

Noteworthy record of the kit fox, *Vulpes macrotis*, in the southcentral limit of its historical distribution

Registro notable de la zorrilla del desierto, *Vulpes macrotis*, en el límite centro-sur de su distribución histórica

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Kit fox, *Vulpes macrotis*, is a nocturnal carnivore uncommon to rare that inhabits desert and semiarid regions of western North America. Unlike the northern populations, there is less information about this species in the southcentral part of its distribution. In this work, we report a noteworthy record of the kit fox from northwestern San Luis Potosí, México. On 12 August 2017, one road-killed male kit fox was recorded from the municipality of Charcas, San Luis Potosí, México. The specimen was photographed and external somatic measurements were taken. Additionally, geographic coordinates were taken and the characteristics of the habitat type were determined. Our record represents the first reliable evidence of the kit fox in the state of San Luis Potosí, México, and it is also possibly the second southernmost record for this species in the southcentral part of its historical range. The individual was found 107 km northwest the previous record from 11.26 km S at Real de Los Pinos, Zacatecas, México. The presence of the kit fox is confirmed in northwest San Luis Potosí, México, after 65 years of its last record in the closest locality in the state of Zacatecas. The biological implications of this record, as well as the need to carry out effective long-term monitoring in order to know the distribution of kit foxes' populations and their ecological parameters are discussed.

Key words: Canid; carnivores; highway fatalities; roads; run over; San Luis Potosí.

La zorrilla del desierto, *Vulpes macrotis*, es un carnívoro nocturno poco común a raro que habita las regiones desérticas y semiáridas del oeste de Norteamérica. A diferencia de las poblaciones más norteñas, en el centro-sur de su distribución geográfica existe menos información sobre esta especie. En esta nota, reportamos un registro notable de la zorrilla del desierto en el noroeste de San Luis Potosí, México. El 12 de agosto de 2017, se realizó el registro de un ejemplar macho atropellado en una carretera del municipio de Charcas San Luis Potosí, México. Esta zorrilla del desierto fue fotografiada y se le tomaron medidas somáticas externas. Adicionalmente, se tomaron las coordenadas geográficas y se determinaron las características del tipo de hábitat. Nuestro registro representa la primera evidencia confiable de la zorrilla del desierto en el estado de San Luis Potosí, México y posiblemente también es el segundo registro más sureño de la especie en el centro-sur de su distribución histórica. El ejemplar fue registrado a 107 km al noroeste del registro anterior en 11.26 km al S de Real de Los Pinos, Zacatecas, México. Se confirma la presencia de la zorrilla del desierto para el noroeste de San Luis Potosí, México, después de 65 años de su último registro en la localidad más cercana en el estado de Zacatecas. Se discuten las implicaciones biológicas de este registro, así como la necesidad de realizar un seguimiento efectivo a largo plazo para conocer la distribución y determinar los parámetros ecológicos de las poblaciones de la zorrilla del desierto en la zona.

Palabras clave: Atropellamientos; cánido; carnívoros; carreteras; distribución; San Luis Potosí.

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The kit fox, *Vulpes macrotis* Merriam, 1888, is the smallest North American canid, weighing between 1.4 to 3 kg ([Arjo et al. 2003](#)). This species is closely associated with desert climates and it is inhabiting desert scrub, chaparral, saltbush, creosote bush, and natural grassland habitats with sandy and deep soils ([McGrew 1979](#); [O'Farrell 1987](#)). It is a semi fossorial and primarily nocturnal carnivore that is uncommon to rare, and their population densities fluctuates in relation to annual environmental conditions ([Cypher and List 2014](#)). Their trophic spectrum includes a wide variety of

species of rodents, lagomorphs, birds, reptiles, and insects ([McGrew 1979](#); [White et al. 1996](#); [List et al. 2003](#)). They can also occasionally feed on seeds and some fruits of Cactaceae ([Morrell 1972](#)).

Kit foxes are historically distributed in desert and semi-arid regions of western North America ([McGrew 1979](#)). Its current distribution probably includes from southeastern United States (southern California to western Colorado and western Texas towards North into southern Oregon and Idaho), and to North and Central México from Baja

California Peninsula, Sonora, and Chihuahua to western Nuevo León, Zacatecas, and San Luis Potosí (McGrew 1979; Hall 1981; Dragoo *et al.* 1990; Álvarez-Castañeda 2000; Álvarez-Castañeda 2002).

In México, kit fox is listed as threatened (SEMARNAT 2010). However, globally its conservation status is considered as Least Concern (Cypher and List 2014). Unlike kit foxes' populations from the United States of America, in Central México their distribution and ecology are poorly known. Due to the lack of information on the size and population trends, it is not possible to determine their conservation status (Cypher and List 2014). The main threats for kit fox conservation include the habitat loss by changes in land use, the use of poisoned grains to control rodents, and possibly hunting (Cypher and List 2014; Martínez de la Vega *et al.* 2016). Besides that, because this canid is unwary, highway fatalities are a significant source of mortality (Clever *et al.* 2010).

The state of San Luis Potosí, México, represents its southernmost distribution limit, and there are not documented records for *V. macrotis* in the state (Dalquest 1951; Martínez de la Vega *et al.* 2016). The records for this canid in the nearest locality from the state of Zacatecas dates back 65 years (Sydney and Hadary 1965). In this context, it is fundamental to know the kit fox's current distribution and ecology requirements to implement measures that contribute to its conservation in southcentral México. In this work, we

report a noteworthy record of the kit fox from northwestern San Luis Potosí, México.

On 12 August 2017, we recorded a run over kit fox male in a federal highway from the municipality of Charcas, San Luis Potosí, México. Geographic location of the kit fox record was projected on a map of the region and in relation to its historical range according to the IUCN (Cypher and List 2014). The specimen was photographed and its external somatic measurements were taken, along with the habitat's characteristics. Unfortunately, the specimen could not be collected because we did not have a scientific collection permit at this time. The confirmation of the taxonomic identity of this species was confirmed by experts. The main types of vegetation in the area correspond to desert microphilous scrub, desert rosetophilous scrub, and crassicaule scrub, where the physiognomically dominant species are *Larrea tridentata*, *Flourensia cernua*, *Yucca carnerosana*, *Agave lechuguilla*, and *Opuntia* sp. (Reyes-Agüero *et al.* 1996).

In order to know the distribution of *V. macrotis* in San Luis Potosí and other nearby localities in adjacent states, we conducted a search of scientific literature using the Web of Science, Scopus and Google Academic platforms. This information was supplemented with records and observations gathered from Global Biodiversity Information Facility (GBIF 2021), and Naturalista (Naturalista, CONABIO 2021).

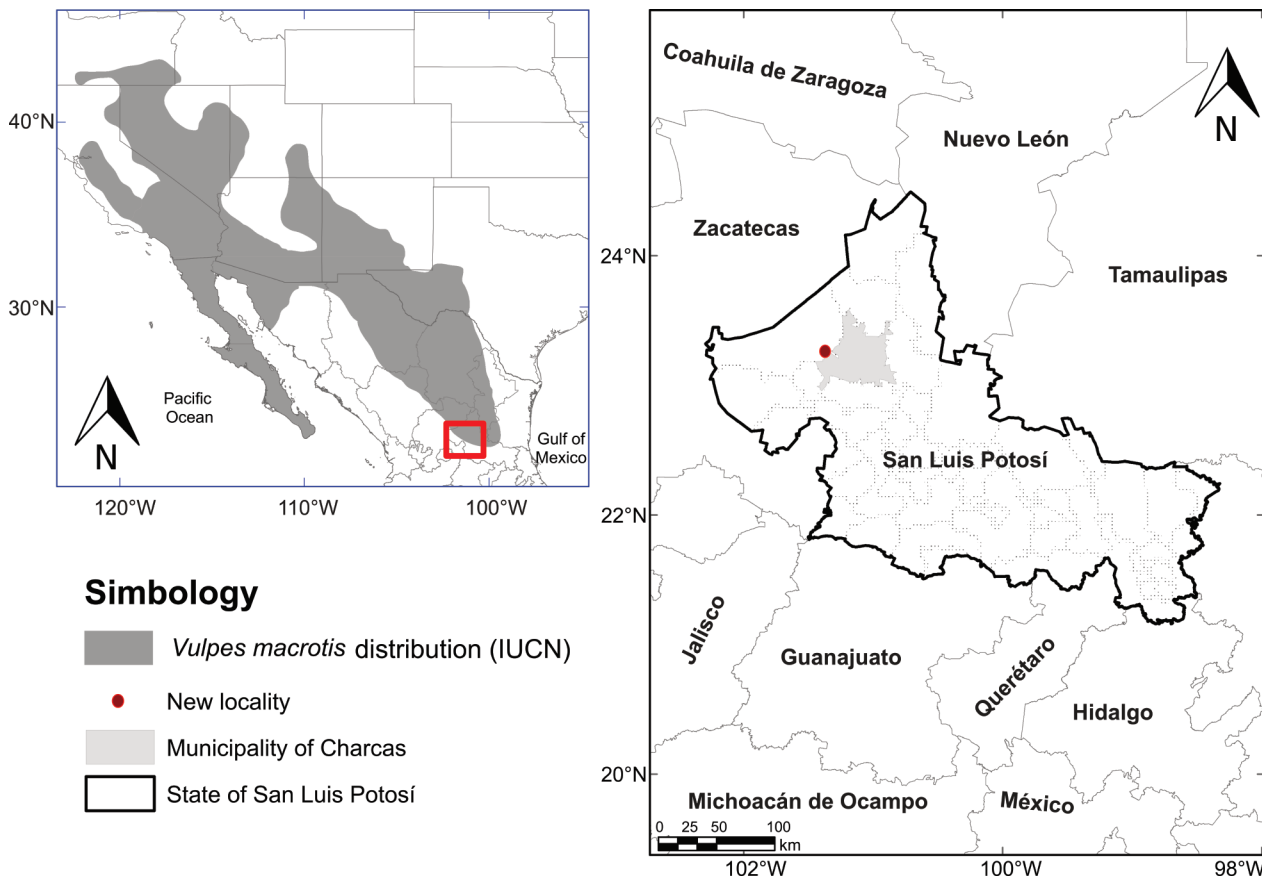


Figure 1. Geographic location of the male kit fox, *Vulpes macrotis*, recorded in the state of San Luis Potosí: 107 km northwest from 7 mi S at Real de Los Pinos, Zacatecas, México. The historical distribution of the kit fox by the IUCN is indicated (Cypher and List 2014).

Our record of the kit fox is located at northwestern San Luis Potosí, México (23° 15' 48.6" N, 101° 21' 18.36" W at 2,240 m; Figure 1). This location is approximately 107 km northwest of the previous record from 11.26 km S at Real de Los Pinos, Zacatecas, México (Sydney and Hadary 1965). The external somatic measures (in mm) of this specimen were as follows: total length, 732; tail length, 280; hind foot length, 110; ear length, 85, and the weight was 2,750 gr (Figure 2a). The type of vegetation where the road-killed kit fox specimen was found corresponds to crassicaule scrub (Figure 2b).

According to our literature and database search, this record represents the first reliable evidence of the kit fox in the state of San Luis Potosí, México. Furthermore, it is possibly the second southernmost record of the species after six decades of not being recorded in the area (Sydney and Hadary 1965; Martínez de la Vega et al. 2016). It should be noted that the external somatic measurements for the specimen are within the range of those reported for the species (McGrew 1979; Álvarez-Castañeda et al. 2017). One road-killed kit fox, plus a single rock squirrel (*Otospermophilus variegatus*), and three domestic dogs larger than a coyote were observed in autumn 2005 along the road from northwestern San Luis Potosí (Dean et al. 2006). However, the locality, specific coordinates as well as date and measurements of the specimen are not provided.

The effect of road developments on kit fox mortality rates are apparently different through its geographical distribution. For example, highway kills, shooting, and eagle predation were the main mortality factors in Tooele County, Utah (Egoscue 1962). By contrast, the effects of two-lane roads did not appear to impact on kit fox demographic and ecological attributes in western Kern County, California (Cypher et al. 2009). However, it's possible that road effects could be more pronounced under low prey availability or other adverse environmental conditions because kit foxes would have to travel greater distances for foraging (Cypher et al. 2009).

The most recent records of kit fox in México correspond to localities in the states of Coahuila (Contreras-Balderas et al. 2007), Sonora (Verona-Trejo et al. 2012), and the Baja California Peninsula (Álvarez-Castañeda 2002; Escobar-Flores et al. 2017). As well as to other citizen-based observations in Baja California Sur, Baja California, Sonora, Chihuahua, Coahuila and Nuevo León (Naturalista, CONABIO 2021). While in the southern limit of the distribution of *V. macrotis* there is less data on the distribution of its populations. In order to correct this lack of knowledge about this elusive and cryptic canid, it is necessary to implement long-term monitoring efforts with the use of more efficient methods (e.g., camera-traps), in addition to determining geographic location of its dens, use of habitat, and prey availability, among other important factors.

In desert communities, *V. macrotis* is an ecologically very relevant predator since it regulates the abundance of many prey species, mainly rodents (Ostfeld and Hold 2004). Therefore, the absence of kit fox populations can alter the behavioral ecology of preys, causing negative changes in the habitat by impoverishing it and favoring the desertification of the environment (Roemer et al. 2009). In this context, it is necessary to identify kit fox populations in southcentral México and implement effective conservation actions to ensure its long-term presence and conservation in the area.

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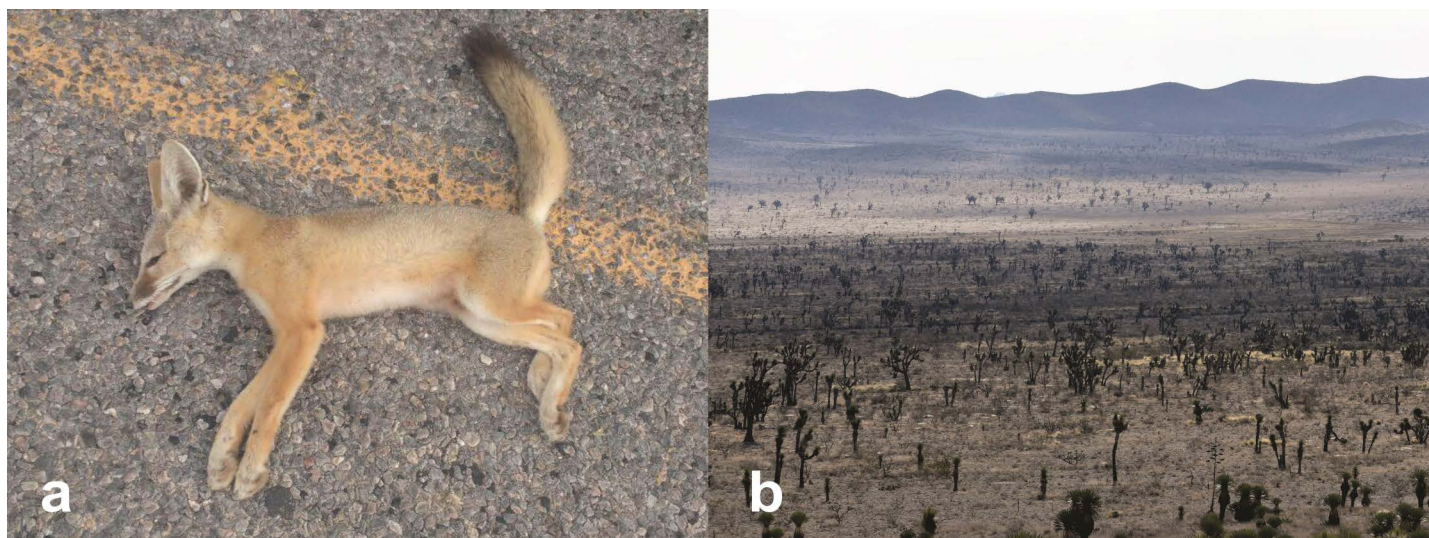


Figure 2. a) A male kit fox, *Vulpes macrotis*, killed in a road from the Municipality of Charcas, San Luis Potosí, México; b) type of vegetation near to the area where the road-killed kit fox was found.

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