

Potential predation on the tiger rat snake *Spilotes pullatus* by the gray fox *Urocyon cinereoargenteus*

Probable depredación de la serpiente voladora *Spilotes pullatus* por la zorra gris *Urocyon cinereoargenteus*

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Studies on diet allow understanding trophic relationships within biotic communities. The gray fox is a solitary mammal with activity during daytime and nighttime hours. It has an omnivorous diet, with flexible and opportunistic habits. The tiger rat snake is a diurnal colubrid with a remarkable ability to move between tree branches. The potential predation event was recorded in Komchén de los Pájaros, a locality in northern Yucatán. We placed 8 camera traps from 23 December 2019 to 31 December 2021; 6 worked as separate stations and 2 as a dual station. They were set to remain operational 24 hr a day. On 4 December 2021, a gray fox (*Urocyon cinereoargenteus*) was recorded at station 4. The photo shows a moving fox carrying a tiger rat snake (*Spilotes pullatus*) in the snout. Although there is no evidence of the fox actually feeding on the snake, this may have occurred. Few reptile species have been recorded in the diet of *U. cinereoargenteus*. To date, only the green iguana *Iguana iguana* and the Texas alligator lizard *Gerrhonotus infernalis* have been reported as prey. No such records are currently available for *S. pullatus*. Although we found no direct evidence that the gray fox actually consumed the snake, this is potentially the first record of a predator-prey interaction between these species.

Key words: Camera traps; diet; Komchén; predator; tropical forest.

Los estudios sobre la dieta permiten entender las relaciones tróficas entre las comunidades bióticas. La zorra gris es un mamífero de hábitos solitarios y activo tanto de día como de noche, tiene una dieta omnívora, con hábitos alimentarios flexibles y oportunistas. La serpiente voladora es un colúbrido de actividad diurna con una amplia agilidad entre las ramas de los árboles. La zona donde se obtuvo el registro de la zorra fue en Komchén de los Pájaros, se ubica al norte del estado de Yucatán. Del 23 de diciembre de 2019 hasta el 31 de diciembre de 2021, se colocaron 8 cámaras-trampas, 6 funcionaron como estaciones independientes y 2 como una estación doble. Fueron programadas para su funcionamiento de 24 horas. El 4 de diciembre de 2021, se registró en la estación 4 a una zorra gris (*Urocyon cinereoargenteus*). La imagen muestra a la zorra en marcha y llevando en el hocico a una serpiente voladora (*Spilotes pullatus*), aunque sin evidencia de que la consumiera, lo que indica que potencialmente pudo existir dicho evento. Se han registrado pocas especies de reptiles en la dieta de *U. cinereoargenteus*, hasta ahora se han identificado a la iguana *Iguana iguana*, y la lagartija caimán norteña *Gerrhonotus infernalis*. Para el caso específico de *S. pullatus* no hay ningún registro actual. Aunque no encontramos evidencia de que la zorra gris consumiera a la serpiente, potencialmente este sería el primer registro de esta interacción.

Palabras clave: Depredador; dieta; fototampas; Komchén; selva baja.

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Wildlife species consume the food that is available in their habitat. Therefore, their diet functions as a link between the local resources, being a key driver of balance in ecosystems ([Ojasti and Dallmeier 2000](#)). Studies on diet allow understanding trophic relationships between biotic communities ([Villalobos et al. 2014](#); [Viteri-Pasch and Mármot-Kattán 2019](#)), as well as the quantity and quality of the food consumed ([Ojasti and Dallmeier 2000](#); [Cruz-Espinoza et al. 2010](#)).

The gray fox *Urocyon cinereoargenteus* is listed as Least Concern in the Red List of the International Union for the

Conservation of Nature (IUCN; [Roemer et al. 2016](#)). It is a medium-sized predator weighing between 3 kg and 5 kg ([Fritzell and Haroldson 1982](#)), with solitary habits, and active during daytime and nighttime hours ([Fuller and Cypher 2004](#)). This fox is distributed from southern Canadá to northern Venezuela and Colombia, except for some mountainous regions in the northern United States and eastern Central America ([Fritzell and Haroldson 1982](#)). In México, it is distributed throughout the country ([Roemer et al. 2016](#)), inhabiting almost all vegetation types ([Fritzell and Haroldson 1982](#)).

Urocyon cinereoargenteus has an omnivorous diet with flexible feeding habits like the coyote *Canis latrans*, the raccoon *Procyon lotor*, and the jaguarundi *Herpailurus yagouaroundi* (Guerrero *et al.* 2002). Among the studies on the diet and food webs of the gray fox, it is worth highlighting the works of Errington (1935), Wood (1954), Fritzell and Haroldson (1982), Hockman and Chapman (1983), Arnaud and Acevedo (1990), Novaro *et al.* (1995), Guerrero *et al.* (2002), Villalobos *et al.* (2014), Harmsen *et al.* (2019), and Wong-Smer *et al.* (2022). Its diet includes fruits, nuts, grains (seeds), small vertebrates, and invertebrates.

For its part, the snake *Spilotes pullatus* is listed as Least Concern in the IUCN Red List (Arzamendia *et al.* 2019). Its maximum size is about 260 mm to 270 mm (Köhler 2008), and it feeds mainly on small mammals, birds, and eggs (Lee 1996). This snake is a diurnal colubrid commonly found among tree branches, sometimes on the ground, and frequently near water bodies (Harrington *et al.* 2018). It is distributed in México in the states of Tamaulipas, Veracruz, Tabasco, Querétaro, Hidalgo, northern Oaxaca, Chiapas, and the Yucatán Peninsula, southward through Belize, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panamá, and Argentina, inhabiting dry and wet forests from sea level to 1,500 m (Köhler 2008). It was reported in Yucatán by Lee (1996) and later confirmed by González-Sánchez *et al.* (2017).

There are no records of predator-prey interactions between these two species. There are records of *S. pullatus* being preyed on by the great black hawk, *Buteogallus urubitinga* (Gerhardt *et al.* 1993). Furthermore, a predation attempt by the middle American indigo snake *Drymarcon melanurus* was also reported (Oakley and Theodorou 2020). Considering the importance of understanding and studying these interactions, this note reports the potential predation of *S. pullatus* by *U. cinereoargenteus* in northern Yucatán.

The interaction between the gray fox and the tiger rat snake was recorded in Komchén de los Pájaros, a private area voluntarily dedicated to conservation. The protected area comprises 300 ha of tropical deciduous forest (Flores and Espejel 1994) located in northern Yucatán, in the kilometer 1.5 of the Dzemul-Xtampú road section, in the south of the Dzemul municipality (21° 13' 30" N, 89° 19' 17.03" W; 21° 13' 38.64" N, 89° 20' 18.60" W; 21° 12' 14.7" N, 89° 20' 22.91" W; 21° 12' 9.36" N, 89° 19' 17.03" W; Figure 1). Altitude ranges from 0 to 15 m (INEGI 2005), and the dominant soil type is Leptosol (INEGI 2009). The prevailing climate is warm sub-humid with summer rains (INEGI 2009). The dry season in this area lasts from 7 to 8 months (November to June), slightly attenuated by "Norte" winter rains or storms.

A systematic sampling was conducted as part of a terrestrial vertebrate monitoring program from 23 December 2019 to 31 December 2021. We selected 4 permanent sites (2, 4, 6, 9; Figure 1) according to accessibility (paths) and water availability (artificial drinking troughs and cenotes) to capture the highest diversity of species, according

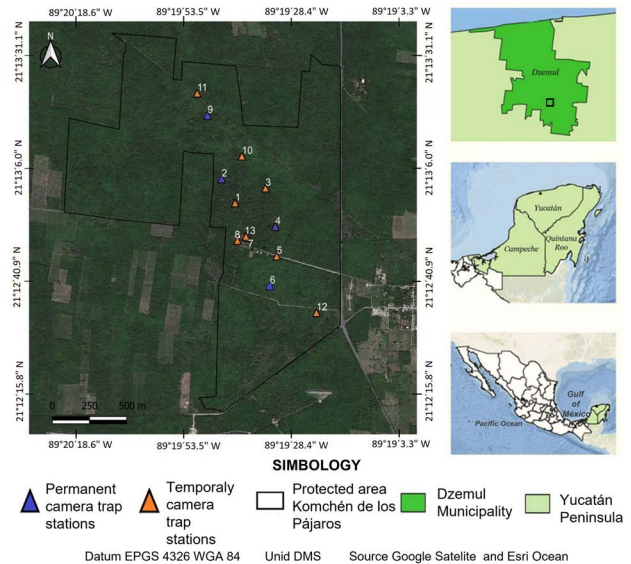


Figure 1. Distribution and location of the monitoring stations at Komchén de los Pájaros, Yucatán, México.

to O'Brien *et al.* (2011). Simultaneously, a non-systematic sampling was conducted, consisting of 4 temporary camera traps set at each site to capture photos over 2 months (1, 3, 5, 7, 8, 10, 11, 12, 13; Figure 1). Sampling sites were selected based on previous records of mammal tracks (scats or footprints). The permanent sites 2 and 6 worked as a dual station for 6 months (January-July 2021). Eight camera traps were used for the sampling; 1 Moultrie (M-4000), 1 Primo (63053), 3 Bushnell HD (119876), and 3 CuddeBack (h-1453). Camera traps were placed on tree trunks 50 cm above the ground. Each camera was set to capture photos 24 hr per day, with 3 consecutive shots per capture event. The memory cards were reviewed weekly.

A sampling effort of 623 trap days (14,952 hr) was recorded from 23 December 2019 to 31 December 2021. In total, 157 records of gray fox (*U. cinereoargenteus*) were captured with the camera traps. On 4 December 2021 at 11:40 hr, a gray fox was captured at station 4 (21° 13' 22.72" N, 89° 19' 50.34" W; Figure 2). The photo shows a moving gray fox carrying a tiger rat snake (*S. pullatus*) in the snout, which may have been either preyed on or picked as carrion. The snake showed the highly noticeable black-greenish yellow dorsal pattern with both colors balanced in proportion and yellow scales with black edges forming transverse stripes (Pérez-Higareda *et al.* 2007). These characteristics are typical of *S. pullatus*, allowing its identification with the guide by Lee (1996) and Köhler (2008). We recorded no evidence of the gray fox actually consuming the snake; however, the record of the fox carrying the snake in its snout suggests a likely predator-prey interaction between these species.

The predator-prey interaction between *U. cinereoargenteus* and *S. pullatus* has not been previously reported, so this is the first record of the potential predation of the tiger rat snake by a gray fox. Few reptile species are currently reported in the diet of *U. cinereoargenteus*. The green

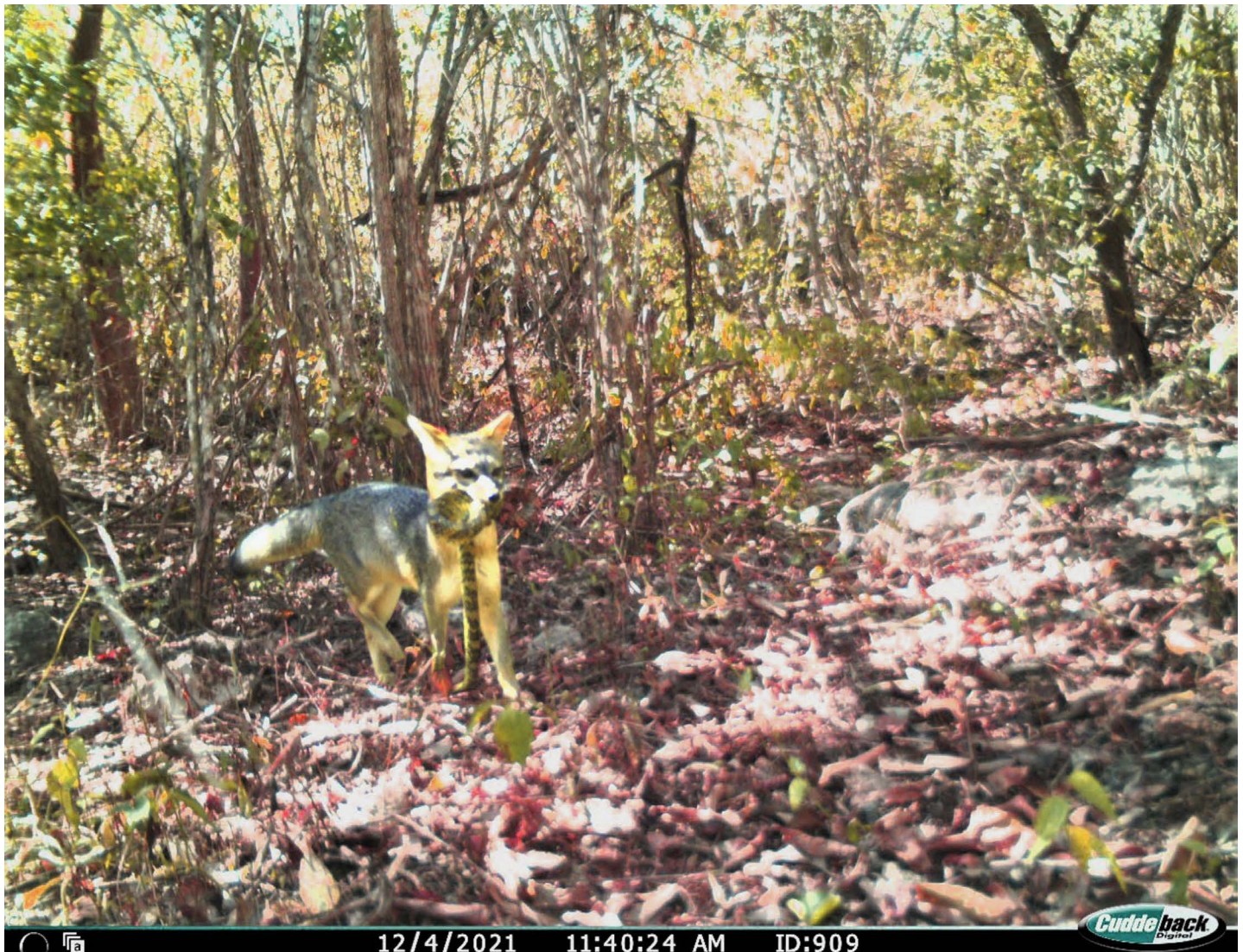


Figure 2. Gray fox (*Urocyon cinereoargenteus*) carrying a tiger rat snake (*Spilotes pullatus*) in its snout at Komchén de los Pájaros, Yucatán, México.

iguana *Iguana iguana* was recorded in a tropical deciduous forest on the coast of Jalisco (Guerrero et al. 2002), and the Texas alligator lizard *Gerrhonotus infernalis* in a pine-oak forest in Nuevo León (García-Bastida et al. 2018). In the particular case of *S. pullatus*, there are no current records showing that it is preyed on by the gray fox. These reports suggest that the gray fox is a highly adaptable species (Guerrero et al. 2002) due to its generalist habits (Ceballos and Galindo 1984) and the ability to adapt its diet to the resources locally available (Villalobos et al. 2014). Moreover, Neale and Sacks (2001) reported that *U. cinereoargenteus* focus its diet on the most abundant food source. The record of the potential predation of *S. pullatus* by *U. cinereoargenteus* reported herein shows the likely opportunistic behavior of the gray fox. Therefore, we suggest considering the tiger rat snake as a component of the gray fox diet.

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