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Urocyon cinereoargenteus predating to *Canis lupus familiaris* in an anthropized tropical environment

Urocyon cinereoargenteus depredando a *Canis lupus familiaris* en un ambiente tropical antropizado

Viridiana Méndez-Ramírez[1], and Ricardo Serna-Lagunes[1*]

[1]Facultad de Ciencias Biológicas y Agropecuarias, Universidad Veracruzana. Calle Josefa Ortiz de Domínguez s/n, C. P. 94945, Col. Centro, Peñuela, Municipio de Amatlán de Los Reyes. Veracruz, México. E-mail: zs20025004@estudiantes.uv.mx (VM-R); rserna@uv.mx (RS-L).
*Corresponding author

Although the gray fox, *Urocyon cinereoargenteus* (Carnivora: Canidae), is an omnivorous, opportunistic, and generalist carnivore, its predating or scavenging on domestic canids has not been reported. This report documents a predation event a domestic dog (*Canis lupus familiaris*) for gray fox in an anthropized tropical environment. During a project to evaluate the impact on habitat and wildlife populations in forested areas where dynamite is used to fragment stone and limestone rock in Cuauhtémoc, Córdoba, Veracruz, 2 camera traps were installed from August 2021 to May 2022 in areas with coffee cultivations, sugarcane, citrus, banana, palm, secondary vegetation, and tropical forest. The videos reviewed showed an adult female gray fox carrying a domestic dog puppy in her snout. Considering this report, the second on this topic for México, there are 14 species of wild carnivores that prey on domestic dogs. This unusual event could have resulted from several factors, including intraspecific competition with domestic canids or other mesopredators, food scarcity, and habitat anthropization.

Key words: Anthropic pressure; Canidae; Carnivora; diet; domestic dog; gray fox.

Aunque la zorra gris, *Urocyon cinereoargenteus* (Carnívora: Canidae), es un carnívoro omnívoro, oportunista y generalista, no se había reportado la depredación o el carroñeo de cánidos domésticos. El objetivo de este reporte es documentar el registro de depredación de un perro doméstico (*Canis lupus familiaris*) por una zorra gris en un ambiente tropical antropizado. Durante un proyecto que pretende evaluar el impacto del uso de dinamita para extraer piedra y roca caliza sobre el hábitat y las poblaciones de fauna silvestre en áreas boscosas en Cuauhtémoc, Córdoba, Veracruz, se instalaron 2 cámaras trampa, de agosto de 2021 a mayo de 2022 en zonas con cultivos de café, caña, cítricos, plátanos, palma camedor, vegetación secundaria y bosque tropical. Durante la revisión de los videos, se observó a una hembra adulta de zorra gris que lleva en su hocico a un cachorro de un perro doméstico. Con este reporte, son 14 especies de carnívoros silvestres que depredan perros domésticos. Este es el segundo reporte para México. Este evento inusual pudo ser resultado de diversos factores, entre ellos, la competencia intraespecífica con los cánidos domésticos, con otros mesodepredadores, la escasez de alimento y la antropización del hábitat.

Palabras clave: Canidae; Carnívora; dieta; perro doméstico; presión antrópica; zorra gris.

The gray fox (*Urocyon cinereoargenteus* Schreber 1775) is a wild canid belonging to the order Carnivora with an omnivorous diet; that is, it feeds on plants and animals. It is also considered an opportunistic species (it adapts its diet to the available resources) and a generalist species (able to thrive in different environments where it uses a wide variety of resources as part of its diet; Metz *et al.* 2023). The composition of its diet is highly variable, depending on the resources available within and between localities, the season of the year (spring, summer, autumn, or winter), the climatic season (rainy or dry; Arnaud and Acevedo 1990), and its interaction with other mesopredators. Depending on the local availability of food, which in turn is determined by habitat characteristics and ecosystem conditions, such as in mixed forest areas of the department of Huehuetenango, Guatemala, this species consumes seeds of cypress (*Juniperus comitana*) and plants of the family Asteraceae, small mammals such as rodents (*Peromyscus mexicanus* and *P. aztecus*), shrews (Soricidae), opossums (Didelphidae), birds (Columbiformes), and insects (Coleoptera, Carabidae and Orthoptera; Viteri-Pasch and Mármol-Kattán 2019).

On the coast of Oaxaca, México, its diet includes seeds, vertebrates, and invertebrates (Villalobos-Escalante *et al.* 2014). In habitats with changes in land use in Tamaulipas, México, its diet consists of plants, invertebrates and vertebrates (Wong-Smer *et al.* 2022). In southern California, USA, it consumes seeds, fruit pulp, shoots, leaves, and stems of coffee berries (*Rhamnus californica* and *R. illicifolia*), Eastwood's manzanita (*Arctostaphylos glandulosa*), California Christmas berry (*Heteromeles arbutifolia*) and grasses (Gramineae), representative of a vegetation type called chaparral. Rodents of the genera *Perognathus*, *Microtus*, *Neotoma*, and *Peromyscus*, and species such as *Sigmodon hispidus*, *Neotoma fuscipes*, and *Microtus californicus*, as well as rabbits of the genus *Sylvilagus*; gastropods and insects of the order Orthoptera, millipeds, and species of the genus *Stenopelmatus*; reptiles such as *Sceloporus occidentalis* (Wilson and Thomas 1999) and the hunting

tigra flying snake (*Spilotes pullatus*), green iguana (*Iguana iguana*) and the northern alligator lizard (*Gerrhonotus infernalis*; Peláez-Cruz *et al.* 2022). In Baja California, México, the species feeds on mammals, birds, reptiles, and invertebrates, as well as plants of the family Leguminosae (*Prosopis articulata* and *Lysyloma candida*), Cactaceae (*Pachycereus pringlei*, *Opuntia cholla* and *Ferocactus* spp.) and Gramineae, typical of the southern region.

In anthropized environments such as Maine, USA, where the gray fox has expanded its geographic distribution and competes for resources with other canids such as the red fox (*Vulpes vulpes*) and the coyote (*Canis latrans*), the gray fox consumes food of anthropogenic origin such as food waste (Masters and Maher 2022). In the Appalachians and foothills of Maryland, USA, in areas where it coexists with the red fox (*Vulpes vulpes*), the gray fox tends to consume plants such as persimmon fruits (*Diospyros virginiana*), corn (*Zea maize*), and insects (Hockman and Chapman 1983). In the dry season in the Petén area, Belize, the species consumes fruits and arthropods, and is a potential predator of other vertebrates (Novaro *et al.* 1995). Interaction with other canids such as coyotes and felines such as lynx (*Lynx rufus*) may lead the gray fox to expand or reduce food consumption; it was reported that the gray fox consumed ungulates and lagomorphs less frequently, and fruit consumption was higher in the rainy season (Neale and Sacks 2001). In tropical deciduous ecosystems where it interacts with coyotes, raccoons (*Procyon lotor*), and jaguarondis (*Herpailurus yagouaroundi*), the gray fox can diversify its diet and feed on other potential prey, although these have not been reported as part of its diet yet (Guerrero *et al.* 2002). In anthropized areas, gray foxes probably interact with domestic dogs more frequently, directly competing for common areas and resources, which influences the behavior, habitat use, and diet of gray foxes (Sánchez-Londoño 2014) and also involves a higher possibility of zoonotic disease transmission (Hughes and Macdonald 2013).

The negative ecological impact of domestic dogs on biodiversity is well known. However, reports are scarce in megadiverse countries such as México (Orduña-Villaseñor *et al.* 2023), and the effect of predation of and competition with domestic dogs on the native fauna has not yet been evaluated, despite the potential risk of transmission of zoonotic diseases. During a project to evaluate the impact of the use of dynamite to extract stone and limestone on wildlife populations and their habitats in a forested area in Córdoba, Veracruz, México, an unusual record of a gray fox preying on a domestic dog pup was obtained. Since predation events of this type had not previously been reported for this species in México, the objective of this note is to document an event of a gray fox (*Urocyon cinereoargenteus*) predating on a domestic dog pup (*Canis lupus familiaris*) in an anthropized tropical environment.

The project was carried out in the town of Cuauhtémoc, municipality of Córdoba, Veracruz, México (Figure 1), an area that shows different land use covers, including cultivations of sugarcane (*Saccharum officinarum*), coffee (*Coffea arabiga*), citrus (*Citrus lemon* and *C. sinensis*), palm (*Chamedorea tepejilote*), and banana (*Musa paradisiaca*) crops, secondary vegetation, urban settlements, and fragments of tropical forest (medium semi-evergreen forest) that have been isolated as a result of extraction operations in "Las Caleras" (forest areas where dynamite is used to fragment and extract limestone rock, machinery for its crushing to convert it into lime and gravel as a building material; Figure 2). The local climates in the municipality are semi-warm humid with abundant rainfall in summer (87 %), warm humid with abundant rainfall in summer (8 %), and semi-warm humid with rainfall throughout the year (5 %), with a temperature range of 18 to 24 °C and precipitation of 1,900 to 2,100 mm (Cuadernillos Municipales 2021).

Two camera traps were installed from August 2021 to May 2022, separated by 200 m to 500 m at a height of 40 cm and attached to a tree trunk; these cameras were set in photo and video mode and operated 24 hr per day. One camera trap was placed in an area encompassing the interaction spaces or ecotones between coffee crops, sugarcane plots and secondary vegetation, while the other was placed between tropical forest fragments and coffee, banana, and citrus crops. The camera traps were monitored every 15 days to review the photo and video captures. These were deposited for academic safeguarding at the Laboratorio de Bioinformática y Bioestadística de la Facultad de Ciencias Biológicas y Agropecuarias, Orizaba-Córdoba region, Universidad Veracruzana (project ID: mammals2024-Cuauhtémoc).

An event of a female gray fox carrying a domestic dog puppy in her snout was recorded on May 7, 2022 at 19:33 hr and 23 °C. The site where this event occurred is located approximately 800 m from the town of Cuauhtémoc, in the ecotone between the tropical forest and coffee, banana, and citrus fruit plantations. The video (available at https://youtu.be/6xrjQH6XndU) shows a gray fox carrying with its snout a puppy dog by the back. It leaves it on the ground, then grabs it by the belly, and heads towards a path that leads to another area covered by coffee, palm, and citrus crops (Figure 2a, 2b).

At least 13 species of wild carnivores have been reported worldwide preying on domestic dogs, including the gray wolf (*Canis lupus*), leopard (*Panthera pardus*), puma (*Puma concolor*), coyote (*C. latrans*), spotted hyena (*Crocuta crocuta*), tiger (*Panthera tigris altaica*), lion (*Panthera leo*), dingo (*Canis lupus dingo*), striped hyena (*Hyaena hyaena*), jaguar (*Panthera onca*), black-backed jackal (*Canis mesomelas*), polar bear (*Ursus maritimus*) and Asiatic black bear (*U. thibetanus*; Butler *et al.* 2014). In the Americas, there are several reports of dogs predated by wild carnivores, including gray wolf and cougar in the United States, coyote and polar bear in Canadá, cougar in Brazil and Venezuela (Butler *et al.* 2014) and jaguar in México (Carral-García *et al.* 2021). There are no previous records of predation of domestic dogs by the gray fox (Figure 2c). This report brings the list of wild carnivores that prey on dogs to 14 species worldwide.

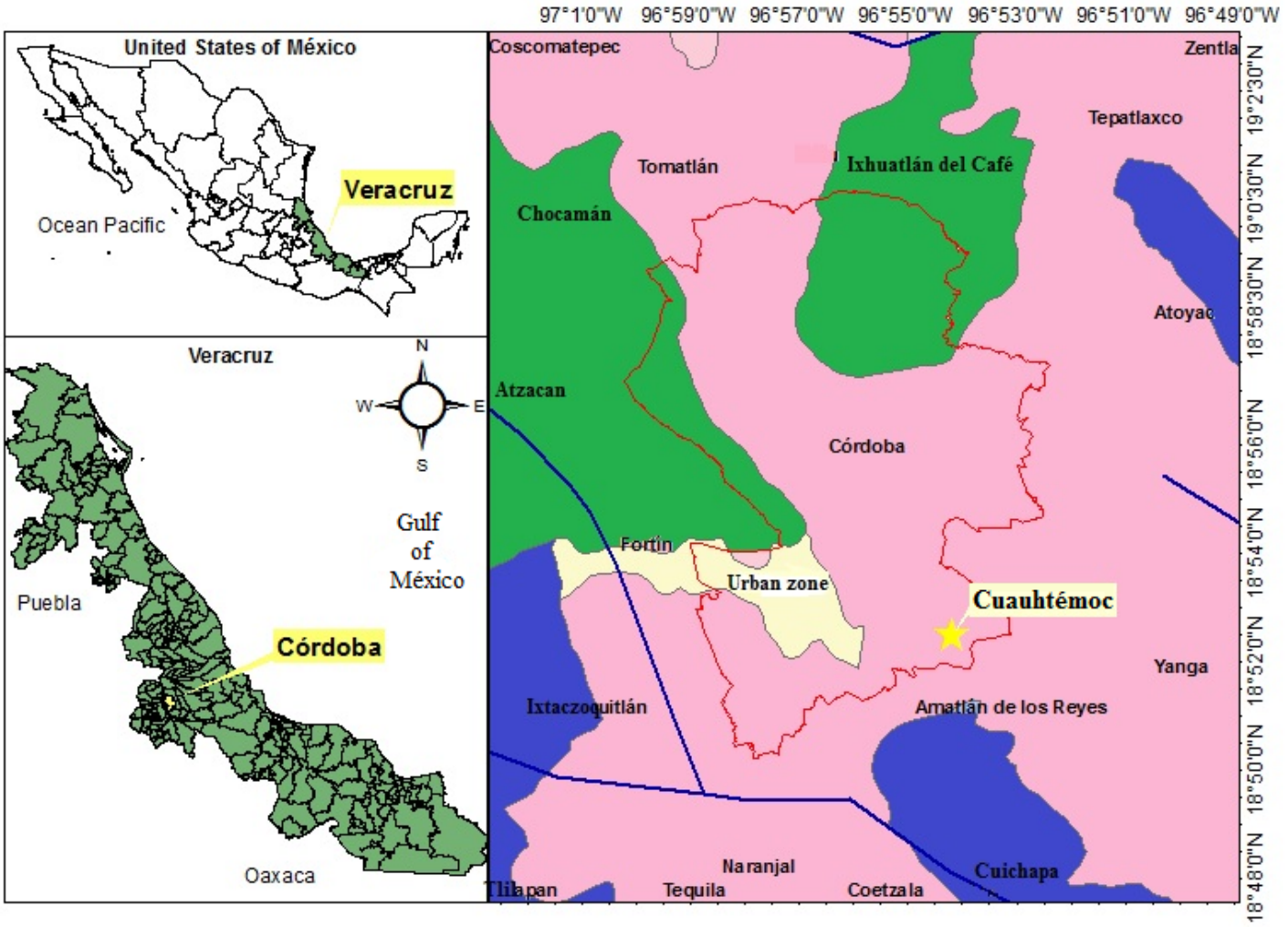

Figure 1. Geographic location of the Cuauhtémoc town (yellow star), municipality of Córdoba, Veracruz, México where predation of a domestic dog pup by a gray fox was recorded. The CONABIO types of land use and vegetation are shown as follows: mountain cloud forest is marked in green, rainfed agriculture in pink, and high evergreen forest in blue. The red line shows the limits of the municipality of Córdoba, and the blue line delineates the rivers. Constructed in ArcMap© version 10.8; 1 cm = 0.5 km.

In addition, this report increases our knowledge about the feeding ecology of the gray fox in anthropized environments. According to Butler *et al.* (2014), the consumption of domestic dogs by wild carnivores results from ecological pressure on the habitat and the scarcity of wild resources in times of low water availability and intraspecific competition with other mesopredators and domestic dogs. In the study area, there is photographic evidence of 1 male gray fox (Figure 2d) and 4 other domestic dogs coexisting in the same area, which probably increases the frequency of encounters between the gray fox and domestic dogs. In addition, competition with other mesopredators in the same locality, such as raccoons (*P. lotor*), coatis (*Nasua narica*), and skunks (Mephitidae), may increase the competition for food resources with domestic dogs. Food scarcity in the dry season (from January to May), together with environmental pressure, could force the gray fox to feed on other types of prey available in its habitat. This may be a consequence of the environmental impact generated by "Las Caleras", which probably decreases the availability and quality of food resources for the gray fox and other species. Future studies should increase the monitoring of locations in different anthropized environments during the 2 climatic seasons of the year.

Elsewhere in the Americas, for example, in the dry forest of San José-Pacasmayo, Perú, a high degree of overlap has been reported between the habitats of the domestic cat (*Felis silvestris catus*), the domestic dog (*C. l. familiaris*), the Sechura fox (*Lycalopex sechurae*), the grassland cat (*Leopardus garleppi*), and the white-backed skunk (*Conepatus semistriatus*), but no consumption events have been reported among these carnivores (Pereda-Sánchez *et al.* 2023). This challenges the event recorded in the anthropized area of the present study, so it is important to continue monitoring to identify the drivers that make the gray fox prey on domestic dog pups.

No evidence was found that the gray fox actually ate the domestic dog pup recorded in the photographs or videos, the debris near the camera trap, or the path that the gray fox followed with the dog pup. Therefore, we cannot be certain that the gray fox feeds on domestic dogs. It is necessary to continue biological monitoring to confirm this hypothesis and obtain additional information on the

Figure 2. Representative photographs of the ecotone between sugarcane, coffee, and banana crops and the medium evergreen forest (a) and the environment impacted by "Las Caleras" (b); photographs captured of a female gray fox (*Urocyon cinereoargenteus*) holding a dog pup (*Canis lupus familiaris*) in the snout (c) and a male gray fox (d) in an anthropized environment in Córdoba, Veracruz, México. Images available at rserna@uv.mx.

interaction between humans, domestic animals, and wildlife (Serna-Lagunes *et al.* 2022).

Information on the consumption of domestic dogs by gray foxes is also relevant from a medical perspective since in areas with anthropic interaction where domestic species reach agricultural zones and wildlife habitats, zoonotic diseases are more frequent (Coronel-Arellano *et al.* 2021). An issue in the interaction of domestic dogs with wildlife is the transmission of diseases and parasites, such as Lyme disease (*Borrelia burgdorferi*), rabies (Rhabdoviridae: *Lyssavirus*), infectious diseases by *Mycoplasma* spp. and *Rickettsia* spp., brucellosis (*Brucella* spp.), foot-and-mouth disease and cysticercosis, mange or scabies transmitted by mites (*Sarcoptes scabiei*), chewing louse (*Trichodectes canis*), and other species of nematodes, cestodes, protozoa, and ticks that cause zoonotic diseases (Valenzuela-Sánchez and Medina-Vogel 2014). Photo trapping provides relevant information for public health programs for human populations, the control of domestic dogs, and information on the interactions between wildlife and exotic and domestic carnivores (Gompper 2014).

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Literature cited

Arnaud, G., and M. Acevedo. 1990. Hábitos alimenticios de la zorra gris *Urocyon cinereoargenteus* (Carnivora: Canidae) en la región meridional de Baja California, México. Revista de Biología Tropical 38:497-500.

Butler, J. R. A., *et al*. 2014. Dog eat dog, cat eat dog: social-ecological dimensions of dog predation by wild carnivores. Pp. 117-143 *in* Free-Ranging Dogs and Wildlife Conservation (Gompper, M. E., ed.). Oxford University Press. New York, U.S.A.

Carral-García, M., *et al*. 2021. Dog predation by jaguars in a tourist town on the Mexican Caribbean. Neotropical Biology and Conservation 16:461-474.

Coronel-Arellano, H., *et al*. 2021. Raining feral cats and dogs? Implications for the conservation of medium-sized wild mammals in an urban protected area. Urban Ecosystems 24:83-94.

Cuadernillos municipales. 2021. Córdoba, Veracruz. Sistema de Información Estadística y Geográfica del Estado de Veracruz de Ignacio de la Llave. Comité Estatal de Información Estadística y Geográfica de Veracruz. Gobierno del Estado de Veracruz. Veracruz, México. http://ceieg.veracruz.gob.mx/2023/08/31/cuadernillos-municipales-2023/

Gompper, M. E. (ed.). 2014. Free-ranging dogs and wildlife conservation. Oxford University Press. New York, U.S.A.

Guerrero, S., *et al*. 2002. Dieta y nicho de alimentación del coyote, zorra gris, mapache y jaguarundi en un bosque tropical caducifolio de la costa sur del estado de Jalisco, México. Acta Zoológica Mexicana (nueva serie) 86:119-137.

Hockman, J. G., and J. A. Chapman. 1983. Comparative feeding habits of red foxes (*Vulpes vulpes*) and gray foxes (*Urocyon cinereoargenteus*) in Maryland. American Midland Naturalist 110:276-285.

Hughes, J., and D. W. Macdonald. 2013. A review of the interactions between free-roaming domestic dogs and wildlife. Biological Conservation 157:341-351.

Masters, H. M., and C. R. Maher. 2022. Diet reveals potential for competition and coexistence among coyotes (*Canis latrans*), red foxes (*Vulpes vulpes*), and gray foxes (*Urocyon cinereoargenteus*). Canadian Journal of Zoology 100:90-97.

Metz, L., *et al*. 2023. Unravelling the trophic guild structure of Neotropical Carnivora: diet specializations, spatial variation and phylogenetic drivers. Mammal Review 54:13-29.

Neale, J. C., and B. N. Sacks. 2001. Food habits and space use of gray foxes in relation to sympatric coyotes and bobcats. Canadian Journal of Zoology 79:1794-1800.

Novaro, A. J., *et al*. 1995. Dry-season food habits of the gray fox (*Urocyon cinereoargenteus fraterculus*) in the Belizean Peten. Mammalia 59:19-24.

Orduña-Villaseñor, M., *et al*. 2023. Tus mejores amigos pueden ser tus peores enemigos: impactos de los gatos y perros domésticos en países megadiversos. Revista Mexicana de Biodiversidad 94:e944850-e944850.

Peláez-Cruz, O., *et al*. 2022. Potential predation on the tiger rat snake *Spilotes pullatus* by the gray fox *Urocyon cinereoargenteus*. Therya Notes 3:176-179.

Pereda-Sánchez, A., *et al*. 2023. Patrones de actividad y superposición temporal entre carnívoros nativos y exóticos en remanentes sureños de bosque seco tumbesino en Perú. Ecología Austral 33:507-515.

Sánchez-Londoño, J. D. 2014. Uso compartido de una letrina por el zorro *Cerdocyon thous* y perros domésticos *Canis familiaris* (Carnivora: Canidae) en una zona periurbana del Valle de Aburrá (Antioquia, Colombia). Mammalogy Notes 1:12-14.

Serna-Lagunes, R., *et al*. 2022. Habitat use by gray fox (*Urocyon cinereoargenteus*, Carnivora: Canidae) in an anthropized tropical ecosystem. Tropical and Subtropical Agroecosystems 25:1-12.

Valenzuela-Sánchez, A., and G. Medina-Vogel. 2014. Importancia de las enfermedades infecciosas para la conservación de la fauna silvestre amenazada de Chile. Gayana (Concepción) 78:57-69.

Villalobos-Escalante, A., *et al*. 2014. Dieta de la zorra gris *Urocyon cinereoargenteus* y su contribución a la dispersión de semillas en la costa de Oaxaca, México. Therya 5:355-363.

Viteri-Pasch, M. V., and G. A. Mármol-Kattán. 2019. Dieta de la zorra gris (*Urocyon cinereoargenteus*) y su posible importancia en la dispersión de semillas de ciprés (*Juniperus comitana*) en Huehuetenango, Guatemala. Revista Mexicana de Mastozoología (Nueva Época) 9:66-71.

Wilson, J. A., and B. Thomas. 1999. Diet and seed dispersal efficiency of the gray fox (*Urocyon cinereoargenteus*) in chaparral. Bulletin Southern California Academy of Sciences 98:119-126.

Wong-Smer, J. R., *et al*. 2022. Dieta y abundancia relativa de la zorra gris *Urocyon cinereoargenteus* (Carnivora: Canidae) en el Área Natural Protegida Altas Cumbres, Tamaulipas, México. Acta Zoológica Mexicana (nueva serie) 38:1-16.

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