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Mammals (Tetrapoda: Mammalia) of the Sierra Madre Occidental, Mexico: megadiversity in an area of high environmental complexity

Mamíferos (Tetrapoda: Mammalia) de la Sierra Madre Occidental, México: megadiversidad en un área de alta complejidad ambiental

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ABSTRACT. The Sierra Madre Occidental (SMO) is the largest mountain range in Mexico (1,400 km long), and yet one of the least studied regions. Using records from museum specimens, direct observations, photographs, and literature data, we built a database with 4,659 unique mammal records. Our aims were to generate a species list, to examine general distribution patterns, to relate these patterns to ecoregions and vegetation, and to discuss the importance of the SMO as a center of endemism and high biological diversity. We recorded 171 species (34.3% of the Mexican terrestrial mammals). Forty-seven are endemic of Mexico, including ten endemics of the SMO. The highest species richness was recorded at the Tropical ecoregion (T, 125 species), followed by Madrean South (MS, 100), and Madrean Xerophylous (MX, 95). The highest number of endemics was recorded in T (37), followed by MS (24), and Madrean tropical (MT, 22). Nine of ten species endemic to the SMO occur in the temperate highlands. Sampling efforts have been scarce or nonexistent for over half the SMO. Species turnover reflects the complexity of the biomes that occur in the Sierra, and not the expected latitudinal patterns of species richness. Only 4.8% of the SMO is within a protected area, and the areas that are protected do not include vulnerable biomes like the cloud forest. Biological research is urgent in the SMO, an area under intensive mining, forestry, cattle ranching, and more recently, tourism and environmental services.

Key words: biodiversity; distribution; endemic species; Mammalia; Mexican Mountain Component; Mexican Transition Zone; turnover

RESUMEN. La Sierra Madre Occidental (SMO) es la cadena montañosa más grande de México (1,400 km), y no obstante una de las regiones menos estudiadas del país. Utilizando registros de ejemplares examinados en colecciones científicas, observaciones directas, fotografías y datos bibliográficos, construimos una base de datos con 4,659 registros únicos de mamíferos. Nuestros objetivos fueron generar una lista de especies, examinar patrones generales de distribución, relacionar estos patrones con ecorregiones y vegetación, y discutir la importancia de la SMO como centro de endemismo y alta diversidad. Se documentaron 171 especies (34.3 % de los mamíferos terrestres mexicanos). Cuarenta y siete son endémicos de México, incluyendo diez endémicos de la SMO. La mayor riqueza de especies se registró en la ecorregión Tropical (125). El mayor número de endemismos se registró en esta misma ecorregión (37), seguida de Madrense Sur (24) y Madrense Tropical (22). Nueve de las diez especies endémicas de la SMO se distribuyen en áreas templadas. Poco o ningún esfuerzo de colecta ha sido llevado a cabo en más de la mitad de la SMO. El recambio de especies refleja la diversidad y complejidad de biomas, más que los gradientes latitudinales que podrían esperarse. Solo 4.8 % de la SMO se encuentra dentro de un área protegida, pero éstas no incluyen biomas vulnerables como el bosque mesófilo. Es urgente la investigación biológica en la SMO, un área donde se desarrollan extensas actividades mineras, forestales, ganaderas, y más recientemente, turísticas y provisión servicios ambientales.

Palabras clave: biodiversidad; distribución; especies endémicas; Mammalia; Componente Mexicano de Montaña; Zona Mexicana de Transición; recambio

INTRODUCTION

The Sierra Madre Occidental (SMO) is the largest mountain range in Mexico, one of the largest silicic igneous provinces in the world, and the largest of the Cenozoic (Ferrari *et al*., 2007). It constitutes the largest portion of the "Mexican mountain component" or Mexican Transition Zone, defined by Morrone and Márquez (2003) as a natural biogeographic region of Mexico. With nearly 1,400 km in length and 240 in width, it covers about 12.5% of the Mexican territory, and part of the Mexican states of Sinaloa, Sonora, Chihuahua, Durango, Nayarit, Zacatecas, Jalisco, and Aguascalientes. The SMO is a source of hydric environmental services for large areas of northwestern Mexico (Fig. 1) and produces about 60% of the standing timber in the country (González-Elizondo *et al*., 2013). The SMO has been actively mined for iron, gold, silver, and other metals at least since the arrival of the Europeans to Mexico (Coll-Hurtado *et al*., 1990).

The SMO extends from the northern Sonora state up to the Mexico-U.S. border, to the Trans-Mexican Volcanic Belt and Sierra Madre del Sur mountain ranges. It follows a northwest-southeast path parallel to the Pacific coast with elevations ranging from 300 to 3,340 m above sea level, with an average height of 2,500 m (González-Elizondo *et al*., 2013). Because of its position, it has a continental and an oceanic slope, and because of its elevation the eastern slope creates an orographic shade on the continental side, which is arid or semi-arid, whereas the western slope and highlands are more mesic. The western side is a series of canyons and ravines that can reach a depth of over 1,500 m. These characteristics result in a high topographic, climatic, and by extension, biological diversity which is seldom evident in biogeographic work (e. g. Morrone, 2020).

The relevance of the SMO as a biographic entity and as a center of biodiversity has been widely recognized by students of flora and vegetation (Bye, 1995; Felger & Wilson, 1995; Spellenberg *et al*., 1996; Felger *et al*., 1997; González-Elizondo, 1997; Luquín *et al*., 2004; Van Devender *et al*., 2003; Van Devender & Reina, 2005; González-Elizondo *et al*., 2007; 2013, among others). This body of work documented that the structure and diversity of the plant associations is complex and far from understood, and that there is a knowledge gap on the ecological and historical underpinnings that result on the current vegetative cover. The SMO is also a center of diversification and speciation for many taxa, a good proportion of which remain unknown to science. Understanding the diversity of the SMO becomes urgent given the ongoing rate of anthropogenic modification and climate change.

The analyses on which the planning of protected areas of Mexico is based (Koleff & Urquiza-Haas, 2011) considered only five sites of extreme importance for conservation in the SMO, or approximately 1,046 km^2 of a total area of 251,546 km, which is little over 0.41% of its total area. This analysis was based on information on vertebrates as well as several ecological and goal-oriented criteria. The results suggest a paucity on the information available for the vertebrate biodiversity of the SMO rather than a real assessment of the biological importance of the area (Warshall, 1995; Flesch *et al*., 2016; González-Elizondo *et al*., 2013).

For mammals, no comprehensive study on the SMO as a biogeographic entity exists. The available works include state-wide taxonomic treatises (Anderson, 1972 for Chihuahua; Baker & Greer, 1962 for Durango; Matson & Baker, 1986 for Zacatecas), and partial studies for selected groups (e. g. Arroyo-Cabrales *et al*., 2008 for bats of Nayarit and Carleton *et al*., 1982 for some rodents, also of Nayarit). There are bibliographic compilations for some areas: Sonora (Álvarez-Castañeda & Patton, 1999, 2000, Aguascalientes (Álvarez-Castañeda *et al*., 2008); or state-wide checklists (Aguascalientes, de la Riva 2008; Sonora, Castillo-Gámez *et al*., 2010; Nayarit, Arroyo-Cabrales *et al*., 2015; Ramírez Silva *et al*., 2015, 2021; Chihuahua, López-González & García Mendoza, 2012; Durango, García-Mendoza & López-González, 2013; Jalisco, Guerrero-Vázquez *et al*., 2017; Zacatecas, López-Ortega *et al*., 2020). More detailed studies address mammal diversity at the regional level (e. g. List & McDonald, 1998; Pacheco *et al*., 2000; López-González & García-Mendoza, 2006; Torres-Morales *et al*., 2010; Espinosa-Flores *et al*., 2012; López-González *et al*., 2014a; Coronel-Arellano *et al*., 2016; López-González *et al*., 2022).

The main objective of this paper is to present an updated account of the mammals that occur in the SMO, based on verified museum information, our own collections, direct observations, photographic records, and specimen- or photograph-based literature data. Secondly, we described and compared the distribution of species by vegetation type and ecoregion (after González-Elizondo *et al*., 2013) and examined species turnover across vegetations and ecoregions describe the variation of species composition across biomes. Finally, we contrasted the species richness of the SMO with other major Mexican mountain ranges.

MATERIALS AND METHODS

Study area The Sierra Madre Occidental is an igneous mountain range that occupies an area of 251,546 km^2 (Fig. 1) according to the polygon provided by S. González-Elizondo of CIIDIR Durango. Because of its position, it has a high climatic and vegetational diversity. Elevation ranges from 300 to 3,340 m, with an average elevation of 2,500 m (González-Elizondo *et al*., 2012; 2013; Fig. 1A). It has a rugged physiography of highland plateaus and deeply cut canyons that spans nearly 1,400 km along the Pacific coast of Mexico, from near the US border (30° 35′ N) to northern Jalisco and western Aguascalientes (21° 00′ N) (González-Elizondo *et al*., 2013). It is a continuous range from Jalisco to Sonora, where it breaks into a set of small, isolated mountain ranges (Sky Islands). Climate is tropical dry on most of the western slope (BS climates), with winter precipitation and a marked dry season the rest of the year, but tropical mesic (Aw) climates occur in the southern portion of the western slope. Temperate climates with summer rains dominate in the highlands (Cw climates), and semiarid climates dominate on the eastern slope (BS climates, González-Elizondo *et al*., 2012; García, 1998). Native vegetation includes pine forest, pine-oak forest, oak woodland, grassland, tropical deciduous forest, tropical semideciduous forest, subtropical scrub, thorn forest, chaparral, evergreen scrub, and small areas of xerophytic scrub, temperate forest gaps, mesophytic forest, gallery forest (Fig. 1B). A considerable area on the eastern slope and highlands has been modified for agricultural and livestock practices (González-Elizondo *et al*., 2012; Fig. 1B). Our analysis follows the delimitation of the SMO by González-Elizondo *et al*. (2013). The limits of the SMO polygon were set by these authors at 1800 m of elevation on the eastern slope, at the transition with the Mexican Plateau; at 300 m on the Pacific slope, and at an average of 1400 m to the north. This delimitation excludes the intermontane valleys of the Sky islands.

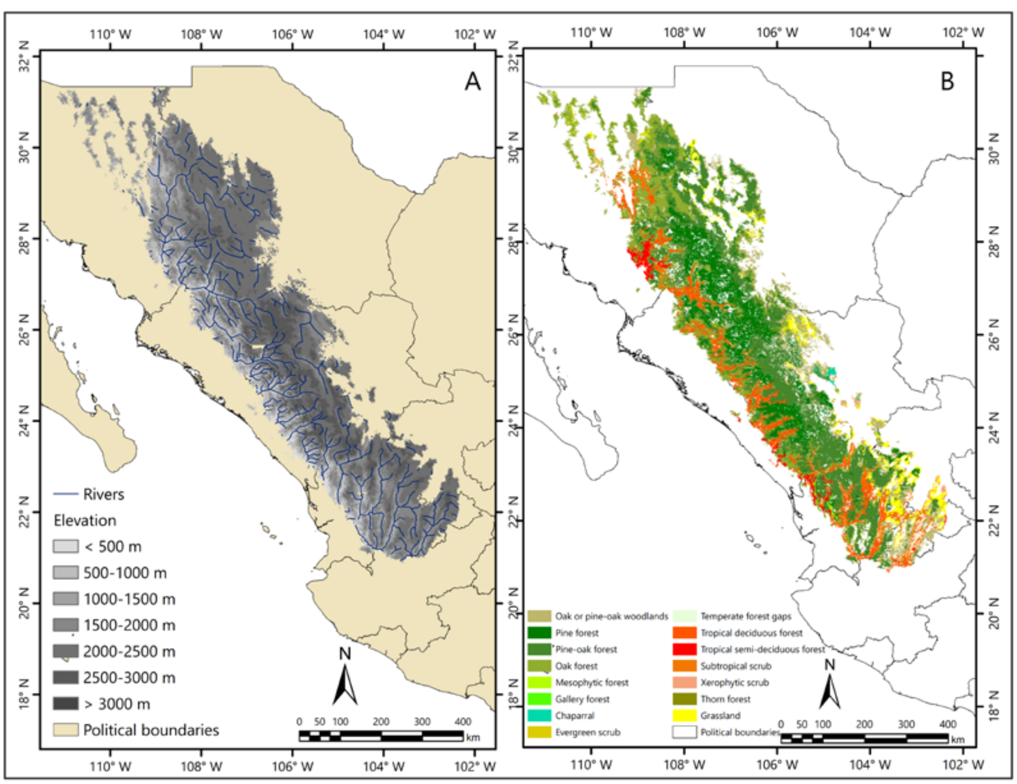

Figure 1. A. Elevational gradient and main rivers in the Sierra Madre Occidental, Mexico. B. Vegetation of the Sierra Madre Occidental after González-Elizondo *et al*. (2012).

Data collection. Data were gathered from four different sources: 1) specimens of mammals collected by us and deposited at Colección Regional Durango Mexico (CRD), CIIDIR Durango, Instituto Politécnico Nacional, and specimens also examined by us, but deposited at other collections: Natural History Museum, The University of Kansas, Lawrence, USA (KU); Museum of Michigan State University, Lansing, Michigan, USA (MSU); Museum of Texas Tech University, Lubbock, Texas USA (TTU); Biodiversity Research and Teaching Collections, Texas A&M USA (TCWC); Mammal Collection, Universidad Autónoma Metropolitana Unidad Iztapalapa (UAMI); Mammal Collection, Instituto de Biología, UNAM, Mexico (CNMA), and Mammal Collection, Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional, Mexico (ENCB), for a total of 2,757 records. 2) Literature records from peer-reviewed publications in which at least a point locality and species can be unequivocally identified. We only included records for which a museum voucher or photograph exists, for a total of 1,529 records. Bibliographic data and collection records of *Peromyscus* of the *boylii* species group not examined by us were omitted because the taxonomy and nomenclature has been changing in the past 50 years, and because without a specimen or tissue sample it is not possible to ascertain the identity some species. These species were included only from recent species descriptions or taxonomic revisions (e. g. Bradley *et al*., 2004; Mathis *et al*., 2013a; b). 3) observations and photographs of medium-sized and large mammals made by the authors by direct observation or using camera-traps, or photographs of sign and track (199 records). 4) database of mammals from Durango and Chihuahua deposited at the mammal collection, Brigham Young University, Utah, and records from the databases SNIB (CONABIO, 2022) and Vertnet (2022), containing information about specimens deposited in North American Collections. From these bases we included only records of medium-sized and large mammals (Orders Artiodactyla, Cingulata, Didelphimorphia, Carnivora, Family Sciuridae), for which most species are easily identifiable (176 records). For Geomyidae we followed the distribution of species proposed by Mathis *et al*. (2013a; b). Because the data from 4) were not verified by us, if a specimen examined by us for the same species and locality existed, we referred the data to the voucher. In all cases records with uncertain or unlikely localities were eliminated. The final base consisted of 4,659 records of 1,392 unique localities (Fig. 2). Classification of orders, families, and genera follow Ramírez-Pulido *et al*. (2014), species nomenclature follows the Mammal Diversity Database of the American Society of Mammalogists (Mammal Diversity Database, 2022).

Georeferencing. Most records from CRD, field observations and camera trap records were georeferenced in the field using GPS devices with a 4-m resolution. All other records were georeferenced using Google Earth 7.3.6.9285 (Google LLC, 2022). Data from CNMA and 4 had associated coordinates, however, errors were detected in some collections, so we decided to revise all localities and georeferenced the erroneous ones again. Latitude and longitude were converted to, or estimated as, decimal degrees; elevation was calculated as, or converted to, meters above sea level.

Data analysis. Records were mapped using ArcMap V.10.1 (ESRI Inc., 2012) over digital layers of political division (CONABIO, 2003), vegetation (González-Elizondo *et al*., 2012), and ecoregions (González-Elizondo *et al*., 2013) to establish the state, vegetation types, and ecoregions where each species occurs, and to visualize information gaps. One record of one species in a state, ecoregion, or vegetation type sufficed to consider that the species occurs in that state, vegetation type, or ecoregion. To facilitate the understanding of the geographic components of the Madrean Region, the subregions were labeled as Madrean North (MN), Madrean Central (MC), and Madrean South (MS) as in González-Elizondo *et al*. (2012) (Fig. 2). We list species richness by vegetation type and state in Supplementary Material S1a, b.

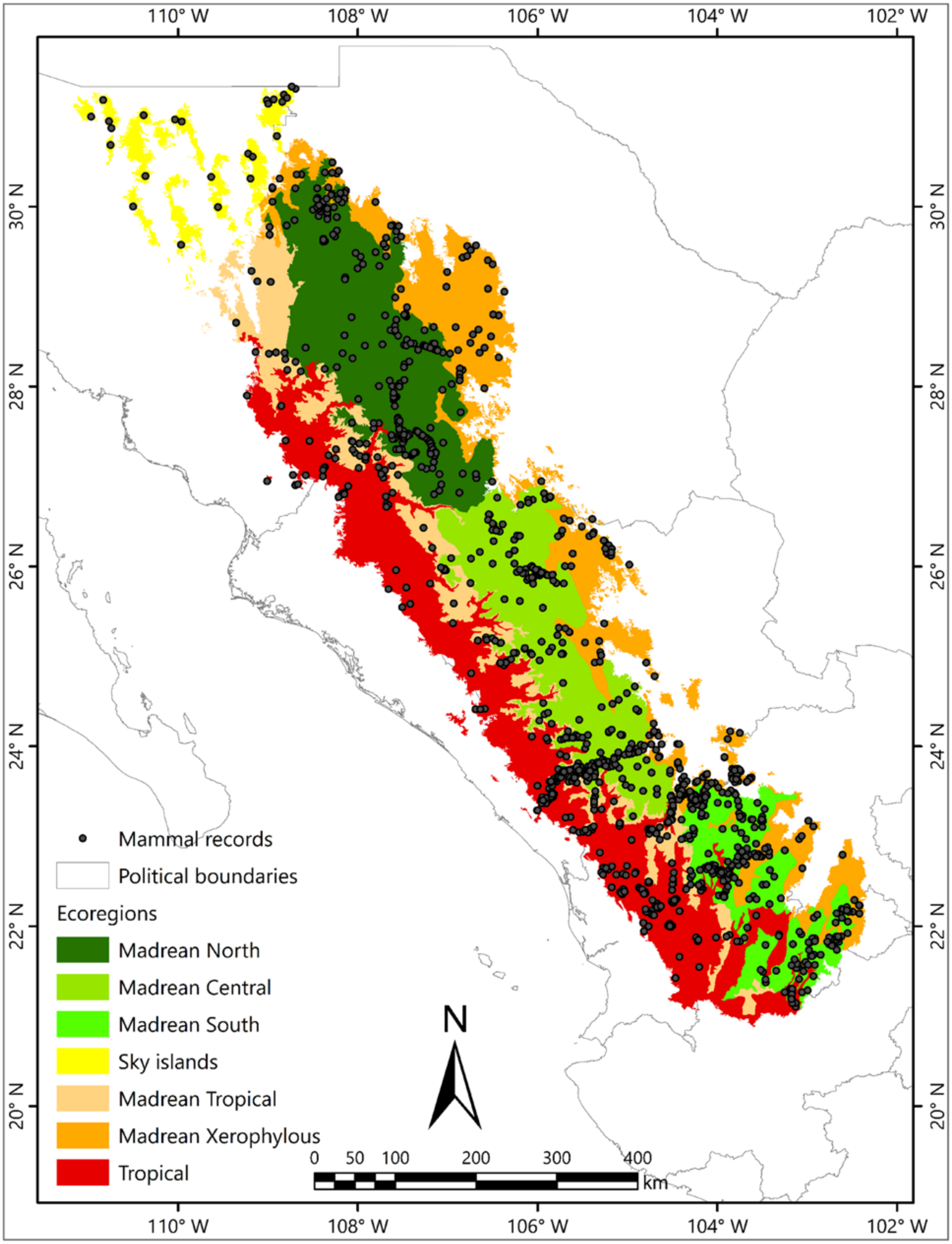

Figure 2. Ecoregions of the Sierra Madre Occidental, after González-Elizondo *et al*. (2013), and localities of occurrence of mammals.

To examine species turnover, using PAST 3.20 (Hammer *et al*., 2001) we conducted a Principal Coordinates Analysis (Manly, 2005) on a matrix of ecoregions-by species using the Whittaker turnover index (Tuomisto, 2010) as a measure of distance. An analogous analysis was performed in a vegetation-by-species matrix using the categories of González-Elizondo *et al.* (2012). We excluded agricultural areas, areas without vegetation cover, secondary chaparral, urban areas, and human-induced grasslands from the analysis because they occur throughout the SMO and their inclusion may conceal the patterns of species richness in native biomes. Gonzalez-Elizondo *et al.* (2012) recognized three kinds of oak forests: "bosque bajo abierto" (of temperate affinities), an open canopy oak or oak-pine woodland at mid elevations on the eastern slope; a temperate oak forest on the highlands of the eastern slope; and a low, open forest of tropical affinities on the western slope. Because of their ecological importance as transitional biomes, we followed this distinction. Finally, we contrasted the species richness at the SMO with other major mountain ranges in Mexico for which general accounts exist, namely the Sierra Madre Oriental (SMOr, León-Paniagua *et al*., 2004), and the Trans-Mexican Volcanic Belt (TMVB, Escalante *et al*., 2007a).

RESULTS

Species richness and conservation status. Eight orders or 72.7% of the 11 orders of terrestrial mammals occurring in Mexico, considering Erinaceomorpha as part of Eulipotyphla (Mammal Diversity Database, 2022), 21 families (58.3%), 82 genera (48.5%), and 171 species (34.3%, Ramírez-Pulido *et al*., 2014; Sánchez-Cordero *et al*., 2014) occur in the SMO (Appendix). Only the orders Sirenia, Primates and Perissodactyla are not represented. The SMO encompasses part of eight Mexican states. Durango had the highest richness (133), followed by Chihuahua (106), Zacatecas (101) and Nayarit (84). Aguascalientes, the smallest state had the lowest richness (37, Supplementary material S1a). From the 171 species recorded, 47 are endemic of Mexico (27.5%; Table 1), and ten are endemic of the SMO: the ground squirrels *Callospermophilus madrensis* Merriam, 1901, *Neotamias bulleri* (J.A. Allen, 1889), the woodrats *Nelsonia neotomodon* (Merriam, 1897) and *Neotoma palatina* Goldman, 1905, the deermice *Peromyscus polius* Osgood, 1904*, P*. *schmidlyi*, and *P*. *carletoni*; the harvest mouse *Reithrodontomys zacatecae* Merriam, 1901, and the pocket gophers *Thomomys sheldoni* and *T*. *nayarensis*. All but *N*. *palatina* are distributed in temperate, forested areas.

The NOM-ECOL-059 (SEMARNAT, 2019) includes 25 species with some status of concern that occur on the SMO: seven under special protection (*Leptonycteris yerbabuenae* Martínez & Villa-R., 1940, *Euderma maculatum* [J. A. Allen, 1891], *Myotis carteri*, *Cynomops mexicanus*, *Callospermophyllus madrensis*, *Dipodomys phillipsii* J. E. Gray, 1841, and *N*. *neotomodon*), and the populations of *Sciurus aberti* Woodhouse, 1853 from the SMO (considered endemic to Mexico by SEMARNAT, 2019). Ten are considered as threatened: the shrews *Megasorex gigas* (Merriam, 1897), *Notiosorex crawfordi* (Coues, 1877), *Notiosorex evotis* (Coues, 1877), *Sorex monticola* Merriam, 1890, the nectar-feeding bats *Choeronycteris mexicana* Tschudi, 1844, and *Leptonycteris nivalis* (Saussure, 1860), the squirrel *Sciurus arizonensis* Coues, 1867, the yaguaroundi *Herpailurus yagouaroundi* (É. Geoffroy Saint-Hilaire, 1803), the river otter *Lontra longicaudis* (Olfers, 1818), and the American badger *Taxidea taxus*. Six species are considered as endangered: the shrew *Sorex arizonae* Diersing & Hoffmeister, 1977, the margay *Leopardus wiedii* (Schinz, 1821), the ocelot *Leopardus pardalis* (Linnaeus, 1758), the jaguar *Panthera onca* (Linnaeus, 1758), the wolf *Canis lupus* Linnaeus, 1758, and the black bear *Ursus americanus* Pallas, 1780. The brown bear *Ursus arctos* Linnaeus, 1758 is listed as extinct in the wild, but because there are extant populations in northern North America (Wilson & Ruff, 1999), it should be considered as extirpated from Mexico (Ceballos & Navarro, 1991). There were recent attempts of reintroduction of the Mexican wolf to the SMO, with mixed results (Cruz-Romo *et al*., 2013). More recent, unpublished reports estimate the number of Mexican wolves in the wild in Mexico from at least 44 (SEMARNAT, 2023), to 33 (USFWS, 2017), to 4 (Western Watersheds Project, 2023). It remains unclear whether an established population exists in the SMO. The IUCN classification lists as endangered only one species (*L. nivalis*), and 14 as near threatened or vulnerable (IUCN, 2022, Appendix). The remaining 156 are considered as not evaluated (22) or of least concern (134). The number of Mexican endemics by region was highest in the Tropical region (T, 37), followed by Madrean South (MS, 24), Madrean Tropical (MT, 22), Madrean Xerophylous (MX, 16), Madrean Central (MC, 15), Madrean North (MN, 11) and Sky Islands (SI, 1).

Species turnover. The Tropical region was the richest in species with 125, followed by MS (100), MX (95), MT (89), MC and MN with 75 each, and SI (43). Turnover (as distance in ordination plot, Fig. 3A) was the highest between the Sky Islands and the rest of the ecoregions, scoring on the extreme positive side of the ordination plot. The tropical regions (MT and T) clustered on the negative side of PCo1. A "temperate" cluster including all the Madrean regions (MX, MN, MC, and MS), scored in the central portion of PCo1. Along PCo2, the tropical regions score on the positive side, whereas the temperate regions score on the negative side. The first axis shows the turnover of species of tropical affinities, MS, which shares many tropical species with the temperate areas, scores on the negative side, whereas MC, MX, and MN have progressively less tropical influence. The SI have an extreme score because data available include species that can occur in the SI and tropical areas, such as mid-sized mammals and some bats, but there are few rodent records. Adding the rodent fauna to the species list presented here likely will change the position for this ecoregion to a more realistic one. Along the second axis of variation (PCo2) the trend is similar but inverse.

The PCoA analysis by vegetation (Fig. 3B) suggests two different sets of species: the first occurs in arid lands (xerophytic scrub, thorn forest, and chaparral) on the positive side of PCo1 and negative of PCo2. The second group scores on the negative side of PCo1 and is distributed along PCo2. This second group illustrates the turnover of species from west to east and from tropical to temperate across the SMO: on the positive side of PCo2 the species that occur in vegetations of the Pacific slope and western piedmont, and the transitional western oak forest and subtropical scrub. On the negate.ve side score the species that occur in temperate vegetations, from pine and pine-oak to grasslands and oak forests of the eastern slope. Thus, PCo1 is related with aridity, whereas PCo2 is related with elevation and slope (Fig. 3B). The position of mesophytic forest and gallery forests on the positive side of PCo1 likely reflects the paucity of data for these areas, which are very small and not well sampled. The small areas of mesophytic forest occur on the W slope of the southern SMO, the gallery forests throughout the SMO.

Comparison with other mountain ranges. Species numbers by order were similar between the three mountain ranges for most orders, except for Chiroptera (Fig. 4A); the TVMB has only 47 species of bats compared with the 59 of the SMO and 69 of the SMOr. The SMOr is the only range that harbors primates (*Ateles geoffroyi* Kuhl). The TVMB had the highest number of endemic species (50), followed by the SMO (47) and SMOr (39; Fig. 4B). The number of local endemic species differs for each mountain range, with SMO having 10, TVMB 15, and SMOr six.

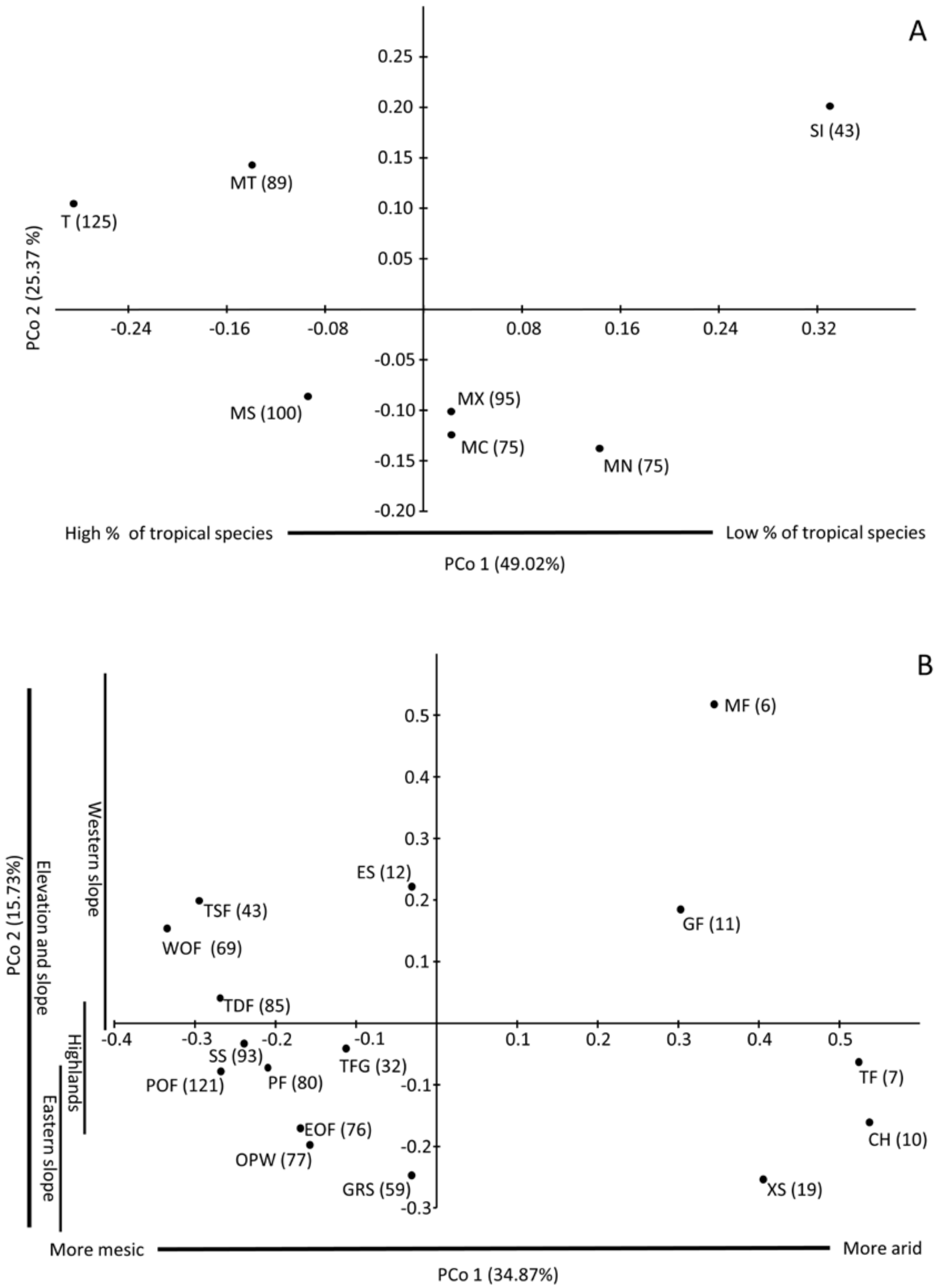

Figure 3. Principal Coordinates Analysis of the distribution of 171 species of mammals that occur in the SMO. A) by ecoregion: Tropical (T), Madrean Tropical (MT), Madrean North (MN), Madrean Central (MC) Madrean South (MS), Madrean Xerophylous (MX), Sky Islands (SI); B) by vegetation type: Oak or pine-oak woodlands (OPW), Pine forest (PF), Pine-oak forest (POF), Western oak forest (WOF), Estern oak forest (EOF), Mesophytic forest (MF), Gallery forest (GF), Chaparral (CH), Evergreen scrub (ES), Temperate forest gaps (TFG,) Tropical deciduous forest (TDF), Tropical semi-deciduous forest (TSF), Subtropical scrub (SS), Xerophytic scrub (XS), Thorn forest (TF), Grassland (GRS), (after González-Elizondo *et al.*, 2012, 2013).

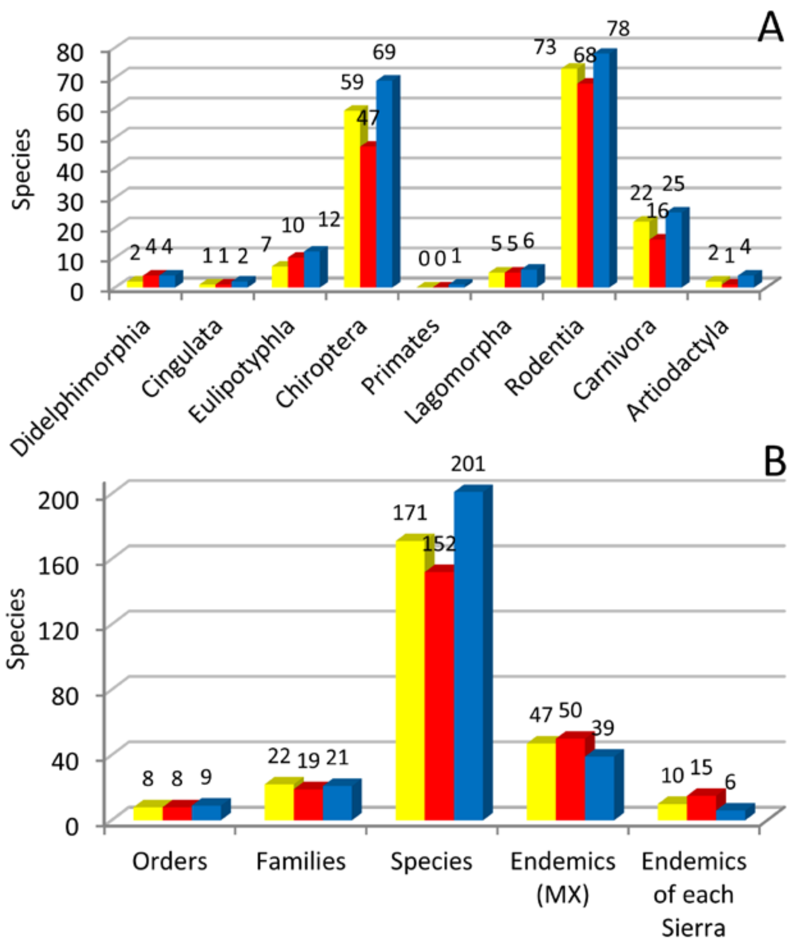

Figure 4. A) Comparison of the species richness by order between the Sierra Madre Occidental (SMO, yellow) and the two next largest Mexican mountain ranges, Sierra Madre Oriental (SMOr, blue) and Trans Volcanic Mexican Belt (TVMB, red). Numbers on top of columns are species richness. B) Species richness by orders, families, species, Mexican endemics, and local endemics by mountain range. Data for TVMB from Escalante *et al*. (2007a), data for SMOr from León - Paniagua *et al*. (2004).

DISCUSSION

Sampling biases and limitations. We documented 171 species of mammals for the SMO, or 34.3% of the terrestrial mammals known for Mexico. Ramírez-Pulido and Castro-Campillo (1990) reported 169 species in a map of Mexican mammals. Our analysis of species distribution is based only on records of mammals that fall within the limits of the SMO as defined by González-Elizondo *et al.* (2013). This means that records of species occurring on the valleys between the Sky Islands were not included. Therefore, the species count can be larger under a different definition of the SMO. The valleys that surround this system of biogeographic isolates warrants examination on their own right, given that the arid lands and the northern edge of the subtropical vegetations mingle in this area, and important conservation areas, such as the Janos Biosphere reserve, and the Campo Verde area of protection of flora and fauna occur there. No other range-wide work is available.

Some comprehensive inventories have been conducted in some CONABIO terrestrial priority areas (Arriaga *et al*., 2000), Alta Tarahumara-Barrancas, Chihuahua (RTP 30; López-González & García-Mendoza, 2006), San Juan de Camarones, Durango (RTP-23; Torres-Morales *et al*., 2010), San Pedro-Mezquital river basin, Durango and Nayarit (RTP 57; López-González *et al*., 2014a), and Jesús María River basin, Nayarit (RTP 59; García-Mendoza *et al*., 2021; López-González *et al*., 2022). Other inventories have focused on protected areas like la Michilía, Durango (Álvarez & Polaco, 1984); Área de Protección de Flora y Fauna Bavispe, Sonora (Coronel-Arellano *et al*., 2016; 2018); and Cerro Mohinora, Chihuahua (Webb & Baker, 1984).

Many collections have been conducted along the Durango-Mazatlán, or the Chihuahua-Hermosillo roads (Fig. 2), the only paved roads that until early 2000 crossed the SMO from east to west. The construction of two more roads across the SMO has opened the opportunity for sampling in the SMO, unfortunately, at the same time the insecurity of these areas has increased, precluding the sampling of mammals in the area. The mid elevations (about 500-2000 m) of the western slope are the least sampled areas, particularly from central Chihuahua to central southern Durango. These areas are of difficult access, pronounced slopes and deep canyons, and therefore sampling is difficult. Large portions of the highlands (2000-3000 m) of northwestern Chihuahua and central north Durango are underexplored, even though most of the timber activity occurs there. In general, these results suggest that half of the SMO is under-sampled or has not been sampled at all (Fig. 2). Yet, between 2000 and 2020, three new species have been discovered using morphological or molecular means (*Peromyscus schmidlyi* Bradley, Carroll, Muñiz-Martínez, Hamilton & Kilpatrick, 2004; *Peromyscus carletoni* Bradley, Ordóñez-Garza, Sotero-Caio, Huynh, Kilpatrick, Iñiguez-Dávalos & Schmidly, 2014; and *Thomomys nayarensis* Mathis, M. S. Hafner, D. J. Hafner, & Demastes, 2013b), and some populations formerly named *Thomomys umbrinus* (Richardson, 1829), are now recognized as a different taxon (*T. sheldoni* Bailey, 1915; Mathis *et al*., 2013a), which suggests that as species groups are studied using integrative taxonomy approaches, more species that so far remain cryptic will be discovered, either in the field or in collections. In addition, further research is being conducted using camera-traps in the northwestern edge of the SMO that is documenting medium-sized and large mammals in selected protected areas (Espinosa-Flores *et al*., 2012; Coronel-Arellano *et al*., 2016; Gallo-Reynoso *et al*., 2021).

Endemic species. The Madrean ecoregions (MS, MC, MT) harbor the highest numbers of endemic species. Some are widely distributed along the highlands from Sonora to Nayarit (e. g. *P. schmidlyi*, *R. zacatecae*), but others are microendemic. For instance, the ground squirrel *C. madrensis*is is distributed only on the highland, mesic pine forests of northern Durango and southern Chihuahua above 2,400 m. Its distribution appears patchy, but the populations seem to be large in the patches it occupies (CLG, pers. obs.). However, no estimation of population size is available, and therefore it is not possible to ascertain its conservation risk. MS contained four of the 10 endemics of the SMO, which is explained by the presence of the Mezquital-San Pedro and Santiago River basins. Resulting from their environmental complexity, numerous micro-environments are created, which promote the diversification of populations, as documented by the pocket gophers (*Thomomys*) and the *P. boylii* species group (Mathis *et al*., 2013a; b; Bradley *et al*., 2014). Other vertebrates for which data are available, also have high numbers of endemic species in the SMO. For herps, Rodríguez-Gutiérrez (2023) reported 116 species endemic of Mexico, and Johnson *et al*. (2017), considered the SMO as one of the most important areas of endemism for Mexico. For birds, Kobelkowsky-Vidrio *et al*. (2014) reported 67 endemic or quasi-endemic of Mexico. Thus, it is likely that the number of endemic species, particularly of organisms like salamanders, shrews, and aquatic or semi-aquatic organisms is under-sampled, and that new endemic species are yet to be discovered.

Distribution and turnover. The general latitudinal gradient in species richness expected from south to north is not evident for the SMO. The southern states (Jalisco and Aguascalientes) do not have the highest species richness, nor the northernmost ones have the lowest richness. The states that encompass the largest proportions of the SMO are the northern ones (Chihuahua, Durango), whereas the ones with the smallest areas are located in the South (Jalisco, Aguascalientes). It could be possible that the effects of area and latitude could cancel each other out, and that the species composition were similar along the 10 degrees of latitude encompassed within the SMO. This is not the case, Durango, on a central-south position, has the highest species richness (Supplementary material S1a), whereas Zacatecas, to the south, and Chihuahua, to the north, have the second highest richness. Factors additional to area or latitude explain the species distributions in the SMO.

Variation in species richness throughout the SMO can be explained by the heterogeneity of its biomes, resulting from a combination of latitudinal, topographic, elevational, and longitudinal (east-to-west) variation. In terms of ecoregions, the area with the highest species richness is the western tropical slope (Fig. 3A). Although considered as a single ecoregion (Tropical, Fig. 2) by González-Elizondo *et al*. (2013), it responds to latitudinal and humidity gradients. The forests on the western slope, approximately from Ruiz, Nayarit to Escuinapa, Sinaloa, are the most mesic and harbor the tallest tropical forests along the western slope. These forests occur only at the lowest elevations and not farther than 60 km E from the edge of the Marismas Nacionales (Fig. 2). The highlands of these areas contain small areas or mesophytic forests. To the northwest, there occur other tropical forests, drier and lower. From Escuinapa northwestward, the western slope of the SMO is dominated by tropical deciduous forest that gradually become subtropical scrub, to finally turn into desert scrub at the northern end of the SMO in western Sonora (González-Elizondo *et al*., 2012). As a result, the mammalian fauna in the southern extreme of the SMO has more in common with the faunas of the coastal plain of Jalisco to the south, than with the coastal plain of northern Sinaloa (López-González *et al*., 2014a; López-González *et al*., 2022).

Another dimension of complexity in the SMO is related to elevation and slope (roughly east-to-west variation). The extreme examples are the Mezquital and Santiago River basins in MS, which traverse the SMO from east to west, through a system of canyons that can reach over 1,500 m in depth (González-Elizondo *et al*., 2007). The result is that the tropical forests of the Pacific slope can penetrate the Sierra, and as elevation rises and humidity diminishes, become subtropical scrub, and finally xerophylous scrub and chaparral on the eastern slope. The change is gradual, and vegetation responds to the local conditions at each point. Because the canyons have a convoluted course throughout, the result is a mosaic of vegetation and climatic conditions that change in short distances, both horizontally and vertically (Fig. 1A, B). A similar effect is observed in all the western slope, where canyons are also deep, creating corridors of tropical vegetation that intermingle with the highland conifer forests. Along the eastern, continental slope, a similar phenomenon occurs, albeit more gradually: the semiarid vegetations of the Mexican Plateau on the south and central SMO, and the Chihuahuan desert and northern prairies on the north, are replaced by temperate forests as elevation increases.

The mammalian fauna responds to this complexity as a function of the breadth of habitat, mobility capabilities, and ecological niche of each species (López-González & Lozano 2015; López-González *et al*., 2014a, 2022). The species-by vegetation ordination (Fig. 3B) illustrates the species turnover across vegetation types, arranging mammalian species composition in each vegetation type according to slope, elevation and aridity gradients. For bats, species of tropical distribution are a subset of the Neotropical species pool plus a few endemics from Mexico. This species set can be further subdivided based on their ability for dispersing throughout the mountain range. One group includes species that occur only in the lowland (<1,000 m), more mesic tropical forests of the south (e. g. *Rhogeessa parvula* H. Allen, 1866, *Dermanura phaeotis* Miller, 1902, *Glyphonycteris sylvestris* Thomas, 1896). Another group is widely distributed in the Neotropics, occurs both in mesic and dry tropical areas, and also is able to penetrate the SMO through the canyons of the western slope, reaching elevations of over 2,000 m, e. g. *Dermanura azteca* and *Anoura geoffroyi* J. E. Gray, 1838 (Sánchez-Hernández *et al*., 2002; Ortega & Alarcón-D., 2007). The distribution of this subgroup roughly coincides with the T and MT regions. It is possible that these species occur in the highlands only part of the year, and that they migrate locally along the elevational gradient following the canyons and avoiding the low temperatures and lack of resources in the highland winters. López-Segoviano *et al.* (2019), proposed that something similar might be occurring for birds at El Palmito, Sinaloa, on the western slope of the Sierra.

The mammal data partially support the subdivision of the highlands in SI, MN, MC, and MS. Three areas are distinguishable in terms of species richness and distribution: The SI, MS, and MC + MN. Considering the latitudinal gradient only, a nested pattern of species turnover could be expected from south to north. However, the contrastingly lower richness of the Sky Islands (43 species) may be the result of collection deficit rather than latitudinal or environmental gradients. This area is one of the least sampled regions of the SMO (Van Devender *et al*., 2013), whereas for Chihuahua, Durango, and Zacatecas there are state-wide, relatively comprehensive inventories. Moreover, because of their very quality of islands, a higher degree of diversification and turnover could be expected for non-flying, small mammals (Warshall, 1995), compared with the continuous range to the south. Comprehensive inventories of the SI are needed to document the yet unknown diversity of the region, particularly of rodents, using integrative taxonomic approaches.

The highlands of the SMO (SI, MN, MC, and MN) include species of Nearctic distribution that reach the southern edge of their distribution in north-central Mexico. This fauna is a subset of those species widely distributed in the temperate areas of North America, except for *Corynorhinus mexicanus*, an endemic of the Mexican highlands. Many of these species occur both in MX and in the more mesic highlands (MN, MC, MS, Fig. 2). A few have been collected only on the arid lands, for instance *Antrozous pallidus* (LeConte, 1856), or in the eastern piedmont and northern arid lands on both slopes (e. g. *Corynorhinus townsendii* Cooper, 1837). A few species are widely distributed on the highlands of both slopes, e. g. *Aeorestes cinereus* (Palisot de Beauvois, 1796). Some of these species are probably able to effect seasonal elevational movements as well. It is even possible that, at least part of the year, in some areas with a marked elevational gradient, bats ascend to the forested areas during the night, and roost in lower, warmer places during the day. These hypotheses are yet to be formally tested. Other bats of temperate origin are able to migrate (like *A. cinereus* or *T. brasiliensis* I. Geoffroy Saint-Hilaire, 1824) or hibernate (*Corynorhinus* spp.; López-González & Torres-Morales, 2004) to escape the cold winters of the SMO highlands. Species like the nectar-feeding bats *Leptonycteris nivalis* and *Choeronycteris mexicana* are widely distributed in tropical and arid regions of México, and in the SMO occur on both slopes, but are limited in elevation by the distribution of the plants on which they feed (Bombacaceae, some legumes, *Agave* spp., *Lemaireocereus* spp., *Ceiba* spp., *Ipomoea* spp., *Myrtillocactus* spp.; Arita & Humphrey, 1988; Álvarez & González Quintero, 1969; Stoner *et al*., 2003).

For non-flying mammals, the patterns are more complex and differ between animals that move considerable distances during their lifetime (in the order of kilometers), and species that have small home ranges (like small rodents). For instance, the jaguar (*Panthera onca*) occurs throughout the western slope SMO, and has been recorded as far as northern Chihuahua, northwestern Sonora and Southern Arizona (Girmendonk, 1994; Brown & López-González, 2000; López-González & Brown, 2002; Navarro-Serment *et al*., 2005). In contrast, some species of rodents inhabit only the highland conifer and mixed forests of the SMO, generally distributed above 2,300 m (e. g. the squirrel *S. aberti*, the deermouse *P. schmidlyi*, and the vole *Microtus mexicanus* (Saussure, 1861)) or small forest patches in the southern edge (e. g., *P. carletoni*). Other species have more complex distribution patterns: for instance, the cactus mice of the *P. eremicus* species group effectively surround the SMO from Nayarit to Sonora to Zacatecas (Riddle *et al*., 2000), with tropical populations entering from the western slope as far as Mesa del Nayar in Nayarit (1,500 m of elevation) and entering from the eastern Mexican Plateau to the Mezquital River Basin at least as far as Agua Zarca, Durango (1,500 m). It is possible that populations of this species enter in contact in the southern portion of the SMO, in the Mezquital or Jesús María basin, but molecular data are not available for this part of the Sierra (Riddle *et al*., 2000). This distributional pattern, and the presence of *P. merriami* Mearns, 1896, a closely related species, in the lowlands of eastern Nayarit (García-Mendoza *et al*., 2021) suggests a more complex, yet to be investigated phylogeographic story for the *Haplomylomys* species group in western Mexico.

As previously documented for some areas of the SMO (López-González *et al*., 2014a; López-González *et al*., 2022), its biological and evolutionary importance resides not only in its absolute richness, but on its high species turnover rate both at large and small scales (Rodríguez *et al*., 2003). At the range scale, the east-west and north-south, effects of orographic shade and latitude, respectively, produce the Nearctic-Neotropical divide described by numerous biogeographers before (e. g. Morrone & Márquez, 2003; Morrone, 2020). At the local scale, environmental complexity, and physiographic variation due to latitude, longitude, canyon depth, elevation, aspect, and slope, create distinct local environments (Fig. 1B) in which habitat-restricted populations may diversify, regardless of their biogeographic affinities or origins. Turnover is only one of the components of beta diversity (Soininen *et al.,* 2018); disentangling the effects of turnover and nestedness in the SMO is beyond the scope of this paper, though some nestedness should be expected along elevational gradients on both the E and W slopes. The available phylogeographic work hints at the effects of scale and beta diversity, in addition to historic processes, to explain the diversity and distribution of the SMO biota (e. g. Bryson *et al*., 2011; Gugger *et al*., 2011; Sánchez-Sánchez *et al*., 2012; López-González *et al*., 2014b).

Comparisons with other mountain ranges. The other two major mountain ranges in Mexico, considered as part of the "Componente Mexicano de Montaña" or Mexican Transition Zone (Morrone & Márquez, 2003; Morrone, 2020), and for which comparable data exist, are the Sierra Madre Oriental (SMOr) and Transvolcanic Mexican Belt (TVMB). In the SMOr, 201 species have been recorded (León-Paniagua *et al*., 2004), at the TVMB, 152 (Escalante *et al*., 2007a). Nonetheless, a relatively recent book on the biodiversity of northern Mexico, devotes very little attention to the SMO (Cartron *et al*., 2005).

The diversity of tropical orders (Didelphimorphia, Cingulata) and of deer (Artiodactyla) is lower in the SMO than in the other mountain ranges because only the white-tailed deer (*Odocoileus virginianus* Zimmermann, 1780) and the peccari *Dycotiles tajacu* (Linnaeus, 1758) are able to reach the highlands, whereas other artiodactyls from northern Mexico like the pronghorn *Antilocapra americana* (Ord, 1815), the mule deer *Odocoileus hemionus* (Rafinesque, 1817), American bison (*Bos bison* Linnaeus, 1758) and bighorn sheep (*Ovis canadensis* Shaw, 1804), seldom have been recorded in the SMO, and all records are from the intermontane valleys of the

Sky Islands (Pacheco *et al*., 2000; Medellín *et al*., 2005; Pelz-Serrano *et al*., 2006; Gallina-Tessaro *et al*., 2019). Chiroptera and Rodentia have similar or higher species richness in the SMO because many species of temperate distribution that can occur in the highlands and lowlands, and because tropical species reach their distributional limits on the western slope. In contrast, in the TMVB and SMOr the species composition has more tropical and endemic components (López-Wilchis *et al*., 1990; León-Paniagua *et al*., 2004; Escalante *et al*., 2007a).

The TVMB, one of the best studied areas of Mexico, harbors 50 mammals endemic of Mexico, whereas the SMO, a mountain range about three times larger (SMO 251,648 km^2 not including the Sky Islands, vs. 175,700 km^2; González-Elizondo *et al*., 2013; Valencia, 2007) and much less explored, has 47. The proportions of local endemics (15 vs 10, respectively) suggest that some of the endemic fauna of the SMO is yet to be discovered. Escalante *et al*. (2007b), using Parsimony Analysis of Endemicity, concluded that the SMO was an important area of endemism. However, in a second analysis (Escalante *et al*., 2009), using a different methodology, the SMO was not considered as an area of endemism, except as part of the Mexican Transition Zone. These results probably reflect lack of information about SMO. These authors report three endemic species for the SMO (Escalante *et al*., 2007a) and later they reported nine (Escalante *et al*., 2009). Since these papers were published, at least four more endemic species have been described (*P*. *schmidlyi*, *P*. *carletoni*, *T*. *nayarensis* and *T*. *sheldoni*). This evinces the need for continuous sampling and inventory, as well as analysis of materials already in collections, to improve our understanding of this mountain range. We expect that in the next years, and if there are consistent efforts to sample the Sky Islands and the western slope of the SMO, particularly on the north, the number of species will become similar to that of the SMOr.

Conservation. The Sierra Madre Occidental is also complex in its human composition. In addition to the mestizo population, in the SMO inhabit six indigenous groups (Serrano Carreto, 2006), some of which occur on the north (Tarahumara o Rarámuri, northern Tepehuano), and others on the south (Cora, Huichol, southern Tepehuano or Odam, and Mexicanero). In some areas one or more of these groups constitute most of the human population. Also, a Mormon (Waterbury, 2013) and a Menonite population (le Polain de Waroux *et al.,* 2021), inhabit northern and central Chihuahua. The main occupations timber logging, agriculture, mining, livestock, and more recently hunting, environmental services, tourism, production of illicit drugs. Most of the population participates in one or more of these activities. Although the population density is relatively low in most of the SMO (about 27.5 inhabitants per squared km, estimated from INEGI, 2020), the SMO has been intensively modified in the last 100 years, so much so that old growth forest, for instance, was practically gone (99.4%) by the end of the 20th century (Lammertink *et al*., 1996).

Despite the magnitude in area and biological diversity of the SMO, the environmental services it provides (Monárrez-González *et al*., 2018) and its high rate of modification, it contains very few protected areas. Some areas of the SMO have been designated as "Regiones Terrestres Prioritarias para la Conservación" (RTPs) or prioritary terrestrial regions for conservation by CONABIO, the Mexican agency in charge of biodiversity knowledge and management (Arriaga *et al*., 2000). There are 35 RTPs (of 152 for Mexico) that are included, all or in part, in the SMO, covering approximately 71,776 km^2 or 28.52% of the SMO polygon as defined here. These areas, however, do not have any legal standing as protected areas, but they are considered important because of their biological characteristics. Only eight RTPs are in a protected area.

There are ten federal protected areas in the SMO: the Michilía Biosphere reserve; the highlands of the Janos Biosphere Reserve; three national parks, the Cascada de Basaseachic, Sierra de Órganos, and Cumbres de Majalca; six areas of flora and fauna protection: Cerro Mohinora, Campo Verde, Papigochic, Bavispe, Tutuaca and the highlands of Sierra de Álamos-Río Cuchujaqui. There are three state reserves, Sierra Fría in Aguascalientes, and el Tecuan state park, and the Area de Protección de Recursos Naturales Quebrada de Santa Bárbara in Durango, covering approximately 12,215 km^2 or 4.8% of the SMO polygon as to 2022 (Lozano-Román & Estrada-Aguilera, 2008; Rentería-Arrieta & Montiel-Antuna, 2017; CONANP, 2022a). According to CONANP (2022b), the Cuenca Alimentadora del Distrito Nacional de Riego 043 is a protected area that includes several municipalities and parts of five states (Aguascalientes, Jalisco, Durango, Nayarit, and Zacatecas), covering an area of 2,329,026.75 ha. However, this area includes several towns, agricultural areas, mountains, as well as part of the Rio Grande de Santiago Basin. Although some CONANP personnel is assigned in some regions of this vast area, it does not have a management plan, and because of its size and complexity, it is unlikely that the decree under which it was created can ever be enforced beyond some local, manageable areas. The currently protected areas do not include mesophytic forests, and only small areas of *Pseudotsuga* or *Picea* forests are included. Of the four priority areas for the conservation of bats (AICOMS, Barquez *et al*., 2022) that exist in the SMO, only a small portion of the Mezquital River Basin occurs in a protected area. It is remarkable the absence of RAMSAR sites in most of the SMO (RAMSAR, 2022), probably explained by the lack of large water bodies (Sandoval *et al*., 2020). Nonetheless, the SMO is winter refuge of numerous terrestrial North American bird species (Wehenkel *et al*., 2017).

There SMO harbors 800 UMAs (units for management and exploitation of resources, SEMARNAT, 2020), a model of conservation that allows the use of wildlife through the sustainable management of their populations (SEMARNAT, 2018). There were 1,722 UMAS in Mexico in 2018 (SEMARNAT, 2018) of which almost half (46.5%) fell in the polygon of the SMO, covering 25,829 km^2 (10.3%, SEMARNAT, 2020). Most UMAs in the SMO are hunting ranches devoted to the harvesting and management of game species, either native (most) or introduced (a few). A recent assessment of the UMA system nationwide (CONABIO, 2012) was conducted by regions, two of which include part of the SMO. Durango (with 279 UMAs in the SMO), Chihuahua (63), Sinaloa (14), and Sonora (146) were included in the Northwestern-North-Central region (NW-NC), whereas Nayarit (19), Jalisco (32), Zacatecas (196) and Aguascalientes (51) were included in the West-Central Region (CONABIO 2012). According to this report, for the NW-NC zone, the one with the most UMAs, only 1.7% of them had objectives and management plans, and a system of indicators of success. Even these few had no clear objectives, or quantifiable measures of success of the management or monitoring goals. Furthermore, only 30.9% of applications for species harvesting included an estimation of population density (CONABIO, 2012). Yet, 27.2% of the UMAs in the NW-NC zone harbored CITES species, and 18.3% harbored species protected by Mexican law (SEMARNAT, 2019). In this information void, it is difficult to assess the impact of these entities as conservation units.

The clearing of the forests by the timber industry has resulted in the gradual loss of litter and therefore humidity of the naturally thin soils that constitute a large proportion of the SMO (Novo-Fernández *et al*., 2018). The loss of organic matter together with the higher incidence of sunlight, is resulting in a gradually drier SMO. In this scenario, all species that require high levels of soil humidity and a thick litter cover to survive, such as voles and shrews, are probably threatened. Because of the pronounced slopes and shallow soils that characterize most of the SMO, it is likely that these species were never widely distributed or abundant, except on the relatively flat mesas of the central portion of the highlands. Yet, the already small areas that meet the requirements for their existence are bound to continue shrinking, and probably disappear as logging and climate change continue. Vázquez *et al*. (2009) concluded that the northern portion of the SMO was one of the three most important areas for conservation of Mexican mammals in Mexico. Based on our results, we propose that the southern portion is also a very important area for protection because of its biological complexity (González-Elizondo *et al*., 2013; López-González *et al*., 2014a; Kobelkowsky-Vidrio *et al*., 2014; López-González *et al*., 2022). An informed reassessment of the conservation priorities that include the participation of all stakeholders and the new data available, is urgently needed for the SMO.

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LITERATURE CITED

Álvarez, T., González Quintero, L. (1969) Análisis polínico del contenido gástrico de murciélagos Glossophaginae de México. *Anales de la Escuela Nacional de Ciencias Biológicas*, 18, 137–165.

Álvarez, T., Polaco, O. J. (1984) Estudio de los mamíferos capturados en La Michilía, sureste de Durango, México. *Anales de la Escuela Nacional de Ciencias Biológicas, México*, 28, 99–148.

Álvarez-Castañeda, S. T., Gutiérrez-Ramos, A., Ríos, E., Méndez, L. (2008) Lista anotada de los mamíferos de Aguascalientes. Pp. 27–63. *In*: C. Lorenzo, E. Espinoza, J. Ortega (Eds.). *Avances en el Estudio de los Mamíferos de México. Publicaciones Especiales, Vol. II*. Asociación Mexicana de Mastozoología, A.C., Ciudad de México, México. http://mamiferosmexico.org/books/Avances_Estudio_Mamiferos_Mexico_II.pdf (accessed November 2022).

Álvarez-Castañeda, S. T., Patton, J. L. (Eds.) (1999) *Mamíferos del noroeste de México*. Centro de Investigaciones Biológicas del Noroeste, A. C., La Paz, México, 583 pp. https://mamiferosmexico.org/books/Alvarez-C_y_Patton_Mamiferos_del_Noroeste_Vol1_parte1.pdf https://mamiferosmexico.org/books/Alvarez-C_y_Patton_Mamiferos_del_Noroeste_Vol1_parte2.pdf (accessed November 2022).

Álvarez-Castañeda, S. T., Patton, J. L. (Eds.) (2000) *Mamíferos del noroeste de México II*. Centro de Investigaciones Biológicas del Noroeste, A.C., La Paz, México, 587–873 pp. http://www.mastozoologiamexicana.com/books/Alvarez-C_y_Patton_Mamiferos_del_Noroeste_Vol2_parte1.pdf (accessed November 2022).

Anderson, S. (1972) Mammals of Chihuahua, taxonomy and distribution. *Bulletin of the American Museum of Natural History*, 148 (2), 149–410. https://digitallibrary.amnh.org/handle/2246/1101 (accessed November 2022).

Arita, H. T., Humphrey, S. R. (1988) Revisión taxonómica de los murciélagos magueyeros del género *Leptonycteris* (Chiroptera: Phyllostomidae). *Acta Zoológica Mexicana (nueva serie)*, 29, 1–60. https://doi.org/10.21829/azm.1988.25291652

Arriaga, L., Espinoza, J. M., Aguilar, C., Martínez, E., Gómez, L., Loa, E. (Coords.) (2000) *Regiones terrestres prioritarias de México. Escala de trabajo 1:1 000 000*. Comisión Nacional para el Conocimiento y uso de la Biodiversidad, Ciudad de México, México, 609 pp. http://www.conabio.gob.mx/conocimiento/regionalizacion/doctos/terrestres.html (accessed November 2022).

Arroyo-Cabrales, J., León-Paniagua, L., Ríos-Muñoz, C. A., Espinosa-Martínez, D. V., Medrano-González, L. (2015) Mamíferos de Nayarit. *Revista Mexicana de Mastozoología (Nueva Época)*, 5 (1), 33–62. https://doi.org/10.22201/ie.20074484e.2015.5.1.208

Arroyo-Cabrales, J., Polaco, O. J., Wilson, D. E., Gardner, A. L. (2008) Nuevos registros de murciélagos para Nayarit, México. *Revista Mexicana de Mastozoología*, 12, 141–162. https://doi.org/10.22201/ie.20074484e.2008.12.1.50

Baker, R. H., Greer, J. K. (1962) Mammals of the Mexican state of Durango. *Publications of the Museum, Michigan State University, Biological Series*, 2 (2), 25–154.

Barquez, R. M., Aguirre, L. F., Nassar, J. M., Burneo, S. F., Mancina, C. A., Díaz, M. M. (Eds.) (2022) *Áreas y sitios de importancia para la conservación de los murciélagos en Latinoamérica y el Caribe.* RELCOM, Yerba Buena, Argentina, 370 pp. https://relcomlatinoamerica.net/component/sppagebuilder/?view=page&id=172 (accessed November 2022).

Bradley, R. D., Carroll, D. S., Haynie, M. L., Muñiz-Martínez, R., Hamilton, M. J. (2004) A new species of *Peromyscus* from western Mexico. *Journal of Mammalogy*, 85 (6), 1184–1193. https://doi.org/10.1644/BEL-113.1

Bradley, R. D., Ordóñez-Garza, N., Sotero-Caio, C. G., Huynh, H. M., Kilpatrick, C. W., Iñiguez-Dávalos, L. I., Schmidly, D. J. (2014) Morphometric, karyotypic, and molecular evidence for a new species of *Peromyscus* (Cricetidae: Neotominae) from Nayarit, Mexico. *Journal of Mammalogy*, 95 (1), 176–186. https://doi.org/10.1644/13-MAMM-A-217

Brown, D. E., López González, C. A. (2000) Notes on the occurrences of jaguars in Arizona and New Mexico. *The Southwestern Naturalist*, 45 (4), 537–546. https://doi.org/10.2307/3672607

Bryson Jr., R. W., Murphy, R. W., Lathrop, A., Lazcano-Villareal, D. (2011). Evolutionary drivers of phylogeographical diversity in the highlands of Mexico: a case study of the *Crotalus triseriatus* species group of montane rattlesnakes. *Journal of Biogeography*, 38 (4), 697–710. https://doi.org/10.1111/j.1365-2699.2010.02431.x

Bye, R. (1995) Prominence of the Sierra Madre Occidental in the Biological Diversity of Mexico. Pp. 19–27. *In*: L. F. DeBano, P. F. Ffolliott, A. Ortega Rubio, G. J. Gottfried, R. H. Hamre, C. B. Edminster (Coords.). *Biodiversity and management of the Madrean archipelago: The sky islands of southwestern United States and northwestern Mexico.19-23 Sept 1994; Tucson, Arizona,* General Technical Report RM 264. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Fort Collins, USA. https://doi.org/10.2737/RM-GTR-264

Carleton, M. D., Wilson, D. E., Gardner, A. L., Bogan, M. A. (1982) Distribution and systematics of *Peromyscus* of Nayarit. *Smithsonian Contributions in Zoology*, 352, 1–46. https://doi.org/10.5479/si.00810282.352

Cartron, J. E., Ceballos, G., Felger, R. S. (Eds.) (2005) *Biodiversity, ecosystems, and conservation in northern Mexico*. Oxford University Press, New York, USA, 496 pp.

Castillo-Gámez, R. A., Gallo-Reynoso, J. P., Egido-Villarreal, J., Caire, W. (2010) Mamíferos. Pp. 421–436. *In*: F. E. Molina-Freaner, T. R. Van Devender (Eds.). *Diversidad Biológica de Sonora*. UNAM-CONABIO, Ciudad de México, México. http://web.ecologia.unam.mx/laboratorios/fmolina/images/stories/publicaciones/LibrosCapitulosLibro/diversidad_biologica_de_sonora_final.pdf (accessed November 2022).

Ceballos, G., Arroyo-Cabrales, J., Medellín, R. A., Medrano, L., Oliva, G. (2005) Diversidad y conservación de los mamíferos de México. Pp. 21–66. *In*: G. Ceballos, G. Oliva (Eds.). *Los mamíferos silvestres de México*. CONABIO-UNAM-Fondo de Cultura Económica, Ciudad de México, México.

Ceballos, G., Navarro, D. (1991) Diversity and Conservation of Mexican Mammals. Pp. 167–198. *In*: M. A. Mares, D. J. Schmidly (Eds.). *Latin American Mammalogy, History, Biodiversity and Conservation*. University of Oklahoma Press, Norman, USA.

Coll-Hurtado, A., Sánchez-Salazar, M. T., Casado-Izquierdo, J. M. (1990) Minería Pp EVII. *In*: A. Coll-Hurtado (Coord.), *Nuevo Atlas Nacional de México*. Instituto de Geografía, UNAM, Ciudad de México, México. http://www.publicaciones.igg.unam.mx/index.php/ig/catalog/series/anm (accessed November 2022).

Comisión Nacional de Áreas Naturales Protegidas [CONANP] (2022a) Áreas Naturales Protegidas de México, CONANP, Ciudad de México, México. https://simec.conanp.gob.mx/informacion.php (accessed November 2022).

Comisión Nacional de Áreas Naturales Protegidas [CONANP] (2022b) Área Natural de Recursos Naturales CADNR 043 Estado de Nayarit, CONANP, Ciudad de México, México, 22 pp. https://simec.conanp.gob.mx/ficha_pdf.php?anp=4&reg=11 (accessed November 2022).

Comisión Nacional para el Conocimiento y Uso de la Biodiversidad [CONABIO] (2003). División Política Estatal de México. Escala 1:250000. CONABIO, Ciudad de México, México. http://geoportal.conabio.gob.mx/metadatos/doc/html/destdv1gw.html (accessed October 2022).

Comisión Nacional para el Conocimiento y Uso de la Biodiversidad [CONABIO] (2012) Proyecto de Evaluación de las Unidades de Manejo para la Conservación de la Vida Silvestre (UMA) (1997-2008). Resultados de la Fase I: Gestión y Administración. Proyectos CONABIO: HV003, HV004, HV007, HV012 y HV019. México. https://www.biodiversidad.gob.mx/diversidad/UMAs (accessed December 2022).

Comisión Nacional para el Conocimiento y Uso de la Biodiversidad [CONABIO] (2022) Sistema Nacional de Información sobre biodiversidad de México. CONABIO, Ciudad de México, México.
https://www.snib.mx/SNIB (accessed November 2022)

Coronel-Arellano, H., Lara-Díaz, N. E., Jiménez-Maldonado, R. E., López-González, C. A. (2016) Species richness and conservation status of medium and large terrestrial mammals from four Sky Islands in Sonora, northwestern Mexico. *Check List*, 12 (1), 1839–1839.
https://doi.org/10.15560/12.1.1839

Coronel-Arellano, H., Lara-Díaz, N. E., Moreno, C. E., Gutiérrez-González, C. E., López-González, C. A. (2018) Biodiversity conservation in the Madrean sky islands: community homogeneity of medium and large mammals in northwestern Mexico. *Journal of Mammalogy*, 99 (2), 465–477.
https://doi.org/10.1093/jmammal/gyx151

Cruz-Romo, J. L., Wolf Webels, R. A., González Bernal, A., González, Z. Y., Aguilar, C., García Chávez, C., Lara Diaz, N. E., López González, C. A. (2013) Re-introduction of the Mexican wolf in the Sierra Madre Occidental, Mexico. Pp. 116–119. *In*: P. S. Soorae (Ed.). *Global Re-introduction Perspectives: 2013. Further case studies from around the globe*. IUCN/ SSC Re-introduction Specialist Group & Abu Dhabi, UAE: Environment Agency-Abu Dhabi. Gland, Switzerland.
https://iucn-ctsg.org/project/global-re-introduction-perspectives-2013/
(accessed November 2022).

de la Riva, G. (2008) Mamíferos. Pp. 161–171. *In*: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO), Instituto del Medio Ambiente del Estado de Aguascalientes (IMAE), Universidad Autónoma de Aguascalientes (UAA) (Eds.). *La Biodiversidad en Aguascalientes: Estudio de Estado*. CONABIO-IMAE-UAA, Ciudad de México, México.
https://bioteca.biodiversidad.gob.mx/janium-bin/detalle.pl?Id=20221207125131
(accessed November 2022).

Environmental Systems Research Institute [ESRI] Inc. (2012) Arcmap v. 10.1. Redlands, CA, USA.

Escalante, T., Rodríguez, G., Gámez, N., León-Paniagua, L., Barrera, O., Sánchez-Cordero, V. (2007a) Biogeografía y conservación de los mamíferos. Pp. 485–502. *In*: I. Luna, J. J. Morrone, D. Espinosa (Eds.). *Diversidad de la Faja Volcánica Transmexicana*. CONABIO-UNAM, Ciudad de México, Mexico.

Escalante, T., Sánchez-Cordero, V., Morrone, J. J., Linaje, M. (2007b) Areas of endemism of Mexican terrestrial mammals: a case study using species' ecological niche modelling, parsimony analysis of endemicity and Goloboff fit. *Interciencia*, 32 (3), 151–159.
https://www.redalyc.org/pdf/339/33912603.pdf (accessed November 2022).

Escalante, T., Szumik, C., Morrone, J. J. (2009) Areas of endemism of Mexican mammals: reanalysis applying the optimality criterion. *Biological Journal of the Linnean Society*, 98 (2), 468–478.
https://doi.org/10.1111/j.1095-8312.2009.01293.x

Espinosa-Flores, E., Lara-Diaz, N. E., López-González, C. A. (2012) Tamaño poblacional del oso negro *Ursus americanus* en dos islas del cielo del noreste de Sonora, México. *Therya*, 3 (3), 403–415.
https://doi.org/10.12933/therya-12-80

Felger, R., Nabhan, G., Bye, R. (1997) The Apachian/Madrean region of southwestern North America and USA. Pp. 172–180. *In*: S. D. Davis, V. H. Heywood, O. Herrera-McBryde, J. Villa-Lobos, A. C. Hamilton (Eds.). *Centres for Plant Diversity: a guide and strategy for their conservation,* *Vol. III, The Americas*. The World Wide Fund for Nature & International Union for the Conservation of Nature-The World Conservation Union, Cambridge, U.K.

Felger, R. S., Wilson, M. F. (1995) Northern Sierra Madre Occidental and its Apachian outliers: A neglected center of biodiversity. Pp. 36–59. *In*: L. F. DeBano, P. F. Ffolliott, A. Ortega Rubio, G. J. Gottfried, R. H. Hamre, C. B. Edminster (Coords.). *Biodiversity and management of the Madrean archipelago: The sky islands of southwestern United States and northwestern Mexico.19-23 Sept 1994; Tucson, Arizona*. General Technical Report RM 264. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Fort Collins, USA. https://doi.org/10.2737/RM-GTR-264

Ferrari, L., Valencia-Moreno, M., Bryan, S. (2007) Magmatism and tectonics of the Sierra Madre Occidental and its relation with the evolution of the western margin of North America. Pp. 1–39. *In*: S. A. Alaniz-Álvarez, Á. F. Nieto-Samaniego (Eds.). *Geology of México: Celebrating the Centenary of the Geological Society of Mexico*. Geological Society of America, Special Paper 422.
https://doi.org/10.1130/2007.2422(01)

Flesch, A. D., González Sánchez, C., Valenzuela Amarillas, J. (2016) Abundance and habitat relationships of breeding birds in the Sky Islands and adjacent Sierra Madre Occidental of northwest Mexico. *Journal of Field Ornithology*, 87 (2), 176–195.
https://doi.org/10.1111/jofo.12151

Gallina-Tessaro, S., Pérez-Solano, L. A., García-Feria, L., Sánchez-Rojas, G., Hernández-Silva, D., Esparza-Carlos, J. P. (2019) Chapter 14, The Mule Deer of Arid Zones. Pp. 347–369. *In*: S. Gallina-Tessaro (Ed.). *Ecology and Conservation of Tropical Ungulates in Latin America*, Springer Nature, Cham, Switzerland.
https://doi.org/10.1007/978-3-030-28868-6_14

Gallo-Reynoso, J. P., Armenta-Mendez, L., Macias Sánchez, S., Van Devender, T. H., Ponce-García, G., Cabrera-Hernández, V. H. (2021) Confirmation of the presence of Abert's squirrel (*Sciurus aberti*) after a century in Sonora, Mexico. *Therya Notes*, 2 (3), 156–159.
https://doi.org/10.12933/therya_notes-21-54

García, E. (1998) Climas (Clasificación de Köppen, modificado por García). Escala 1:1 000 000. CONABIO, México.
http://geoportal.conabio.gob.mx/metadatos/doc/html/clima1mgw.html (accessed November 2022)

García-Mendoza, D. F., López-González, C. (2013) A checklist for the mammals (Mammalia) of Durango, Mexico. *Check List*, 9 (2), 313–322.
https://doi.org/10.15560/9.2.313

García-Mendoza, D. F., López-González, C., Salas-H., T. (2021) Noteworthy records of mammals from west-central Mexico. *Western North American Naturalist*, 81 (4), 571–581.
https://doi.org/10.3398/064.081.0409

Girmendonk, A. L. (1994) Ocelot, jaguar and jaguarundi sighting reports: Arizona and Sonora, Mexico. *Nongame and Endangered Wildlife Program Technical Report 35*. Arizona Game and Fish Department, Phoenix, Arizona, USA, 15 pp.

González-Elizondo, M. S. (1997) Upper Mezquital River Region, Sierra Madre Occidental, Mexico. Pp. 157–160. *In*: S. D. Davis, V. H. Heywood, O. Herrera-McBryde, J. Villa-Lobos, A. C. Hamilton. (Eds.). *Centres for Plant Diversity: a guide and strategy for their conservation, Vol. III, The Americas*. The World Wide Fund for Nature & International Union for the Conservation of Nature-The World Conservation Union. Cambridge, U.K.

González-Elizondo, M. S., González Elizondo, M., Márquez Linares, M. A. (2007) Capítulo IV Vegetación. Pp. 38–129. *In*: M. S. González Elizondo, M. González Elizondo, M. A. Márquez Linares (Eds.). *Vegetación y Ecorregiones de Durango*. Plaza y Valdés Editores-Instituto Politécnico Nacional, Ciudad de México, México.

González-Elizondo, M. S., González-Elizondo, M., Ruacho González, L., López-Enríquez, I. L., Retana Rentería, F. I., Tena Flores, J. A. (2013) Ecosystems and Diversity of the Sierra Madre Occidental. Pp. 204–211. *In*: G. J. Gottfried, P. F. Ffolliott, B. S. Gebow, L. G. Eskew, L. C. Collins (Comps.). *Merging science and management in a rapidly changing world: Biodiversity and management of the Madrean Archipelago III and 7th Conference on Research and Resource Management in the Southwestern Deserts; 1–5 May 2012*; *Tucson, Arizona*. Proceedings. RMRS-P-67. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, USA.
https://www.fs.usda.gov/research/treesearch/44434 (accessed November 2022).

González-Elizondo, M. S., González-Elizondo, M., Tena-Flores, J. A., Ruacho-González, L., López-Enríquez, I. L. (2012) Vegetación de la Sierra Madre Occidental, México: una síntesis. *Acta Botánica Mexicana*, 100, 351–403.
https://doi.org/10.21829/abm100.2012.40

Google LLC. (2022) Google Earth pro v. 7.3.6.9285 (64-bit). Mountain View, USA.

Guerrero-Vázquez, S., Zalapa Hernández, S. S., Godínez Navarro, E. G. (2017) Mamíferos. Pp. 349–356. *In*: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO), Secretaría de Medio Ambiente y Desarrollo Territorial (SEMADET) (Eds.). *La biodiversidad en Jalisco, Estudio de estado. Vol II*. CONABIO-SEMADET, Ciudad de México, México.
https://bioteca.biodiversidad.gob.mx/janium-bin/detalle.pl?Id=20221207133157 (accessed November 2022).

Gugger, P. F., González-Rodríguez, A., Rodríguez-Correa, H., Sugita, S., Cavender-Bares, J. (2011) Southward Pleistocene migration of Douglas-fir into Mexico: phylogeography, ecological niche modeling, and conservation of 'rear edge' populations. *New Phytologist*, 189 (4), 1185–1199.
https://doi.org/10.1111/j.1469-8137.2010.03559.x

Hammer, Ø., Harper, D. A. T., Ryan, P. D. (2001) PAST: Paleontological statistic software package for education and data analysis. *Palaeontologia Electronica*, 4 (1), 1–9.
https://palaeo-electronica.org/2001_1/past/past.pdf (accessed November 2022).

Instituto Nacional de Geografía y Estadística [INEGI] (2020) Densidad.
http://www.cuentame.inegi.org.mx/poblacion/densidad.aspx?tema=P (accessed November 2022).

International Union for Conservation of Nature [IUCN] (2022) The IUCN Red List of Threatened Species. Version 2022-1.
https://www.iucnredlist.org (accessed October, 2022).

Johnson, J. D., Wilson, L. D., Mata-Silva, V., García Padilla, E., DeSantis, D. L. (2017) The endemic herpetofauna of Mexico: organisms of global significance in severe peril. *Mesoamerican Herpetology*, 4 (3), 544–620.
http://mesoamericanherpetology.com/uploads/3/4/7/9/34798824/mh_4-3_johnson_et_al.pdf (accessed November 2022).

Kobelkowsky-Vidrio, T., Ríos-Muñoz, C. A., Navarro-Sigüenza, A. G. (2014). Biodiversity and biogeography of the avifauna of the Sierra Madre Occidental, Mexico. *Biodiversity and Conservation*, 23 (8), 2087–2105.

https://doi.org/10.1007/s10531-014-0706-6

Koleff, P., Urquiza-Haas, T. (Coords.) (2011) *Planeación para la conservación de la biodiversidad terrestre en México: retos en un país megadiverso*. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad-Comisión Nacional de Áreas Naturales Protegidas, Ciudad de México, México, 244 pp. https://www.biodiversidad.gob.mx/publicaciones/versiones_digitales/conservacion133r.pdf (accessed November 2022).

Lammertink, J. M., Rojas-Tomé, J. A., Casillas-Orona, F. M., Otto, R. L. (1996) Status and conservation of old-growth forests and endemic birds in the pine-oak zone of the Sierra Madre Occidental, Mexico. *Verslagen en Technische Gegevens*, 69 (1), 1–89. https://repository.naturalis.nl/pub/506361 (accessed November 2022).

León-Paniagua, L., García Trejo, E., Arroyo-Cabrales, J., Castañeda-Rico, S. (2004) Patrones biogeográficos de la mastofauna. Pp. 469–486. *In*: I. Luna, J. J. Morrone, D. Espinosa (Eds.). *Biodiversidad de la Sierra Madre Oriental*. CONABIO-Facultad de Ciencias UNAM-Las Prensas de Ciencias, Ciudad de México, México.

le Polain de Waroux, Y., Neumann, J., O'Driscoll, A., Schreiber, K. (2021) Pious pioneers: the expansion of Mennonite colonies in Latin America. *Journal of Land Use Science*, 16 (1), 1–17. https://doi.org/10.1080/1747423X.2020.1855266

List, R., McDonald, D. (1998) Carnivora and their larger mammalian prey: species inventory and abundance in the Janos-Nuevo Casas Grandes prairie dog complex, Chihuahua. *Revista Mexicana de Mastozoología*, 3, 95–112. https://doi.org/10.22201/ie.20074484e.1998.3.1.62

López-González, C. A., Brown, D. E. (2002) Distribución y estado de conservación actuales del jaguar en el noroeste de México. Pp. 379–391. *In*: R. A. Medellín, C. Equihua, C. L. B. Chetkiewicz, P. G. Crawshaw, A. Rabinowitz, K. H. Redford, J. G. Robinson, E. Sanderson, A. Taber (Comps.). *El jaguar en el nuevo milenio*. Fondo de Cultura Económica-Universidad Nacional Autónoma de México-Wildlife Conservation Society, Ciudad de México, México.

López-González, C., Correa-Ramírez, M. M., García-Mendoza, D. F. (2014b) Phylogeography of *Peromyscus schmidlyi*: an endemic of the Sierra Madre Occidental, Mexico. *Journal of Mammalogy*, 95 (2), 254–268. https://doi.org/10.1644/13-MAMM-A-166

López-González, C., García-Mendoza, D. F. (2006) Murciélagos de la Sierra Tarahumara, Chihuahua, México. *Acta Zoológica Mexicana (nueva serie)*, 22 (2), 109–135. https://doi.org/10.21829/azm.2006.2222016

López-González, C., García Mendoza, D. F. (2012) A checklist of the Mammals of Chihuahua. *Check List*, 8 (6), 1122–1133. https://doi.org/10.15560/8.6.1122

López-González, C., García-Mendoza, D. F., Salas-H., T. (2022) Mammals of the Jesús María River – Basin. *Western North American Naturalist*, 82 (4), 677–694.

López-González, C., Lozano, A. (2015) Metacommunity structure of small mammals in western Mexico: is the San Pedro-Mezquital River a biological corridor? *The Southwestern Naturalist*, 60 (4), 327–335. https://doi.org/10.1894/0038-4909-60.4.327

López-González, C., Lozano, A., García-Mendoza, D. F., Villanueva-Hernández, A. I. (2014a) Mammals of the San Pedro-Mezquital River Basin, Durango-Nayarit, Mexico. *Check List*, 10 (6), 1277–1289.
https://doi.org/10.15560/10.6.1277

López-González, C., Torres-Morales, L. (2004) Use of abandoned mines by long-eared bats genus *Corynorhinus* (Chiroptera: Vespertilionidae) in Durango, Mexico. *Journal of Mammalogy*, 85 (5), 989–994.
https://doi.org/10.1644/BWG-124

López-Ortega, G., Ballesteros-Barrera, Y., Acosta-Cabrera, Y., Cervantes, F. A. (2020) Mamíferos. Pp. 280–289 *In*: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (Ed.). *La biodiversidad en Zacatecas. Estudio de Estado*. CONABIO, Ciudad de México, México.
http://200.12.166.51/janium-bin/detalle.pl?Id=20221207133609 (accessed November 2022).

López-Segoviano, G., Díaz-Verduzco, L., Arenas-Navarro, M., Arizmendi, M. C. (2019) Diversidad estacional de aves en una región prioritaria para la conservación en el centro-oeste de la Sierra Madre Occidental. *Revista Mexicana de Biodiversidad*, 90, e9027543.
https://doi.org/10.22201/ib.20078706e.2019.90.2754

López-Wilchis, R., López-Ortega, G., Gaona S. (1990) Mastofauna (Mamíferos). Map IV.8.9. *In*: A. García de Fuentes (Coord.). *Atlas Nacional de México 1990-1992*. Instituto de Geografía, UNAM, Ciudad de México, México.
https://geodigital.geografia.unam.mx/atlas_nacional/index.html/grals/Tomo_II/IV.Naturaleza/IV.8.Biogeografia/IV.8.9.jpg (accessed November 2022).

Lozano-Román, L. F., Estrada-Aguilera, V. E. (2008) Áreas naturales protegidas de Aguascalientes. Pp. 313–314. *In*: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO), Instituto del Medio Ambiente del Estado de Aguascalientes (IMAE), Universidad Autónoma de Aguascalientes (UAA) (Eds.). *La Biodiversidad en Aguascalientes: Estudio de Estado*. CONABIO-IMAE-UAA, Ciudad de México, México.
https://bioteca.biodiversidad.gob.mx/janium-bin/detalle.pl?Id=20221207125131 (accessed November 2022).

Luquín, S. H., Nieves, H. G., Ayala, R. J. M. (2004) Vegetación del Norte de Jalisco. Flora del Norte de Jalisco y Etnobotánica Huichola. Pp. 77–83. *In*: J. A. Vázquez-García, M. J. Cházaro B., G. Nieves H., Y. L. Vargas-Rodríguez, M. Vázquez G., A. Flores M. (Eds.). *Serie Fronteras de Biodiversidad 1*. Universidad de Guadalajara (CUCBA-CUSH), Guadalajara, México.
https://www.gbv.de/dms/bs/toc/483508411.pdf (accessed November 2022).

Mammal Diversity Database (2022) Mammal Diversity Database (Version 1.9).
https://www.mammaldiversity.org/index.html (accessed November, 2022)

Manly, B. F. J. (2005) *Multivariate Statistical Methods: a primer 3rd ed*. Chapman & Hall/CRC, Boca Raton, Florida, USA, 214 pp.

Mathis, V. L., Hafner, M. S., Hafner, D. J., Demastes, J. W. (2013a) Resurrection and redescription of the pocket gopher *Thomomys sheldoni* from the Sierra Madre Occidental of Mexico. *Journal of Mammalogy*, 94 (3), 544–560.
https://doi.org/10.1644/12-MAMM-A-225.1

Mathis, V. L., Hafner, M. S., Hafner, D. J., Demastes, J. W. (2013b) *Thomomys nayarensis*, a new species of pocket gopher from the Sierra del Nayar, Nayarit, Mexico. *Journal of Mammalogy*, 94 (5), 983–994.
https://doi.org/10.1644/13-MAMM-A-013.1

Matson, J. O., Baker, R. H. (1986) Mammals of Zacatecas. *Special Publications, The Museum of Texas Tech University*, 24, 1–88. https://doi.org/10.5962/bhl.title.156496

Medellín, R. A., Manterola, C., Valdéz, M., Hewitt, D. G., Doan-Crider, D., Fulbright, T. E. (2005) History, ecology, and conservation of the pronghorn antelope, bighorn sheep, and black bear in Mexico. Pp. 387–404. *In*: J. E. Cartron, G. Ceballos, R. S. Felger (Eds.). *Biodiversity, Ecosystems, and Conservation in Northern Mexico*. Oxford University Press, New York, USA.

Monárrez-González, J. C., Pérez-Verdín, G., López-González, C., Márquez-Linarez, M. A., González-Elizondo, M. S. (2018) Efecto del manejo forestal sobre algunos servicios ecosistémicos en los bosques templados de México. *Madera y Bosques*, 24 (2), e2421569 https://doi.org/10.21829/myb.2018.2421569

Morrone, J. J. (2020) *The Mexican transition zone: a natural laboratory to study biotic assembly*. Springer Nature, Cham, Switzerland, 191 pp. https://doi.org/10.1007/978-3-030-47917-6

Morrone, J. J., Márquez, J. (2003) Aproximación a un atlas biogeográfico de México: componentes bióticos principales y biogeografía. Pp. 87–97. *In*: J. J. Morrone, J. Llorente-Bousquets (Eds.). *Una Perspectiva Latinoamericana de la Biogeografía*. Las Prensas de Ciencias, UNAM, Ciudad de México, México.

Navarro-Serment, C. J., López-González, C. A., Gallo-Reynoso, J. P. (2005) The occurrence of jaguar (*Panthera onca*) in Sinaloa, Mexico. *The Southwestern Naturalist*, 50 (1), 102–106. https://doi.org/10.1894/0038-4909(2005)050<0102:OOJPOI>2.0.CO;2

Novo-Fernández, A., Franks, S., Wehenkel, C., López-Serrano, P. M., Molinier, M., López-Sánchez, C. A. (2018) Landsat time series analysis for temperate forest cover change detection in the Sierra Madre Occidental, Durango, Mexico. *International Journal of Applied Earth Observation and Geoinformation*, 73 (1), 230–244. https://doi.org/10.1016/j.jag.2018.06.015

Ortega, J., Alarcón-D., I. (2007) *Anoura geoffroyi*. *Mammalian Species*, 818, 1–7. https://doi.org/10.1644/818.1

Pacheco, J., Ceballos, G., List, R. (2000) Los mamíferos de la región de Janos-Casas Grandes, Chihuahua, México. *Revista Mexicana de Mastozoología*, 4, 71–85. https://doi.org/10.22201/ie.20074484e.1999.4.1.82

Pelz-Serrano, K., Ponce-Guevara, E., Sierra-Corona, R., List, R., Ceballos, G. (2006) Recent records of desert bighorn sheep (*Ovis canadensis mexicana*) in Eastern Sonora and northwestern Chihuahua, Mexico. *The Southwetstern Naturalist*, 51 (3), 430–434. https://doi.org/10.1894/0038-4909(2006)51[430:RRODBS]2.0.CO;2

Ramírez-Pulido, J., Castro-Campillo, A. (1990) Regionalización Mastofaunística (Mamíferos). Map IV.8.8. *In*: A. García de Fuentes (Coord.). *Atlas Nacional de México 1990-1992*. Instituto de Geografía, UNAM, Ciudad de México, México. https://geodigital.geografia.unam.mx/atlas_nacional/index.html/grals/Tomo_II/IV.Naturaleza/IV.8.Biogeografia/IV.8.8.jpg (accessed November 2022).

Ramírez-Pulido, J., González-Ruiz, N., Gardner, A. L., Arroyo-Cabrales, J. (2014) List of recent land mammals of Mexico, 2014. *Special Publications Museum of Texas Tech University*, 63, 1–69. https://doi.org/10.5962/bhl.title.142891

Ramírez-Silva, J. P., Figueroa-Esquivel, E. M., Puebla-Olivares, F. (2021) Mamíferos terrestres. Pp. 251–256. *In*: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (Ed.). *La biodiversidad en Nayarit. Estudio de Estado. Vol. II*. CONABIO, Ciudad de México, México.

https://bioteca.biodiversidad.gob.mx/janium-bin/detalle.pl?Id=20221207134007 (accessed November 2022).

Ramírez-Silva, J. P., Hernández de la Rosa, D., Hernández-Cadena, F. J., Woolrich-Piña, G. (2015) Conservación de los mamíferos de Nayarit. Pp. 311–328. *In*: M. Briones-Salas, Y. Hortelano-Moncada, G. Magaña-Cota, G. Sánchez-Rojas, J. E. Sosa-Escalante (Eds.). *Riqueza y conservación de los mamíferos en México a nivel estatal*. Instituto de Biología, UNAM-AMMAC- Universidad de Guanajuato, Ciudad de México, México. http://mamiferosmexico.org/books/Riqueza_estatal_AMMAC.pdf (accessed November 2022).

RAMSAR (2022) Ramsar Sites Information Service. https://rsis.ramsar.org (accessed November 2022)

Rentería-Arrieta, L. I., Montiel-Antuna, E. (2017) Áreas Naturales Protegidas. Pp 129–171. *In*: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, Secretaría de Recursos Naturales y Medio Ambiente (Eds.). *La Biodiversidad en Durango, Estudio de Estado*. CONABIO-SRMA. Ciudad de México, México. https://bioteca.biodiversidad.gob.mx/janium-bin/detalle.pl?Id=20221207134334 (accessed November 2022).

Rodríguez, P., Soberón, J., Arita, H. T. (2003) El componente beta de la diversidad de mamíferos de México. *Acta Zoológica Mexicana (nueva serie)*, 89, 241–259. https://doi.org/10.21829/azm.2003.89891785

Rodríguez-Gutiérrez, M. F. (2023) *Análisis panbiogeográfico de los saurios de la Sierra Madre Occidental*. Tesis de Maestría. Centro Interdisciplinario de Investigación para el Desarrollo Integral Regional, Unidad Durango, Instituto Politécnico Nacional Durango, México, 191 pp.

Riddle, B. R., Hafner, D. J., Alexander, L. F. (2000) Phylogeography and systematics of the *Peromyscus eremicus* species group and the historical biogeography of North American warm regional deserts. *Molecular Phylogenetics and Evolution*, 17 (2), 145–160. https://doi.org/10.1006/mpev.2000.0841

Sánchez-Cordero, V., Botello, F., Flores-Martínez, J. J., Gómez-Rodríguez, R. A., Guevara, L., Gutiérrez-Granados, G., Rodríguez-Moreno, Á. (2014) Biodiversity of Chordata (Mammalia) in Mexico. *Revista Mexicana de Biodiversidad*, 85, S496–S504. https://doi.org/10.7550/rmb.31688

Sánchez-Hernández, C., Romero-Almaraz, M. L., Schnell, G. D., Kennedy, M. L., Best, T. L., Owen, R. D., López-González, C. (2002) Bats of Colima, Mexico: new records, geographic distribution, and reproductive condition. *Occasional Papers, Sam Noble Oklahoma Museum of Natural History*, 12, 1–23. https://www.auburn.edu/cosam/faculty/biology/best/research/PDFs/2002SanchezHernandezEtAl.pdf (accessed November 2022).

Sánchez-Sánchez, H., López-Barrera, G., Peñaloza-Ramírez, J. M., Rocha-Ramírez, V., Oyama, K. (2012) Phylogeography reveals routes of colonization of the bark beetle *Dendroctonus approximatus* Dietz in Mexico. *Journal of Heredity*, 103 (5), 638–650. https://doi.org/10.1093/jhered/ess043

Sandoval, S., Escobar-Flores, J. G., Sánchez-Ortíz, E. (2020) Water resource inventory in the Sierra Madre Occidental (Mexico) based on remote sensing and GIS. *Investigaciones Geográficas*, 102, e59975. https://doi.org/10.14350/rig.59975

Secretaría del Medio Ambiente y Recursos Naturales [SEMARNAT] (2018) Importancia de las UMAS. https://www.gob.mx/semarnat/articulos/las-uma-sitios-dedicados-a-la-conservacion-de-la-vida-silvestre (accessed December 2022).

Secretaría del Medio Ambiente y Recursos Naturales [SEMARNAT] (2019) Modificación del Anexo Normativo III, Lista de especies en riesgo de la Norma Oficial Mexicana NOM-059-SEMARNAT-2010, Protección ambiental-Especies nativas de México de flora y fauna silvestres-Categorías de riesgo y especificaciones para su inclusión, exclusión o cambio-Lista de especies en riesgo, publicada el 30 de diciembre de 2010. *Diario Oficial de la Federación, México*, 14 November 2019. https://www.dof.gob.mx/nota_detalle.php?codigo=5578808&fecha=14/11/2019#gsc.tab=0 (accessed November 2022).

Secretaría del Medio Ambiente y Recursos Naturales [SEMARNAT] (2020) Unidades de Manejo para la Conservación de la Vida Silvestre (UMA), 2020. https://gisviewer.semarnat.gob.mx/geointegrador2Beta/index.html (Accessed December 2022).

Secretaría del Medio Ambiente y Recursos Naturales [SEMARNAT] (2023). Acciones Ambientales. Se recupera la población de lobo mexicano. https://www.gob.mx/semarnat/articulos/accionesambientales-se-recupera-la-poblacion-de-lobo-mexicano#:~:text=la%20sociedad%20civil.-,Actualmente%2C%20el%20n%C3%BAmero%20de%20ejemplares%20en%20vida%20libre%20asciende%20a,ejemplares%20adquiere%20gran%20relevancia%20ecol%C3%B3gica (Accessed 1 November 2023).

Serrano Carreto, E. (Coord.) (2006) *Regiones indígenas de México*. Comisión Nacional para el Desarrollo de los Pueblos Indígenas & Programa de las Naciones Unidas para el Desarrollo, Ciudad de México, México, 147 pp. https://www.gob.mx/cms/uploads/attachment/file/35735/cdi-regiones-indigenas-mexico.pdf (accessed November 2022).

Soininen, J., Heino, J., Wang, J. (2018). A meta-analysis of nestedness and turnover components of beta diversity across organisms and ecosystems. *Global Ecology and Biogeography*, 27, 96-109. https://doi.org/10.1111/geb.12660

Spellenberg, R., Lebgue, T., Corral-Díaz, R. (1996) A specimen-based, annotated checklist of the vascular plants of Parque Nacional “Cascada de Basaseachi” and adjacent areas, Chihuahua, Mexico. *Listados Florísticos de México XIII*. Instituto de Biología UNAM, Ciudad de México, 72 pp.

Stoner, K. E., O.-Salazar, K. A., R.-Fernández, R. C., Quesada, M. (2003) Population dynamics, reproduction, and diet of the lesser long-nosed bat (*Leptonycteris curasoae*) in Jalisco, Mexico: implications for conservation. *Biodiversity and Conservation*, 12 (2), 357–373. https://doi.org/10.1023/A:1021963819751

Torres-Morales, L., García-Mendoza, D. F., López-González, C., Muñiz-Martínez, R. (2010) Bats of Northwestern Durango, Mexico: Species Richness at the Interface of Two Biogeographic Regions. *The Southwestern Naturalist*, 55 (3), 347–362. https://doi.org/10.1894/MLK-12.1

Tuomisto, H. (2010) A diversity of beta diversities: straightening up a concept gone awry. Part 1. Defining beta diversity as a function of alpha and gamma diversity. *Ecography*, 33, 2–22. https://doi.org/10.1111/j.1600-0587.2009.05880.x

United States Fish and Wildlife Service (USFWS) (2017). Biological report for the Mexican wolf (*Canis lupus baileyi*), November 2017. https://www.fws.gov/sites/default/files/documents/2017MexicanWolfBiologicalReportFinal_0.pdf (accessed 1 November 2023).

Valencia, A. S. (2007) Encinos. Pp. 139–148. *In*: I. Luna, J. J. Morrone, D. Espinosa (Eds.). *Diversidad de la Faja Volcánica Transmexicana*. CONABIO-UNAM, Ciudad de México, México.

Van Devender, T. R., Ávila-Villegas, S., Emerson, M., Turner, D., Flesch, A. D., Deyó N. S. (2013) Biodiversity in the Madrean Archipelago of Sonora, Mexico. Pp. 10–16. *In*: G. J. Gottfried, P. F. Ffolliott, B. S. Gebow, L. G. Eskew, L. C. Collins (Comps.). *Merging science and management in a rapidly changing world: Biodiversity and management of the Madrean Archipelago III and 7th Conference on Research and Resource Management in the Southwestern Deserts;1-5 May 2012*; *Tucson, Arizona*. Proceedings. RMRS-P-67. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, USA. https://www.fs.usda.gov/research/treesearch/44406 (accessed November 2022).

Van Devender, T. R., Reina, A. L. (2005) Floristic comparison of an Arizona Sky Island and the Sierra Madre Occidental in eastern Sonora: the Huachuca Mountains and the Yécora Area. Pp. 154–157. *In*: G. J. Gottfried, B. S. Gebow, L. G. Eskew, C. B. Edminster (Comps.). *Connecting mountain islands and desert seas: biodiversity and management of the Madrean Archipelago II. 11–15 May 2004; Tucson, Arizona.* Proceedings RMRS-P-36. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, USA. https://www.fs.usda.gov/research/treesearch/23188 (accessed November 2022).

Van Devender, T. R., Reina, G. A. L., Peñalba, G. M. C., Ortega, R. C. I. (2003) The Ciénega de Camilo: a threatened habitat in the Sierra Madre Occidental of eastern Sonora, Mexico. *Madroño*, 50 (3), 187–195. https://www.jstor.org/stable/41425514 (accessed November, 2022).

Vázquez, L. B., Bustamante-Rodríguez, C. G., Bahena Arce, D. G. (2009). Area selection for conservation of Mexican mammals. *Animal Biodiversity and Conservation*, 32 (1), 29–39. https://doi.org/10.32800/abc.2009.32.0029

VertNet. (2022) VertNet portal, National Science Foundation, USA. http://vertnet.org/ (accessed November 2022).

Warshall, P. (1995) The Madrean Sky Island Archipelago: A Planetary Overview. Pp. 6–17. *In*: L. F. DeBano, P. F. Ffolliott, A. Ortega Rubio, G. J. Gottfried, R. H. Hamre, C. B. Edminster (Coords.). *Biodiversity and management of the Madrean archipelago: The sky islands of southwestern United States and northwestern Mexico.19-23 Sept 1994; Tucson, Arizona,* General Technical Report RM 264. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Fort Collins, USA. https://doi.org/10.2737/RM-GTR-264

Waterbury, S. (2013) *Mexico's Mormon Colonies: 1876 to Revolution Chihuahua and Sonora Farmers*. Student Theses, Papers and Projects (History). Western Oregon University, 22 pp. https://digitalcommons.wou.edu/cgi/viewcontent.cgi?article=1401&context=his (accessed November 2022).

Webb, R. G., Baker, R. H. (1984) Terrestrial vertebrates of the Cerro Mohinora region. Chihuahua, Mexico. *The Southwestern Naturalist*, 29 (2), 243–246.

https://doi.org/10.2307/3671037

Wehenkel, C., Reyes-Martínez, A., Martínez-Guerrero, J. H., Pinedo-Álvarez, C., López-Sánchez, C. A. (2017) The bird species diversity in the wintering season is negatively associated with precipitation, tree species diversity and stand density in the Sierra Madre Occidental, Durango, Mexico. *Community Ecology*, 18 (1), 63–71. https://doi.org/10.1556/168.2017.18.1.8

Western Watersheds Project (2023). WWP 2023 FWS Mexico population. https://www.biologicaldiversity.org/species/mammals/Mexican_gray_wolf/pdfs/WWP-2023-FWS-Mexico-Mexican-gray-wolf-population.pdf (accessed 1 November 2023)

Wilson, D. E., Ruff, S. (1999) *The Smithsonian book of North American mammals*. Smithsonian Institution Press. Washington, USA, 750 pp.

APPENDIX

Mammals of Sierra Madre Occidental (SMO), Mexico. Conservation status IUCN: Endangered (E), Least concern (LC), Near Threatened (NT), Vulnerable (VU), Not evaluated (NE); MEX: Mexican Law (SEMARNAT, 2019): Threatened species (A), Species probably extinct in the wild (E), Endangered species (P), Special protection species (Pr). DIST: Distribution modified from Ceballos *et al*. (2005): Mexican species shared with other North American countries (NA), Mexican species shared with other South American countries (SA), species that are endemic to Central America (MA), Mexican endemic species (MX); endemic to SMO (*). Ecoregions (González-Elizondo *et al*. 2013): Madrean-North (MN), Madrean Central (MC), Madrean South (MS), Madrean Xerophylous (MX), Madrean Tropical (MT), Tropical (T), Sky Islands (SI). SRCE: Source of record: Museum specimen examined (1), Literature source (2), Observations (3), Museum records of specimens not examined (4). References: source of literature data. The complete list of references for this table can be found in Supplementary Material S2 by number.

	Conservation status		**DIST**	**Ecorregion**							**SRCE**	**Reference**
	UICN	**MEX**		**MN**	**MC**	**MS**	**MX**	**MT**	**SI**	**T**		
ORDER DIDELPHIMORPHIA												
Family Didelphidae												
Didelphis virginiana Kerr, 1792	LC		AM	X	X	X	X	X	X	X	1, 2, 3, 4	4, 5, 9, 23, 31, 40, 45, 50
Tlacuatzin sinaloae (J. A. Allen, 1892)	NE		MX			X		X		X	1, 2	2, 9, 45
ORDER CINGULATA												
Family Dasypodidae												
Dasypus novemcinctus Linnaeus, 1758	LC		AM		X	X		X		X	1, 2, 4	9, 45
ORDER EULIPOTYPHLA												
Family Soricidae												
Megasorex gigas (Merriam, 1897)	LC	A	MX							X	2	21
Notiosorex crawfordi (Coues, 1877)	LC	A	NA	X		X	X		X		1, 2	18, 21
Notiosorex evotis (Coues, 1877)	LC	A	MX							X	2	9
Sorex altoensis Carraway, 2007	NE		MX		X			X		X	1, 4	
Sorex arizonae Diersing & Hoffmeister, 1977	LC	P	NA	X							4	
Sorex emarginatus H. T. Jackson, 1925	LC		MX		X	X		X		X	1, 2	21, 45
Sorex monticola Merriam, 1890	LC	A	NA	X	X						1, 2, 4	1, 21
ORDER CHIROPTERA												
Family Emballonuridae												
Balantiopteryx plicata W. Peters, 1867	LC		SA			X		X		X	1, 2, 3	18, 38, 57
Family Molossidae												
Cynomops mexicanus (J. K. Jones & Genoways, 1967)	LC	Pr	MX							X	1	
Eumops perotis (Schinz, 1821)	LC		AM						X	X	1, 2	16, 45
Eumops underwoodi G. G. Goodwin, 1940	LC		AM							X	2	5
Molossus molossus (Pallas, 1766)	LC		SA							X	1, 2	38
Molossus rufus É. Geoffroy Saint-Hilaire, 1805	LC		SA					X		X	1	38

	Conservation status		DIST	Ecorregion							SRCE	Reference
	UICN	MEX		MN	MC	MS	MX	MT	SI	T		
Nyctinomops aurispinosus (Peale, 1848)	LC		SA							X	1, 2	45
Nyctinomops femorosaccus (Merriam, 1889)	LC		NA			X	X			X	1, 2	11, 45
Nyctinomops macrotis (J. E. Gray, 1839)	LC		AM		X	X	X			X	1, 2	30, 38, 45
Tadarida brasiliensis (I. Geoffroy Saint-Hilaire, 1824)	LC		AM	X	X	X	X	X	X	X	1, 2	12, 16, 18, 30, 45
Family Natalidae												
Natalus lanatus Tejedor, 2005	NE		MX	X						X	1, 2	54
Natalus mexicanus G. S. Miller, 1902	LC		SA	X						X	1, 2	18, 38, 45
Family Mormoopidae												
Mormoops megalophylla (W. Peters, 1864)	LC		AM		X	X		X		X	1, 2	38, 45, 57
Pteronotus fulvus (O. Thomas, 1892)	NE		MA			X				X	1, 2, 3	38, 45
Pteronotus mexicanus (G. S. Miller, 1902)	NE		MX			X				X	1, 2	5, 38, 45, 57
Pteronotus psilotis (Dobson, 1878)	NE		MA							X	1	
Family Phyllostomidae												
Desmodus rotundus (É. Geoffroy Saint-Hilaire, 1810)	LC		SA			X		X		X	1, 2, 3	4, 38, 45, 57
Anoura geoffroyi J. E. Gray, 1838	LC		SA		X	X	X	X		X	1, 2	38, 45
Choeronycteris mexicana Tschudi, 1844	NT	A	NA			X	X	X	X	X	1, 2	4, 5, 11, 16, 18, 38, 45, 57
Glossophaga commissarisi A. L. Gardner, 1962	LC		SA		X					X	1, 2	38
Glossophaga leachii (J. E. Gray, 1844)	LC		MA					X		X	1	
Glossophaga mutica Merriam, 1898	NE		MA			X	X	X		X	1, 2, 4	38, 45, 57
Leptonycteris nivalis (Saussure, 1860)	E	A	NA			X	X	X		X	1, 2	7, 13, 45
Leptonycteris yerbabuenae L. Martínez & Villa-R., 1940	NT	A	MA			X	X	X	X	X	1, 2	5, 7, 16, 38, 45, 57
Glyphonycteris sylvestris O. Thomas, 1896	LC		SA							X	1	
Macrotus californicus S. F. Baird, 1858	LC		NA	X		X	X	X	X	X	1, 2	5, 6, 18, 38, 45, 57
Artibeus hirsutus K. Andersen, 1906	LC		MX			X	X			X	1, 2	4, 38, 45, 57
Artibeus intermedius J. A. Allen, 1897	NE		SA				X	X		X	1, 2	38, 45
Artibeus jamaicensis Leach, 1821	LC		SA			X				X	1, 2	4, 38, 45
Dermanura azteca (K. Andersen, 1906)	LC		MA	X			X	X		X	1, 2	38
Dermanura phaeotis G. S. Miller, 1902	LC		SA							X	1, 2	38
Dermanura tolteca (Saussure, 1860)	LC		MA							X	1, 2	38, 45, 57
Centurio senex J. E. Gray, 1842	LC		SA							X	1, 2	11, 38
Chiroderma scopaeum Handley, 1966	NE		MX							X	1, 2	29, 38, 45
Sturnira hondurensis G. G. Goodwin, 1940	LC		MA					X		X	1, 2	38
Sturnira parvidens E. A. Goldman, 1917	LC		MA		X	X	X	X		X	1, 2	4, 38, 45, 57
Family Vespertilionidae												
Antrozous pallidus (Le Conte, 1856)	LC		NA		X	X	X	X	X	X	1, 2, 3	5, 11, 12, 16, 30, 45
Myotis auriculus R. H. Baker & Stains, 1955	LC		NA	X	X	X	X	X	X	X	1, 2	5, 18, 45
Myotis californicus (Audubon & Bachman, 1842)	LC		NA	X	X	X	X	X		X	1, 2	5, 18, 30, 38, 45
Myotis carteri LaVal, 1973	NE	Pr	MX							X	1	
Myotis ciliolabrum (Merriam, 1886)	LC		NA	X	X	X	X			X	1, 2, 3	30, 45

	Conservation status		DIST	Ecorregion							SRCE	Reference
	UICN	MEX		MN	MC	MS	MX	MT	SI	T		
Myotis fortidens G. S. Miller & G. M. Allen, 1928	LC		MA							X	1, 2	38
Myotis occultus Hollister, 1909	LC		NA	X		X	X				1, 2	5
Myotis thysanodes G. S. Miller, 1897	LC		NA		X	X	X	X	X		1, 2	5, 16, 18, 30, 45
Myotis velifer (J. A. Allen, 1890)	LC		NA	X	X	X	X	X	X	X	1, 2, 4	4, 12, 16, 18, 38, 45
Myotis volans (H. Allen, 1866)	LC		NA	X	X	X	X				1, 2	5, 30
Myotis yumanensis (H. Allen, 1864)	LC		NA	X	X	X	X	X		X	1, 2	4, 12,18, 30, 38
Parastrellus hesperus (H. Allen, 1864)	LC		NA	X	X	X	X	X	X	X	1, 2	5, 11, 18, 30, 38, 45, 57
Eptesicus fuscus (Palisot de Beauvois, 1796)	LC		AM	X	X	X	X	X	X	X	1, 2, 3, 4	5, 18, 30, 38, 45
Aeorestes cinereus (Palisot de Beauvois, 1796)	LC		NA	X	X	X	X	X		X	1, 2, 3	5, 18, 30, 57
Dasypterus ega (P. Gervais, 1856)	LC		AM		X			X		X	1	
Lasiurus frantzii (W. Peters, 1870)	NE		NA, MA			X	X	X		X	1, 2, 3	18, 38, 45
Rhogeessa alleni O. Thomas, 1892	LC		MX			X				X	1, 2	45, 48
Rhogeessa gracilis G. S. Miller, 1897	LC		MX			X					2	57
Rhogeessa parvula H. Allen, 1866	LC		MX							X	1, 2	38, 45
Corynorhinus mexicanus G. M. Allen, 1916	NT		MX	X	X	X	X	X	X		1, 2, 3	16, 38, 45
Corynorhinus townsendii (W. Cooper, 1837)	LC		NA	X	X	X	X	X	X		1, 2	4, 5, 16, 18, 30, 45
Euderma maculatum (J. A. Allen, 1891)	LC	Pr	NA		X	X					1	
Idionycteris phyllotis (G. M. Allen, 1916)	LC		NA		X	X					1, 2	30
ORDER LAGOMORPHA												
Family Leporidae												
Lepus alleni Mearns, 1890	LC		NA					X		X	1, 2	9, 18
Lepus californicus J. E. Gray, 1837	LC		NA	X	X		X	X			1, 2, 3	5, 8, 12, 45, 52
Lepus callotis Wagler, 1830	VU		NA	X		X	X			X	1, 2, 3	5, 45
Sylvilagus audubonii (S. F. Baird, 1858)	LC		NA	X			X		X		1, 2	12, 23, 45
Sylvilagus holzneri (Mearns, 1896)	NE		NA	X	X	X	X	X	X	X	1, 2, 3, 4	5, 8, 9, 23, 45, 51
ORDER RODENTIA												
Family Sciuridae												
Ammospermophilus harrisii (Audubon & Bachman, 1854)	LC		NA					X			2	18
Callospermophilus madrensis Merriam, 1901	NT	Pr	MX*	X	X						1, 2, 4	5
Ictidomys mexicanus (Erxleben, 1777)	LC		MX			X					2	45
Otospermophilus variegatus (Erxleben, 1777)	LC		NA	X	X	X	X	X	X	X	1, 2, 3, 4	3, 4, 5, 8, 16, 23, 30, 35, 45, 58
Xerospermophilus spilosoma (E. T. Bennett, 1833)	LC		NA	X		X	X				1, 2, 4	5, 45
Sciurus aberti Woodhouse, 1853	LC	Pr	NA	X	X		X	X			1, 2, 4	5, 26, 30
Sciurus arizonensis Coues, 1867	NE	A	NA						X		2	18, 23
Sciurus aureogaster F. Cuvier, 1829	LC		MA			X				X	2, 3	45
Sciurus colliaei J. Richardson, 1839	LC		MX					X		X	1, 2, 4	5, 18, 35, 58

	Conservation status		DIST	Ecorregion							SRCE	Reference
	UICN	MEX		MN	MC	MS	MX	MT	SI	T		
Sciurus nayaritensis J. A. Allen, 1890	LC		NA	X	X	X	X	X	X	X	1, 2, 3, 4	5, 16, 18, 23, 39, 45, 58
Neotamias bulleri (J. A. Allen, 1889)	VU		MX*			X	X	X			1, 2	45
Neotamias dorsalis (S. F. Baird, 1855)	LC		NA	X	X	X	X	X	X		1, 2, 3, 4	3, 5, 16
Neotamias durangae (J. A. Allen, 1903)	LC		MX		X			X			1, 2, 4	5
Family Geomyidae												
Pappogeomys bulleri (O. Thomas, 1892)	LC		MX				X				1	
Thomomys atrovarius J. A. Allen, 1898	NE		MX*					X		X	2	2, 34, 43, 44, 47
Thomomys bottae (Eydoux & P. Gervais, 1836)	LC		NA				X	X		X	2	5, 16, 18, 44, 47
Thomomys nayarensis Mathis, M. S. Hafner, D. J. Hafner, & Demastes, 2013	NE		MX*							X	1, 2	44
Thomomys sheldoni V. O. Bailey, 1915	NE		MX*	X	X	X	X	X		X	1, 2, 4	3, 4, 5, 12, 30, 34, 37, 43, 45
Family Heteromyidae												
Dipodomys merriami Mearns, 1890	LC		NA				X			X	2, 4	16
Dipodomys ordii Woodhouse, 1853	LC		NA	X		X	X				1, 2, 4	5, 12, 45
Dipodomys phillipsii J. E. Gray, 1841	LC	Pr	MX			X	X			X	1, 2, 4	45
Heteromys irroratus J. E. Gray, 1868	LC		NA		X	X	X			X	1, 2, 3	4, 12, 30, 32, 45
Heteromys pictus O. Thomas, 1893	LC		MA					X		X	1, 2, 4	5, 18, 45
Chaetodipus artus (Osgood, 1900)	LC		MX					X		X	1, 2, 4	5, 18
Chaetodipus durangae Neiswenter, D. J. Hafner, Light, Cepeda, Kinzer, L. F. Alexander, & Riddle, 2019	NE		MX				X	X			1	
Chaetodipus eremicus (Mearns, 1898)	LC		NA				X				1, 4	
Chaetodipus goldmani (Osgood, 1900)	NT		MX							X	2	5, 18
Chaetodipus hispidus (S. F. Baird, 1858)	LC		NA	X		X	X				1, 2	45
Chaetodipus intermedius (Merriam, 1889)	LC		NA					X			1	
Chaetodipus lineatus (Dalquest, 1951)	NE		MX			X					1	
Chaetodipus nelsoni (Merriam, 1894)	LC		MX		X	X	X	X		X	1, 2, 4	4, 45
Chaetodipus penicillatus (Woodhouse, 1852)	LC		NA				X	X	X		2	16, 18
Chaetodipus pernix (J. A. Allen, 1898)	LC		MX							X	1, 2	16, 18
Perognathus flavus (S. F. Baird, 1855)	LC		NA	X	X	X	X			X	1, 2, 4	5, 12, 30, 45
Family Cricetidae												
Microtus mexicanus (Saussure, 1861)	LC		NA	X	X						1, 2, 4	5
Baiomys taylori (O. Thomas, 1887)	LC		NA	X	X	X	X	X		X	1, 2, 3, 4	4, 5, 12, 30, 45
Hodomys alleni (Merriam, 1892)	LC		MX							X	1	
Nelsonia neotomodon Merriam, 1897	LC	Pr	MX	X	X	X		X		X	1, 2, 4	36, 45
Neotoma albigula Hartley, 1894	LC		NA	X			X	X	X	X	1, 2	5, 16, 18
Neotoma leucodon Merriam, 1894	LC		NA		X	X	X				1, 2, 4	4, 30, 45
Neotoma mexicana S. F. Baird, 1855	LC		NA	X	X	X	X	X		X	1, 2, 3, 4	2, 4, 5, 16, 30, 36, 30, 45
Neotoma palatina E. A. Goldman, 1905	VU		MX*			X				X	1, 2	45
Onychomys arenicola Mearns, 1896	LC		NA	X		X	X				1, 2, 4	5, 12, 45
Onychomys torridus (Coues, 1874)	LC		NA					X		X	2	18
Peromyscus boylii (S. F. Baird, 1855)	LC		NA	X	X	X	X	X		X	1, 2, 3, 4	14

	Conservation status		DIST	Ecorregion							SRCE	Reference
	UICN	MEX		MN	MC	MS	MX	MT	SI	T		
Peromyscus carletoni R. D. Bradley, Ordóñez-Garza, Sotero-Caio, Huynh, Kilpatrick, Iñiguez-Dávalos, & Schmidly, 2014	NE		MX*					X		X	1, 2	15
Peromyscus difficilis (J. A. Allen, 1891)	LC		MX	X	X	X	X	X		X	1, 2, 4	4, 5, 36, 45
Peromyscus eremicus (S. F. Baird, 1858)	LC		NA	X	X	X	X	X	X	X	1, 2, 3	5, 18, 45
Peromyscus gratus Merriam, 1898	LC		NA	X	X	X	X	X		X	1, 2, 4	4, 5, 30, 45
Peromyscus leucopus (Rafinesque, 1818)	LC		NA				X				1, 4	
Peromyscus labecula D. G. Elliot, 1903	NE		NA	X	X	X	X			X	1, 2, 4	4, 5, 12, 30, 45
Peromyscus melanotis J. A. Allen & F. M. Chapman, 1897	LC		NA	X	X	X		X			1, 2, 4	5, 45
Peromyscus merriami Mearns, 1896	LC		NA					X		X	1, 2	18
Peromyscus micropus R. H. Baker, 1952	NE		MX			X	X	X		X	1, 2, 3	19, 45
Peromyscus nasutus (J. A. Allen, 1891)	LC		NA	X							1	
Peromyscus pectoralis Osgood, 1904	LC		MX		X	X	X	X		X	1, 2, 3	4, 45
Peromyscus polius Osgood, 1904	NT		MX*	X	X		X				1, 2	5
Peromyscus schmidlyi R. D. Bradley, D. S. Carroll, Haynie, Muñiz Martínez, Hamilton, & Kilpatrick, 2004	LC		MX*	X	X	X	X	X		X	1, 2, 4	14, 17
Peromyscus simulus Osgood, 1904	VU		MX							X	1, 2	19
Peromyscus spicilegus J. A. Allen, 1897	LC		MX	X		X		X		X	1, 2, 3, 4	19
Peromyscus zamorae Osgood, 1904	NE		MX			X	X			X	1, 2, 4	45
Reithrodontomys fulvescens J. A. Allen, 1894	LC		NA	X	X	X	X	X	X	X	1, 2, 4	4, 5, 18, 30, 45, 18
Reithrodontomys megalotis (S. F. Baird, 1858)	LC		NA		X	X	X				1, 2, 4	5, 12, 45
Reithrodontomys montanus (S. F. Baird, 1855)	LC		NA				X				4	
Reithrodontomys zacatecae Merriam, 1901	LC		MX*	X	X	X	X	X		X	1, 2, 4	5, 37, 45
Oryzomys couesi (Alston, 1877)	LC		AM							X	1	
Sigmodon alleni V. O. Bailey, 1902	VU		MX		X					X	1	
Sigmodon arizonae Mearns, 1890	LC		NA			X		X		X	1, 2, 4	18, 20
Sigmodon fulviventer J. A. Allen, 1889	LC		NA	X	X	X	X			X	1, 2, 4	3, 4, 5, 12, 45
Sigmodon hispidus Say & Ord, 1825	LC		NA		X	X	X			X	1, 2, 4	45
Sigmodon leucotis V. O. Bailey, 1902	LC		MX	X	X	X	X	X		X	1, 2, 4	5, 45
Sigmodon mascotensis J. A. Allen, 1897	LC		MX			X		X		X	1, 2	45
Sigmodon ochrognathus V. O. Bailey, 1902	LC		NA	X			X				1, 2	5
ORDER CARNIVORA												
Family Felidae												
Herpailurus yagouaroundi (É. Geoffroy Saint-Hilaire, 1803)	LC	A	AM					X		X	1, 2	55
Leopardus pardalis (Linnaeus, 1758)	LC	P	AM	X		X		X	X	X	2, 3, 4	23, 41, 42, 51, 53, 56
Leopardus wiedii (Schinz, 1821)	NT	P	AM					X		X	3	
Lynx rufus (von Schreber, 1777)	LC		NA	X	X	X	X		X	X	1, 2, 4	5, 8, 10, 23, 50, 51
Puma concolor (Linnaeus, 1771)	LC		AM	X	X	X	X	X	X	X	1, 2, 3, 4	5, 8, 23, 50
Panthera onca (Linnaeus, 1758)	NT	P	AM						X	X	1, 2, 4	23
Family Canidae												

	Conservation status		DIST	Ecorregion							SRCE	Reference
	UICN	MEX		MN	MC	MS	MX	MT	SI	T		
Canis latrans Say, 1823	LC		NA	X	X	X	X	X	X	X	1, 2, 3, 4	5, 8, 12, 23, 45, 50, 51, 52
Canis lupus Linnaeus, 1758	LC	E	NA	X	X	X	X				1, 2. 4	5, 45
Urocyon cinereoargenteus (von Schreber, 1775)	LC		AM	X	X	X	X	X	X	X	1, 2, 3, 4	5, 8, 10, 12, 23, 33, 45, 50, 51
Family Ursidae												
Ursus americanus Pallas, 1780	LC	P	NA	X	X	X	X		X		1, 2, 4	5, 8, 23, 24, 28, 49, 52
Ursus arctos Linnaeus, 1758	LC	E	NA	X			X		X		2, 4	5, 28
Family Mephitidae												
Conepatus leuconotus (H. Lichtenstein, 1832)	LC		NA	X	X	X	X	X	X	X	1, 2, 4	5, 8, 10, 18, 23, 45
Mephitis macroura H. Lichtenstein, 1832	LC		AM	X	X	X	X	X	X	X	1, 2, 3, 4	4, 5, 8, 10, 12, 16, 23, 45
Mephitis mephitis (von Schreber, 1776)	LC		NA	X	X		X		X		1, 2, 4	5, 8, 12, 23
Spilogale gracilis Merriam, 1890	LC		NA	X	X	X	X		X	X	1, 2, 3, 4	5, 8, 10, 23, 45, 50
Family Mustelidae												
Lontra canadensis (von Schreber, 1776)	LC						X				2	27
Lontra longicaudis (Olfers, 1818)	NT	A	SA	X		X	X	X	X	X	1, 2, 3	5, 18, 22, 25, 27
Neogale frenata (H. Lichtenstein, 1831)	LC		AM	X		X	X				2	5, 45
Taxidea taxus (von Schreber, 1778)	LC	A	NA							X	2	18
Family Procyonidae												
Bassariscus astutus (H. Lichtenstein, 1830)	LC		NA	X	X	X		X	X	X	1, 2, 3, 4	5, 10, 23, 45, 46, 50
Nasua narica (Linnaeus, 1766)	LC		AM	X	X	X	X	X	X	X	1, 2, 3, 4	5, 8, 10, 16, 23, 45, 56
Procyon lotor (Linnaeus, 1758)	LC		AM	X	X	X	X	X	X	X	1, 2, 3, 4	5, 8, 10, 23, 45, 56
ORDER ARTIODACTYLA												
Family Cervidae												
Odocoileus virginianus (E. A. W. Zimmermann, 1780)	LC		AM	X	X	X	X	X	X	X	1, 2, 3, 4	3, 5, 8, 16, 18, 23, 45, 50, 51, 52
Family Tayassuidae												
Dicotyles tajacu (Linnaeus, 1758)	LC		AM	X	X	X	X	X	X	X	1, 2, 3, 4	5, 8, 23, 45, 50
TOTAL				75	75	100	95	89	43	125		