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Scientific articles

**Fauna feral asociada a la selva mediana de Acapulco de Juárez,
Guerrero**

***Feral fauna associated with the medium forest of Acapulco de Juárez,
Guerrero***

***Fauna selvagem associada à selva de médio porte de Acapulco de Juárez,
Guerrero***

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Resumen

La presencia de fauna feral en ecosistemas conservados causa impactos negativos y aunado a presiones a las que está sometida la flora y la fauna nativa, tales como incendios, fragmentación, cambio de uso de suelo, repercuten negativamente en la distribución y densidad de las especies, así como la pérdida de las mismas, mientras que la fauna puede ser o estar sujeta a procesos de desplazamiento o extinción de manera local. La finalidad del presente estudio es identificar las especies de fauna feral y sus hábitos en una porción de selva mediana en Acapulco, Guerrero. Se ubicaron y georreferenciaron ocho cámaras trampa, en un fragmento de selva media con una superficie de ocho hectáreas del periodo marzo del 2022 a enero 2023. Del muestreo se obtuvieron 1184 fotografías, en donde se observaron dos especies de mamíferos terrestres ferales y 5 de fauna nativa. Las especies más abundantes fueron *Didelphis virginiana* ($n = 22$), *Dasyopus novemcinctus* ($n = 12$), *Canis lupus familiaris* ($n=10$), *Felis silvestris catus* ($n=9$) y las poco abundantes fueron *Procyon lotor* ($n = 3$) y *Tamandua mexicana* ($n = 1$); se evidenció que las especies ferales y nativas ambas tienen hábitos nocturnos crepusculares, por lo que si no coinciden utilizan los mismos senderos, lo que aumenta la posibilidad de encuentros. Por ello, se requieren actividades de control, contención para la fauna feral ya que el área del proyecto colinda con áreas naturales protegidas.

Palabras clave: cámaras trampa, control de fauna, especies introducidas.

Abstract

The presence of feral fauna in protected ecosystems has been demonstrated to exert a deleterious influence on the distribution and density of species, as well as their loss. This is occurring concurrently with the pressures to which native flora and fauna are subjected, including fires, fragmentation, and changes in land use. The fauna may also be or become subject to displacement or extinction processes in a localized manner. The objective of this study was to identify the wildlife species present and to gain insight into their habits in a portion of the mid-successional rainforest of Acapulco, Guerrero. Eight camera traps were strategically positioned and georeferenced within a 8-hectare fragment of mid-successional forest between March 2022 and January 2023. The sampling yielded 1,184 photographs in which two species of feral terrestrial mammals and five species of native fauna were observed. The most abundant species were *Didelphis virginiana* ($n=22$), *Dasyopus novemcinctus* ($n=12$), *Canis lupus familiaris* ($n=10$), *Felis silvestris catus* ($n=9$), and the least



abundant species. Additionally, *Procyon lotor* (n=3) and *Tamandua mexicana* (n=1) were observed. It was evident that both feral and native species exhibited crepuscular nocturnal habits, indicating that when they do not coincide, they utilize the same trails, thereby increasing the possibility of encounters. Therefore, control and containment measures for feral fauna are necessary, given that the project area is adjacent to protected natural areas.

Keywords: camera traps, introduced species, wildlife control.

Resumo

A presença de fauna silvestre em ecossistemas conservados causa impactos negativos e, aliada às pressões a que estão submetidas a flora e a fauna nativas, como incêndios, fragmentação, mudança no uso do solo, impactam negativamente na distribuição e densidade das espécies, como bem como a sua perda, enquanto a fauna pode estar ou estar sujeita a processos locais de deslocamento ou extinção. O objetivo deste estudo é identificar as espécies da fauna silvestre e seus hábitos em uma porção de selva de médio porte em Acapulco, Guerrero. Oito armadilhas fotográficas foram localizadas e georreferenciadas em um fragmento de floresta média com área de oito hectares no período de março de 2022 a janeiro de 2023. Da amostragem foram obtidas 1.184 fotografias, onde foram encontradas duas espécies de mamíferos terrestres silvestres e 5 de fauna. foram observados. As espécies mais abundantes foram *Didelphis virginiana* (n = 22), *Dasyopus novemcinctus* (n = 12), *Canis lupus familiaris* (n = 10), *Felis silvestris catus* (n = 9) e as menos abundantes foram *Procyon lotor* (n = 3) e Tamanduá Mexicano (n = 1); Ficou evidente que ambas as espécies silvestres e nativas possuem hábitos noturnos crepusculares, portanto, caso não coincidam, utilizam as mesmas trilhas, o que aumenta a possibilidade de encontros. Portanto, são necessárias atividades de controle e contenção para a fauna selvagem, uma vez que a área do projeto faz fronteira com áreas naturais protegidas.

Palavras-chave: armadilhas fotográficas, controle de fauna, espécies introduzidas.

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Introduction

The term feral fauna refers to domestic animals that for different reasons are abandoned or have escaped from their owners and have adopted wild behavior, so when this fauna returns to conserved ecosystems it generates negative effects, all of this happens when they move away from human contact. returning to fierce behavior (Cruz-Reyes, 2009). These animals can represent a danger to wildlife, since they compete for resources, and can prey on native species, in addition to transmitting diseases (Carloza and Morales, 2019). Some examples of feral fauna are dogs, cats, pigs and horses; some of these with high reproductive rates, which in many cases are impossible to control, in addition to having parasites, viruses, bacteria that cause potentially harmful diseases for some other species, including humans (Haro Tirado *et al.*, 2023).

This domestic fauna that later returned to the ecosystems is known as feral or semiferal fauna, the latter being those animals that maintain some type of relationship with humans, but in both cases they feed and reproduce in nature (Jiménez-Alvarado *et al.* , 2017).

These animals can be grouped or solitary, and live near urban or rural areas. Examples of this are stray dogs, domestic cats, parakeets and pigeons. All this feral or semiferal fauna has negative impacts on ecosystems that can cause ecological imbalances, deteriorating biodiversity and the relationships of food networks (Romo and Hernández-Pérez, 2021).

This problem is framed within the global context, it is considered in one of the Sustainable Development Goals established by the United Nations Organization (goal 15), life of terrestrial ecosystems, which aims to conserve and face the crisis due to the loss of biodiversity and conserve the environmental services provided by ecosystems as a whole (Smith *et al.*, 2021).

Faced with the threat of the loss of ecosystems and the extinction of species (local, regional or global), this process can be accelerated, since different factors participate such as change in land use, fires, feral fauna, etc., (Maldonado , 2018). This accumulation of impacts results in the reduction and fragmentation of distribution areas, loss of species richness and density (García del Valle *et al.*, 2005).

One way of knowing the environment and the processes that occur in it is the study of biological diversity through the use of camera traps. Recently, these studies have gained relevance in Mexico and the state of Guerrero, since they are not very invasive. . There are some references to research using phototrapping for the southeast of the country and for

Guerrero, with the latter being reduced or limited (Mandujano, 2019), some of these studies carried out in the state of Guerrero, is the one carried out by Briseño-Hernández and Naranjo (2021), in Chilpancingo, finding eight species of mammals; In the same way, another study for Guerrero was carried out in eight municipalities in different landscapes, reporting 19 species of mammals (Ruiz-Gutiérrez *et al.*, 2020), however for Acapulco and areas close to the project, the investigations are few, being the carried out by Marín *et al.*, (2016), the closest reference, taking into account that in all cases no mention is made of the feral fauna. Based on the above, the objective was to identify the species of feral fauna and their habits in a portion of medium-sized jungle located in Acapulco, Guerrero.

Materials and methods

Study area

The study was carried out in the area occupied by the Acapulco Botanical Garden, which is located in the southern part of the state of Guerrero, Mexico. Its physiography responds to a position in the Sierra Madre del Sur in a portion of the low mountains, with a rugged landscape, a warm subhumid climate with rain in summer, medium humidity, the type of vegetation corresponds to medium-sized subevergreen forest (INEGI, 2010).

The study area is characterized by bordering urbanized or semi-urbanized areas, to the north with the Cumbres de Llano Largo neighborhood and El Veladero National Park, to the south with the La Cima Residencial Fractionation, to the east with Loyola University and the Bicentenario State Park and to the west with the Cumbres de Llano Largo Colony (Figures 1 and 2). The records of the photocollection are deposited on the inaturalist.org platform.

The monitoring-research was carried out in the period from March 2022 to January 2023, on an area of eight hectares, within which eight camera traps were placed which were georeferenced (Table 1), (Figure 2).

Records of wild terrestrial vertebrates were made and identified using automatic camera traps (digital with infrared motion sensor, Kudeback brand). Each camera trap was programmed to take a photograph for each detection, with an interval of 30 seconds in addition to a five-second video. The cameras were located in places where it was possible to recognize the passage of native or feral fauna, such as gaps or natural paths where vertebrates travel; bait was not used at any monitoring point.

In order to use the records in a systematized manner, the images captured by the camera traps were considered, which had to be separated by more than 24 hours to guarantee

independence (Vásquez-Palacios *et al.* , 2019; Monroy-Vilchis *et al.* , 2011). The taxonomic determination and nomenclature was carried out based on Ceballos and Oliva (2005) and Serna-Lagunes *et al.*, (2023).

To describe the behavior of the feral fauna, the Activity Patterns were determined for the species with at least 9 observations. The number of photographs was grouped in intervals of one hour and to be located within four periods: a) daytime (08:01-17:59); b) nocturnal (20:01-05:59), c) crepuscular (06:00-08:00 and 18:00-20:00) and d) cathemeral (species without a clear pattern) (Monroy-Vilchis *et al.* , 2011), consider that the study mentions the habits or patterns of all the species observed.

The Relative Abundance Index (RAI) was calculated for each species (Jenks *et al.*, 2011):

$$IAR = C/EM * 1000 \text{ trap days}$$

Where: C = Captures or photographed events.

EM = Sampling Effort (No. of cameras * days of monitoring) Seasonal or Total.

1000 cheat days (Standard Unit).

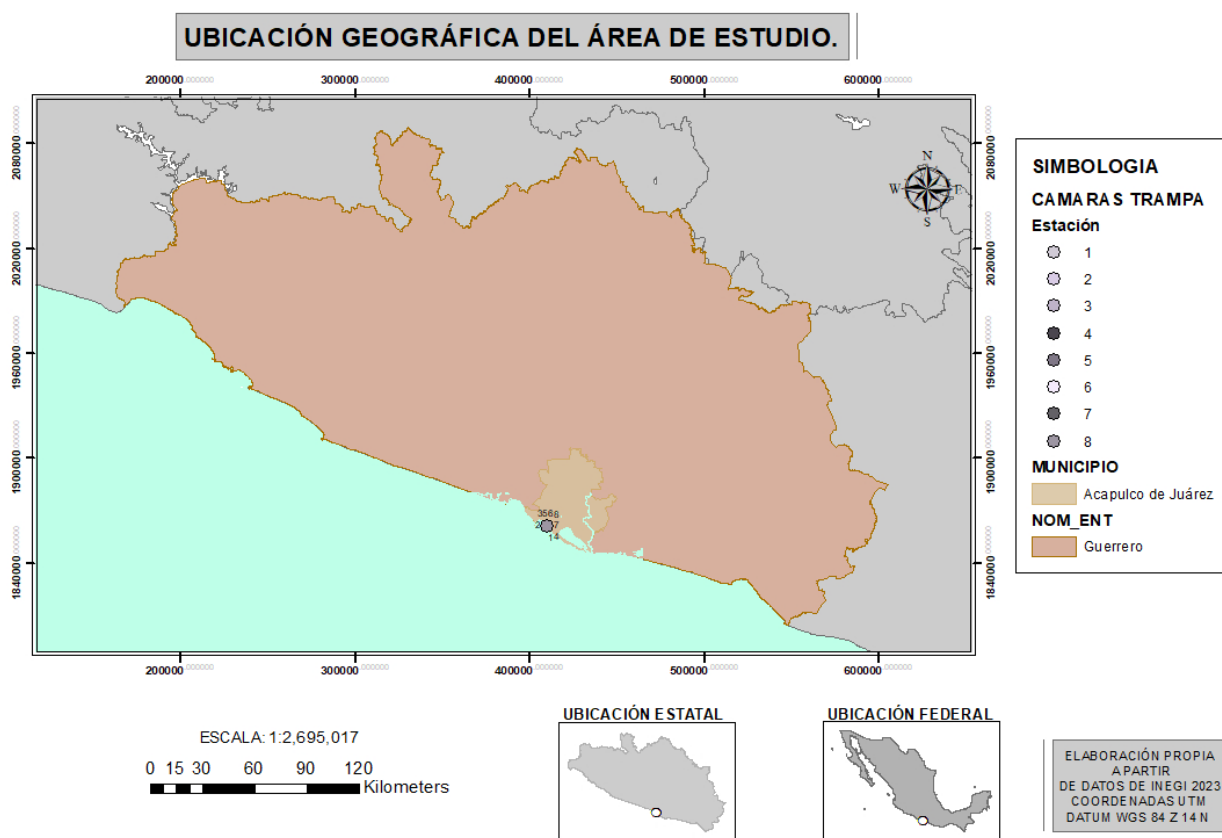
Only independent photographs were taken for the calculation of this parameter. Although the study focuses on feral fauna, all observed species were verified, their category in the Mexican standard NOM-059-SEMARNAT-2010 and in the International Union for Conservation of Nature [IUCN] (2020).

Table 1.- Geographic location of the camera traps, UTM datum coordinates WGS 1984. ZN.

Place	x	AND
1	409889	1860637
2	409876	1860665
3	409853	1860595
4	409759	1860616
5	409836	1860559
6	409797	1860558
7	409724	1860578
8	409812	1860496

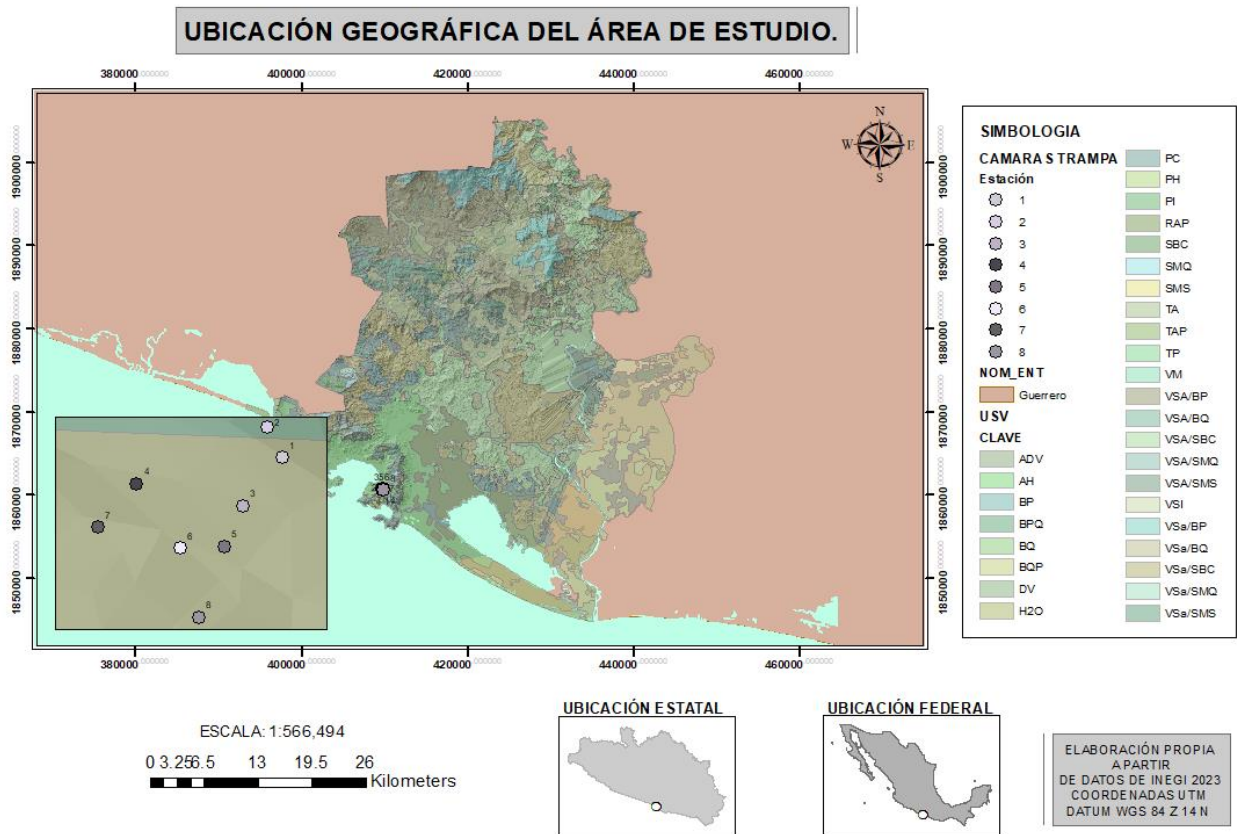
Source: own elaboration.

Figure 1 . Regional location of the study area.



Source: own elaboration.

Figure 2 . Location of camera traps or sampling sites.



Source: own elaboration.

Results

From monitoring, there is a sampling effort for the eight camera traps of 2920 trap days, with 1184 photographs, but only 62 independent photographic records for all species; Five species of native terrestrial mammals and two of feral or feral terrestrial mammals (cat and dog) were observed (Figure 4), which are grouped into six families (Table 2). Two species of native mammals are reported, the most abundant being *Didelphis virginiana* (IAR = 7.53, $n = 22$) and *Dasyurus novemcinctus* (IAR = 4.10, $n = 12$), followed by the feral mammals *Canis lupus familiaris* (IAR = 3.42, $n = 10$) and *Felis silvestris catus* (IAR = 3.08, $n = 9$), and less abundant are *Procyon lotor* (IAR = 1.02, $n = 3$) and *Tamandua mexicana* (IAR = 0.34, $n = 1$) (Table 3), (Figure 3).

Table 2 . Feral mammals and species found. Pr: special protection, Lc: least concern .

Order	Family	Species	common name	NOM-059-SEMARNAT-2010	IUCN
Didelphimorphia	Didelphidae	<i>Didelphis virginiana</i> Kerr, 1793	Tlacuache		Lc
Carnivore	Procyonidae	<i>Nasua narica</i> (Linnaeus, 1766)	Badger		Lc
		<i>Procyon lotor</i> (Linnaeus, 1758)	Raccoon		Lc
	Felidae	<i>Felis silvestris catus</i> *	common cat		
	Canidae	<i>Canis lupus familiaris</i> *	Dog		
Cingulata	Dasypodidae	<i>Dasypus novemcinctus</i> Linnaeus, 1758	Armadillo		Lc
Hairy	Myrmecophagidae	<i>Mexican tamandua</i> (Saussure, 1860)	Ant-eater	Pr	Lc

Source: own elaboration.

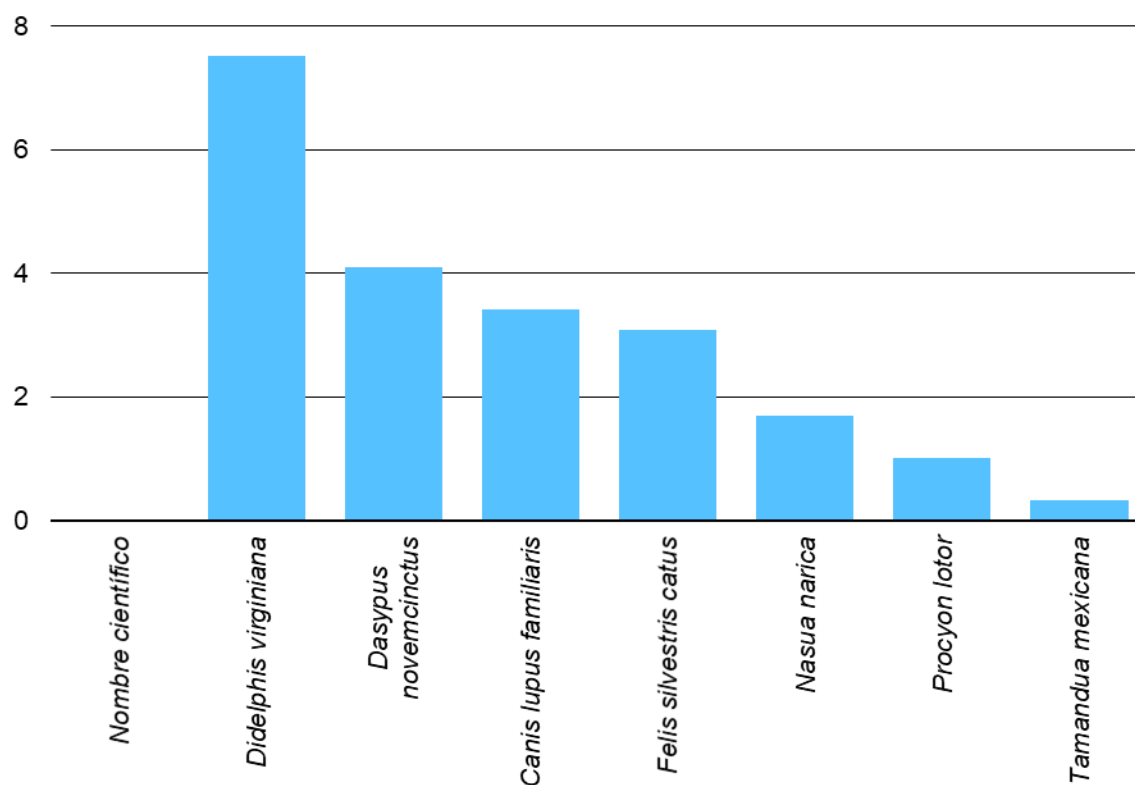
The activity patterns were established for the species found (Table 4), for few of the feral species *Felis silvestris catus* and *Canis lupus familiaris* present nocturnal *habits or patterns* 20:01-05:59-crepuscular 18:00-20:00, *Dasypus novemcinctus* and *Didelphis virginiana* were classified as nocturnal 20:01-05:59, *Tamandua mexicana* is crepuscular (18:00-20:00) and with crepuscular/nocturnal activities (nocturnal 20:01-05:59- crepuscular 18:00-20:00) *Nasua narica*, and *Procyon lotor*. With this, the feral fauna presents activity patterns that overlap with the native fauna. The recorded fauna presents nocturnal and crepuscular patterns, these results being similar to those reported by Hernández-Pérez (2015) and Albanesi *et al.* (2016).

Table 3. Relative abundance values (RAI).

scientific name	common name	Number of records	IAR
<i>Didelphis virginiana</i>	Tlacuache	22	7.53
<i>Dasypus novemcinctus</i>	Armadillo	12	4.1
<i>Canis lupus familiaris</i>	Dog	10	3.42
<i>Felis silvestris catus</i>	common cat	9	3.08
<i>nasua nose</i>	Badger	5	1.71
<i>Procyon lotor</i>	Raccoon	3	1.02
<i>Mexican tamandua</i>	Ant-eater	1	0.34

Source: own elaboration.

Figure 3 . Distribution of relative abundance indices.



Source: own elaboration.

Discussion

indices infer pressures exerted by feral fauna on native fauna, also considering the activities carried out in the surrounding areas such as construction, presence of roads that affect and habitat fragmentation. This has negative impacts on the richness and abundance of local species, since the areas surrounding the studied area are urbanized, creating an island effect in areas with conserved vegetation and affecting native fauna (McKinney, 2008). Likewise, it has been shown that feral fauna and the presence of exotic species are one of the main components that allow the initiation of strong imbalances in ecosystems, which can lead to the extinction, reduction or displacement of native species, with those that are more vulnerable. They are in risk categories (Orduña-Villaseñor, *et al.*, 2023). The coexistence between native fauna and feral fauna is confirmed, mainly observing that they converge in the nocturnal-twilight activity pattern.

The largest number of records was obtained between 18:00-20:00 and 20:01-05:59, this in congruence with the habits of Neotropical mammals, this coincides with what was reported with a study carried out in the Chimalapas (63 %) where mammals are mostly nocturnal/crepuscular (Srbek-Araujo and García-Chiarello, 2005).

The records of the five species of mammals native to the study area had already been reported (Espinosa-Martínez *et al.*, 2017 and Marín *et al.*, (2016), this indicates a low diversity, but it is still conserved, without ceasing to be relevant, since species such as the anteater are important since it is listed in Mexican regulations, with This the presence of feral fauna, hunting activities, people who live in the area and roads, surely affect the native fauna. Regarding abundance, the organisms that present the highest values are for the armadillo (*Dasybus novemcinctus*) and the opossum (*Didelphis virginiana*) (Figure 5), for the feral fauna they are for the dog (*Canis lupus familiaris*) and the cat (*Felis silvestris catus*) (Figure 4), the first two species that have already been reported in the area, some of these are used or affected by the inhabitants of the area (Espinoza-Martínez *et al.*, 2017).

Figure 4. Feral terrestrial mammals, first two images *Canis lupus familiaris* (dog) and the third image *Felis silvestris catus* (cat).



Source: own elaboration

Regarding the anteater (*Tamandua mexicana*), it is a species subject to "special protection" according to Mexican laws (NOM-059-SEMARNAT-2010); this species is slow-moving and was observed with a single image which was classified in a nocturnal pattern, its activities converging with those of feral fauna.

Figure 5. Native mammals in the study area in descending order: *Didelphis virginiana*, *Tamandua mexicana* and *Procyon lotor* .



Source: own elaboration.

Native species with nocturnal or nocturnal-crepuscular habits (*Dasybus novemcintus* Linnaeus, *Didelphis virginiana*, *Nasua narica* and *Procyon lotor*), have to do or are related to avoiding or reducing the probability of contacts with predators, including humans; However, the feral fauna in the study area presents similar habits, considering that they use the same trails and at some point encounters between native and feral fauna occur.

Thus, activity schedules and common transit paths for native and feral species (*Felis silvestris catus* and *Canis lupus familiaris*) reaffirm the risk of predation (Table 4; Figure 4).

Table 4 . Activity patterns of the reported species.

scientific name	common name	No. of photographs	Observations on the pattern	Schedules	Activity patterns
<i>Dasypos novemcinctus</i>	Armadillo	12	11 Nocturnal 1 Twilight	20:01-05:59	Night
<i>Mexican tamandua</i>	Ant-eater	1	1 Twilight	18:00-20:00	Twilight
<i>Didelphis virginiana</i>	Tlacuache	22	21 Nocturnal 1 Twilight	20:01-05:59	Night
<i>nasua nose</i>	Badger	5	3 Twilight 2 Nocturnal	18:00-20:00 - 20:01-05:59	Twilight/Nocturnal
<i>Procyon lotor</i>	Raccoon	3	2 Nocturnal 1 Twilight	18:00-20:00 - 20:01-05:59	Twilight/Nocturnal
<i>Felis sylvestris catus</i>	Common Cat	9	6 Nocturnal 3 Crepuscular	18:00-20:00 - 20:01-05:59	Night/Twilight
<i>Canis lupus familiaris</i>	Dog	10	3 Twilight 7 Nocturnal	18:00-20:00 - 20:01-05:60	Night/Twilight

Source: own elaboration.

Conclusion

The presence of feral or feral species has nocturnal-crepuscular habits which coincide with those of the native fauna. Feral species are among the four with the highest number of records and relative abundance.

The impacts of feral fauna are predation of native fauna, transmission of diseases (zoonoses), which is why care programs are required to control this, where environmental education, sterilization, vaccines and animal care are considered. fauna before being feral. In all cases, for the control of feral fauna, the applicable federal, state and municipal legislation must be considered.

For feral or feral species, exclusion or containment actions should be considered to avoid encounters with native fauna. Although the number of species is low for the study area,

it is recommended to continue evaluating feral species in the long term to determine the future impact.

Future lines of research

From the evidence obtained, various questions have arisen that can be considered in future studies. One of the points to be considered will be to know in a timely manner the possible encounters between feral fauna and native fauna, in order to quantify the impacts on the native fauna, also, to know the size and location of populations of feral fauna to have as a basis or reference in future studies.

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