Monitoring Maternal Attendance in an Urban Bobcat Den

Abstract:

In urban environments, understanding changes in the behavior of bobcats is essential for how these species adapt to fragmented habitats while raising kittens. However, there is still a lack of data regarding how maternal presence at den sites actually fluctuates as kittens age in these human-dominated landscapes. While general feline behavior is well-documented, Bobcats in Tucson (BIT) informs that there are no studies on the precise timing of maternal detachment in these bobcat dens. This project investigated the behavioral dynamics of a mother bobcat and her kittens to determine how presence/absence shifts over time within an urban ecosystem. By analyzing 304 trail camera videos at a single bobcat den collected over a one-month period in 2025, the scientist tracked the precise duration the mother spent present at the den versus the time she spent away. The hypothesis was that the maternal attendance of the mother bobcat with her kittens would go down overtime based on the assumption that the kittens would need less attention with their mother as they start to mature. The collected data confirmed this hypothesis in the case of this one bobcat. Additional data collection could help make this conclusion stronger.

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Research Question/Variables: How does the amount of time a mother bobcat in an urban area spend with her kittens change as the kittens age over a 1-month period? *The 1-month period of mother bobcat with her kittens and human interactions*.

Background Research: As cities continue to grow, animals like bobcats are learning to live closer to people, which can change how they raise their young. This research focuses on how much time a mother bobcat spends with her kittens compared to how much time she spends away from them while living in an urban area. By studying the timestamps from trail cam footage, the research will show whether the mother spends more time caring for her kittens or away from the den. This is important because it helps reveal how urban environments affect a bobcat's parenting behavior and the survival of her young. Some societal impact of this study show that it can help people understand how to safely share space with wildlife, reduce conflicts between humans and animals like bobcats, and support conservation efforts that protect bobcats and other species like them living in an urban environment.

Through the years, many different species of animals have been affected by urbanization, straining their mental health, behavior, reproductive rate, and overall well-being. One of these targets is the bobcats living in the suburban areas of the United States. Over time, urbanization has taken a Toll on the well-being of these curious animals and has impacted their way of living to the point where they've had permanent damage from the impact of living too close to urban areas. As their own natural habitat shrinks through fragmentation, bobcats are forced to adapt to smaller living areas, facing the impacts of human activity. This leads to smaller hunting areas, higher stress levels, and a higher risk of disease, which could possibly reduce the population of bobcats living in the United States. It is crucial to understand the effects on bobcats and mitigate the harmful strategies that could have a significant impact not only on the bobcats but also on the ecosystem they sustain.

Many studies across the United States have proven that a bobcat's environmental niche has been shown to shrink due to the effects of urbanization and human contact

(NPS, 2023). Because of urbanization impacting a bobcat's territory, these vertebrates' hunting strategies have decreased astronomically ***(Lewis, 2019)***. The effects lead to their hunting corridors getting shifted and decreasing, increasing food scarcity, and a higher risk of starvation. But the main problem with smaller habitat corridors is an increased risk of disease, weaker immune systems, and stress ***(Bobcats in Tucson, 2024).*** Together, these factors show how urbanization plays a specific role when threatening these bobcats, and overall, how they thrive in their natural territories.

The National Park Service in the Santa Monica Mountains of California says, "as suburban development increases, bobcats are forced to navigate fragmented habitats, which can raise stress levels, disrupt normal behaviors, and even affect their reproductive success" ***(National Park Service, 2023).*** This proves that urbanization is a big deal when it comes to the reproductive rate and succession of these urban bobcats. If urbanization impacts these bobcats anymore, their reproductive rate could decrease, and this could result in a smaller population of urban bobcats throughout the United States. Another result of a decreased population is a feedback loop where decreased population faces increased stress, limiting genetic diversity, and an increase in the spread of disease. In general, if urbanization continues at this pace, it could lead to long-term population declines and highlights the urgent need to protect the bobcat population when it comes to reducing human-related stressors.

The Conservation Ecology Lab in Phoenix states that, "bobcats play a crucial role in maintaining ecosystem balance, and disruptions to their populations can have wide-reaching effects on other wildlife and plant communities" ***(Markovchick-Nicholls, 2019).*** This just shows how important it is to keep urbanization and a minimal standard when it comes to bobcat fragmentation, which includes lasting effects on other species other than bobcats. As new cities, roads, and buildings are expanded every day, they interfere with the bobcat's behavior and natural movements across their niche, which will have negative impacts on their well-being and the biological roles they play in the vast ecosystem.

Urbanization's effects on bobcats have taken a toll on society, influencing how communities interact with and manage the bobcats. After a bobcat loses its natural habitat and hunting space, its instinct is to go find new hunting grounds, leading to the bobcats migrating into urban areas ***(Bobcats in Tucson, 2020).*** But this has major consequences as it leads to increased interactions between humans. If this continues, then humans need to be taught how to cope with wildlife in order not to scare them away. By understanding bobcats' nature, communities will learn to cope with these animals and create wildlife foundations to help the bobcats live a less stressed, more natural life in the environment.

Materials List:

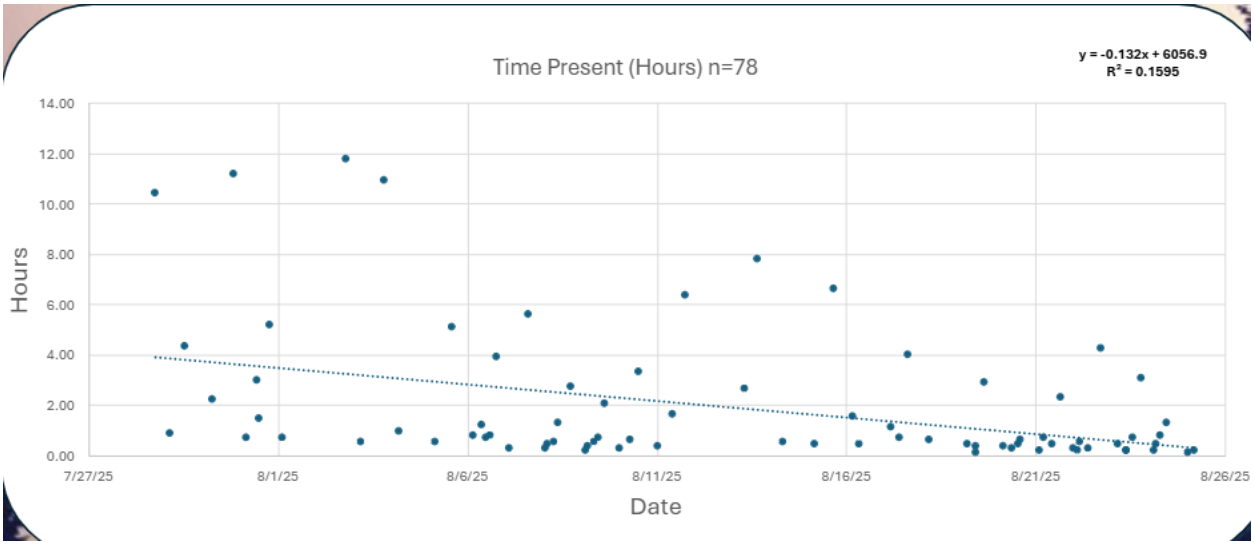
1. *Computer for measuring data*
2. *Research/lab notebook for calculating data*
3. *Trail cam for measuring bobcat times in and out*

Experimental procedure/methods: Backyard trail cam footage of a bobcat's urban den from 2025 was analyzed to see how the mother's time with her kittens changed as they grew. A total of 304 videos from 2025 were reviewed. Each video was examined to record the times when the mother was present at the den with her kittens and when she was away over a 1-month period. For every observation, timestamps were used to calculate the amount of time the mother spent at the den and away from her kittens. The total times were added for each week to determine the total time spent with and away from the kittens on a weekly basis. After totaling the weekly times over the 1-month period, the data was organized into a table, then transferred to a graph to show how the mother's time with her kittens changed as the kittens got older. The trail cam videos were reviewed, and past research on bobcats living with their kittens in wildlife or suburban areas was used for comparison which helped interpret the patterns seen in the urban environment.

Data Analysis/Discussion: The data was analyzed by calculating the total and average amount of time the mother bobcat spent with her kittens compared to the time spent away from the den over the 1-month period. Timestamps were used to record the mother's

activities, specifically when she was at the den with her kittens and when she was away. Each timestamp included the date, and the time in and out was marked on a table and written down in a notebook. The times were totaled for each week to track changes in the mother's attention to the kittens as they grew. The table was eventually converted into a bar graph to show the total time and percentage of time the mother bobcat spent with her kittens compared to the time she spent away from them over the 1 months. This analysis helped determine how the age of the kittens affected the amount of time the mother spent at the den with them.

Claim for graph: As the kittens age over the one-month period, the amount of time a mother bobcat in an urban area spends with her kittens decreases. The data shows that average time spent away from the kittens is greater than the average time spent present, indicating that the mother bobcat gradually spends less time with her kittens as they grow older and become more independent.



Claim for Trend: This first graph shows the amount of time the mother bobcat spent with her kittens over a one-month period. At the beginning of the study, the time present was higher, meaning the bobcat stayed with her kittens for longer periods. As time goes on, the graph shows a general decrease in time present. This indicates that the mother bobcat gradually spent less time with her kittens as they grew older. This supports the hypothesis that the time the bobcat spends with her young would

decrease over the one-month period. One possibility is the decrease likely happened because the kittens became more independent and required less constant care from the mother.

Time Away				Time Present		
Video	DateTime	Delta (hours)		Video	DateTime	Delta (hours)
DSC0085	7/27/25 2:33 AM	6.55		DSC0092	7/28/25 6:48 PM	10.38
DSC0088	7/28/25 3:16 AM	8.37		DSC0094	7/29/25 4:16 AM	0.83
DSC0091	7/28/25 8:25 AM	3.80		DSC0096	7/29/25 12:50 PM	4.25
DSC0093	7/29/25 3:26 AM	8.63		DSC0101	7/30/25 7:06 AM	2.13
DSC0095	7/29/25 8:35 AM	4.32		DSC0104	7/30/25 7:34 PM	11.10
DSC0105	7/31/25 3:39 AM	8.08		DSC0106	7/31/25 4:15 AM	0.60
DSC0107	7/31/25 7:50 AM	3.58		DSC0108	7/31/25 10:46 AM	2.93
DSC0109	7/31/25 11:25 AM	0.65		DSC0110	7/31/25 12:48 PM	1.38
DSC0111	7/31/25 1:23 PM	0.58		DSC0112	7/31/25 6:28 PM	5.08
DSC0113	8/1/25 2:44 AM	8.27		DSC0114	8/1/25 3:21 AM	0.62
DSC0119	8/3/25 4:03 AM	8.47		DSC0118	8/2/25 7:35 PM	11.73
DSC0121	8/3/25 8:28 AM	3.98		DSC0120	8/3/25 4:29 AM	0.43
DSC0123	8/4/25 3:57 AM	8.63		DSC0122	8/3/25 7:19 PM	10.85
DSC0130	8/5/25 9:30 AM	5.98		DSC0124	8/4/25 4:48 AM	0.85
DSC0005	8/6/25 8:48 AM	4.88		DSC0129	8/5/25 3:31 AM	0.42
DSC0007	8/6/25 11:48 AM	1.83		DSC0001	8/5/25 2:31 PM	5.02
DSC0009	8/6/25 1:36 PM	1.15		DSC0004	8/6/25 3:55 AM	0.75
DSC0014	8/7/25 3:02 AM	8.10		DSC0006	8/6/25 9:58 AM	1.17
DSC0016	8/7/25 8:00 AM	4.77		DSC0008	8/6/25 12:27 PM	0.65
DSC0019	8/7/25 10:00 AM	0.10		DSC0010	8/6/25 2:20 PM	0.73

Extra data explains the time away vs the time present by date and hours demonstrated in the graph above (Not full data table presented)

Conclusion: The experiment examined changes in the amount of time a mother bobcat spent with her kittens over one month. The graph showing time present supported the hypothesis by showing a decrease in time spent with the kittens as time progressed, suggesting that the kittens were becoming more independent. However, the graph showing time away did not display a clear overall trend, so it neither strongly supported nor contradicted the hypothesis. Because the data points were widely spread, more data collected over a longer period would be needed to draw a stronger and more reliable conclusion.

Ideas from future Research: *After researching bobcats for a while here are a few ideas that I have which would be fun to research in the future.*

1. GPS tracking and understanding habitat usage
2. Habitat corridors based on interaction with humans
3. Population dynamics

Acknowledgments: *Someone who helped me with my research was my dad as he provided all the trail cam footage and without him my project would never have succeeded. I would also like to thank Bobcats in Tucson for its urban bobcat study which was critical to me for compiling background information.*

Bibliography: McNitt, David C., et al. "Sex-Specific Effects of Reproductive Season on Bobcat Space Use, Movement, and Resource
Selection in the Appalachian Mountains of Virginia." PLOS ONE, vol. 15, no. 8, Aug. 2020, p. e0225355. PLoS Journals, https://doi.org/10.1371/journal.pone.0225355

The study examined sex-specific differences in bobcat behavior in the Appalachian Mountains of Virginia, focusing on how reproductive season influences movement, space use, and habitat selection. The authors found that male bobcats maintained larger home ranges and increased movements during the breeding season, likely to maximize access to females, while females restricted their movements, particularly when caring for kittens. Both sexes adjusted their habitat selection based on
resource availability, but the types of preferred habitats differed by sex and season. These findings demonstrate that reproductive season plays a significant role in shaping bobcat ecology, highlighting the importance of considering sex and reproductive timing in wildlife management and conservation strategies.

Young, Julie K., et al. "Space Use and Movement of Urban Bobcats." Animals : An Open Access Journal from MDPI, vol. 9, no. 5, May 2019, p. 275. PubMed Central, https://doi.org/10.3390/ani9050275

The article analysis shows the effects of urbanization on bobcats throughout the mountains of California. The scientists measured their well-being and behavior after they were exposed to humans. It also analyzed the space use and migration of the bobcats showing how far away they were from humans and the basic data on how it affects their well-being.

Schmidt, Greta M., et al. “Bobcats in Southern California Respond to Urbanization at Multiple Scales.” Biological Conservation, vol. 278, Feb. 2023, p. 109849. ui.adsabs.harvard.edu, https://doi.org/10.1016/j.biocon.2022.109849

The scientists used their studies of bobcat fragmentation and degradation to figure out how urbanization was affecting bobcats, migration patterns, and behavior. This research was all done across the San-Diego County. They tagged the bobcats with a collar and connected it through GPS readings and maps to figure where they had been, and where they were going. The results showed that bobcats moved away from the urbanization areas according to Harvard Edu. Calabasas, Mailing Address: 26876 Mulholland Highway, and CA 91302 Phone: 805 370-2301 Contact Us. Bobcats: Living
on the Urban Edge - Santa Monica Mountains National Recreation Area (U.S. National Park Service).
https://www.nps.gov/samo/learn/nature/bobcats.htm. Accessed 10 Sep. 2025

The scientists did a study on how urbanization affects bobcats and their well-being between the freeway and the Santa Monica mountains in southern California. They determined that the bobcats migrated away from the urban areas because it was scaring away the bobcats, affecting their well-being and the behavioral issues when they reproduce. Based on the study they figured out since 1996 that male bobcats need 3 miles of space and female bobcats need 1.5 miles of space to reproduce compared to how far way the freeway.

Project, B. I. T. R. (n.d.). Bobcats in Tucson Research Project ©. Bobcats in Tucson Research
Project ©. https://bobcatsintucson.net/final-technical-report

Research did an experiment on bobcats who migrated into different backyards in Tucson, AZ, and how fast they would come out after a human left a bowl of water out. The results showed that the bobcats trusted the humans enough to lay their kittens in the backyard and keep them there for about a month before migrating to a new environment to raise another litter of kittens. They also measured the well-being of the bobcats and how they were affected by the urban areas which corresponds to how much they reproduce proven in figure 1 based on the bobcats' reproductive rate.