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A Collaborative Social-Ecological Research Approach to Inform & Address Urban Coyote Management Challenges

Coyotes (*Canis latrans*) play an important mesopredator role in urban habitats and provide valuable ecosystem services, but also risk factors to human safety. Because of rare, but high-profile instances of human-coyote conflict, urban coyotes are often perceived only as a nuisance, or even dangerous, to human populations and their domestic animals. This tension between urban wildlife and communities can result in policy and management decisions that are not effective or beneficial to either population. We believe that effective urban coyote management requires an understanding of the resident coyotes in a given city, as well as the human residents' behavior, knowledge, and perceptions related to coyotes. This type of assessment can be done as a collaboration with researchers and city leaders to inform wildlife management and educational outreach. In this research note, we describe one such social-ecological research and outreach approach that has been implemented in two cities in Southern California: Long Beach and Culver City, CA. Components of these projects include: identifying coyote movement patterns through motion activated cameras; examining coyote diets through analysis of scat samples; gathering information about resident knowledge and behavior through public surveys; and developing formal and informal curricula to be used in public education and outreach programming. We will describe this process in detail, provide early findings, and highlight instances of particular success and difficulty in implementation. We will close with a discussion of implications for wildlife management and environmental stewardship in urban settings.

Keywords

urban wildlife, social-ecological research, urban environmental stewardship, coyote management, Canis latrans

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INTRODUCTION

As more than half of the world's populations now lives in urban areas (Ritchie & Roser 2018), both urban animal and human populations face unique challenges as they attempt to share the habitat. Urbanization changes the landscape by fragmenting natural habitat (Forman 2014). Urbanization can also change where and what animals eat (Fuirst et al. 2018, Smith et al. 2018), and produce novel community dynamics by altering the distribution of existing animals (Newsome & Ripple 2015, Smith et al. 2018) and introducing new competitors, predators and prey sources (Kikillus et al. 2016). Urban animals must co-adapt with their new neighbors, humans, who are not always happy to share their environment with wildlife that they often consider to be pest species. Human-wildlife conflict is now a well-documented threat to animals living near human-inhabited areas and seems to be a particular threat to large carnivore species (Draheim et al. 2019).

Only 14% of terrestrial carnivore species can be found near urban areas (Iossa et al. 2010), often as a result of human management practices and attitudes toward sharing their environment with carnivores. These species pose a documented, but highly variable threat to both humans and their pets and livestock (Draheim et al. 2019). In response to these perceived threats, many large carnivores have been driven from human-dominated areas and their populations have declined precipitously. Coyotes (*Canis latrans*), in contrast, have continued to thrive despite intense persecution. In the United States, more than 400,000 coyotes are killed each year, yet their population has not declined (Fox & Papouchis 2005). They can now be found in almost every city in the United States and Canada as they expand their range into most of North America (Laliberte & Ripple 2004). In the absence of larger predators, coyotes have established themselves as the apex predator in many urban environments (Gehrt & McGraw 2007) and often exploit human food sources (Larson et al. 2020).

Though coyotes do not pose a large threat to people living in shared habitats (White & Gehrt 2009), human attitudes toward coyotes trend toward unfavorable, largely because they threaten pets (Alexander & Quinn 2011). Humans in neighborhoods utilized by coyotes often favor lethal removal; however, this method is largely ineffective (Sterling et al. 1983) and ignores the positive impacts coyotes have on local ecosystems, including removing rodents and maintaining diverse bird and reptile populations by controlling other mesopredators that consume them (Silverstein 2005, Kays et al. 2015). In southern California, human-coyote conflicts have increased with intensity of urbanization (Ordeñana et al. 2010). Many cities have experienced increased coyote occurrences throughout the greater Los Angeles area, including the City of Long Beach and City of Culver City, both of which contacted the Center of Urban Resilience at Loyola Marymount University for assistance with management plans in response to increased pet death. In the City of Culver City, for example, 72 cat deaths were reported in 18 months. The human-coyote conflict is complex, with potential for misconception driven by fear as well as the challenge of social polarization around issues of conflict. This points towards the need for an integrated, transdisciplinary approach to wildlife management. A successful 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 coyotes, alongside the importance of coyotes to ecosystems. Thus, we conducted separate three-year social-ecological research and outreach projects to produce management plans in the Cities of Long Beach and Culver City (Strauss et al. 2020, Weaver et al. 2022).

SOCIAL-ECOLOGICAL APPROACH TO URBAN COYOTE MANAGEMENT

As humans continue to expand their range into animal habitats, conserving biodiversity must incorporate the relationships between people, places and nature, and examine why conservation might be relevant to people, recognizing that conservation "depends on social, economic, political, and cultural systems to sustain it" (Morrison 2016). Human attitudes toward urban animals tend to vary as many consider them to be pests that knock over garbage cans and steal vegetables from gardens, while others enjoy having a diverse ecosystem in their neighborhoods and put out food to encourage visitors. Attitudes can be very strong toward coyotes as residents often love or hate them. Thus, when considering a management plan for a city, it is important to consider the ecological benefits of having diverse ecosystems as well as human attitudes and threat risks in those neighborhoods. Developing a plan like this requires not only gathering the necessary data on local animals and human residents, but also meeting with a variety of stakeholders, such as city officials, city employees who deal with the threats, and residents of affected areas. In these two case studies, we employed a multifaceted plan toward a comprehensive, durable coyote management plan for each city. We collected coyote movement data through camera traps and radio collars, which allowed us to determine where the coyotes are traveling and a rough estimate of how many are using the cities. We collected scat to identify dietary patterns and their changes throughout the year. We surveyed residents to better understand attitudes, behavior and knowledge regarding coyotes. We utilized the information gathered to create educational materials for both school students and the general public to provide additional information about urban animals and strategies for living together. At each step of this process, we met with the above-mentioned stakeholders frequently to address real-time problems, such as injured coyotes or pet deaths, as well as help them implement specific measures themselves so that they may feel confident to continue implementing the management plan after our research had ended. This process is transferable to other urban areas, though the methodology allows it to be sensitive to local conditions and needs.

Identifying Coyote Distribution and Denning Patterns

Studies of coyotes in urban environments have revealed that coyotes prefer natural habitat (reviewed in Gehrt & McGraw 2007), likely because it is more difficult to locate preferred prey in patchy urban areas (Ellington & Gehrt 2019) and anthropogenic food sources (e.g. trash, pet food) are low in fat and protein (Murray et al. 2015). However, coyotes are now found in every city in the US, and many are utilizing human food and water sources. Thus, we must determine which coyotes are causing the conflicts and when this is happening. To do this, we placed camera traps strategically throughout the cities with the guidance of residents, animal control and police officers, and park officials. In the City of Long Beach, two areas were identified as highly trafficked coyote areas: a fire station and a nursery. We placed cameras along these travel corridors and observed two packs, collecting more than 250,000 images that were then sorted and analyzed. Coyotes in both packs were more active at night, which overlapped significantly with both cats and opossums: two of their main prey sources.

Because the City of Culver City is a smaller town, which had a higher level of reported coyote-human conflict, we placed more than 30 cameras throughout the entire city along the Ballona Creek travel corridor, in all city parks, and in the backyards of residents where coyote scat was collected (Figure 1). We also placed them on the grounds of Marycrest Manor, a nursing facility with a campus adjacent to several large green spaces where coyotes were often seen. We left these cameras in place for two years and recorded nearly 2 million images. 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 cameras 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. 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. For more information on this methodology, please see Davenport et al. (2022).

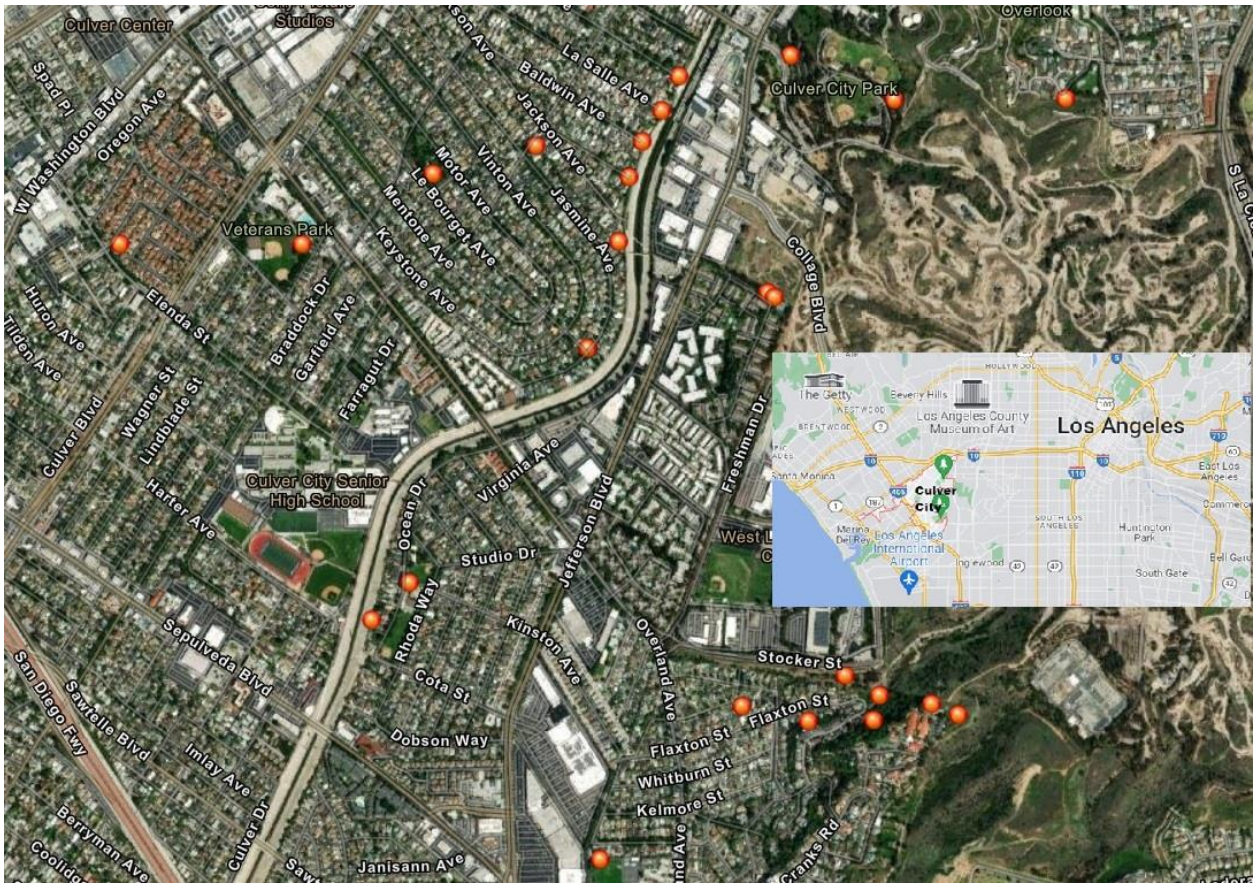

Figure 1. A map of the locations for all of the game cameras set up in Culver City.

From these data, we were able to observe trends in the animal populations in the green spaces and adjacent neighborhoods of Culver City. 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 (1,632 in 2020 vs. 1,630 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. Thus, with a decrease in a natural prey, coyotes might have entered cities 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 picture to observing no more than two rabbits in a photo at one time. There was also a slight decline in opossum, another prey source of coyotes, from 2,036 in 2020 to 1,472 in 2021, though rats did not decline. It is worth noting, of course, that these numbers do not represent actual declines in population; rather, they are indicators that there were fewer animals in the environment, as we cannot measure population from these camera photos alone. Animals may have also selected different movement routes through the parks and not have declined as significantly. However, the decline in the rabbit population at Marycrest Manor is worth noting since it is so closely located to the population's den sites and likely did not relocate outside of the camera areas. Our most notable find from this study, however, was the overlap of cats and coyotes in

the green spaces. Previous studies on coyote and cat interactions have demonstrated that cats modify their behavior to avoid coyote presence (Gehrt et al. 2013, Kays et al. 2015). However, a similar occupancy analysis in Culver City revealed something different. 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). Thus, cat behavior might explain better than coyote behavior the significant increase in cat 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 environmental preferences in Los Angeles but do in other areas, they are likely encountering more coyotes and thus having more negative interactions with them.

We were also able to radio collar two animals in Culver City, which had not been possible in Long Beach. Early in the study, we identified a pack of seven that lived in the oil fields and surrounding park areas and radio collared two animals from that pack to see how often they entered the city areas. In collaboration with the National Park Service, we trapped and radio collared two individuals from that pack, both males. We trapped the dominant male of the pack, c171, in spring 2021 and trapped one of his male offspring, c165, in November of 2020. Unfortunately, c165 died in spring 2022 when he was hit by a car. The radio collar collects data hourly during the night and every four hours during the day, when coyotes are less active. Collecting hourly versus more frequently allows the radio collars to work longer so that we can collect data during a longer period of time (pers. comm.).

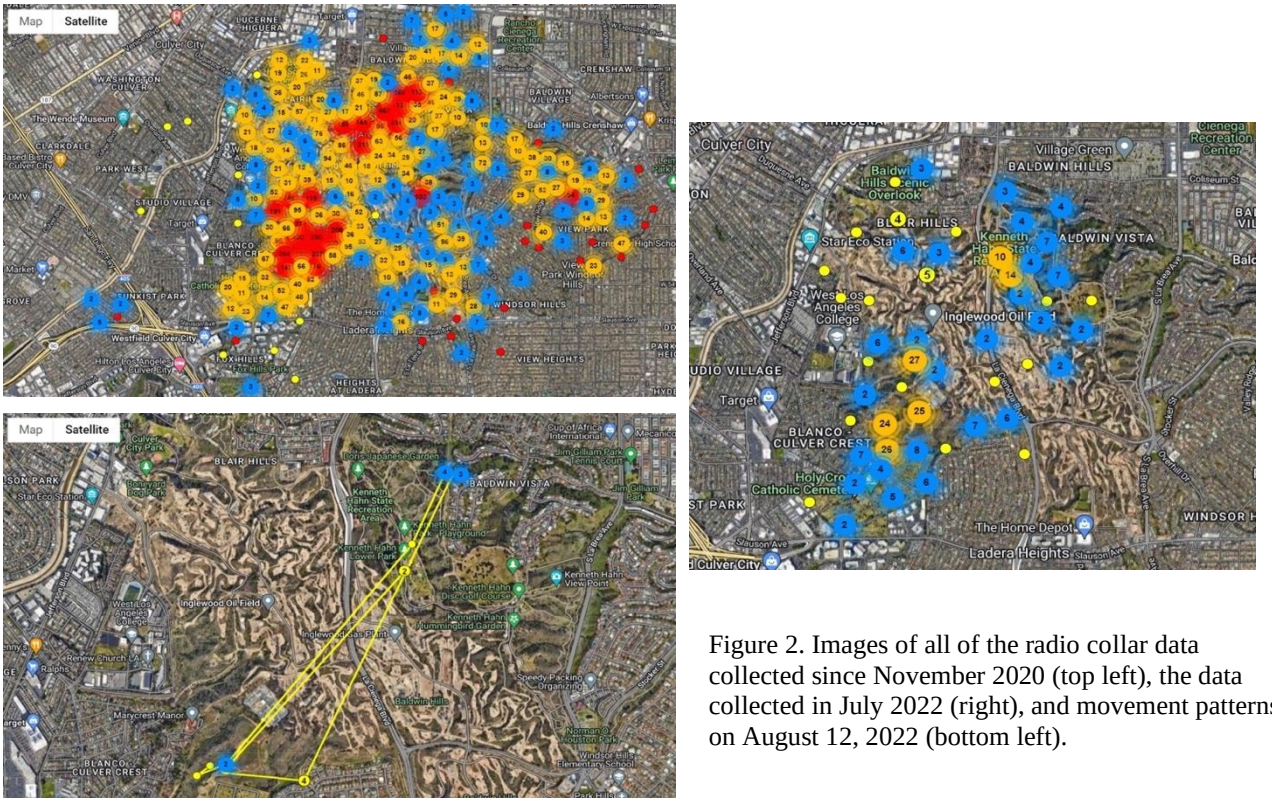

Figure 2. Images of all of the radio collar data collected since November 2020 (top left), the data collected in July 2022 (right), and movement patterns on August 12, 2022 (bottom left).

In addition to determining the size and range of the territories (Figure 2), we looked at habitat preference between coyotes (Figure 3). Both coyotes showed a preference for natural habitat, but 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. He was also more likely to choose an urban environment at night. 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.

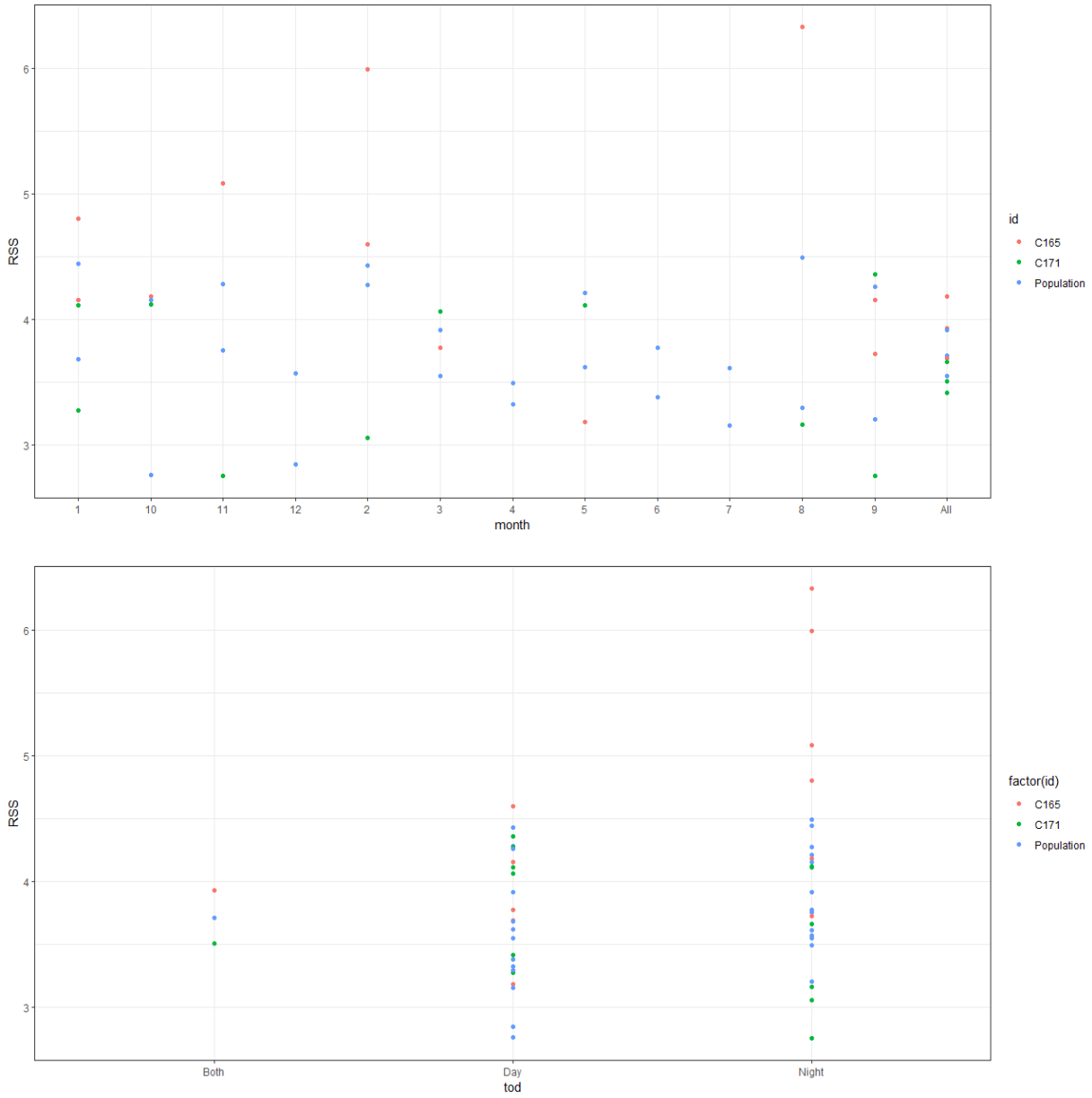

Figure 3. Habitat preference of two radio collared coyotes (c165 and c171) based on comparison between natural and urban areas. The y-axis represents how many times the coyotes would select natural habitats over urban (thus, a value of 3 represents a coyote being three times more likely to choose a natural habitat to urban). Top shows preference based on months of the year and bottom shows preference based on time of day.

Examining Coyote Diets

Most studies conducted on coyote diets in urban areas have revealed that coyotes do not utilize anthropogenic resources as a high percentage of their diets, ranging from 3% in Chicago to 13% in Seattle (Quinn 1997, Hernández et al. 2002, Prugh 2005, Gehrt & McGraw 2007, Murray et al. 2015, Poessel et al. 2017, Santana & Armstrong 2017). In California, however, Larson et al. (2020) found

cat remains in 20% of scat in Los Angeles and Larson et al. (2015) found cat in 29% of coyote scat in San Diego. Our preliminary studies in Long Beach showed similar results to the Larson studies, but our data in Culver City told a different story. In both cities, we determined the contents of scat using dry analysis, which consisted of: drying collected scat in an oven placed at 60 degrees Celsius overnight to kill pathogens, placing it in nylon stockings and washing and drying it in a commercial washing machine and dryer to remove all particles, and using a microscope to identify the remaining hair.

In Long Beach, the scat was collected at the Jauregui Tree Nursery at 7200 E. Wardlow Rd, one of the sites where cameras were placed. Students walked the transect on a monthly basis throughout 2018 and collected 21 scat samples that were fresh enough when collected to be analyzed. Of those 21 scat samples, 14 contained cat hair and 12 contained rabbit hair (Figure 4). Thus, 70% of the scat collected contained cat hair, significantly higher than previous studies. In Culver City, scat was collected monthly along a transect in Marycrest Manor near the oil fields as well as along the Creek, though it often could not be found there. Because we could not always collect scat along the Creek, we analyzed the data from Marycrest Manor, which consisted of more than 100 samples. We found that percentage of cat in coyote diet changed both annually and seasonally (Figure 4). In 2020, cat was 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. The 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 collar data, which showed the c170 spent more time in urban areas during September, October, and November than other months. We also notice that rabbits are completely absent from the diet that winter, which indicates that there was something interesting happening in the coyote environment.

In the two years prior to this study, when data suggested that as many as 72 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 stronger habitat in 2020. However, in 2020, the drought resumed, causing a tougher breeding season that could have caused a decline in animals, which is consistent with our photo analysis data. 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.

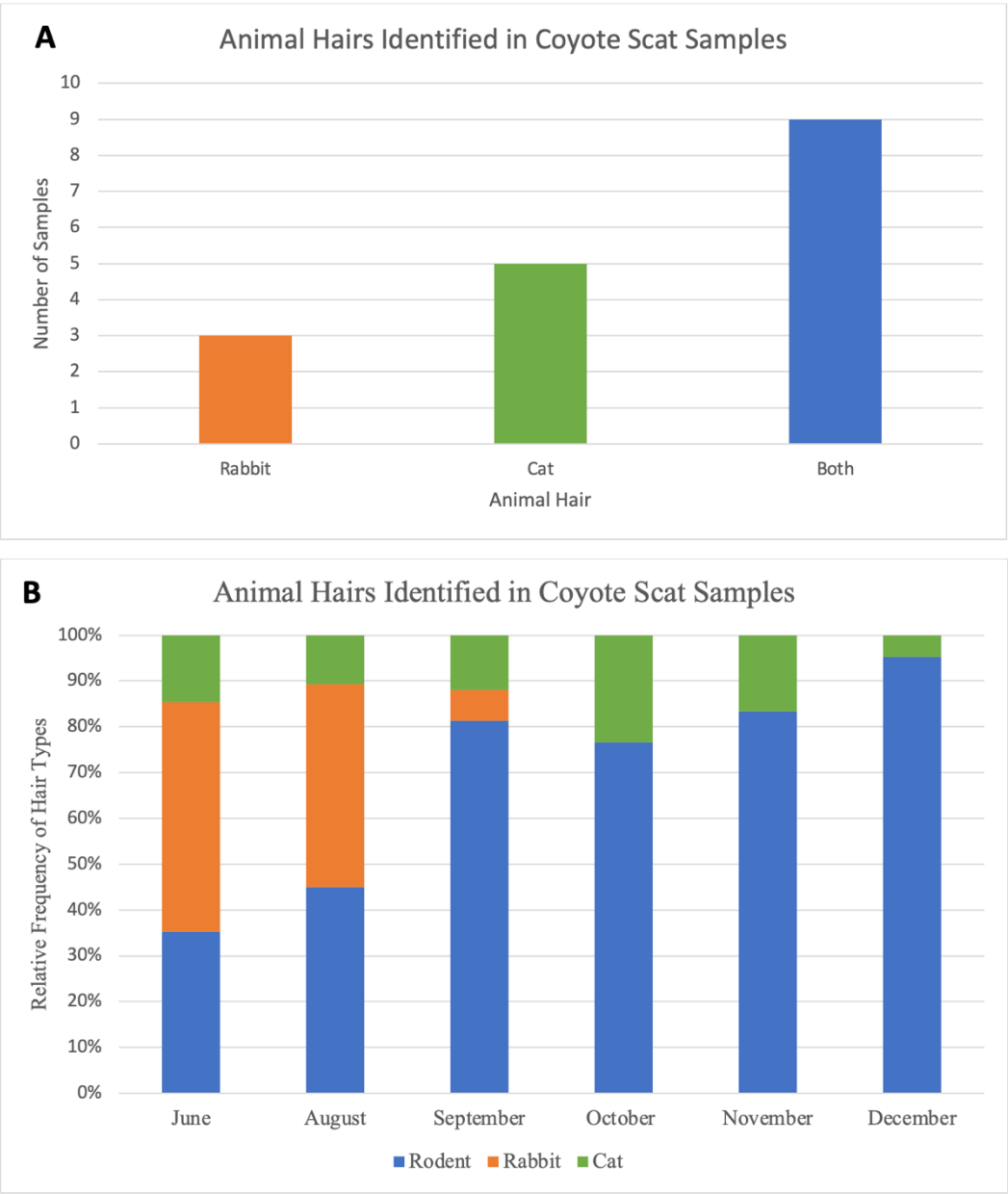

Figure 4. Results of scat analysis for both the City of Long Beach (a) and City of Culver City (b).

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, two local parks, 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. Based on radio collar data, 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. 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 remain around for a year or two to help with future litters if the environment does not favor dispersing. Scat collected at both parks matched with Marycrest Manor scat; however, scat

collected on the Creek did not. There were male and female scats collected at this location that did not match with the known pack, confirming our suspicions that there were two packs entering the neighborhoods in Culver City, potentially traveling down the Creek and causing a threat to neighborhood cats. This indicates to us that trapping Marycrest Manor coyotes would not be effective as they have low levels of cat in their scat and are not the pack traveling on the Creek. Thus, if we were to make recommendations on coyote trapping, we could suggest focusing on the Creek rather than the known Marycrest Manor pack.

Gathering Information about Resident Knowledge and Behavior

Research has shown that while residents enjoy seeing wildlife in their neighborhood (Baker & Harris 2007, König 2008, Mankin et al. 1999), this sentiment may not extend to coyotes (Elliot et al. 2016). One recent study found that the type of city (e.g. tourism-driven, industrial, or commercial economy) impacted how residents felt toward coyotes (Drake et al. 2020), while another study (Draheim et al. 2013) suggested that wildlife professionals have unique opportunities in urban areas to target tailored outreach messages to various demographic and social groups and potentially reduce the likelihood of human-coyote conflict. These findings underscore the value of gathering information about residents' knowledge, attitudes and behavior regarding coyotes. Throughout our two case studies, we have gathered information using several methodologies tailored to each city. In Long Beach, we conducted key informant interviews with wildlife professionals and other practitioners to understand their perspectives on the challenges to coyote management. In both cities, we conducted surveys of residents that included demographic questions, as well as questions about their coyote knowledge, perceptions, encounters, and safety concerns. In Long Beach, which has a population of over 450,000 residents, we adopted a mail survey approach as it was deemed the best way to reach a large, diverse population. In Culver City, with a population of approximately 40,000, we determined the appropriate strategy was to utilize a web-based survey distributed by city officials through its existing outreach approaches (e.g. city newsletter, social media and neighborhood forums, city bus advertisements). Details on methods for each city can be found in the study reports (Strauss et al. 2020, Weaver et al. 2022).

Table 1. Survey responses to statements regarding Culver City 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%

We asked respondents whether they agreed or disagreed with a number of statements about coyotes (Table 1). We found that in both Long Beach and Culver City, large numbers of respondents disagreed that coyotes should be allowed in the city (40% of respondents in each city) or that coyotes and humans can live in the same places (33% disagreed in Long Beach; the question was not asked in Culver City). However, nearly half of the survey respondents in Long Beach and nearly two-thirds of respondents in Culver City reported that they understand coyote behavior. Over 50% of respondents in each city agreed that they know where coyotes are in the City. These responses were not expected, as past research has shown that the general public is not well informed about urban coyotes. For example, a previous survey of Los Angeles 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). We speculate that many respondents may be basing their perceived knowledge of coyotes in their city on the information, and potentially misinformation, that is spread through social media and other personal communication. This was partially supported in Culver City in response to the question, "Where do you learn about the City's coyote management efforts/tips?" There were 28% of respondents who learn about coyote management through personal social media, and 27% who learn about it through word of mouth. This concern was further supported by our interviews with Long Beach professionals. For example, one interviewee expressed concern that residents share as truth, "what they might have heard somewhere or read somewhere," and another stated, "the dissemination of accurate information is a very tough challenge for Long Beach." We see this as an opportunity for our research team to work closely with city representatives and others to develop tailored educational materials to directly focus on what was revealed through the social data collection and analyses.

Developing Curricula for Public Education and Outreach

A review of coyote management plans throughout North America reveals that all of them contain an educational component, and many studies reviewing those stress the importance of humans understanding how their actions can contribute to increases in human-coyote conflict (Baker & Harris 2007, Farrar 2016, Draheim et al. 2019). We believe that our research can be more valuable to communities when we can communicate it effectively. Therefore, our plan for the City of Culver City consisted of several educational elements. First, we developed a backyard survey for which concerned citizens could sign up to assess the level at which their backyard is attracting coyotes. A member of our team would go out and assess trash areas, fences, areas where pets are fed, water sources and other food sources, finishing with recommendations on how to reduce urban animals in their yards. As a testament to the value of this approach, during this study, Canadian cities have contacted us for advice on implementing this program.

In addition, we created a series of educational units on urban wildlife, specifically coyotes, that can be accessed by middle schools and high schools in the area to teach youth about interacting with urban animals. This unit contains 12 weeks of lessons focusing on urban animals in our environment, specifically coyote ecology and behavior, and the best strategies for co-existing with urban wildlife (Figure 5).

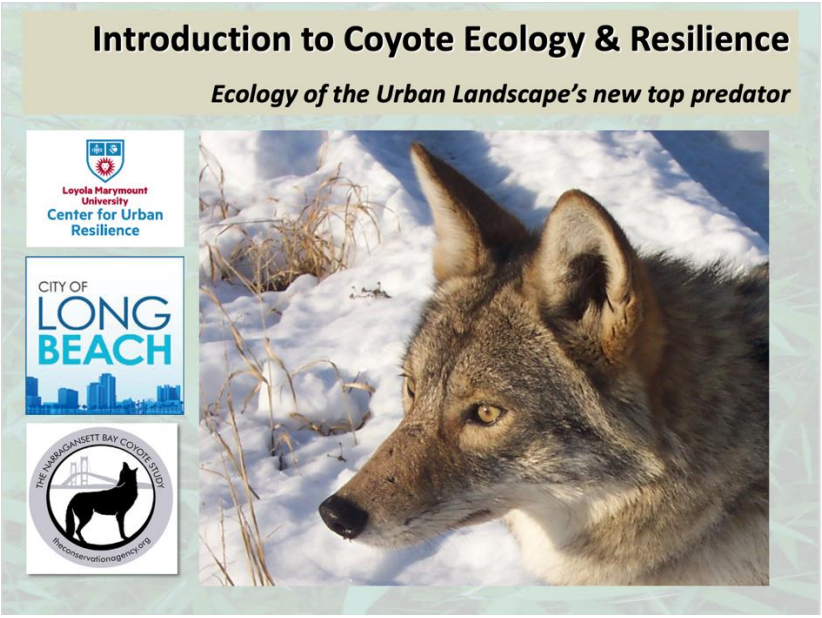

Figure 5. The introductory lesson in our Long Beach focused urban coyote curriculum.

We have also packaged several informational items (PowerPoints, flyers, social media posts, YouTube videos) that can be distributed to adults through social media campaigns and public events, so that anyone interested in learning more about coyote prevention has access to the information. Finally, we developed an evidence-based social media calendar for the City of Culver City to share seasonally appropriate information and tips to residents (Figure 6).

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).

Figure 6. Calendar of suggested seasonal social media posts based on data collected during the study.

The cities in which we work may consider targeting specific populations with an outreach campaign. For example, while there are groups of residents that strongly love or hate coyotes, as an interviewee stated, the "vast majority of people are not horribly concerned about coyotes." By focusing educational programming toward people that may not know about coyotes, there is potential to build awareness of their role in the local ecosystem and create a new group of people that care about coyotes. Research has shown that "connection to coyotes had the greatest effect on predicting coyote perceptions, suggesting efforts to promote positive emotional connections to wildlife may be a better way to increase acceptance of carnivores in urban areas than focusing on biological knowledge" (Drake et al. 2020).

DISCUSSION

Integrated studies of management challenges such as those with urban coyotes can generate a more complete understanding of the complexity of human dominated landscapes and the interventions necessary to achieve resilient solutions. Including community engagement that informs the social and wildlife sciences and drives municipal policies will support the integration of more holistic and durable management actions. The behavioral ecology and natural history of urban coyotes demonstrates the extremely adaptive nature of synanthropic meso-predators. As such, no *one-size-fits-all* approach to management is likely to be successful. Recent studies have revealed just how variable and context dependent are the behaviors exhibited by coyotes. The complex landscape of urban neighborhoods, along with local changes in weather patterns can alter the apparent boldness of coyotes, their fear of hazing and likelihood of approach to human subjects (Breck et al. 2018, Young et al. 2019). As a result, local stakeholder engagement is central to effective, resilient urban coyote management plans.

The arc of management ranging from eradication to coexistence has been applied to coyote conflict management across the urban to rural gradient with mixed results. Isolated efforts at management can lead to a vicious cycle where community engagement wanes and trust is broken between the municipality and the resident stakeholders. Each year, more than 400,000 coyotes are killed in North America through a variety of lethal management tools. Despite these interventions, the population continues to grow and expand, often leading to the intensification of eradication efforts. Traditional efforts to use lethal control on coyotes fragments the population, disrupts territorial boundaries and can even lead to local increases in population densities. We offer here a more thoroughly integrated approach that seeks to understand and address this challenge from multiple perspectives. Each component of the social-ecological research is incorporated into a comprehensive report in which we provide a number of evidence-based recommendations and suggestions of effective strategies to implement them (see Strauss et al. 2020, Weaver et al. 2022).

Lethal coyote removal is not discarded as an option, but more thoroughly integrated into a scaled response that is sensitive to context and local history. Highly managed coexistence is likely more effective, less expensive and exploits the positive ecosystem services that intact coyote populations provide. By developing a plan rooted in the local community and based on information gathered directly from their own animal and human populations, targeted recommendations and outreach can help spur a successful co-existence and amelioration of human-animal conflict.

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