revista mexicana de **mastozoología** nueva época | NOTA

Altitudinal record of the jaguarundi (*Herpailurus yagouaroundi*), in a temperate forest of the Neovolcanic Belt in the State of Mexico

Registro altitudinal del jaguarundi (Herpailurus yagouaroundi), en un bosque templado del Eje Neovolcánico del Estado de México

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ABSTRACT

We recorded with camera traps two jaguarundis (*Herpailurus yagouaroundi*) in the Hermenegildo Galeana State Park, Tenancingo, State of Mexico, at 2475 masl in 2016 and 2017. This is the first record of the species in the temperate forests of the Neovolcanic Belt in the center of the country and the highest altitude record of the species in Mexico. We assume that the jaguarundi used the forests of the state park seasonally, moving from lower elevations with tropical vegetation, since we only recorded it on two occasions, separated by six months (november 2016-may 2017), even though we sampled throughout over 23 months (july 2016-june 2018). In our study we obtained records of 12 additional species of mammals, including the bobcat (*Lynx rufus*), the coyote (*Canis latrans*), the gray fox (*Urocyon cineroagenteus*), the coati (*Nasua narica*), and the raccoon (*Procyon lotor*). The discovery of a high number of medium-sized mammals in the Hermenegildo Galeana State Park, very close to populated areas such as San Antonio Agua Bendita and Monte de Pozo, located in the reserve influence area, highlights the importance of protected areas, in this case of a state reserve, for the conservation of biological diversity at the regional and national levels.

Key words: altitudinal range, camera-traps, , conservation, jaguarundi, medium-sized mammals, protected areas.

Nuevo registro de jaguarundi en el bosque templado del Eje Neovolcánico del centro del país

RESUMEN

En este estudio registramos con cámaras trampa dos jaguarundis (Herpailurus yagouaroundi) *en el Parque Estatal Hermenegildo Galeana, Tenancingo, Estado de México, a 2475 msnm en 2016 y 2017. Este es el primer registro de la especie en los bosques templados del Eje Neovolcánico en el centro del país y el registro de mayor altitud de la especie en México. Asumimos que el jaguarundi utilizó estacionalmente los bosques del parque estatal, moviéndose desde elevaciones más bajas con vegetación tropical, ya que solo lo registramos en dos ocasiones, separadas por seis meses (noviembre 2016-mayo 2017), a pesar de que muestreamos a lo largo de dos años (julio 2016-junio 2018). Adicionalmente, en nuestro estudio obtuvimos registros de 12 especies de mamíferos, incluyendo el gato montés* (Lynx rufus), *el coyote* (Canis latrans), *el zorro gris* (Urocyon cinereoargen-

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https://doi.org/10.22201/ie.20074484e.2023.13.1.377 ISSN-e:2007-4484

teus), *el coatí* (Nasua narica) *y el mapache* (Procyon lotor). *El hallazgo de un alto número de mamíferos medianos en el Parque Estatal Hermenegildo Galeana, muy cerca de poblados como San Antonio Agua Bendita y Monte de Pozo, ubicados en el área de influencia de la reserva, resalta la importancia de las áreas protegidas, en este caso de una reserva estatal, para la conservación de la diversidad biológica a nivel regional y nacional.*
Palabras clave: *áreas protegidas, cámara-trampa, conservación, jaguarundi, mamíferos medianos, rango altitudinal.*

The jaguarundi (*Herpailurus yagouaroundi*) is one of the medium-sized mammals for which there is less biological information. It is an unmistakable mammal due to its morphology and coloration; there are two kinds of coats, the gray and the reddish. It is distributed from the southern United States to central Argentina (Giordano, 2015). In Mexico it is found in tropical and subtropical regions from Sonora to Chiapas on the Pacific slope and from Tamaulipas to Tabasco and the Yucatan Peninsula on the Gulf of Mexico slope, from sea level and up to 2,000 meters, although the most records are below 1,000 meters (Aranda, 2012; Ceballos, 2014; Ceballos, 2014; Ceballos y Oliva, 2005; Hall, 1981; Oliveira, 1998). They are diurnal and live mainly in tropical and subtropical regions in vegetation types such as scrub, low, medium and high jungles, and mangroves. They are also found in cloud forests and temperate pine-oak forests in the ecotone between temperate and tropical regions, and in disturbed areas such as induced grasslands and crops (Ceballos, 2014; Ceballos and Oliva, 2005; Giordano, 2015 Hall, 1981; Oliveira, 1998). It is a relatively common species that is listed globally as "least concern" (IUCN, 2021). In Mexico, it is considered a threatened species (SEMARNAT, 2019). However, it is a widely distributed species in the country, abundant and tolerant to disturbance (Oliveira, 1998; Reid, 1997).

There are few records of the jaguarundi in central Mexico. In this note we report the record of the jaguarundi in a temperate forest of the Neovolcanic Belt at the center of the country, which represents the highest altitude record in its distribution in the country.

STUDY SITE

The study site is the Hermenegildo Galeana State Park, located in the municipality of Tenancingo in the State of Mexico, Mexico, whose extreme coordinates are 19° 00' 21.603" and 19° 01' 24.769" N, and 99° 38' 06.923" and 99° 36' 01.987" W (figure 1). It has an area of 368 hectares, with a forest cover of 95%, mainly pine, pine and oak, and broadleaf forests (CEPANAF, 2015b). The climate is cool temperate, with an average annual temperature of 16°C. The annual precipitation range is between 9 mm (december) and 238 mm (september). The altitude range is between 2,400 and 2,700 masl (CEPANAF, 2015b).

METHODS

We studied the mammals of the state park through photo trapping from july 2016 to june 2018. We used five camera traps of the brand CuddebackTM. We placed the camera traps in three camera trap stations, two doubles and one single. The stations were no more than 300 linear meters apart and within a square kilometer quadrant. During the sampling period, the stations were located in 28 georeferenced sites within the polygon of the state park, on well-marked trails and close to ravines with perennial or intermittent runoff. We programmed the camera traps to work 24 hours a day and take 5 photos and a 30-second video for each event. We place the camera-traps following the Photo Trapping Manual for the Study of Wildlife (Chávez *et al.*, 2013). They were arranged 35 cm from the ground and fixed to the trees in safe boxes. Likewise, to increase the capture events we use two types of baits. One was a mix of oatmeal, peanut butter, vanilla, and chopped apple; the second bait was olfactory for which perfume fragrance was added, Chanel No. 5 ®, as it appeals to some carnivores.

The date and time of activity was recorded in the photographs and videos. In addition, in the review of the material we didn't note any other interesting observation. We reviewed the cameras every 30 days to download the information collected, maintain and clean them. We sampled 730 days corresponding to an effort of 3,650 trap-days. We obtained 8,868 photos and 2,968 videos. We identify the species based on our experience and specialized literature (Ceballos, 2014; Ceballos and Oliva, 2005; Ceballos *et al.*, 2009).

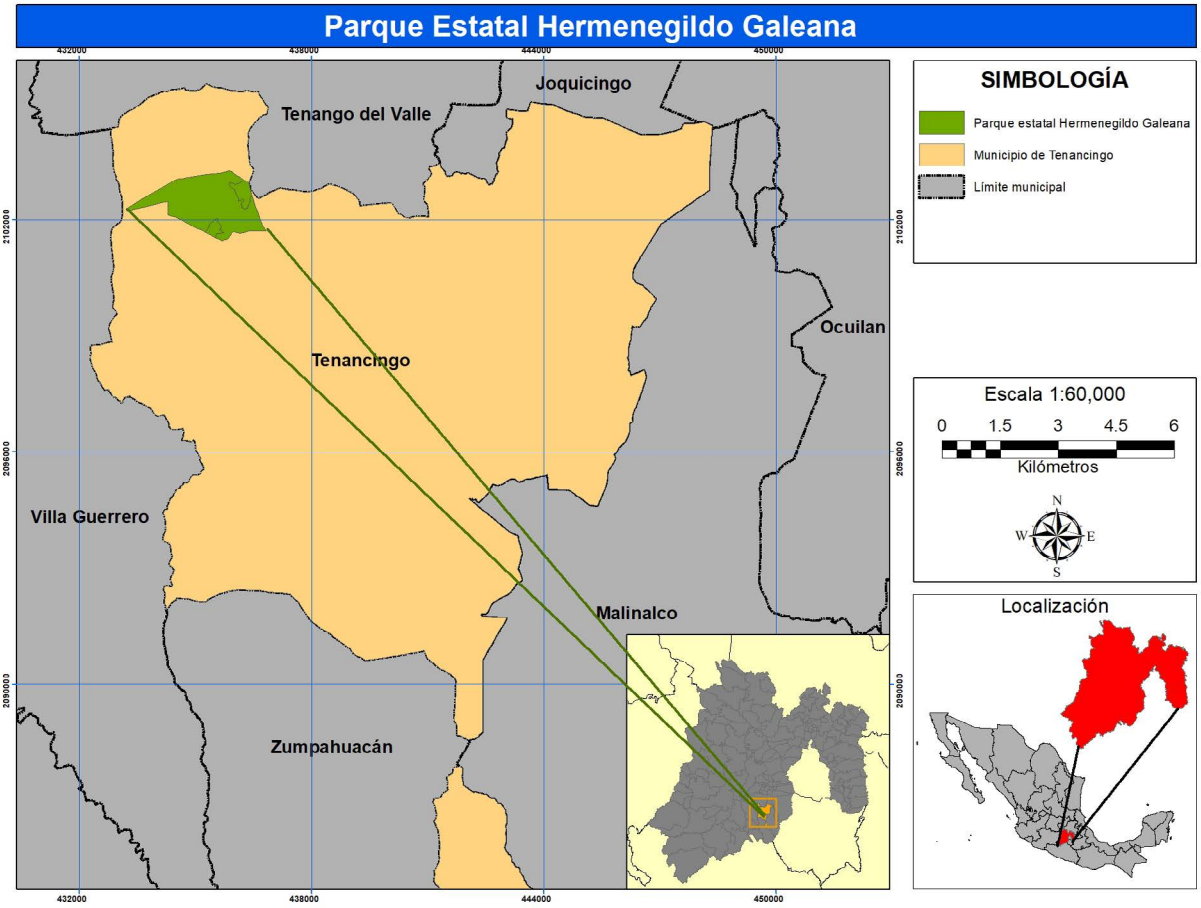

Figure 1. Location of the Hermenegildo Galeana State Park (grey), municipality of Tenancingo (purple), State of Mexico (red).

RESULTS AND DISCUSSION

Unexpectedly, we got jaguarundi records on two occasions (figures 2, 3). The first was an adult male in the "dark phase" coloration, which was recorded on november 27, 2016, at 2:23 pm. We obtained five consecutive photographs and a 30-second video, at a single station located in a pine forest near a stream polluted by wastewater and with poor quality perennial runoff (190 0´ 39.47" N and 990 36` 36.64" W) at an altitude of 2,475 masl (figure 2). The second record was obtained on may 5, 2017 at 2:30 pm. It was an individual with the "red phase" coloration, of unidentified sex. The image was captured at a simple station located in a pine forest at coordinates 190 0´37.47" N and 990 36` 34.64" W, at an altitude of 2,460 masl (figure 3). The two records of the species occurred at noon, at 14:20 pm and 14:30 pm, which is consistent with the patterns of activity and natural history reported by Aranda (2012). These records were six months apart and from the color patterns we can conclude that these are two different individuals.

There are very few published records of jaguarundi in the State of Mexico, all from the tropical regions of the Balsas basin towards the extreme south of the state. One of us (G. Ceballos) saw one in 1994 crossing a dirt road, surrounding by induced grasslands and remnants of tropical dry forests, a few kilometers north of the town of Amatepec (Amatepec municipality). Several additional records are from the Sierra de Nanchititla Nature Reserve, Luvianos municipality, at elevations up to 1,600 masl, in tropical dry forests and in the transition of tropical dry and temperate oak and pine forests (Monroy-Vilchis *et al.* 2011a,b). One record is from a case of predation of a jaguar undi by a boa (*Boa constrictor*) that was reported from the transition zone between lowland forest and mixed pine-oak forest at an altitude of 1,600 masl

Figure 2. Camera-trap images of the first jaguarundi (*H. yagouaroundi*) recorded in our study site in the Hermenegildo Galeana State Park, State of Mexico. Note the dark phase coloration.

Figure 3. Camera-trap images of the second jaguarundi (*H. yagouaroundi*) recorded in our study site in the Hermenegildo Galeana State Park, State of Mexico. Note the red phase coloration.

Figura 4. Temperate forest in f the Hermenegildo Galeana State Park, State of Mexico. Photo: Leopoldo Islas.

(Monroy-Vilchis *et al.*, 2011b). Our records are from temperate forest located roughly 80 to 100 km in straight line northeast from Amaptepec and Luvianos and represent the most central records of jaguarundi in the Neovolcanic Belt in Central Mexico.

Our records also represent the highest altitudinal observations of jaguarundi in Mexico. There are many jaguarundi's records from central Mexico but all at lower elevations. For example, in Hidalgo (Mejenes-López *et al.*, 2007), Michoacan (Monterrubio-Rico *et al.*, 2012; Urrea-Galeano *et al.*, 2016), Morelos (Álvarez *et al.*, 2009), Puebla, and Oaxaca (Botello *et al.*, 2013; Farías *et al.*, 2015) there are in many localities all below 1,1800 masl. We found published records at higher elevations in the Sierra de Manantlan Biosphere Reserve, Jalisco-Colima (2,070 masl; Aranda *et al.*, 2012) and the Cumbres de Monterrey National Park in the state of Nuevo Leon at 2,188 masl (Salinas Camarena *et al.*, 2016). Therefore, this is the highest altitudinal record (2,475 masl) for the species in Mexico.

In the same monitoring period, we recorded 12 additional species of mammals (table 1). It is noteworthy the abundance of medium size mammals in this locality, especially considering that it is close to croplands and relatively large towns, like San Antonio Agua Bendita and Monte de Pozo, which have a few thousand inhabitants.

Our results have two broader implications for conservation. First, they highlight the importance of state protected areas such as the Hermenegildo Galeana reserve as a site for the conservation of both biodiversity, including priority species such as the H. yagouaroundi, and ecosystem services. They also show the relevance of short-term biodiversity monitoring studies to generate basic scientific information for decision-making in management and conservation. The effective conservation of biodiversity and the adequate management of natural resources depend on the existence of updated and quality information on which to make decisions.

Acknowledgements

We thank the Director of the State Commission for Natural Parks and Fauna (CEPANAF), Napoleón Fillat Ordoñez, for the support and permissions provided to carry out these studies; to the

Table 1. Report additional species of mammals			
Reported vertebrates		Scientific name	Conservation category
	Birds		
1		*Dendrortyx macroura*	Endemic / threatened (NOM059)
	Carnivore		
2		*Canis latrans*	
3		*Urocyon cinereoargentus*	
4		*Lynx rufus escuinapae*	
5		*Herpailurus yagouaroundi*	No Endemic / threatened (NOM059)
6		*Bassariscus astutus*	Endemic / threatened (NOM059)
7		*Nasua narica*	Endemic / threatened (NOM059)
8		*Procyon lotor*	
9		*Mustela franata*	
10		*Mephitis macroura*	
11		*Spilogale angustifrons*	
12	Rodentia	*Sciurus aureogaster*	

coordinator of Hermenegildo Galeana State Park, Juan Ceballos for his support in the field work; to each and every one of the students, volunteers and collaborators who participated indirectly and selflessly, especially to: Ana Sofía Manzur García Maass (Director of CEPANAF during the period 2014-2019), Carlos Ortega Contreras for his illustration, Diana Ruiz Reyes, Kendra Gonzales, Daniela Salazar and Catalina Gonzáles.

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