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City of Culver City Coyote Management Report

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Submitted by:

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Center for Urban Resilience

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TABLE OF CONTENTS

AUTHORS & ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

The scientific staff at the LMU Center for Urban Resilience, along with affiliated scientists, collaborators and students conducted a three-year management study in order to assist the City of Culver City and its residents in managing the dynamic challenge of coexisting with resident and transient coyotes. Despite the considerable social and logistical upheaval caused by the Covid-19 outbreak, CURes staff and collaborators collected and analyzed data continuously through the various phases of the pandemic. The goals of the project were to: 1) Gather appropriate ecological, technical and human social data with regard to coyote ecology and human-wildlife conflict, 2) analyze these findings in comparison with other studies conducted across North America and 3) develop durable management interventions linked with formal and informal education to reduce the negative impacts of the expanding coyote population in Culver City and beyond.

The study employed various data collection methods including remote camera traps, radio-telemetric collars, dietary analysis, direct observation, molecular analytics, and a survey of residents. During the three-year study, we collected nearly 2 million photos, radiocollared two male coyotes, collected nearly 200 scat samples, surveyed 377 residents, and developed educational resources and a backyard study that can help residents determine the coyote risk in their backyard. Some key findings are as follows:

1. While coyote densities did not change much during the three years, densities of their prey species, particularly rabbits, did. These declines could be attributed to decreased rainfall during the study, which has been linked to declining levels of rabbits in the Sonoran desert as well.

2. Studies in other cities, such as Chicago and North Carolina, where cats make up a very small percentage of coyote diet, found that cats avoid areas where coyotes are common. Our study did not find this. Locations where cats were recorded and time of day when they were spotted overlapped significantly with coyote locations and time of day, increasing risk of predation on cats.

3. There are seasonal patterns to when coyotes spend more time within the City rather than the oilfields. There also appears to be a seasonal pattern to when cat appears in coyote diet. Cat appears in greater quantities in summer and fall and is rare in the diet during the winter. Based on this, we recommend a social media schedule that could help inform residents when their cats are at greater risk. Educational outreach utilizing some of the findings of this study may help residents change behavior on how they manage their outdoor cats.

4. DNA analysis from scat samples show that there are likely two packs of coyotes entering Culver City. The first is a pack that ranges from 6-8 near Marycrest Manor and the oilfields. The second does not appear to live within the Culver City limits but enters the City from Ballona Creek, where they appear to travel but not den.

5. Dry scat analysis shows that the Marycrest Manor pack does not prefer cat as their top prey and typically has less than 5% cat in their diet. However, as rabbit density decreased, we saw a change in the coyote diet. In the first year of the study, more than 50% of coyote scat

contained rabbit, and very few scat contained cats. However, in the second year, rabbit decreased dramatically from the diet, and cat increased to nearly 20% in October.

6. The survey of residents showed 64% of respondents agreeing that they understand coyote behavior and activities, and 53% agreeing that they know where coyotes frequent. This perceived knowledge goes against previous research and our own experience, suggesting a need for further outreach and education. More than one-fourth of respondents indicated that they are unaware of the City's coyote management efforts, thus we suggest that the City use a multi-faceted outreach approach.

The findings suggest that coyotes in Culver City are responding to a variety of ecological conditions, including drought, prey availability, adjacency to the Ballona Creek and other naturalized patches of habitat. The behavior of coyotes in Culver City is both similar to that of coyotes in other cities, but also expresses novel characteristics that are likely shared by coyotes exploiting the urbanized habitats of Southern California.

Predation on domestic cats was not evenly distributed spatially across Culver City, temporally across seasons or equally among coyote subpopulations foraging in Culver City habitats. These variations are likely the result of dynamic prey availability in Culver City and provide insight into future management solutions. Risk of predation of domestic cats by coyotes is impacted by these factors and also by human factors as revealed by our backyard safety surveys and social surveys: in particular, residents' perceived knowledge of urban coyotes and domestic cats.

Core interventions implemented by Culver City officials and local resident stakeholders are informed by the following set of management suggestions:

Recommendation 1.
Increasing specialized education for stakeholders with regard to reducing coyote risk.

Recommendation 2.
Implementing a suite of interventions at the individual parcel level that can decrease the potential threat from coyotes.

Recommendation 3.
Following a tiered response to coyote management with respect to documented incidences.

Recommendation 4.
Introducing a palette of strategies that can be applied to residential pet owners as they try to find a balance between pet safety and outdoor activities.

Each of these interventions have detailed elements in the following report that allow for a tiered response to coyote conflicts with humans and their domestic pets. The success of these approaches is contingent upon the creation of effective feedback loops among the stakeholders so that gaps in the response do not occur and the management interventions are geared to the existing and future threats.

1. INTRODUCTION

Only 14% of terrestrial carnivore species can be found near urbanized areas (Iossa et al. 2010). This is due in part from management actions that stem from human attitudes toward carnivores, which can pose a threat to both humans and their pets and livestock (Draheim et al. 2019). Because of these negative attitudes, large carnivores such as cougars, bears, and wolves are often excluded from urban areas, allowing coyotes (*Canis latrans*) and other meso-predators to thrive in the absence of competition from top order predators. In the United States, more than 400,000 coyotes are killed each year, yet their population has not declined (Fox & Papouchis 2005). They are found in major cities throughout the United States and Canada as they expand their range into most of North America (Laliberte & Ripple 2004). In addition to reduced competition, coyotes also benefit from being excellent exploiters of human food sources, such as pets, trash, and fruit (Larson et al. 2020). Their behavior ecology allows them to increase their population density and distribution throughout urban areas and come in contact with an increasing number of humans, many of whom do not view them favorably.

Cities in greater Los Angeles seem to be facing a unique challenge with regards to human-coyote conflict, and a recent study concluded that these conflicts, as expected, have increased with intensity of urbanization (Ordeñana et al. 2010). While most major cities, such as New York and Chicago, find less than 10% cat in coyote diets, a recent study in Los Angeles found more than 30% (Larson et al. 2020). In the last two years, there have also been an increase of reports of coyotes biting humans, mostly in Orange County and Long Beach, most recently a toddler in Orange County. None have been life-threatening and typically not resulting in serious injury, but all are frightening and increase the urgency for scientists and cities to work together on action plans that can reduce these types of conflicts. In the most recent instance, a coyote with matching DNA was euthanized in response to the bite, but previous efforts have not been successful. For example, two years ago, an elderly man was bitten in Laguna Beach, and two coyotes were euthanized. However, both were male, and DNA results showed that the coyote who bit him was female.

When a coyote conflict occurs, even those that are not threatening to humans, as are the majority of human-coyote interactions, neighborhoods often leap to lethal removal as the preferred solution. However, more than 400,000 coyotes are killed annually in North America, and their population continues to grow and expand. Traditional efforts to use lethal control on coyotes fragments the population, disrupts territorial boundaries, and can even lead to local increases in population densities. These plans also ignore the importance of coyotes as contributors to a balanced ecosystem or for how coyotes select habitat in urban areas. Isolated efforts at management without understanding local communities can lead to a vicious cycle where community engagement wanes and trust is broken between the municipality and the resident stakeholders.

A comprehensive approach to coyote management requires the coordination of many stakeholders throughout the area, as it must balance a spectrum of factors, such as negative public attitudes toward cat-killing coyotes, polarization between those who seek lethal control and those who promote preserving natural areas and the wildlife they contain, the importance of coyotes (and the detriment of free-ranging cats) to ecosystems, and differences in individual coyote packs. This report details the results of a three-year examination of coyotes in the City of Culver City, from 2019 to 2022, undertaken by the Loyola Marymount University (LMU) Center for Urban Resilience

(CURes) and its collaborators. In an effort to understand holistically the challenges surrounding coyotes in Culver City, CURes conducted an applied research project which included both ecological and social scientific research, development of educational materials, and recommendations for the City. This type of social-ecological approach allows for a better understanding not only of the coyote populations and their behavior, but also of the human population and their interactions with this urban wildlife.

The goal of this and any successful management plan is to minimize the need for lethal predator control in order to break the cycle of dependency of coyotes on direct human resources that create the ecological conditions for dangerous human-coyote conflict. The suggestions we put forth in this document highlight that need and provide a range of solutions, along with highlighting the need for an effective system to remove coyotes when they become aggressive toward humans.

2. CAMERA TRAP ANALYSIS

Studies of coyotes in urban environments have revealed that they prefer their natural, more rural habitats to urban environments (reviewed in Gehrt & McGraw 2007). While anthropogenic food sources are more readily available in human dominated landscapes, (e.g. trash, compost, pet food), it is often high in carbohydrates and low in fat and protein (Murray et al. 2015). Also, natural vegetation is patchy throughout urban environments, so it is often more difficult to locate preferred prey (Ellington and Gehrt 2019). Thus, coyote territory size actually becomes larger with percentage of urban landscape within the territory as they may have to travel greater distances to hunt for high quality prey rather than consuming anthropogenic food sources (Gehrt & McGraw 2007; Figure 1).

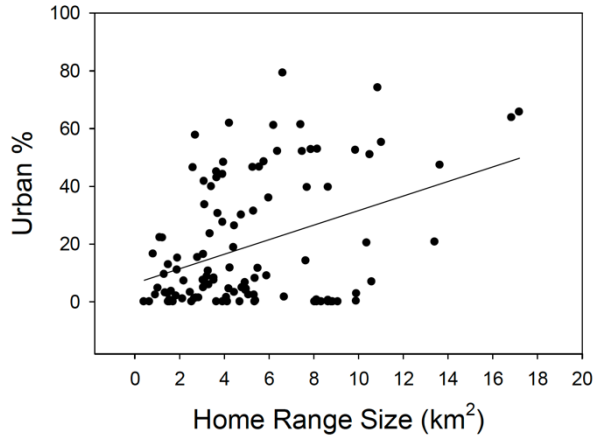


Figure 1. Coyote territory size increases with percentage of urbanized habitat (Gehrt & McGraw 2007).

Coyotes also have to alter their behavior to live around human populations. Coyotes in areas where they are not persecuted by humans are most active during the daytime. However, in areas where they are hunted or surrounded by high densities of humans, they alter their behavior to increase activity at night (Kitchen et al. 2000). In addition, freeways and busy streets create dangerous areas that may create areas that are difficult for animals to cross when searching for food or mates. In fact, a study in Chicago showed that cars presented the biggest threat to the survival of urban

coyotes (Gehrt & McGraw 2007; Figure 2). However, coyotes are becoming more prevalent in neighborhoods and city parks throughout the country, including crowded cities such as Chicago, New York, and Los Angeles. Questions facing researchers are: How are coyotes using this environment, and how do they travel through neighborhoods as they search for places to den and hunt? Does their switch to nocturnal behavior adjust their overlap with other mammal species, and do those species alter their behavior in response?

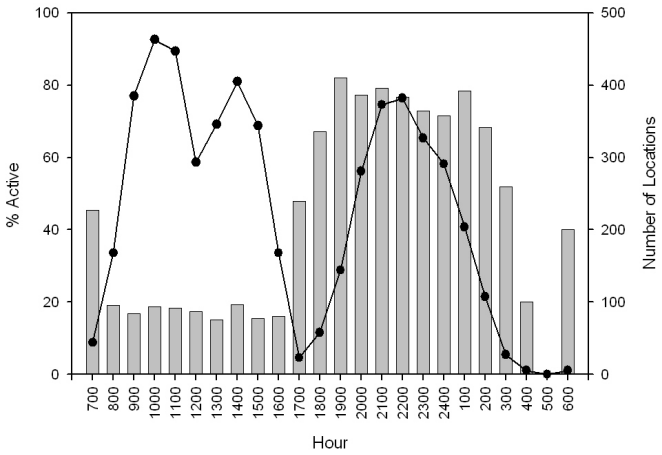


Figure 2. Activity behavior of coyotes in Chicago where bars represent frequency of active locations and lines represent number of locations per hour (Gehrt et al. 2011).

There are two core methodologies used to gather these data: radio telemetry and camera traps. Each has its own set of advantages and disadvantages. Radio telemetry allows researchers to pinpoint exact locations of coyotes and record travel routes throughout the day. This paints a detailed picture of coyote activity during the lifespan of the collar (Ellington & Gehrt 2019). However, animals must be trapped in order to attach collars, collars can be expensive, and tracking the locations of the coyotes can be time-consuming (pers comm). Camera traps consist of setting up motion-sensing camera traps throughout the area of interest and analyzing the photos collected. This method is ideal because it is less invasive and more cost effective than radio telemetry (Frey et al. 2017). The limitations are that researchers can only view behavior where the cameras are established and do not know where the animal travels from that site (Frey et al. 2017). However, it is often the preferred method for animals that are elusive and difficult to track, such as coyotes and other predators that often evade detection (Frey et al. 2017). Since coyotes are nocturnal and tend to avoid people, camera traps often present the best means for understanding travel and behavior, though it does not give a continuous understanding of coyote travel time and energy usage throughout the day. Ideally, researchers would utilize a combination of these methods and compare data collected in both formats to create a more detailed understanding of coyote activities within the study area. Fortunately, this study allowed to do just that.

2.1 Camera Trap Analysis

Based on reports of coyote sightings and reported cat deaths in Culver City, CURes worked with the City to develop a heat map of coyote activity (Figure 3). Based on this data, we placed 30 cameras strategically throughout Culver City in areas where coyote sightings were highest. These correlated to roughly two neighborhoods: the neighborhoods surrounding Carlson Park, which

included neighborhood streets along Ballona Creek, and the neighborhoods surrounding Marycrest Manor, which is adjacent to the Inglewood Oil Fields. We placed 30 cameras in these neighborhoods (Figure 4), hoping to discover where coyotes were entering the neighborhoods and how they were using them once they arrived. In the Carlson Park area, we placed cameras at Veteran's Park, Carlson Park, and Lindberg Park as well as every street between Jackson and Duquesne that dead ends on Ballona Creek (Figure 5). We also placed cameras in neighborhood yards when approached to do so by homeowners. The cameras later expanded to the Sunkist neighborhood as coyote sightings increased there, when Marino and Blanco Parks were added. In the areas surrounding Marycrest Manor, we had to rely primarily on neighborhood yards and Marycrest Manor itself as there are few neighborhood parks in that area. We also had cameras at the edge of West LA College, in the Raintree Condominium Complex, and at Culver City Park.

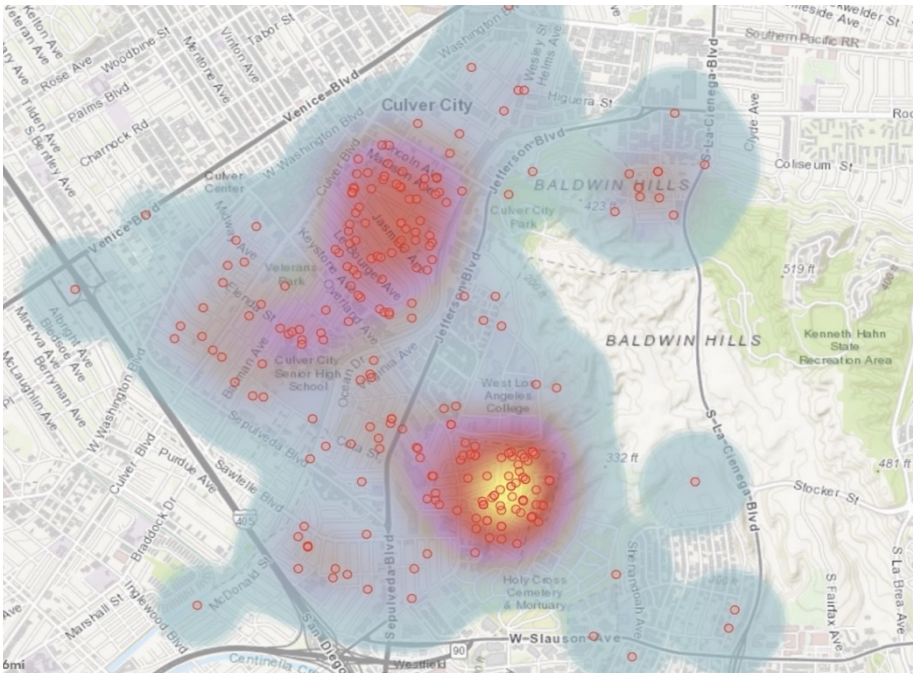


Figure 3. Heat map of Culver City coyote sightings in 2018-2021.

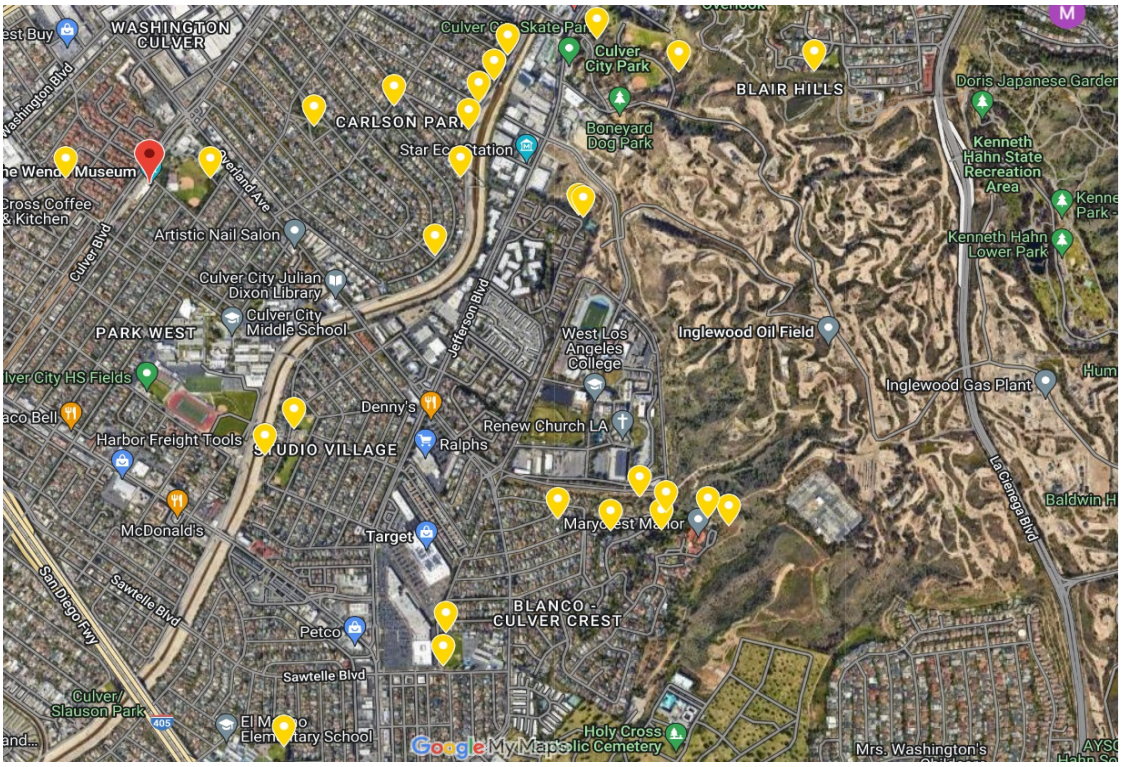


Figure 4. Location of cameras throughout Culver City.

When possible, these cameras were left in place from December 2019 until December 2021. However, because of repeated vandalism, they had to be removed from some parks. The photos were active at all times of the day, activated by motion. They were placed at about knee height, which is an ideal height for capturing small mammal data, but they also collected a lot photos of human legs and humans interacting with the camera. All of those were removed to eliminate any data that may have been invasive to Culver City residents. Cameras were placed such that they were meant to capture animal corridors rather than human ones, but it was hard to place cameras in locations where there were no people. We collected photos on a weekly basis from these cameras and had a team of undergraduates analyze the photos from home. This was invaluable during COVID as students were able to retain their research participation and funding, and most reported increased mental health during this time because of the project involvement.

Figure 5. Cameras placed at Blanco and Veteran's Park.

We collected nearly 2 million photos at these cameras (Figure 6; see Appendix for a greater selection of photos). Though many of them were human or moving vegetation photos that were discarded, we also collected 3,262 coyote photos, 3,031 cat photos, and 4,584 rabbit photos. We also collected 3,508 opossum photos, 3,189 raccoon photos, 983 rat photos, 4,329 skunk photos, and four fox photos (Figure 7). All of these animals are common urban mammals, found in most cities. Opossum and rat are both common prey of coyotes, but raccoons and skunk are not and tend to be relatively unaffected by coyote behavior (Gehrt & Prange 2006). Fox, however, are commonly found to be the leading cause of mortality for foxes when their territories overlap (reviewed in Gehrt & Prange 2006), thus the reason for the low number of fox when they used to be prevalent in southern California. These photos showed coyotes and cats hunting and carrying food as well as skunks, raccoons, and opossums eating human food sources. There were no photos where coyotes were seen with other animals (except hunting a rabbit), but other animals, such as opossums, skunks, and raccoons were often seen in photos together.

Figure 6a. Coyotes captured on Culver City cameras.

Figure 6b. Photos captured of animals other than coyotes on Culver City cameras.

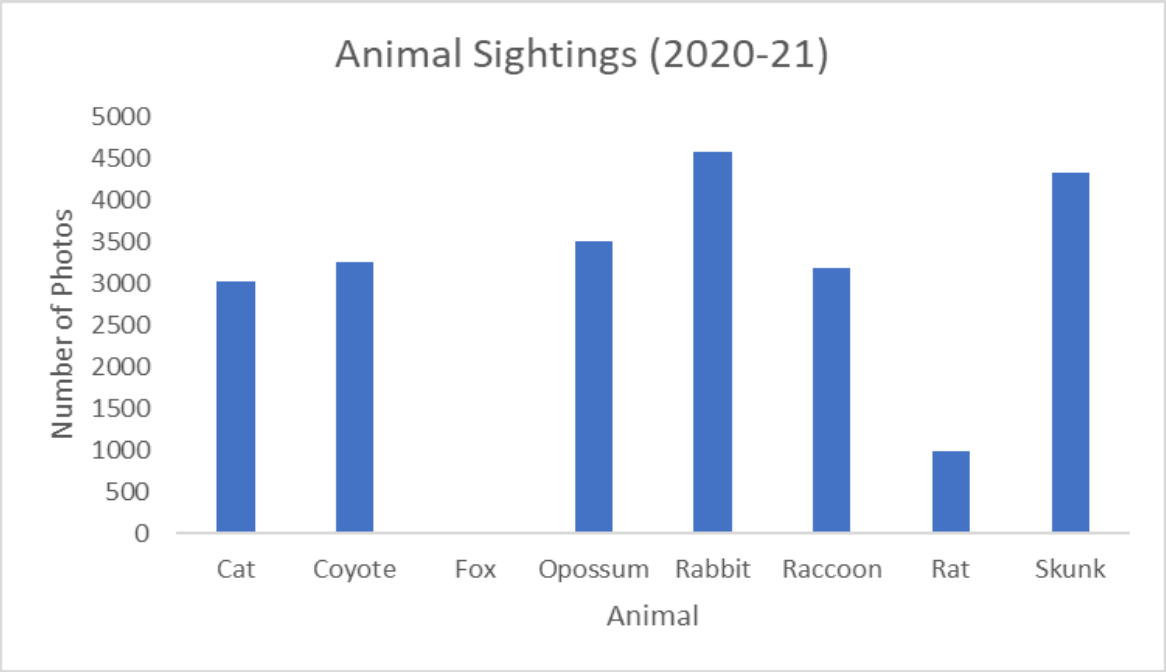


Figure 7. Number of photos collected of each urban mammal found in Culver City.

The photometric data sets from 2020 and 2021 varied considerably in response to variables such as the pandemic and rainfall. 2020 was the beginning of a pandemic that dramatically reduced human activity and allowed animals worldwide to move throughout their natural areas with a little more freedom from human contact (Zellmer et al. 2020). In addition, 2020 was following a relatively wet year (2019) for Los Angeles, where it received nearly 15 inches of rain. However, in 2020, Los Angeles received less than 5 inches of rain, making 2021 a drier and more difficult year for animals as humans also emerged from the pandemic and became more active. The advantage in conducting a multi-year study is that one year can often be an anomaly rather than representative of a pattern. When multiple years are observed, it helps researchers recognize potential trends and patterns that could lead to a more durable solution for addressing wildlife conflict issues.

In this case, we did observe differences in animal densities during the two years. Overall, there were fewer animal sightings in 2021. However, that number is more obvious in some species than others. While the number of coyotes stays about the same (1632 in 2020 vs 1630 in 2021), the number of rabbits declines from 3,294 in 2020 to 1,290 in 2021, and the number of cats declines from 2,311 in 2020 to 720 in 2021 (Figure 8). Another common prey species, rats, remained about the same (436 in 2020 to 547 in 2021). Thus, with a decrease in natural prey in 2021, coyotes were likely to enter human dominated neighborhoods more often looking for food, not being able to sustain their diet in the oil fields near Marycrest Manor. In fact, we went from observing pictures with more than 25 rabbits per image to observing no more than two rabbits in a photo at one time. There was also a major decline in skunk photos (3,724 in 2020 to 605 in 2021); however, since they do not interact with coyotes or serve as their prey, we will not delve into this analysis. However, the decline in opossum, another prey source of coyotes, from 2,036 in 2020 to 1,472 in 2021 may have impacted cat populations in Culver City. It is worth noting, of course, that these values don't represent actual changes in population, per se, but serve as indicators that there were fewer animals in the environment. We cannot measure populations directly from these camera photos

alone, but the data do provide a robust indication of ecological activity. Animals may have also selected different movement routes through the parks that would result in fewer camera "sightings". However, the decline in the rabbit population at Marycrest Manor is worth noting since it is so closely located to the populations den sites and likely did not relocate outside of the camera areas.

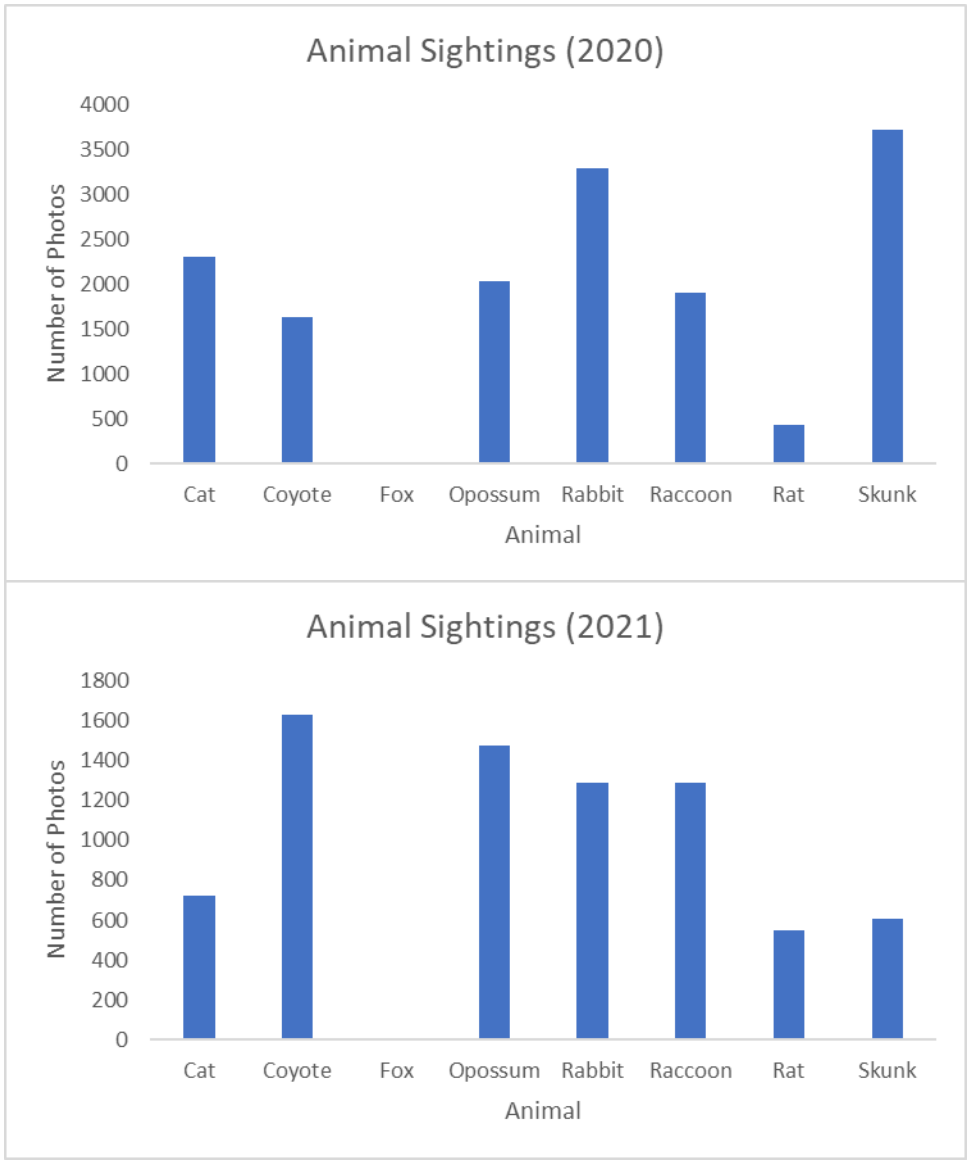


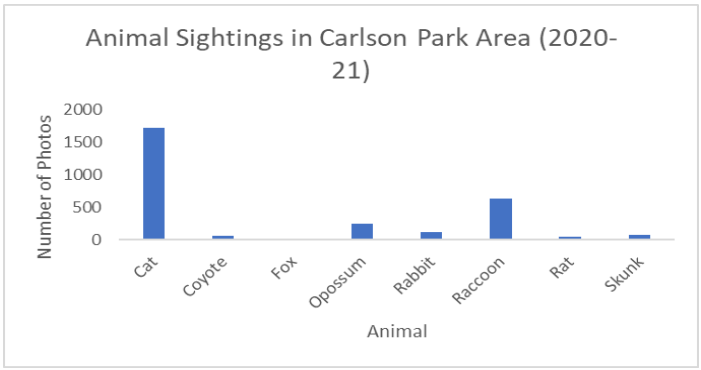
Figure 8. Number of photos collected of each urban mammal found in Culver City, broken down by year.

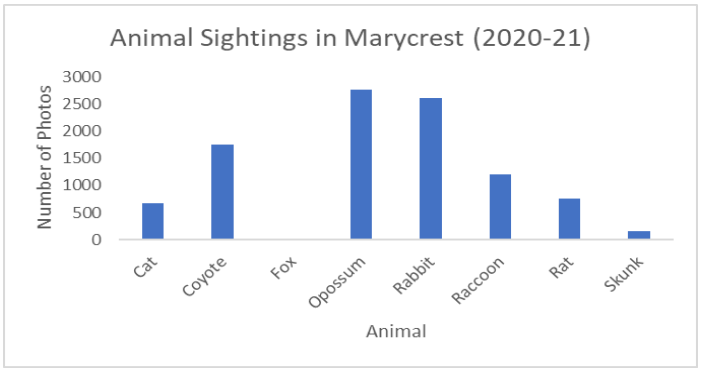
By gathering two years of camera analysis data, we were also able to observe two successive coyote breeding seasons and noticed a decline there as well (Figure 9). In 2020, the pack had a litter of four, growing their pack to seven. In 2021, only one offspring was recorded, late in the breeding season, and it is unknown if he grew to full size and continued to live with the pack. Thus, we can see that the coyotes also may have been experiencing a decline in resources and, therefore, could not sustain such a large litter in the second season.

Figure 9. Difference in litter size per year. The top photo is 2020's offspring, and the bottom photo is 2021's offspring.

We were also able to observe differences in the temporal patterns of when coyotes entered neighborhoods based on when we saw them in photos. For example, when we began the study, there were no coyote sightings recorded around the Sunkist neighborhood. However, in spring of 2020, we started getting calls from residents and putting up cameras in parks. At first, we saw very little activity. Over time, we saw increased cat activity. Upon talking to residents of that area, we discovered that there was a feral cat colony where cats were regularly being fed near Marino Park. A few months after the cat photos increased, we began to see coyotes in these parks. Thus, it appeared that the coyotes were coming into the neighborhoods as anthropogenic food sources increased. Even if they aren't preying on cats directly, coyotes are also known to eat cat food and may be entering the neighborhoods just to capitalize on a food source that they don't have to expend energy chasing. A previous study with collaborators in Rhode Island showed that areas

where cats were fed had increases of other animals, such as opossums, skunks, raccoons, and coyotes (pers. comm.). We have also included an analysis on which areas experienced the highest levels of coyotes (and other animals), broken down into our two neighborhoods: the neighborhoods around Carlson Park and the neighborhoods around Marycrest Manor (Figure 10). We separated Culver City Park into its own analysis as it experiences a high volume of animal sightings because of all the human food discarded in the park. You can see that the Carlson Park neighborhood has the highest number of cat photos (1,727) while Marycrest Manor has the highest number of coyote photos (1,758). Carlson Park also had the lowest number of coyote photos (59) while Culver City Park had the fewest cat photos (311).





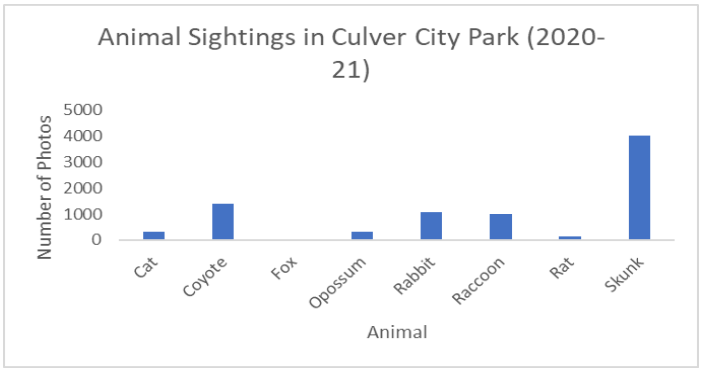


Figure 10. Number of photos captured per neighborhood in 2020-21.

However, it's important to record how many coyotes that we observe, and, *when* we see them. As mentioned previously, most urbanized mammals are nocturnal, allowing them to hunt and interact socially without contact with humans, many of whom see these animals as pest species. Movement of a predator, such as coyotes, can change mammal activity; however, studies have shown that raccoons, skunks, and opossums rarely modify their behavior based on coyote activity (Gehrt & Prange 2006). Thus, our activity analysis focused specifically on cats and coyotes, which are our primary mammals of concern. First, we wanted to see which months coyotes were entering the neighborhoods around Carlson Park, putting them in closer proximity with humans and their pets (Figure 11). We found that they were more commonly observed in the winter months, though there was a spike in July, with December having by far the most coyote visits (28) followed by January (20) and October (19). However, of these months, our scat samples show high cat presence in coyote diet only in October (Figure 19 below). Therefore, the data suggest that the increased visits in the winter are either from dispersing coyotes or increased visits from the Ballona Creek pack and may not necessarily be resulting in increased cat deaths. Coyotes might be using human

environments for other purposes at that time, such as human food or water sources, or simply may be dispersing and looking for new territories.

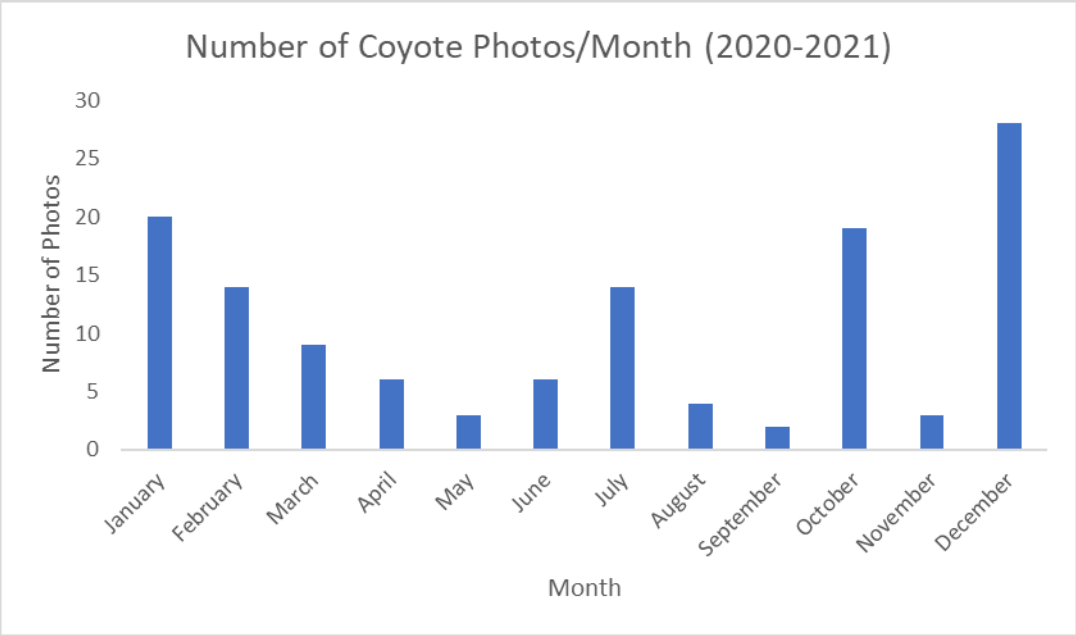


Figure 11. Number of coyote photos captured per month in 2020-21.

In addition, it is important to observe what time of day coyotes choose to enter urban neighborhoods and how this pattern overlaps with times that cats prefer to roam outdoors. As both are nocturnal in urban areas, this can lead to increased encounters, which could lead to increased cat deaths. In general, it is recommended that cats be kept indoors from 7 p.m. to 7 a.m., and this does appear to be the time when coyotes are most active in Culver City as well (Figure 12). Unfortunately, this also overlaps significantly with times that we observed cats on our cameras. However, cats are active during all hours of the day, most likely because they are active during the hours their owners allow them to be outside. Cats active during the day are less likely to encounter coyotes as coyotes were rarely spotted on our cameras between 8 a.m. and 6 p.m.

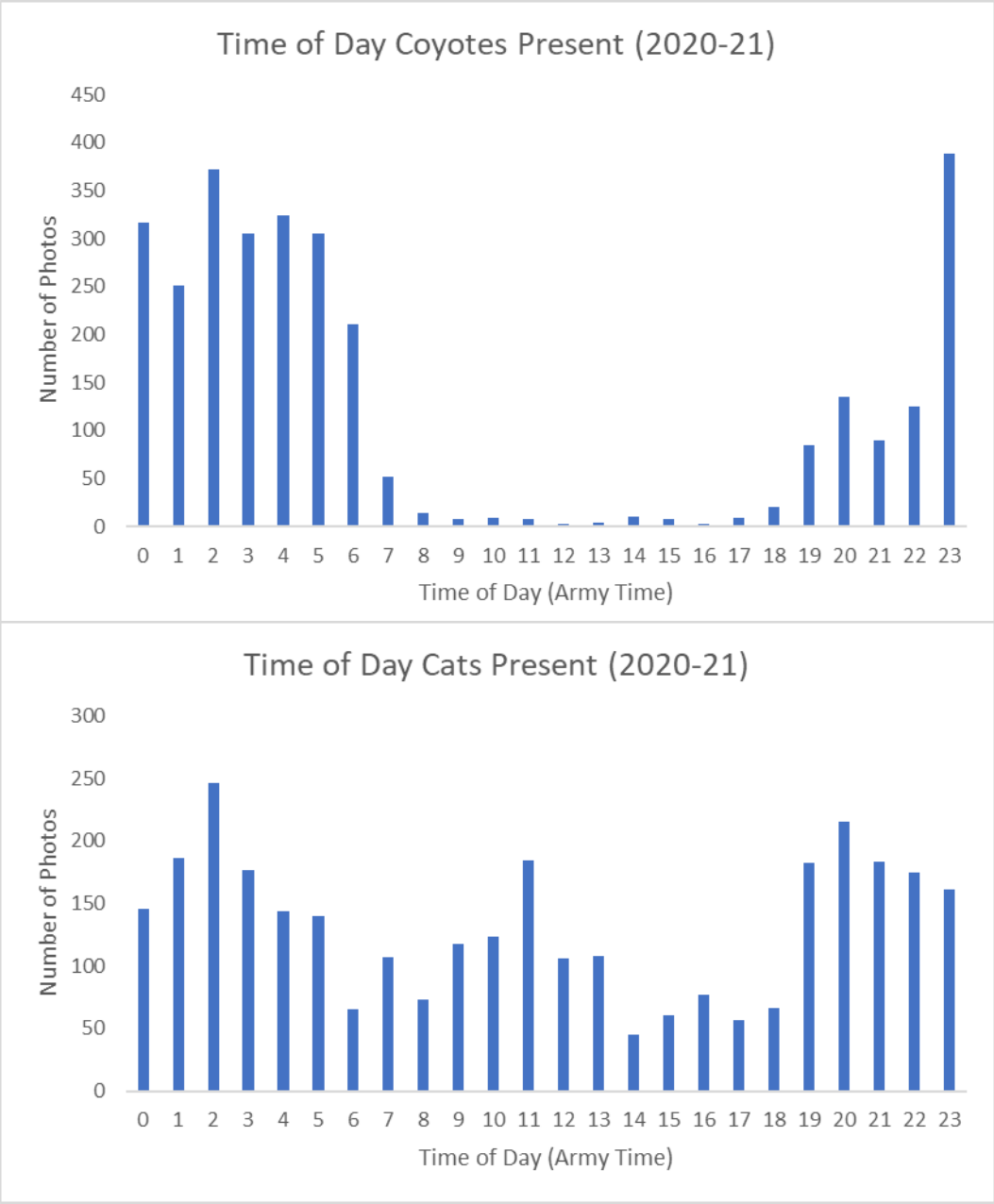


Figure 12. Number of photos captured per hour in 2020-21 for coyotes (top) and cats (bottom).

Previous studies on coyote and cat interactions have demonstrated that cats modify their behavior to avoid coyote presence (Figure 13). Studies in both Chicago (Gehrt et al. 2013) and North Carolina (Kays et al. 2015) both showed that coyotes preferred natural areas to urban ones, so cats avoided those areas. However, when running a similar occupancy analysis in Culver City, we did not find that to be the case. We found that while coyotes still preferred natural areas to urban ones, cats had no preference and did not avoid areas where coyotes were found (Davenport et al. 2022; Figure 13). This study was the senior thesis for one of our undergraduates and will be released to the City once it has finished peer review this fall. Thus, cat behavior might explain better than coyote behavior

the significant increase in cat remains found in coyote diet (25% in Los Angeles; Larson et al. 2020 vs 1-2% in Chicago; Gehrt & McGraw 2007). If cats do not alter their environmentally preferences in Los Angeles but do in other areas, they are likely encountering more coyotes and thus having more negative interactions with them. Cat owners near wildlife corridors or natural areas should be especially wary allowing their cats outdoors because of the wildlife they can encounter there.

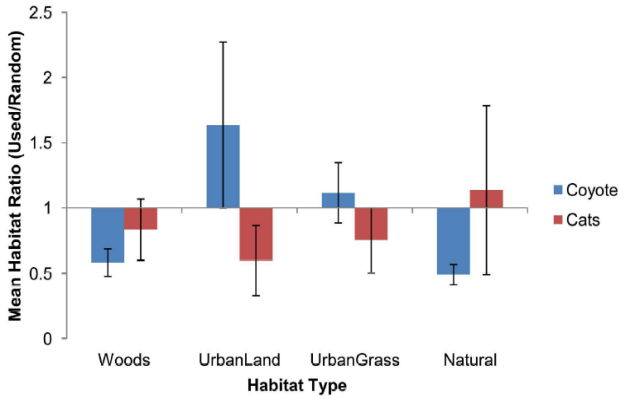


Figure 4. Mean (95% CI) habitat selection ratios for coyotes and free-roaming cats in the Chicago metropolitan area during 2008-2009. Selection ratios are the ratio of the distance to habitat type for observed locations/random locations. Ratios <1 indicate selection for the habitat, and >1 avoidance.

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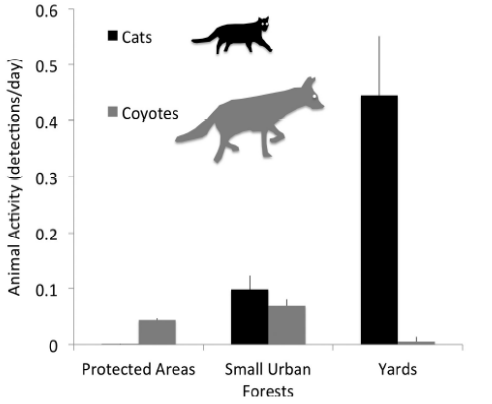


Fig. 2.—Average detection rates of cats and coyotes (*Canis latrans*) recorded by camera traps set in different habitats including 32 protected areas in the eastern United States and 177 urban sites around Raleigh, North Carolina. Error bars show *SE* of the mean. Rates were statistically different across habitats for both coyotes and cats (Kruskal–Wallis test, $P < 0.0001$).

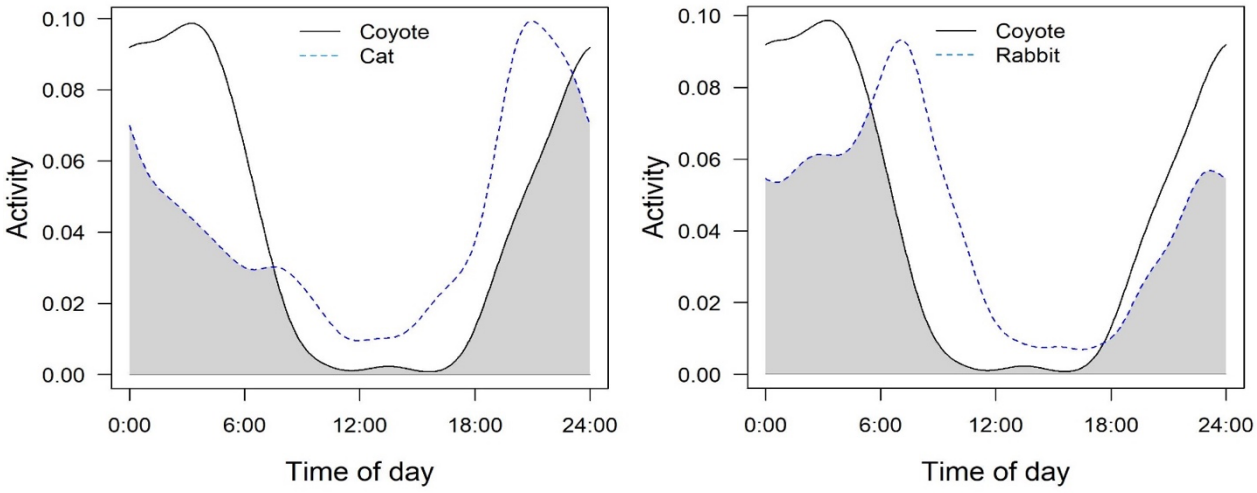


Figure 13. Habitat preference between cats and coyotes in Chicago (Gehrt et al. 2013; top left), North Carolina (Kayes et al. 2015; top right), and Culver City (Davenport et al. 2022; bottom).

2.2 Radio Collar Analysis

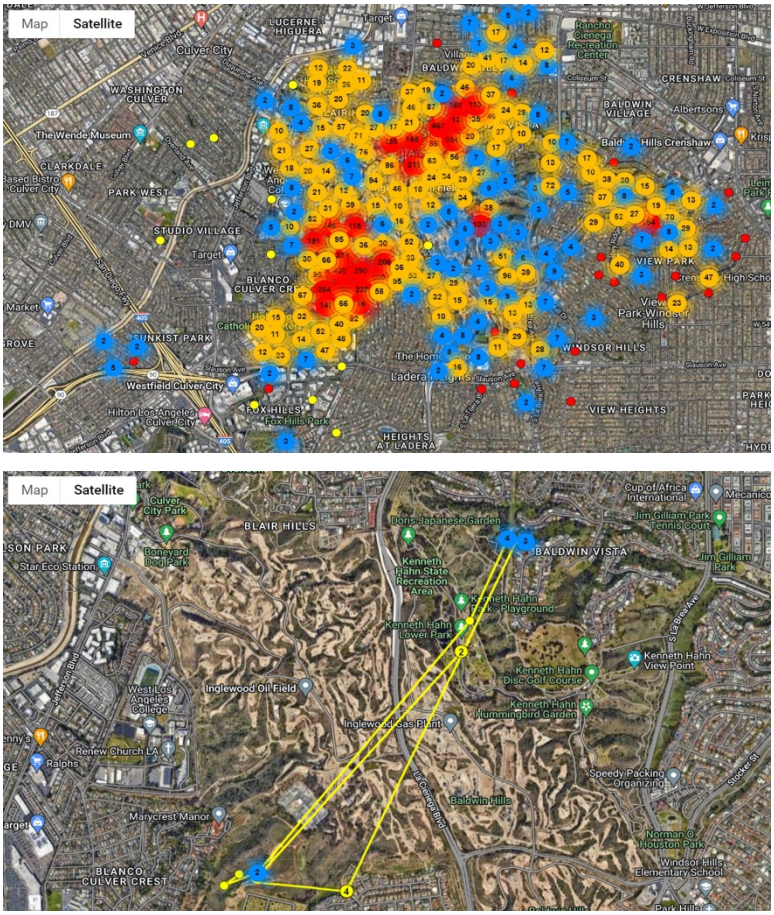
Although camera trap analysis is less invasive and expensive than other techniques and allows researchers to observe multiple individuals moving through the environment. However, it does provide as complete picture of what individual animals are doing because when they are not in view of cameras, there are no data points being collected. Thus, combining camera trap analysis with selected radiotelemetric analysis allows researchers to observe with enhanced detail how much time is being spent in urban vs natural areas for individuals who have been collared. Their

spatial movements are being recorded for 24 hours for the life of the collar, which is up to two years. In collaboration with the National Parks Service (NPS), we trapped and radio collared two individuals from the Marycrest Manor pack, both of whom were males. The first, c171, was the largest and oldest male of the pack; therefore, we believe him to be the dominant male. We trapped him in spring 2021 and trapped one of his male offspring, c165, in November of 2020 (Figure 14). Unfortunately, c165 died in spring 2022 when he was hit by a car. However, we were able to collect more than a year of data from both individuals during this study and are still collecting it from c171. Data were collected hourly during the night and every four hours during the day, when coyotes are less active. Collecting hourly vs more frequently allows the radio collars to function longer so that we can collect data during a greater period of time (pers. comm.).

Figure 14. An image of c165 captured by our cameras at Culver City Park.

In order to make sense of the data collected, we collaborated with Dr. Tal Agvar's movement ecology lab at Utah State University to analyze the data for possible movement patterns. Though c171 is the dominant male of the Marycrest Manor pack, he had a smaller territory (14 km^2 vs c165's 39 km^2). Since c165 was young and still living with his natal pack, he may have been traveling more, searching for a mate. In fact, one day, he made it all the way to the beach traveling down Ballona Creek. Neither of them spent much time in Culver City neighborhoods. The majority of their time was spent in the Inglewood Oilfields, Holy Cross Cemetery, Marycrest Manor, Culver City Park, Kenneth Hahn Park, and the Kenneth Hahn Ballpark (Figure 15). When they did venture into a neighborhood, it was typically in the Baldwin Hills area. However, c171 did spend some time in the Sunkist neighborhood, which is where the feral cat colonies were observed midway through the study. The maps below show all two years of data as well as just the month of July, as fewer data

points make it easier to view geographical references (Figure 15). The collars can also be tracked on a daily basis if precise movements are of interest (Figure 15).



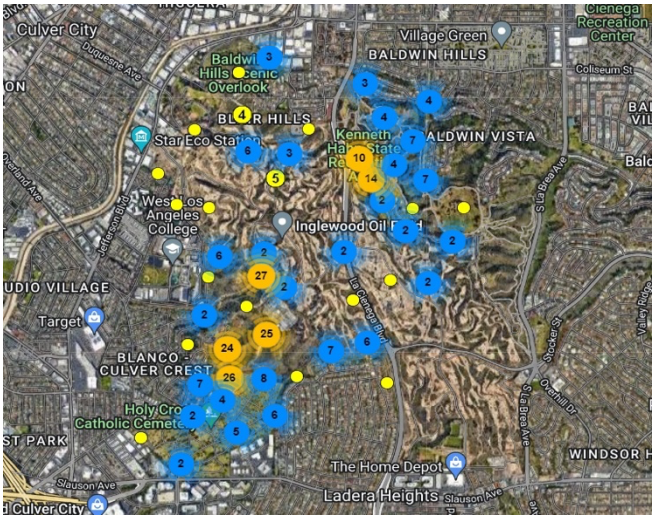


Figure 15. Images of all of the radio collar data collected since November 2020 (top left), the data collected in July 2022 (right), and movement patterns on August 12, 2022 (bottom left).

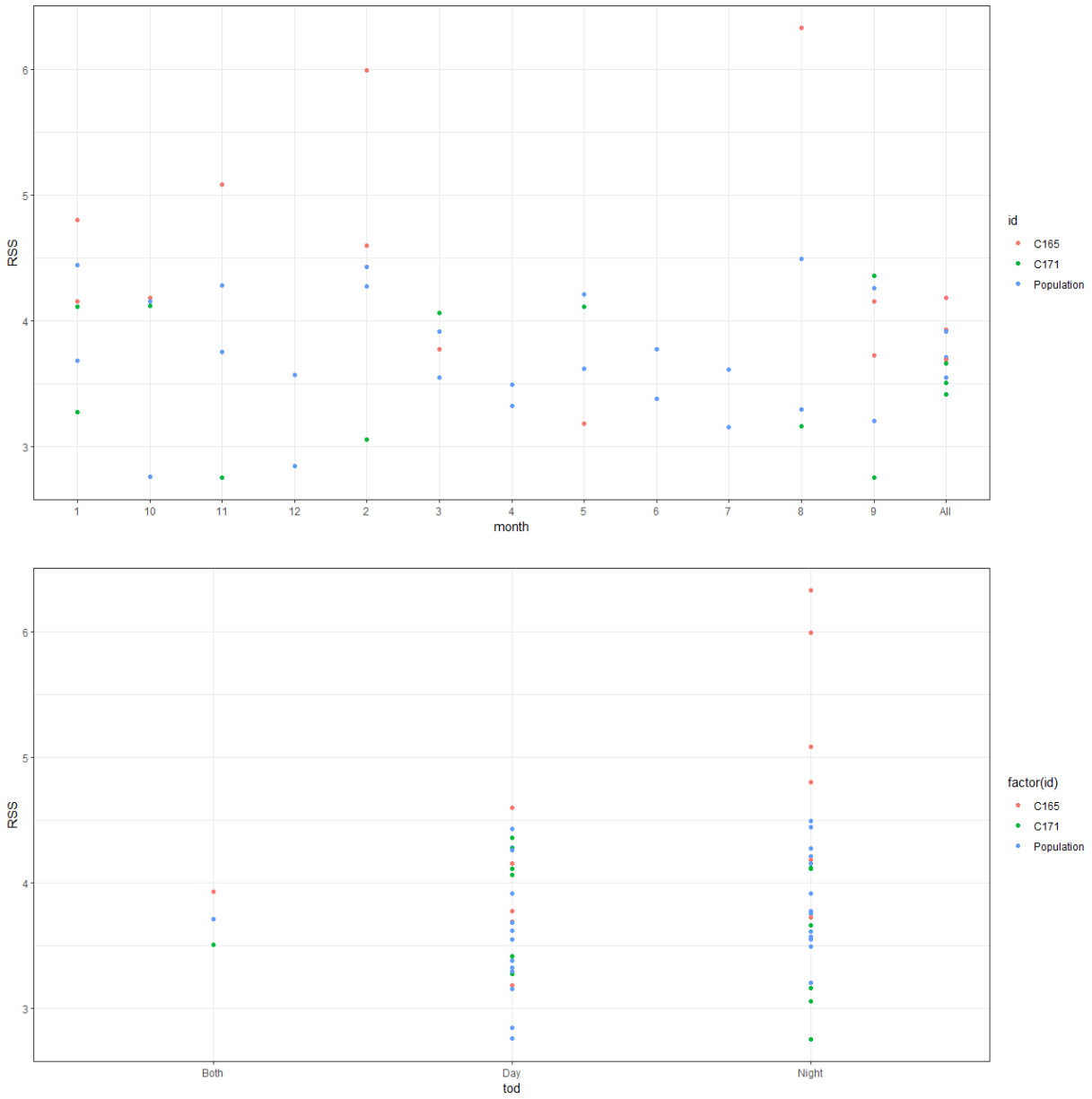


Figure 16. Habitat preference based on comparison between natural and urban areas. The y-axis represents how many times the coyotes would select natural habitats over urban (thus, a value of 3 represents a coyote being three times more likely to choose a natural habitat to urban). Top shows preference based on months of the year and bottom shows preference based on time of day.

In addition to determining the size and range of the territories, we looked at habitat preference between coyotes. The graphs above show preference for natural areas between the two coyotes (Figure 16). The higher the number on the graph, the higher the preference for natural habitats. We looked at these both monthly and day vs night to see if there were any patterns that could allow us

to predict when we might be more likely to see coyotes in urban areas. Despite having a larger territory overall, c165 more strongly preferred natural areas. Consistent with the camera trap data, we can see that both coyotes, but particularly c171, was more likely to choose urban habitat between September and December (Figure 16). He was also more likely to choose an urban environment at night (Figure 16). However, both strongly preferred natural habitats at an average of being about three times more likely to choose natural habitats than urban, no matter what time of year or time of day (Figure 16). This indicates that coyotes in this pack are not seeking out urban environments consistently and prefer their natural areas when prey and water are both available. These patterns align with other research findings.

3. SCAT ANALYSIS

Having enough food to survive and reproduce is the top priority for animals, so anthropogenic food sources is often identified as a driver for encounters between urban wildlife and humans or their domesticated pets (Hopkins et al. 2012). Coyotes are dietary generalists, which means they can exploit a wide array of food sources and have been known to eat everything from rodents and rabbits to fruit and trash (reviewed in Gehrt and McGraw 2007). A study of coyotes in Canada revealed that urban coyotes had even more diverse diets than rural populations, including multiple species of mammals, insects, birds, trash and fruit (Murray et al. 2015; Figure 17). Urban coyotes were 47% more likely than rural coyotes to have more than one type of mammal per scat and consumed 29% less animal, making up for that with anthropogenic food sources (Murray et al. 2015). Among animals that urban coyotes are known to consume are domesticated cats, bringing them into further conflict with humans (White and Gehrt 2009). This could be exacerbated by changes in the environment that contribute to reductions in their native prey sources, such as the recent droughts, pollution runoff, poisoning nuisance prey sources, or developing previously natural areas, further reducing hunting grounds.

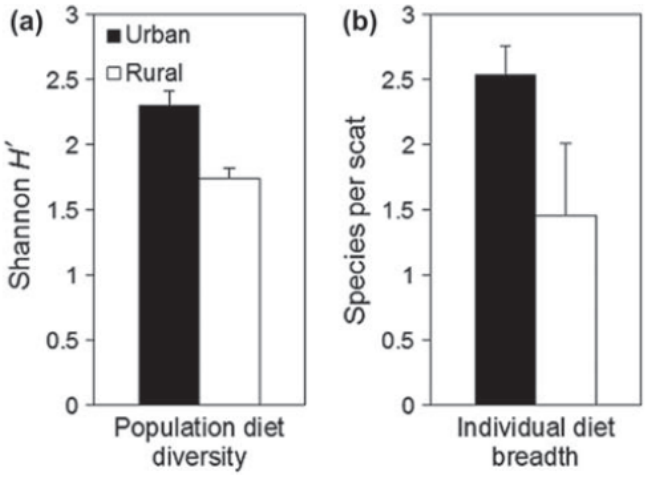


Figure 17. Murray et al. (2015) used the Shannon Diversity Index to calculate diversity of diets and found that urban coyotes showed more dietary diversity and individual breadth than rural counterparts.

Many of the seminal studies on coyote diet have been conducted in Chicago and found that even in urban areas, coyotes do not utilize anthropogenic resources as a high percentage of their diets (Gehrt and McGraw 2007). Particularly, these studies found that coyotes rarely preyed on domestic animals, such as cats and dogs, which made up only 1-2% of their diet (Gehrt and McGraw 2007). Studies in Alaska, Arizona, Canada and Denver supported these findings (Hernandez et al. 2002; Murray et al. 2015; Poessel et al. 2017; Prugh 2005), although a study in

Alabama showed they made up about 8% of coyote diet (Santana and Armstrong 2017) and one in Washington found that cats made up 13% of the coyote diet (Quinn 1997).

Table 1. Occurrence of prey items in 119 coyote scats collected in San Diego, CA, where n = number of scats, FO = frequency of occurrence, and PO = percentage of occurrence (Larson et al. 2015).

	Small fragment (N = 91)			Large fragment (N = 28)			All sites (N = 119)		
	n_i	FO	PO	n_i	FO	PO	n_i	FO	PO
Mammals	72	79%	43%	28	100%	47%	100	84%	44%
Rodentia[a]	39	43%	23%	17	61%	28%	56	47%	24%
Cricetidae	21	23%	13%	13	46%	22%	34	29%	15%
Sciuridae	9	10%	5%	1	4%	2%	10	8%	4%
Geomyidae	7	8%	4%	1	4%	2%	8	7%	3%
Heteromyidae	1	1%	1%	0	0%	0%	1	1%	0%
Unidentified	2	2%	1%	2	7%	3%	4	3%	2%
Lagomorpha	18	20%	11%	9	32%	15%	27	23%	12%
Carnivora[b]	14	15%	8%	3	11%	5%	17	14%	7%
Mustelidae	5	5%	3%	0	0%	0%	5	4%	2%
Mephitidae	3	3%	2%	2	7%	3%	5	4%	2%
Felidae	2	2%	1%	0	0%	0%	2	2%	1%
Procyonidae	1	1%	1%	1	4%	2%	2	2%	1%
Canidae	1	1%	1%	0	0%	0%	1	1%	0%
Unidentified	2	2%	1%	0	0%	0%	2	2%	1%
Soricomorpha	10	11%	6%	1	4%	2%	11	9%	5%
Talpidae	3	3%	2%	0	0%	0%	3	3%	1%
Soricidae	2	2%	1%	0	0%	0%	2	2%	1%
Unidentified	5	5%	3%	1	4%	2%	6	5%	3%
Artiodactyla	1	1%	1%	3	11%	5%	4	3%	2%
Didelphimorpha	2	2%	1%	1	4%	2%	3	3%	1%
Unidentified mammal	4	4%	2%	1	4%	2%	5	4%	2%
Anthropogenic items[c]	34	37%	20%	5	18%	8%	39	33%	17%
Domestic cat	26	29%	16%	0	0%	0%	26	22%	11%
House mouse	1	1%	1%	1	4%	2%	2	2%	1%
Fruit and seeds	23	25%	14%	10	36%	17%	33	28%	14%
Birds	15	16%	9%	6	21%	10%	21	18%	9%
Invertebrates	9	10%	5%	6	21%	10%	15	13%	7%
Niche breadth (B)		6.58			6.34			6.56	

[a]Excludes house mouse *Mus musculus*.
[b]Excludes domestic cat *Felis cattus*.
[c]Includes anthropogenic items such as trash (tinfoil, thread, plastic, paper, and bandages) and 2 commensal species (house mouse and domestic cat).

In California, however, these results are dramatically different. Larson et al. (2015) found cat tissue in 29% of coyote scat in San Diego (Table 1). In neighborhoods throughout Los Angeles, reports of coyotes killing cats have reached record numbers. In Culver City, 73 cats were killed during a two-year period in 2018-2019 (pers comm). A large study conducted throughout the greater Los Angeles area by the National Park Service found cat remains in 20% of coyote scat, indicating that this is a more common occurrence throughout Los Angeles than other reported studies (Larson et al. 2020; Figure 18). In order to determine why this difference occurs, researchers must understand how coyote behavior and diet differs in Los Angeles vs other large cities, such as Chicago and Tucson. Is this behavior typical of urban Los Angeles coyotes or are a few individuals causing most of the

damage? Are there unique aspects of the Los Angeles landscape, prey selection, or animal behavior that lead to these differences?

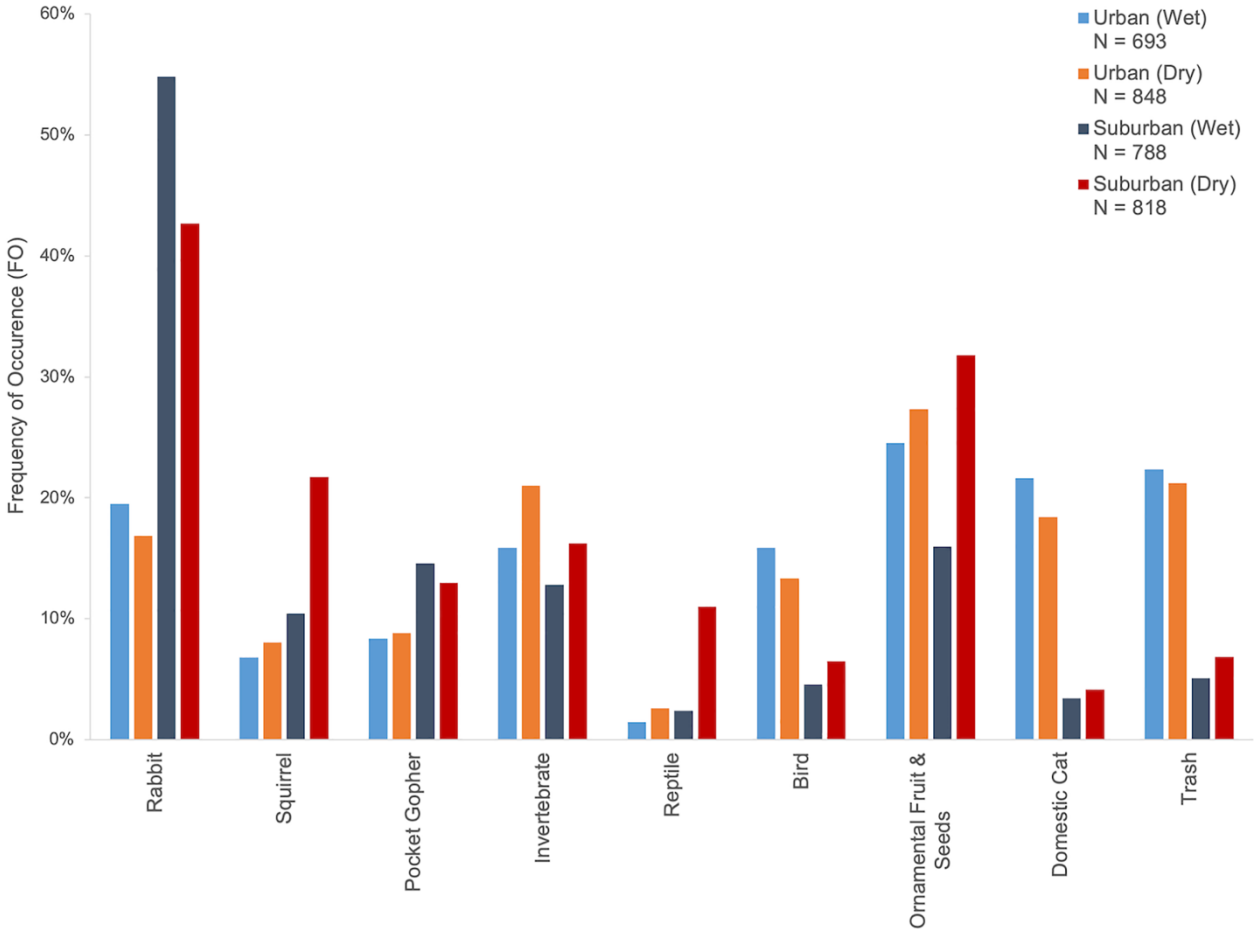


Figure 18. Frequency of occurrence of prey items in coyote scat throughout Los Angeles County, which included collection in urban and suburban areas during both wet and dry seasons (Larson et al. 2020).

While there were Culver City collection sites in the National Park Service study, no study had focused exclusively on the Culver City pack, so we collected two years' worth of scat samples for dietary analysis. The aim was to look for how many cats appeared in coyote scat as well as a well-known natural prey (rabbits), which appears in more than 40% of coyote scat in Chicago, Alaska, and Arizona studies. Dry analysis is the standard through which dietary analysis is done, including the National Park Service study, so we conducted this type of analysis, using similar methodology, for comparable results. This consists of drying collected scat in an oven placed at 60 degrees Celsius for 24 hours to kill pathogens, then placing it in nylon mesh bags, and washing and drying it in a portable washing machine for 20 minutes, which removed all particles and left behind only hair and bone. To determine the presence of cat, rodent, or rabbit, we identified hair, which is quite distinctive, under the microscope.

In the first year, we collected scat opportunistically, visiting parks and walking the Ballona Creek, hoping to find as many scat samples as possible. However, coyotes typically use scat for scent marking and may not want to mark urban areas that they visit infrequently. Thus, in addition to the opportunistic scat hunting, we were able to secure a transect on the Edison lien of the Inglewood Oil Fields where the Marycrest Manor pack was known to frequent. We walked that transect nearly every month for two years from January 2020-December 2021, collecting scat samples. As this was a part of the territory, we found scat on every collection period, collecting from 4-18 samples per month. Collecting samples over this arc of time allowed us to look at seasonal and yearly patterns that may be able to help better inform residents of Culver City when cats are highest in the diet. It also allows us to observe the degree to which this pack is consuming cats in order to determine the level of threat to neighborhood pets.

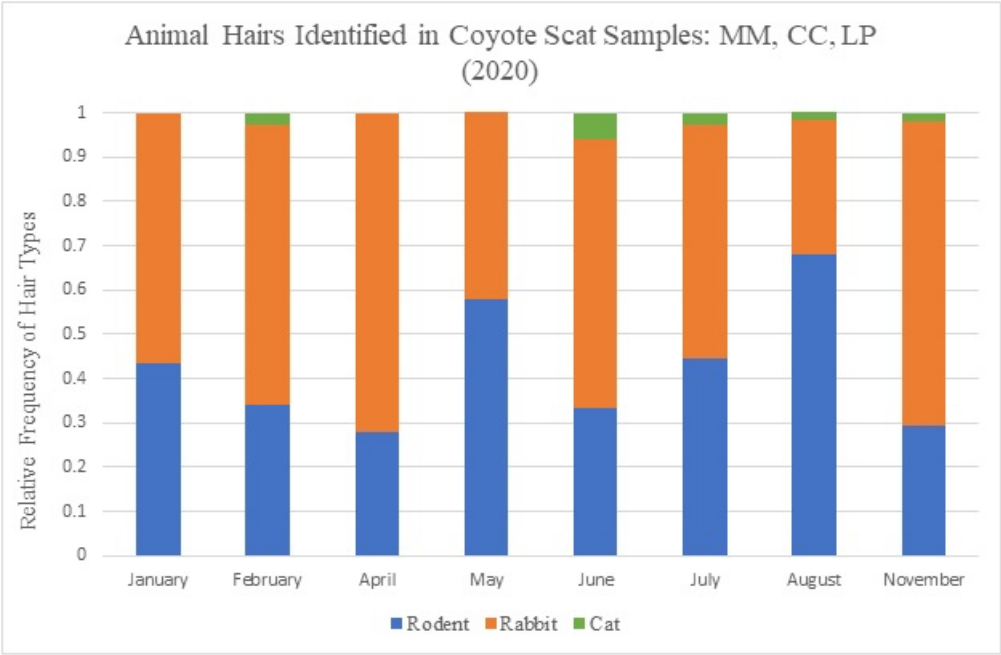
In addition to dry analysis, we removed small bits of 100 samples collected in 2020 and sent them to Dr. Lisette Waits at the University of Idaho for DNA analysis. These samples were collected at Marycrest Manor, Culver City Park, Lindberg Park, and along the Ballona Creek. While photo analysis is good for detecting movement patterns, individual coyotes are very difficult to discern. Thus, unless we see every member of the pack in one photo, it is hard to tell pack size or pack number in Culver City. Comparing DNA samples at a variety of locations allows us to see how many individuals we typically are observing in Culver City and how far their range expands. We had started to suspect that the Marycrest Manor pack was not the same as that on the Ballona Creek, which has better access to the neighborhood and may be responsible for more cat deaths, and this would allow us to determine that with more certainty.

The DNA analysis revealed that we had collected scat samples from 10 individuals: seven males and three females. Eight of those individuals were collected at Marycrest Manor, meaning that during the two years, there had been eight pack members living in that area, with some likely dispersing. However, we captured seven in one photo once when the 2020 litter were juveniles, so the pack has been large at times. Of those eight, there were six males and two females, which we suspected given that all three individuals that we trapped were males. In coyote packs, male offspring will stick around for a year or two to help with future litters if the environment doesn't favor dispersing. Scat collected at Culver City Park matched scat collected from a Marycrest Manor male, which also fits with our photo analysis and radio collar data. Scat collected at Lindberg Park matched with a female collected at Marycrest Manor; thus, we can see that the pack does travel into the Culver City neighborhoods.

In addition, the scat collected at Ballona Creek near Lindberg Park, across from the high school, did not match with scat collected at Marycrest Manor. As we suspected, there is a second pack, which travels down the Creek, likely also entering the neighborhood at times. We tried to track this pack and believe we found an abandoned den, but it was outside Culver City city limits. This pack may be primarily located in Playa Vista or Westchester, where there have also been increased coyote sightings in the last two years. There were two individual scats collected in this pack, one male and one female. Because we had such limited information from this pack, we excluded them from the dry scat analysis and focused only on the data collected at Marycrest Manor during the two-year period of 2020-2021 when we were also radio collaring individuals from that pack and observing their behavior through photo analysis.

In 2020, our data matched scat data found in other major cities, like Chicago, which indicate that cat is a very small part of the Culver City coyote diet. The greatest percentage that we saw was around 5% in June 2020, and there were some months, like April and May, when there was none (Figure 19). Marycrest Manor diet consists largely of rabbit, which we knew to be a preferred prey source, and rodent, which is a significant prey source in other cities but has not been known to be a consistent prey source in Los Angeles (Larson et al. 2020). However, in the second half of 2021, cat becomes much more prevalent in the diet. While it is still low in December, heading toward the spring, it is higher in the fall months, reaching a peak of 25% in October. This coincides with our radio-telemetric data, which showed the c170 spent more time in urban areas during September, October, and November than other months. We also notice that rabbits were completely absent from the diet that winter, which indicates that there was something novel happening in the coyotes' environment.

In the two years prior to this study, when 73 cats were eaten in 18 months in Culver City, Los Angeles was suffering from a severe drought. In 2018-19, there was a brief reprieve where Los Angeles received normal rainfalls and the pandemic caused a rebound in animal populations worldwide (Zellmer et al. 2020), causing potentially a wildlife rich habitat in 2020. However, in 2020, the drought resumed, causing harsher conditions and constrained breeding season that could have caused a decline in animals (Figure 8 above). These prey patterns likely indicate that with an abundance of rabbits and rodents, coyotes prefer their natural prey sources. However, when the rabbit population depleted, coyotes may have had to supplement their diet with cats. During this time, we went from observing up to 25 rabbits in one photo at Marycrest Manor to few rabbits at all (Figure 10). A study in the Chihuahuan Desert, which expands through much of the desert and semi-arid Southwest with landscape and weather patterns similar to southern California, showed that rabbit populations increased or decreased relative to rainfall and plant production (Lightfoot et al. 2011). Therefore, we can hypothesize that rabbit populations decline in Culver City during drought conditions, causing coyotes to search for dietary supplements, such as domestic cats. Understanding this environmental connection can allow us to make better predictions about when coyotes may be hunting cats and take better steps to prevent this from occurring.



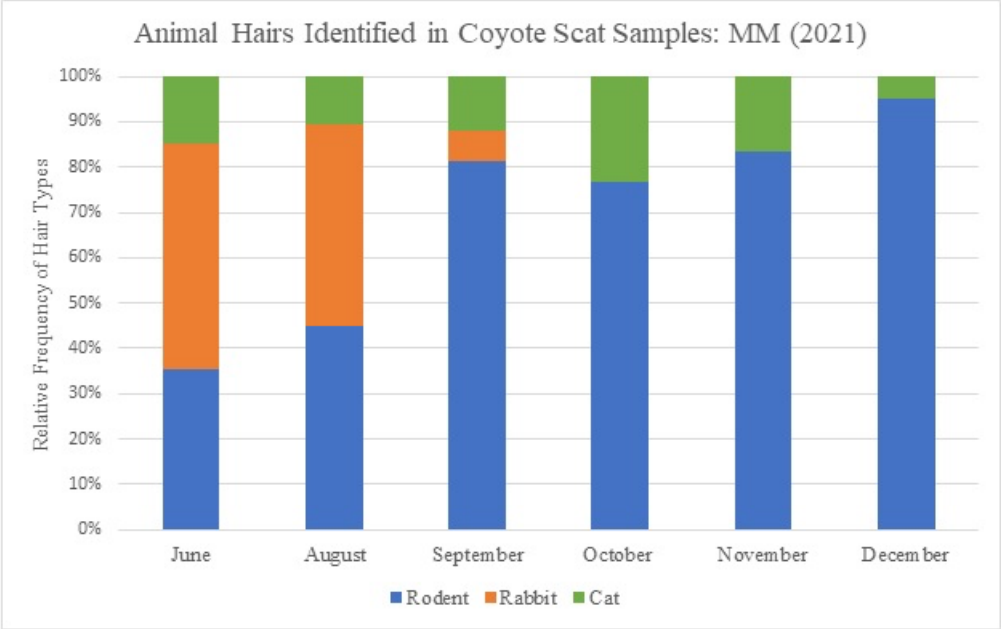


Figure 19. The first graph depicts scat collected throughout Culver City (though primarily at Marycrest Manor) throughout 2020. The second graph depicts scat collected at Marycrest Manor in 2021. Monthly collections ranged from 4-18, depending on the month.

4. SURVEY OF RESIDENTS

In Year 3 of the project, a social survey was conducted with residents in the City of Culver City. In partnership with City staff and their marketing partners from Tripepi Smith, CURes researchers developed a short questionnaire to assess public knowledge and perceptions of, and interactions with, coyotes. Demographic questions were also asked to determine how well respondents

represented the population of Culver City. The survey protocol was approved by the Institutional Review Board at Loyola Marymount University.

Researchers used Qualtrics survey software to produce a web-based survey that was available on the Culver City coyote web page. Survey subjects were selected through multiple forms of outreach. Most of the outreach was conducted by the City. First, the survey link was directly emailed to residents through GovDelivery. Second, the survey link was promoted through various social media platforms, including all Culver City neighborhoods' NextDoor forums and through the City's Instagram, Twitter, and Facebook accounts. Third, the survey was physically advertised on Culver City buses, in which riders could scan a QR code to take the survey. Finally, LMU staff conducted in-person recruitment via intercept survey at public locations in the City, including parks, outside of City Hall, and the Culver City Town Plaza. The intercept surveys were delivered using tablets. The criteria for taking the survey were that the respondent was 18 or older, a resident of Culver City, and had not yet taken the survey.

The survey was open from February 25, 2022 until April 15, 2022. Supplemental intercept surveys were conducted at several public locations in the City until May 8, 2022. There were 420 respondents who attempted to take the survey, but 43 of these either did not meet the screening criteria or did not complete the survey. There were 377 responses complete enough to include in the analysis that follows.[1]

4.1 Coyote Knowledge, Perceptions, and Interactions

Respondents were asked to indicate how strongly they agree or disagree with three statements regarding coyotes. Results are shown in Table 2.

Table 2. Responses to statements regarding residents' knowledge and opinions about coyotes.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I understand coyote behavior and activities.	10%	12%	14%	42%	22%
I know where coyotes frequent in Culver City.	16%	14%	17%	39%	14%
Coyotes should be allowed in Culver City.	27%	13%	22%	17%	22%

As shown, the majority (64%) of residents somewhat or strongly agreed that they understand coyote behavior and activities. Similarly, 53% agreed that they know where coyotes frequent in Culver City. However, past research has shown that the general public is not typically well informed about urban coyotes. A previous survey of LA County residents found that knowledge of coyote ecology, behavior, and how to react to a coyote encounter was extremely poor, irrespective of the respondents' attitude toward wildlife in general or coyotes in particular (Elliot et al. 2016). Residents that believe they know how to respond to urban coyotes may be more likely to conduct activities that further attract coyotes. They may also be more likely to spread misinformation.

[1] Some questions were left blank, and so the sample size (N) is reported for each individual question.

The results for the statement "Coyotes should be allowed in Culver City" (Table 2) were almost evenly divided between those who somewhat or strongly agreed (39%) and those who somewhat or strongly disagreed (40%). Given what is known about urban ecosystems and coyote population dynamics, it is nearly impossible to eradicate coyotes from a given location. Even if it was possible, it is not desirable, as removal of one species would have cascading effects on the ecosystem.

Respondents were asked about their own interactions with coyotes, as well as their understanding of their neighbors' interactions.

- **Have you encountered any coyotes in your neighborhood?** (N=377)
    - **How many times have you encountered a coyote in your neighborhood?** (N=177)
    - **Approximately when was your last encounter with a coyote in your neighborhood?** (N=172)

There were 47% of survey respondents who reported encountering a coyote in their neighborhood at least once. While the median number of encounters was 2, the number of reported encounters had a wide range, from 1 encounter to over 300. Figure 20 shows this range. Most (61%) of these respondents indicated their coyote encounters took place within the past six months (November 2021 – April 2022), with 20% of all reported encounters taking place in February 2022. Thus, 1/5 of respondents had seen a coyote within the month prior to the survey opening on February 25, 2022

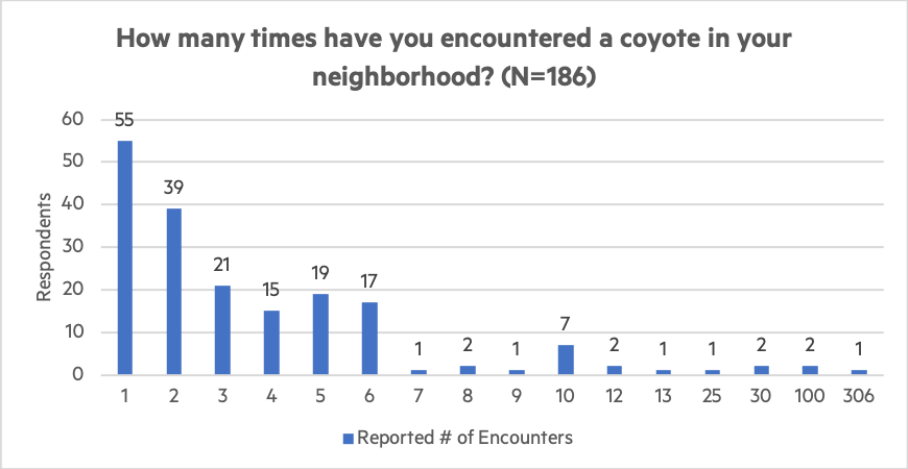


Figure 20. The range of coyote encounters reported by respondents.

- **Do you know anyone who has encountered a coyote in your area?** (N=374)
    - **How many people that you know have encountered a coyote in your area?** (N=234)

There were 63% of respondents who reported knowing someone in their neighborhood that has encountered a coyote. When asked how many people they know that have encountered a coyote in their neighborhood, respondents indicated a range from 1 to 30 neighbors, with a median of 3 neighbors.

- **Do you have children under the age of 18 living at home with you?** (N = 377)
    - **Do you have concerns about coyotes and the safety of your children?** (N=148)

Just over 1/3 (39%) reported having children living at home. Of those that indicated that they have children living at home, 36% reported having concerns about the presence of coyotes in regards to the safety of their children.

- **Do you have any of the following pets?** (N=372)
    - **Do you have any concerns about coyotes and the safety of your pet(s)?** (N=264)

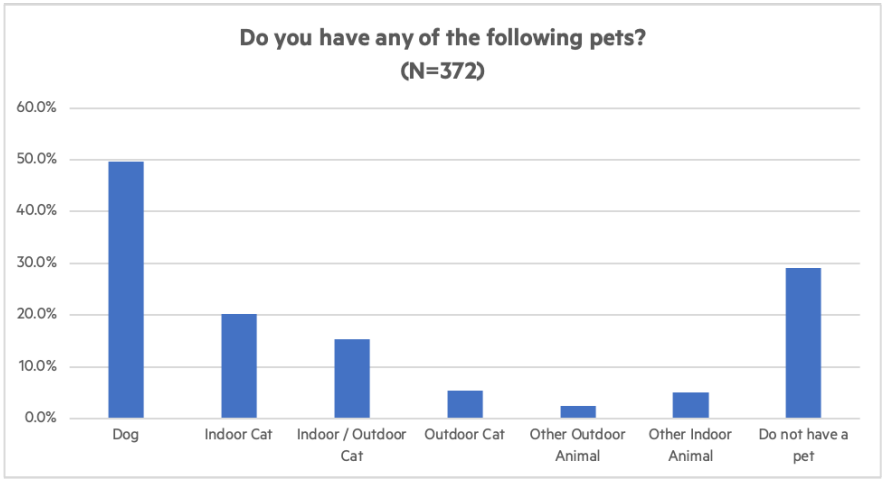


Figure 21. Types of pets reported by respondents.

Half (49.7%) of all respondents indicated that they have a dog, 20.7% indicated having a cat that spends at least some time outdoors, and a small number (2.4%) indicated having another outdoor animal. Other outdoor animals, included tortoises and turtles, feral cats, squirrels, chickens, and Koi fish.

Those that reported pets were also asked if they had any concerns about coyotes and the safety of their pets. Out of 264 that reported having pets, 63% replied yes, they did have safety concerns with their pets and coyotes.

- **How often do you offer food outdoors to your pets and/or other animals?** (N=373)

The vast majority of respondents (80.4%) indicated that they "never" feed animals outside. Of the remaining responses, 8.3% chose "always" or "often," and 12.3% chose "sometimes" or "rarely" in regards to feeding animals outside. This low number is encouraging, as leaving food outside the home provides an attractant to draw coyotes closer to homes. However, even a small percentage of homes with food outside may produce risks to neighboring homes and pets.

- **What is the relationship between your outdoor cat and the natural surroundings?** (N=74)

When asked their thoughts on their outdoor cat's relationship with their natural surroundings, the majority of residents with outdoor cats were split between "My cat neither benefits nor harms the natural surroundings" (39%) and "My cat benefits the natural surroundings" (40%). Only 4% of respondents with outdoor cats indicated that "My cat harms the natural surroundings." The

remaining 17% were unsure about their cat's relationship with the natural surroundings. These survey results support other work (McDonald et al. 2015) finding that cat owners do not agree that their cats are harmful to wildlife, even after being presented with data showing the opposite.

Cats are predators, and many research studies assert that free roaming cats can negatively impact local ecosystems by preying on wildlife (e.g., van Heezik 2010, Medina et al. 2011). While outdoor cats can be effective at removing rodents, especially in rural areas (Kauhala et al. 2015), they also compete with coyotes for these prey. As we have found with our field study (Figure 19), coyotes seem to prefer rodents and rabbits to cats, but may be preying on cats when these small mammal populations are low.

- **Where do you learn about the City's coyote management efforts/tips?** (N=377)

As shown in Figure 22, half of respondents get their information about the City's coyote management from Culver City social media. However, many others indicated that they get their information through personal social media (28%) or word of mouth (27%). Over 1/4 of respondents indicated that they did not know of the city's coyote management efforts. Given the distribution of the survey via Culver City outlets, it is likely that even more residents that are unaware of the City's efforts. This suggests that while the City is reaching a good number of residents, there is more work to be done to ensure complete and accurate information is received by residents.

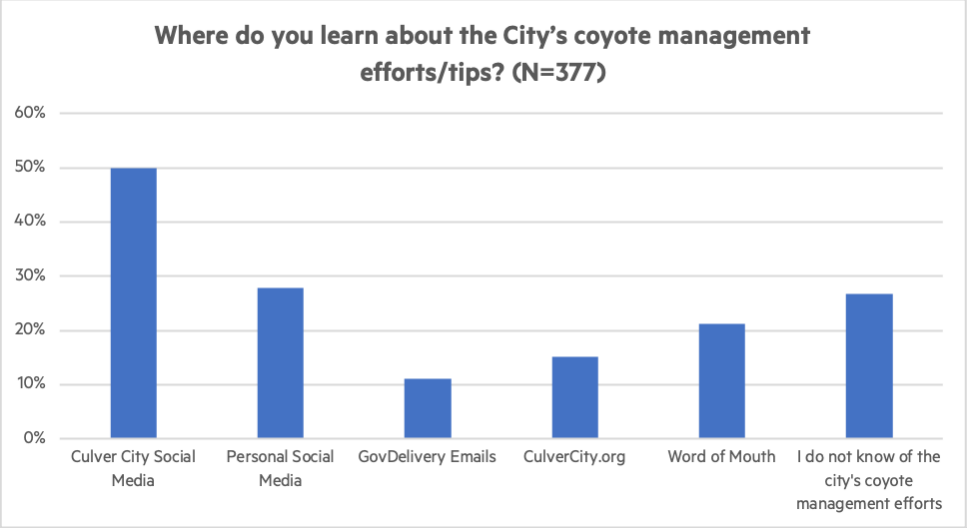


Figure 22. Responses to how residents learn about coyote management efforts. The percentages add to over 100% as respondents could choose all modes of information that they utilize.

4.2 Participant Characteristics

Respondents were asked a number of questions about their residency in Culver City, as well as demographics questions. This provides another layer of information for the City as they consider best public outreach strategies regarding coyotes.

Residence-related questions

- **How many years have you lived in Culver City? (N=340)**

Survey respondents have a long tenure in Culver City. When asked how long they have lived in the City, responses ranged from 6 months to 80 years, with a median of 21 years.

- **Please identify the closest park to your home. (N=377)**

Given a choice of the 12 Culver City parks, the largest share of responses reported living near Carlson Park (24%), followed by El Marino Park (13%), Veteran's Park (12%), Lindberg Park (11%), and Culver City Park (9%). Figure 23 shows the full distribution of responses to this question.

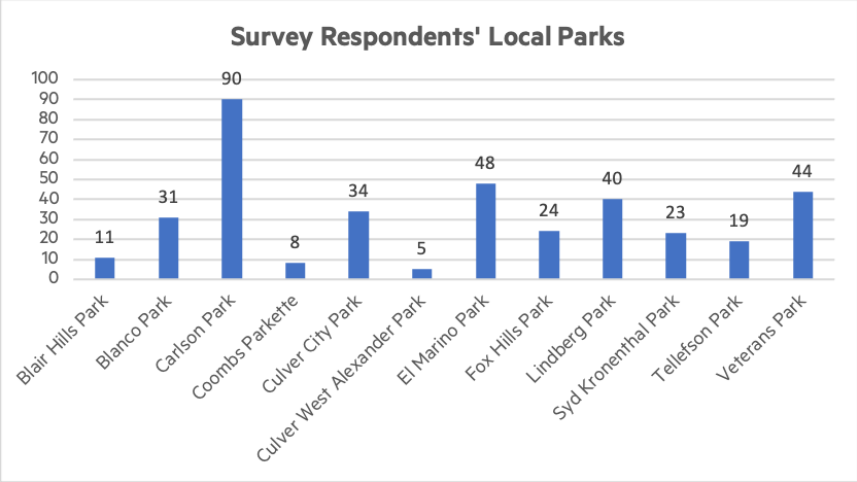


Figure 23. Distribution of the closest park to survey respondents' homes.

- **Do you rent or own your home? (N=345)**

There was a high representation of home owners, with 81.4% of respondents reporting that they own their Culver City homes. This is not reflective of the overall population of Culver City, as just over half (53.8%) of residents lived in owner-occupied housing according to the most recent US Census (see Table 3 in the next section).

Demographics

Results from survey questions regarding the demographic characteristics of participants are reported below. Respondents that selected "Prefer not to answer" or left the question blank were removed from the reported sample size (N) and the analysis. Given the large number of respondents who preferred not to answer these questions, as well as the fact that residents under 18 years old were excluded from the survey, these results should be interpreted with caution.

The first set of demographic questions reported here asked about racial, ethnic, and gender identities. For their racial identity, respondents were given the option to choose "all that apply." Figure 24 shows how racial identities were distributed. White/Caucasian (80.8%) was the predominant racial identity, followed by much smaller numbers for Asian (14.2%), Black/African

American (3.6%), American Indian/Alaska Native (1.3%), and Native Hawaiian/Pacific Islander. There were 4.0% of respondents choosing a "Racial Identity not listed".

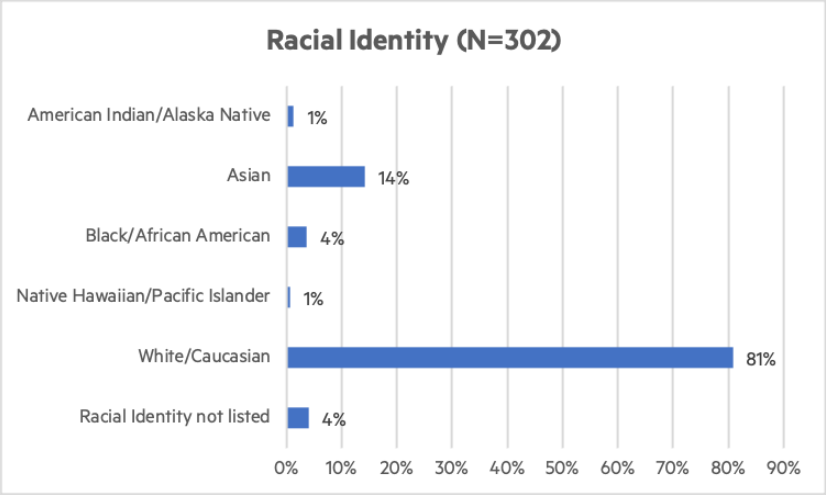


Figure 24. Racial identities listed by survey respondents. The percentages add to over 100% as respondents could choose all races that they identified with.

The racial identity data were also analyzed to make them comparable to US Census data. This included categorizing those who chose only one race separately from those who chose two or more races. Those who wrote in a race had to be excluded from this analysis, unless their described race could be categorized into one of the US Census categories. Table 3 shows how racial identities of the survey respondents were (or were not) representative of the Culver City population as a whole.

Table 3. Survey respondents' demographic identities compared to the City of Culver City overall.

Demographic category	Survey respondents	City of Culver City*
Racial Identity (N=296)		
White alone	79.4%	59.7%
Black or African American alone	3.0%	9.3%
American Indian and Alaska Native alone	0.3%	0.3%
Asian alone	11.8%	17.5%
Native Hawaiian and Other Pacific Islander alone	0.3%	0.3%
Two or More Races	5.1%	8.4%
Hispanic or Latinx Identity (N=304)		
Hispanic or Latino	11.5%	20.2%
Gender Identity (N=343)		
Female	68.9%	53.7%
Home Ownership (N=345)		
Owner-occupied housing	81.4%	53.8%

*data from the US Census (Quick Facts V2021).

Table 3 also shows the results from the questions about Hispanic/Latinx identity and gender identity. As shown, the percentage of survey respondents identifying as Hispanic or Latinx (11.5%) is lower than the 20.2% of residents in the City as a whole, and those survey identifying as Female is higher than residents of the City as a whole.

It is difficult to compare the survey data for age directly to US Census data for a number of reasons, including that children under the age of 18 were excluded from the study. However, it does seem likely that the surveyed population is older than the residents of Culver City as a whole. Figure 25 is offered as a side-by-side visual comparison, but is not a statistical analysis. As shown, the 18-24 and 25-34 age ranges are underrepresented in the survey population, while all ranges between 25-74 are overrepresented. The 75+ age group is relatively well represented in the survey data.

Finally, respondents were asked about education and income. Of those that responded, 68% reported an income of over $100k, and 80% of respondents reported the highest level of education they completed as a college degree or higher (Figure 26).

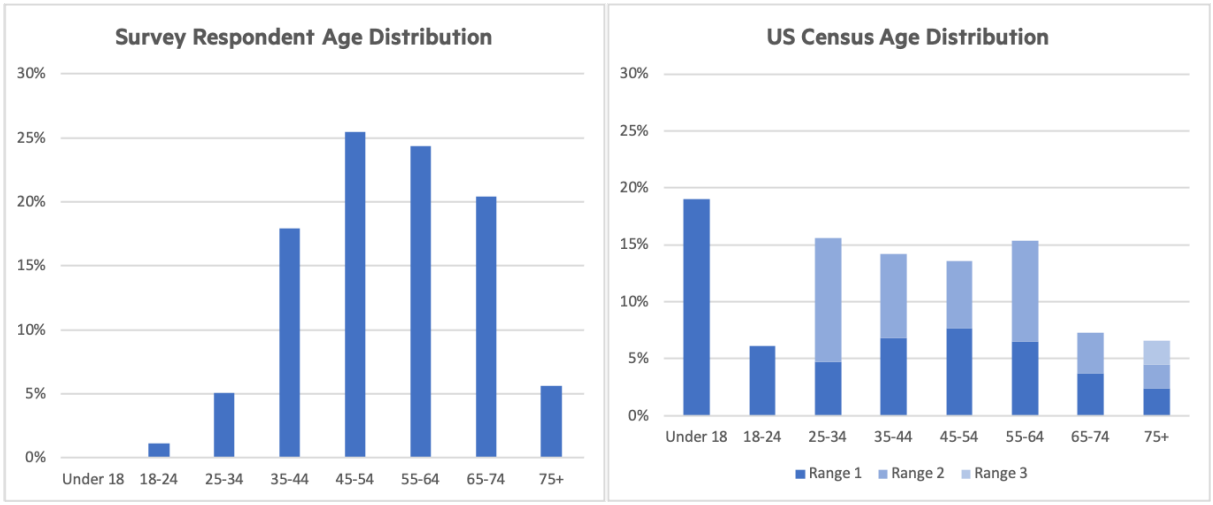


Figure 25. Side-by-side comparison of age distributions for Survey Respondent (left) vs. US Census data (right) for the entire population.[2]

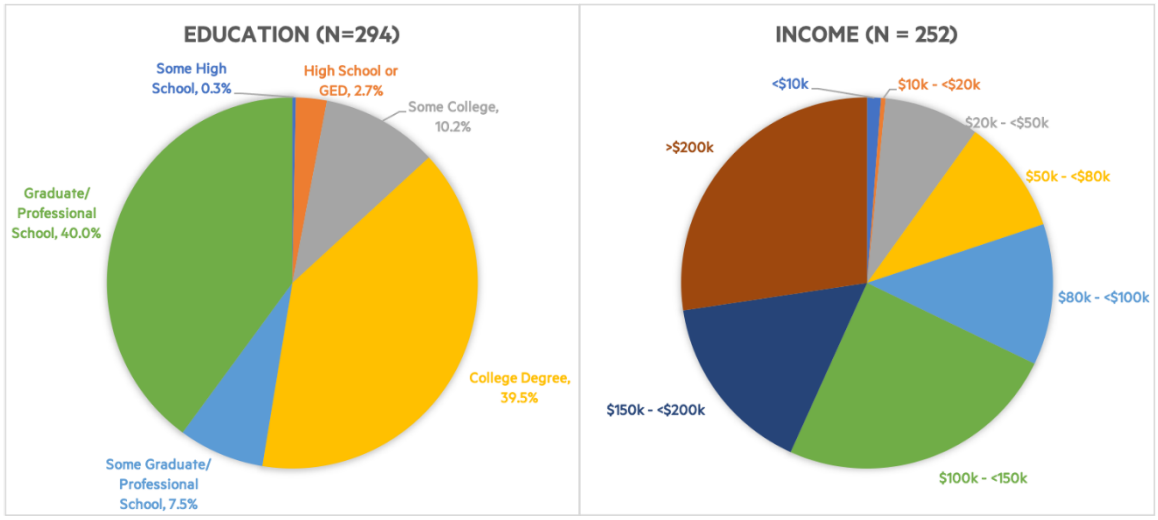


Figure 26. Education (left) and income (right) distribution of Culver City Coyote Survey participants.

5. K-12 EDUCATION CURRICULA

An important component of implementing a coyote management plan is education, both for adults and students. However, students continue to be a key focus of our initiatives as they are a captive audience and often enter educational programs with more enthusiasm and fewer biases. Therefore, as a part of our funding in this project, we created a program that consists of five lessons at 50 minutes each of an Urban Wildlife EcoLab curriculum that can be implemented in the schools.

[2] The US Census age question allows for response in increments of 5 years, so the data in Figure 25 are reported in aggregate as a stacked column. Source: US Census 2020 American Community Survey.

CURes has more than a decade of experience creating *Urban EcoLab* modules for various projects. The Urban Wildlife module is Module 12, created specifically based on research from coyote studies conducted at CURes and targeted toward students in Culver City. To create this middle and high school level program (though it could also target younger grade levels), we identified relevant, subject-matter core Next Generation Science Standards (NGSS) for Grades 9-12 and created lessons and activities that meet those standards. These lessons teach students about coexisting with urban wildlife and reducing conflict between humans and urban animals, with a specific focus on coyote ecology and management plans. We created a Standards Alignment Chart for this curriculum (see Appendix for materials), which is currently available online at academics.lmu.edu/cures/partners/k12teachers/urbanecolab/module12. These lessons will help students learn about coyote ecology, genetics, and behavior while emphasizing ways to reduce coyote presence in their neighborhoods through proper yard management and hazing techniques. Knowledge gained through the Culver City research project will be featured prominently such that students will know specifically how to deal with the coyotes they are likely to encounter in their environment.

There are five lessons in this curriculum, each designed to be taught during four 50-minute class periods. All lessons consist of all materials needed to teach the classes, including a PowerPoint presentation, background reading materials, instructions for various learning activities, all materials required to complete those activities, and a final reinforcing activity that brings all of the topics in the lesson together. Here is a summary of the five lessons to which students will be introduced:

- Lesson 1: Coyote Ecology and Resiliency – The purpose of this lesson is to facilitate student acquisition of background knowledge on topics related to coyote ecology, including geographic distribution, physiology, sociobiology, genetic variation and evolution, among others. Threaded throughout the lessons will be an exploration and discussion of human-impact on coyote geographic distribution, home ranges, physiology, diet, behavior, adaptations, and resiliency. Special focus will be spent on identifying notable behavioral changes that have occurred in urban coyotes over the past century.
- Lesson 2: Coyote Population Dynamics – The purpose of this lesson is to encourage students to begin thinking about the interactions between animals in an environment and the ways in which those interactions affect each animal. Students will learn about predator/prey dynamics and ecosystem biodiversity through the lens of coyotes and other city predators, primarily cats, by learning about their diets and movement patterns. They will then be asked to consider the impacts of humans and feral cat colonies on urban environments.
- Lesson 3: Coyote Traits, Adaptations, and Behavior – The purpose of this lesson is to facilitate student acquisition of background knowledge on topics related to Canid speciation and evolution. This will focus on unique physical and behavioral characteristics of coyotes from other Canids as well as those adaptations that have allowed them to become so widely distributed through North America, though not quite as well distributed as dogs, which will also be a focus of this lesson.
- Lesson 4: Coyote Biodiversity – The purpose of this lesson is to facilitate student acquisition of background knowledge on topics related to human and coyote impacts on biodiversity. This will focus on how humans impact biodiversity in urban areas, how coyotes fit into the urban food web, and how the two species interact with one another.
- Lesson 5: Coyote Wildlife Management – The purpose of this lesson is to facilitate student acquisition of knowledge on topics related to human and coyote interactions. This will

focus on how humans and coyotes interact in urban areas and ways in which scientists can mitigate conflicts between the two species.

While all materials are available for teachers free online, allowing any teacher to implement the program in their classroom, CURes staff is also available to conduct programs within the school or conduct teacher workshops that prepare teachers to deliver the materials. Because COVID prevented us from being able to launch this program during the timeframe of the contract, we are willing to conduct these programs during the next year with no additional financial commitment from Culver City. We are also available to work with the City on an advertising campaign to inform teachers about the resources available to them. We believe that this educational component is key to reducing human-animal conflict in Culver City and have also prepared materials that can be taught in only one class period and materials that are geared toward adult presentations (see Appendix for materials).

6. DEVELOPMENT OF BACKYARD COYOTE RISK ASSESSMENT

From our previous experience conducting a survey of City of Long Beach residents, we learned that most residents don't have much information about coyotes or coyote management. Thus, it is likely that they are not sure how to keep coyotes out of their yard or if they are doing something to inadvertently draw coyotes to their yard. Conversations with Culver City residents reinforced this as most residents who had coyotes in their yards or heard about them in their neighbors' yards weren't sure why the coyotes were there or what they could do to reduce their exposure to risk. Culver City sits adjacent to the Ballona Creek, which is a corridor for coyote travel, and has many large natural areas for coyotes to hide, we wanted to see if we could use some basic information from residents to determine what characteristics were drawing coyotes into a neighborhood rather than passing them by.

From the map of coyote sightings created by CURes and the City of Culver City, we could see two neighborhoods where the coyote sightings were happening: the hills around MaryCrest Manor/Culver City Park and the neighborhood along the Ballona Creek from Duquesne to Overland. Other neighborhoods in Culver City were relatively free of coyote sightings and associated cat mortality. While we did see a migration of coyote sightings during the study (see Camera Trap Analysis above for more details), we wanted to see if we could determine a pattern between the neighborhoods with high sightings vs the neighborhoods with low sightings.

We developed a backyard coyote risk assessment to help homeowners determine if their yard is high risk of attracting coyotes (see Appendix for full assessment). This assessment had 12 question areas that address fencing, outdoor pets, potential food sources, and water sources that residents may have in their yards. These questions were designed by reviewing multiple coyote diet studies and consulting with other coyote experts on what draws coyotes into urban neighborhoods. The answers to these questions can give residents a score from 0-15, with 0-5 being low risk and above 10 being high risk.

To create interest in this assessment, we posted notices on all of the Culver City and CURes social media channels as well as NextDoor. We also went door-to-door with flyers in high-coyote neighborhoods. However, COVID pandemic arrived not long after the study began and lasted the duration of the study. Therefore, most people did not want a survey at their house. This means we had fewer than 20 surveys completed, all from neighborhoods with high coyote sightings and all with scores less than 10. We predicted that this was because residents in high-risk areas are the

ones most likely to be paying attention to coyote issues and want to participate. Thus, we were not able to draw any conclusions from this assessment. However, we did send personalized recommendations to everyone who completed the survey and would recommend that the City continue to make this accessible to the public.

In the Appendix, we have attached the assessment along with general guidelines to make your yard less coyote friendly. This will be valuable information to residents who may not want to take the survey but still receive tips. More than half of the cities with coyote management plans offer some version of a backyard assessment survey, and since we have created this one for the City, other cities have contacted us for a copy of ours to include in their upcoming management plans. Therefore, we think this will be a valuable resource for the city.

7. SUMMARY & RECOMMENDATIONS

During the period studying the coyotes of Culver City, we made several important discoveries and learned about the unique structure of these packs that allow us to make targeted recommendations that best benefit the citizens of Culver City. We found that coyotes and cats overlap significantly, both spatially and temporally, putting cats in increased risks of interactions with coyotes. However, we found this risk increased at night and between the months of October-December particularly. In general, there was very little cat in the diet of the Marycrest Manor pack, but it did increase in 2021 with the decline of rabbits, a trend which could increase if the drought continues to plague rabbit population. We also found an increase of cat in the scat in the fall months. While much of what we learned suggested good news about the Marycrest Manor pack, we do know that there are still cat deaths in that neighborhood. We have less data on the packs or dispersing coyotes who may come into the neighborhoods while using the Ballona Creek to hunt for food, take advantage of the water source, or travel in search of a new territory. Thus, a wholistic approach focuses on all of these challenges and makes recommendations for all contingencies, which we aimed to do in this report. Our recommendations include 1) increasing specialized education for stakeholders with regard to reducing coyote risk, 2) implementing a suite of interventions at the individual parcel level that can decrease the potential threat from coyotes, 3) following a tiered response to coyote management with respect to documented incidences, and 4) introducing a palette of strategies that can be applied to residential pet owners as they try to find a balance between pet safety and outdoor activities.

Recommendation 1: Increasing specialized education for stakeholders with regard to managing and reducing the risks from coyotes

The relationship between humans and coyotes is complex and dynamic, driven both by the differing, often extreme, attitudes people have about coyotes and the individual variation in the behavioral ecology of the coyotes they encounter. Some of the animosity can be attributed to humans believing that coyotes are encroaching on their habitat as increasing interactions with coyotes during the last decade has given the impression that coyotes are expanding their range. In fact, coyote populations are likely not increasing – but human populations are. As coyotes continue to see a decrease in their habitat, they continue to search for new ways to survive, leading them closer to human settlements. While data in southern California suggests that we are experiencing a novel, increased risk of domesticated animal predation from coyotes, our study in Culver City indicates that each city may actually experience novel interactions with their individual packs, and

interactions may increase as the drought increases and resources decrease. Though dietary studies around Los Angeles suggest that cat is present in 25% of coyote scat, we found this to be true in only one month of our two-year study while cat could not be found in scat during several months during the year. This indicates that cat consumption by coyotes may be seasonal and predictable with more long-term studies. Our first responsibility to the citizens of Culver City then is to keep them informed through a comprehensive education plan and social media calendar.

Many cities utilize pre-made brochures from the Humane Society and Project Coyote (see Table 4 for a summary of U.S. and Canadian city coyote plans). However, some plans include unique material produced by the cities themselves, which we recommend in this case since Culver City now has a wealth of information on the behavior of their specific coyotes and the unique challenges they face living on the Ballona Creek, which serves as a popular animal travel corridor. The City of New Castle, NY, opened their management plan with this: "New Castle residents have formed deep emotional attachments to their pets and, as current and former pet owners ourselves, our Committee grieves for animals that have been lost. These pets cannot be replaced, but in their memory we can formulate a responsible, sustainable public policy to prevent future coyote-pet conflicts and address concerns regarding human safety. To that end, we strongly believe that the most effective solutions to coyote-pet conflicts will be found through a dispassionate, objective, and scientific evaluation of our ecosystem, animal behavior and human behavior." We believe this to be an important acknowledgment in the final coyote management plan, given the loss of the 72 cats in 18 months that Culver City experienced in the two years prior to this study.

Table 4. A list of city coyote management plans and the services they provide.

City	Brochures	K-12 Education	Plan: Tiered Response	Backyard Assessment	Hotline	Hazing Guidelines
Cypress, CA	X		X	X	X	X
Calabasas, CA	X				X	X
New Castle, NY	X		X		X	X
Riverside, IL	X		X		X	X
Mount Pleasant, SC	X	X	X		X	X
Castle Pines North, CO			X		X	X
Broomfield, CO	X		X		X	X
Superior, CO			X		X	
Wheat Field, CO	X		X		X	X
Wheaton, IL	X		X		X	X
Austin, TX	X		X		X	X
Vancouver, BC	X	X	X	X	X	X
San Dimas, CA			X	X		X
Torrance, CA	X		X	X	X	X
Long Beach, CA	X	X	X	X	X	X
Palos Verdes Estates, CA	X	X	X	X	X	X
Costa Mesa, CA	X		X	X	X	X
Denver, CO	X		X		X	X
Brea, CA	X		X	X	X	X

Huntington Beach, CA	X	X	X	X	X	X
Anaheim, CA	X	X	X	X	X	X
Newport Beach, CA	X	X	X	X	X	X
Whittier, CA	X		X	X		X
Davis, CA	X	X	X			X
Yorba Linda, CA	X		X		X	X
Chicago, IL	X			X		X
Seal Beach, CA	X	X	X	X	X	X
Atlantic Beach, FL	X		X	X	X	X
Glendale, WI	X		X	X		X
St. Paul, IL						X
Fountain Valley, CA	X	X	X	X		X
Rosemead, CA	X		X	X		X
Centennial, CO	X	X	X			X
Milwaukee, WI	X		X	X		X
Cherry Hills Village, CO	X					X
Markham, ON	X		X			X
Frisco, TX			X			X
Ventura County, CA	X		X	X		X

We recommend creating a city-specific brochure on city-branded materials, even if it is a Humane Society or Project Coyote brochure that reiterates the same information. Brochures include photos, basic coyote ecology, human behavior that leads to conflict, who to contact if you experience conflict, and tips to reduce conflict. These tips include:

- Remove all sources of food and water. Many people don't know that during a drought, water can be as enticing as a bowl of food. Make sure you remove all water sources at night and secure or chlorinate any backyard water features.
- Clean up downed or low-hanging fruit on fruit trees. Coyotes are omnivores. They will eat any food source in your yard.
- Keep pet indoors at night and inspect the yard before letting them out.
- Maintain fences and trim vegetation. If there is a hole in your fence, a coyote will find it. In addition, they can easily jump a 6-foot fence, so purchasing coyote rollers is the most effective way to ensure a coyote never enters your yard.
- Install motion sensor lights.
- Don't approach or feed wild animals and teach children not to do so.
- Walk dogs on a short leash and carry a walking stick, pepper spray, or noisemakers when walking at night.
- Don't turn your back on or run from a coyote.
- Don't let pets interact with coyotes.
- Close pet doors at night. In the Marycrest Manor neighborhoods, one coyote was recorded waiting outside a cat door and chasing the cat as soon as it exited. If coyotes know a resource exists, they will continue to patrol that yard. Break the

cycle by not allowing your cats to use those doors between 5 p.m. and 8 a.m. unless you have checked the yard yourself.

- Haze or harass coyotes observed in your neighborhood and alert neighbors to sightings so they will know to do the same.

As residents change and may only pay attention when their particular neighborhood experiences a coyote increase, on-going sustained education efforts are likely critical in establishing and then maintaining a successful coyote management plan. These efforts include formal programs in the public and private schools, informal programs at the community level and within the neighborhoods, and regular social media posts through Culver City social media pages and NextDoor. The tools for these interventions include the formal school curriculum that we have developed, the backyard coyote safety survey, sustained public information outreach, and direct interactions with residents through brochures and signage that they may request. Residents often find it difficult to confront neighbors who are feeding animals or maintaining feral cat colonies and have requested signage they can post in their yard or brochures they can anonymously leave for neighbors. We recommend that the City provides this literature by request (Figure 27). Coyote Project provides these signs free for download if the City would like to distribute it rather than unique material (https://projectcoyote.org/resources/download-and-share/).

FEEDING WILDLIFE:

It's hard to resist feeding the wildlife but please don't — for their health and your safety.

THEIR HEALTH

- The native animals who live here, including coyotes, birds, squirrels, raccoons, and other wildlife, need nature's diet to be healthy.
- Human food is "junk food" for wildlife. Well intentioned handouts may cause disease, injury, and even death for the animals.
- Providing unnatural food encourages wildlife to congregate in large numbers, leading to territorial fighting, attacks by predators, and being hit by cars.
- Animals you feed today may be killed as "pests" tomorrow. Don't harm wildlife with your kindness... help them remain healthy, safe, and free.

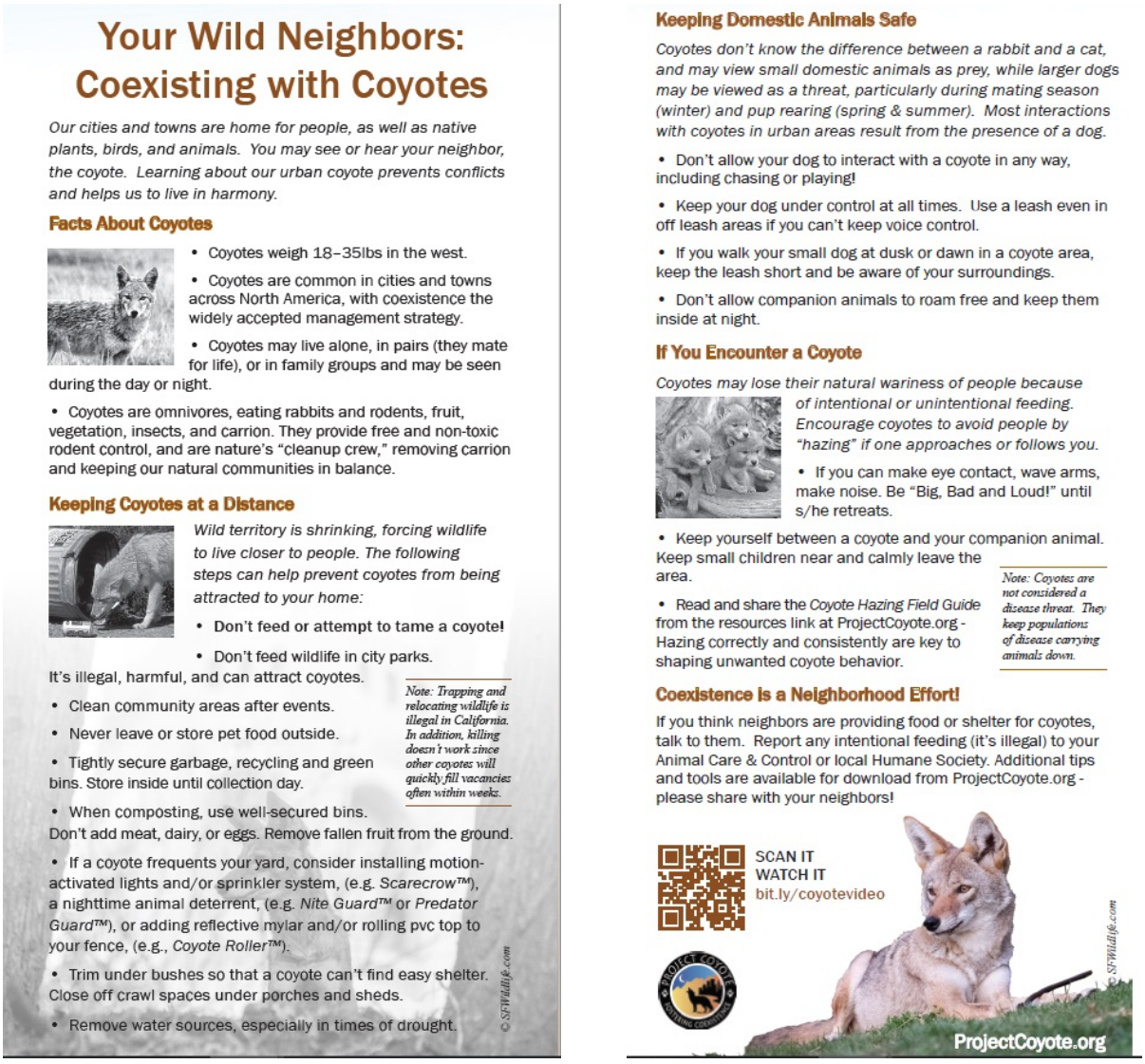
YOUR SAFETY

Native animals who eat human food:

- May bite, scratch or threaten other visitors.
- May come into conflict with your pets.
- May spread disease.

FED WILDLIFE IS DEAD WILDLIFE. IF YOU CARE, DON'T FEED!

PROJECTCOYOTE.ORG



Your Wild Neighbors: Coexisting with Coyotes

Our cities and towns are home for people, as well as native plants, birds, and animals. You may see or hear your neighbor, the coyote. Learning about our urban coyote prevents conflicts and helps us to live in harmony.

Facts About Coyotes

- Coyotes weigh 18–35lbs in the west.
- Coyotes are common in cities and towns across North America, with coexistence the widely accepted management strategy.
- Coyotes may live alone, in pairs (they mate for life), or in family groups and may be seen during the day or night.
- Coyotes are omnivores, eating rabbits and rodents, fruit, vegetation, insects, and carrion. They provide free and non-toxic rodent control, and are nature's "cleanup crew," removing carrion and keeping our natural communities in balance.

Keeping Coyotes at a Distance

Wild territory is shrinking, forcing wildlife to live closer to people. The following steps can help prevent coyotes from being attracted to your home:

- **Don't feed or attempt to tame a coyote!**
- Don't feed wildlife in city parks. It's illegal, harmful, and can attract coyotes.
- Clean community areas after events.
- Never leave or store pet food outside.
- Tightly secure garbage, recycling and green bins. Store inside until collection day.
- When composting, use well-secured bins. Don't add meat, dairy, or eggs. Remove fallen fruit from the ground.
- If a coyote frequents your yard, consider installing motion-activated lights and/or sprinkler system, (e.g. *Scarecrow™*), a nighttime animal deterrent, (e.g. *Nite Guard™* or *Predator Guard™*), or adding reflective mylar and/or rolling pvc top to your fence, (e.g., *Coyote Roller™*).
- Trim under bushes so that a coyote can't find easy shelter. Close off crawl spaces under porches and sheds.
- Remove water sources, especially in times of drought.

Note: Trapping and relocating wildlife is illegal in California. In addition, killing doesn't work since other coyotes will quickly fill vacancies often within weeks.

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Keeping Domestic Animals Safe

Coyotes don't know the difference between a rabbit and a cat, and may view small domestic animals as prey, while larger dogs may be viewed as a threat, particularly during mating season (winter) and pup rearing (spring & summer). Most interactions with coyotes in urban areas result from the presence of a dog.

- Don't allow your dog to interact with a coyote in any way, including chasing or playing!
- Keep your dog under control at all times. Use a leash even in off leash areas if you can't keep voice control.
- If you walk your small dog at dusk or dawn in a coyote area, keep the leash short and be aware of your surroundings.
- Don't allow companion animals to roam free and keep them inside at night.

If You Encounter a Coyote

Coyotes may lose their natural wariness of people because of intentional or unintentional feeding. Encourage coyotes to avoid people by "hazing" if one approaches or follows you.

- If you can make eye contact, wave arms, make noise. Be "Big, Bad and Loud!" until s/he retreats.
- Keep yourself between a coyote and your companion animal. Keep small children near and calmly leave the area.
- Read and share the *Coyote Hazing Field Guide* from the resources link at ProjectCoyote.org - Hazing correctly and consistently are key to shaping unwanted coyote behavior.

Note: Coyotes are not considered a disease threat. They keep populations of disease carrying animals down.

Coexistence is a Neighborhood Effort!

If you think neighbors are providing food or shelter for coyotes, talk to them. Report any intentional feeding (it's illegal) to your Animal Care & Control or local Humane Society. Additional tips and tools are available for download from ProjectCoyote.org - please share with your neighbors!

SCAN IT
WATCH IT
bit.ly/coyotevideo

ProjectCoyote.org

© SFWildlife.com

Figure 27. Sample sign and doorhanger that could be distributed or made available to residents per request.

While many citizens will want an in-hand project, another key component of a successful education plan is a strong online presence. At the beginning of this project, CURes assisted the City in creating a web site and digital map of instances that residents can view to see if there are changes in the status of coyote reports in their neighborhood. We recommend that the City maintain this web site, which may require regular staff person monitoring reports and placing these online. Residents only report sightings if they feel they are being heard, so regularly updating the web site is key. CURes staff is happy to train a staff member to update this map or help the City implement another program that will be more convenient going forward.

In addition, we suggest a regular social media calendar with helpful tips on coyote management specific to certain seasons. Some cities include in their management plans taking out ads in local newspapers with some of these tips. If there is a local paper that older Culver City residents read, placing an ad or two in the fall when coyote activity is high may be a good addition to the social

media calendar plan. Here is a calendar of suggested posts, which can be shortened or expanded depending on the format (we also recommend adding photos when possible from the selection provided in the Appendix):

- January: Coyotes often keep their packs small, consisting of one pair and remaining offspring. As coyotes prepare to begin mating, some older offspring might disperse this time of year, so be on the lookout for coyotes. If you see one, employ the hazing techniques listed on our web site to encourage the coyote to keep moving, rather than settle in your neighborhood.
- February: February is a great month to be a coyote! Rainy seasons means more food for their prey, thus an abundance of natural prey. As they are traveling through Ballona Creek, looking for den space, be sure to keep all trash and food picked up at night. If you do feed your cats outdoors, make sure to do it at a set time during the day so you can pick it up at night and not inadvertently attract coyotes to your 'hood!
- March: Coyotes may have young offspring at this time. If you see a den, do not disturb it. Report it to the City, so we may take the proper steps to keep our residents safe.
- April: Citrus trees in bloom? Remember that coyotes LOVE fruit, so pick up all downed and low-hanging fruit every day.
- May: Everyone loves songbirds, but did you know that birdseed on the ground attracts rodents? Rodents are a preferred prey of not just your cats but also coyotes! Sweep up birdseed every evening to avoid attracting both rodents and coyotes to your yard.
- June: As it heats up and gets drier, remember that water is as enticing to wild animals as food is. Secure all water sources at night, and don't leave water out for your pets.
- July: Coyotes are creatures of habit. If your lawn has something attractive, it will continue to visit for weeks afterward to see if it is still there. But once they realize it isn't coming back, they won't either. Curious if you are attracting coyotes? Check out the backyard survey on our web site!
- August: Feeding feral cats attracts coyotes. How can you reduce conflict? Several cities have had luck with this plan: feed the cats at a certain time every and pick up the food afterward. Just like your indoor pets get used to eating at a certain time, they will too. Don't leave food out where other animals can feast on it later.
- September: It's the end of the summer dry season, and there is less for wild animals to eat. This marks the beginning of fall when we see a lot more coyotes in the City. Don't leave food outside, pick up trash, and bring in or secure your water features at night.
- October: October is when we see the highest percentage of cat in the coyote diet. Please keep your cats safe by keeping them indoors between 6 p.m. and 8 a.m. when coyotes are most active.
- November: Coyotes are active this time of year, and so are lots of other urban mammals. Curious what's happening your backyard? Check out some pictures we captured during our survey at https://www.youtube.com/watch?v=4Hei74eU97g.
- December: This is the month when we see the most coyote visitors in our neighborhoods. Want to keep coyotes out of your backyard? The best way is with coyote rollers (and ensuring there is no food or water for them to consume).

While citizens will be able to request this plan, the video that we produced (https://www.youtube.com/watch?v=4Hei74eU97g) also displays our results in easily digestible chunks, so this can be promoted to residents during times of high coyote sightings or questions from residents. In addition, we have prepared a coyote presentation that can be delivered to residents of Culver City at council meetings or other City events where appropriate. This presentation covers basic ecology of coyotes, research learned from this study, and general tips for living alongside coyotes. We also include a section on hazing, which we recommend be built into a page on your coyote web site. One of the most common phone calls we received during our research was a resident telling us that they saw a coyote and didn't know how to respond. In fact, most just stop and take pictures. Having a page or handout dedicated to how humans should interact with wildlife is important (Figure 20). We also recommend that you make the backyard survey (Appendix) widely available so that people can be aware how they may be inadvertently tracking coyotes to their neighborhood. It highlights attractants of which people are often not aware, such as figs, fruit, and water.

The final component of our education plan is a school program, which can be geared toward elementary, middle, or high school students. While some plans mention contracting wildlife or conservation agencies to provide educational materials to schools (see Table 4), only Vancouver (and now Long Beach and Culver City) actually has such materials. Vancouver's plan consists of a 30-minute auditorium presentation and materials that can be sent to the school and used either in conjunction with the presentation or at the teacher's discretion. The program focuses on teaching students and their parents how to identify coyotes, understand coyote behavior, respond to coyotes, and keep their yards/schools free from coyote attractants. Activities include making your school and yard free from coyote attractants, developing a coyote action plan, and making your own noisemakers for deterrents. We have developed an entire interactive 20-lesson module for the City of Culver City to incorporate into middle or high school curriculums, which will help promote learning about and adapting to life with coyotes in Los Angeles. This includes many of the aspects listed in the Vancouver plan but delves deeper into issues between wildlife and urban areas, culminating with student developing their own urban management plan! See the above education section for a full list of proposed lessons.

Recommendation 2: Implementing a suite of interventions at the individual parcel level that can decrease the potential threat from coyotes

The conflicts that humans have with coyotes typically involve resources coyotes need, such as food, or competition coyotes perceive for access to those resources. This can result in coyote aggressive behavior, predation on domestic pets as food, and attacks on domestic pets as perceived competitors. On rare occasions, coyote attacks can also be directed at humans. While rare, coyote bites are becoming more common in southern California, and response has been mixed, at best, from local municipalities (which we will address in the next section). Most of these conflicts are avoidable, however, through changes adopted by homeowners in the immediate vicinity of coyote conflict.

We cannot address a plan to mitigate coyote conflict without discussing cat management as well. As mentioned previously, dietary studies reveal that around 25% of coyote scat contains cats, which

is an order of magnitude more than seminal coyote studies in places like Chicago that found cat in less than 3% of scat. When trying to understand this problem, we have to address it from two core questions: How are California coyotes behaving differently to put them in greater conflict with cats, and how are California cats behaving differently to put them in greater conflict with coyotes? The same researchers in Chicago that found only 1-2% of coyote scat contained cat also found that cats avoided areas that coyotes preferred (Gehrt et al. 2013). Coyotes prefer natural areas, so cats stick to urban areas (Figure 13). However, just like dietary studies in Los Angeles uncovered different results, our activity results also told a different story. Coyotes still prefer natural areas, but cats don't have a preference, leading them to be present everywhere: even in areas where coyote sightings are common.

This indicates to us that it actually may be the cat behavior that requires a deeper look – and maybe some changes in the areas where cats are allowed. If domestic animals are indoors, they are almost completely immune to aggression from coyotes. This is perhaps the area of most variation in human attitude about their relationship to, and attitude about, coyotes. Pet owner attitude about the degree to which their pets are allowed outdoors varies considerably. There is an undeniable relationship between outdoor activities of pets and risk of coyote attack. While it is undesirable to many pet owners to keep cats and small dogs indoors, that risk of attack needs to be part the calculus that people do in both owning and managing their pets. Continuing the conversation with residents on which concessions they are willing to make with their pets combined with data on when coyotes are most active and most likely to prey on pets will help the City make the best recommendations to Culver City citizens.

However, dietary studies in Los Angeles have revealed that it isn't cats as prey luring coyotes into neighborhoods. They're actually looking for something easier to hunt: pet food and garbage. Larson et al. (2020) revealed that urban coyotes are getting around 75% of their diet from anthropogenic sources, including pet food left outdoors, trash, meat and dairy composting, and fruit, such as citrus and figs. Larson's study in San Diego (2015) also showed that in areas where they found coyote scat, residents had an average of 1.7 cats, and most of them were allowed outdoors. Therefore, cats may not be the primary target but attacked when they are present at sites where coyotes would like to eat. In areas like Chicago, in fact, cats are often attacked as competitors rather than prey, increasing the risk of conflict even further at outdoor feeding sites.

To find out for what specifically Culver City coyotes may be searching, CURes developed its backyard risk assessment survey (see Appendix). Initially, we had hoped to collect data from people who wanted the risk assessment, which would allow us to look at neighborhoods with both high and low coyote sightings and determine what the greatest differences were between yards in those areas. However, the pandemic prevented us from gathering enough data to understand these differences. While no cities are currently offering assessments, some web sites do have self-audit backyard assessments. We recommend that the City continue to distribute this assessment and ask people to self-report their results to allow the City to collect this data. Integrating scientifically-monitored studies will help cities track which factors may be leading to increased coyote presence and improve education materials in attempts to reduce them. We recommend handing it out at community events in different neighborhoods, and we have incorporated it into the school curriculum so that students can participate on behalf of their parents. As we have seen that coyote behavior varies dramatically between individual packs, this data could be instrumental in

determining what draws these packs into Culver City, thus helping us solidify a plan that will reduce their impact.

With the help of our backyard survey, homeowners can learn what elements of their property create the highest risk of coyote nuisance visitation. Some elements are obvious, such is leaving out pet food, food waste, or water. Others may be less obvious to the homeowner, such as fruits or other agricultural resources that coyotes consume. Removing these resources will dramatically reduce the motivation for coyotes to visit your backyard. If those resources are absent, an occasional visit by a coyote goes unrewarded and is unlikely to be repeated. However, even an occasional reward from the yard will likely encourage a coyote to return repeatedly since coyotes are creatures of habit and travel anywhere there is potential for food. The key element of success in reducing human coyote conflict here is to make sure that the resources are absent prior to the first visit. Interventions such as coyote rollers and other physical barriers around the yard are often used after the basic management strategies for resources have failed to be enacted. These are expensive and may not solve the fundamental problem. Understanding the unique attractants of southern California yards may give us the final piece of the puzzle that can reduce coyote exploitation of urban areas.

Recommendation 3: Following a tiered response to coyote management with respect to documented incidences

When increased coyote sightings occur and danger to pets increases, people often feel threatened and respond accordingly. Although it may be tempting to remove and euthanize any coyotes that appear to be aggressive, that management approach is fraught with three significant problems. First, it is often difficult do identify which individual coyote is involved with the aggressive behavior. A human attack in Orange County in the spring of 2020 illustrates this problem. In this instance, a person was bitten, and two male coyotes were captured and euthanized. Only later was it revealed that they could not have been the aggressors as forensic analysis revealed the bite was delivered by a female coyote. Thus, the offending coyote was still at large and two potentially innocent coyotes euthanized. Second, when a coyote family is disrupted and an adult is removed, that territory is likely to collapse and be reoccupied buy one or more expanding coyote families. This has the effect of increasing the local population density which may further intensify the conflicts occurring in the neighborhood. Thirdly, lethal wildlife management policies have significant ethical issues that are often left unaddressed.

Lethal removal of coyotes is sometimes necessary but should be used only as a last resort. Other interventions should be tried and the overall management response needs to be scaled to meet the degree of severity and risk experienced by humans. Overall, the presence of meso-predators such as coyotes in urbanized areas is generally a positive ecosystem service and likely serves to reduce human risk to zoonotic disease, as they kill rodents and other pest species that carry diseases. Therefore, the management interventions need to strike a balance so that the positive benefits of resident coyotes can be enjoyed by the human community with the negative aspects managed with clarity of intent. Therefore, the cities listed in Table 4 above have created tiered management plans that incorporate the severity of the incident in determining a response, and we recommend that Culver City do the same.

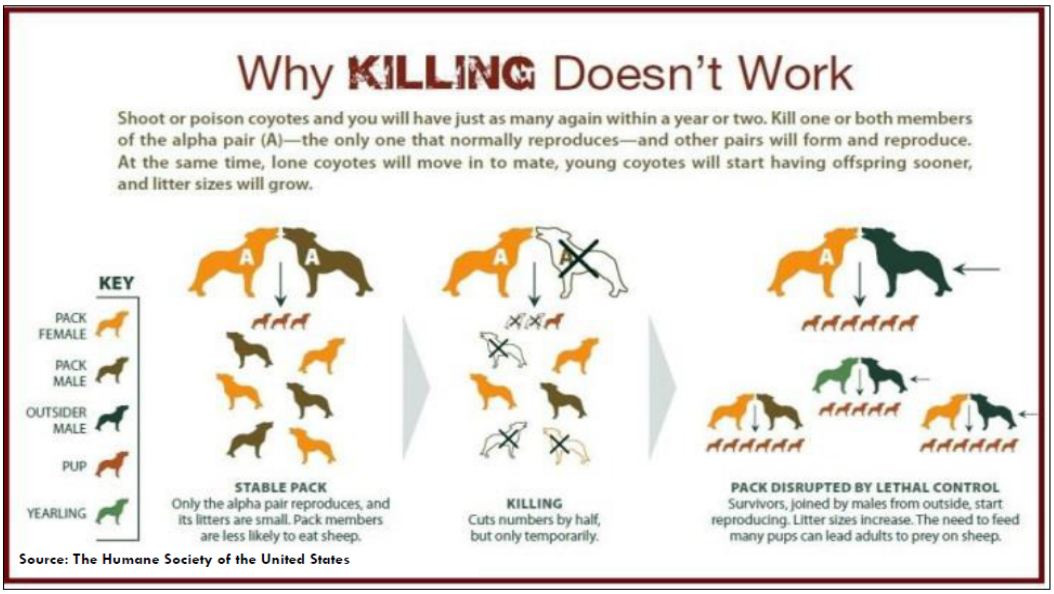

Figure 28. Infographic about the problems associated with lethal removal of coyotes.

It is important to note that none of the plans have lethal measures in their policies unless coyotes are aggressive toward humans or pets in the presence of humans, with the exception of Torrance, CA, which authorizes seasonal trap and kill methods for reducing populations. In fact, Austin, TX, has made it illegal to kill coyotes, declaring itself a no-kill city. In the state of New York, if a coyote kills a pet, cities refer the citizen to a private trapper and expect the citizen to cover the cost of any attempted removal expense. Figure 28 is an example of an infographic from the Humane Society that appears in many city management plans that explains why untargeted lethal removal is ineffective. We recommend that all educational materials from the City include this information to reduce demands from citizens who do not want coyotes in southern California at all (a very unlikely feat), and we have included it in all of our presentations and educational curriculum.

However, lethal removal is sometimes required. During this research period, we discovered a Marycrest Manor coyote very sick with mange that was sleeping on people's porches during the day. This coyote was not only a threat but also suffering. The City did not have the proper equipment to trap and remove the coyote, and we recommend that proper training on coyote trapping be employed or a trapper subcontracted for such situations. Trapping coyotes is more difficult than trapping other urban mammals because they are very hesitant to enter traps. Thus, a training program or subcontractor would be useful to help the City act should it become necessary.

In addition, the City should develop a tiered response, ranking potential coyote behaviors and solutions for solving any issues related to those. A team of researchers in Austin, Texas, has developed a creative solution to this that gave its residents a greater say in how coyote problems were handled: a model that provides a more quantitative method to rank problem coyotes (Farrar 2016). The team kept geo-location data on all coyote sightings and ranked them based on behavior displayed by the coyote with aggression toward an adult human during the day being the highest score. They then asked residents to rank their tolerance of certain behaviors. Coyotes that violated any of these behaviors were mapped onto an area, and those areas were then targeted for more intensive management plans.

The Center for Urban Resilience began a similar model in Culver City, when creating the heat map. Blue dots represented sightings and red dots pet deaths. This allowed us to target neighborhoods with high levels of red dots in our research. While we found that coyotes were active in these neighborhoods, the residential pack did not have a high percentage of cat in its scat. In fact, many times of the year, there was no scat at all, particularly when rabbit populations were high. Thus, targeting this pack would have been a mistake as a new, more aggressive pack could have moved in when these were eradicated. Instead, it appears to be coyotes traveling on Ballona Creek that are the greater threat, and targeted action should begin there. We recommend that the City continue this map in order to keep track of coyote sightings, and those sightings that result in behavior that is upsetting to the residents. In areas near the Creek, trapping may become necessary if a particularly aggressive coyote is traveling through.

Most cities, however, opted for more traditional tiered approaches that rank behaviors either with a number or color system and then detail a response that the given city will take in case these behaviors arise. We have provided three examples below as a guideline for ranking systems that appear in the most successful coyote management plans throughout the United States and Canada (Figure 29).

LEVEL	GENERAL OVERVIEW
BLUE	- Coyote seen or heard in an area. - Sighting may be during the day or night. - Coyote may be seen moving through an area or resting in one place. - Education and hazing recommended.
YELLOW	- Coyote frequents an area with humans or human-related food sources, and exhibits little wariness of human presence, and/or is involved with an unattended domestic animal loss incident. - Coyote is seen during the day resting or continuously moving through an area frequented by people. - Education and aggressive hazing necessitated, and increased response and patrols by Animal Control Officers may be implemented.
ORANGE	- Coyote involved in an incident where there is an attended domestic animal loss, where it enters a dwelling or yard in which people are present, or where it acts aggressively toward people. - Multiple incidents of this level, occurring within relative proximity of one another, may indicate the presence of a habituated coyote(s). - Education and aggressive hazing necessitated, increased response and patrols by Animal Control Officers to be implemented, and circumstances to be discussed by department management. - If three investigated and confirmed level orange incidents have occurred in the same general area within a timespan of two weeks, targeted lethal removal may be implemented. - Lethal removal may be employed at the discretion of the Director of Animal Care Services in cases involving extreme instances of aggression towards humans.
RED	- Coyote involved in an investigated and documented attack, either provoked or unprovoked, on a human. - City staff will notify California Department of Fish and Wildlife (DFW), which assumes the role of lead agency, and will work with DFW to locate and eliminate the responsible coyote(s).

Coyote Action	Classification	Response
Coyote heard	Observation Priority Four	Provide educational materials and info on normal coyote behavior
Coyote seen moving in area	Sighting Priority Four	Provide education materials and info on normal coyote behavior
Coyote seen resting in area	Sighting Priority Three or Four	If area frequented by people, educate on normal behavior and haze to encourage animal to leave. Look for and eliminate attractants.
Coyote following or approaching a person w/o pet (Stalking)	Encounter Priority Three	Educate on hazing techniques, what to do tips
Coyote following or approaching a person & pet (Stalking)	Sighting Encounter Priority Three	Educate on hazing techniques, what to do tips and pet safety
Coyote entering a yard without pets	Sighting Priority Three	Educate on coyote attractants, yard audit, provide hazing info
Coyote entering a yard with pets	Encounter Priority Three	Educate on coyote attractants, yard audit, hazing info, pet safety
Coyote entering yard and injuring or killing pet w/o people present	Pet Attack Priority Two	Develop hazing team in area, gather info on specific animals involved, report on circumstances, educate on coyote attractants, yard and neighborhood audits, pet safety
Coyote entering yard with people & pets, no injury occurring	Encounter Priority Two	Gather info on specific animals involved, document circumstances, educate on coyote attractants, yard/neighborhood audits, hazing, pet safety
Coyote biting or injuring unattended pet / pet on leash longer than 6'	Pet Attack Priority Two	Gather info on specific animals involved, report circumstances, educate on coyote attractants, yard/ neighborhood audits, hazing, pet safety
Coyote biting or injuring attended pet / pet on leash 6' or less	Pet Attack Priority Two	Gather info on specific animals involved, document circumstances, educate on coyote attractants, yard/ neighborhood audits, hazing, pet safety
Coyote entering interior of dwelling	Encounter Threat Priority Two	Gather info on specific animals involved, report circumstances, educate on coyote attractants, yard/ neighborhood audits, Aggressive hazing, pet safety.
Coyote aggressive, showing teeth, back fur raised, lunging, nipping w/o contact	Threat Priority Two	Gather info on specific animals involved, report circumstances, educate on coyote attractants, yard/ neighborhood audits, Aggressive hazing, pet safety.
Coyote biting or injuring person	Attack Priority One	Identify and gather information on specific animal involved, report circumstances, educate on coyote attractants, yard/ neighborhood audits, hazing, and pet safety. City staff will inform the California Department of Fish and Game. Lethal removal recommended.

Table 1		Detailed Reporting	Targeted Educational Efforts	Broad Educational Efforts	Aversive conditioning	Targeted Lethal Removal
1	An increase in observing on streets and in yards at night	Begin	Begin			
2	Approaching adults and/or taking pets at night	Continue	Continue	Begin		
3	Early morning and late afternoon daylight observance on streets and in parks and yards	Continue	Intensify	Intensify	Begin	
4	Daylight observance chasing or taking pets	Continue	Continue to Intensify	Continue to Intensify	Intensify	
5	Attacking and taking pets on leash or in close proximity to their owners, chasing joggers, bicyclists, and other adults	Continue	Continue to Intensify	Continue to Intensify	Continue to Intensify	Consider Targeted Lethal Removal
6	Seen at mid-day around children's play area, school grounds, or parks	Continue	Continue to Intensify	Continue to Intensify	Continue to Intensify	Individual Lethal Removal
7	Acting aggressively towards adults in mid-day	Continue	Continue to Intensify	Continue to Intensify	Continue to Intensify	Lethal removal of several individuals

Figure 29. Three examples of tiered approaches to coyote management from the US and Canada.

Recommendation 4: Introducing a pallette of strategies that can be applied to residential pet owners as they try to find a balance between pet safety and outdoor activities

Individual management of human-coyote risk remains one of the most effective tools in ameliorating coyote aggressive behavior around your house and activity area. Interventions include: 1) removing food resources from coyote foraging areas, 2) isolating domestic pets from areas of coyote activity, 3) actively hazing coyotes when observed on, or near your property, and 4) carefully recording and reporting all coyote sightings to appropriate officials. These strategies have been mentioned throughout the report because of their importance but will be outlined in this final section to create specific recommendations for residents.

1. Removing food resources is a critical part of reducing unwanted coyote visits to your yard or local neighborhood. Coyotes maintain large activity areas and may move a dozen miles or more in a single night. If their attempts to gather food resources from your immediate area are unsuccessful and met with low key hostility in the form of hazing, you can significantly reduce the probability of a return visit. This has the compounding effect when all neighbors practice this plan. Combined efforts to deny foraging coyotes food resources will cause them to shift their hunting patterns to the more fruitful areas of their range, which is their preferred habitat when prey is abundant anyway. As a result, the natural food resources of coyotes, such as small

mammals, will continue to be a more extensive part of their diet. These prey species are most likely found in the most highly vegetated areas in the peri-urban areas – away from your property.

The results of the scat analysis, and research gathered from other studies in the area, point to exciting directions for future research. We demonstrated in this study that dry scat analysis could be combined with, admittedly more expensive, DNA analysis to form a complete picture of coyote diet in known packs. This DNA analysis can reveal gender of offending coyotes and the amount of cat found in the diet. This is enough information to guide a targeted removal, if necessary. It can also help determine which coyotes around them are the larger threat so they can increase hazing when certain coyotes are spotted, encouraging them to spend time elsewhere in their territory. Combined with the removal of any potential food sources, this could dramatically reduce coyote activity in any neighborhood if all neighbors partake.

In order to encourage neighborhood-wide participation, we recommend targeted social media and newspaper posts as detailed above and disseminating signage or brochures throughout high-sighting areas. Distribute backyard surveys and encourage residents to return them. Finally, remind residents that it's not only pet food that can draw in coyotes and encourage them to properly secure trash, compost, and water features that cannot be removed at night. In addition, they should be encouraged to clean up downed and low-hanging fruit (even citrus) and figs as well as sweep up dropped birdseed at night. If there is no food for the coyotes, they will move to another area.

2. Domestic cats and small dogs are at risk when the travel alone outside the home. The risks involve many factors, including exposure to zoonotic disease, being struck by a car, consuming poisonous bait or food, injurious encounters with other cats or domestic dogs, and lethal encounters with coyotes. While each of these particular risks vary with location, ecological conditions and various municipal policies, the focus of this report is the role that coyotes play in local community. We cannot stress enough that the safest place for suburban and urban domestic cats is indoors. Kittens raised as indoor cats adapt readily to that life and often avoid the risks described when cats venture outdoors. Especially with risk to attack from coyotes, no strategy works more effectively that keeping domestic cats indoors.

   However, if a cat owner feels compelled to allow their cats outside, there are some strategies they can employ to reduce the risks of coyote attack. First, the cats should be let out during the day under human supervision. Coyotes in Culver City are active between the hours of 6 p.m. and 7 a.m., so make sure to avoid those hours. During daylight hours, the risk of coyote attacks is lower, and the presence of humans reduces the likelihood that coyotes will approach. In addition, we know that coyotes are more active within the City between September and January, so these would be good times to keep cats nearby as well. Domestic cats can also be trained to walk on a leash or harness, providing residents with another opportunity to get their cats outdoor exposure. The tethered connection provides the ability to control where the cats roam and allows rapid retrieval of the cat in dangerous conditions. This approach has become more common in urbanized communities.

Studying behavioral responses of domesticated vs feral cats in response to predators or larger conspecifics through boldness assays may allow researchers to uncover differences between populations. If this is the case, domesticated cats could potentially be trained to respond differently to predators that might reduce their risk of attack, at cat "hazing" technique. While no one has currently conducted these studies, the handful of studies on cat behavior reveal that early interactions during development, such as play with other cats (West 1974), can induce aggressive or defense behavior later in life (Adamec et al. 1980). Thus, future research should incorporate differences in domesticated and feral cat behavior and behavior modifications that owners could teach in order to help their cats defend themselves. CURes is currently working on a collaboration with Annenberg Pet Space to learn more about cat behavior and will contact Culver City residents who might be interested in participating when the research design is further developed.

Many of the cats being preyed upon in the Los Angeles area, including Culver City, appear to be free-roaming domesticated cats (pers. comm.). Domestication of animals in known to lead to a variety of changes, including reduced sensitivity to stimuli that may be threatening to a wild animal and reduced aggression (reviewed in Price 1999). Both of these could result in behavioral changes that make domesticated animals more vulnerable to predation, which they appear to be (Price 1999). Various videos of cat and coyote interactions reveal an interesting pattern: when cats turn to face a coyote, the coyote typically responds by backing away; however, when the cat flees, the coyote chases, making the cat vulnerable (pers. comm.). In fact, a study by Grubbs and Krausman (2009) found that in 32 cat-coyote interactions, 19 resulted in cat death. Has domestication altered cat behavior designed to reduce behavior toward humans and other pets had consequences that has resulted in a lack of defense behavior when faced with a predator?

Little work has been done on cat temperament and behavior when compared with other domesticated species and even some species of wild animals (Ha and Ha 2017). However, the few studies that have been conducted indicate that cats have behavioral syndromes that include many traits, such as aggression and sociality with other cats (Ha and Ha 2017). Cats, in comparison to other domesticated animals, are often treated as solitary animals, living in isolation in their homes without the interactions given to other pets, particularly dogs with which we live as closely. However, if there are enough resources in their environments, feral cats often occupy social colonies that range in size from only a few individuals to larger colonies and engage in many social behaviors, such as grooming, playful interactions and sleeping in packs (Crowell-Davis et al. 2003). These interactions often influence personality traits and behavioral responses throughout the cat's adult life, especially when raised in social colonies (Crowell-Davis 2007). Thus, cats may learn defense behaviors from interactions with other cats, giving feral cats an advantage over domesticated cats in interactions with predators such as coyotes. But these colonies may also attract coyotes to the area putting domesticated cats who have not developed such defense behaviors at higher risk. Further work may help us demonstrate to cat owners who live near those colonies why it puts their cats at greater danger to leave them outdoors during certain times of day and certain times of the year. As we move forward with understanding coyote-human conflicts, it is imperative that we include cat behavior in this research.

3. As coyotes increase use of urban areas, whether simply for traveling or for denning and hunting, humans must respond in a way that discourages from using habitat that puts humans and pets in danger. The typical recommendation when witnessing a coyote in close proximity to urban populations is referred to as 'hazing,' which consists of attempts to scare the coyote through verbal or physical action (Bonnell and Breck, 2016). However, success of this technique is variable. According to a study conducted by Baker (2007), hazing is only effective when coyotes are first seen in the neighborhoods. After they are already familiar with the neighborhoods, hazing may work for a few months, but coyotes will return to previous bold behavior. Therefore, it is important to begin hazing efforts as soon as coyotes are spotted in urban neighborhoods. Bonnell and Breck (2016) found that even when people were trained to properly haze, success ranged from the coyote fleeing to approaching the hazing human. This may depend on the behavior of the person or the temperament of the coyote. For example, if a coyote has previously found that a yelling human will not harm it, they may continue to ignore the hazing. A case study in Chicago showed that an aggressive coyote could be coerced into relocating through a hazing protocol, but the protocol lasted for several days and was conducted by coyote researchers (pers. comm.). Thus, any coyote management plan must include a massive community education component and willingness on the part of researchers and animal control to persistently haze problem coyotes if they cannot be removed from the area. Since coyotes who show reduced fear toward humans can pass these traits on to offspring (Schell et al. 2018), hazing programs are important for coyotes who frequent human-populated areas. Hazing plans include some or all of the following guidelines:
    - Hazing should only be used when appropriate, such as when coyotes are in crowded areas with humans, approaching humans and their pets, or occupying human-populated areas during the day time.
    - Hazing should begin aggressively as it is designed to startle the coyote. Coyotes may not react to hazing at first because they may not understand how to respond to humans and may desensitize if the hazing efforts are too small initially and gradually increase.
    - The more often a coyote is hazed by a variety of people in a variety of ways, the more effective hazing will be. Coyotes can recognize people and learn to avoid only certain individuals.
    - The coyote must understand that hazing is coming from the human, so the hazer must be visible to the coyote.
    - Hazing can take the form of aggressive stances, yelling and arm waving, or utilize tools, such as noise makers, projectiles, hoses, or water guns with vinegar. If you can make it multisensory (incorporate more than one hazing method), that is even better.
    - Coyotes are creatures of habit, so if a coyote is frequenting an area with high human traffic, it is important to haze him there so that habit will be broken.
    - Hazing must continue until the animal leaves.
    - Hazing must be consistent, each time the animal is present.
    - Hazing must not injure the animal, and no one should ever haze an injured animal, as they can be aggressive and unpredictable.

- Humans can also employ hazing strategies in their yards at night by installing motion sensor lights, noise makers, and/or water sprinklers that trigger an aversive response when entering the yard.

4. Finally, it is vital to continue collecting data on coyotes in order to understand changes in pack dynamics and responses to environmental shifts, such as drought and increasing temperatures. Therefore, it is critical to maintain a coyote hotline or web site that tracks all coyote sightings and pet deaths and reports those to the residents of Culver City in a timely fashion such that they have up-to-date information about coyote presence in their neighborhoods. This will inspire a feeling of good will and community between city officials and the residents, encouraging residents to enact city-recommended plans to reduce human-coyote conflict. Many residents have expressed a desire for increased communication from the City, and the social media calendar presented above and regular presentations that have been developed through this study will allow residents to learn more about their environment and act accordingly, ultimately benefitting humans, pets, and wildlife.

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APPENDIX

This Appendix contains the following documents, provided as separate files:

- **Selected Photos from Game Cameras**
- **Database of Coyote Genotypes**
- **Fun Facts About Fruit**
- **Coyote Risk Assessment Backyard Survey**
- **Culver City Coyote Presentation**
- **Urban EcoLab Coyote Curriculum**

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