



Mammal decline in the Middle America

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ARTICLE INFO

Article history:

Received 1 June 2015

Received in revised form 15 October 2015

Accepted 15 October 2015

Keywords:

Biodiversity loss

Biogeographic approach

Conservation

Mammalian population

Nearctic–Neotropical boundary

Threatened species

ABSTRACT

The Middle America is located in the Nearctic–Neotropical boundary. The combination of temperate and tropical biota of these two biogeographic regions, plus an area of biotic overlap propitiates unusually high species diversity and endemism. We present the first general assessment based on the IUCN Red List of Threatened Species that provides evidence of widespread decline in the conservation status of land mammals from southern U.S.A. to Panama. One in every three species considered in our study ($n = 273$) is classified as threatened, and the rate of biodiversity loss increased 0.64% between 2008 and 2012. Endangered species of the Middle America represents 11.8% of the global endangered mammal species, and 7.9% of the threatened species. Habitat loss and the introduction of alien species are the major threats; however, the relative impact of these threats varies among habitats. For continental species, habitat loss is prevalent, while for insular species the introduction of alien species has devastating effects. Our results suggest that if no integral multi-species conservation actions are applied in the short-term, more than 20% of the extant mammal species in the region could become extinct in the near future (10–50 years).

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1. Introduction

Rapid population declines and species extinctions following the widespread destruction of natural habitats have been reported across the natural world (Brook, Bradshaw, Koh, & Sodhi, 2006). Vertebrates, and particularly mammals, represent a small fraction of the biomass and energy flow in any ecosystem. Nonetheless through their interactions with other species, e.g., predator–prey relationships, competition, or mutualism, they play important roles in ecological processes and have profound effects on habitat structure, species composition, and biochemical processes (Brown & Heske 1990; Brown, Whitham, Morgan, & Gehring, 2001). In fact, several studies (e.g., Brown et al., 2001; Stevenson, Link, & Ramírez, 2005; Peres & Palacios, 2007) have shown the relationship between the population reductions of mammals and the collapse of vegetal communities, from mature and rain forests to arid deserts.

At global level, one-fifth of the world's vertebrates are threatened and, on average, more than 50 species of birds, mammals, and amphibians move one category closer to extinction each year (Hoffman et al., 2010). World mammal's diversity includes 5487

species recognized as extant (Wilson & Reeder, 2005), but their conservation status is worrisome: 1.4% of known present mammal species are considered as extinct, 20.8% are classified as threatened, including 3.4% classified as Critical Endangered, 8.2% as Endangered, and 9.2% as Vulnerable (Schipper et al., 2008), and the global rate of mammalian biodiversity loss is increasing (Hoffman et al., 2010).

The Middle America is the land between the United States and South America (Winker, 2011). It is a region in the mid-latitudes of the Americas that comprises southern U.S.A., Mexico, Central America, and the Caribbean; its southern boundary is the border between Panama and Colombia (American Ornithologists' Union, 1998). The area is considered as megadiverse, and this high diversity is explained by its physical geography: it includes the boundary between Nearctic and Neotropical regions, with its large and well defined Mexican Transition Zone (Morrone, 2002, 2006) (Fig. 1). The combination of temperate and tropical flora and fauna of these biogeographic regions and the presence of an area of biotic overlap propitiates unusually high diversity and endemism (Ramamoorthy, Bye, Lot, & Fa, 1993; Ortega & Arita, 1998).

The Nearctic–Neotropical boundary has one of the most diverse mammalian faunas of the world; only in Mexico more than 520 species have been described (Ceballos & Oliva, 2005; Ceballos & Arroyo-Cabral, 2012). However, the overall conservation status

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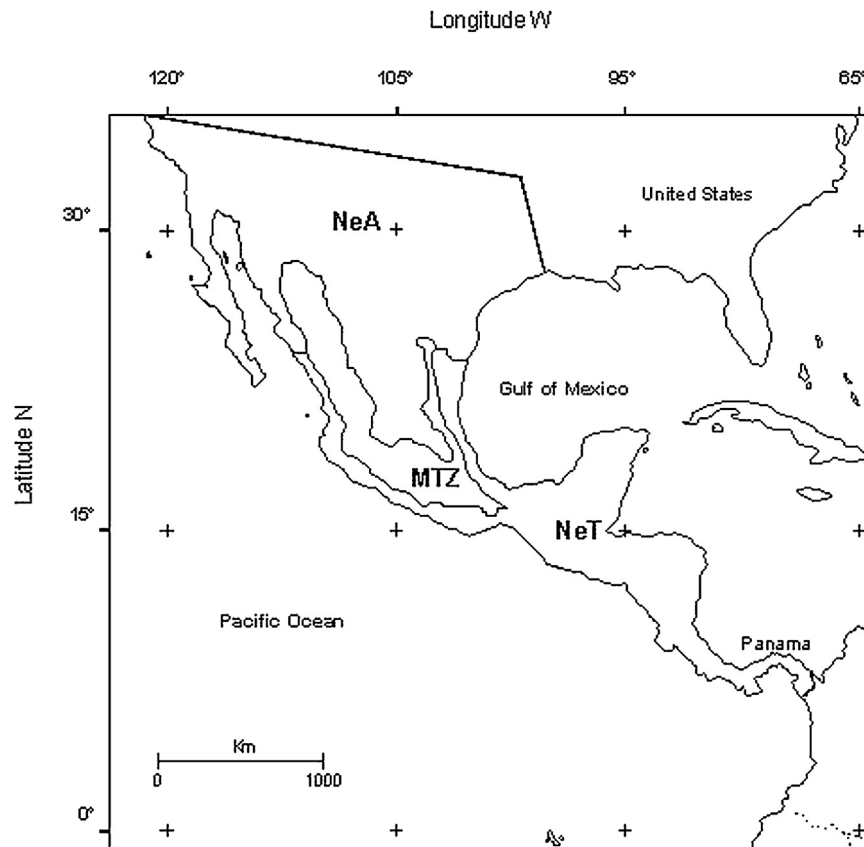


Fig. 1. Biogeographic regions in the Middle America. Bold lines are the limits of the study area. NeA = Nearctic region, MTZ = Mexican Transition Zone, NeT = Neotropical region.

of the native mammals of this area has not been evaluated in detail. Thus, in this paper we present the first general assessment that summarizes the current status of the endemic land mammals of this geographical region based on the IUCN Red List of Threatened Species. Our aim is to create an informative reference for future regional conservation studies and programs focused on the biodiversity management of the Middle America.

2. Materials and methods

The Nearctic region comprises the temperate areas of North America from Canada to northern Mexico, the Neotropical region comprises the tropics of America and includes most of South America, and all of Central America, southern Mexico, the West Indies, and southern Florida; the Mexican Transition Zone is a complex and varied area where biotic components of the Nearctic and Neotropical regions overlap (Morrone, 2006). Given that the species' distribution does not correspond to the current geopolitical borders, in this study we include endemic land species of the southernmost limit of the Nearctic region, from the southern border of the U.S.A. states of Texas, New Mexico, Arizona, and central-southern California to northern Mexico, the endemic species of the Mexican Transition Zone, and the endemic species of the northernmost limit of the Neotropical region, from southern Mexico to Panama (Fig. 1).

By land mammals species we mean those which use terrestrial habitats either continental or insular to perform all their vital activities. Thus, pinnipeds, the sea otter, the Antillean manatee, and all cetaceans were excluded. The list of land mammals used was elaborated based on specialized literature (Hall, 1981; Ceballos & Oliva 2005; Wilson & Reeder, 2005; Escalante, Sánchez-Cordero,

Morrone, & Linaje, 2007; Ceballos & Arroyo-Cabral, 2012), and public databases of CONABIO (www.conabio.org.mx/informacion/mamiferos), Global Biodiversity Information Facility (www.gbif.org), Index of Mammalian Species (www.science.smith.edu/msi), and NatureServe (www.natureserve.org/natureserve-network).

We consulted the IUCN Red List of Threatened Species (www.iucnredlist.org) to obtain information on the species' conservation status, population trends, and major threats. The list has eight risk categories: Extinct (EX); Extinct in the Wild (EW); Critically Endangered (CR); Endangered (EN); Vulnerable (VU); Near Threatened (NT); Least Concern (LC); and, Data Deficient (DD). Species categorized as CR, EN, and VU are considered as threatened (International Union for Conservation of Nature (IUCN), 2012). We used the IUCN Red List because it is widely accepted as the most comprehensive and scientifically rigorous information about a species conservation status (Rodrigues, Pilgrim, Lamoreux, Hoffman, & Brooks, 2006). A concern when using the IUCN Red List at the regional level is that its criteria assess the global extinction risk of a species. However, in our analyses we included only species endemic to each area defined in Fig. 1, and for these taxa global and regional assessments of extinction risk are identical (Gärdenfors, 2001).

We calculated the threat level (Schipper et al., 2008) and the Red List Index (RLI) (Butchart et al., 2007) to analyze respectively, the conservation status and the rate of biodiversity loss. The threat level is a measurement of the conservation status across a group of species. It was calculated based on the IUCN Red List 2012 dataset as $\text{Threat level} = [(N_{CR} + N_{EN} + N_{VU}) / (N_{TOTAL} - N_{DD})] \times 100$, and its range is between $[(N_{CR} + N_{EN} + N_{VU}) / N_{TOTAL}] \times 100$, and $[(N_{CR} + N_{EN} + N_{VU} + N_{DD}) / N_{TOTAL}] \times 100$, where N is the number of species in each IUCN risk category (Schipper et al., 2008).

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