Nature Conservation

Nature Conservation 53: 279–295 (2023)
DOI: 10.3897/natureconservation.53.104135

Research Article

Analysis of the effects of habitat characteristics, human disturbance and prey on felids presence using long-term community monitoring information

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OPEN ACCESS

Academic editor: Cássio Cardoso Pereira
Received: 27 March 2023
Accepted: 28 September 2023
Published: 17 October 2023

ZooBank: https://zoobank.org/5EF6E1BB-8EDB-4DA1-87DA-49CB44D98927

Citation: Sosa-López JR, Díaz Bernal NN, Padilla E, Briones-Salas M (2023) Analysis of the effects of habitat characteristics, human disturbance and prey on felids presence using long-term community monitoring information. Nature Conservation 53: 279–295. https://doi.org/10.3897/natureconservation.53.104135

Abstract

Predator species are essential for ecosystems as they maintain the ecological integrity of the habitat. Particularly, felids populations have declined globally due to their sensitivity to habitat disturbances. Nevertheless, in Mexico, there are areas protected by indigenous communities to preserve a portion of their territory, benefiting multiple species, including felids. Although the National Commission of Natural Protected Areas of Mexico sponsors a long-term national-wide communal monitoring programme using camera traps, there is not a systematic analysis of the information generated by the programme. We assessed the occurrence of three felids species known to occur in a Zapotec indigenous community conservation area in Oaxaca, Mexico. Specifically, we evaluated how habitat characteristics, human disturbance and prey influence felids' occurrence across the protected area. None of the variables explained better than the null model the proportion of sites used by Pumas (*Puma concolor*). Bobcats and Margays favour areas with medium-sized prey. Our study shows the importance of community-based monitoring and information systems (CBMIS) for identifying communal reserve characteristics that contribute to the occupation of carnivores. Further, our results also suggest that management should consider the habitat requirements of felids´ prey. By understanding wildlife habitat use, communal authorities could improve sustainable forest management within the reserves.

Key words: biodiversity, CBMIS, conservation, co-occurrence, GLMM, Oaxaca

Introduction

The combination of natural resources and environmental conditions where organisms can reproduce and survive defines a species´ suitable habitat (Morrison et al. 1992). Habitat loss, through anthropogenic activities, affects the reproduction and survival of some species, impacting the diversity of ecosystems. The worldwide vertebrate populations declined by one-third between 1970 and 2006, the Tropics being the most affected ecosystem (CBD 2020). Estimations suggest that 24% of all mammals at extinction risk are mainly due

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to modifying habitats caused by human activities (PBD 2001). Within mammals, felids are indicators of the conservation status of an ecosystem (Boitani 2001). Most species of felids are susceptible to alterations in their habitat, particularly to changes triggered by anthropogenic activities (Cramer and Portier 2001; Ordiz et al. 2021), for example, roads (Basille et al. 2013) and habitat loss and fragmentation (Zanin et al. 2015). Thus, by protecting felids, other species habiting the same areas would benefit, maintaining the ecological integrity of these areas (Scognamillo et al. 2003; Ripple et al. 2014).

In Mexico, there are six species of felids (Puma, *Puma concolor*; Jaguarundi, *Herpailurus yagouaroundi*; Bobcat, *Lynx rufus*; Ocelot, *Leopardus pardalis*; Jaguar, *Panthera onca*; and Margays, *Leopardus wiedii*). Particularly, Pumas, Bobcats and Margays have been little studied. Studies of habitat use and abundance in pumas stand out (Lira and Naranjo 2003; Estrada 2008; Monroy et al. 2009; Rodríguez-Soto et al. 2013; Prude and Cain 2021), in Bobcats (Monroy-Vilchis and Velázquez 2002; Burton et al. 2003; Elizalde et al. 2012; Espinosa-Flores and López-González 2017; Flores-Morales et al. 2019; Lavariega et al. 2022) and in Margays (Carvajal et al. 2012; Pérez-Irineo et al. 2017). All six species of felids that live in Mexico have been recorded in areas protected by indigenous communities, mainly in the Mexican tropics (Briones-Salas et al. 2016).

Since 2008, the Mexican government officially recognised some of these areas through a protection scheme called Voluntary Destined Areas for Conservation (ADVC by its Spanish acronym). The ADVCs must be designated voluntarily by the communities or private owners to get institutional recognition (Elizondo and López-Merlín 2009). This scheme allows indigenous and peasant communities to get involved in ecosystem conservation programmes and the sustainable use of their natural resources. These spaces are managed by the inhabitants through social consensus, which establishes rules of use, including restrictions on hunting, looting plant, species and removing plant cover for agricultural and livestock activities (Anta-Fonseca & Mondragón-Galicia 2006). ADVCs cover variable extensions of forests and aim to protect the most fragile natural environments.

Within the ADVCs, one essential activity is wildlife monitoring, which is carried out by locals called “monitores comunitarios” (community monitors). Some authors have questioned this activity for not following a systematised monitoring scheme or lacking analysis of the information generated (e.g. Burton (2012); Méndez-López et al. (2015)). However, there are examples of success in biodiversity monitoring and conservation activities in indigenous conservation areas, either directly or with the support of other actors, such as technicians, academics and government institutions (e.g. DeCaro and Stokes (2008); Lavariega et al. (2020)). Most of these achievements are mainly due to the active participation of community monitors (Méndez-López et al. 2015).

The National Commission of Natural Protected Areas of Mexico (CONANP by its Spanish acronym) sponsors a national-wide community monitoring programme to increase the knowledge of biodiversity in various country regions by fomenting the use of camera traps to detect wildlife. In Oaxaca, southern Mexico, this programme has been used successfully to assess the status of Jaguar populations (Lavariega et al. 2020), the herpetofauna (Simón-Salvador et al. 2021) and the study of birds in the Chinantla Region (Noria-Sánchez et al. 2015). From the governmental level, there is no difference in the management regime between community monitoring in the ADVCs and monitoring in the ANPs. The monitoring that is carried out in the ANPs of Oaxaca of the Sierra Juárez Mixteca direction (including the ADVC that attends) is carried out with the training, economic support, equipment and accompaniment of CONANP technicians. The results are discussed with the community authorities and sometimes in assemblies. For instance, during the last 10 years, communal monitors at the Voluntary Conservation Area La Cruz-Corral de Piedra in San Pablo Etla have been using camera traps to understand habitat use in three felid species found in the reserve (i.e. Pumas, Bobcats and Margays). However, despite a great deal of information generated by the community monitoring programme, there is no systematic approach to analyse the data. Furthermore, due to the limited number of studies carried out in Mexico and Latin America, little is known about habitat use, prey and conflicts with humans in Pumas, Bobcats and Margay.

Here, we analysed the information generated by a long-term wildlife monitoring programme at an ADVC protected by a Zapotec indigenous community to understand habitat use in three felids species (Pumas, Bobcats and Margays). The objective of this study was to evaluate the effect of habitat characteristics, human disturbance and the presence of prey which influence the occurrence of felines in the protected area. We used GLMM models to assess the association between landscape variables related to habitat characteristics, human disturbances and the presence of prey on felids occurrence within the protected area. We hypothesised that felids' occurrence would be explained by habitat characteristics and prey presence (e.g. Nowell and Jackson (1996); Laundré and Hernández (2010)) and limited by pressures related to human settlements or roads (e.g. Angelieri et al. (2016); Horn et al. (2020); Mayer et al. (2022)). We anticipate that the acquired results will be instrumental in aiding decision-making processes by indigenous communities concerning the preservation of the biodiversity they safeguard.

Materials and methods

Study area and community monitors

We carried out the study at the Voluntary Conservation Area La Cruz-Corral de Piedra in San Pablo Etla, Oaxaca, Mexico, in a Zapotec ethnic group (17°07' and 17°12'N, 96°39' and 96°48'W; Fig. 1). The reserve is in a mountainous area of the Sierra Madre de Oaxaca, its area is 23.35 km^2, its height ranges from 1,500 to 3,300 m a.s.l., it has an average annual temperature of 17.8 °C and an average annual rainfall of 1022 mm. The dominant vegetation types are pine forest: 5.5 km^2, pine-oak forest: 15.56 km^2 and oak forest: 2.22 km^2 (Ojeda-Lavariega et al. 2019). CONANP technicians trained 12 community members in three workshops in 2013, 2016 and 2019. During the workshops, the technicians and communal monitors established the objectives and designed the monitoring programme. The community monitors have been installing the trap cameras periodically with the help of CONANP technicians since 2013.

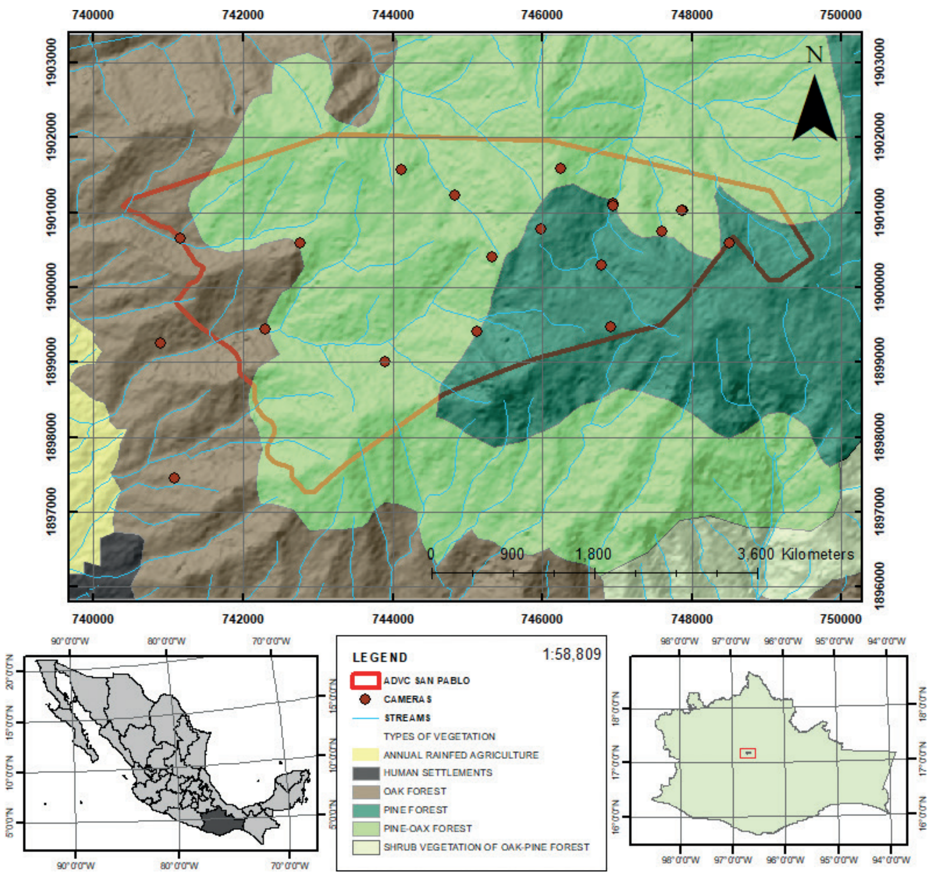

Figure 1. The geographical location of the Voluntary Conservation Areas "La Cruz-Corral de Piedra" in the Northern Sierra of Oaxaca, Mexico (red line). Circles and triangles show camera traps installed by community monitors and during our study, respectively. Dark green indicates vegetation dominated by pine, light green by pine-oak and light brown by oak.

Sampling sites selection

The sampling was carried out from January 2013 to June 2017 using 23 camera traps (12 Bushnell Trophy Cam and X8; nine Cuddeback Expert and Capture; two Simmons 119234C). We generated a grid spanning all the ADVC polygons using the ArcGIS programme (v.10.3). We followed previous studies with medium-sized felines to establish the sizes of the cells and generated 26 cells of 1.5 x 1.5 km (Burton et al. 2003; Lira and Briones 2012; Pérez-Irineo et al 2017). Community monitors installed 15 camera traps in the centre of 15 quadrants mainly east of the ADVC between January 2013 and June 2017 (Suppl. material 1: table S1). We installed eight additional camera traps in the centre of the unsampled cells between June 2016 and March 2017 to extend the sampling in most of the ADVC territory. The 23 camera traps were installed on natural trails, ravines, dry streams and riverbanks, at a height between 40 and 50 cm from the ground and spaced from each other at 1.5 km so as not to leave larger areas unsampled and assuming that this distance is large enough to achieve statistical independence between the trapping stations. The circuit of these cameras was programmed to remain active for 24 hours. The position of each one of them was georeferenced with a geopositioned Garmin etrex model.

Monitoring programme design

The monitoring programme established by the community allows us to have monthly information regarding the presence/absence of multiple species at each sampling site over time. However, the monitoring programme was not regular for all sampling sites, with maximum sampling periods that ranged from two to 54 months (Suppl. material 1: table S1). The cameras were programmed to remain active 24 hours a day with a 30-second separation between each shot and were checked monthly to change batteries and download the information. The following cases were considered as independent photographic records: a) consecutive photographs of different individuals and b) consecutive photographs of the same species separated by 24 hours (this criterion was applied when it was not clear if a series of photographs corresponded to the same individual, so photographs taken before 24 hours were considered as a single record) (Maffei et al. 2002; Lira et al. 2014). We reviewed all photographs identifying all mammal and bird species with the help of field guides. We elaborated tables with the records of the three species of felids studied. The community monitoring sampling effort was 16,200 days, which, according to Shannon et al. (2014), is higher than the minimum required in a monitoring programme.

Habitat variables

We gathered 11 habitat variables associated with each sampling site, following Mostacedo and Fredericksen (2000) and Mueller-Dombois and Ellenberg (2002). We used the point-centred quarter method for the vegetation traits, which involves establishing four 25-metre transects at each of the four cardinal points, taking the location of the camera trap as the central point. We marked five points in each transect, separated by 5 m, for a total of 20 points and each point was divided into four quadrants, encompassing 2500 square metres (following Cottam and Curtis 1956).

We assessed shrub layer density, defined as the number of plants per area with > 40 cm and < 2 m in height. Density was estimated using the correction factor proposed by Warde and Petranka (1981), as some quadrants had no shrubs layer; the basal area of the trees was obtained by assessing the diameter at breast height (DBH) at a height of 1.3 m above the ground (Mostacedo and Fredericksen 2000) of trees taller than 2 m using a BEN MEADOWS diametric tape. The basal area of the trees was estimated using the following formula: basal area = pi*DBH2/4, where: pi = 3.141592 and DBH = diameter at breast height.

We also calculated the importance value (IV) of the genus *Quercus*, the genus *Pinus* and other tree species (we pooled together plants of the genus: *Litesea*, *Arbutus*, *Abies*, *Alnus* and *Buddleja*), as these species were found mostly concentrated in sites, such as glens and creeks, following Cottam and Curtis (1956). We calculated IV as the sum of the relative tree density, relative tree frequency and relative tree dominance, given by the following formula:

$$\text{Importance Value (IV)} = \text{relative density} + \text{relative dominance} + \text{relative frequency}$$

We assessed seven variables associated with terrain characteristics and human presence: five continuous variables: altitude, slope (assessed with a

Clinometer SUUNTO PM-5/360PC); closest distances between the camera trap to any water body (e.g. rivers, dams or waterfalls); closest distances between the camera-trap to any main road within the Reserve (i.e. roads with a width of 7 to 10 m, where cars can circulate); and closest distances to human settlements (i.e. one or more people living in at least one building) and two binary variables: the presence of crags, defined as steep or rugged cliffs; the presence of trails, defined as narrow paths (≤ 2 m wide), formed by the passage of animals or people and located within the vegetation sampling quadrant. For the variables, closest distance to bodies of water, to the main road of the Reserve and human settlements, high-definition topographic maps of San Pablo Etla were reviewed and analysed in the ArcGis programme (version 10.3) generating the Euclidean distance between the sampling stations and the characteristics of the area evaluated.

Prey species

We identified 16 species as possible prey for the three felids. We classified all potential prey species into three categories, based on size and generated a detection history for each category. In the small-size prey category, we included: *Bassariscus astutus*, *Sylvilagus floridanus*, *Sylvilagus cunicularis*, *Conepatus leuconotus*, *Mephitis macroura*, *Sciurus aureogaster*, *Pipilo ocai*, *Cyanocitta stelleri* and *Dendrortyx macroura*. In the medium-size prey category, we included *Eira barbara*, *Nasua narica*, *Procyon lotor*, *Didelphis virginiana* and *Cuniculus paca*. In the large-size prey category, we included *Odocoileus virginianus* and *Dicotyles angulatus*.

Statistical analysis

We used generalised linear mixed models (GLMM) to assess the association between habitat and prey variables with the presence/absence for Pumas, Bobcats and Margays. We defined sampling units as station-month combinations, thus ‘stacking’ the month detection histories, achieving a larger effective sample size. The total sample size for this dataset is n = 531 sites/month combinations for each of the three felid species.

We generated GLMMs with Binomial error and complementary log-log function, as the probability of an event (presence) in our database was small and tended to fit better the data than logistic and probit. We included the presence/absence of Pumas, Bobcats or Margays as a dependent factor, while habitat variables and prey presence/absence were included as fixed factors. We included CameraID and Years as random factors. Including year as a random factor allowed us to meet the assumption of close populations at survey locations since presence/absence in one year is independent of occupancy in the other year. Models were constructed following a forward stepwise procedure, by adding one predictor variable at a time, starting with an empty model (null model) and selecting the variable that provides the best fit to the data according to the Akaike Information Criterion (AIC). We screened sets of predictor variables included in multivariable models to avoid having correlated ($r > 0.6$) variables together within models. We chose the most parsimonious models using the Akaike Information Criterion ($\Delta AIC < 2$; Burnham and Anderson (2002)). As the study site was smaller than the average home ranges of the species being assessed, which violates the assumption of closure, we interpreted our results as “the proportion of sampled sites used by the species” rather than the “probability of occupancy”, following Madsen et al. (2020). Values are reported as means (± standard error). GLMM was performed in SPSS statistical analysis software (v.25 IBM Corp., Armonk, NY, USA).

Results

We recorded the three focal felids species *P. concolor*, *L. rufus* and *L. wiedii* (Fig. 2), in addition to other species of meso-predators, such as *Puma yagouaroundi*, *Canis latrans*, *Urocyon cinereoargenteus* and some species, such as potential prey: *Odocoileus virginianus*, *Pecari tajacu*, *Bassariscus astutus*, *Nasua narica*, *Didelphis virginiana*, *Sylvilagus floridanus*, *Sylvilagus cunicularis*, *Conepatus leuconotus*, *Mephitis macroura*, *Sciurus aureogaster*, *Cuniculus paca* and birds such as: *Pipilo ocai*, *Cyanocitta stelleri* and *Dendrortyx macroura* (Fig. 3).

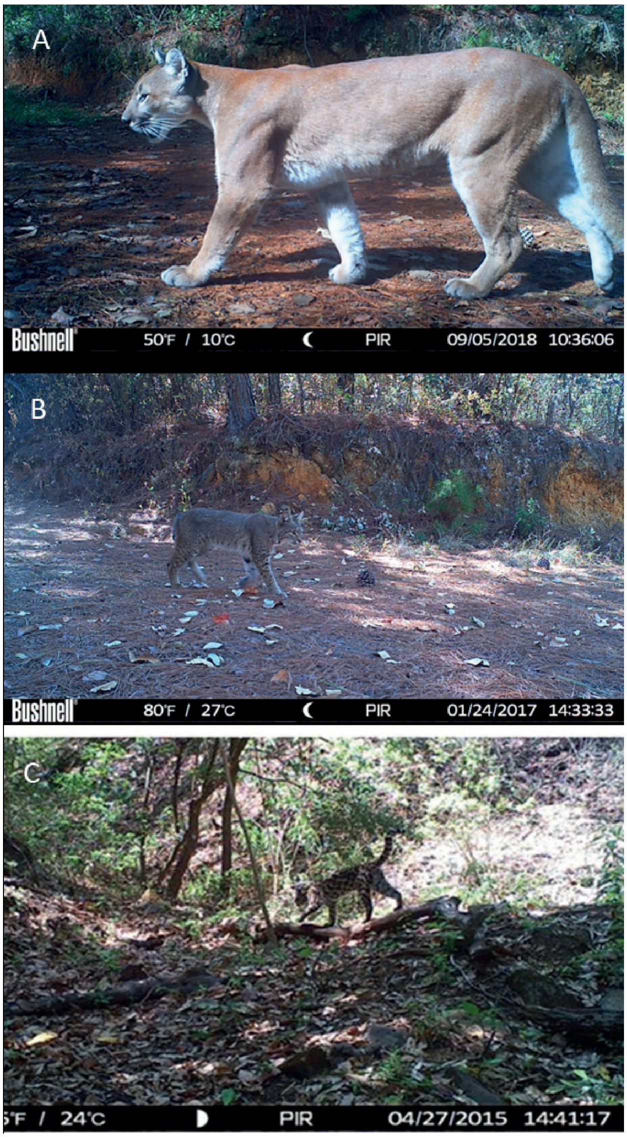

Figure 2. Images of Puma (*Puma concolor*: **A**), Bobcat (*Lynx rufus*: **B**) and Margay (*Leopardus wiedii*: **C**), obtained by camera trapping in the Voluntary Conservation Area La Cruz-Corral de Piedra in San Pablo Etla, Oaxaca, Mexico.

Figure 3. Images of feline prey: white-tailed deer (*Odocoileus virginianus*: **A**), squirrel (*Sciurus aureogaster*: **B**), collared peccary (Dicotyles angulatus: **C**) and white-nosed coati (*Nasua narica*), obtained by camera trapping in the Voluntary Conservation Area La Cruz -Corral de Piedra in San Pablo Etla, Oaxaca, Mexico.

Specifically, the Puma was detected 58 times in seven sampling stations; the Lynx was detected 29 times in five sampling stations and the Margay was detected 20 times in six sampling stations.

For the Puma, the presence was best explained by the null model and the model that included medium-size prey (F = 0.69, P = 0.40, Fig. 4A) (Table 1), indicating that Puma occurrence increased in sites with the presence of medium-size prey (Fig. 4A; Table 2). The most parsimonious model suggests that the sites used by Bobcats and Margay were better explained by the variable medium-size prey (Table 1), indicating that Bobcats and Margay occurrence increased in sites with the presence of medium-size prey F = 0.43, P = 0.51, Fig. 4B and F = 0.20, P = 0.65, Fig. 4C, respectively; Table 2). Full sets of tested GLMMs and averaged estimates of the function slopes of variables for the three felid species are presented in the Suppl. material (Suppl. material 1: table S2 for Puma, table S3 for Bobcats and table S4 for Margay).

Discussion

In the study, it was observed that the occurrence of the three felid species was high in areas where their prey species were present, indicating a potential influence of prey on the occupation patterns of these felines. None of the other variables explained the presence of felines; however, there are studies suggesting that human settlements or urbanisation have a negative effect on Pumas, Bobcats and Margays distribution (e.g. Angelieri et al. (2016); Horn et al. (2020); Mayer et al. (2022)). A possible explanation is that access to the ADVC is restricted by the community, with few visitors and motor cars all year round, resulting in a non-negative effect on the occurrence of the felid in the area.

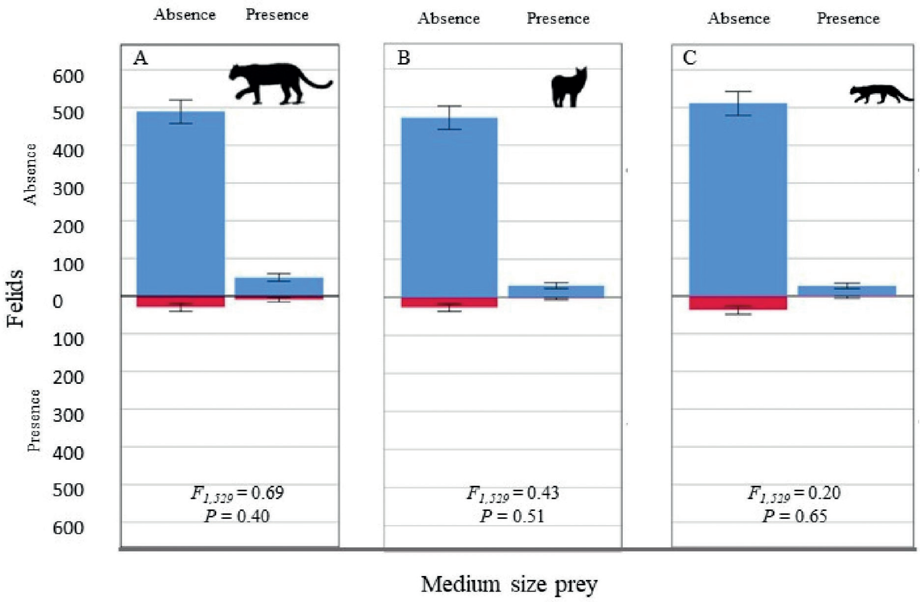

Figure 4. Graphs depicting the relationship between the presence of medium-size prey and Puma (*Puma concolor*: **A**), Bobcat (*Lynx rufus*: **B**) and Margay (*Leopardus wiedii*: **C**). The y axis indicates counts. Model with predictive accuracy by adding one predictor variable at a time, starting with an empty model (null model) and selecting the variable that provides the best fit to the data according to the Akaike Information Criterion (AIC). *P*-values evaluate the null hypothesis, not model performance. Error bars show standard error. Blue bars refer to absence and red bars refer to presence.

Table 1. Best generalised linear mixed models (GLMM) describing the proportion of sampled sites used by the three species felid species. The best five models are presented for each species.

Model	-2log likelihood	AIC	ΔAIC	AICw
Puma				
Null	1907.21	1911.23	0.00	0.51
Medium-size prey	1907.33	1911.35	0.12	0.48
Medium-size prey * Presence of trails	1921.16	1925.18	13.95	0.00
Presence of trails	1923.71	1927.73	16.50	0.00
Medium-size prey + Presence of trails	1923.89	1927.91	16.68	0.00
Bobcat				
Medium-size prey	2021.75	2025.77	0.00	0.70
Medium-size prey + Season	2024.69	2028.72	2.95	0.16
Null	2025.80	2029.82	4.05	0.09
Season	2027.92	2031.94	6.17	0.03
Medium-size prey + Presence of trails	2028.93	2032.95	7.18	0.02
Margay				
Medium-size prey	2024.41	2028.41	0.00	0.69
Medium-size prey + Season	2026.69	2030.71	2.30	0.22
Null	2094.48	2033.48	5.07	0.05
Medium-size prey + Presence of trails	2031.55	2035.57	7.16	0.02
Season	2031.79	2035.79	7.38	0.02

The Akaike Information Criterion score (AICc), the -2log, the difference between the given model and the most parsimonious model (Δ) and the Akaike weight (w) are listed.

Table 2. Averaged estimates of the function slopes of variables present in the most parsimonious GLMMs. Estimates of radon factors are shown. Standard errors (SE) and 95% confidence limits (CL) are shown. Tests of significance of variables (*F* and *P*) are also given. The asterisk (*) indicates the reference variable.

Variables	Estimate	SE	Lower 95% CL	Upper 95% CL	*F* (df1, df2)	*P*
Puma						
Null	0.24	0.19	0.82	1.66		< 0.001
Medium-size prey					0.69 (1,529)	0.40
Absence	0.21	0.255	-0.28	0.74		
Presence	0*					
CameraID	0.37	0.16	0.15	0.88		0.02
Year	0.05	0.05	0	0.42		0.34
Bobcat					0.43 (1,529)	0.51
Medium-size prey						
Absence	0.19	0.29	-0.39	0.78		
Presence	0*					
CameraID	0.25	0.11	0.10	0.62		0.02
Year	0	0.07	0	0.49		0.46
Margay						
Medium-size prey					0.20 (1,529)	0.65
Absence	0.13	0.3	-0.45	0.73		
Presence	0*					
CameraID	0.27	0.12	0.11	0.66		0.02
Year	0	0.11	0.21	0.60		0.69

Although the best model suggests that Pumas' presence was not associated with any of the variables assessed in this study, the second-best model in our study suggests that the occurrence of the Puma was related to the occurrence of medium-size prey, as has been seen in other investigations. (e.g. Aranda and Sánchez-Cordero (1996); Hass (2009); Hernández-SaintMartín et al. (2015); Prude and Cain (2021)). Unlike other studies, our results suggest no relationship with pine-oak forests even though they are ideal places to ambush their prey, with easy access to resting and refuge sites (Cox et al. 2006; Land et al. 2008; Laundré and Hernández 2010).

Regarding Margay, it is one of the least-studied cats (Brodie 2009), highlighting the importance of our study. Recognising the association between prey and the presence of Margays is valuable for residents, as it indicates that to preserve this endangered feline (SEMARNAT-NOM-059; IUCN; CITES) in their territories, they must also prioritise efforts to conserve prey species. In this study, we analysed data from camera traps capturing individuals at ground level, indicating successful observations of Margays. The Margay species have been observed to engage in both ground and tree-based-hunting behaviour, with the interesting behaviour of climbing trees to consume prey captured on the ground (Aranda 2005). Furthermore, some authors mention that Margays undertake exploratory tours on the ground when not actively foraging for food (De Oliveira 1998; Hodge 2014). High densities of shrubs have been associated with the presence of Margays, as it facilitates the presence of prey (small mammals of Order: Didelphomorphia and Rodentia, principally; Bianchi et al. (2011)) and provides shelter for Margays (Goulart et al. 2009; Hodge 2014).

Bobcat diet is mainly constituted by lagomorphs and rodents and, to a lesser extent, by opossums, coatis and birds (e.g. Aranda et al. (2002); Hass (2009)), while Margay's diet is mainly constituted by small mammals, lagomorphs, rodents, as well as birds and reptiles (e.g. Sunquist and Sunquist (2002)). Our results indicate that medium-size prey is positively associated with the presence of Bobcats and Margays, supporting the high encounter hypothesis for Bobcats, but not for Margays. Other studies have mentioned the utilisation of the habitat by bobcat is correlated to the abundance of their prey (Litvaitis et al. 1986).

We acknowledge that the study area is very small, considering all three felid species have large home ranges – Margay: 10–21 km^2 (Konecny 1989), Bobcat:11 km^2 (Monroy and Briones-Salas 2012), Puma: 83 km^2 (Nuñez-Pérez and Miller 2019), that the number of camera-traps was relatively small and that the sampling periods between cameras were not the same. Thus, the results should be taken with caution. However, this study highlights the importance of community monitoring of wildlife in protected areas by indigenous communities. In addition to incentivising local people, we believe that community wildlife monitoring is a viable alternative since it is relatively cheaper in the long run and is more effective in drawing on local experiences. Further, currently, the monitoring programme is operating on several communal reserves across Mexico; we encourage communal authorities and CONANP to conduct a global analysis of the information generated by the monitoring programme to implement a monitoring protocol that will lead to better management of forest practices national-wide.

Conclusions

This study highlights that community monitoring (in this case, indigenous monitoring) contributes to scientific knowledge. In this study, information was obtained on the local-scale habitat use of three felids; for one of them, the region represents its southernmost distribution area (*L. rufus*). Bobcats and Margays favour areas with medium-sized prey. Pumas' presence did not correlate with the assessed variables. Additionally, the high occurrence of all three felid species in areas with their prey suggests prey influence on their habitat selection. By understanding the relationship between these carnivores, habitat characteristics, human disturbances and the presence of prey, community authorities could improve sustainable forest management. Considering that many indigenous communities around the world protect their natural resources – even without official recognition – (Farhan Ferrari et al. 2015; Jurrius and López Rodríguez 2020), community conservation efforts are essential for preserving biodiversity and environmental services.

Acknowledgements

We thank the communal authorities and residents of San Pablo Etla for access to their lands. To CONANP for providing information on various species of wildlife obtained in San Pablo Etla through the programme "Biological Monitoring of Biodiversity in Protected Natural Areas, Sierra Juárez Mixteca Directorate". R.E. Galindo contributed with revisions and contributions to the document. MBS thanks the Operation and Promotion of Academic Activities Committee (COFAA) at the IPN. MBS and JRSL thanks the Research Performance Stimulus Program (EDI) at the IPN, as well as the National System of Researchers (SNI) for its recognition and support.

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Funding

This work was supported by the National Council of Science and Technology (CONACYT) through a scholarship for Master's studies to NNDB at the Instituto Politécnico Nacional (717791/591006) and the Basic Scientific found a programme (250910 granted to JRSL); and IPN Research and Postgraduate Secretariat (SIP: 20195164 and SIP: 20200713 granted to MBS, and SIP: 20220208 and 20231274 granted to JRSL).

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Data availability

NNDB, MBS and JRSL conceived and designed the study. NNDB and EP compiled and identified the species for generating the database. NNDB and JRSL performed the statistical analyses. All authors contributed to the interpretation of results and the writing of the manuscript.

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Supplementary material 1

Sampling sites and dates on which the camera-traps were installed and Generalized linear mixed models (GLMM) for Puma, Bobcat and Margay

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Data type: docx

Explanation note: **table S1.** Sampling sites and dates on which the camera-traps were installed. **table S2.** Generalized linear mixed models (GLMM) for Puma. **table S3.** Generalized linear mixed models (GLMM) for Bobcat. **table S4.** Generalized linear mixed models (GLMM) for Margay.

Link: https://doi.org/10.3897/natureconservation.53.104135.suppl1