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Abstract: In Tamaulipas, jaguar populations still remain. However, due to anthropogenic factors such as habitat loss and by poaching, the distribution of this felid has been affected. For twelve years, data about jaguar presence on different locations within the State, have been recorded through interviews and surveys to local people and field visits. Recently, available habitat analysis was conducted using LANDSAT imagery, to identify the remaining locations with the largest amount of jaguar habitat. An area of available jaguar habitat for the state of Tamaulipas was estimated of about 1,110,878 ha, being the Sierra Madre Oriental and the Sierra of Tamaulipas the areas with the greatest habitat availability. This suggests that this jaguar population has some chances for long term persistence.

STATUS OF JAGUARS IN THE STATE OF TAMAULIPAS

ARTURO CASO

Resumen

En Tamaulipas aún existen poblaciones de jaguar, pero debido a factores antropogénicos como la destrucción del hábitat y la cacería furtiva, la distribución de este felino se ha visto seriamente afectada. Durante 12 años se recopilaron datos de campo sobre la presencia del jaguar en el estado, mediante entrevistas, encuestas y visitas de campo. Para determinar su situación actual se realizó un análisis del hábitat disponible del jaguar utilizando imágenes LANDSAT. Se estimó una superficie de 1,110,878 ha de hábitat disponible para el jaguar en todo el estado de Tamaulipas, siendo la Sierra Madre Oriental y la Sierra de Tamaulipas los sitios con mayor superficie de hábitat. Esto indica que aún es posible mantener estas poblaciones a largo plazo.

Abstract

In Tamaulipas, jaguar populations still remain. However, due to anthropogenic factors such as habitat loss and by poaching, the distribution of this felid has been affected. For twelve years, data about jaguar presence on different locations within the State, have been recorded through interviews and surveys to local people and field visits. Recently, available habitat analysis was conducted using LANDSAT imagery, to identify the remaining locations with the largest amount of jaguar habitat. An area of available jaguar habitat for the state of Tamaulipas was estimated of about 1,110,878 ha, being the Sierra Madre Oriental and the Sierra of Tamaulipas the areas with the greatest habitat availability. This suggests that this jaguar population has some chances for long term persistence.

Introduction

Jaguar populations still remain in Tamaulipas. However, they are affected by several factors, such as habitat destruction and modification due to agriculture, and poaching. In areas with livestock farming, jaguars have been driven to attack livestock because of the pressure of humans on natural prey, such as deer or peccary, or injuries that make hunting difficult. This has been recorded on several locations in their range (Rabinowitz, 1986). The result of these events is usually the death of one or more jaguars, since lethal control is not targeted to problem individuals (Caso, 1993). This has led to a dramatic decline in jaguar populations over the last 30 years, reducing the species' original range by almost 1,000 km towards the south (Sunquist and Sunquist, 2002; Swank and Teer, 1989).

Jaguars are at the top of the food chain and require large stretches of natural habitat to survive. They should be considered as an indicator of ecosystem status

(Caso, 1994; Miller *et al.*, 2001). Successful conservation of jaguars indirectly protects other wild animal species of great importance –endangered species such as the ocelot (*Leopardus pardalis*), game species such as the white-tailed deer (*Odocoileus virginianus*), or species that attract tourism, such as the yellow-crowned Amazon (*Amazona ochrocephala*). In Tamaulipas, these species share their range with the jaguar and are also suffering from habitat destruction.

Although the jaguar still occurred in the state of Texas, USA, in the 1940s, the last confirmed report of the species was in 1946, when a jaguar was hunted 10 km south of San Benito, Texas (Taylor, 1947). There are no recent records of the jaguar in Texas, which indicates that the northernmost part of its range is now the Sierra Madre Oriental in Tamaulipas. Leopold (1959) and Alvarez (1963) mentioned the distribution of the species in the center and all along the coastal plain of the state of Tamaulipas. More recent publications set the northeastern limit of its range in the states of Nuevo León, Coahuila and Tamaulipas (Brown and López-González, 2001; Neff, 1982; Rosas-Rosas and López-Soto, 2002; Sunquist and Sunquist, 2002). Tamaulipas was historically an area where jaguars were hunted, which is why most of the little information available comes from hunters. Therefore, the aim of this study was to document current or recent jaguar presence in Tamaulipas and determine how much habitat is still available for the species.

Methods

To carry out this study, we used data obtained during 12 years of fieldwork in the state of Tamaulipas through interviews, surveys sampling and field trips (Appendix 1). We took measurements and other data from hunted specimens. To estimate the amount of suitable jaguar habitat, we considered the home range reported for Mexico and Central America (Ceballos *et al.*, 2002; Rabinowitz, 1986). We included pine-oak woodlands in our analysis, as they have been reported to be used by jaguars (Brown and López-González, 2002; Leopold, 1959). Some areas such as the Sierra de San Carlos were not included in the analysis because in an earlier visit no locals reported seeing any jaguars, tracks or scats, or mentioned any losses of livestock attributed to jaguars. The general analysis of jaguar habitat was based on a 2000 ETM-7 LANDSAT image of the state of Tamaulipas. We used ArcGis 9.0 and ERDAS IMAGINE 8.7 software to classify the areas according to their vegetation cover and refractive potential.

To classify the truthfulness of records, we used the criteria set by Tewes and Everett (1982) and only considered Class I sightings, which imply direct possession or observation of the animal by the authors, possession of the animal or skin by the observer, photographs of the animal taken in situ (e.g., with a remote camera) or capture of the animal.

Results and discussion

Ten recent (<15 years) Class I records of the jaguar were obtained in Tamaulipas, in the following municipalities: Aldama, Gómez Farías, González, Hidalgo, Jaumave, Ocampo, Soto la Marina and Villa de Casas (Table 1). Observations and habitat analysis with ArcGis software led to estimating a total surface of 1,110,878 ha of suitable jaguar habitat in the state of Tamaulipas (Table 2; Figure 1).

The area estimated to be suitable jaguar habitat in Tamaulipas must be considered with caution, as the different habitat types considered in the satellite images must be validated in the field. Besides, a greater number of records is necessary to increase accuracy. In spite of these limitations, the area estimated in this study for the Sierra de Tamaulipas is consistent with other studies carried out in the same area (Ortega-Huerta and Medley, 1999). Based on the available habitat and records of predation on livestock, there is likely to be a considerable population of jaguars in this mountain range, now isolated from the Sierra Madre Oriental.

Jaguar habitat in Tamaulipas has decreased compared to reports on its distribution in the past (Alvarez, 1963; Leopold, 1959). One of the factors directly determining jaguar habitat loss is the deforestation due to charcoal production. Poaching also exerts pressure on existing jaguar populations, as shown by the fact that half of the jaguar records in the state were skins of illegally hunted animals.

Table 1. Recent jaguar records in the state of Tamaulipas

No	Year	Site	Municipality	Record	Topography
1	1991	E. Los Caballos	Hidalgo	Skin of hunted animal	Sierra Madre Oriental
2	1992	R. La Lajilla	V. de Casas	Tracks, scats	Sierra de Tamaulipas
3	1993	R. Miradores	S. la Marina	Skin of hunted animal	Sierra de Tamaulipas
4	1993	R. El Porvenir	S. la Marina	Capture	Sierra de Tamaulipas
5	1995	E. Noche Buena	S. la Marina	Skin of hunted animal	Sierra de Maratines
6	2001	E. San Vicente	Jaumave	Livestock killed by jaguar	Sierra Madre Oriental
7	2001	E. Ricardo Flores Magón I	Ocampo	Skin of hunted animal	Sierra Madre Oriental
8	2003	Gómez Farías	Gómez Farías	Direct observation	Sierra Made Oriental
9	2003	R. Almagre	González	Skin of hunted animal	Sierra de Tamaulipas
10	2004	R. Balcones	Aldama	Capture and photograph	Sierra de Tamaulipas

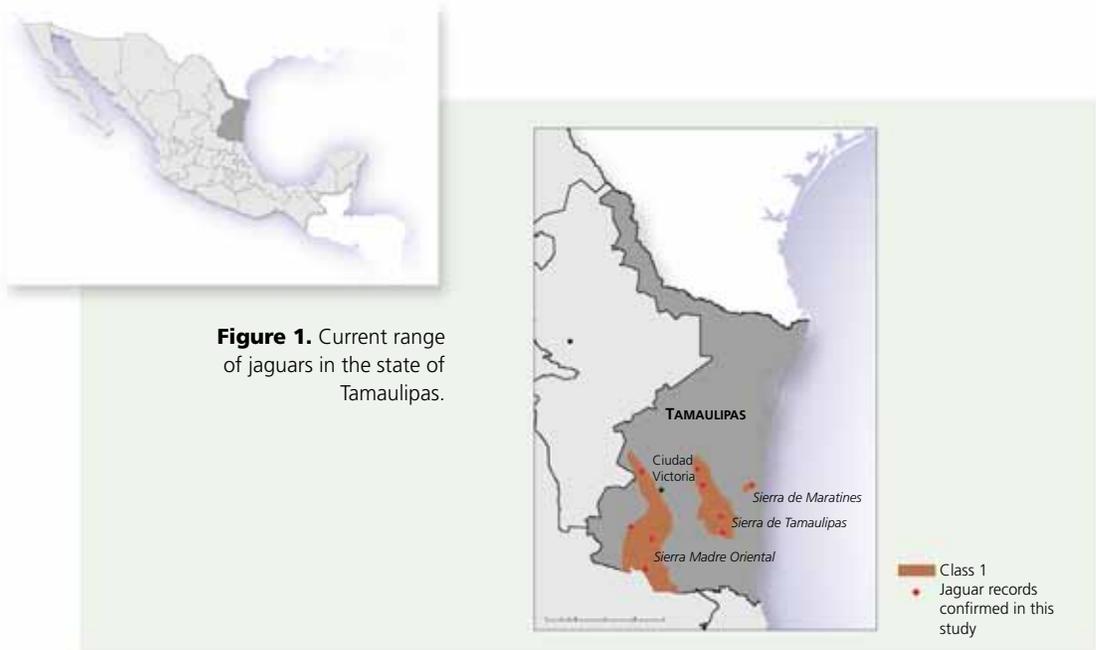
E. = Ejido; R. = Ranch

Table 2. Regions and surface available with jaguar habitat in the state of Tamaulipas

Regions	Surface (ha)
Sierra Madre Oriental	729,812
Sierra de Tamaulipas	366,493
Sierra de Maratines	14,573
Total	1,110,878

The three areas where jaguars are present are separated and probably isolated from each other. The distance between them is at least 50 km of land that has been cleared for agriculture, with several highways. This represents a major barrier for the jaguar and suggests that the populations are isolated.

In the Sierra Madre Oriental, most records were obtained in the south, in the municipalities of Llera, Ocampo and Jaumave. There was one direct sighting in El Cielo Biosphere Reserve, in the Gómez Farías region. However, jaguar presence is sporadic in that area and locals complain more about livestock losses caused by black bear (*Ursus americanus*) than by large felids (puma and jaguar). The limited number of jaguar records in this region is probably also linked to the low abundance of potential prey such as the collared peccary (*Tayassu tajacu*), white-nosed coati (*Nasua*



narica), and white-tailed deer (*Odocoileus virginianus*), which are hunted by locals (Aranda, 1994). The Sierra Madre Oriental in Tamaulipas extends southwards to San Luis Potosí, where there are no verified reports . However, the findings show that there is suitable jaguar habitat, so there may be a jaguar population in this region as well. In the northwest, this mountain range is connected to the Sierra Plegada in Nuevo León, where jaguar presence has been recorded (Rosas-Rosas and López-Soto, 2002).

Jaguar conservation in Tamaulipas requires accurately determining its current status, since there are no data about population size or ecology. It is therefore urgent to conduct studies on the status of this species and to carry out conservation actions to ensure the future of this population.



Figure 2. The mountain ranges in Tamaulipas contain the northernmost jaguar populations on the side of the Gulf of Mexico. Jaguar has serious conflicts in Tamaulipas due to livestock predation.

Photo: Arturo Caso

Appendix 1

Form used to record jaguar presence in interviews

Record of death caused by a jaguar

No. _____

Date of the attack ___/___/___

Name of ranch _____

Name of owner _____

1) What animal was killed?

a) calf b) young bull or heifer c) cow or bull d) horse e) other _____

2) Approximate age of the animal killed (months; years) _____

3) Vegetation type where the carcass was found _____

4) How far was the animal dragged from the place where it was attacked (approximately)? _____

5) How long after the attack was the carcass found? _____

6) The carcass was found (mark the appropriate answers with a cross)

a) Only dead (not eaten)

b) If eaten, what part was eaten? _____

c) It was covered with leaves and dirt

d) It had blood (and marks of bites) on its throat

e) It had blood (and marks of bites) on its neck or skull

f) If the cat was seen eating the prey, what species was it? _____

g) Were any tracks found? _____

7) This attack represents the (number) _____ of my animals killed by cats this year.

8) Do cats cause problems to your livestock all year round? Yes ___ no _____. If the answer is yes, how many animals do you think are killed by big cats on your property every year? _____ What kind of cat –puma or jaguar– do you think causes the damage? _____

9) Have you used any methods to control big cats in your property? Yes _____ no _____. If the answer is yes, please explain _____

10) Would you like to find out more about the choices available to solve the problem of livestock losses caused by big cats? Yes _____ no _____