activities and tourism.

Sierra Madre Oriental (*SMO*). The Sierra Madre Oriental (Fig. 5) is an extensive mountain system that extends for about 1,350 km from the Río Grande on the northwest, to about the Isthmus of Tehuantepec in northeastern Oaxaca on the southeast (Campbell 1999). Collectively, this area constitutes 2.84% of the land in Mexico (Morrone 2001; CONABIO 2008). In Veracruz, the northern limit of the SMO lies at 25°36'23.13"N, -100°17'38.99"W and the southern limit at 17°28'45.86"N, -96°04'34.85"W. The upper elevations of the SMO in Veracruz range from 2,500–3,700 m (CONABIO 2008). To the east, the SMO is bordered by the GCL, and to the west by a very small portion of the Northern Plateau Basins and Ranges (NB; Wilson and Johnson 2010), the Mesa Central (MC; which includes a small portion of TVB), and the Sierra Madre del Sur (SUR) (Campbell 1999). The SMO contains portions of 22 municipalities. This region is geologically complex and consists mostly of sedimentary and metamorphic rocks from the Cretaceous and Jurassic (CONABIO 2008). The mean annual precipitation varies considerably, ranging from 400–800 mm in montane cloud forests in the municipalities of Xalapa and Chiconquiaco (CONABIO 2008) to 220 and 234 mm in drier areas in the municipalities of Perote and Las Vigas, respectively. The average annual temperature for the region is 17.4 °C, and in winter and summer ranges from 4–28 °C in montane areas, and from 10–40 °C in temperate valleys. On the wetter slopes, the numerically dominant vegetation communities are coniferous forest (28%), oak forest (26%), and cloud forest (8%), while xerophilous scrub (16%) occurs in the drier areas (CONABIO 2008).

Transmexican Volcanic Belt (*TVB*). The Transmexican Volcanic Belt (Fig. 6) is a volcanic arc located in the Mesa Central (Campbell 1999) that slightly tilts in a northwest to southeast direction and extends from Nayarit on the

Table 1. Monthly minimum, mean (in parentheses), maximum, and annual temperature data (in °C) for the physiographic regions of Veracruz, Mexico. Representative locality (and its elevation) for each region: Gulf Coastal Lowlands, city of Veracruz (40 m); Sierra de Los Tuxtlas, San Andrés Tuxtla (700 m); Sierra Madre Oriental, Huayacocotla (2,300 m); and Transmexican Volcanic Belt, Orizaba (3,000 m). Data were obtained from http://www.worldclim.org/bioclim (Accessed: 7 July 2020) and Archivo Meteorológico San Andrés Tuxtla at: https://www.meteoblue.com/es/tiempo/historyclimate/weatherarchive/san-andres-tuxtla_m%C3%A9xico_3519907?fcstlength=1m&year=2019&month=7 (Accessed: 9 July 2020).

Physiographic region	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Gulf Coastal Lowlands	18.4 (22.6) 22.9	20.1 (25.6) 27.7	21.6 (25.4) 27.0	24.2 (28.4) 32.6	25.1 (29.3) 33.4	25.3 (28) 32.3	24.2 (28.4) 35.4	24.7 (29.7) 34.8	24.7 (29.5) 33.8	23.1 (28.3) 29.6	23.8 (27.6) 27.4	20.9 (25.3) 27.2	23.0 (27.3) 30.3
Sierra de Los Tuxtlas	11.5 (17.2) 25	14.7 (18.5) 24.2	17.9 (21.5) 29	18.2 (23.9) 29.6	20.3 (25.7) 31.4	19.8 (25.5) 31.3	19.2 (24.5) 29.8	19.4 (27.2) 33.4	23.8 (27.5) 30.6	19.6 (26.6) 27.5	18.8 (24) 26.2	19.7 (23.2) 26.5	18.6 (23.8) 28.6
Sierra Madre Oriental	7.0 (13.8) 20.5	8.2 (15.9) 21.8	10.9 (17.6) 24.4	12.7 (19.4) 26.2	13.8 (20.5) 27.3	13.1 (19.8) 26.6	11.7 (28.8) 33.5	11.7 (32.8) 33.6	11.3 (29.4) 29.8	9.8 (26.9) 28.2	8.4 (15.5) 25.8	7.1 (14.3) 21.5	10.5 (21.2) 26.6
Transmexican Volcanic Belt	6.1 (13.1) 20.2	7.1 (14.3) 21.4	9.6 (16.8) 23.9	11.3 (18.5) 25.6	12.3 (19.5) 26.6	11.6 (18.8) 25.9	9.5 (17.8) 31.1	9.5 (18.8) 30.1	9.10 (17.4) 25.7	10.8 (16.1) 24.3	6.4 (14.7) 23.0	5.4 (13.7) 21.9	9.0 (16.6) 25.0

Pacific versant (Ferrusquía-Villafranca 2007; CONABIO 2008), and then parallels the northern slope of the Balsas Basin into Veracruz, where it converges with the SMO near Pico de Orizaba. This belt is formed by a set of volcanoes of different ages (Miocene to Plio-Pleistocene), and is positioned within coordinates 19°31’54.81”N, -98°37’42.45”W and 21°53’40.02”N, -105°36’09.80”W. This region occupies 8% of Mexico’s surface area, and ranges in elevation from 1,000–5,747 m. In Veracruz, the TVB reaches elevations from 1,500–5,747 m. Within the TVB are Pico de Orizaba, Cofre de Perote, Sierra de Zongolica, and Sierra de Chiconquiaco (CONABIO 2008). The mean annual precipitation ranges from 581–2,236 mm, and the mean annual temperature is 15.3 °C (Suárez-Mota et al. 2014). Numerically dominant natural vegetation communities are represented primarily by coniferous forest (31%) and oak forest (28%), with the remainder composed of subalpine scrub and subtropical dry forest; disturbed areas such as farmland and pastures have replaced the natural vegetation.

Climate

Temperature. The monthly minimum, mean, and maximum temperatures for a single locality are indicated in each of the four recognized physiographic regions in Veracruz in Table 1. The elevations for these localities range from 40 m in the city of Veracruz to 3,000 m at Orizaba. The mean annual temperature is highest at Veracruz (40 m asl) in the GCL at 27.3 °C, followed by San Andrés Tuxtla (700 m asl) in the SLT at 23.8 °C, and Huayacocotla (2,300 m asl) in the SMO at 21.2 °C, with the lowest mean temperature of 16.6 °C at Orizaba in the TVB (3,000 m asl).

In the four physiographic regions in Veracruz, the minimum annual temperatures range from 4.3–10.7 °C lower than the maximum annual temperatures (Table 1). The mean minimum monthly temperatures peak in May (SLT and SMO), June (GCL), or September (TVB), and reach their lowest levels in January (GCL, SLT, and SMO) or December (TVB). The mean monthly temperatures are highest in May (TVB), July (GCL), and August (SLT and SMO), and lowest in January (GCL, SMO, and TVB) or February (SLT).

Precipitation. As typical in tropical climates, the precipitation regime in Veracruz is partitioned into a six-month wet season that extends from May to October, and a dry season of similar length, from November to April (Table 2). The mean monthly precipitation is highest in September (GCL), October (SLT, TVB), or November (SMO), and lowest in January (GCL, SLT, TVB) or February (SMO). During the rainy season (May to October) from 58.8 to 76.5% of the annual precipitation occurs. The annual rainfall ranges from 267.6 mm in the TVB to 2,218.8 mm in the SLT (Table 2).

No. 1. *Incilius cavifrons* (Firschein, 1950). The Mountain Toad is a state endemic species restricted in distribution to the Sierra de los Tuxtlas physiographic region (Frost 2020). This individual was found at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013a) calculated its EVS as 13, placing it at the upper limit of the medium vulnerability category. Its conservation status has been established as Endangered by the IUCN, and as Special Protection (Pr) by SEMARNAT. *Photo by Christian Berriozabal-Islas.*

No. 2. *Hyalinobatrachium viridissimum* (Taylor, 1942). The Northern Glassfrog is a non-endemic species distributed from Guerrero and Veracruz, Mexico, through Guatemala and Belize to northwestern Honduras, and possibly to the departments of Santa Ana and Cabañas in El Salvador (Frost 2020). This individual was found at Comapa, in the municipality of the same name. We determined its EVS as 11, placing it in the middle of the medium vulnerability category. Its conservation status has not been assessed by either the IUCN or SEMARNAT. *Photo by Aarón Arias Hernández*.

No. 3. *Craugastor alfredi* (Boulenger, 1898). Alfred's Rainfrog is a non-endemic species distributed from central Veracruz, Mexico, to western El Petén, Guatemala (Köhler 2011). This individual was encountered at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013a) calculated its EVS as 11, placing it in the middle of the medium vulnerability category. Its conservation status has been evaluated as Vulnerable by the IUCN, but this species has not been assessed by SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 4. *Craugastor rhodopis* (Cope, 1867). The Polymorphic Robber Frog is a country endemic species found in western Veracruz and adjacent Hidalgo and Puebla, as well as in central and southeastern Chiapas and adjacent Oaxaca (Frost 2020). This individual was found at Huayacocotla, in the municipality of the same name. Wilson et al. (2013a) determined its EVS as 14, placing it at the lower limit of the high vulnerability category. Its conservation status has been assessed as Vulnerable by the IUCN, but this species has not been evaluated by SEMARNAT. *Photo by Christian Berriozabal-Islas*.

Table 2. Monthly and annual precipitation data (in mm) for the physiographic regions of Veracruz, Mexico. Representative locality (and its elevation) for each region: Gulf Coastal Lowlands, city of Veracruz (40 m); Sierra de Los Tuxtlas, San Andrés Tuxtla (700 m); Sierra Madre Oriental, Huayacocotla (2,300 m); and Transmexican Volcanic Belt, Orizaba (3,000 m). Data in the shaded area indicate the months of the rainy season. Data were obtained from http://www.worldclim.org/bioclim (Accessed: 7 July 2020) and Archivo Meteorológico San Andrés Tuxtla at: https://www.meteoblue.com/es/tiempo/historyclimate/weatherarchive/san-andres-tuxtla_m%C3%A9xico_3519907?fcstlength=1m&year=2019&month=7 (Accessed: 9 July 2020).

Physiographic region	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Gulf Coastal Lowlands	22.9 (40.2) 50.4	24.2 (40.5) 50.8	50.5 (41.3) 51.6	38.6 (55.9) 70.2	44.7 (75.7) 100.6	31.3 (95.5) 109.9	79.8 (94.5) 119.2	130.0 (184.7) 239.4	129.3 (224.5) 319.7	127.6 (222.3) 317	125.4 (150.1) 214.8	93.3 (118.0) 212.7	77.1 (111.9) 152.4
Sierra de Los Tuxtlas	60.6 (62.1) 70.6	55.4 (63.6) 77.6	50.6 (77.7) 80.9	47.8 (52.7) 88.9	80.9 (100.1) 150.9	150.6 (236.3) 281.0	181.0 (224.2) 330.6	280.3 (310.2) 480.5	330.9 (371.3) 480.9	200.9 (454.2) 550.6	150.5 (176.3) 350.8	80.9 (90.1) 120.8	139.2 (184.9) 255.3
Sierra Madre Oriental	23.5 (20.8) 28.7	21.8 (20.6) 31.2	24.4 (57.6) 68.9	76.2 (99.4) 122.7	87.3 (100.5) 139.8	96.6 (119.8) 189.1	96.0 (118.8) 211.7	126.0 (200.8) 281.7	125.6 (218.4) 311.3	124.2 (216.9) 489.81	200.8 (255.5) 338.4	21.5 (98.3) 167.1	85.3 (127.3) 198.4
Transmexican Volcanic Belt	10.5 (12.2) 19.9	15.5 (13.2) 20.9	12.8 (15.5) 22.8	11.4 (17.1) 24.3	12.2 (17.9) 25.6	10.7 (15.4) 28.9	10.6 (16.5) 27.8	15.3 (26.6) 37.8	24.9 (36.1) 67.4	23.6 (44.9) 76.2	22.4 (33.7) 64.9	11.3 (18.6) 33.9	15.1 (22.3) 37.5

Recent Literature on the Veracruz Herpetofauna

Our knowledge of the Mexican herpetofauna continues to expand. As of this writing, several modern state-level treatments have appeared, in book form in some cases and as lengthy papers in others. Although the herpetofauna of Veracruz is one of the most diverse in the entire country, it has not undergone such a recent treatment. Toward this end, a summary of the pertinent literature is assembled here to document the composition of the herpetofauna of Veracruz (Table 3). The literature citations are organized in this table in alphabetical order for each of the physiographic regions, and then by year of publication.

Composition of the Herpetofauna

Families

The herpetofaunal species in Veracruz are classified in 51 families, including 11 families of anurans, four of salamanders, one of caecilians, one of crocodylians, 25 of squamates, and nine of turtles (Table 4). This total figure represents 85.0% of the 60 herpetofaunal families known from Mexico (Wilson et al. 2013a,b; J. Johnson, unpub. data, 19 March 2020). Of the 16 amphibian families, 72.1% (88) of the 122 species (Tables 5–6) are in the families Bufonidae (nine), Hylidae (29), Ranidae (eight), and Plethodontidae (42). Among the 35 families of reptiles, 70.0% (166) of the 237 species (Table 5) are allocated to the families Anguidae (10), Dactyloidae (18), Phrynosomatidae (20), Colubridae (41), Dipsadidae (46), Natricidae (14), and Viperidae (17).

Genera

One hundred and forty-two herpetofaunal genera are represented in Veracruz, including 32 genera of anurans, 10 of salamanders, one of caecilians, one of crocodylians, 84 of squamates, and 14 of turtles (Table 4). These 142 genera comprise 66.0% of the 215 recorded from Mexico (J. Johnson, unpub. data, 19 March 2020). Among the amphibians (Table 5), the species are most numerous in the genera *Incilius* (seven species), *Craugastor* (11), *Eleutherodactylus* (seven), *Lithobates* (eight), *Chiropterotriton* (10), *Pseudoeurycea* (10), and *Thorius* (nine). Among the reptiles (Table 5), the most speciose genera are *Norops* (18 species), *Sceloporus* (17), *Tantilla* (five), *Coniophanes* (five), *Geophis* (eight), *Rhadinaea* (seven), *Thamnophis* (11), and *Crotalus* (10).

Species

The herpetofauna of Veracruz consists of 359 species, including 76 anurans, 45 salamanders, one caecilian, one crocodylian, 217 squamates, and 19 turtles (Table 4). The current numbers of native species in these six

No. 5. *Craugastor vulcani* (Shannon and Werler, 1955). The Volcán San Martín Rainfrog is a state endemic species restricted in distribution to the Sierra de Los Tuxtlas physiographic region (Frost 2020). This individual was encountered at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013a) calculated its EVS as 17, placing it in the middle of the high vulnerability category. Its conservation status has been determined as Endangered by the IUCN, but this species has not been evaluated by SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 6. *Megastomatohyla mixomaculata* (Taylor, 1950). The Variegated Treefrog is a country endemic species only known from the municipalities of Coscomatepec, Zongolica, and Los Reyes in central Veracruz, and in the Sierra Negra region of southeastern Puebla, Mexico, at elevations from 900 to 1,650 m (Frost 2020). This individual was photographed at Finca Santa Martha, in the municipality of Los Reyes. Wilson et al. (2013a) ascertained its EVS as 14, placing it in the lower portion of the high vulnerability category. Its conservation status has been assessed as Endangered by the IUCN, and as Threatened (A) by SEMARNAT. *Photo by Jesse Hosman*.

No. 7. *Rheohyla miotympanum* (Cope, 1863). The Small-eared Treefrog is a country endemic species distributed from "Nuevo León and Coahuila (Sierra Madre Oriental) to Guanajuato (Sierra Santa Rosa), Hidalgo, and Oaxaca, adjacent Veracruz, and central Chiapas" (Frost 2020). This individual was found at El Potrero, in the municipality of Acultzingo. Wilson et al. (2013a) determined its EVS as 9, placing it at the upper limit of the low vulnerability category. Its conservation status has been judged as Near Threatened by the IUCN, but this species has not been evaluated by SEMARNAT. *Photo by Bruno Rosas Fragoso*.

No. 8. *Scinax staufferi* (Cope, 1865). Stauffer's Long-nosed Treefrog is a non-endemic species occurring in savannas and sub-humid forest in lowlands to moderate elevations from southern Tamaulipas, Mexico, southward to Nicaragua on the Caribbean versant, and from Guerrero, Mexico, to northwestern Costa Rica on the Pacific; it also occurs in disjunct areas along the Pacific lowlands of western to central Panama (Frost 2020). This individual was found at Misantla, in the municipality of the same name. Wilson et al. (2013a) ascertained its EVS as 4, placing it in the low vulnerability category. Its conservation status has been assessed as Least Concern by the IUCN, and this species is not listed by SEMARNAT. *Photo by Bruno Rosas-Fragoso*.

Table 3. Summary of the literature documenting the composition and physiographic distribution of the herpetofauna of Veracruz, Mexico.

Physiographic region	Documentation
Gulf Coastal Lowlands	Aguilar-López and Canseco-Márquez (2006); Aguilar-López and Pineda (2015); Aguilar-López et al. (2010, 2015, 2016, 2020); Altamirano-Álvarez and Soriano-Sarabia (2010); Ávila-Nájera et al. (2018); Badillo-Saldaña et al. (2018); Barrio-Amorós (2019); Bury and Whelan (1984); Campbell and Lamar (1989, 2004); Carbajal-Márquez et al. (2020); Cázares-Hernández (2015); Chambers and Hillis (2020); Chavez-Lugo (2015); de la Torre-Loranca et al. (2006); Dixon and Lemos-Espinal (2010); Duellman (1958, 2001); Duellman and Trueb (1986); Escobedo-Galván and González-Salazar (2011); Flores-Villela (1998); Frost (2020); García-Vázquez et al. (2010); Guzmán-Guzmán (2011); Iverson (1992); Johnson et al. (2010); Jones and Lovich (2009); Klauber (1972); Lemos-Espinal and Dixon (2013); Márquez (1994); McCranie et al. (2020); Méndez-de la Cruz and Casas-Andreu (1992); Mendoza-Henao et al. (2020); Meza-Lázaro and Nieto-Montes de Oca (2015); Morales-Mávil et al. (2017); Myers et al. (2017); Ochoa-Ochoa and Flores-Villela (2011); Oliver-López et al. (2009); Ordóñez-Gómez and Valadez-Azúa (2008); Palacios-Aguilar and Flores-Villela (2020); Pérez-Higareda and Smith (1991); Pineda-Arredondo (2015); Ramírez-Bautista et al. (2006, 2009, 2010, 2014); Ramírez-González and Canseco-Márquez (2015); Reyes-Velasco et al. (2020); Rossman et al. (1996); Roze (1996); Ruane et al. (2014); Sánchez-Juárez (2002); Scarpetta et al. (2015); SEMARNAT (2018); Smith and Taylor (1966); Solis-Zurita et al. (2019); Uribe-Peña et al. (1999); Valverde and Rouse-Holzwart (2017); Vázquez-Díaz and Quintero-Díaz (2005); Werler and Dixon (2000); Wilson (1970); Wilson et al. (2010, 2013a,b); Wright and Wright (1957); Yáñez-Arenas et al. (2016).
Sierra de Los Tuxtlas	Ávila-Nájera et al. (2018); Badillo-Saldaña et al. (2014, 2018); Barrio-Amorós (2019); Bury and Whelan (1984); Campbell and Lamar (2004); Carbajal-Márquez et al. (2020); Chambers and Hillis (2020); de la Torre-Loranca et al. (2006); Dixon and Lemos-Espinal (2010); Duellman (1958, 2001); Flores-Villela (1998); Frost (2020); García-Vázquez et al. (2010); Guzmán-Guzmán (2011); Iverson (1992); Johnson et al. (2010); Lemos-Espinal and Dixon (2013); McCranie et al. (2020); Mendoza-Henao et al. (2020); Meza-Lázaro and Nieto-Montes de Oca (2015); Ochoa-Ochoa and Flores-Villela (2011); Oliver-López et al. (2009); Palacios-Aguilar and Flores-Villela (2020); Pérez-Higareda and Smith (1991); Pérez-Higareda et al. (2007); Pineda-Arredondo (2015); Ramírez-Bautista (1977); Ramírez-Bautista and Nieto-Montes de Oca (1997); Ramírez-Bautista et al. (2006, 2009, 2010, 2014); Ramírez-González and Canseco-Márquez (2015); Rossman et al. (1996); Roze (1996); SEMARNAT (2018); Sherbrooke and Lazcano-Villareal (1999); Sherbrooke (2003); Smith and Taylor (1966); Solis-Zurita et al. (2019); Urbina-Cardona et al. (2006); Uribe-Peña et al. (1999); Vázquez-Díaz and Quintero-Díaz (2005); Werler and Dixon (2000); Wilson et al. (2010, 2013a,b).
Sierra Madre Oriental	Ávila-Nájera et al. (2018); Bury and Whelan (1984); Campbell and Lamar (1989, 2004); Canseco-Márquez and Gutiérrez-Mayén (2010); Canseco-Márquez et al. (2016); Castillo-Juárez et al. (2020); Cázares-Hernández et al. (2018); Cerón-de la Luz (2010); Chacón-Juárez and Vásquez-Cruz (2018); Chambers and Hillis (2020); Contreras-Calvario et al. (2019); Cruz-Elizalde et al. (2020); de la Torre-Loranca et al. (2006, 2019); Dixon and Lemos-Espinal (2010); Duellman (1958, 2001); Ernst and Ernst (2003); Flores-Villela (1998); Frost (2020); García-Bañuelos et al. (2020); García-Castillo et al. (2018); García-Morales et al. (2017); Guzmán-Guzmán (2011); Iverson (1992); Johnson et al. (2010); Jones and Lovich (2009); Klauber (1972); Lara-Hernández and Vásquez-Cruz (2020); Lemos-Espinal and Dixon (2013); Lemos-Espinal et al. (2019); Macario-Cueyatcle et al. (2019); McCranie et al. (2020); Mendoza-Henao et al. (2020); Meza-Lázaro and Nieto-Montes de Oca (2015); Ochoa-Ochoa and Flores-Villela (2011); Oliver-López et al. (2009); Paredes-García et al. (2011); Peralta-Hernández et al. (2019); Pérez-Higareda and Smith (1991); Pérez-Sato et al. (2018); Pineda-Arredondo (2015); Ramírez-Bautista et al. (2006, 2009, 2010, 2014); Reyes-Velasco et al. (2020); Rossman et al. (1996); Roze (1996); SEMARNAT (2018); Sherbrooke (2003); Sherbrooke and Lazcano-Villareal (1999); Smith and Taylor (1966); Solis-Zurita et al. (2019); Uribe-Peña et al. (1999); Vásquez-Cruz and Canseco-Márquez (2020); Vásquez-Cruz et al. (2018, 2019, 2020a,b); Wilson et al. (2010, 2013ab); Wright and Wright (1957).
Transmexican Volcanic Belt	Ávila-Nájera et al. (2018); Bello-Sánchez et al. (2014); Bury and Whelan (1984); Campbell and Lamar (1989, 2004); Canseco-Márquez and Gutiérrez-Mayén (2010); Canseco-Márquez et al. (2016); Carbajal-Márquez et al. (2020); Castillo-Juárez et al. (2020); Cázares-Hernández et al. (2018); Cerón-de la Luz (2010); Chacón-Juárez and Vásquez-Cruz (2018); Chambers and Hillis (2020); Conant (2003); Contreras-Calvario et al. (2019); de la Torre-Loranca et al. (2006, 2019); Dixon and Lemos-Espinal (2010); Duellman (1958, 2001); Duellman and Trueb (1986); Ernst and Ernst (2003); Flores-Villela (1998); Frost (2020); García-Bañuelos et al. (2020); García-Castillo et al. (2018); García-Morales et al. (2017); González-Romero and Murrieta-Galindo (2008); González-Zamora et al. (2018); Guzmán-Guzmán (2011); Iverson (1992); Johnson et al. (2010); Kelly-Hernández et al. (2020); Klauber (1972); Lara-Hernández and Vásquez-Cruz (2020); Lemos-Espinal and Dixon (2013); Lemos-Espinal et al. (2019); Macario-Cueyatcle et al. (2019); McCranie et al. (2020); Mendoza-Henao et al. (2020); Meza-Lázaro and Nieto-Montes de Oca (2015); Murrieta-Galindo et al. (2013); Ochoa-Ochoa and Flores-Villela (2011); Oliver-López et al. (2009); Ordóñez-Gómez and Valadez-Azúa (2008); Palacios-Aguilar and Flores-Villela (2020); Paredes-García et al. (2011); Parra-Olea et al. (2020); Peralta-Hernández et al. (2019); Pérez-Higareda and Smith (1991); Pérez-Sato et al. (2018); Pineda-Arredondo (2015); Ramírez-Bautista et al. (2006, 2009, 2010, 2014); Reyes-Velasco et al. (2020); Rossman et al. (1996); Roze (1996); Sandoval-Comte et al. (2017); SEMARNAT (2018); Smith and Taylor (1966); Solis-Zurita et al. (2019); Uribe–Peña et al. (1999); Vásquez-Cruz and Canseco-Márquez (2020); Vásquez-Cruz et al. (2018, 2019, 2020a,b); Wilson et al. (2010, 2013a,b); Yáñez-Arenas et al. (2016).

No. 9. *Triprion spinosus* (Steindachner, 1864). The Coronated Treefrog is a non-endemic species with a disjunct distribution in humid forests, primarily in the premontane zone, in eastern Mexico (Tabasco, Veracruz, Puebla, Oaxaca, and Chiapas, 800–2,068 m asl), Guatemala, northeastern Honduras (95 m asl), the Atlantic versant of Costa Rica and western Panama, and from southwestern Costa Rica to west-central Panama on the Pacific slopes, at elevations from 350 to 1,330 m (Frost 2020). This individual was found at Finca Santa Martha, in the municipality of Los Reyes. Wilson et al. (2013a) ascertained its EVS as 14, placing it in the lower portion of the high vulnerability category. Its conservation status has been assessed as Least Concern by the IUCN, and this species is not listed by SEMARNAT. *Photo by Jesse Hosman*.

No. 10. *Agalychnis taylori* Funkhouser, 1957. The Northern Red-eyed Treefrog is a non-endemic species occurring from "west-central Honduras north through Guatemala along the Atlantic lowlands of Oaxaca and southern Veracruz, Mexico" (Frost 2020). This individual was encountered at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013a) ascertained its EVS as 11, placing it in the middle of the medium vulnerability category. Its conservation status has been assessed as Least Concern by the IUCN, and this species is not listed by SEMARNAT. *Photo by Elí García-Padilla*.

No. **11**. *Lithobates vaillanti* (Brochi, 1877). Vaillant's Frog is a non-endemic species occurring at low and moderate elevations from north-central Veracruz and northern Oaxaca to the central Río Magdalena region in Colombia on the Atlantic versant, and on the Pacific versant in southeastern Oaxaca and northwestern Chiapas, Mexico, and from northwestern Nicaragua to southwestern Ecuador, at elevations from 0 to 1,700 m (Frost 2020). This individual was photographed in the vicinity of Catemaco, in the municipality of the same name. Wilson et al. (2013a) determined its EVS as 9, placing it in the higher portion of the low vulnerability category. Its conservation status has been assessed as Least Concern by the IUCN, and this species is not listed by SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 12. *Aquiloeurycea cafetalera* Parra-Olea, Rovito, Márquez-Valdelmar, Cruz, Murrieta-Galindo, and Wake, 2010. The Coffee Grove Salamander is a country endemic species known to occur in the municipalities of Chocoman, Zongolica, Los Reyes, Tequila y Unión, and Progreso in Veracruz (Frost 2020), as well as in Puebla (Woolrich et al. 2017). This individual was encountered at Finca Santa Martha, in the municipality of Los Reyes. Johnson et al. (2017) calculated the EVS as 17, placing it in the middle of the high vulnerability category. Its conservation status has not been determined by either the IUCN or SEMARNAT. *Photo by Matthieu Berroneau*.

Table 4. Composition of the native and non-native herpetofauna of Veracruz, Mexico.

Order	Families	Genera	Species
Anura	11	32	76
Caudata	4	10	45
Gymnophiona	1	1	1
Subtotal	**16**	**43**	**122**
Crocodylia	1	1	1
Squamata	25	84	217
Testudines	9	14	19
Subtotal	**35**	**99**	**237**
Total	**51**	**142**	**359**

groups in Mexico are, respectively, 408, 154, three, three, 885, and 51 (J. Johnson, unpub. data, 6 July 2020). The 359 herpetofaunal species in Veracruz comprise 26.7% of the 1,347 species in the entire Mexican herpetofauna (J. Johnson, unpub. data, 6 July 2020). In all the species listed in the text, those that are country (Mexico) endemics are indicated by (*) and those that are state (Veracruz) endemics are indicated by (**).

Veracruz shares a border with seven other Mexican states, i.e., Tamaulipas, San Luis Potosí, Hidalgo, Puebla, Oaxaca, Chiapas, and Tabasco (Fig. 1). Studies of the herpetofauna of five of these seven states (Tamaulipas, Hidalgo, Puebla, Chiapas, and Oaxaca) have appeared thus far in the MCS (Terán-Juárez et al. 2016; Ramírez-Bautista et al. 2020; Woolrich-Piña et al. 2017; Johnson et al. 2015a; and Mata-Silva et al. 2015, respectively). The herpetofaunas of each of these five states include, respectively, 184, 203, 267, 330, and 442 species, and the number of composite species increases from north to south. The state area/species richness ratios for these five states are as follows: Tamaulipas (80,249 km^2/184 = 436.1); Hidalgo (20,813/203 = 102.5); Puebla (34,306/267 = 128.5); Chiapas (73,311/330 = 222.2); and Oaxaca (93,757/442 = 212.1). The comparable figure for Veracruz is 200.1 (71,826/359), which is most similar to that for Oaxaca. This relationship ranges from highest to lowest among the six states in the following order: Tamaulipas, Chiapas, Oaxaca, Veracruz, Puebla, and Hidalgo.

Patterns of Physiographic Distribution

Here, we recognize four physiographic regions in Veracruz (Fig. 1) and document the distribution of the herpetofauna among these four regions in Table 5, and summarize the data in Table 6.

The total number of species in each of these four regions ranges from a low of 179 in the Sierra de Los Tuxtlas (SLT) to 236 in the Sierra Madre Oriental (SMO). The intermediate figures are 222 for the Transmexican Volcanic Belt (TVB) and 190 for the Gulf Coastal Lowlands (GCL). The percentage of the entire state herpetofauna comprising each of the four physiographic regions is, in order of size (236/359) 65.7% (SMO),

Table 5. Distribution of the herpetofaunal species of Veracruz, Mexico, by physiographic region. See text for descriptions of these regions. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxa	Physiographic regions of Veracruz				Number of regions occupied
	Gulf Coastal Lowlands	Sierra de Los Tuxtlas	Sierra Madre Oriental	Transmexican Volcanic Belt	
Anura (76 species)					
Bufonidae (9 species)					
*Anaxyrus compactilis**			X	X	2
*Incilius cavifrons***	X	X			2
*Incilius cristatus**		X	X	X	3
Incilius macrocristatus	X				1
*Incilius marmoreus**	X		X	X	3
Incilius nebulifer	X		X	X	3
*Incilius occidentalis**			X	X	2
Incilius valliceps	X	X	X	X	4
Rhinella horribilis	X	X	X	X	4
Centrolenidae (1 species)					
Hyalinobatrachium viridissimum	X	X	X	X	4
Craugastoridae (11 species)					
Craugastor alfredi	X	X	X	X	4
*Craugastor berkenbuschii**	X	X	X	X	4
*Craugastor decoratus**			X	X	2

No. 13. *Bolitoglossa platydactyla* (Gray, 1831). The Broad-footed Salamander is a country endemic species distributed from "southern Tamaulipas and eastern San Luis Potosí south through Hidalgo to southern Veracruz, Puebla, Oaxaca, and extreme northeastern Chiapas" (Frost 2020). This individual was found at Siete Palmas, in the municipality of Ixcatepec. Wilson et al. (2013a) determined its EVS as 15, placing in the lower portion of the high vulnerability category. Its conservation status has been evaluated as Least Concern by the IUCN, and as Special Protection (Pr) by SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 14. *Bolitoglossa rufescens*. The Common Dwarf Salamander is a non-endemic species found from "extreme eastern San Luis Potosí…south through Veracruz, and, provisionally east of the Isthmus of Tehuantepec in Chiapas to Belize and northwestern Honduras" (Frost 2020). This individual was encountered at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013a) calculated its EVS as 9, placing it at the upper limit of the low vulnerability category. Its conservation status was determined as Least Concern by the IUCN, and as Special Protection (Pr) by SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 15. *Isthmura gigantea* (Taylor, 1939). The Giant False Brook Salamander is a country endemic species known from the La Joya-Jalapa region of Veracruz into northeastern Hidalgo (Frost 2020). This individual was found on the road between Zongolica and Tequila, in the municipality of Zongolica. Wilson et al. (2013a) determined its EVS as 16, placing it in the middle of the high vulnerability category. Its conservation status has been calculated as Critically Endangered by the IUCN, but this species has not been evaluated by SEMARNAT. *Photo by Matthieu Berroneau*.

No. 16. *Pseudoeurycea werleri* Darling and Smith, 1954. Werler's False Brook Salamander is a country endemic species "known from the Sierra de Los Tuxtlas, southern Veracruz…and the northern slopes of the Sierra de Juarez [sic] about Vista Hermosa, northern Oaxaca" (Stuart et al. 2008). This individual was located on Volcán San Martín, in the municipality of San Andrés Tuxtla. Wilson et al. (2013a) ascertained its EVS as 17, placing it in the middle of the high vulnerability category. Its conservation status has been determined as Endangered by the IUCN, and as Special Protection (Pr) by SEMARNAT. *Photo by Elí García-Padilla*.

Table 5 (continued). Distribution of the herpetofaunal species of Veracruz, Mexico, by physiographic region. See text for descriptions of these regions. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxa	Physiographic regions of Veracruz				Number of regions occupied
	Gulf Coastal Lowlands	Sierra de Los Tuxtlas	Sierra Madre Oriental	Transmexican Volcanic Belt	
Craugastor laticeps	X	X			2
Craugastor loki	X	X	X	X	4
*Craugastor megalotympanum***		X			1
*Craugastor mexicanus**			X	X	2
Craugastor pygmaeus	X	X	X	X	4
*Craugastor rhodopis**	X	X	X	X	4
*Craugastor spatulatus**			X	X	2
*Craugastor vulcani***	X	X			2
Eleutherodactylidae (7 species)					
Eleutherodactylus cystignathoides			X	X	2
Eleutherodactylus leprus	X	X			2
*Eleutherodactylus longipes**	X				1
*Eleutherodactylus nitidus**			X	X	2
*Eleutherodactylus planirostris****	X		X	X	3
*Eleutherodactylus verrucipes**		X	X		2
*Eleutherodactylus verruculatus***			X	X	2
Hylidae (29 species)					
*Bromeliohyla dendroscarta**		X	X	X	3
*Charadrahyla nephila**		X			1
*Charadrahyla taeniopus**			X	X	2
Dendropsophus ebraccatus	X	X	X		3
Dendropsophus microcephalus	X	X	X	X	4
Dryophytes arenicolor				X	1
*Dryophytes euphorbiaceus**			X	X	2
*Dryophytes eximius**		X	X	X	3
*Dryophytes plicatus**			X	X	2
*Duellmanohyla chamulae**	X				1
*Ecnomiohyla valancifer***		X			1
*Exerodonta bivocata**	X				1
*Megastomatohyla mixomaculata**		X	X	X	3
*Megastomatohyla nubicola***			X	X	2
*Ptychohyla zophodes**			X	X	2
*Quilticohyla zoque**	X				1
*Rheohyla miotympanum**	X	X	X	X	4
*Sarcohyla arborescandens**			X	X	2
*Sarcohyla bistincta**			X	X	2
*Sarcohyla pachyderma***			X		1
*Sarcohyla siopela**			X	X	2
Scinax staufferi	X	X	X	X	4
Smilisca baudinii	X	X	X	X	4
Smilisca cyanosticta	X	X	X	X	4
*Tlalocohyla godmani**			X	X	2
Tlalocohyla loquax	X	X	X	X	4
Tlalocohyla picta	X	X	X	X	4
Trachycephalus vermiculatus	X	X	X	X	4
Triprion spinosus	X	X	X	X	4
Leptodactylidae (3 species)					
Engystomops pustulosus	X	X			2
Leptodactylus fragilis	X	X	X	X	4
Leptodactylus melanonotus	X	X	X	X	4

Table 5 (continued). Distribution of the herpetofaunal species of Veracruz, Mexico, by physiographic region. See text for descriptions of these regions. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxa	Physiographic regions of Veracruz				Number of regions occupied
	Gulf Coastal Lowlands	Sierra de Los Tuxtlas	Sierra Madre Oriental	Transmexican Volcanic Belt	
Microhylidae (3 species)					
Gastrophryne elegans	X	X			2
Hypopachus ustus	X	X	X	X	4
Hypopachus variolosus	X	X	X	X	4
Phyllomedusidae (2 species)					
Agalychnis callidryas	X	X	X	X	4
Agalychnis moreletii	X	X	X	X	4
Ranidae (8 species)					
Lithobates berlandieri	X	X	X	X	4
Lithobates brownorum	X	X			2
*Lithobates catesbeianus****	X	X	X	X	4
*Lithobates johni**				X	1
Lithobates maculatus	X	X			2
*Lithobates montezumae**			X	X	2
*Lithobates spectabilis**			X	X	2
Lithobates vaillanti	X	X	X	X	4
Rhinophrynidae (1 species)					
Rhinophrynus dorsalis	X	X			2
Scaphiopodidae (2 species)					
Scaphiopus couchii	X		X	X	3
Spea multiplicata			X	X	2
Caudata (45 species)					
Ambystomatidae (1 species)					
*Ambystoma velasci**			X	X	2
Plethodontidae (42 species)					
*Aquiloeurycea cafetalera**			X	X	2
*Aquiloeurycea cephalica**			X	X	2
*Aquiloeurycea praecellens***			X	X	2
*Bolitoglossa alberchi**		X			1
Bolitoglossa mexicana	X	X	X	X	4
Bolitoglossa occidentalis		X			1
*Bolitoglossa platydactyla**	X	X	X	X	4
Bolitoglossa rufescens	X	X	X	X	4
*Bolitoglossa veracrucis**	X				1
*Chiropterotriton aureus***			X		1
*Chiropterotriton casasi***				X	1
*Chiropterotriton ceronorum**				X	1
*Chiropterotriton chiropterus**				X	1
*Chiropterotriton chondrostega**				X	1
*Chiropterotriton lavae***				X	1
*Chiropterotriton nubilus***				X	1
*Chiropterotriton perotensis***				X	1
*Chiroterotriton terrestris**			X		1
*Chiropterotriton totonacus***				X	1
*Isthmura corrugata***				X	1
*Isthmura gigantea**			X	X	2
*Isthmura naucampatepetl***			X	X	2
*Parvimolge townsendi***			X	X	2
*Pseudoeurycea firscheini**			X	X	2
*Pseudoeurycea gadovii**			X	X	2
*Pseudoeurycea granitum***			X	X	2

Table 5 (continued). Distribution of the herpetofaunal species of Veracruz, Mexico, by physiographic region. See text for descriptions of these regions. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxa	Physiographic regions of Veracruz				Number of regions occupied
	Gulf Coastal Lowlands	Sierra de Los Tuxtlas	Sierra Madre Oriental	Transmexican Volcanic Belt	
*Pseudoeurycea leprosa**			X	X	2
*Pseudoeurycea lineola***		X	X	X	3
*Pseudoeurycea lynchi**			X	X	2
*Pseudoeurycea melanomolga**			X	X	2
*Pseudoeurycea nigromaculata***		X	X	X	3
*Pseudoeurycea orchimelas***		X			1
*Pseudoeurycea werleri**		X			1
*Thorius dubitus**			X	X	2
*Thorius lunaris***			X		1
*Thorius magnipes***			X		1
*Thorius minydemus***			X		1
*Thorius munificus***			X		1
*Thorius narismagnus***		X			1
*Thorius pennatulus***		X	X	X	3
*Thorius spilogaster***				X	1
*Thorius troglodytes***			X	X	2
Salamandridae (1 species)					
Notophthalmus meridionalis	X		X		2
Sirenidae (1 species)					
Siren intermedia	X				1
Gymnophiona (1 species)					
Dermophiidae (1 species)					
Dermophis mexicanus	X	X		X	3
Crocodylia (1 species)					
Crocodylidae (1 species)					
Crocodylus moreletii	X	X			2
Squamata (217 species)					
Anguidae (10 species)					
*Abronia chiszari***		X			1
*Abronia graminea**			X	X	2
*Abronia reidi***		X			1
*Abronia taeniata**	X		X	X	3
*Barisia imbricata**			X	X	2
Gerrhonotus liocephalus	X	X	X	X	4
*Gerrhonotus ophiurus**			X	X	2
*Mesaspis antauges***			X	X	2
*Ophisaurus ceroni***	X				1
*Ophisaurus incomptus**				X	1
Corytophanidae (4 species)					
Basiliscus vittatus	X	X	X	X	4
Corytophanes hernandesii	X	X	X	X	4
Laemanctus longipes	X			X	2
Laemanctus serratus	X	X			2
Dactyloidae (18 species)					
*Norops alvarezdeltoroi**	X				1
*Norops barkeri**	X	X			2
Norops beckeri	X	X			2
Norops biporcatus	X	X	X		3
*Norops compressicauda**	X				1
*Norops cymbops**			X	X	2
*Norops duellmani***		X			1

Table 5 (continued). Distribution of the herpetofaunal species of Veracruz, Mexico, by physiographic region. See text for descriptions of these regions. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxa	Physiographic regions of Veracruz				Number of regions occupied
	Gulf Coastal Lowlands	Sierra de Los Tuxtlas	Sierra Madre Oriental	Transmexican Volcanic Belt	
Norops laeviventris		X	X	X	3
Norops lemurinus	X	X	X	X	4
*Norops naufragus**			X		1
Norops petersii	X	X	X	X	4
*Norops purpuronectes**	X				1
Norops rodriguezii	X	X			2
*Norops sagrei****	X	X			2
*Norops schiedii***			X	X	2
Norops sericeus	X	X	X	X	4
Norops tropidonotus		X	X	X	3
Norops uniformis	X	X			2
Dibamidae (1 species)					
*Anelytropsis papillosus**			X	X	2
Diploglossidae (4 species)					
*Celestus enneagrammus**			X	X	2
*Celestus ingridae***		X			1
*Celestus legnotus**			X		1
Celestus rozellae	X				1
Eublepharidae (1 species)					
Coleonyx elegans	X	X	X	X	4
Gekkonidae (3 species)					
*Hemidactylus frenatus****	X	X			2
*Hemidactylus mabouia ****	X	X		X	3
*Hemidactylus turcicus****	X	X			2
Iguanidae (2 species)					
Ctenosaura acanthura	X	X	X	X	4
Iguana iguana	X	X			2
Mabuyidae (1 species)					
Marisora lineola	X	X	X	X	4
Phrynosomatidae (20 species)					
Holbrookia propinqua	X				1
*Phrynosoma braconnieri**			X	X	2
*Phrynosoma orbiculare**			X	X	2
*Sceloporus aeneus**			X	X	2
*Sceloporus aureolus**			X		1
*Sceloporus bicanthalis**			X	X	2
Sceloporus cyanogenys			X		1
*Sceloporus formosus**			X	X	2
Sceloporus grammicus	X		X	X	3
Sceloporus internasalis		X		X	2
*Sceloporus jalapae**			X	X	2
*Sceloporus megalepidurus**			X	X	2
*Sceloporus mucronatus**			X	X	2
*Sceloporus salvini**		X	X	X	3
*Sceloporus scalaris**			X	X	2
Sceloporus serrifer	X			X	2
*Sceloporus spinosus**			X	X	2
Sceloporus teapensis	X	X	X	X	4
*Sceloporus torquatus**			X	X	2
Sceloporus variabilis	X	X	X	X	4
Scincidae (5 species)					

Table 5 (continued). Distribution of the herpetofaunal species of Veracruz, Mexico, by physiographic region. See text for descriptions of these regions. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxa	Physiographic regions of Veracruz				Number of regions occupied
	Gulf Coastal Lowlands	Sierra de Los Tuxtlas	Sierra Madre Oriental	Transmexican Volcanic Belt	
*Plestiodon brevirostris**			X	X	2
*Plestiodon copei**		X	X	X	3
*Plestiodon lynxe**	X		X	X	3
Plestiodon sumichrasti		X	X	X	3
Plestiodon tetragrammus			X		1
Sphaerodactylidae (2 species)					
Gonatodes albogularis	X				1
Sphaerodactylus glaucus	X	X	X	X	4
Sphenomorphidae (3 species)					
Scincella cherriei	X	X	X	X	4
*Scincella gemmingeri**	X	X	X	X	4
*Scincella silvicola**		X	X		2
Teiidae (5 species)					
*Aspidoscelis costata**			X	X	2
Aspidoscelis deppii	X				1
Aspidoscelis gularis	X		X	X	3
*Aspidoscelis guttatus**	X	X	X	X	4
*Holcosus amphigrammus**	X	X	X	X	4
Xantusiidae (5 species)					
Lepidophyma flavimaculatum	X	X			2
*Lepidophyma pajapanense**	X	X			2
*Lepidophyma sylvaticum**	X		X		2
*Lepidophyma tuxtlae**	X	X			2
*Lepidophyma zongolica**			X	X	2
Xenosauridae (3 species)					
*Xenosaurus grandis**		X	X	X	3
*Xenosaurus rectocollaris**			X		1
*Xenosaurus tzacualtipantecus**			X		1
Boidae (1 species)					
Boa imperator	X	X	X	X	4
Colubridae (41 species)					
Coluber constrictor	X				1
*Conopsis acuta**	X				1
*Conopsis lineata**			X	X	2
*Conopsis nasus**			X	X	2
Dendrophidion vinitor		X			1
Drymarchon melanurus	X	X	X	X	4
Drymobius chloroticus	X	X			2
Drymobius margaritiferus	X	X	X	X	4
*Ficimia olivacea**		X	X	X	3
Ficimia publia	X	X			2
Ficimia streckeri	X		X		2
*Ficimia variegata**	X	X			2
Lampropeltis polyzona	X	X	X	X	4
Lampropeltis triangulum	X				1
Leptophis ahaetulla	X				1
Leptophis mexicanus	X	X	X	X	4
Masticophis flagellum	X				1
Masticophis mentovarius	X	X			2
Masticophis schotti	X		X		2
Mastigodryas melanolomus	X		X	X	3

Table 5 (continued). Distribution of the herpetofaunal species of Veracruz, Mexico, by physiographic region. See text for descriptions of these regions. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxa	Physiographic regions of Veracruz				Number of regions occupied
	Gulf Coastal Lowlands	Sierra de Los Tuxtlas	Sierra Madre Oriental	Transmexican Volcanic Belt	
Oxybelis aeneus	X	X	X		3
Oxybelis fulgidus		X		X	2
Pantherophis emoryi	X		X		2
Phrynonax poecilonotus	X	X			2
*Pituophis deppei**	X		X	X	3
Pituophis lineaticollis			X	X	2
Pseudelaphe flavirufa	X	X	X		3
*Salvadora bairdi**		X	X	X	3
Salvadora grahamiae			X	X	2
Senticolis triaspis	X	X	X	X	4
Spilotes pullatus	X	X	X	X	4
Stenorrhina degenhardtii	X	X	X	X	4
Stenorrhina freminvillii				X	1
*Tantilla bocourti**			X	X	2
Tantilla rubra			X	X	2
Tantilla schistosa	X	X	X	X	4
*Tantilla shawi**			X		1
*Tantilla slavensi***		X			1
Tantillita lintoni	X	X	X	X	4
Trimorphodon biscutatus		X		X	2
*Trimorphodon tau**	X		X	X	3
Dipsadidae (46 species)					
Adelphicos quadrivirgatum	X	X	X		3
Adelphicos visoninum	X				1
Amastridium sapperi	X	X	X	X	4
*Chersodromus liebmanni**	X		X	X	3
Clelia scytalina	X	X	X	X	4
Coniophanes bipunctatus	X	X	X	X	4
Coniophanes fissidens	X	X	X	X	4
Coniophanes imperialis	X	X	X	X	4
Coniophanes quinquevittatus	X	X			2
*Coniophanes taeniatus**	X	X		X	3
Conophis lineatus	X	X	X	X	4
*Conophis morai***		X		X	2
Diadophis punctatus			X	X	2
*Geophis bicolor**				X	1
*Geophis blanchardi**			X	X	2
Geophis carinosus		X	X		2
*Geophis chalybeus***			X		1
*Geophis juliai***	X	X		X	3
*Geophis lorancai**			X	X	2
*Geophis mutitorques**			X		1
*Geophis semidoliatus**		X	X	X	3
Imantodes cenchoa	X	X	X	X	4
Imantodes gemmistratus	X	X	X		3
Leptodeira frenata	X	X			2
Leptodeira maculata	X	X	X	X	4
Leptodeira polysticta	X	X			2
Leptodeira septentrionalis	X	X	X	X	4
Ninia diademata	X	X	X	X	4
Ninia sebae	X	X	X	X	4

Table 5 (continued). Distribution of the herpetofaunal species of Veracruz, Mexico, by physiographic region. See text for descriptions of these regions. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxa	Physiographic regions of Veracruz				Number of regions occupied
	Gulf Coastal Lowlands	Sierra de Los Tuxtlas	Sierra Madre Oriental	Transmexican Volcanic Belt	
Oxyrhopus petolarius	X	X			2
Pliocercus elapoides	X	X	X	X	4
*Rhadinaea cuneata**	X		X	X	3
Rhadinaea decorata	X	X	X	X	4
*Rhadinaea forbesi***			X		1
*Rhadinaea fulvivittis**			X	X	2
*Rhadinaea macdougalli**		X	X		2
*Rhadinaea marcellae**			X		1
*Rhadinaea quinquelineata**			X		1
*Rhadinella schistosa**			X		1
Sibon dimidiatus		X	X		2
*Sibon linearis***		X			1
Sibon nebulatus	X	X			2
Tretanorhinus nigroluteus	X	X			2
Tropidodipsas fasciata	X	X			2
Tropidodipsas sartorii	X	X	X	X	4
Xenodon rabdocephalus	X	X			2
Elapidae (4 species)					
*Micrurus diastema**	X	X	X	X	4
Micrurus elegans	X	X	X	X	4
*Micrurus limbatus***		X			1
Micrurus tener			X		1
Leptotyphlopidae (4 species)					
Epictia phenops	X	X	X		3
*Epictia resetari**		X	X		2
Rena dulcis	X		X		2
*Rena myopica**	X		X		2
Natricidae (14 species)					
Nerodia rhombifer	X		X	X	3
Storeria dekayi			X	X	2
*Storeria storerioides**			X	X	2
*Thamnophis chrysocephalus**			X	X	2
*Thamnophis conanti**			X		1
Thamnophis cyrtopsis			X		1
Thamnophis eques			X	X	2
*Thamnophis godmani**			X	X	2
Thamnophis marcianus			X	X	2
Thamnophis proximus	X	X	X	X	4
*Thamnophis pulchrilatus**			X		1
*Thamnophis scalaris**			X	X	2
*Thamnophis scaliger**				X	1
*Thamnophis sumichrasti**			X	X	2
Sibynophiidae (1 species)					
Scaphiodontophis annulatus	X	X		X	3
Typhlopidae (2 species)					
Amerotyphlops tenuis	X	X	X	X	4
*Virgotyphlops braminus****	X	X	X	X	4
Viperidae (17 species)					
*Agkistrodon taylori**	X		X		2
Bothrops asper	X	X	X	X	4
*Cerrophidion petlalcalensis**			X	X	2

Table 5 (continued). Distribution of the herpetofaunal species of Veracruz, Mexico, by physiographic region. See text for descriptions of these regions. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxa	Physiographic regions of Veracruz				Number of regions occupied
	Gulf Coastal Lowlands	Sierra de Los Tuxtlas	Sierra Madre Oriental	Transmexican Volcanic Belt	
*Crotalus aquilus**				X	1
Crotalus atrox	X				1
*Crotalus intermedius**	X		X	X	3
*Crotalus mictlantecuhtli***	X	X		X	3
Crotalus molossus			X	X	2
*Crotalus polystictus**				X	1
*Crotalus ravus**			X	X	2
Crotalus scutulatus			X	X	2
*Crotalus totonacus**			X	X	2
*Crotalus triseriatus**			X	X	2
*Metlapilcoatlus nummifer**			X	X	2
Metlapilcoatlus olmec	X	X			2
*Ophryacus smaragdinus**			X	X	2
*Ophryacus undulatus**			X	X	2
Testudines (19 species)					
Cheloniidae (4 species)					
Caretta caretta	X	X			2
Chelonia mydas	X	X			2
Eretmochelys imbricata	X	X			2
Lepidochelys kempii	X	X			2
Chelydridae (1 species)					
Chelydra rossignonii	X	X			2
Dermatemyidae (1 species)					
Dermatemys mawii	X				1
Dermochelyidae (1 species)					
Dermochelys coriacea	X	X			2
Emydidae (3 species)					
*Terrapene mexicana**	X				1
*Trachemys scripta****	X	X		X	3
Trachemys venusta	X				1
Geoemydidae (1 species)					
Rhinoclemmys areolata	X	X			2
Kinosternidae (5 species)					
Kinosternon acutum	X	X			2
Kinosternon flavescens	X				1
*Kinosternon herrerai**	X			X	2
Kinosternon leucostomum	X	X			2
Kinosternon scorpioides	X	X			2
Staurotypidae (2 species)					
Claudius angustatus	X	X			2
Staurotypus triporcatus	X	X			2
Testudinidae (1 species)					
Gopherus berlandieri	X				1

(222/359) 61.8% (TVB), (190/359) 52.9% (GCL), and (179/359) 49.9% (SLT). The average percentage of occupancy is 57.6%, or somewhat in excess of one-half of the number of Veracruz's herpetofaunal species.

The numbers of amphibian species in the SMO and TVB (Table 6) are very similar to each other (57 and 56 anurans of 76; 28 and 31 salamanders of 45; 0 and one caecilian of one; and totals of 85 and 88 of 122, respectively). The numbers of reptile species in these two regions (Table 6), however, are relatively dissimilar when compared to the situation with amphibians (0 and 0 crocodylians of one; 151 and 132 squamates of 217; 0 and two turtles of 19; and totals of 151 and 134 of 237, respectively).

Table 6. Summary of distributional occurrence of the herpetofaunal families in Veracruz, Mexico, by physiographic province. GLC = Gulf Coastal Lowlands; SLT = Sierra de los Tuxtlas; SMO = Sierra Madre Oriental; and TVB = Transmexican Volcanic Belt.

Family	Number of species	Distributional occurrence			
		GCL	SLT	SMO	TVB
Bufonidae	9	6	4	7	7
Centrolenidae	1	1	1	1	1
Craugastoridae	11	7	8	8	8
Eleutherodactylidae	7	3	2	5	4
Hylidae	29	13	15	23	22
Leptodactylidae	3	3	3	2	2
Microhylidae	3	3	3	2	2
Phyllomedusidae	2	2	2	2	2
Ranidae	8	5	5	5	6
Rhinophrynidae	1	1	1	—	—
Scaphiopodidae	2	1	—	2	2
Subtotal	**76**	**45**	**44**	**57**	**56**
Ambystomatidae	1	—	—	1	1
Plethodontidae	42	4	11	26	30
Salamandridae	1	1	—	1	—
Sirenidae	1	1	—	—	—
Subtotal	**45**	**6**	**11**	**28**	**31**
Dermophiidae	1	1	1	—	1
Subtotal	**1**	**1**	**1**	**—**	**1**
Total	**122**	**52**	**56**	**85**	**88**
Crocodylidae	1	1	1	—	—
Subtotal	**1**	**1**	**1**	**—**	**—**
Anguidae	10	3	3	6	7
Corytophanidae	4	4	3	2	3
Dactyloidae	18	12	12	9	7
Dibamidae	1	—	—	1	1
Diploglossidae	4	1	1	2	1
Eublepharidae	1	1	1	1	1
Gekkonidae	3	3	3	—	1
Iguanidae	2	2	2	1	1
Mabuyidae	1	1	1	1	1
Phrynosomatidae	20	5	4	17	17
Scincidae	5	1	2	5	4
Sphaerodactylidae	2	2	1	1	1
Sphenomorphidae	3	2	3	3	2
Teiidae	5	4	2	4	4
Xantusiidae	5	4	3	2	1
Xenosauridae	3	—	1	3	1
Subtotal	**87**	**45**	**42**	**58**	**53**
Boidae	1	1	1	1	1
Colubridae	41	27	22	26	23
Dipsadidae	46	29	32	32	25
Elapidae	4	2	3	3	2
Leptotyphlopidae	4	3	2	4	—
Natricidae	14	2	1	13	11
Sibynophiidae	1	1	1	—	1
Typhlopidae	2	2	2	2	2
Viperidae	17	6	3	12	14
Subtotal	**130**	**73**	**67**	**93**	**79**
Cheloniidae	4	4	4	—	—
Chelydridae	1	1	1	—	—
Dermatemyidae	1	1	—	—	—
Dermochelyidae	1	1	1	—	—
Emydidae	3	3	1	—	1
Geoemydidae	1	1	1	—	—
Kinosternidae	5	5	3	—	1
Staurotypidae	2	2	2	—	—
Testudinidae	1	1	—	—	—
Subtotal	**19**	**19**	**13**	**—**	**2**
Total	**237**	**138**	**123**	**151**	**134**
Sum Total	**359**	**190**	**179**	**236**	**222**

No. 17. *Abronia graminea*. The Sierra de Tehuacan Arboreal Alligator Lizard is a country endemic species distributed in central Veracruz, eastern Puebla, and Oaxaca (Uetz et al. 2020). This individual was found at Finca Santa Martha, in the municipality of Los Reyes. Wilson et al. (2013b) determined its EVS as 15, placing it in the lower portion of the high vulnerability category. Its conservation status has been assessed as Endangered by the IUCN, and as Threatened (A) by SEMARNAT. *Photo by Matthieu Berroneau*.

No. 18. *Barisia imbricata*. The Transvolcanic Alligator Lizard is a country endemic species that occurs broadly in the Sierra Madre Oriental and Transmexican Volcanic Belt from Hidalgo south to Oaxaca, and west to Jalisco and Michoacán (Ramírez-Bautista et al. 2014). This individual was located at San Isidro, in the municipality of Mariano Escobedo. Wilson et al. (2013b) assessed its EVS as 14, placing it at the lower limit of the high vulnerability category. Its conservation status has been determined as Least Concern by the IUCN, and as Special Protection (Pr) by SEMARNAT. *Photo by René Ávalos-Vela*.

No. 19. *Gerrhonotus ophiurus* Cope, 1867. The Snake Lizard is a country endemic species distributed from central San Luis Potosí south to eastern Querétaro, Hidalgo, Tlaxcala, northern Veracruz, and Puebla (Lemos-Espinal and Dixon 2013). This individual was discovered at Comapa, in the municipality of the same name. Wilson et al. (2013b) determined its EVS as 12, placing it in the middle of the medium vulnerability category. Its conservation status has been determined as Least Concern by the IUCN, but this species has not been evaluated by SEMARNAT. *Photo by Aarón Arias*.

No. 20. *Ophisaurus ceroni* Holman, 1965. Ceron's Glass Lizard is a state endemic species distributed in the Gulf Coastal Lowlands physiographic region (Uetz et al. 2020). This individual was located at Cuitlahuac, in the municipality of the same name. Wilson et al. (2013b) calculated its EVS as 14, placing it at the lower limit of the high vulnerability category. Its conservation status has been assessed as Endangered by the IUCN, and as Threatened (A) by SEMARNAT. *Photo by Matthieu Berroneau*.

The members of the Veracruz herpetofauna occupy from 1–4 of the four physiographic regions, as follows: one (86; 24.0%), two (153; 42.6%), three (45; 12.5%), and four (75; 20.9%). The mean regional occupancy is 2.3, meaning that each species, on average, inhabits only slightly more than one-half of the physiographic regions located in the state.

A large proportion of the herpetofauna is found in one or two regions (239 species, or 66.6% of the total). This situation is of significant conservation importance, as discussed below in the section on conservation status.

The number of species found in a single region varies from 16 in the SLT to 27 in the GCL. The 27 single-region species in the GCL are:

Incilius macrocristatus
*Eleutherodactylus longipes**
*Duellmanohyla chamulae**
*Exerodonta bivocata**
*Quilticohyla zoque**
*Bolitoglossa veracrucis**
Siren intermedia
*Ophisaurus ceroni***
*Norops alvarezdeltoroi**
*Norops compressicauda**
*Norops purpuronectes**
Celestus rozellae
Holbrookia propinqua
Gonatodes albogularis
Aspidoscelis deppii
Coluber constrictor
*Conopsis acuta**
Lampropeltis triangulum
Leptophis ahaetulla
Masticophis flagellum
Adelphicos visoninum
Crotalus atrox
Dermatemys mawii
*Terrapene mexicana**
Trachemys venusta
Kinosternon flavescens
Gopherus berlandieri

Sixteen of the 27 GCL single-region species (59.3%) are non-endemics, 10 (37.0%) are country endemics (indicated by asterisks) and one (3.7%) is a state endemic. As expected, the largest number of these lowland-inhabiting species ranges outside the limits of Mexico.

The 25 single-region species in the SMO are as follows:

*Sarcohyla pachyderma***
*Chiropterotriton aureus***
*Chiropterotriton terrestris**
*Thorius lunaris***
*Thorius magnipes***
*Thorius minydemus***
*Thorius munificus***
*Norops naufragus**
*Celestus legnotus**
*Sceloporus aureolus**
Sceloporus cyanogenys
Plestiodon tetragrammus
*Xenosaurus rectocollaris**
*Xenosaurus tzacualtipantecus**
*Tantilla shawi**
*Geophis chalybeus***
*Geophis mutitorques**
*Rhadinaea forbesi***
*Rhadinaea marcellae**
*Rhadinaea quinquelineata**
*Rhadinella schistosa**
Micrurus tener
*Thamnophis conanti**
Thamnophis cyrtopsis
*Thamnophis pulchrilatus**

Thirteen of the 25 SMO single-region species (52.0%) are Mexican endemics, eight (32.0%) are state endemic species, and four (16.0%) are non-endemic species. As expected, the largest number of these species in this montane region are Mexican endemics, with the next largest number being state endemics, for a total of 21 endemic taxa (84.0%).

The 18 single-region species in the TVB are as follows:

Dryophytes arenicolor
*Lithobates johni**
*Chiropterotriton casasi***
*Chiropterotriton ceronorum**
*Chiropterotriton chiropterus**
*Chiropterotriton chondrostega**
*Chiropterotriton lavae***
*Chiropterotriton nubilus***
*Chiropterotriton perotensis***
*Chiropterotriton totonacus***
*Isthmura corrugata***
*Thorius spilogaster***
*Ophisaurus incomptus**
Stenorrhina freminvillii
*Geophis bicolor**
*Thamnophis scaliger**
*Crotalus aquilus**
*Crotalus polystictus**

Nine of the 18 single-region TVB species (50.0%) are country endemics, seven (38.9%) are state endemics, and two (11.1%) are non-endemics. Again, it was expected that the largest number of these species in this montane region would be Mexican endemics, with the next largest number being state endemics, for a total of 16 endemic taxa (88.9%).

No. 21. *Corytophanes hernandezii* (Wiegmann, 1831). Hernandez's Helmeted Basilisk is a non-endemic species ranging from southeastern San Luis Potosí south to northwestern Honduras (Köhler 2008). This individual was located at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013b) assessed its EVS at 13, placing it at the upper limit of the medium vulnerability category. Its conservation status has been determined as Least Concern by the IUCN, and as Special Protection (Pr) by SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 22. *Norops barkeri* Schmidt, 1939. Barker's Anole is a country endemic species found in the region of the Isthmus of Tehuantepec in Veracruz, Tabasco, Oaxaca, and Chiapas (Köhler 2008). This individual was found at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013b) determined its EVS as 15, placing in the lower portion of the high vulnerability category. Its conservation status has not been evaluated by either the IUCN or SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 23. *Celestus enneagrammus* (Cope, 1861). The Huaxteca Lesser Galliwasp is a country endemic species found in the states of Veracruz, Puebla, Oaxaca, and Chiapas (Uetz et al. 2020). This individual was located at Tequila, in the municipality of the same name. Wilson et al. (2013b) ascertained its EVS as 14, placing it at the lower limit of the high vulnerability category. Its conservation status is indicated as Least Concern by the IUCN, and as Special Protection (Pr) by SEMARNAT. *Photo by René Ávalos-Vela*.

No. 24. *Sceloporus salvini* Günther, 1890. Salvin's Spiny Lizard is a country endemic species that ranges into Veracruz and Oaxaca (Uetz et al. 2020). This individual was discovered at Tepexilotla, in the municipality of Chocamán. Wilson et al. (2013b) determined its EVS as 15, placing it in the lower portion of the high vulnerability category. Its conservation status has been evaluated as Data Deficient by the IUCN, and as Threatened (A) by SEMARNAT. *Photo by René Ávalos-Vela*.

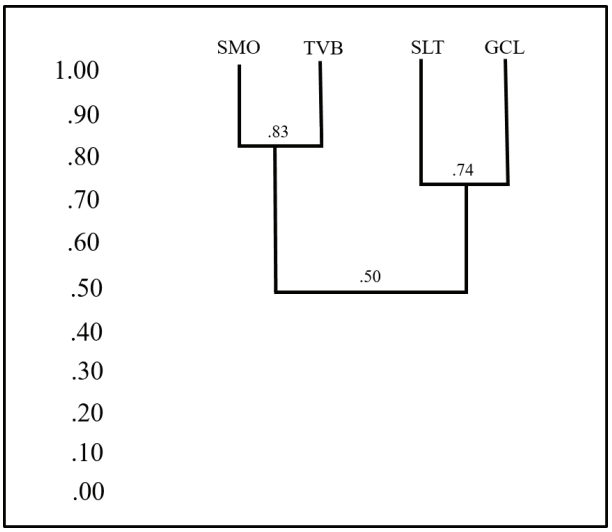

Fig. 7. UPGMA generated dendrogram illustrating the similarity relationships of species richness among the herpetofaunal components in the four physiographic regions of Veracruz (based on the data in Table 7; Sokal and Michener 1958). Similarity values were calculated using Duellman's (1990) Coefficient of Biogeographic Resemblance (CBR).

The 16 single-region species in the SLT are as follows:

*Craugastor megalotympanum***
*Charadrahyla nephila**
*Ecnomiohyla valancifer***
*Bolitoglossa alberchi**
Bolitoglossa occidentalis
*Pseudoeurycea orchimelas***
*Pseudoeurycea werleri**
*Thorius narismagnus***
*Abronia chiszari***
*Abronia reidi***
*Norops duellmani***
*Celestus ingridae***
Dendrophidion vinitor
*Tantilla slavensi***
*Sibon linearis***
*Micrurus limbatus***

Eleven of the 16 single-region SLT species (68.8%) are state endemics, three (18.8%) are country endemics, and two (12.5%) are non-endemics. Given the isolation of this montane region relative to others in the vicinity, this is also the expected pattern, with the prevalence of state endemics versus the other distributional categories represented. In total, this region supports 14 endemic taxa (87.5%).

In summary, of the 86 single-region species in Veracruz, 24 (27.9%) are non-endemics, 35 (40.7%) are Mexican endemics, and 27 (31.4%) are state endemics. Of the four physiographic regions, the SMO has the greatest conservation significance given that it encompasses the greatest overall number of species (236 of 359, or 65.7%), the greatest numbers of country and state endemics (130 [109 and 21, respectively] of 182, or 71.4%), and the second highest number of single-region species (25 of 86, or 29.1%).

A Coefficient of Biogeographic Resemblance (CBR) matrix was constructed for assessing the herpetofaunal similarity relationships (Duellman 1990) among the four physiographic regions in Veracruz (Table 7) and those data were used to create a UPGMA dendrogram (Fig. 7; Sokal and Michener 1958). The SMO contains the greatest amount of species richness (236 species) and the SLT the least (179 species). The mean species richness value for all four regions is 206.8. The number of shared species between each regional pair ranges from a high of 190 between the SMO and TVB, to a low of 100 between the TVB and GCL. The mean value of shared species among all four regions is 123.0. The lowest number of shared species between the TVB and GCL (100 species) was expected, as these two regions are completely separated from each other by the SMO and are environmentally different on an elevational scale. The GCL, with an elevational range from sea level to about 200 m, contains tropical evergreen forest, scrub, sub-deciduous forest, and tropical dry forest (CONABIO, 2008). Conversely, with a limited geographic area within Veracruz, the TVB contains primarily coniferous and oak forest vegetation with the remainder comprised of subalpine scrub, cloud forest, xerophilous scrub, and tropical dry forest. The elevations for the TVB range from 1,000 m in sloping river valleys to 5,700 m on the highest volcanic peak. The TVB and SMO share the most

Table 7. Pair-wise comparison matrix of Coefficient of Biogeographic Resemblance (CBR) data of herpetofaunal relationships for the four physiographic regions in Veracruz, Mexico. Underlined values = number of species in each region; upper triangular matrix values = species in common between two regions; and lower triangular matrix values = CBR values. The formula for this algorithm is CBR = $2C/N_1 + N_2$ (Duellman 1990), where C is the number of species in common to both regions, N_1 is the number of species in the first region, and N_2 is the number of species in the second region. See Fig. 7 for the UPGMA dendrogram produced from the CBR data.

	Gulf Coastal Lowlands	Sierra de Los Tuxtlas	Sierra Madre Oriental	Transmexican Volcanic Belt
Gulf Coastal Lowlands	**190**	137	105	100
Sierra de Los Tuxtlas	0.74	**179**	104	102
Sierra Madre Oriental	0.49	0.50	**236**	190
Transmexican Volcanic Belt	0.49	0.51	0.83	**222**

No. 25. *Scincella cherriei* (Cope, 1893). The Brown Forest Skink is a non-endemic species occurring from Veracruz to western Panama (Uetz et al. 2020). This individual was found at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013b) calculated its EVS as 8, placing it in the upper portion of the low vulnerability category. Its conservation status has not been assessed by either the IUCN or SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 26. *Lepidophyma tuxtlae* Werler and Shannon, 1957. The Tuxtla Tropical Night Lizard is a country endemic species distributed from the Sierra de Los Tuxtlas to the El Ocote region of Chiapas (Köhler 2008). This individual was located at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013b) determined its EVS as 11, placing it in the middle of the medium vulnerability category. Its conservation status is designated as Data Deficient by the IUCN, and as Threatened (A) by SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 27. *Sphaerodactylus glaucus* (Cope, 1866). The Collared Dwarf Gecko is non-endemic species occurring from Veracruz, Tabasco, Oaxaca, and Chiapas in Mexico, through the Yucatan Peninsula and northern Guatemala to the interior of western Honduras, at elevations from 200 to 1,000 m (Köhler 2008). This individual was found at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013b) determined its EVS as 12, placing it in the medium vulnerability category. This species has not been assessed by either the IUCN or SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 28. *Boa imperator* Daudin, 1803. The Central American Boa Constrictor is a non-endemic species occurring in Central America (including South American populations in the Choco of Colombia and Ecuador [and probably Peru], and North American populations along the Gulf coast of Mexico (west of the Isthmus of Tehuantepec; Card et al. 2016). This individual was encountered at Los Tuxtlas, in the municipality of San Andrés Tuxtla. We calculated its EVS as 10, placing it at the lower limit of the medium vulnerability category. Its conservation status has not been determined by the IUCN or SEMARNAT. *Photo by Christian Berriozabal-Islas*.

species (190), which also was expected because they are directly adjacent to each other in Veracruz and share many of the same montane environments in their limited geographic ranges within the state. The SLT and GCL share the second largest number of species (137). The SLT is an isolated mountainous region with a maximum elevation of 1,700 m, which is nearly surrounded by lowland habitats, some of which ascend upward to an elevation of 200 m into lower montane areas on volcanic slopes. Pairwise comparisons of the aligned regions in order from highest to lowest species richness (underlined values) and their corresponding numbers of shared species (in parentheses) are as follows:

SMO 236: TVB (190), SLT (104), GCL (105)
TVB 222: SMO (190), SLT (102), GCL (100)
GCL 190: SLT (137), SMO (105), TVB (100)
SLT 179: GCL (137), SMO (104), TVB (102)

In general, the pattern indicates how species richness values within each of the four biogeographic regions of Veracruz equate to numbers of shared species among the other three regions. There is a higher correlation of species richness values to the numbers of shared species between regions that are in contact with each other, but also a correlation between regions that share ecological parameters. Interestingly, the two regions that share the second highest number of species (137) are a highland region (SLT) and a lowland region (GCL), which is probably due to the GCL containing many generalist species that tolerate both montane and non-montane environments at low to moderate elevations. The fact that the GCL shares fewer species with the SMO and TVB gives credibility to the premise that regions separated by ecological barriers will share fewer species than they will with regions in direct contact.

The following data show the ranges and mean numbers of shared species (bold in parentheses) for each of the four regions, and are arranged according to increasing species richness (underlined values) in each region:

Sierra Madre Oriental, SMO (236): 104–190 (**133**)
Transmexican Volcanic Belt, TVB (222): 100–190 (**130.7**)
Gulf Coastal Lowlands, GCL (190): 100–137 (**114**)
Sierra de Los Tuxtlas, SLT (179): 102–137 (**114.3**)

The mean numbers of shared species compared to the species richness in the four regions indicate that higher species richness in a pairwise comparison tends, with one exception, to translate into higher reciprocal numbers when all the regional pairs are totaled. The comparison between the SMO and TVB are 1st and 2nd in species richness and 1st and 2nd in the average value of shared species, respectively. The minor exception is that the GCL, a lowland region, is 3rd in species richness but last (4th) in the mean number of shared species, whereas the SLT is lower in species richness but slightly higher in the mean numbers of shared species. Apparently, the size of the region has an important effect on species richness, and the ecological variability (highlands vs. lowlands) has an important effect on the average number of shared species in Veracruz.

Regarding area, the GCL in Veracruz is by far larger than all three mountainous areas combined (SMO, TVB, and SLT), but is 3rd in species richness; it has 11 more species than the SLT. The total area of the SLT is much smaller compared to the other three regions and it is located only within a small portion of southeastern Veracruz, whereas the other three regions have much larger ranges outside of the state.

Based on the data in Table 7, a UPGMA dendrogram (Fig. 7) depicts herpetofaunal similarity resemblance patterns in a hierarchical fashion among the four physiographic regions of Veracruz (Fig. 1). The dendrogram is composed of two distinct clusters: one comprising two montane regions (SMO and TVB) at the 0.83 level, and the other containing one montane region (SLT) and one lowland region (GCL) at the 0.74 level. The two clusters connect with each other at the 0.50 level. Regions in both clusters have portions adjacent to each other somewhere in their total ranges, and the GCL surrounds the SLT to a varying degree only in southeastern Veracruz. Many of the shared species with the GCL contain wide-ranging generalist species that occur all along the Gulf lowlands from Tamaulipas and the adjacent USA into the Yucatan Peninsula of Mexico and northern Central America, and a few enter northern South America (Wilson and Johnson 2010). In our opinion, those lowland generalist species are the main reason why the SLT clusters with the GLC instead of with the SMO, even though the GLC and SMO share borders along the northern half of Veracruz.

Distribution Status Categorizations

This analysis of the distributional status of the members of the Veracruz herpetofauna utilizes the same system employed by Alvarado-Díaz et al. (2013) and all the other entries in the MCS (see above). The four categories in this system are non-endemic, country endemic, state endemic, and non-native. The data are presented based on these categories in Table 8, and summarized in Table 9.

In descending order of size, the numbers of species in each of these categories are non-endemics: 169 (47.1%), country endemics: 138 (38.4%), state endemics: 44 (12.3%), and non-natives: 8 (2.2%). The herpetofauna of Veracruz, therefore, resembles several other state herpetofaunas covered previously in the MCS in that the largest number of species fall into the non-endemic category, i.e., Oaxaca (Mata-Silva et al. 2015); Chiapas (Johnson et al. 2015a); Tamaulipas (Terán-Juárez et al. 2016); Nuevo León (Nevárez-de los Reyes et al. 2016); the Mexican Yucatan Peninsula (González-Sánchez et al. 2017); and Coahuila (Lazcano et al. 2019). In other

No. 29. *Spilotes pullatus* Linnaeus, 1758. The Tropical Tree Snake is a non-endemic species found from Tamaulipas southward through Central America and South America to Argentina on the Atlantic versant, and from the Isthmus of Tehuantepec to Ecuador on the Pacific versant (Lemos-Espinal and Dixon 2013). This individual was found at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013b) determined its EVS as 6, placing it in the middle of the low vulnerability category. Its conservation status has not been determined by either the IUCN or SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 30. *Adelphicos quadrivirgatum* Jan, 1862. The Mesoamerican Earth Snake is a non-endemic species distributed from Tamaulipas to Honduras on the Atlantic versant, and from Oaxaca to Guatemala on the Pacific versant (Lemos-Espinal and Dixon 2013). This individual was located at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013b) ascertained its EVS as 10, placing it at the lower limit of the medium vulnerability category. Its conservation status has been calculated as Least Concern by the IUCN, and as Special Protection (Pr) by SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 31. *Clelia scytalina* (Cope, 1867). The Mexican Snake Eater is a non-endemic species ranging from southern Mexico to Guatemala and Belize (Köhler 2008). This individual was found at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013b) determined its EVS as 13, placing it at the upper limit of the medium vulnerability category. Its conservation status has not been determined by either the IUCN or SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 32. *Imantodes cenchoa* (Linnaeus, 1758). The Blunt-headed Treesnake is a non-endemic species occurring at low and moderate elevations (up to 1,600 m) on the Atlantic versant from southern Tamaulipas, southward through Central and South America to Argentina. It also occurs along the Pacific lowlands and premontane slopes from Chiapas to Guatemala. In the Yucatán Peninsula, it is known from southern Campeche and Quintana Roo, but apparently is absent from the arid north-western region of the peninsula (Heimes 2016). This individual was found at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013b) determined its EVS as 6, placing it in the low vulnerability category. Its conservation status has not been determined by either the IUCN or SEMARNAT. *Photo by Elí García-Padilla.*

Table 8. Distributional and conservation status measures for members of the herpetofauna of Veracruz, Mexico. Distributional Status: CE = endemic to country of Mexico; SE = endemic to state of Veracruz; NE = not endemic to state or country; and NN = non-native. The numbers suffixed to the NE category signify the distributional categories developed by Wilson et al. (2017) and implemented in the taxonomic list at the *Mesoamerican Herpetology* website (http://www.mesoamericanherpetology.com), as follows: 3 = species distributed only in Mexico and the United States; 4 = species found only in Mexico and Central America; 6 = species ranging from Mexico to South America; 7 = species ranging from the United States to Central America; 8 = species ranging from the United States to South America; and 9 = Oceanic species. Environmental Vulnerability Scores (taken from Wilson et al. 2013a,b): low (L) vulnerability species (EVS 3–9); medium (M) vulnerability species (EVS 10–13); and high (H) vulnerability species (EVS 14–19). IUCN categorization: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; and NE = Not Evaluated. SEMARNAT Status: A = Threatened; P = Endangered; Pr = Special Protection; and NS = No Status. See Alvarado-Díaz et al. (2013), Johnson et al. (2015a), and Mata-Silva et al. (2015) for explanations of the EVS, IUCN, and SEMARNAT rating systems.

Taxon	Distributional status	Environmental Vulnerability Category (score)	IUCN categorization	SEMARNAT status
*Anaxyrus compactilis**	CE	H (14)	LC	NS
*Incilius cavifrons***	SE	M (13)	EN	Pr
*Incilius cristatus**	CE	H (14)	CR	Pr
Incilius macrocristatus	NE4	M (11)	VU	NS
*Incilius marmoreus **	CE	M (11)	EN	NS
Incilius nebulifer	NE3	L (6)	CR	NS
*Incilius occidentalis**	CE	M (11)	LC	NS
Incilius valliceps	NE4	L (6)	LC	NS
Rhinella horribilis	NE7	L (3)	NE	NS
Hyalinobatrachium viridissimum	NE4	M (11)	NE	NS
Craugastor alfredi	NE4	M (11)	VU	NS
*Craugastor berkenbuschii**	CE	H (14)	NT	Pr
*Craugastor decoratus**	CE	H (15)	VU	Pr
Craugastor laticeps	NE4	M (12)	NT	Pr
Craugastor loki	NE4	M (10)	LC	NS
*Craugastor megalotympanum***	SE	H (18)	CR	Pr
*Craugastor mexicanus**	CE	H (16)	LC	NS
Craugastor pygmaeus	NE4	L (9)	VU	NS
*Craugastor rhodopis**	CE	H (14)	VU	NS
*Craugastor spatulatus**	CE	H (16)	EN	Pr
*Craugastor vulcani***	SE	H (17)	EN	NS
Eleutherodactylus cystignathoides	NE3	M (12)	LC	NS
Eleutherodactylus leprus	NE4	M (12)	VU	NS
*Eleutherodactylus longipes**	CE	H (15)	VU	NS
*Eleutherodactylus nitidus**	CE	M (12)	LC	NS
*Eleutherodactylus planirostris****	NN	—	—	—
*Eleutherodactylus verrucipes**	CE	H (16)	VU	Pr
*Eleutherodactylus verruculatus***	SE	H (18)	DD	NS
*Bromeliohyla dendroscarta**	CE	H (17)	CR	Pr
*Charadrahyla nephila**	CE	M (13)	VU	NS
*Charadrahyla taeniopus**	CE	M (13)	VU	A
Dendropsophus ebraccatus	NE6	M (12)	LC	NS
Dendropsophus microcephalus	NE6	L (7)	LC	NS
Dryophytes arenicolor	NE3	L (7)	LC	NS
*Dryophytes euphorbiaceus**	CE	M (13)	NT	NS
*Dryophytes eximius**	CE	M (10)	LC	NS
*Dryophytes plicatus**	CE	M (11)	LC	A
*Duellmanohyla chamulae**	CE	M (13)	EN	Pr
*Ecnomiohyla valancifer***	SE	H (18)	CR	Pr
*Exerodonta bivocata**	CE	H (15)	DD	NS
*Megastomatohyla mixomaculata**	CE	H (14)	EN	A
*Megastomatohyla nubicola***	SE	H (14)	EN	A

Table 8 (continued). Distributional and conservation status measures for members of the herpetofauna of Veracruz, Mexico. Distributional Status: CE = endemic to country of Mexico; SE = endemic to state of Veracruz; NE = not endemic to state or country; and NN = non-native. The numbers suffixed to the NE category signify the distributional categories developed by Wilson et al. (2017) and implemented in the taxonomic list at the *Mesoamerican Herpetology* website (http://www.mesoamericanherpetology.com), as follows: 3 = species distributed only in Mexico and the United States; 4 = species found only in Mexico and Central America; 6 = species ranging from Mexico to South America; 7 = species ranging from the United States to Central America; 8 = species ranging from the United States to South America; and 9 = Oceanic species. Environmental Vulnerability Scores (taken from Wilson et al. 2013a,b): low (L) vulnerability species (EVS 3–9); medium (M) vulnerability species (EVS 10–13); and high (H) vulnerability species (EVS 14–19). IUCN categorization: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; and NE = Not Evaluated. SEMARNAT Status: A = Threatened; P = Endangered; Pr = Special Protection; and NS = No Status. See Alvarado-Díaz et al. (2013), Johnson et al. (2015a), and Mata-Silva et al. (2015) for explanations of the EVS, IUCN, and SEMARNAT rating systems.

Taxon	Distributional status	Environmental Vulnerability Category (score)	IUCN categorization	SEMARNAT status
*Ptychohyla zophodes**	CE	M (13)	DD	NS
*Quilticohyla zoque**	CE	H (14)	NE	NS
*Rheohyla miotympanum**	CE	L (9)	NT	NS
*Sarcohyla arborescandens**	CE	M (11)	EN	Pr
*Sarcohyla bistincta**	CE	L (9)	LC	Pr
*Sarcohyla pachyderma***	SE	H (15)	CR	Pr
*Sarcohyla siopela**	CE	H (15)	CR	NS
Scinax staufferi	NE4	L (4)	LC	NS
Smilisca baudinii	NE7	L (3)	LC	NS
Smilisca cyanosticta	NE4	M (12)	NT	NS
*Tlalocohyla godmani**	CE	M (13)	VU	A
Tlalocohyla loquax	NE4	L (7)	LC	NS
Tlalocohyla picta	NE4	L (8)	LC	NS
Trachycephalus vermiculatus	NE6	L (4)	LC	NS
Triprion spinosus	NE4	H (15)	LC	NS
Engystomops pustulosus	NE6	L (7)	LC	NS
Leptodactylus fragilis	NE8	L (5)	LC	NS
Leptodactylus melanonotus	NE6	L (6)	LC	NS
Gastrophryne elegans	NE4	L (8)	LC	Pr
Hypopachus ustus	NE4	L (7)	LC	Pr
Hypopachus variolosus	NE7	L (4)	LC	NS
Agalychnis taylori	NE6	M (11)	LC	NS
Agalychnis moreletii	NE4	L (7)	CR	NS
Lithobates berlandieri	NE3	L (7)	LC	Pr
Lithobates brownorum	NE4	L (8)	NE	Pr
*Lithobates catesbeianus****	NN	—	—	—
*Lithobates johni**	CE	H (14)	EN	P
Lithobates maculatus	NE4	L (5)	LC	NS
*Lithobates montezumae**	CE	M (13)	LC	Pr
*Lithobates spectabilis**	CE	M (12)	LC	NS
Lithobates vaillanti	NE6	L (9)	LC	NS
Rhinophrynus dorsalis	NE7	L (8)	LC	Pr
Scaphiopus couchii	NE3	L (3)	LC	NS
Spea multiplicata	NE3	L (6)	LC	NS
*Ambystoma velasci**	CE	M (10)	LC	Pr
*Aquiloeurycea cafetalera**	CE	H (17)	NE	NS
*Aquiloeurycea cephalica**	CE	H (14)	LC	A
*Aquiloeurycea praecellens***	SE	H (18)	CR	A
*Bolitoglossa alberchi**	CE	H (15)	VU	NS
Bolitoglossa mexicana	NE4	M (11)	LC	Pr
Bolitoglossa occidentalis	NE4	M (11)	LC	Pr
*Bolitoglossa platydactyla**	CE	H (15)	LC	Pr

Table 8 (continued). Distributional and conservation status measures for members of the herpetofauna of Veracruz, Mexico. Distributional Status: CE = endemic to country of Mexico; SE = endemic to state of Veracruz; NE = not endemic to state or country; and NN = non-native. The numbers suffixed to the NE category signify the distributional categories developed by Wilson et al. (2017) and implemented in the taxonomic list at the *Mesoamerican Herpetology* website (http://www.mesoamericanherpetology.com), as follows: 3 = species distributed only in Mexico and the United States; 4 = species found only in Mexico and Central America; 6 = species ranging from Mexico to South America; 7 = species ranging from the United States to Central America; 8 = species ranging from the United States to South America; and 9 = Oceanic species. Environmental Vulnerability Scores (taken from Wilson et al. 2013a,b): low (L) vulnerability species (EVS 3–9); medium (M) vulnerability species (EVS 10–13); and high (H) vulnerability species (EVS 14–19). IUCN categorization: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; and NE = Not Evaluated. SEMARNAT Status: A = Threatened; P = Endangered; Pr = Special Protection; and NS = No Status. See Alvarado-Díaz et al. (2013), Johnson et al. (2015a), and Mata-Silva et al. (2015) for explanations of the EVS, IUCN, and SEMARNAT rating systems.

Taxon	Distributional status	Environmental Vulnerability Category (score)	IUCN categorization	SEMARNAT status
Bolitoglossa rufescens	NE4	L (9)	LC	Pr
*Bolitoglossa veracrucis**	CE	H (17)	EN	Pr
*Chiropterotriton aureus***	SE	H (18)	CR	NS
*Chiropterotriton casasi***	SE	H (18)	CR (provisional)	NS
*Chiropterotriton ceronorum**	CE	H (17)	CR (provisional)	NS
*Chiropterotriton chiropterus**	CE	H (16)	CR	Pr
*Chiropterotriton chondrostega**	CE	H (17)	EN	Pr
*Chiropterotriton lavae***	SE	H (18)	CR	Pr
*Chiropterotriton nubilus***	SE	H (18)	CR	NS
*Chiropterotriton perotensis***	SE	H (18)	EN (provisional)	NS
*Chiropterotriton totonacus***	SE	H (18)	CR (provisional)	NS
*Chiropterotriton terrestris**	CE	H (18)	CR	NS
*Isthmura corrugata***	SE	H (18)	CR	NS
*Isthmura gigantea**	CE	H (16)	CR	NS
*Isthmura naucampatepetl***	SE	H (17)	CR	NS
*Parvimolge townsendi***	SE	H (16)	CR	A
*Pseudoeurycea firscheini**	CE	H (18)	EN	Pr
*Pseudoeurycea gadovii**	CE	M (13)	VU	Pr
*Pseudoeurycea granitum***	SE	H (16)	EN	NS
*Pseudoeurycea leprosa**	CE	H (16)	LC	A
*Pseudoeurycea lineola***	SE	H (14)	EN	Pr
*Pseudoeurycea lynchi**	CE	H (17)	EN	NS
*Pseudoeurycea melanomolga**	CE	H (16)	EN	Pr
*Pseudoeurycea nigromaculata***	SE	H (17)	EN	Pr
*Pseudoeurycea orchimelas***	SE	H (17)	EN	NS
*Pseudoeurycea werleri**	CE	H (17)	EN	Pr
*Thorius dubitus**	CE	H (16)	CR	Pr
*Thorius lunaris***	SE	H (18)	CR	NS
*Thorius magnipes***	SE	H (17)	CR	NS
*Thorius minydemus***	SE	H (18)	EN	NS
*Thorius munificus***	SE	H (18)	CR	NS
*Thorius narismagnus***	SE	H (18)	CR	NS
*Thorius pennatulus***	SE	H (15)	EN	Pr
*Thorius spilogaster***	SE	H (17)	CR	NS
*Thorius troglodytes***	SE	H (16)	EN	Pr
Notophthalmus meridionalis	NE3	M (12)	EN	P
Siren intermedia	NE3	M (12)	LC	A
Dermophis mexicanus	NE4	M (11)	LC	Pr
Crocodylus moreletii	NE4	M (13)	LC	Pr
*Abronia chiszari***	SE	H (17)	EN	P
*Abronia graminea**	CE	H (15)	EN	A
*Abronia reidi***	SE	H (18)	DD	P

Table 8 (continued). Distributional and conservation status measures for members of the herpetofauna of Veracruz, Mexico. Distributional Status: CE = endemic to country of Mexico; SE = endemic to state of Veracruz; NE = not endemic to state or country; and NN = non-native. The numbers suffixed to the NE category signify the distributional categories developed by Wilson et al. (2017) and implemented in the taxonomic list at the *Mesoamerican Herpetology* website (http://www.mesoamericanherpetology.com), as follows: 3 = species distributed only in Mexico and the United States; 4 = species found only in Mexico and Central America; 6 = species ranging from Mexico to South America; 7 = species ranging from the United States to Central America; 8 = species ranging from the United States to South America; and 9 = Oceanic species. Environmental Vulnerability Scores (taken from Wilson et al. 2013a,b): low (L) vulnerability species (EVS 3–9); medium (M) vulnerability species (EVS 10–13); and high (H) vulnerability species (EVS 14–19). IUCN categorization: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; and NE = Not Evaluated. SEMARNAT Status: A = Threatened; P = Endangered; Pr = Special Protection; and NS = No Status. See Alvarado-Díaz et al. (2013), Johnson et al. (2015a), and Mata-Silva et al. (2015) for explanations of the EVS, IUCN, and SEMARNAT rating systems.

Taxon	Distributional status	Environmental Vulnerability Category (score)	IUCN categorization	SEMARNAT status
*Abronia taeniata**	CE	H (15)	VU	Pr
*Barisia imbricata**	CE	H (14)	LC	Pr
Gerrhonotus liocephalus	NE3	L (6)	LC	Pr
*Gerrhonotus ophiurus**	CE	M (12)	LC	NS
*Mesaspis antauges***	SE	H (16)	DD	Pr
*Ophisaurus ceroni***	SE	H (14)	EN	A
*Ophisaurus incomptus**	CE	H (15)	NE	P
Basiliscus vittatus	NE4	L (7)	LC	NS
Corytophanes hernandesii	NE4	M (13)	LC	Pr
Laemanctus longipes	NE4	L (9)	NE	Pr
Laemanctus serratus	NE4	L (8)	LC	Pr
*Norops alvarezdeltoroi**	CE	H (17)	DD	NS
*Norops barkeri**	CE	H (15)	VU	Pr
Norops beckeri	NE4	M (12)	NE	NS
Norops biporcatus	NE6	M (10)	NE	Pr
*Norops compressicauda**	CE	H (15)	LC	NS
*Norops cymbops**	CE	H (17)	DD	A
*Norops duellmani***	SE	H (17)	DD	Pr
Norops laeviventris	NE4	L (9)	NE	NS
Norops lemurinus	NE4	L (8)	NE	NS
*Norops naufragus**	CE	M (13)	VU	Pr
Norops petersii	NE4	L (9)	NE	NS
*Norops purpuronectes**	CE	H (16)	NE	NS
Norops rodriguezii	NE4	M (10)	NE	NS
*Norops sagrei****	NN	—	—	—
*Norops schiedii***	SE	H (16)	DD	Pr
Norops sericeus	NE4	L (8)	NE	NS
Norops tropidonotus	NE4	L (9)	NE	NS
Norops uniformis	NE4	M (13)	NE	NS
*Anelytropsis papillosus**	CE	M (10)	LC	A
*Celestus enneagrammus**	CE	H (14)	LC	Pr
*Celestus ingridae***	SE	H (17)	DD	NS
*Celestus legnotus**	CE	H (14)	LC	NS
Celestus rozellae	NE4	M (13)	NT	Pr
Coleonyx elegans	NE4	L (9)	LC	A
*Hemidactylus frenatus****	NN	—	—	—
*Hemidactylus mabouia****	NN	—	—	—
*Hemidactylus turcicus****	NN	—	—	—
Ctenosaura acanthura	NE4	M (12)	NE	Pr
Iguana iguana	NE6	M (12)	NE	Pr
Marisora lineola	NE4	M (10)	NE	NS
Holbrookia propinqua	NE3	H (15)	LC	NS

Table 8 (continued). Distributional and conservation status measures for members of the herpetofauna of Veracruz, Mexico. Distributional Status: CE = endemic to country of Mexico; SE = endemic to state of Veracruz; NE = not endemic to state or country; and NN = non-native. The numbers suffixed to the NE category signify the distributional categories developed by Wilson et al. (2017) and implemented in the taxonomic list at the *Mesoamerican Herpetology* website (http://www.mesoamericanherpetology.com), as follows: 3 = species distributed only in Mexico and the United States; 4 = species found only in Mexico and Central America; 6 = species ranging from Mexico to South America; 7 = species ranging from the United States to Central America; 8 = species ranging from the United States to South America; and 9 = Oceanic species. Environmental Vulnerability Scores (taken from Wilson et al. 2013a,b): low (L) vulnerability species (EVS 3–9); medium (M) vulnerability species (EVS 10–13); and high (H) vulnerability species (EVS 14–19). IUCN categorization: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; and NE = Not Evaluated. SEMARNAT Status: A = Threatened; P = Endangered; Pr = Special Protection; and NS = No Status. See Alvarado-Díaz et al. (2013), Johnson et al. (2015a), and Mata-Silva et al. (2015) for explanations of the EVS, IUCN, and SEMARNAT rating systems.

Taxon	Distributional status	Environmental Vulnerability Category (score)	IUCN categorization	SEMARNAT status
*Phrynosoma braconnieri**	CE	H (15)	LC	Pr
*Phrynosoma orbiculare**	CE	M (12)	LC	A
*Sceloporus aeneus**	CE	M (13)	LC	NS
*Sceloporus aureolus**	CE	H (15)	NE	NS
*Sceloporus bicanthalis**	CE	M (13)	LC	NS
Sceloporus cyanogenys	NE3	M (13)	NE	NS
*Sceloporus formosus**	CE	H (15)	LC	NS
Sceloporus grammicus	NE3	L (9)	LC	Pr
Sceloporus internasalis	NE4	M (11)	LC	NS
*Sceloporus jalapae**	CE	M (13)	LC	NS
*Sceloporus megalepidurus**	CE	H (14)	VU	Pr
*Sceloporus mucronatus**	CE	M (13)	LC	NS
*Sceloporus salvini**	CE	H (15)	DD	A
*Sceloporus scalaris**	CE	M (12)	LC	NS
Sceloporus serrifer	NE4	L (6)	LC	NS
*Sceloporus spinosus**	CE	M (12)	LC	NS
Sceloporus teapensis	NE4	M (13)	LC	NS
*Sceloporus torquatus**	CE	M (11)	LC	NS
Sceloporus variabilis	NE4	L (5)	LC	NS
*Plestiodon brevirostris**	CE	M (11)	LC	NS
*Plestiodon copei**	CE	H (14)	LC	Pr
*Plestiodon lynxe**	CE	M (10)	LC	Pr
Plestiodon sumichrasti	NE4	M (12)	NE	NS
Plestiodon tetragrammus	NE3	M (12)	LC	NS
Gonatodes albogularis	NE6	M (11)	NE	Pr
Sphaerodactylus glaucus	NE4	M (12)	LC	Pr
Scincella cherriei	NE4	L (8)	NE	NS
*Scincella gemmingeri**	CE	M (11)	LC	Pr
*Scincella silvicola**	CE	M (12)	LC	A
*Aspidoscelis costata**	CE	M (11)	LC	Pr
Aspidoscelis deppii	NE4	L (8)	LC	NS
Aspidoscelis gularis	NE3	L (9)	LC	NS
*Aspidoscelis guttatus**	CE	M (12)	LC	NS
*Holcosus amphigrammus**	CE	M (11)	NE	NS
Lepidophyma flavimaculatum	NE4	L (8)	LC	Pr
*Lepidophyma pajapanense**	CE	M (13)	LC	Pr
*Lepidophyma sylvaticum**	CE	M (11)	LC	Pr
*Lepidophyma tuxtlae**	CE	M (11)	DD	A
*Lepidophyma zongolica**	CE	H (16)	NE	NS
*Xenosaurus grandis**	CE	L (9)	VU	Pr
*Xenosaurus rectocollaris**	CE	H (16)	LC	NS
*Xenosaurus tzacualtipantecus**	CE	H (17)	NE	NS

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Taxon	Distributional status	Environmental Vulnerability Category (score)	IUCN categorization	SEMARNAT status
Boa imperator	NE6	M (10)	NE	NS
Coluber constrictor	NE7	M (10)	LC	A
*Conopsis acuta**	CE	H (14)	NE	NS
*Conopsis lineata**	CE	M (13)	LC	NS
*Conopsis nasus**	CE	M (11)	LC	NS
Dendrophidion vinitor	NE4	M (13)	LC	NS
Drymarcon melanurus	NE6	L (6)	LC	NS
Drymobius chloroticus	NE4	L (8)	LC	NS
Drymobius margaritiferus	NE8	L (6)	NE	NS
*Ficimia olivacea**	CE	L (9)	NE	NS
Ficimia publia	NE4	L (9)	NE	NS
Ficimia streckeri	NE3	M (12)	LC	NS
*Ficimia variegata**	CE	H (14)	DD	NS
Lampropeltis polyzona	NE6	L (8)	NE	NS
Lampropeltis triangulum	NE3	L (9)	NE	A
Leptophis ahaetulla	NE6	M (10)	NE	Pr
Leptophis mexicanus	NE4	L (6)	LC	A
Masticophis flagellum	NE3	L (8)	LC	A
Masticophis mentovarius	NE6	L (6)	LC	A
Masticophis schotti	NE3	M (13)	LC	NS
Mastigodryas melanolomus	NE4	L (6)	LC	NS
Oxybelis aeneus	NE8	L (5)	NE	NS
Oxybelis fulgidus	NE6	L (9)	NE	NS
Pantherophis emoryi	NE3	M (13)	LC	NS
Phrynonax poecilonotus	NE6	M (10)	LC	NS
*Pituophis deppei**	CE	H (14)	LC	A
Pituophis lineaticollis	NE4	L (8)	LC	NS
Pseudelaphe flavirufa	NE4	M (10)	LC	NS
*Salvadora bairdi**	CE	H (15)	LC	Pr
Salvadora grahamiae	NE3	M (10)	LC	NS
Senticolis triaspis	NE7	L (6)	LC	NS
Spilotes pullatus	NE6	L (6)	NE	NS
Stenorrhina degenhardtii	NE6	L (9)	NE	NS
Stenorrhina freminvillii	NE4	L (7)	NE	NS
*Tantilla bocourti**	CE	L (9)	LC	NS
Tantilla rubra	NE4	L (5)	LC	Pr
Tantilla schistosa	NE4	L (8)	LC	NS
*Tantilla shawi**	CE	H (15)	EN	Pr
*Tantilla slavensi***	SE	H (14)	DD	Pr
Tantillita lintoni	NE4	M (12)	LC	Pr
Trimorphodon biscutatus	NE4	L (7)	NE	NS
*Trimoprhodon tau**	CE	M (13)	LC	NS

Table 8 (continued). Distributional and conservation status measures for members of the herpetofauna of Veracruz, Mexico. Distributional Status: CE = endemic to country of Mexico; SE = endemic to state of Veracruz; NE = not endemic to state or country; and NN = non-native. The numbers suffixed to the NE category signify the distributional categories developed by Wilson et al. (2017) and implemented in the taxonomic list at the *Mesoamerican Herpetology* website (http://www.mesoamericanherpetology.com), as follows: 3 = species distributed only in Mexico and the United States; 4 = species found only in Mexico and Central America; 6 = species ranging from Mexico to South America; 7 = species ranging from the United States to Central America; 8 = species ranging from the United States to South America; and 9 = Oceanic species. Environmental Vulnerability Scores (taken from Wilson et al. 2013a,b): low (L) vulnerability species (EVS 3–9); medium (M) vulnerability species (EVS 10–13); and high (H) vulnerability species (EVS 14–19). IUCN categorization: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; and NE = Not Evaluated. SEMARNAT Status: A = Threatened; P = Endangered; Pr = Special Protection; and NS = No Status. See Alvarado-Díaz et al. (2013), Johnson et al. (2015a), and Mata-Silva et al. (2015) for explanations of the EVS, IUCN, and SEMARNAT rating systems.

Taxon	Distributional status	Environmental Vulnerability Category (score)	IUCN categorization	SEMARNAT status
Adelphicos quadrivirgatum	NE4	M (10)	LC	Pr
Adelphicos visoninum	NE4	L (8)	LC	NS
Amastridium sapperi	NE4	M (10)	NE	NS
*Chersodromus liebmanni**	CE	M (12)	LC	Pr
Clelia scytalina	NE4	M (13)	NE	NS
Coniophanes bipunctatus	NE4	L (9)	LC	NS
Coniophanes fissidens	NE6	L (7)	NE	NS
Coniophanes imperialis	NE7	L (8)	LC	NS
Coniophanes quinquevittatus	NE4	M (13)	LC	NS
*Coniophanes taeniatus**	CE	H (15)	NE	NS
Conophis lineatus	NE4	L (9)	LC	NS
*Conophis morai***	SE	H (17)	DD	NS
Diadophis punctatus	NE3	L (4)	LC	NS
*Geophis bicolor**	CE	H (15)	DD	Pr
*Geophis blanchardi**	CE	H (15)	DD	Pr
Geophis carinosus	NE4	L (8)	LC	NS
*Geophis chalybeus***	SE	H (15)	DD	Pr
*Geophis juliai***	SE	M (13)	VU	NS
*Geophis lorancai**	CE	H (14)	NE	NS
*Geophis mutitorques**	CE	M (13)	LC	Pr
*Geophis semidoliatus**	CE	M (13)	LC	NS
Imantodes cenchoa	NE6	L (6)	NE	Pr
Imantodes gemmistratus	NE6	L (6)	NE	Pr
Leptodeira frenata	NE4	M (12)	LC	NS
Leptodeira maculata	NE4	L (7)	LC	Pr
Leptodeira polysticta	NE4	L (8)	NE	NS
Leptodeira septentrionalis	NE8	L (8)	NE	NS
Ninia diademata	NE4	L (9)	LC	NS
Ninia sebae	NE4	L (4)	LC	NS
Oxyrhopus petolarius	NE6	H (14)	NE	NS
Pliocercus elapoides	NE4	M (10)	LC	NS
*Rhadinaea cuneata**	CE	H (15)	DD	Pr
Rhadinaea decorata	NE6	L (9)	LC	NS
*Rhadinaea forbesi***	SE	H (15)	DD	Pr
*Rhadinaea fulvivittis**	CE	M (11)	VU	NS
*Rhadinaea macdougalli**	CE	M (12)	DD	Pr
*Rhadinaea marcellae**	CE	M (12)	EN	Pr
*Rhadinaea quinquelineata**	CE	H (15)	DD	Pr
*Rhadinella schistosa**	CE	M (13)	LC	NS
Sibon dimidiatus	NE4	M (10)	LC	NS
*Sibon linearis***	SE	H (16)	DD	NS
Sibon nebulatus	NE6	L (5)	NE	NS

Table 8 (continued). Distributional and conservation status measures for members of the herpetofauna of Veracruz, Mexico. Distributional Status: CE = endemic to country of Mexico; SE = endemic to state of Veracruz; NE = not endemic to state or country; and NN = non-native. The numbers suffixed to the NE category signify the distributional categories developed by Wilson et al. (2017) and implemented in the taxonomic list at the *Mesoamerican Herpetology* website (http://www.mesoamericanherpetology.com), as follows: 3 = species distributed only in Mexico and the United States; 4 = species found only in Mexico and Central America; 6 = species ranging from Mexico to South America; 7 = species ranging from the United States to Central America; 8 = species ranging from the United States to South America; and 9 = Oceanic species. Environmental Vulnerability Scores (taken from Wilson et al. 2013a,b): low (L) vulnerability species (EVS 3–9); medium (M) vulnerability species (EVS 10–13); and high (H) vulnerability species (EVS 14–19). IUCN categorization: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; and NE = Not Evaluated. SEMARNAT Status: A = Threatened; P = Endangered; Pr = Special Protection; and NS = No Status. See Alvarado-Díaz et al. (2013), Johnson et al. (2015a), and Mata-Silva et al. (2015) for explanations of the EVS, IUCN, and SEMARNAT rating systems.

Taxon	Distributional status	Environmental Vulnerability Category (score)	IUCN categorization	SEMARNAT status
Tretanorhinus nigroluteus	NE4	M (10)	NE	NS
Tropidodipsas fasciata	NE4	M (13)	NE	NS
Tropidodipsas sartorii	NE4	L (9)	LC	Pr
Xenodon rabdocephalus	NE6	M (13)	NE	NS
*Micrurus diastema**	CE	L (8)	LC	Pr
Micrurus elegans	NE4	M (13)	LC	Pr
*Micrurus limbatus***	SE	H (17)	LC	Pr
Micrurus tener	NE3	M (11)	LC	NS
Epictia phenops	NE4	L (6)	NE	NS
*Epictia resetari**	CE	M (13)	NE	NS
Rena dulcis	NE3	M (13)	LC	NS
*Rena myopica**	CE	M (13)	LC	NS
Nerodia rhombifer	NE3	M (10)	LC	NS
Storeria dekayi	NE7	L (7)	LC	NS
*Storeria storerioides**	CE	M (11)	LC	NS
*Thamnophis chrysocephalus**	CE	H (14)	LC	A
*Thamnophis conanti**	CE	H (17)	NE	NS
Thamnophis cyrtopsis	NE7	L (7)	LC	A
Thamnophis eques	NE3	L (8)	LC	A
*Thamnophis godmani**	CE	H (14)	LC	A
Thamnophis marcianus	NE7	M (10)	NE	A
Thamnophis proximus	NE7	L (7)	NE	A
*Thamnophis pulchrilatus**	CE	H (15)	LC	NS
*Thamnophis scalaris**	CE	H (14)	LC	A
*Thamnophis scaliger**	CE	H (15)	VU	A
*Thamnophis sumichrasti**	CE	H (15)	LC	A
Scaphiodontophis annulatus	NE4	M (11)	NE	NS
Amerotyphlops tenuis	NE4	M (11)	LC	NS
*Virgotyphlops braminus****	NN	—	—	—
*Agkistrodon taylori**	CE	H (17)	LC	A
Bothrops asper	NE6	M (12)	NE	NS
*Cerrophidion petlalcalensis**	CE	H (18)	DD	NS
*Crotalus aquilus**	CE	H (16)	LC	Pr
Crotalus atrox	NE3	L (9)	LC	Pr
*Crotalus intermedius**	CE	H (15)	LC	A
*Crotalus mictlantecuhtli***	SE	H (16)	NE	NS
Crotalus molossus	NE3	L (8)	LC	Pr
*Crotalus polystictus**	CE	H (16)	LC	Pr
*Crotalus ravus**	CE	H (14)	LC	A
Crotalus scutulatus	NE3	M (11)	LC	Pr
*Crotalus totonacus**	CE	H (17)	NE	NS
*Crotalus triseriatus**	CE	H (16)	LC	NS

Table 8 (continued). Distributional and conservation status measures for members of the herpetofauna of Veracruz, Mexico. Distributional Status: CE = endemic to country of Mexico; SE = endemic to state of Veracruz; NE = not endemic to state or country; and NN = non-native. The numbers suffixed to the NE category signify the distributional categories developed by Wilson et al. (2017) and implemented in the taxonomic list at the *Mesoamerican Herpetology* website (http://www.mesoamericanherpetology.com), as follows: 3 = species distributed only in Mexico and the United States; 4 = species found only in Mexico and Central America; 6 = species ranging from Mexico to South America; 7 = species ranging from the United States to Central America; 8 = species ranging from the United States to South America; and 9 = Oceanic species. Environmental Vulnerability Scores (taken from Wilson et al. 2013a,b): low (L) vulnerability species (EVS 3–9); medium (M) vulnerability species (EVS 10–13); and high (H) vulnerability species (EVS 14–19). IUCN categorization: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; and NE = Not Evaluated. SEMARNAT Status: A = Threatened; P = Endangered; Pr = Special Protection; and NS = No Status. See Alvarado-Díaz et al. (2013), Johnson et al. (2015a), and Mata-Silva et al. (2015) for explanations of the EVS, IUCN, and SEMARNAT rating systems.

Taxon	Distributional status	Environmental Vulnerability Category (score)	IUCN categorization	SEMARNAT status
*Metlapilcoatlus nummifer**	CE	M (13)	LC	A
Metlapilcoatlus olmec	NE4	H (15)	LC	A
*Ophryacus smaragdinus**	CE	H (14)	NE	NS
*Ophryacus undulatus**	CE	H (15)	VU	Pr
Caretta caretta	NE9	—	EN	P
Chelonia mydas	NE9	—	EN	P
Eretmochelys imbricata	NE9	—	CR	P
Lepidochelys kempii	NE9	—	CR	P
Chelydra rossignonii	NE4	H (17)	VU	NS
Dermatemys mawii	NE4	H (17)	CR	P
Dermochelys coriacea	NE9	—	VU	P
*Terrapene mexicana**	CE	H (19)	NE	NS
*Trachemys scripta****	NN	—	—	—
Trachemys venusta	NE6	H (19)	VU	NS
Rhinoclemmys areolata	NE4	M (13)	NT	A
Kinosternon acutum	NE4	H (14)	NT	Pr
Kinosternon flavescens	NE3	M (12)	LC	NS
*Kinosternon herrerai**	CE	H (14)	NT	Pr
Kinosternon leucostomum	NE6	M (10)	NE	Pr
Kinosternon scorpioides	NE6	M (10)	NE	Pr
Claudius angustatus	NE4	H (14)	NT	P
Staurotypus triporcatus	NE4	H (14)	NT	A
Gopherus berlandieri	NE3	H (18)	LC	A

state herpetofaunas, the largest number of species lies in the country endemic category, including Michoacán (Alvarado-Díaz et al. 2013), Nayarit (Woolrich-Piña et al. 2016), Jalisco (Cruz-Sáenz et al. 2017), Puebla (Woolrich-Piña et al. 2017), and Hidalgo (Ramírez-Bautista et al. 2020).

In the 11 previous MCS entries, the numbers of state endemic species vary significantly from one in Nayarit and Nuevo León (Woolrich-Piña et al. 2016; Nevárez-de los Reyes et al. 2016, respectively) to 93 in Oaxaca (Mata-Silva et al. 2015). The number of state endemics in Veracruz lies below the mid-point in this range at 44 (Table 9). Half of these 44 species (22) are plethodontid salamanders of the genera *Aquiloeurycea* (one species), *Chiropterotriton* (six), *Isthmura* (two), *Parvimolge* (one), *Pseudoeurycea* (four), and *Thorius* (eight). The remaining species are anurans (seven species) and squamates (15).

As noted above, in some cases in the MCS the number of non-endemic species exceeds that of the country endemics, whereas in other cases the situation is reversed. So, the ratio of non-endemics to country endemics varies considerably. The ratios in which the number of non-endemic species exceeds that of the country endemic species range from 1.12 in the case of Oaxaca (Mata-Silva et al. 2015) to 127.0 in the Yucatan Peninsula (González-Sánchez et al. 2017). The ratios in which the number of country endemic species supersedes that of the non-endemics vary from 0.53 in the case of Jalisco to 0.88 in Hidalgo. As expected, the nature of this ratio depends on the proximity of the given Mexican state or region to either the USA or to Central America. In the case of the three MCS states that border the USA, the ratios are 3.22 (100/31 in Coahuila; Lazcano et al. 2019), 2.44 (95/39 in Nuevo León; Nevárez-de los Reyes et al. 2016), and 2.43 (119/49 in Tamaulipas; Terán-

No. 33. *Leptodeira maculata* (Hallowell, 1861). The Banded Cat-eyed Snake is a non-endemic species distributed from southern Tamaulipas along the Atlantic versant and from southern Sinaloa on the Pacific versant southward to Chiapas and western Guatemala (Daza et al. 2009). This individual was located at Jonotal, in the municipality of Las Vigas de Ramírez. Wilson et al. (2013b) calculated its EVS as 7, placing it in the middle of the low vulnerability category. Its conservation status has been assessed as Least Concern by the IUCN, and as Special Protection (Pr) by SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 34. *Pliocercus elapoides* (Cope, 1860). The Variegated False Coralsnake is a non-endemic species occurring at low and moderate elevations (up to about 2,000 m) on the Atlantic slope from southern Tamaulipas, and on the Pacific from western Oaxaca, southward to western Honduras and El Salvador. In the Yucatán Peninsula, the species is known only from the base, in the south, and from the north (Heimes 2016). This individual was encountered at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013b) determined its EVS as 10, placing it in the lower portion of the medium vulnerability category. Its conservation status has been assessed as Least Concern by the IUCN, and this species is not listed by SEMARNAT. *Photo by Elí García-Padilla.*

No. 35. *Bothrops asper* (Garman, 1883). The Terciopelo is a non-endemic snake ranging from southwestern Tamaulipas to coastal Venezuela on the Atlantic versant, and from Costa Rica to southern Ecuador on the Pacific versant, with a disjunct population occurring in southern Chiapas and adjacent Guatemala (Lemos-Espinal and Dixon 2013). This individual was found at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013b) determined its EVS as 12, placing it in the upper portion of the medium vulnerability category. Its conservation status has not been determined by either the IUCN or SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 36. *Cerrophidion petlalcalensis* Lopez-Luna, Vogt, and Torre-Loranca, 1999. The Cerro Petlalcala Montane Pitviper is a country endemic species ranging at the type locality in the Cerro Petlalcala, in west-central Veracruz at elevations from 2,100 to 2,300 m (López-Luna et al. 1999). This species also is known from the municipalities of Atlahuilco, Los Reyes, and Tequila in Veracruz, and in Oaxaca from the Sierra Mazateca (De La Torre-Loranca et al. 2019). This individual was found at San Andrés Tenejapan, in the municipality of the same name. Wilson et al. (2013b) calculated its EVS at 18, placing it in the upper portion of the high vulnerability category. Its conservation status has been assessed as Data Deficient by the IUCN, and this species is not listed by SEMARNAT. *Photo by René Ávalos-Vela*.

Table 9. Summary of the distributional status of herpetofaunal families in Veracruz, Mexico.

Family	Number of species	Distributional status			
		Non-endemic (NE)	Country Endemic (CE)	State Endemic (SE)	Non-native (NN)
Bufonidae	9	4	4	1	—
Centrolenidae	1	1	—	—	—
Craugastoridae	11	4	5	2	—
Eleutherodactylidae	7	2	3	1	1
Hylidae	29	10	16	3	—
Leptodactylidae	3	3	—	—	—
Microhylidae	3	3	—	—	—
Phyllomedusidae	2	2	—	—	—
Ranidae	8	4	3	—	1
Rhinophrynidae	1	1	—	—	—
Scaphiopodidae	2	2	—	—	—
Subtotal	**76**	**36**	**31**	**7**	**2**
Ambystomatidae	1	—	1	—	—
Plethodontidae	42	3	17	22	—
Salamandridae	1	1	—	—	—
Sirenidae	1	1	—	—	—
Subtotal	**45**	**5**	**18**	**22**	**—**
Dermophiidae	1	1	—	—	—
Subtotal	**1**	**1**	**—**	**—**	**—**
Total	**122**	**42**	**49**	**29**	**2**
Crocodylidae	1	1	—	—	—
Subtotal	**1**	**1**	**—**	**—**	**—**
Anguidae	10	1	5	4	—
Corytophanidae	4	4	—	—	—
Dactyloidae	18	9	6	2	1
Dibamidae	1	—	1	—	—
Diploglossidae	4	1	2	1	—
Eublepharidae	1	1	—	—	—
Gekkonidae	3	—	—	—	3
Iguanidae	2	2	—	—	—
Mabuyidae	1	1	—	—	—
Phrynosomatidae	20	7	13	—	—
Scincidae	5	2	3	—	—
Sphaerodactylidae	2	2	—	—	—
Sphenomorphidae	3	1	2	—	—
Teiidae	5	2	3	—	—
Xantusiidae	5	1	4	—	—
Xenosauridae	3	—	3	—	—
Subtotal	**87**	**34**	**42**	**7**	**4**
Boidae	1	1	—	—	—
Colubridae	41	30	10	1	—
Dipsadidae	46	28	13	5	—
Elapidae	4	2	1	1	—
Leptotyphlopidae	4	2	2	—	—
Natricidae	14	6	8	—	—
Sibynophiidae	1	1	—	—	—
Typhlopidae	2	1	—	—	1
Viperidae	17	5	11	1	—
Subtotal	**130**	**76**	**45**	**8**	**1**
Cheloniidae	4	4	—	—	—
Chelydridae	1	1	—	—	—
Dermatemyidae	1	1	—	—	—
Dermochelyidae	1	1	—	—	—
Emydidae	3	1	1	—	1
Geoemydidae	1	1	—	—	—
Kinosternidae	5	4	1	—	—
Staurotypidae	2	2	—	—	—
Testudinidae	1	1	—	—	—
Subtotal	**19**	**16**	**2**	**—**	**1**
Total	**237**	**127**	**89**	**15**	**6**
Sum total	**359**	**169**	**138**	**44**	**8**

Table 10. Summary of the distributional categories of the herpetofaunal families which include non-endemic species in Veracruz, Mexico. The categorizations are: MXUS = species distributed only in Mexico and the United States (except perhaps for a few also found in Canada); MXCA = species found only in Mexico and Central America; MXSA = species ranging from Mexico to South America; USCA = species ranging from the United States to Central America (except perhaps for a few also found in the Antilles); and USSA = species ranging from the United States to South America.

Family	Number of non-endemic species	Distributional status					
		MXUS species (3)	MXCA species (4)	MXSA species (6)	USCA species (7)	USSA species (8)	OCEA species (9)
Bufonidae	4	1	2	—	1	—	—
Centrolenidae	1	—	1	—	—	—	—
Craugastoridae	4	—	4	—	—	—	—
Eleutherodactylidae	2	1	1	—	—	—	—
Hylidae	10	1	5	3	1	—	—
Leptodactylidae	3	—	—	2	—	1	—
Microhylidae	3	—	2	—	1	—	—
Phyllomedusidae	2	—	1	1	—	—	—
Ranidae	4	1	2	1	—	—	—
Rhinophrynidae	1	—	—	—	1	—	—
Scaphiopodidae	2	2	—	—	—	—	—
Subtotal	**36**	**6**	**18**	**7**	**4**	**1**	**—**
Plethodontidae	3	—	3	—	—	—	—
Salamandridae	1	1	—	—	—	—	—
Sirenidae	1	1	—	—	—	—	—
Subtotal	**5**	**2**	**3**	**—**	**—**	**—**	**—**
Dermophiidae	1	—	1	—	—	—	—
Subtotal	**1**	**—**	**1**	**—**	**—**	**—**	**—**
Total	**42**	**8**	**22**	**7**	**4**	**1**	**—**
Crocodylidae	1	—	1	—	—	—	—
Subtotal	**1**	**—**	**1**	**—**	**—**	**—**	**—**
Anguidae	1	1	—	—	—	—	—
Corytophanidae	4	—	4	—	—	—	—
Dactyloidae	9	—	8	1	—	—	—
Diploglossidae	1	—	1	—	—	—	—
Eublepharidae	1	—	1	—	—	—	—
Iguanidae	2	—	1	1	—	—	—
Mabuyidae	1	—	1	—	—	—	—
Phrynosomatidae	7	3	4	—	—	—	—
Scincidae	2	1	1	—	—	—	—
Sphaerodactylidae	2	—	1	1	—	—	—
Sphenomorphidae	1	—	1	—	—	—	—
Teiidae	2	1	1	—	—	—	—
Xantusiidae	1	—	1	—	—	—	—
Subtotal	**34**	**6**	**25**	**3**	**—**	**—**	**—**
Boidae	1	—	—	1	—	—	—
Colubridae	30	6	12	8	2	2	—
Dipsadidae	28	1	18	7	1	1	—
Elapidae	2	1	1	—	—	—	—
Leptotyphlopidae	2	1	1	—	—	—	—
Natricidae	6	2	—	—	4	—	—
Sibynophiidae	1	—	1	—	—	—	—
Typhlopidae	1	—	1	—	—	—	—
Viperidae	5	3	1	1	—	—	—
Subtotal	**76**	**13**	**35**	**17**	**7**	**3**	**—**
Cheloniidae	4	—	—	—	—	—	4
Chelydridae	1	—	1	—	—	—	—
Dermatemyidae	1	—	1	—	—	—	—
Dermochelyidae	1	—	—	—	—	—	1
Emydidae	1	—	—	1	—	—	—
Geoemydidae	1	—	1	—	—	—	—
Kinosternidae	4	1	1	2	—	—	—
Staurotypidae	2	—	2	—	—	—	—
Testudinidae	1	1	—	—	—	—	—
Subtotal	**16**	**2**	**6**	**3**	**—**	**—**	**5**
Total	**127**	**21**	**67**	**23**	**7**	**3**	**5**
Sum Total	**169**	**29**	**89**	**30**	**11**	**4**	**5**

Juárez et al. 2016). In the case of the states or the region bordering Central America, the ratios are 8.38 (268/32 in Chiapas; Johnson et al. 2015a) and 127.00 (127/1 in the Yucatan Peninsula; González-Sánchez et al. 2017). The extreme figure for the Yucatan Peninsula is due, in part, to this region of Mexico being confluent with the portion of the peninsula that lies in Central America, principally northern Guatemala. This MCS area is the only one in which the number of country endemics is overwhelmed by the number of regional endemics, i.e., one compared to 11 (González-Sánchez et al. 2017). As indicated above, Veracruz is a state in which the number of non-endemic species is greater than that of the country endemics, so the ratio of the former to the latter is 169/138, or 1.22.

Eight non-native species currently reside in Veracruz: *Eleutherodactylus planirostris*, *Lithobates catesbeianus*, *Norops sagrei*, *Hemidactylus frenatus*, *H. mabouia*, *H. turcicus*, *Virgotyphlops braminus,* and *Trachemys scipta*. Two of these species (*H. frenatus* and *I. braminus*) are the most widespread of the non-native species reported in the previous 11 MCS entries, as they have been reported in 11 and 12 states, respectively (González-Sánchez et al. 2017, which covers the three Mexican states of the Yucatan Peninsula).

Wilson et al. (2017) designed a system for categorizing the distribution of the herpetofauna of Mesoamerica, and it was applied to the pertinent categories in this study, with the data summarized in Table 10. As mentioned above, of the 359 total species in Veracruz, 169 are non-endemic, and these 169 taxa were placed in six of the nine categories recognized by Wilson et al. (2017), including MXUS, MXCA, MXSA, USCA, USSA, and OCEA. Given the proximity of Veracruz to Guatemala, in Central America, and the location of the state south of the Tropic of Cancer, understandably the largest number of species is in the MXCA category (89; 52.7%). The next largest number is allocated to the MXSA category (30; 17.8%), followed closely by the number in the MXUS category (29; 17.2%). The remaining 20 species are placed in the USCA (11; 6.5%), USSA (four; 2.4%), and OCEA (five; 3.0%) categories.

Principal Environmental Threats

In this section, we highlight the most significant problems that we believe affect the sustainability of the herpetofaunal populations in Veracruz. As elsewhere in the world, Mexico is subject to many of these problems, and Veracruz is no exception to the countrywide situation. Various negative factors apply here, such as the increasing and unregulated clearing of forests for farming and livestock raising (for grazing areas), the construction of roads, the constant and increasing pollution of bodies of water, emerging diseases, forest fires, and strongly ingrained cultural factors (Cruz-Elizalde et al. 2017; Ramírez-Bautista et al. 2020), and all are caused either directly or indirectly by humans (anthropogenic effects).

Deforestation. The state of Veracruz has a surface area of 71,826 km^2 (INEGI 2011), which represents 3.6% of the area of the country. A high diversity (17 types) of environments is found in the state, and each has a strong degree of deterioration. Currently, exceedingly small areas represent these environments, including evergreen tropical forest (251,505 ha), cloud forest (135,271 ha), deciduous tropical forest (22,843 ha), and sub-deciduous tropical forest (1,432 ha), as each has been converted largely to pastures for livestock grazing (3,254,999 ha; Castillo-Campos et al. 2011). Unfortunately, environmental degradation continues at an accelerated rate, eliminating ~1,200–5,102 ha of natural vegetation cover per year, similar to the situation occurring in other Mexican states (SEMARNAT 2012).

Given the high rate of expansion of grazing areas in Veracruz, the loss of natural habitats affects both the biological communities and human development. The loss of vegetation cover accelerates soil erosion, increases water runoff and the evaporation rates of the bodies of water that serve many local communities, and also impacts all biodiversity, including amphibians and reptiles (Ramírez-Bautista et al. 2014; Cruz-Elizalde et al. 2017).

At the local level, increased deforestation is driven primarily by conversion of the land to agricultural fields and grazing areas, of which the latter are prevalent in Veracruz (Fig. 8). Unfortunately, in the case of agriculture and agroecosystems, deforestation triggers the major clearing of lands (Fig. 8), which are utilized for only one or two years and then abandoned (Ramírez-Bautista et al. 2014). For example, in the southeastern portions of the state, tropical evergreen and tropical deciduous forests most often are damaged by changes in land use when larger trees are removed, thereby eliminating the lower vegetation and leaf litter. The removal of the upper canopy layer strongly affects the diversity of species, including the herpetofauna, which is dependent on specific microclimatic conditions (Ramírez-Bautista et al. 2020). For example, salamanders (e.g., *Bolitoglossa mexicana* and *B. platydactyla*) and anurans (e.g., *Craugastor rhodopis*) inhabit leaf litter. Hylid frogs (e.g., *Dendropsophus ebraccatus* and *Rheohyla miotympanum*) need trees and their associated water sources for all stages of their life cycles. Bodies of water are necessary for kinosternid turtles and ranid frogs to reproduce, as well as for some genera of lizards (e.g., *Abronia*, *Norops*, *Corytophanes*, *Laemanctus*, *Lepidophyma*, and *Xenosaurus*) and snakes (e.g., *Boa, Leptophis, Spilotes, Thamnophis*, *Metlapilcoatlus*, *Bothrops*, and *Ophryacus*) (Ramírez-Bautista et al. 2014; Cruz-Elizalde et al. 2017).

Livestock production. As mentioned above, large sections of land in Veracruz are converted annually into livestock grazing areas (Fig. 9). This activity involves removing the vegetation, often for short-term exploitation (1–2 years). In particular, this situation is evident in cattle producing regions in the central, northern, and southern portions

Fig. 8. *Deforestation*. Recently deforested and burned area converted to cropland in the municipality of Uxpanapa, Gulf Coastal Lowlands, in the southeastern portion of the state, at an elevation of ca. 75 m. *Photo by Ricardo Luria Manzano.*

Fig. 9. *Deforestation*. Conversion of montane perennial forest to cattle pasture at San Andrés Tuxtla, in the municipality of San Andrés Tuxtla, at an elevation of 80 m. *Photo by Christian Berriozabal-Islas.*

Fig. 10. *Deforestation*. Conversion of mangrove forest to exotic grassland in the vicinity of Tumilco, in the municipality of Túxpan. *Photo by Uriel Hernández-Salinas.*

Fig. 11. *Livestock*. Cattle paddock in tropical dry forest in the vicinity of Tumilco, in the municipality of Túxpan. *Photo by Uriel Hernández-Salinas.*

Fig. 12. *Roads*. *Lampropeltis polyzona* found dead on the road in the vicinity of Xico, in the municipality of the same name. *Photo by José Adrián Montiel Veranza.*

Fig. 13. *Pollution of water bodies*. Creek flowing through mangrove forest in an urban area of the city of Veracruz desecrated with non-biodegradable trash, in the municipality of Veracruz. *Photo by Christian Berriozabal-Islas.*

of the state, and causes negative effects on biodiversity, since vast amounts of the native vegetation are destroyed. The soils in grazing areas are prone to erosion and will only support livestock activity for one or two years. As is common throughout Mexico, ranchers then are forced to look elsewhere for new sites to clear at the expense of natural ecosystems (Ramírez-Bautista et al. 2014, 2020; Cruz-Elizalde et al. 2017). Physiographically, the areas most affected are inside the SMO, GCL, and SLT. In the SLT, it is especially disheartening to see how pristine evergreen forests have been converted to pastures. Similar deforestation occurs in arid or semiarid districts, such as in the Perote region, where thousands of hectares of oak, pine, and juniper forests, and cacti and agaves, have been destroyed in areas that today are completely eroded (Magno-Benítez et al. 2016). Obviously, this situation is troubling, since it has dramatically damaged the amphibian and reptile populations in these regions.

Fig. 14. *Myths and other cultural factors.* Illegal killing of a rattlesnake (*Crotalus mictlantecuhtli*) in a fallow crop field in Salmoral, municipality of La Antigua. *Photo by Isaac Ajactle-Tequiliquihua.*

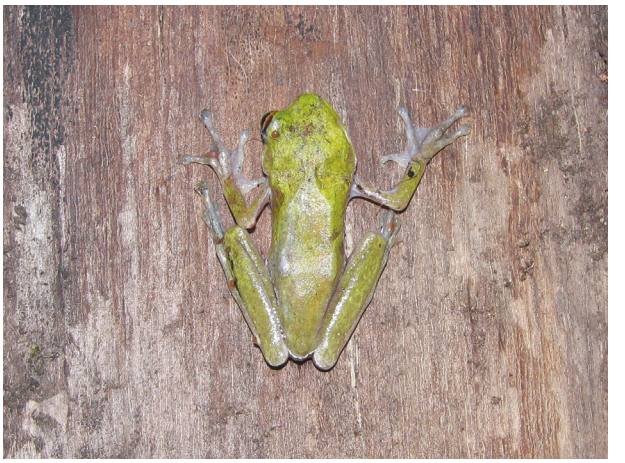

Fig. 15. *Diseases*. Individual of *Rheohyla miotympanum* afflicted with degenerative anophthalmia of the right eye, photographed at Zoncuantla, municipality of Coatepec, Veracruz, near the Río Consolapa or Pixquiac. *Photo by Salvador Guzmán.*

Roads. The government of the state works vigorously on road construction for trade interests without any apparent concern for the destruction of thousands of hectares of pristine vegetation (Cruz-Elizalde et al. 2017; Ramírez-Bautista et al. 2020). State authorities believe that road infrastructure improvements are necessary for economic and social growth, even though these developments bring adverse consequences for biodiversity (Puc-Sánchez et al. 2013). The building of roads not only destroys a considerable number of natural habitats, but the roads also act as physical barriers for many amphibian and reptile species, thereby reducing the connectivity among populations. Another negative factor of roads is vehicle-induced mortality, or "roadkills," which is one of the most visible effects they generate when individuals attempt to cross busy highways during migration, or when they use the pavement for basking (Fig. 12).

Pollution of water bodies. The continuous growth of the human population in Veracruz, and the lack of urban development plans, have exacerbated the improper disposal of waste products (Fig. 13), which in turn has affected water resources, such as rivers and lakes, especially in the GCL, SLT, and SMO regions (Cruz-Elizalde et al. 2017). During the early 20th century in central Veracruz, within the Chiconquiaco region of the SMO, the rivers and lakes near towns contained a high diversity of amphibians (e.g., *Lithobates*) and reptiles (e.g., *Thamnophis*). Today, the water levels of these rivers and lakes have dropped dramatically and the biodiversity has been lost; or if any water remains, the level of detergents is so high that amphibians and reptiles can no longer survive in them. Sewage that ends up in rivers has modified the water properties significantly and caused many frog and turtle populations to disappear from those sites (Ramírez-Bautista et al. 2014; Magno-Benítez et al. 2016). This situation is extremely upsetting, because most people in the villages do not have the basic education to understand the need for maintaining and conserving the local biodiversity. Unfortunately, the authorities that are supposedly assigned to protect the environments of these regions have been ineffective.

Myths and other cultural factors. As in many countries, people's customs are ingrained in their culture, and it is difficult to change their minds about the importance of animals in their ecosystems. In this regard, the people of Veracruz are no exception (Ramírez-Bautista et al. 2014). Two aspects of their culture markedly contribute to the detriment of the herpetofauna of the state: (1) a lack of awareness of the important roles that amphibians and reptiles play in their ecosystems; and (2) the harmful misconceptions that often lead to their persecution, which are maintained and supported by myths (Cruz-Elizalde et al. 2017). For example, many people from the Los Tuxtlas region believe that some species of salamanders (e.g., in the genera *Chiropterotriton* and *Bolitoglossa*) impregnate women, that lizards (of the genera *Abronia*, *Barisia*, *Hemidactylus*, and *Ophisaurus*) are considered venomous, and that all snakes are indiscriminately regarded as venomous, and therefore killed on sight (Fig. 14). In this region, people also believe that all snakes are the products of the devil and must be killed. Although, the consumption of most members of the herpetofauna is not well documented in the state, in some rural communities, anurans (e.g., *Lithobates berlandieri* and *L. vaillanti*) are known to be part of the human diet. In addition, some inhabitants use rattlesnakes for folk medicine, and *Ctenosaura acanthura* and *Iguana* are heavily exploited for commercial purposes (Cruz-Elizalde et al. 2017).

Diseases. Globally, many amphibian populations are disappearing due to chytridiomycosis, caused by the fungus *Batrachochytrium dendrobatidis* (Bd; Rovito et al. 2009; Hernández-Austria 2017). Although this disease has not been reported in the amphibians of Veracruz, it may exist there since it has been detected in more than 50 species of salamanders and anurans in northeastern,

Fig. 16. *Exotic and invasive species.* Originally, this invasive species, *Eleutherodactylus planirostris*, was documented in the state of Veracruz by García-Vinalay et al. (2020). This individual was photographed in Puerto de Veracruz, in the municipality of the same name. *Photo by Madeleine Fernández Teco.*

Fig. 17. *Illegal commerce.* Due to its bright colors and natural beauty, *Abronia graminea* is among one the more persecuted species for the illegal pet trade market in the state of Veracruz. *Photo by Aarón Arias Hernández, Torito Wildlife.*

central, and southeastern Mexico (Mendoza-Almeralla et al. 2015), with members of the families Hylidae and Plethodontidae being the most affected. The records for Bd are concentrated in areas of high amphibian diversity (e.g., the TVB and highlands of Oaxaca and Chiapas; Rovito et al. 2009). One report indicates that Bd is known from anurans in Hidalgo, a state that borders Veracruz, where it was found in the following taxa: *Craugastor rhodopis*, *Lithobates berlandieri*, *L. johni*, and *Rheohyla miotympanum* (Hernández-Austria 2017). Thus, populations of these species in Veracruz might be infected as well (Fig. 15).

Exotic and invasive species. Historically, several exotic herpetofaunal species have been introduced as a result of human activities in Veracruz. Many of them are not offensive to native species, such as lizards of the genus *Hemidactylus* that have seemingly exploited previously empty ecological niches by using microhabitats such as rock crevices, beneath tree bark, and often the walls of buildings. Nonetheless, one introduced amphibian that is known to cause significant harmful effects to native species is the American Bullfrog, *Lithobates catesbeianus*. This frog is considered invasive since it actively feeds on a broad array of prey (González-Sánchez et al. 2021). In other places in Mexico, this species has invaded water sources and caused the local extinctions of fish, anuran amphibians (e.g., *Dryophytes eximius*, *D. plicatus,* and *L. berlandieri*), axolotls (*Ambystoma velasci*), and reptiles (turtle eggs and hatchlings).

Illegal commerce. Illegal trafficking in herpetofauna is a widely prevalent activity worldwide. Many species are trafficked in Mexico, primarily those thought to have medicinal or food value, or which are simply of interest as pets (Cruz-Elizalde et al. 2017). In particular, these factors negatively affect the species richness and distribution of the endemic amphibian and reptiles. As in many other states in Mexico, a high percentage of reptile genera are trafficked in Veracruz, including turtles (*Kinosternon*), lizards (*Abronia*, *Ophisaurus*, *Ctenosaura*, and *Xenosaurus*), and snakes (*Crotalus*, *Boa*, *Lampropeltis*, and *Micrurus*). Many of these are sold as exotic pets (Fig. 17) in the domestic and international markets (Lavín-Murcio and Lazcano 2010; Paredes-García et al. 2011). In southeastern Veracruz, local authorities allow the illegal sale of live herpetofauna, and turtle and iguana eggs, in the markets.

Consequently, governmental authorities at all levels and conservation groups must invest more time and effort in protecting the affected species and the habitats in which they occur. Such efforts are particularly critical in regions that contain species and habitats that already are vulnerable to anthropogenic pressures. Another critical step for authorities is the need to invest in more resources for educating the public on the important roles of herpetofauna in ecosystems. Without these efforts, adequate protection for these species will remain an elusive goal.

Conservation Status

The conservation status of the members of the herpetofauna of Veracruz was evaluated using the same three systems of conservation assessment employed in the previous MCS entries: SEMARNAT (2010), the IUCN Red List (http://iucnredlist.org), and the EVS (Wilson et al. 2013a,b), with the EVS data updated as necessary.

The SEMARNAT System

As noted by Ramírez-Bautista et al. (2020: 91), the SEMARNAT system for assessing conservation status was developed and implemented by the Secretaría del Medio Ambiente y Recursos Naturales of the federal government of Mexico (SEMARNAT 2010). The status ratings for some of the resident herpetofaunal species in Veracruz are given in Table 8, and summarized in Table 11. As also noted by Ramírez-Bautista et al. (2020: 91),

Table 11. SEMARNAT categorizations for the herpetofaunal species found in Veracruz, Mexico, arranged by families. Non-native species are excluded.

Family	Number of species	SEMARNAT categorizations			
		Endangered (P)	Threatened (A)	Special protection (Pr)	No status (NS)
Bufonidae	9	—	—	2	7
Centrolenidae	1	—	—	—	1
Craugastoridae	11	—	—	5	6
Eleutherodactylidae	6	—	—	1	5
Hylidae	29	—	5	6	18
Leptodactylidae	3	—	—	—	3
Microhylidae	3	—	—	2	1
Phyllomedusidae	2	—	—	—	2
Ranidae	7	1	—	3	3
Rhinophrynidae	1	—	—	1	—
Scaphiopodidae	2	—	—	—	2
Subtotal	**74**	**1**	**5**	**20**	**48**
Ambystomatidae	1	—	—	1	—
Plethodontidae	42	—	4	17	21
Salamandridae	1	1	—	—	—
Sirenidae	1	—	1	—	—
Subtotal	**45**	**1**	**5**	**18**	**21**
Dermophiidae	1	—	—	1	—
Subtotal	**1**	**—**	**—**	**1**	**—**
Total	**120**	**2**	**10**	**39**	**69**
Crocodylidae	1	—	—	1	—
Subtotal	**1**	**—**	**—**	**1**	**—**
Anguidae	10	3	2	4	1
Corytophanidae	4	—	—	3	1
Dactyloidae	17	—	1	5	11
Dibamidae	1	—	1	—	—
Diploglossidae	4	—	—	2	2
Eublepharidae	1	—	1	—	—
Iguanidae	2	—	—	2	—
Mabuyidae	1	—	—	—	1
Phrynosomatidae	20	—	2	3	15
Scincidae	5	—	—	2	3
Sphaerodactylidae	2	—	—	2	—
Sphenomorphidae	3	—	1	1	1
Teiidae	5	—	—	1	4
Xantusiidae	5	—	1	3	1
Xenosauridae	3	—	—	1	2
Subtotal	**83**	**3**	**9**	**29**	**42**
Boidae	1	—	—	—	1
Colubridae	41	—	6	6	29
Dipsadidae	46	—	—	15	31
Elapidae	4	—	—	3	1
Leptotyphlopidae	4	—	—	—	4
Natricidae	14	—	9	—	5
Sibynophiidae	1	—	—	—	1
Typhlopidae	1	—	—	—	1
Viperidae	17	—	5	6	6
Subtotal	**129**	**—**	**20**	**30**	**79**
Cheloniidae	4	4	—	—	—
Chelydridae	1	—	—	—	1
Dermatemyidae	1	1	—	—	—
Dermochelyidae	1	1	—	—	—
Emydidae	2	—	—	—	2
Geoemydidae	1	—	1	—	—
Kinosternidae	5	—	—	4	1
Staurotypidae	2	1	1	—	—
Testudinidae	1	—	1	—	—
Subtotal	**18**	**7**	**3**	**4**	**4**
Total	**231**	**10**	**32**	**64**	**125**
Sum Total	**351**	**12**	**42**	**103**	**194**

No. 37. *Metlapilcoatlus nummifer* (Rüppell, 1845). The Jumping Pitviper is a country endemic occurring from San Luis Potosí southward through Hidalgo and west-central Veracruz to northern and southeastern Oaxaca (Lemos-Espinal and Dixon 2013). This individual was located at Los Reyes, in the municipality of the same name. Wilson et al. (2013b) determined its EVS as 13, placing it at the upper limit of the medium vulnerability category. Its conservation status has been evaluated as Least Concern by the IUCN, and as Threatened (A) by SEMARNAT. *Photo by René Ávalos-Vela*.

No. 38. *Metlapilcoatlus olmec* (Pérez-Higareda et al. 1985). The Olmecan Jumping Pitviper is a non-endemic species with a highly disjunct distribution, with populations occurring in the Sierra de Los Tuxtlas of southern Veracruz, the Sierra Atravesada (Cerro Baúl region) of south-eastern Oaxaca, the Mesa de Ocozocoautla of northwestern Chiapas, and some isolated localities in central Guatemala (Purulhá in Baja Verapaz and Sierra de las Minas); its vertical distribution extends from about 530 to at least 1,200 m asl (Heimes 2016). This individual was photographed at Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013b) determined its EVS as 15, placing it in the lower portion of the high vulnerability category. Its conservation status has been evaluated as Least Concern by the IUCN, and this species is not listed by SEMARNAT. *Photo by Elí García-Padilla.*

No. 39. *Ophryacus smaragdinus* Grünwald, Jones, Franz-Chávez, and Ahumada-Carillo, 2015. The Emerald Horned Pitviper is a country endemic species ranging from west-central Veracruz and east-central Hidalgo to northeastern Puebla and north-central Oaxaca (Grünwald et al. 2015). This individual was found at Nogales, in the municipality of the same name. Johnson et al. (2017) calculated its EVS as 14, placing it at the lower limit of the high vulnerability category. Its conservation status has not been evaluated by either the IUCN or SEMARNAT. *Photo by René Ávalos-Vela*.

No. 40. *Ophryacus undulatus* Jan, 1859. The Mexican Horned Pitviper is a country endemic species occurring from west-central Veracruz to southern Oaxaca and central Guerrero (Uetz et al. 2020). This individual was found at Finca Santa Martha, in the municipality of Los Reyes. Wilson et al. (2013b) determined its EVS as 15, placing it in the lower portion of the high vulnerability category. Its conservation status has been assessed as Vulnerable by the IUCN, and as Special Protection (Pr) by SEMARNAT. *Photo by Matthieu Berroneau*.

Table 12. Comparison of the SEMARNAT and distributional categorizations for the herpetofauna of Veracruz, Mexico. Non-native species are excluded.

	SEMARNAT category				
Distributional category	Endangered (P)	Threatened (A)	Special protection (Pr)	No status (NS)	**Total**
Non-endemic species (NE)	8	15	38	108	**169**
Country-endemic species (CE)	2	23	49	64	**138**
State-endemic species (SE)	2	4	16	22	**44**
Total	**12**	**42**	**103**	**194**	**351**

three categories of assessment exist in the SEMARNAT system: Endangered (P), Threatened (A), and Under Special Protection (Pr); while species that remain unassessed in this system are assigned a "No Status" (NS) category (Tables 8 and 11).

The data in Table 11 show that of the 351 native members of the Veracruz herpetofauna, only 157 (44.7%) have been assessed using the SEMARNAT system. Thus, 194 species (55.3%) lack an evaluation based on this system. Of the 157 species that are evaluated, 12 (7.6%) are allocated to the Endangered (P) category, 42 (26.8%) to the Threatened (A) category, and 103 (65.6%) to the Special Protection (Pr) category.

One might wonder whether the deficiencies of applying this system of conservation assessment (i.e., where more than one-half of the native members of the Veracruz herpetofauna remain unassessed) result from an emphasis being placed by SEMARNAT personnel on the species endemic to a given state or the country at large. If so, "then that consideration should be evident by comparison of the SEMARNAT assignments to both distributional categories and to SEMARNAT categories" (Ramírez-Bautista et al. 2020: 91). In order to examine whether such a bias might be evident, these comparisons are allocated in Table 12. These data indicate that of the 12 species allocated to the Endangered (P) category, eight (66.7%) are non-endemics, two (16.7%) are country endemics, and two (16.7%) are state endemics. Of the 42 species placed in the Threatened (A) category, 23 (54.8%) are country endemics, 15 (35.7%) are non-endemics, and four (9.5%) are state endemics. Of the 103 species allotted to the Special Protection (Pr) category, 49 (47.6%) are country endemics, 38 (36.9%) are non-endemics, and 16 (15.5%) are state endemics. Of the 194 species that remain unevaluated, 108 (55.7%) are non-endemics, 64 (33.0%) are country endemics, and 22 (11.3%) are state endemics. Of the total of 182 country and state endemic species, 96 (52.7%) have been allocated to one of the three SEMARNAT categories. In comparison, of the 169 non-endemic species, 61 (36.1%) have been apportioned into one of the three categories. Thus, these data do not demonstrate a clear bias toward the assessment of endemic species, although they indicate that the SEMARNAT system of assessment has not been extended to a sufficient percentage of the Veracruz herpetofauna to be of much value for their conservation action planning. As indicated by the data in Table 12, only 61 of 169 non-endemic species (36.1%), 74 of 138 country endemic species (53.6%), and 22 of 44 state endemic species (50.0%) have been allocated to one of the SEMARNAT categories.

The IUCN System

The IUCN system of conservation assessment can be applied to all organisms at a global level, but primarily has been used for vertebrate animals and flowering plants (Ramírez-Bautista et al. 2020). This system consists of six categories (Table 13), including three so-called "threat categories," i.e., Critically Endangered, Endangered, and Vulnerable; two lesser threat categories, i.e., Near Threatened and Least Concern; and one non-assessed category, i.e., Data Deficient. This last category is applied to species for which too little information about their population status is available to allow for their allocation to one of the other categories. Since it seems that some subset of species is not placed into one of the six above-mentioned categories, here we placed them in a "Not Evaluated" category.

The data for allocating members of the Veracruz herpetofauna to the IUCN categories are shown in Table 8, and summarized in Table 13. The data in the latter table indicate that of the 351 native members of the herpetofauna, 30 (8.5%) are placed in the Critically Endangered (CR) category, 31 (8.8%) in the Endangered (EN) category, and 25 (7.1%) in the Vulnerable (VU) category, for a total of 86 (24.5%) in the "threat categories." Among the lesser threat categories, 11 (3.1%) are apportioned in the Near Threatened (NT) category and 161 (45.9%) in the Least Concern (LC) category, for a total of 172 (49.0%). Finally, 24 species (6.8%) are placed in the Data Deficient (DD) category, and 69 species (19.7%) are Not Evaluated (Table 13).

In order to ascertain the relationship between the application of the IUCN categories and the distributional categories, the data on the correspondence between these two allocations are shown in Table 14. These data demonstrate that of the 182 country and state endemic species, 71 (39.0%) are placed in one of the three threat categories, with most of them (53) allocated to the CR and EN categories. The majority of the 351 native species (161; 45.9%) are apportioned to the LC category,

Table 13. IUCN Red List categorizations for the herpetofaunal families in Veracruz, Mexico. Non-native species are excluded. The three shaded columns to the left are the "threat categories," and the two shaded columns to the right are the categories for which too little information on conservation status exists to allow the taxa to be placed in any other IUCN category, or they have not been evaluated.

Family	Number of species	IUCN Red List categorization						
		Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)	Near Threatened (NT)	Least Concern (LC)	Data Deficient (DD)	Not Evaluated (NE)
Bufonidae	9	2	2	1	—	3	—	1
Centrolenidae	1	—	—	—	—	—	—	1
Craugastoridae	11	1	2	4	2	2	—	—
Eleutherodactylidae	6	—	—	3	—	2	1	—
Hylidae	29	4	4	3	3	12	2	1
Leptodactylidae	3	—	—	—	—	3	—	—
Microhylidae	3	—	—	—	—	3	—	—
Phyllomedusidae	2	1	—	—	—	1	—	—
Ranidae	7	—	1	—	—	5	—	1
Rhinophrynidae	1	—	—	—	—	1	—	—
Scaphiopodidae	2	—	—	—	—	2	—	—
Subtotal	**74**	**8**	**9**	**11**	**5**	**34**	**3**	**4**
Ambystomatidae	1	—	—	—	—	1	—	—
Plethodontidae	42	19	14	2	—	6	—	1
Salamandridae	1	—	1	—	—	—	—	—
Sirenidae	1	—	—	—	—	1	—	—
Subtotal	**45**	**19**	**15**	**2**	—	**8**	—	**1**
Dermophiidae	1	—	—	—	—	1	—	—
Subtotal	**1**	**—**	**—**	—	**—**	**1**	**—**	**—**
Total	**120**	**27**	**24**	**13**	**5**	**43**	**3**	**5**
Crocodylidae	1	—	—	—	—	1	—	—
Subtotal	**1**	**—**	**—**	**—**	**—**	**1**	**—**	**—**
Anguidae	10	—	3	1	—	3	2	1
Corytophanidae	4	—	—	—	—	3	—	1
Dactyloidae	17	—	—	2	—	1	4	10
Dibamidae	1	—	—	—	—	1	—	—
Diploglossidae	4	—	—	—	1	2	1	—
Eublepharidae	1	—	—	—	—	1	—	—
Iguanidae	2	—	—	—	—	—	—	2
Mabuyidae	1	—	—	—	—	—	—	1
Phrynosomatidae	20	—	—	1	—	16	1	2
Scincidae	5	—	—	—	—	4	—	1
Sphaerodactylidae	2	—	—	—	—	1	—	1
Sphenomorphidae	3	—	—	—	—	2	—	1
Teiidae	5	—	—	—	—	4	—	1
Xantusiidae	5	—	—	—	—	3	1	1
Xenosauridae	3	—	—	1	—	1	—	1
Subtotal	**83**	**—**	**3**	**5**	**1**	**42**	**9**	**23**
Boidae	1	—	—	—	—	—	—	1
Colubridae	41	—	1	—	—	25	2	13
Dipsadidae	46	—	1	2	—	20	9	14
Elapidae	4	—	—	—	—	4	—	—
Leptotyphlopidae	4	—	—	—	—	2	—	2
Natricidae	14	—	—	1	—	10	—	3
Sibynophiidae	1	—	—	—	—	—	—	1
Typhlopidae	1	—	—	—	—	1	—	—
Viperidae	17	—	—	1	—	11	1	4
Subtotal	**129**	—	**2**	**4**	**—**	**73**	**12**	**38**
Cheloniidae	4	2	2	—	—	—	—	—
Chelydridae	1	—	—	1	—	—	—	—
Dermatemyidae	1	1	—	—	—	—	—	—
Dermochelyidae	1	—	—	1	—	—	—	—
Emydidae	2	—	—	1	—	—	—	1
Geoemydidae	1	—	—	—	1	—	—	—
Kinosternidae	5	—	—	—	2	1	—	2
Staurotypidae	2	—	—	—	2	—	—	—
Testudinidae	1	—	—	—	—	1	—	—
Subtotal	**18**	**3**	**2**	**3**	**5**	**2**	**—**	**3**
Total	**231**	**3**	**7**	**12**	**6**	**118**	**21**	**64**
Sum total	**351**	**30**	**31**	**25**	**11**	**161**	**24**	**69**
Category total	**351**		**86**		**172**		**93**	

Table 14. Comparison of the IUCN and distributional categorizations for the herpetofauna of Veracruz, Mexico. Non-native species are excluded.

Distributional category	IUCN categories							
	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)	Near Threatened (NT)	Least Concern (LC)	Data Deficient (DD)	Not Evaluated (NE)	**Total**
Non-endemic species (NE)	5	3	7	7	96	—	51	**169**
Country-endemic species (CE)	8	15	17	4	64	13	17	**138**
State-endemic species (SE)	17	13	1	—	1	11	1	**44**
Total	**30**	**31**	**25**	**11**	**161**	**24**	**69**	**351**

including 64 country endemics (64/161; 39.8%) and one state endemic. Of the 24 DD species, 13 are country endemics and 11 are state endemics. Of the 69 species (69/351; 19.7%) which were Not Evaluated, the majority are non-endemic species (51; 73.9%), while 18 (26.1%) are country and state endemics. Thus, slightly less than one-fifth of the native species occurring in Veracruz have not been evaluated by the IUCN system. An additional 24 species (6.8%) presently are allocated to the DD category. Thus, a total of 93 species (26.5%) are either considered as Data Deficient or have not been evaluated by using this system.

The EVS System

The EVS (Environmental Vulnerability Score) system of conservation assessment was designed initially for use in evaluating the conservation status of members of the herpetofauna of Honduras (Wilson and McCranie 2014), but subsequently has been employed in the same way for other elements of the Mexican and Central American herpetofaunas (e.g., Wilson et al. 2010, 2013a,b; Johnson et al. 2015b, 2017; Mata-Silva et al. 2015, 2019; and all entries in the MCS [see above]). In this study, the EVS values for 346 native non-marine species residing in Veracruz are provided in Table 8, and summarized in Table 15.

The EVS values range from 3 to 19, or one less than the entire theoretical range of 3 to 20. The most frequent values (applied to 10 or more species) are: 6 (16), 7 (15), 8 (23), 9 (25), 10 (23), 11 (27), 12 (29), 13 (40), 14 (31), 15 (34), 16 (21), 17 (26), and 18 (20). We applied these 13 values to 330 of the 346 native non-marine species (95.4%) in Veracruz. The lowest score of 3 was determined for three species (*Rhinella horribilis*, *Smilisca baudinii*, and *Scaphiopus couchii*) and the highest score of 19 for two turtles (*Terrapene mexicana** and *Trachemys venusta*).

As in all previous MCS studies, herein the EVS values are assembled into three categories of low (scores 3–9), medium (10–13), and high (14–19) vulnerability. Based on this categorization, the species figures increase from low vulnerability (93) through medium vulnerability (119) to high vulnerability (134). Typically, this pattern is characteristic of state herpetofaunas containing more country and state endemic species (182 in the case of Veracruz) than non-endemic species (169), as we discovered previously in Michoacán (Díaz-Alvarado et al. 2013), Oaxaca (Mata-Silva et al. 2015), Jalisco (Cruz-Sáenz et al. 2017), and Puebla (Woolrich-Piña et al. 2017).

The IUCN categorizations for the Veracruz herpetofauna were compared to those of the EVS system (Table 16), and 61 of the 134 high vulnerability species (45.5%) are allocated to the three IUCN "threat categories." At the other extreme, 60 low vulnerability species (by EVS) account for 37.3% of the 161 LC species (by IUCN). Thus, apparently there is poor correspondence between the evaluations offered by the IUCN and EVS systems, as was reported in previous MCS entries.

As indicated in prior MCS studies, the reason for the poor correspondence between the evaluations of conservation status offered by the IUCN and EVS systems is the relatively high number of species allocated to the DD, NE, and LC categories (254 of 346 species, or 73.4%; Table 16). Interestingly, of the 24 DD species, which include three anurans and 21 squamates, 13 are country endemics and 11 are state endemics (Table 17). All but three species are in the high vulnerability EVS category, as those three have an EVS of 11, 12, and 13. We consider these 24 species as ill-served by remaining in the IUCN DD category. In our opinion, the species with EVS values of 11 (*Lepidophyma tuxtlae**), 12 (*Rhadinaea macdougalli**), and 13 (*Ptychohyla zophodes**) should be placed in the NT category. The two species with an EVS of 14 (*Ficimia variegata** and *Tantilla slavensi***) should be allocated to the VU category. The 11 species with an EVS of 15 or 16 need to be placed in the EN category. The eight species with an EVS of 17 or 18 should be allocated to the CR category.

Sixty-nine species remain unassessed by using the IUCN system, so we allocated them to the NE category (Table 18). These 69 species include four anurans, one salamander, 61 squamates, and three turtles. Of these species, 17 are country endemics, one is a state endemic, and the remaining 51 are non-endemics. Their EVS values extend from 3 to 19, the entire range applicable to the Veracruz herpetofauna. The 38 species with values of 3 to 10 can be allocated to the LC category. The 15 species with an EVS of 11 (*Hyalinobatrachium viridissimum*, *Gonatodes albogularis*, *Holcosus*

No. 41. *Rhinoclemmys areolata* (Duméril, Bibron, and Duméril, 1851). The Furrowed Wood Turtle is a non-endemic species ranging from southern Veracruz southward through Tabasco and northern Chiapas to the Yucatan Peninsula and eastern Guatemala and northwestern Honduras (Lee 2000; McCranie 2018). This individual was found at Minatitlán, in the municipality of the same name. Wilson et al. (2013b) calculated its EVS as 13, placing it at the upper limit of the medium vulnerability category. Its conservation status was assessed as Near Threatened by the IUCN, and as Threatened (A) by SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 42. *Kinosternon scorpioides* Linneaus, 1766. The Scorpion Mud Turtle is a non-endemic species occurring from northern Tamaulipas to southern Brazil (Lemos-Espinal and Dixon 2013). This individual was located at Coatzacoalcos, in the municipality of the same name. Wilson et al. (2013b) determined its EVS as 10, placing it in the lower portion of the medium vulnerability category. Its conservation status has not been determined by the IUCN, but was assessed as Special Protection (Pr) by SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 43. *Claudius angustatus* Cope, 1865. The Narrow-bridged Musk Turtle is a non-endemic species occurring from central Veracruz across northern Guatemala to northern Belize (Köhler 2008). This individual came from Coatzacoalcos, in the municipality of the same name. Wilson et al. (2013b) calculated its EVS as 14, placing it at the lower limit of the high vulnerability category. Its conservation status has been evaluated as Near Threatened by the IUCN, and as Endangered (P) by SEMARNAT. *Photo by Christian Berriozabal-Islas*.

No. 44. *Staurotypus triporcatus* (Wiegmann, 1828). The Mexican Giant Musk Turtle is a non-endemic species distributed from Veracruz through the base of the Yucatan Peninsula to western Honduras (Köhler 2008). This individual was found at Laguna la Escondida, Los Tuxtlas, in the municipality of San Andrés Tuxtla. Wilson et al. (2013b) determined its EVS as 14, placing it at the lower limit of the high vulnerability category. Its conservation status has been assessed as Near Threatened by the IUCN, and as Threatened (A) by SEMARNAT. *Photo by Christian Berriozabal-Islas*.

Table 15. Environmental Vulnerability Scores (EVS) for the herpetofaunal species in Veracruz, Mexico, arranged by family. The shaded area to the left encompasses low vulnerability scores, and the one to the right high vulnerability scores. Non-native species are excluded.

Family	Number of species	Environmental Vulnerability Score (EVS)																
		3	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
Bufonidae	9	1	—	—	2	—	—	—	—	3	—	1	2	—	—	—	—	—
Centrolenidae	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—
Craugastoridae	11	—	—	—	—	—	—	1	1	1	1	—	2	1	2	1	1	—
Eleutherodactylidae	6	—	—	—	—	—	—	—	—	—	3	—	—	1	1	—	1	—
Hylidae	29	1	2	—	—	3	1	2	1	2	2	6	3	4	—	1	1	—
Leptodactylidae	3	—	—	1	1	1	—	—	—	—	—	—	—	—	—	—	—	—
Microhylidae	3	—	1	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—
Phyllomedusidae	2	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	—
Ranidae	7	—	—	1	—	1	1	1	—	—	1	1	1	—	—	—	—	—
Rhinophrynidae	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
Scaphiopodidae	2	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	**74**	**3**	**3**	**2**	**4**	**7**	**4**	**4**	**2**	**8**	**7**	**8**	**8**	**6**	**3**	**2**	**3**	—
Ambystomatidae	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Plethodontidae	42	—	—	—	—	—	—	1	—	2	—	1	2	3	8	11	14	—
Salamandridae	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
Sirenidae	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
Subtotal	**45**	—	—	—	—	—	—	**1**	**1**	**2**	**2**	**1**	**2**	**3**	**8**	**11**	**14**	—
Dermophiidae	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—
Subtotal	**1**	—	—	—	—	—	—	—	—	**1**	—	—	—	—	—	—	—	—
Total	**120**	**3**	**3**	**2**	**4**	**7**	**4**	**5**	**3**	**11**	**9**	**9**	**10**	**9**	**11**	**13**	**17**	—
Crocodylidae	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—
Subtotal	**1**	—	—	—	—	—	—	—	—	—	—	**1**	—	—	—	—	—	—
Anguidae	10	—	—	—	1	—	—	—	—	—	1	—	2	3	1	1	1	—
Corytophanidae	4	—	—	—	—	1	1	1	—	—	—	1	—	—	—	—	—	—
Dactyloidae	17	—	—	—	—	—	2	3	2	—	1	2	—	2	2	3	—	—
Dibamidae	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Diploglossidae	4	—	—	—	—	—	—	—	—	—	—	1	2	—	—	1	—	—
Eublepharidae	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Iguanidae	2	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—
Mabuyidae	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Phrynosomatidae	20	—	—	1	1	—	—	1	—	2	3	6	1	5	—	—	—	—
Scincidae	5	—	—	—	—	—	—	—	1	1	2	—	1	—	—	—	—	—
Sphaerodactylidae	2	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—
Sphenomorphidae	3	—	—	—	—	—	1	—	—	1	1	—	—	—	—	—	—	—
Teiidae	5	—	—	—	—	—	1	1	—	2	1	—	—	—	—	—	—	—
Xantusiidae	5	—	—	—	—	—	1	—	—	2	—	1	—	—	1	—	—	—
Xenosauridae	3	—	—	—	—	—	—	1	—	—	—	—	—	—	1	1	—	—
Subtotal	**83**	—	—	**1**	**2**	**1**	**6**	**8**	**5**	**9**	**12**	**11**	**6**	**10**	**5**	**6**	**1**	—
Boidae	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Colubridae	41	—	—	2	7	2	5	6	5	1	2	5	4	2	—	—	—	—
Dipsadidae	46	—	2	1	2	2	5	5	5	1	4	8	2	7	1	1	—	—
Elapidae	4	—	—	—	—	—	1	—	—	1	—	1	—	—	—	1	—	—
Leptotyphlopidae	4	—	—	—	1	—	—	—	—	—	—	3	—	—	—	—	—	—
Natricidae	14	—	—	—	—	3	1	—	2	1	—	—	3	3	—	1	—	—
Sibynophiidae	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—
Typhlopidae	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—
Viperidae	17	—	—	—	—	—	1	1	—	1	1	1	2	3	4	2	1	—
Subtotal	**129**	—	**2**	**3**	**10**	**7**	**13**	**12**	**13**	**7**	**7**	**18**	**11**	**15**	**5**	**5**	**1**	—
Chelydridae	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
Dermatemyidae	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
Emydidae	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Geoemydidae	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—
Kinosternidae	5	—	—	—	—	—	—	—	2	—	1	—	2	—	—	—	—	—
Staurotypidae	2	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—
Testudinidae	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
Subtotal	**13**	—	—	—	—	—	—	—	**2**	—	**1**	**1**	**4**	—	—	**2**	**1**	**2**
Total	**226**	—	**2**	**4**	**12**	**8**	**19**	**20**	**20**	**16**	**20**	**31**	**21**	**25**	**10**	**13**	**3**	**2**
Sum total	**346**	**3**	**5**	**6**	**16**	**15**	**23**	**25**	**23**	**27**	**29**	**40**	**31**	**34**	**21**	**26**	**20**	**2**
Category total	**346**				**93**					**119**					**134**			

Table 16. Comparison of the Environmental Vulnerability Scores (EVS) and IUCN categorizations for members of the herpetofauna of Veracruz, Mexico. Non-native species are excluded. The shaded area at the top encompasses low vulnerability category scores, and the one at the bottom high vulnerability category scores.

EVS	IUCN category							Total
	Critically Endangered	Endangered	Vulnerable	Near Threatened	Least Concern	Data Deficient	Not Evaluated	
3	—	—	—	—	2	—	1	**3**
4	—	—	—	—	5	—	—	**5**
5	—	—	—	—	4	—	2	**6**
6	1	—	—	—	10	—	5	**16**
7	1	—	—	—	10	—	4	**15**
8	—	—	—	—	16	—	7	**23**
9	—	—	2	1	13	—	9	**25**
10	—	—	—	—	14	—	10	**24**
11	—	2	3	—	17	1	4	**27**
12	—	2	1	2	17	1	5	**28**
13	—	2	6	3	22	1	6	**40**
14	1	5	2	5	12	2	5	**32**
15	2	3	7	—	10	8	3	**33**
16	4	4	1	—	6	3	3	**21**
17	6	8	1	—	2	5	4	**26**
18	13	3	—	—	1	3	—	**20**
19	—	—	1	—	—	—	1	**2**
Total	**28**	**29**	**24**	**11**	**161**	**24**	**69**	**346**

Table 17. Environmental Vulnerability Scores (EVS) for members of the herpetofauna of Veracruz, Mexico, allocated to the IUCN Data Deficient category. * = country endemic; ** = state endemic.

Taxon	Environmental Vulnerability Score (EVS)			
	Geographic distribution	Ecological distribution	Reproductive mode/Degree of persecution	Total score
*Eleutherodactylus verruculatus***	6	8	4	18
*Exerodonta bivocata**	6	8	1	15
*Ptychohyla zophodes**	5	7	1	13
*Abronia reidi***	6	8	4	18
*Mesaspis antauges***	6	7	3	16
*Norops alvarezdeltoroi**	6	8	3	17
*Norops cymbops**	6	8	3	17
*Norops duellmani***	6	8	3	17
*Norops schiedii***	5	8	3	16
*Celestus ingridae***	6	8	3	17
*Sceloporus salvini**	5	7	3	15
*Lepidophyma tuxtlae**	5	4	2	11
*Ficimia variegata**	5	7	2	14
*Tantilla slavensi***	5	7	2	14
*Conophis morai***	6	7	4	17
*Geophis bicolor**	5	8	2	15
*Geophis blanchardi**	5	8	2	15
*Geophis chalybeus***	6	7	2	15
*Rhadinaea cuneata**	6	7	2	15
*Rhadinaea forbesi***	5	8	2	15
*Rhadinaea macdougalli**	5	5	2	12
*Rhadinaea quinquelineata**	5	8	2	15
*Sibon linearis***	6	8	2	16
*Cerrophidion petlalcalensis**	5	8	5	18

Table 18. Environmental Vulnerability Scores (EVS) for members of the herpetofauna of Veracruz, Mexico, that are currently Not Evaluated (NE) by the IUCN. Non-native taxa are excluded. * = country endemic; ** = state endemic.

Taxon	Environmental Vulnerability Score (EVS)			
	Geographic distribution	Ecological distribution	Reproductive mode/Degree of persecution	Total score
Rhinella horribilis	1	1	1	3
Hyalinobatrachium viridissimum	4	4	3	11
*Quilticohyla zoque**	5	8	1	14
Lithobates brownorum	4	3	1	8
*Aquiloeurycea cafetalera**	6	7	4	17
*Ophisaurus incomptus**	5	8	2	15
Laemanctus longipes	1	5	3	9
Norops beckeri	3	6	3	12
Norops biporcatus	3	4	3	10
Norops laeviventris	3	3	3	9
Norops lemurinus	3	2	3	8
Norops petersi	2	4	3	9
*Norops purpuronectes**	5	8	3	16
Norops rodriguezii	4	3	3	10
Norops sericeus	2	3	3	8
Norops tropidonotus	4	2	3	9
Norops uniformis	4	6	3	13
Ctenosaura acanthura	2	4	6	12
Iguana iguana	3	3	6	12
Marisora lineola	4	3	3	10
*Sceloporus aureolus**	5	7	3	15
Sceloporus cyanogenys	4	6	3	13
Plestiodon sumichrasti	4	5	3	12
Gonatodes albogularis	3	5	3	11
Scincella cherriei	3	2	3	8
*Holcosus amphigrammus**	5	3	3	11
*Lepidophyma zongolica**	6	8	2	16
*Xenosaurus tzacualtipantecus**	6	8	3	17
Boa imperator	3	1	6	10
*Conopsis acuta**	5	7	2	14
Drymobius margaritiferus	1	1	4	6
*Ficimia olivacea**	5	2	2	9
Ficimia publia	4	3	2	9
Lampropeltis polyzona	1	1	6	8
Lampropeltis triangulum	3	1	5	9
Leptophis ahaetulla	3	3	4	10
Oxybelis aeneus	1	1	3	5
Oxybelis fulgidus	3	2	4	9
Spilotes pullatus	1	1	4	6
Stenorrhina degenhardtii	3	3	3	9
Stenorrhina freminvillii	1	2	4	7
Trimorphodon biscutatus	2	1	4	7
Amastridium sapperi	4	4	2	10
Clelia scytalina	4	5	4	13
Coniophanes fissidens	1	3	3	7
*Coniophanes taeniatus**	5	7	3	15
*Geophis lorancai**	5	7	2	14
Imantodes cenchoa	1	3	2	6
Imantodes gemmistratus	1	3	2	6
Leptodeira polysticta	1	3	4	8
Leptodeira septentrionalis	2	2	4	8
Oxyrhopus petolarius	3	6	5	14
Sibon nebulatus	1	2	2	5
Tretanorhinus nigroluteus	3	5	2	10
Tropidodipsas fasciata	5	4	4	13
Xenodon rabdocephalus	3	5	5	13
Epictia phenops	1	4	1	6
*Epictia resetari**	5	7	1	13
*Thamnophis conanti**	5	8	4	17
Thamnophis marcianus	1	5	4	10
Thamnophis proximus	1	2	4	7
Scaphiodontophis annulatus	1	5	5	11
Bothrops asper	3	4	5	12
*Crotalus mictlantecuhtli***	5	6	5	16
*Crotalus totonacus**	5	7	5	17
*Ophryacus smaragdinus**	3	6	5	14
*Terrapene mexicana**	5	8	6	19
Kinosternon leucostomum	3	4	3	10
Kinosternon scorpioides	3	4	3	10

Table 19. Environmental Vulnerability Scores (EVS) for members of the herpetofauna of Veracruz, Mexico, that are currently allocated to the Least Concern (LC) category by the IUCN. Non-native taxa are excluded. * = country endemic; ** = state endemic.

Taxon	Environmental Vulnerability Score (EVS)			
	Geographic distribution	Ecological distribution	Reproductive mode/Degree of persecution	Total score
*Anaxyrus compactilis**	5	8	1	14
*Incilius occidentalis**	5	5	1	11
Incilius valliceps	3	2	1	6
Craugastor loki	2	4	4	10
*Craugastor mexicanus**	5	7	4	16
Eleutherodactylus cystignathoides	2	6	4	12
*Eleutherodactylus nitidus**	5	3	4	12
Dendropsophus ebraccatus	3	6	1	10
Dendropsophus microcephalus	3	3	1	7
Dryophytes arenicolor	2	4	1	7
*Dryophytes eximius**	5	4	1	10
*Dryophytes plicatus**	5	5	1	11
*Sarcohyla bistincta**	5	3	1	9
Scinax staufferi	2	1	1	4
Smilisca baudinii	1	1	1	3
Tlalocohyla loquax	3	3	1	7
Tlalocohyla picta	2	5	1	8
Trachycephalus vermiculatus	1	2	1	4
Triprion spinosus	3	6	5	14
Engystomops pustulosus	3	2	2	7
Leptodactylus fragilis	1	2	2	5
Leptodactylus melanonotus	1	3	2	6
Gastrophryne elegans	2	5	1	8
Hypopachus ustus	2	4	1	7
Hypopachus variolosus	2	1	1	4
Agalychnis taylori	3	5	3	11
Lithobates berlandieri	4	2	1	7
Lithobates maculatus	3	1	1	5
*Lithobates montezumae**	5	7	1	13
*Lithobates spectabilis**	5	6	1	12
Lithobates vaillanti	3	5	1	9
Rhinophrynus dorsalis	2	5	1	8
Scaphiopus couchii	1	1	1	3
Spea multiplicata	1	4	1	6
*Ambystoma velasci**	5	4	1	10
*Aquiloeurycea cephalica**	5	5	4	14
Bolitoglossa mexicana	4	3	4	11
Bolitoglossa occidentalis	4	3	4	11
*Bolitoglossa platydactyla**	5	6	4	15
Bolitoglossa rufescens	1	4	4	9
*Pseudoeurycea leprosa**	5	7	4	16
Siren intermedia	3	8	1	12
Dermophis mexicanus	4	3	4	11
Crocodylus moreletii	2	5	6	13
*Barisia imbricata**	5	6	3	14
Gerrhonotus liocephalus	2	1	3	6
*Gerrhonotus ophiurus**	5	4	3	12
Basiliscus vittatus	1	3	3	7
Corytophanes hernandesii	4	6	3	13
Laemanctus serratus	2	3	3	8
*Norops compressicauda**	5	7	3	15

Table 19 (continued). Environmental Vulnerability Scores (EVS) for members of the herpetofauna of Veracruz, Mexico, that are currently allocated to the Least Concern (LC) category by the IUCN. Non-native taxa are excluded. * = country endemic; ** = state endemic.

Taxon	Environmental Vulnerability Score (EVS)			
	Geographic distribution	Ecological distribution	Reproductive mode/Degree of persecution	Total score
*Anelytropsis papillosus**	5	4	1	10
*Celestus enneagrammus**	5	6	3	14
*Celestus legnotus**	5	6	3	14
Coleonyx elegans	2	3	4	9
Holbrookia propinqua	4	8	3	15
*Phrynosoma braconnieri**	5	7	3	15
*Phrynosoma orbiculare**	5	4	3	12
*Sceloporus aeneus**	5	5	3	13
*Sceloporus bicanthalis**	5	5	3	13
*Sceloporus formosus**	5	7	3	15
Sceloporus grammicus	2	4	3	9
Sceloporus internasalis	4	4	3	11
*Sceloporus jalapae**	5	5	3	13
*Sceloporus mucronatus**	5	5	3	13
*Sceloporus scalaris**	5	4	3	12
Sceloporus serrifer	2	1	3	6
*Sceloporus spinosus**	5	4	3	12
Sceloporus teapensis	4	6	3	13
*Sceloporus torquatus**	5	3	3	11
Sceloporus variabilis	1	1	3	5
*Plestiodon brevirostris**	5	3	3	11
*Plestiodon copei**	5	6	3	14
*Plestiodon lynxe**	5	2	3	10
Plestiodon tetragrammus	4	5	3	12
Sphaerodactylus glaucus	4	5	3	12
*Scincella gemmingeri**	5	3	3	11
*Scincella silvicola**	5	4	3	12
*Aspidoscelis costata**	5	3	3	11
Aspidoscelis deppii	1	4	3	8
Aspidoscelis gularis	2	4	3	9
*Aspidoscelis guttatus**	5	4	3	12
Lepidophyma flavimaculatum	1	5	2	8
*Lepidophyma pajapanense**	5	6	2	13
*Lepidophyma sylvaticum**	5	4	2	11
*Xenosaurus rectocollaris**	5	8	3	16
Coluber constrictor	1	6	3	10
*Conopsis lineata**	5	6	2	13
*Conopsis nasus**	5	4	2	11
Dendrophidion vinitor	3	7	3	13
Drymarcon melanurus	1	1	4	6
Drymobius chloroticus	1	3	4	8
Ficimia streckeri	3	7	2	12
Leptophis mexicanus	1	1	4	6
Masticophis flagellum	1	3	4	8
Masticophis mentovarius	1	1	4	6
Masticophis schotti	4	5	4	13
Mastigodryas melanolomus	1	1	4	6
Pantherophis emoryi	3	6	4	13
Phrynonax poecilonotus	3	4	3	10
*Pituophis deppei**	5	5	4	14
Pituophis lineaticollis	2	2	4	8

Table 19 (continued). Environmental Vulnerability Scores (EVS) for members of the herpetofauna of Veracruz, Mexico, that are currently allocated to the Least Concern (LC) category by the IUCN. Non-native taxa are excluded. * = country endemic; ** = state endemic.

Taxon	Environmental Vulnerability Score (EVS)			
	Geographic distribution	Ecological distribution	Reproductive mode/Degree of persecution	Total score
Pseudelaphe flavirufa	2	4	4	10
*Salvadora bairdi**	5	6	4	15
Salvadora grahamiae	4	2	4	10
Senticolis triaspis	2	1	3	6
*Tantilla bocourti**	5	2	2	9
Tantilla rubra	2	1	2	5
Tantilla schistosa	3	3	2	8
Tantillita lintoni	4	6	2	12
*Trimoprhodon tau**	5	4	4	13
Adelphicos quadrivirgatum	4	4	2	10
Adelphicos visoninum	4	3	1	8
*Chersodromus liebmanni**	5	5	2	12
Coniophanes bipunctatus	1	5	3	9
Coniophanes imperialis	2	3	3	8
Coniophanes quinquevittatus	4	6	3	13
Conophis lineatus	2	3	4	9
Diadophis punctatus	1	1	2	4
Geophis carinosus	2	4	2	8
*Geophis mutitorques**	5	6	2	13
*Geophis semidoliatus**	5	6	2	13
Leptodeira frenata	4	4	4	12
Leptodeira maculata	2	1	4	7
Ninia diademata	4	3	2	9
Ninia sebae	1	1	2	4
Pliocercus elapoides	4	1	5	10
Rhadinaea decorata	1	6	2	9
*Rhadinella schistosa**	5	6	2	13
Sibon dimidiatus	1	5	4	10
Tropidodipsas sartorii	2	2	5	9
*Micrurus diastema**	2	1	5	8
Micrurus elegans	4	4	5	13
*Micrurus limbatus***	5	7	5	17
Micrurus tener	1	5	5	11
Rena dulcis	4	8	1	13
*Rena myopica**	5	7	1	13
Nerodia rhombifer	1	5	4	10
Storeria dekayi	1	4	2	7
*Storeria storerioides**	5	4	2	11
*Thamnophis chrysocephalus**	5	5	4	14
Thamnophis cyrtopsis	2	1	4	7
Thamnophis eques	2	2	4	8
*Thamnophis godmani**	5	5	4	14
*Thamnophis pulchrilatus**	5	6	4	15
*Thamnophis scalaris**	5	5	4	14
*Thamnophis sumichrasti**	5	6	4	15
Amerotyphlops tenuis	4	6	1	11
*Agkistrodon taylori**	5	7	5	17
*Crotalus aquilus**	5	6	5	16
Crotalus atrox	1	3	5	9
*Crotalus intermedius**	5	5	5	15
Crotalus molossus	2	1	5	8

Table 19 (continued). Environmental Vulnerability Scores (EVS) for members of the herpetofauna of Veracruz, Mexico, that are currently allocated to the Least Concern (LC) category by the IUCN. Non-native taxa are excluded. * = country endemic; ** = state endemic.

Taxon	Environmental Vulnerability Score (EVS)			
	Geographic distribution	Ecological distribution	Reproductive mode/Degree of persecution	Total score
*Crotalus polystictus**	5	6	5	16
*Crotalus ravus**	5	4	5	14
Crotalus scutulatus	2	4	5	11
*Crotalus triseriatus**	5	6	5	16
*Metlapilcoatlus nummifer**	5	3	5	13
Metlapilcoatlus olmec	4	6	5	15
Kinosternon flavescens	3	6	3	12
Gopherus berlandieri	4	8	6	18

*amphigrammus**, and *Scaphiodontophis annulatus*), 12 (*Norops beckeri*, *Ctenosaura acanthura*, *Iguana iguana*, *Plestiodon sumichrasti*, and *Bothrops asper*), or 13 (*Norops uniformis*, *Sceloporus cyanogenys*, *Clelia scytalina*, *Tropidodipsas fasciata*, *Xenodon rabdocephalus*, and *Epictia resetari**) should be placed in the NT category. The five species with an EVS of 14 (*Quilticohyla zoque**, *Conopsis acuta**, *Geophis lorancai**, *Oxyrhopus petolarius*, and *Ophryacus smaragdinus**) should be placed in the VU category; and all but one of these species are country endemics. The six species with an EVS of 15 (*Ophisaurus incomptus**, *Sceloporus aureolus**, and *Coniophanes taeniatus**) or 16 (*Norops purpuronectes**, *Lepidophyma zongolica**, and *Crotalus mictlantecuhtli***) should be allocated to the EN category; and all these species are country and state endemics. Finally, the five species with an EVS of 17 (*Aquiloeurycea cafetalera**, *Xenosaurus tzacualtipantecus**, *Thamnophis conanti**, and *Crotalus totonacus**) or 19 (*Terrapene mexicana**) should be placed in the CR category; and all of these species are country endemics.

The largest number of species in the herpetofauna of Veracruz is placed in the LC category (Table 19). Among this group of 161 species are 34 anurans, eight salamanders, one caecilian, one crocodylian, 115 squamates, and two turtles. Of these 161 species, 96 are non-endemics, 64 are country endemics, and one is a state endemic. The EVS values range from 3 to 18, just one less than the range for the entire Veracruz herpetofauna. Seventy-four of these species have EVS values of 3 to 10, and in our opinion can be retained in the LC category. The 56 species with an EVS of 11 to 13 should be placed in the NT category. Twelve species have an EVS of 14, and should be allocated to the VU category. The 16 species with an EVS of 15 (*Bolitoglossa platydactyla**, *Norops compressicauda**, *Holbrookia propinqua*, *Phrynosoma braconnieri**, *Sceloporus formosus**, *Salvadora bairdi**, *Thamnophis pulchrilatus**, *T. sumichrasti**, *Crotalus intermedius**, and *Metlapilcoatlus olmec*) or 16 (*Craugastor mexicanus**, *Pseudoeurycea leprosa**, *Xenosaurus rectocollaris**, *Crotalus aquilus**, *C. polystictus**, and *C. triseriatus**) should be relegated to the EN category. Finally, the three species with an EVS of 17 (*Micrurus limbatus*** and *Agkistrodon taylori**) or 18 (*Gopherus berlandieri*) should be placed in the CR category.

Relative Herpetofaunal Priority

The concept of Relative Herpetofaunal Priority (RHP) was initiated by Johnson et al. (2015a) and consists of a simple means for determining the relative importance of the herpetofauna of any geographical entity (e.g., a physiographic region, a municipality, or a state). Ascertaining the RHP depends on the use of two methods: (1) computation of the proportion of country and state endemics relative to the entire physiographic regional herpetofauna; and (2) calculation of the absolute number of high EVS category species in each physiographic

Table 20. Number of herpetofaunal species in the four distributional status categories among the four physiographic regions of Veracruz, Mexico. Rank order is based on the sum of country and state endemics.

Physiographic region	Distributional category				Total	Rank order
	Non-endemics	Country endemics	State endemics	Non-natives		
Gulf Coastal Lowlands	142	35	5	8	190	4
Sierra de Los Tuxtlas	123	30	19	7	179	3
Sierra Madre Oriental	103	109	21	3	236	1
Transmexican Volcanic Belt	94	102	21	5	222	2

Table 21. Number of herpetofaunal species in the three EVS categories among the four physiographic regions of Veracruz, Mexico. Rank order is determined by the relative number of high EVS species. Non-native and marine species are excluded.

Physiographic province	Low EVS	Medium EVS	High EVS	Total	Rank order
Gulf Coastal Lowlands	74	68	35	177	4
Sierra de Los Tuxtlas	69	59	39	167	3
Sierra Madre Oriental	70	85	78	233	2
Transmexican Volcanic Belt	71	67	79	217	1

regional herpetofauna. The pertinent data for these two approaches are shown in Tables 20 and 21.

Based on the relative number of combined country and state endemic species in each of the four physiographic regions and the rank each region occupies (Table 20), the SMO region occupies rank number one, with 130 endemics of a total of 236 species (55.1%). The other ranks are as follows: second is TVB (123 of 222, 55.4%); third is SLT (49 of 179, 27.4%); and fourth is GCL (40 of 190, 21.1%).

The data on the relative number of high vulnerability species (Table 21) indicate that rank number one is occupied by the TVB region, with 79 of its total of 217 species (36.4%), followed closely by the SMO region, occupying rank two, with 78 of its total of 233 species (33.5%). The other two ranks are as follows: third is SLT (39 of 167, 23.4%) and fourth is GCL (35 of 177, 19.8%).

Although the rankings of the SMO and TVB regions are reversed when considering endemic species (SMO = 1, TVB = 2) compared to high vulnerability species (TVB = 1, SMO = 2), the numbers of species involved and their proportions of their regional total numbers of species are similar to one another, especially with regard to the accounting for the high vulnerability species, which differ only by a single species (TVB = 79 species, SMO = 78 species). The rankings for the other two regions (GCL and SLT) are the same for the two RHP measures (Tables 20–21).

Even given the reversal of rankings between the SMO and TVB regions, evidently the SMO region is the most important from the standpoint of conservation (Rank one). This region houses the largest number of country and state endemics and the second largest number of high vulnerability species, differing by only a single species (78 vs. 79). The 130 endemic species include 28 anurans (25 country endemics and three state endemics), 25 salamanders (11 country endemics and 14 state endemics), and 77 squamates (73 country endemics and four state endemics). These 130 species are listed in Table 5, with either a single asterisk (country endemic) or a double asterisk (state endemic). The SMO also includes 78 high vulnerability species, consisting of 15 anurans, 23 salamanders, and 40 squamates. Of these 78 species, 56 are country endemics, 21 are state endemics, and one is a non-endemic; and their EVS ranges from 14 to 18, as follows:

*Anaxyrus compactilis** (14)
*Incilius cristatus** (14)
*Craugastor berkenbuschii** (14)
*Craugastor decoratus** (15)
*Craugastor mexicanus** (16)
*Craugastor rhodopis** (14)
*Craugastor spatulatus** (16)
*Eleutherodactylus verrucipes** (16)
*Eleutherodactylus verruculatus*** (18)
*Bromeliohyla dendroscarta** (17)
*Megastomatohyla mixomaculata** (14)
*Megastomatohyla nubicola*** (14)
*Sarcohyla pachyderma*** (15)
*Sarcohyla siopela** (15)
Triprion spinosus (14)
*Aquiloeurycea cafetalera** (17)
*Aquiloeurycea cephalica** (14)
*Aquiloeurycea praecellens*** (18)
*Bolitoglossa platydactyla** (15)
*Chiropterotriton aureus*** (18)
*Chiropterotriton terrestris** (18)
*Isthmura gigantea** (16)
*Isthmura naucampatepetl*** (17)
*Parvimolge townsendi*** (16)
*Pseudoeurycea firscheini** (18)
*Pseudoeurycea granitum*** (16)
*Pseudoeurycea leprosa** (16)
*Pseudoeurycea lineola*** (14)
*Pseudoeurycea lynchi** (17)
*Pseudoeurycea melanomolga** (16)
*Pseudoeurycea nigromaculata*** (17)
*Thorius dubitus** (16)
*Thorius lunaris*** (18)
*Thorius magnipes*** (17)
*Thorius minydemus*** (18)
*Thorius munificus*** (18)
*Thorius pennatulus*** (15)
*Thorius troglodytes*** (16)
*Abronia graminea** (15)
*Abronia taeniata** (15)
*Barisia imbricata** (14)
*Mesaspis antauges*** (16)
*Norops cymbops** (17)
*Norops schiedii*** (16)
*Celestus enneagrammus** (14)
*Celestus legnotus** (14)
*Phrynosoma braconnieri** (15)
*Sceloporus aureolus** (15)
*Sceloporus formosus** (15)
*Sceloporus megalepidurus** (14)

*Sceloporus salvini** (15)
*Plestiodon copei** (14)
*Lepidophyma zongolica** (16)
*Xenosaurus rectocollaris** (16)
*Xenosaurus tzacualtipantecus** (17)
*Pituophis deppei** (14)
*Salvadora bairdi** (15)
*Tantilla shawi** (15)
*Geophis blanchardi** (15)
*Geophis chalybeus*** (15)
*Geophis lorancai** (14)
*Rhadinaea cuneata** (15)
*Rhadinaea forbesi*** (15)
*Rhadinaea quinquelineata** (15)
*Thamnophis chrysocephalus** (14)
*Thamnophis conanti** (17)
*Thamnophis godmani** (14)
*Thamnophis pulchrilatus** (15)
*Thamnophis scalaris** (14)
*Thamnophis sumichrasti** (15)
*Agkistrodon taylori** (17)
*Cerrophidion petlalcalensis** (18)
*Crotalus intermedius** (15)
*Crotalus ravus** (14)
*Crotalus totonacus** (17)
*Crotalus triseriatus** (16)
*Ophryacus smaragdinus** (14)
*Ophryacus undulatus** (15)

The TVB region (Rank two) is of similar conservation significance, as it contains 123 country and state endemic species, and 79 high vulnerability species. The 123 endemic species comprise 27 anurans (25 country endemics and two state endemics), 29 salamanders (15 country endemics and 14 state endemics), 66 squamates (61 country endemics and five state endemics), and one turtle (one country endemic). The TVB also harbors 79 high vulnerability species (Table 21), including 14 anurans, 27 salamanders, 37 squamates, and one turtle. Of the 79 endemic high vulnerability species, 41 are country endemics and 38 are state endemics, and their EVS ranges from 14 to 18, as follows:

*Anaxyrus compactilis** (14)
*Incilius cristatus** (14)
*Craugastor berkenbuschii** (14)
*Craugastor decoratus** (15)
*Craugastor mexicanus** (16)
*Craugastor rhodopis** (14)
*Craugastor spatulatus** (16)
*Eleutherodactylus verruculatus*** (18)
*Bromeliohyla dendroscarta** (17)
*Megastomatohyla mixomaculata** (14)
*Megastomatohyla nubicola*** (14)
*Sarcohyla siopela** (15)
Triprion spinosus (14)
*Lithobates johni** (14)
*Aquiloeurycea cafetalera** (17)
*Aquiloeurycea cephalica** (14)
*Aquiloeurycea praecellens*** (18)
*Bolitoglossa platydactyla** (15)
*Chiropterotriton casasi*** (18)
*Chiropterotriton ceronorum** (17)
*Chiropterotriton chiropterus** (16)
*Chiropterotriton chondrostega** (17)
*Chiropterotriton lavae*** (18)
*Chiropterotriton nubilus*** (18)
*Chiropterotriton perotensis*** (18)
*Chiropterotriton totonacus*** (18)
*Isthmura corrugata*** (18)
*Isthmura gigantea** (16)
*Isthmura naucampatepetl*** (17)
*Parvimolge townsendi*** (16)
*Pseudoeurycea firscheini** (18)
*Pseudoeurycea granitum*** (16)
*Pseudoeurycea leprosa** (16)
*Pseudoeurycea lineola*** (14)
*Pseudoeurycea lynchi** (17)
*Pseudoeurycea melanomolga** (16)
*Pseudoeurycea nigromaculata*** (17)
*Thorius dubitus** (16)
*Thorius pennatulus*** (15)
*Thorius spilogaster*** (17)
*Thorius troglodytes*** (16)
*Abronia graminea** (15)
*Abronia taeniata** (15)
*Barisia imbricata** (14)
*Mesaspis antauges*** (16)
*Ophisaurus incomptus** (15)
*Norops cymbops** (17)
*Norops schiedii*** (16)
*Celestus enneagrammus** (14)
*Phrynosoma braconnieri** (15)
*Sceloporus formosus** (15)
*Sceloporus megalepidurus** (14)
*Sceloporus salvini** (15)
*Plestiodon copei** (14)
*Lepidophyma zongolica** (16)
*Pituophis deppei** (14)
*Salvadora bairdi** (15)
*Coniophanes taeniatus** (15)
*Conophis morai*** (17)
*Geophis bicolor** (15)
*Geophis blanchardi** (15)
*Geophis lorancai** (14)
*Rhadinaea cuneata** (15)
*Thamnophis chrysocephalus** (14)
*Thamnophis godmani** (14)
*Thamnophis scalaris** (14)
*Thamnophis scaliger** (15)
*Thamnophis sumichrasti** (15)
*Cerrophidion petlalcalensis** (18)
*Crotalus aquilus** (16)
*Crotalus intermedius** (15)

*Crotalus mictlantecuhtli*** (16)
*Crotalus polystictus** (16)
*Crotalus ravus** (14)
*Crotalus totonacus** (17)
*Crotalus triseriatus** (16)
*Ophryacus smaragdinus** (14)
*Ophryacus undulatus** (15)
*Kinosternon herrerai** (14)

Rank three is occupied by the Sierra de Los Tuxtlas region (Table 20), which contains 49 country and state endemics, including 13 anurans (nine country and four state endemics), eight salamanders (three country and five state endemics), and 28 squamates (18 country and 10 state endemics). This region also supports 39 high vulnerability species (Table 21), including 10 anurans, eight salamanders, 17 squamates, and four turtles. Of these 39 high vulnerability species, 15 are country endemics, 17 are state endemics, and seven are non-endemics. Their EVS ranges from 14 to 18.

*Incilius cristatus** (14)
*Craugastor berkenbuschii** (14)
*Craugastor megalotympanum*** (18)
*Craugastor rhodopis** (14)
*Craugastor vulcani*** (17)
*Eleutherodactylus verrucipes** (16)
*Bromeliohyla dendroscarta** (17)
*Ecnomiohyla valancifer*** (18)
*Megastomatohyla mixomaculata** (14)
Triprion spinosus (14)
*Bolitoglossa alberchi** (15)
*Bolitoglossa platydactyla** (15)
*Pseudoeurycea lineola*** (14)
*Pseudoeurycea nigromaculata*** (17)
*Pseudoeurycea orchimelas*** (17)
*Pseudoeurycea werleri** (17)
*Thorius narismagnus*** (18)
*Thorius pennatulus*** (15)
*Abronia chiszari*** (17)
*Abronia reidi*** (18)
*Norops barkeri** (15)
*Norops duellmani*** (17)
*Celestus ingridae*** (17)
*Sceloporus salvini** (15)
*Plestiodon copei** (14)
*Ficimia variegata** (14)
*Salvadora bairdi** (15)
*Tantilla slavensi*** (14)
*Coniophanes taeniatus** (15)
*Conophis morai*** (17)
Oxyrhopus petolarius (14)
*Sibon linearis*** (16)
*Micrurus limbatus*** (17)
*Crotalus mictlantecuhtli*** (16)
Metlapilcoatlus olmec (15)
Chelydra rossignonii (17)
Kinosternon acutum (14)
Claudius angustatus (14)
Staurotypus triporcatus (14)

Rank four is occupied by the GCL region (Table 20), which includes 40 country and state endemic species, and 35 high vulnerability species. The 40 endemic species constitute 10 anurans (eight country and two state endemics), two salamanders (two country endemics), 26 squamates (23 country and three state endemics), and two turtles (two country endemics). The 35 high vulnerability species in the GCL (Table 21) include nine amphibians and 26 reptiles, collectively composed of seven anurans, two salamanders, 17 squamates, and nine turtles. Of the 35 species, 21 are country endemics, three are state endemics, and 11 are non-endemics; and their EVS ranges from 14 to 19, the entire span for the high vulnerability species. These 35 species are as follows:

*Craugastor berkenbuschii** (14)
*Craugastor rhodopis** (14)
*Craugastor vulcani*** (17)
*Eleutherodactylus longipes** (15)
*Exerodonta bivocata** (15)
*Quilticohyla zoque** (14)
Triprion spinosus (14)
*Bolitoglossa platydactyla** (15)
*Bolitoglossa veracrucis** (17)
*Abronia taeniata** (15)
*Ophisaurus ceroni*** (14)
*Norops alvarezdeltoroi** (17)
*Norops barkeri** (15)
*Norops compressicauda** (15)
*Norops purpuronectes** (16)
Holbrookia propinqua (15)
*Conopsis acuta** (14)
*Ficimia variegata** (14)
*Pituophis deppei** (14)
*Coniophanes taeniatus** (15)
Oxyrhopus petolarius (14)
*Rhadinaea cuneata** (15)
*Agkistrodon taylori** (17)
*Crotalus intermedius** (15)
*Crotalus mictlantecuhtli*** (16)
Metlapilcoatlus olmec (15)
Chelydra rossignonii (17)
Dermatemys mawii (17)
*Terrapene mexicana** (19)
Trachemys venusta (19)
Kinosternon acutum (14)
*Kinosternon herrerai** (14)
Claudius angustatus (14)
Staurotypus triporcatus (14)
Gopherus berlandieri (18)

Of all the species in the herpetofauna of Veracruz, 134 are high vulnerability taxa (Table 8), and the proportions

of these species documented in the four physiographic regions are as follows: SMO (58.2%); TVB (59.0%); SLT (29.1%); and GCL (26.1%). These data are of considerable importance in designing management plans for the protected areas in the state (see discussion below).

Protected Areas in Veracruz

Protected areas are the regions legally established for conserving the habitats and the organisms they support for perpetuity. Such areas are intended to remain unaltered by the destructive effects produced by humans, whose populations generally are found along the periphery of these areas. Protected areas, therefore, exist as islands of natural habitat within the seas of areas occupied by members of our own species. Ramírez-Bautista et al. (2020) identified our species, *Homo sapiens*, as "the principal invasive species," in the sense of "any nonnative species that significantly modifies or disrupts the ecosystems it colonizes" (http://www.britannica.com/science/invasive-species). So, curiously, protected areas are set up by some members of our species to protect a given area from the destructive effects of other members of our species. Importantly, given that that the populations of this principal invasive species grow at an exponential rate of increase, then the continued existence of protected areas always will be a matter of critical concern that requires constant vigilance.

Therefore, the question arises as to how well the herpetofauna is being protected by the system of protected areas that exist in Veracruz. To initiate this examination, a set of data on various features of protected areas in the state was compiled and is shown in Table 22.

A total of only six protected areas exists in Veracruz, including four national parks, one biosphere reserve, and the sixth is an Área de Protección de Flora y Fauna. These six areas were established on dates ranging from 1937 to 2009, and they range in size from 11,530.7 ha (115.3 km^2) to 155,122.5 ha (1,551.2 km^2). All of these areas are administered at the federal level. Four of the six areas contain a complete array of facilities; however, two of the six have no facilities for visitors. Unfortunately, all six areas are occupied to some degree by landowners, which is an undesirable situation since the goals of the landowners likely conflict with those of conservation. Management plans, however, are available for all the areas, except one.

Herpetofaunal surveys have been completed for only one of the six protected areas (i.e., Reserva de la Biosfera Los Tuxtlas). Nonetheless, the available information on the known herpetofauna from these six areas was collated and is shown in Table 23, and summarized in Table 24.

Of the 359 species recorded to date from the state of Veracruz, 265 (73.8%) have been documented collectively in the six protected areas (Table 24). The numbers of species in each of the six areas range from five in the Sistema Arrecifal Lobos-Tuxpan to 179 in the Reserva de la Biosfera Los Tuxtlas. Of the 265 species recorded from the six areas, 138 (52.1%) are non-endemics, 89 (33.6%) are country endemics, 31 (11.7%) are state endemics, and seven (2.6%) are non-native species. Interestingly, the ratio of non-native to country endemics in these six parks varies among them. In Parque Nacional Cañón del Río Blanco the ratio is close to one (66 to 61; 1.1). In Reserva de la Biosfera Los Tuxtlas and Sistema Arrecifal Veracruzano, the ratios are several times in favor of the non-native species relative to the country endemics: (123 to 30; 4.1) and (47 to 16; 2.9), respectively. In Parque Nacional Pico de Orizaba, the relative proportions are reversed (4 to 37; 0.11).

The representation of protected areas among the four physiographic regions of the state is biased heavily in favor of the GCL (Table 22), which, as previously demonstrated, is the region of least conservation significance. In addition, the area we identified above as the most significant from a conservation perspective, i.e., the Sierra Madre Oriental, has no protected areas within its borders. Rectifying this imbalance should be of the highest priority for additional conservation efforts at the federal governmental level.

In Veracruz, 93 herpetofaunal native species are not represented in any of the six protected areas. These species, along with their distributional status and the physiographic regions from which they are known are as follows:

Incilius macrocristatus (GCL)
Incilius nebulifer (GCL, SMO, TVB)
*Eleutherodactylus longipes** (GCL)
Dryophytes arenicolor (TVB)
*Duellmanohyla chamulae** (GCL)
*Exerodonta bivocata** (GCL)
*Ptychohyla zophodes** (SMO, TVB)
*Quilticohyla zoque** (GCL)
*Sarcohyla pachyderma*** (SMO)
*Tlalocohyla godmani** (SMO, TVB)
*Lithobates johni** (TVB)
*Lithobates montezumae** (SMO, TVB)
*Lithobates spectabilis** (SMO, TVB)
*Aquiloeurycea cafetalera** (SMO, TVB)
*Aquiloeurycea praecellens*** (SMO, TVB)
*Bolitoglossa veracrucis** (GCL)
*Chiropterotriton aureus*** (SMO)
*Chiropterotriton casasi*** (TVB)
*Chiropterotriton terrestris** (SMO)
*Chiropterotriton totonacus*** (TVB)
*Isthmura corrugata*** (TVB)
*Isthmura gigantea** (SMO, TVB)
*Pseudoeurycea granitum*** (SMO, TVB)
*Pseudoeurycea lynchi** (SMO, TVB)
*Thorius lunaris*** (SMO)
*Thorius magnipes*** (SMO)
*Thorius minydemus*** (SMO)

Table 22 Characteristics of the six Natural Protected Areas in Veracruz, Mexico. Abbreviations for available facilities: A = administrative services; R = park guards; S = systems of pathways; and V = facilities for visitors.

Name	Category	Date of decree	Area (ha)	Municipalities	Jurisdiction	Physiographic region	Facilities available	Occupied by landowners	Management plan available	Herpetofaunal survey completed
Cañón del Río Blanco	Parque Nacional	22 March 1938	48,799.78	Orizaba, Fortín, Ixtaczoquitlán, Atzacan, Nogales, Camerino Z. Mendoza, Maltrata, Aquila, Río Blanco, Rafael Delgado, Acultzingo, Soledad Atzompa	Mexican Federal Government	Gulf Coastal Lowlands	A, R, S, V	Yes	No	No
Cofre de Perote o Nauhcampatépetl	Parque Nacional	4 May 1937	11,530.73	Perote, Ayahualulco, Ixhuacán de los Reyes, Xico	Mexican Federal Government	Gulf Coastal Lowlands	A, R, S, V	Yes	Yes	No
Los Tuxtlas	Reserva de la Biosfera	23 November 1998	155,122.47	Ángel R. Cabada, Santiago Tuxtla, San Andrés Tuxtla, Catemaco, Mecayapan, Tatahuicapan de Juárez, Soteapan, Pajapan	Mexican Federal Government	Sierra de Los Tuxtlas	A, R, S, V	Yes	Yes	Yes
Pico de Orizaba	Parque Nacional	4 January 1937	19,750.01	Calcahualco, La Perla, Tlachichuca, Chalchicomula de Sesma, Atzitzintla	Mexican Federal Government	Transmexican Volcanic Belt	A, R, S, V	Yes	Yes	No
Sistema Arrecifal Lobos-Tuxpan	Área de Protección de Flora y Fauna	5 June 2009	30,571.15	Frente a las costas de Tamiahua y Tuxpan	Mexican Federal Government	Gulf Coastal Lowlands	A, R, S	Yes	Yes	No
Sistema Arrecifal Veracruzano	Parque Nacional	24 August 1992	65,516.47	Frente a la costa de Veracruz, Boca del Río y Alvarado	Mexican Federal Government	Gulf Coastal Lowlands	A, R, S	Yes	Yes	No

Table 23. Distribution of herpetofaunal species in the Natural Protected Areas of Veracruz, Mexico, based on herpetofaunal surveys. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxon	Natural Protected Area					
	Cañón del Río Blanco	Cofre de Perote o Nauhcampatépetl	Los Tuxtlas	Pico de Orizaba	Sistema Arrecifal Lobos-Tuxpan	Sistema Arrecifal Veracruzano
Anura (62 species)						
Bufonidae (7 species)						
*Anaxyrus compactilis**						X
*Incilius cavifrons***			X			
*Incilius cristatus**	X		X			X
*Incilius marmoreus**						X
*Incilius occidentalis**	X					
Incilius valliceps	X	X	X			X
Rhinella horribilis	X	X	X			X
Centrolenidae (1 species)						
Hyalinobatrachium viridissimum		X	X			
Craugastoridae (11 species)						
Craugastor alfredi	X		X			X
*Craugastor berkenbuschii**	X	X	X			
*Craugastor decoratus**	X	X		X		
Craugastor laticeps			X			
Craugastor loki	X	X	X			
*Craugastor megalotympanum***			X			
*Craugastor mexicanus**		X				
Craugastor pygmaeus	X	X	X			X
*Craugastor rhodopis**	X	X	X	X		X
*Craugastor spatulatus**	X					
*Craugastor vulcani***			X			
Eleutherodactylidae (5 species)						
Eleutherodactylus cystignathoides	X	X				
Eleutherodactylus leprus			X			
*Eleutherodactylus nitidus**	X	X				
*Eleutherodactylus verrucipes**			X			
*Eleutherodactylus verruculatus***	X					
Hylidae (22 species)						
*Bromeliohyla dendroscarta**	X		X			
*Charadrahyla nephila**			X			
*Charadrahyla taeniopus**		X				
Dendropsophus ebraccatus			X			
Dendropsophus microcephalus	X		X			
*Dryophytes euphorbiaceus**	X			X		
*Dryophytes eximius**	X	X	X	X		
*Dryophytes plicatus**				X		
*Ecnomiohyla valancifer***			X			
*Megastomatohyla mixomaculata**	X	X	X			
*Megastomatohyla nubicola***	X					
*Rheohyla miotympanum**	X	X	X			
*Sarcohyla arborescandens**	X	X		X		
*Sarcohyla bistincta**	X			X		
*Sarcohyla siopela**		X				
Scinax staufferi	X		X			X
Smilisca baudinii	X	X	X			X
Smilisca cyanosticta			X			
Tlalocohyla loquax	X		X			X
Tlalocohyla picta	X		X			X

Table 23 (continued). Distribution of herpetofaunal species in the Natural Protected Areas of Veracruz, Mexico, based on herpetofaunal surveys. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxon	Natural Protected Area					
	Cañón del Río Blanco	Cofre de Perote o Nauhcampatépetl	Los Tuxtlas	Pico de Orizaba	Sistema Arrecifal Lobos-Tuxpan	Sistema Arrecifal Veracruzano
Trachycephalus vermiculatus	X		X			X
Triprion spinosus	X		X			
Leptodactylidae (3 species)						
Engystomops pustulosus			X			
Leptodactylus fragilis	X	X	X			X
Leptodactylus melanonotus	X		X			X
Microhylidae (3 species)						
Gastrophryne elegans			X			
Hypopachus ustus	X		X			X
Hypopachus variolosus		X	X			
Phyllomedusidae (2 species)						
Agalychnis taylori	X		X			
Agalychnis moreletii	X		X			
Ranidae (5 species)						
Lithobates berlandieri	X	X	X			
Lithobates brownorum			X			
*Lithobates catesbeianus****			X			
Lithobates maculatus			X			
Lithobates vaillanti	X	X	X			
Rhinophrynidae (1 species)						
Rhinophrynus dorsalis			X			X
Scaphiopodidae (2 species)						
Scaphiopus couchii						X
Spea multiplicata	X					
Caudata (28 species)						
Ambystomatidae (1 species)						
*Ambystoma velasci**		X		X		
Plethodontidae (26 species)						
*Aquiloeurycea cephalica**	X	X		X		
*Bolitoglossa alberchi**			X			
Bolitoglossa mexicana	X		X			
Bolitoglossa occidentalis			X			
*Bolitoglossa platydactyla**	X	X	X	X		
Bolitoglossa rufescens	X		X			
*Chiropterotriton ceronorum**				X		
*Chiropterotriton chiropterus**	X	X		X		
*Chiropterotriton chondrostega**						X
*Chiropterotriton lavae***		X				
*Chiropterotriton nubilus***		X				
*Chiropterotriton perotensis***		X				
*Isthmura naucampatepetl***		X				
*Parvimolge townsendi***	X	X				
*Pseudoeurycea firscheini**	X					
*Pseudoeurycea gadovii**	X	X		X		
*Pseudoeurycea leprosa**	X	X		X		
*Pseudoeurycea lineola***	X		X	X		
*Pseudoeurycea melanomolga**		X		X		
*Pseudoeurycea nigromaculata***	X		X			
*Pseudoeurycea orchimelas***			X			
*Pseudoeurycea werleri**			X			

Table 23 (continued). Distribution of herpetofaunal species in the Natural Protected Areas of Veracruz, Mexico, based on herpetofaunal surveys. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxon	Natural Protected Area					
	Cañón del Río Blanco	Cofre de Perote o Nauhcampatépetl	Los Tuxtlas	Pico de Orizaba	Sistema Arrecifal Lobos-Tuxpan	Sistema Arrecifal Veracruzano
*Thorius dubitus**	X	X		X		
*Thorius narismagnus***			X			
*Thorius pennatulus***	X		X			
*Thorius troglodytes***	X	X				
Sirenidae (1 species)						
Siren intermedia					X	
Gymnophiona (1 species)						
Dermophiidae (1 species)						
Dermophis mexicanus			X			X
Crocodylia (1 species)						
Crocodylidae (1 species)						
Crocodylus moreletii			X			
Squamata (159 species)						
Anguidae (8 species)						
*Abronia chiszari***			X			
*Abronia graminea**	X	X		X		
*Abronia reidi***			X			
*Abronia taeniata**	X					
*Barisia imbricata**	X	X		X		
Gerrhonotus liocephalus	X		X	X		
*Mesaspis antauges***	X			X		
*Ophisaurus ceroni***						X
Corytophanidae (3 species)						
Basiliscus vittatus	X		X			X
Corytophanes hernandesii	X		X			X
Laemanctus serratus			X			X
Dactyloidae (13 species)						
*Norops barkeri**			X			
Norops beckeri			X			
Norops biporcatus			X			
*Norops duellmani***			X			
Norops laeviventris	X		X			
Norops lemurinus	X		X			
Norops petersii	X		X			
Norops rodriguezii			X			
*Norops sagrei****			X			
*Norops schiedii***		X				
Norops sericeus		X	X			
Norops tropidonotus	X		X			X
Norops uniformis			X			
Dibamidae (1 species)						
*Anelytropsis papillosus**		X				
Diploglossidae (2 species)						
*Celestus enneagrammus**	X	X				
*Celestus ingridae***			X			
Eublepharidae (1 species)						
Coleonyx elegans			X			
Gekkonidae (3 species)						
*Hemidactylus frenatus****			X			
*Hemidactylus mabouia ****		X	X			X

Table 23 (continued). Distribution of herpetofaunal species in the Natural Protected Areas of Veracruz, Mexico, based on herpetofaunal surveys. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxon	Natural Protected Area					
	Cañón del Río Blanco	Cofre de Perote o Nauhcampatépetl	Los Tuxtlas	Pico de Orizaba	Sistema Arrecifal Lobos-Tuxpan	Sistema Arrecifal Veracruzano
*Hemidactylus turcicus****			X			X
Iguanidae (2 species)						
Ctenosaura acanthura	X		X			X
Iguana iguana			X			X
Mabuyidae (1 species)						
Marisora lineola	X		X			
Phrynosomatidae (17 species)						
*Phrynosoma braconnieri**	X					
*Phrynosoma orbiculare**	X	X		X		
*Sceloporus aeneus**	X	X		X		X
*Sceloporus bicanthalis**				X		
*Sceloporus formosus**	X	X		X		
Sceloporus grammicus	X	X		X		
Sceloporus internasalis			X			
*Sceloporus jalapae**	X	X				
*Sceloporus megalepidurus**	X	X		X		X
*Sceloporus mucronatus**	X	X		X		X
*Sceloporus salvini**			X			
*Sceloporus scalaris**	X	X				
Sceloporus serrifer						X
*Sceloporus spinosus**	X	X		X		
Sceloporus teapensis	X		X			
*Sceloporus torquatus**	X	X		X		X
Sceloporus variabilis	X	X	X	X		X
Scincidae (4 species)						
*Plestiodon brevirostris**	X	X		X		
*Plestiodon copei**			X	X		
*Plestiodon lynxe**		X		X		
Plestiodon sumichrasti	X		X			X
Sphaerodactylidae (1 species)						
Sphaerodactylus glaucus			X			
Sphenomorphidae (3 species)						
Scincella cherriei	X		X			X
*Scincella gemmingeri**	X	X	X			
*Scincella silvicola**			X			
Teiidae (5 species)						
*Aspidoscelis costata**	X					
Aspidoscelis deppii						X
Aspidoscelis gularis	X					
*Aspidoscelis guttatus**	X	X	X			X
*Holcosus amphigrammus**	X		X			X
Xantusiidae (3 species)						
Lepidophyma flavimaculatum			X			
*Lepidophyma pajapanense**			X			
*Lepidophyma tuxtlae**			X			
Xenosauridae (1 species)						
*Xenosaurus grandis**	X		X			
Boidae (1 species)						
Boa imperator	X		X			X
Colubridae (28 species)						

Table 23 (continued). Distribution of herpetofaunal species in the Natural Protected Areas of Veracruz, Mexico, based on herpetofaunal surveys. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxon	Natural Protected Area					
	Cañón del Río Blanco	Cofre de Perote o Nauhcampatépetl	Los Tuxtlas	Pico de Orizaba	Sistema Arrecifal Lobos-Tuxpan	Sistema Arrecifal Veracruzano
Coluber constrictor						X
*Conopsis lineata**	X	X				X
Dendrophidion vinitor			X			
Drymarchon melanurus		X	X			
Drymobius chloroticus			X			
Drymobius margaritiferus	X	X	X			X
*Ficimia olivacea**	X		X			X
Ficimia publia			X			
*Ficimia variegata**			X			
Lampropeltis polyzona			X			
Leptophis mexicanus	X		X			
Masticophis mentovarius			X			
Mastigodryas melanolomus	X					
Oxybelis aeneus			X			X
Oxybelis fulgidus			X			
Phrynonax poecilonotus			X			
*Pituophis deppei**	X	X		X		
Pseudelaphe flavirufa			X			
*Salvadora bairdi**	X	X	X			
Senticolis triaspis			X			
Spilotes pullatus	X	X	X			
Stenorrhina degenhardtii	X		X			
Tantilla rubra	X					
Tantilla schistosa	X		X			
*Tantilla slavensi***			X			
Tantillita lintoni			X			
Trimorphodon biscutatus			X			
*Trimorphodon tau**	X					
Dipsadidae (36 species)						
Adelphicos quadrivirgatum			X			
Amastridium sapperi			X			
*Chersodromus liebmanni**	X			X		
Clelia scytalina			X			
Coniophanes bipunctatus	X		X			X
Coniophanes fissidens	X	X	X			
Coniophanes imperialis	X		X			X
Coniophanes quinquevittatus			X			
*Coniophanes taeniatus**			X			
Conophis lineatus			X			
*Conophis morai***			X			
*Geophis blanchardi**	X					
Geophis carinosus			X			
*Geophis juliai***			X			
*Geophis semidoliatus**	X	X	X			X
Imantodes cenchoa	X		X			
Imantodes gemmistratus			X			
Leptodeira frenata			X			
Leptodeira maculata	X		X			
Leptodeira polysticta			X			
Leptodeira septentrionalis	X		X			

Table 23 (continued). Distribution of herpetofaunal species in the Natural Protected Areas of Veracruz, Mexico, based on herpetofaunal surveys. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxon	Natural Protected Area					
	Cañón del Río Blanco	Cofre de Perote o Nauhcampatépetl	Los Tuxtlas	Pico de Orizaba	Sistema Arrecifal Lobos-Tuxpan	Sistema Arrecifal Veracruzano
Ninia diademata	X		X			
Ninia sebae	X	X	X			
Oxyrhopus petolarius			X			
Pliocercus elapoides	X		X			X
Rhadinaea decorata	X		X			
*Rhadinaea forbesi***				X		
*Rhadinaea fulvivittis**	X					
*Rhadinaea macdougalli**			X			
Sibon dimidiatus			X			
*Sibon linearis***			X			
Sibon nebulatus			X			
Tretanorhinus nigroluteus			X			
Tropidodipsas fasciata			X			
Tropidodipsas sartorii	X		X			
Xenodon rabdocephalus			X			
Elapidae (3 species)						
*Micrurus diastema**	X		X			X
Micrurus elegans	X		X			
*Micrurus limbatus***			X			
Leptotyphlopidae (2 species)						
Epictia phenops			X			
*Epictia resetari**			X			
Natricidae (7 species)						
Storeria dekayi	X					
*Thamnophis chrysocephalus**	X			X		
Thamnophis eques	X					X
*Thamnophis godmani**	X					
Thamnophis proximus	X		X			X
*Thamnophis scalaris**	X	X		X		
*Thamnophis sumichrasti**	X	X				
Sibynophiidae (1 species)						
Scaphiodontophis annulatus	X		X			X
Typhlopidae (2 species)						
Amerotyphlops tenuis	X		X			
*Virgotyphlops braminus****			X			
Viperidae (11 species)						
Bothrops asper	X		X			X
*Crotalus intermedius**	X	X		X		
*Crotalus mictlantecuhtli***			X			
Crotalus molossus	X	X		X		
*Crotalus ravus**	X	X		X		
Crotalus scutulatus	X	X				
*Crotalus triseriatus**	X	X		X		
*Metlapilcoatlus nummifer**	X	X				X
Metlapilcoatlus olmec			X			
*Ophryacus smaragdinus**	X					
*Ophryacus undulatus**	X			X		
Testudines (14 species)						
Cheloniidae (4 species)						
Caretta caretta			X		X	X

Table 23 (continued). Distribution of herpetofaunal species in the Natural Protected Areas of Veracruz, Mexico, based on herpetofaunal surveys. * = species endemic to Mexico; ** = species endemic to Veracruz; and *** = non-native species.

Taxon	Natural Protected Area					
	Cañón del Río Blanco	Cofre de Perote o Nauhcampatépetl	Los Tuxtlas	Pico de Orizaba	Sistema Arrecifal Lobos-Tuxpan	Sistema Arrecifal Veracruzano
Chelonia mydas			X		X	X
Eretmochelys imbricata			X		X	X
Lepidochelys kempii			X		X	X
Chelydridae (1 species)						
Chelydra rossignonii			X			
Dermochelyidae (1 species)						
Dermochelys coriacea			X			X
Emydidae (1 species)						
*Trachemys scripta****			X			X
Geoemydidae (1 species)						
Rhinoclemmys areolata			X			
Kinosternidae (4 species)						
Kinosternon acutum			X			X
*Kinosternon herrerai**		X				
Kinosternon leucostomum			X			X
Kinosternon scorpioides			X			X
Staurotypidae (2 species)						
Claudius angustatus			X			X
Staurotypus triporcatus			X			X

Table 24. Summary of the distributional status of herpetofaunal species in protected areas of Veracruz, Mexico. Total = total number of species recorded in all of the listed protected areas.

Protected area	Number of species	Distributional status			
		Non-endemic (NE)	Country Endemic (CE)	State Endemic (SE)	Non-native (NN)
Cañón del Río Blanco	135	66	61	8	—
Cofre de Perote o Nauhcampatépetl	76	21	47	7	1
Los Tuxtlas	179	123	30	19	7
Pico de Orizaba	44	4	37	3	—
Sistema Arrecifal Lobos-Tuxpan	5	5	—	—	—
Sistema Arrecifal Veracruzano	67	47	16	1	3
Total	**265**	**138**	**89**	**31**	**7**

*Thorius munificus*** (SMO)
*Thorius spilogaster*** (TVB)
Notophthalmus meridionalis (GCL, SMO)
*Gerrhonotus ophiurus** (SMO, TVB)
*Ophisaurus incomptus** (TVB)
Laemanctus longipes (GCL, TVB)
*Norops alvarezdeltoroi** (GCL)
*Norops compressicauda** (GCL)
*Norops cymbops** (SMO, TVB)
*Norops naufragus** (SMO)
*Norops purpuronectes** (GCL)
*Celestus legnotus** (SMO)
Celestus rozellae (GCL)
Holbrookia propinqua (GCL)
*Sceloporus aureolus** (SMO)
Sceloporus cyanogenys (SMO)
Plestiodon tetragrammus (SMO)
Gonatodes albogularis (GCL)
*Lepidophyma sylvaticum** (GCL, SMO)
*Lepidophyma zongolica** (SMO, TVB)
*Xenosaurus rectocollaris** (SMO)
*Xenosaurus tzacualtipantecus** (SMO)
*Conopsis acuta** (GCL)
*Conopsis nasus** (SMO, TVB)
Ficimia streckeri (GCL, SMO)
Lampropeltis triangulum (GCL)
Leptophis ahaetulla (GCL)
Masticophis flagellum (GCL)
Masticophis schotti (GCL, SMO)
Pantherophis emoryi (GCL, SMO)
Pituophis lineaticollis (SMO, TVB)
Salvadora grahamiae (SMO, TVB)

Stenorrhina freminvillii (TVB)
*Tantilla bocourti** (SMO, TVB)
*Tantilla shawi** (SMO)
Adelphicos visoninum (GCL)
Diadophis punctatus (SMO, TVB)
*Geophis bicolor** (TVB)
*Geophis chalybeus*** (SMO)
*Geophis lorancai** (SMO, TVB)
*Geophis mutitorques** (SMO)
*Rhadinaea cuneata** (GCL, SMO, TVB)
*Rhadinaea marcellae** (SMO)
*Rhadinaea quinquelineata** (SMO)
*Rhadinella schistosa** (SMO)
Micrurus tener (SMO)
Rena dulcis (GCL, SMO)
*Rena myopica** (GCL, SMO)
Nerodia rhombifer (GCL, SMO, TVB)
*Storeria storerioides** (SMO, TVB)
*Thamnophis conanti** (SMO)
Thamnophis cyrtopsis (SMO)
Thamnophis marcianus (SMO, TVB)
*Thamnophis pulchrilatus** (SMO)
*Thamnophis scaliger** (TVB)
*Agkistrodon taylori** (GCL, SMO)
*Cerrophidion petlalcalensis** (SMO, TVB)
*Crotalus aquilus** (TVB)
Crotalus atrox (GCL)
*Crotalus polystictus** (TVB)
*Crotalus totonacus** (SMO, TVB)
Dermatemys mawii (GCL)
*Terrapene mexicana** (GCL)
Trachemys venusta (GCL)
Kinosternon flavescens (GCL)
Gopherus berlandieri (GCL)

Forty-nine of these 93 species (52.7%) are country endemics, 13 (14.0%) are state endemics, and 31 (33.3%) are non-endemics. Thus, 62 species (66.7%) are endemic, but are not represented within the protected areas of the state.

Additional surveys are necessary to determine which of these 93 species might be located in one or more of the existing protected areas, and which would require protection in newly-established areas. The numbers of these species recorded in the four physiographic regions of the state are as follows: GCL (35), SLT (0), SMO (57), and TVB (38). Interestingly, the largest proportion of these 93 species that are not represented in existing protected areas is in the SMO (61.3%), a region that currently does not contain any designated protected areas. This fact provides an additional reason why protected areas should be established in the limited portion of the state occupied by elements of the SMO.

Conclusions and Recommendations

Conclusions

A. Currently, the herpetofauna of Veracruz is comprised of 359 species, including 76 anurans, 45 salamanders, one caecilian, one crocodylian, 217 squamates (87 lizards and 130 snakes), and 19 turtles.

B. The number of herpetofaunal species known from each of the four physiographic regions in Veracruz ranges from 179 in the SLT to 236 in the SMO.

C. The number of species shared among the physiographic regions ranges from 100 between the GCL and the TVB to 190 between the SMO and the TVB. The Coefficient of Biogeographic Resemblance values range from a low of 0.49 between the GCL and the SMO and between the GCL and the TVB to a high of 0.83 between the SMO and the TVB. The UPGMA dendrogram illustrates two distinct clusters, one including the SMO and TVB and the other including the SLT and GCL. The former cluster results from the sharing of a large number of herpetofaunal species from highland environments, while the latter cluster reflects the sharing of a sizable number of wide-ranging generalist lowland species found on both versants of Mexico and Central America.

D. The level of herpetofaunal endemism in Veracruz is relatively high. Of the 359 species that comprise the entire herpetofauna, 182 species (50.7%) are either endemic to the country of Mexico or to the state of Veracruz. Most of the endemic species are country endemics (138; 75.8%), whereas 44 (24.2%) are endemic to the state of Veracruz. The 44 state endemic species include seven anurans, 22 salamanders, and 15 squamates. One-half of the state endemics in Veracruz are salamanders of the plethodontid genera *Aquiloeurycea* (one species), *Chiropterotriton* (six), *Isthmura* (two), *Parvimolge* (one), *Pseudoeurycea* (four), and *Thorius* (eight).

E. The distributional status of the 359 members of the Veracruz herpetofauna is as follows (in order of decreasing species numbers): non-endemics (169, 47.1%); country endemics (138, 38.4%); state endemics (44, 12.3%); and non-natives (8, 2.2%).

F. The 169 non-endemic species fall into the following distributional categories: MXCA (89, 52.7%); MXSA (30, 17.8%); MXUS (29, 17.2%); USCA (11, 6.5%); USSA (four, 2.4%); and OCEA (five, 3.0%).

G. The principal environmental threats to the herpetofauna of Veracruz are deforestation, livestock production, roads, pollution of water bodies, myths and other cultural factors, diseases, exotic and invasive species, and illegal commerce.

H. We evaluated the conservation status of the herpetofauna of Veracruz by using the SEMARNAT, IUCN, and EVS systems. As with previous MCS studies,

the SEMARNAT system was found to be of minimal value, since only 157 of 351 native herpetofaunal species have been evaluated using that system. Of the 157 assessed species, 12 are placed in the Endangered (P) category, 42 in the Threatened (A) category, and 103 in the Special Protection (Pr) category. Using the SEMARNAT system does not appear to be biased toward evaluating endemic vs. non-endemic species, but it has not been applied widely enough to be useful for evaluating the conservation status of the Veracruz herpetofauna.

I. The results of applying the IUCN conservation system by category and the proportions of 351 native herpetofaunal species are as follows: CR (30, 8.5%); EN (31, 8.8%); VU (25, 7.1%); NT (11, 3.1%); LC (161, 45.9%); DD (24, 6.8%); and NE (69, 19.7%).

J. A comparison of applying the IUCN categories by distributional status of the 182 country and state endemic species indicate that 71 (39.0%) are allocated to one of the three threat categories, with the majority of them (53) placed in the CR and EN categories. The largest portion of the 351 native species (161, 45.9%) is assigned to the LC category, which includes 64 country endemics and one state endemic. Of the 24 DD species, 13 are country endemics and 11 are state endemics. Finally, of the 69 NE species, the majority are non-endemic species (51, 73.9%), whereas 18 (26.1%) are endemic species. Thus, a total of 93 native species (26.5%) are placed in the DD and NE categories.

K. An application of the EVS system of conservation assessment to the 346 native non-marine species demonstrates that categorical values increase from the low vulnerability species (93, 26.9%) through the medium vulnerability species (119, 34.4%) to the high vulnerability species (134, 38.7%).

L. A comparison of the IUCN and EVS conservation status categorizations demonstrates that 45.5% of the 134 high vulnerability species are placed in one of the three IUCN "threat categories" (CR, EN, or VU), and that 37.3% of the low vulnerability species are allocated to the LC category. Thus, as in previous studies, the results of applying these two conservation assessment systems to the Veracruz herpetofauna do not align well.

M. An examination of 254 of the 346 native species (73.4%) allocated to the IUCN DD, NE, and LC categories indicates that many are assessed improperly, when compared to their respective EVS values, so we provided guidance on how these species might be re-evaluated to better indicate their prospects for survival in perpetuity.

N. The RHP measure was used to determine the conservation significance of the four regional herpetofaunas in Veracruz. These analyses demonstrate that the most significant regional herpetofauna is found within the SMO, since it harbors the largest number of endemic species (130, 71.4%) of the 182 total country and state endemics. In addition, the number of high vulnerability species (78) for this region is only one less than for the TVB. The conservation significance of these two regions is similar, because the SMO and TVB include 130 and 123 total endemic species, respectively, as well as 78 and 79 high vulnerability species, respectively. These two regions also share a significant number of species (190 of the 236 in the SMO, and 222 in the TVB). The other two regions (GCL and SLT) are distinctly clustered from the SMO and TVB pairing, inasmuch as they both have fewer than one-half of the number of high vulnerability species as either the SMO or TVB, and only about one-third of the endemic species.

O. Relatively few protected areas exist in Veracruz, and all are administered by the federal government. The collective size of the six protected areas is 331,290.6 ha (3,312.9 km^2), which is 4.6 % of the area of the state. Four of these six areas are located in the GCL, which is the state's least significant physiographic region. A single area is located in the TVB and only one in the SLT. None of the current protected areas are located within the SMO, the region of greatest conservation significance. Most of the six protected areas contain the full array of the requisite facilities, but landowners occupy all of these areas. Management plans are available for all but one of the protected areas, but herpetofaunal surveys have been completed for only one of them.

P. Herpetofaunal records collated for each of the six protected areas demonstrate that collectively, 265 of the 359 total number of species in the state are known from these areas. Of these 265 species, 138 are non-endemics, 89 are country endemics, 31 are state endemics, and seven are non-natives. The proportions of these species groups are, respectively: 52.1%, 33.6%, 11.7%, and 2.6%.

Recommendations

A. Our interest in writing this 12th entry in the MCS has been the same as for all the preceding entries, i.e., to document the composition, physiographic distribution, and conservation status of the native herpetofaunal species, which number 359 in Veracruz. By using the EVS methodology, we demonstrated that of the 346 native non-marine species recorded for the state, 93 are allocated to the low vulnerability category, 119 to the medium category, and 134 to the high category, confirming that the herpetofauna is of major conservation significance. Our use of the RHP measure indicated that from a conservation perspective the most significant physiographic region is the SMO, as it contains high numbers of both endemic species and

species of high vulnerability. Other MCS studies found a serious disconnection between the relative importance of a given region's herpetofauna and the representation of protected areas. In the case of Veracruz, no protected areas have been established within the SMO; and the major conservation challenge, therefore, is to address this disconnection by identifying and establishing one or more protected areas within this region, while providing special attention to protecting the resident country and state endemic species.

B. The next most important conservation challenge is to determine, through additional surveys, which of the 93 native species not yet recorded from any of the six existing protected areas in Veracruz might be found in any of them, and which species might require protection by establishing new protected areas. This effort should consider not only the herpetofaunal species already known to occur in those areas, but also ones that might be encountered in the future. Based on recent herpetological work, such species likely will be salamanders.

C. Once all the species comprising the Veracruz herpetofauna are demonstrated to occur within the protected area system, the next most important step will be to set up programs for monitoring the long-term survival needs for all the species involved.

D. These steps need to be undertaken as rapidly as possible, especially because from a conservation perspective the most significant regions in the state (i.e., the SMO and TVB) are the two smallest of the four physiographic regions in Veracruz, and likely the most vulnerable. Time is of the essence, because Veracruz is the 3rd most populous state in Mexico, and the 10th most densely populated.

"Homo sapiens*, the wise human being, must now learn from its mistakes and live up to its name. We who are alive today have the formidable task of making sure that our species does so. We must not give up hope. We have all the tools we need, the thoughts and ideas of billions of remarkable minds and the immeasurable energies of nature to help us in our work. And we have one more thing—an ability, perhaps unique among the living creatures on the planet—to imagine a future and work towards achieving it."*

David Attenborough (2020)

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***Addendum* (changes which occurred past the conclusion of analyses)**

We chose a cut-off date of 31 October 2020 to discontinue our revision of the sizeable number of calculations dealing with the herpetofauna of Veracruz. After this date, we added the pertinent taxa and publications to this addendum, as follows:

Exerodonta abdivita. De la Torre-Loranca et al. (2020) reported this hylid frog as new for the state of Veracruz, based on a "dead-on-roadside" (DOR) specimen found at 1,900 m in Atlanca, in the municipality of Los Reyes.

Phrynosoma cornutum. Köhler (2021) indicated the distribution of this lizard in the extreme northern of Veracruz, however, these records have not been genetically confirmed.

Metlapilcoatlus borealis. Tepos-Ramírez et al. (2021) described a new species of jumping viper (*Metlapilcoatlus borealis*), which they showed to be distributed in Veracruz. These authors also indicated that *M. nummifer* is still distributed in this state, such that now two species of jumping vipers are known from Veracruz.

Kinosternon integrum. De la Torre-Loranca et al. (2020) reported this Mud Turtle as new for the state of Veracruz at Ocotepec, in the municipality of Los Reyes, at an elevation of 1,622 m, and at Sierra de Agua, in the municipality of Acultzingo, at an elevation of 1,389 m.

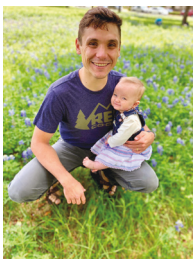
Lizzeth A. Torres-Hernández is a Biology Bachelor's intern at Universidad Autónoma del Estado de Hidalgo in Mexico. She is interested in the topics of ecology, diversity, and conservation of amphibians and reptiles of Mexico, as well as the study of climatic niches and the effects of climate change on the distribution of these biological groups. She has realized minor contributions on the diversity and conservation of amphibians and reptiles of Mexico.

Aurelio Ramírez-Bautista began his herpetological career conducting research as an undergraduate student at the Los Tuxtlas Biological Field Station, Veracruz, Mexico. He received his Bachelor's degree in Biology from Universidad Veracruzana in Veracruz, Mexico. He earned his Master's degree in Science and his Doctorate at the Universidad Nacional Autónoma de México (UNAM), and received a postdoctoral appointment at the University of Oklahoma, Norman, Oklahoma, USA. His main research involves studies on ecology, demography, reproduction, conservation, and life history evolution, using the amphibians and reptiles of Mexico as models. He served as president of the Sociedad Herpetologica Mexicana, as a section editor for the journal *Mesoamerican Herpetology*, and as a professor at UNAM. Currently, he is a professor at Universidad Autónoma del Estado de Hidalgo (UAEH), where he teaches courses in population ecology, herpetology, and the natural history of amphibians and reptiles. He has authored or co-authored 295 peer-reviewed papers and books on herpetology, ecology, life history evolution, sexual size dimorphism, reproduction, global climate change, potential distribution, demography, conservation, behavior, and thermal ecology. As a professor, he has graduated 71 students, including 44 undergraduate students, 18 Master's in Science students, and seven Ph.D. students; he also has participated as an external advisor for Ph.D. students at Brigham Young University (Provo, Utah, USA), the University of Miami (Coral Gables, Florida, USA), and Eastern Carolina University (Greenville, North Carolina, USA). Aurelio has received several national (Helia Bravo Hollis Award by the Technical Council of Scientific Research of the UNAM, member of the National System of Researchers level II) and international (Donald Tinkle Award by Southwestern Association of Naturalists) awards, and has a PRODEP (Programa para el Desarrollo Profesional Docente) profile at UAEH.

Raciel Cruz-Elizalde is a Mexican herpetologist who received his B.Sc. in Biology, M.Sc. in Biodiversity and Conservation, and Ph.D. in Biodiversity and Conservation from the Universidad Autónoma del Estado de Hidalgo (UAEH). Raciel is interested in the ecology, life history evolution, diversity, and conservation of amphibians and reptiles of Mexico. He has authored or co-authored several publications, including papers, notes, book chapters, and books on ecology, life history evolution, sexual size dimorphism, reproduction, and the conservation of amphibians and reptiles. His current research includes the life history evolution of diverse lizard species of the genus *Sceloporus*, conservation issues in natural protected areas, and the analysis of ecological and morphological traits in the composition of amphibian and reptile assemblages, mainly in cloud forests.

Uriel Hernández-Salinas earned his Bachelor's, Master's, and Ph.D. degrees at the Universidad Autónoma del Estado de Hidalgo in Mexico. He is a herpetologist and the co-author of three books: *Herpetofauna del Valle de México: Diversidad y Conservación*; *Lista Anotada de los Anfibios y Reptiles del Estado de Hidalgo, México*; and *Los Anfibios y Reptiles del Estado de Hidalgo: Diversidad, Biogeografía y Conservación*. He is a full-time professor at CIIDIR Durango, Mexico, and curator-in-charge of the scientific collection of amphibians and reptiles at the same research center. In addition to having authored or co-authored several peer-reviewed papers, he teaches Environmental Management II and Fauna Management in the Master's and Doctoral programs. In 2015, he received the academic distinction of becoming a member of the National System of Researchers, level 1. His main topics of interest are biodiversity, species richness, biogeography, and the evolution of life histories of various species of amphibians and reptiles in Mexico.

Christian Berriozabal-Islas earned his Bachelor's degree at the Universidad Autónoma del Estado de Hidalgo in Mexico, and his Master's and Ph.D. degrees in the Biodiversity and Conservation program of this university. He is a herpetologist with an interest in species diversity, thermal ecology, functional diversity, climatic change, and distributional patterns using amphibians and reptiles as biological models. Currently, he is a professor at the Universidad Politécnica de Quintana Roo in Mexico. Christian has been involved with projects on environmental education and wildlife conservation in rural communities, and is a co-author of the book *Los Anfibios y Reptiles del Estado de Hidalgo, México: Diversidad, Biogeografía y Conservación* (2014). He also has authored or co-authored several papers on diversity, ecology, and climate change. One of his primary interests is the natural history of Mexican turtles.



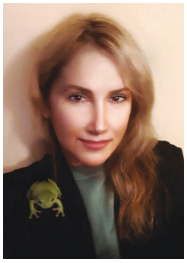
Dominic L. DeSantis is an Assistant Professor of Biology at Georgia College and State University (Milledgeville, Georgia, USA), in the Department of Biological and Environmental Sciences. Dominic's research interests broadly include the behavioral ecology, conservation biology, and natural history of herpetofauna. In addition to ongoing collaborative projects associated with the Mesoamerican Research Group, much of Dominic's current research focuses on using novel animal-borne sensor technologies to study the behavior of snakes in the field. While completing his Ph.D. at the University of Texas at El Paso, Dominic accompanied Vicente Mata-Silva, Elí García-Padilla, and Larry David Wilson on survey and collecting expeditions to Oaxaca in 2015, 2016, and 2017, and was a co-author on numerous natural history publications produced from those visits, including an invited book chapter on the conservation outlook for herpetofauna in the Sierra Madre del Sur of Oaxaca.

Jerry D. Johnson is Professor of Biological Sciences at The University of Texas at El Paso, and has extensive experience studying the herpetofauna of Mesoamerica, especially that of southern Mexico. Jerry is the Director of the 40,000-acre "Indio Mountains Research Station," was a co-editor of the book *Conservation of Mesoamerican Amphibians and Reptiles* and co-author of four of its chapters. He is also the senior author of the recent paper "A conservation reassessment of the Central American herpetofauna based on the EVS measure," and is Mesoamerica/Caribbean editor for Geographic Distribution section of *Herpetological Review*. Johnson has authored or co-authored over 130 peer-reviewed papers, including two 2010 articles, "Geographic distribution and conservation of the herpetofauna of southeastern Mexico" and "Distributional patterns of the herpetofauna of Mesoamerica, a biodiversity hotspot." One species, *Tantilla johnsoni*, has been named in his honor. Presently, he is an Associate Editor and Co-chair of the Taxonomic Board for the website *Mesoamerican Herpetology*.

Arturo Rocha is a Ph.D. student in the Ecology and Evolutionary Biology program at the University of Texas at El Paso. His interests include the study of the biogeography, physiology, and ecology of amphibians and reptiles in the southwestern United States and Mexico. A graduate of the University of Texas at El Paso, his thesis centered on the spatial ecology of the Trans-Pecos Rat Snake (*Bogertophis subocularis*) in the northern Chihuahuan Desert. To date, he has authored or co-authored over 20 peer-reviewed scientific publications.

Elí García-Padilla is a herpetologist who focuses primarily on the study of the ecology and natural history of the Mexican herpetofauna. His research efforts have centered on the Mexican states of Baja California, Tamaulipas, Chiapas, and Oaxaca. His first experience in the field was researching the ecology of the insular endemic populations of the rattlesnakes *Crotalus catalinensis*, *C. muertensis* (*C. pyrrhus*), and *C. tortugensis* (*C. atrox*) in the Gulf of California. For his Bachelor's degree, he presented a thesis on the ecology of *C. muertensis* (*C. pyrrhus*) on Isla El Muerto, Baja California, Mexico. To date, he has authored or co-authored over 100 peer-reviewed scientific publications. Currently, he is employed as a formal Curator of Amphibians and Reptiles from Mexico in the electronic platform *Naturalista* of the Comisión Nacional para el Uso y Conocimiento de la Biodiversidad (CONABIO; http://www.naturalista.mx). One of his main passions is environmental education, and for several years he has been working on various projects that include the use of audiovisual media as a powerful tool to reach large audiences and to promote the importance of the knowledge, protection, and conservation of the Mexican biodiversity. Elí's interests include wildlife and conservation photography, and his art has been published in several recognized scientific, artistic, and educational books, magazines, and websites. Presently he is collaborating in a research project evaluating the Jaguar (*Panthera onca*) as an umbrella species for the conservation of the herpetofauna of Nuclear Central America.

Vicente Mata-Silva is a herpetologist originally from Río Grande, Oaxaca, Mexico. His interests include ecology, conservation, natural history, and biogeography of the herpetofaunas of Mexico, Central America, and the southwestern United States. He received his B.S. degree from the Universidad Nacional Autónoma de México (UNAM), and his M.S. and Ph.D. degrees from the University of Texas at El Paso (UTEP). Vicente is an Assistant Professor of Biological Sciences at UTEP in the Ecology and Evolutionary Biology Program, and Co-Director of UTEP's Indio Mountains Research Station, located in the Chihuahuan Desert of Trans-Pecos, Texas, USA. To date, Vicente has authored or co-authored over 100 peer-reviewed scientific publications. He also was the Distribution Notes Section Editor for the journal *Mesoamerican Herpetology*, and is currently Acting Section Editor for the journal *Herpetological Review*, for Geographic Distribution.



Lydia Allison Fucsko, who resides in Melbourne, Australia, is an environmental activist and amphibian conservationist. As a photographer with international publications, she has taken countless amphibian photographs, including photo galleries of frogs mostly from southeastern Australia. Dr. Fucsko has a Bachelor of Humanities from La Trobe University (Bundoora, Victoria, Australia) and a Diploma in Education from the University of Melbourne (Parkville, Victoria, Australia). She has postgraduate diplomas in computer education and in vocational education and training from the University of Melbourne (Parkville). Additionally, Dr. Fucsko has a Master's Degree in Counseling from Monash University (Clayton, Victoria, Australia). She received her Ph.D. on Environmental Education, which promoted habitat conservation, species perpetuation, and global sustainable management, from Swinburne University of Technology (Hawthorn, Victoria, Australia), while being mentored by the late Australian herpetologist and scholar Dr. Michael James Tyler (Order of Australia recipient). Dr. Fucsko, a sought-after educational consultant, has academic interests that include: clinical psychology, focusing on psychopathology; neuroscience and empathy; environmental education for sustainable development; sentient ecology; academic writing; and creative writing, which includes poetry and creative non-fiction books for children and young adults. Dr. Fucsko is also the senior author (with Boria Sax) of a chapter in the 2019 *Springer Encyclopedia of Sustainability in Higher Education* entitled "Learning Activities for Environmental Education for Sustainable Development." In 2020, the species *Tantilla lydia*, with the suggested common name, Lydia's Little Snake, was named in her honor.

Larry David Wilson is a herpetologist with lengthy experience in Mesoamerica. He was born in Taylorville, Illinois, USA, and received his university education at Millikin University in Decatur, Illinois, the University of Illinois at Champaign-Urbana (B.S. degree), and at Louisiana State University in Baton Rouge (M.S. and Ph.D. degrees). He has authored or co-authored more than 450 peer-reviewed papers and books on herpetology. Larry is the senior editor of the book *Conservation of Mesoamerican Amphibians and Reptiles* and the co-author of eight of its chapters. His other books include: *The Snakes of Honduras*; *Middle American Herpetology*; *The Amphibians of Honduras*; *Amphibians & Reptiles of the Bay Islands and Cayos Cochinos, Honduras*; *The Amphibians and Reptiles of the Honduran Mosquitia*; and *Guide to the Amphibians & Reptiles of Cusuco National Park, Honduras*. To date, he has authored or co-authored the descriptions of 75 currently recognized herpetofaunal species, and seven species have been named in his honor, including the anuran *Craugastor lauraster*, the lizard *Norops wilsoni*, and the snakes *Oxybelis wilsoni*, *Myriopholis wilsoni*, and *Cerrophidion wilsoni*. Currently, Larry is Co-chair of the Taxonomic Board for the website *Mesoamerican Herpetology.*