

PERSPECTIVES ON THE PRESENCE OF COYOTES IN
OKLAHOMA: A Q METHODOLOGY STUDY

By

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Abstract: Increased urbanization across the United States has led to a growing interface between natural areas and human habitat (Radeloff et al., 2005; Theobald & Romme, 2007). With this growing interface comes more wildlife species adapting to urban environments (Bateman & Fleming, 2012) and increased interactions between humans and wildlife (Bar-Massada et al., 2014; Soulsbury & White, 2015). As interactions and experience with wildlife, such as coyotes, becomes more prominent, wildlife managers need to understand residents' perceptions of these urban-adapted species to create effective management plans which are understood and supported by the public (Bright & Burtz, 2006; Madden, 2004).

This study focused specifically on coyotes, which are often viewed more negatively than other urban wildlife (Gehrt, 2007; Hunold & Lloro, 2019), and studies have shown residents' perceptions of coyotes vary based on location, experiences, information received about coyotes, and other factors (Leong, 2009; Wiczorek Hudenko et al., 2008). However, perceptions of coyotes among Oklahoma residents have not been studied. This study employed Q methodology, which is the scientific study of people's subjective thoughts and opinions (Brown, 1980). Thirty-one Oklahoma residents participated by sorting a set of 38 statements about coyotes according to the condition of instruction: "What are your thoughts about coyotes in human spaces?"

Data analysis using R (R Core Team, 2021) resulted in two factors representing Oklahoma resident perceptions of coyotes: the Content Advocate and the Cautious Urbanite. The Content Advocate has a high respect for coyotes and the environment, is well-informed, and is not concerned about danger from coyotes. The Cautious Urbanite has had fewer experiences with coyotes, is concerned about coyotes becoming a problem, and prefers more separation between people and coyotes.

This study identified two perspectives Oklahoma residents hold about coyotes. The findings of this study indicate there is a gap in information from Oklahoma wildlife managers to the public about coyotes. Further research investigating the causes behind these perspectives, such as media messaging, could benefit wildlife managers and local officials in addressing this gap.

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CHAPTER I

INTRODUCTION

The urban landscape consists of a gradient from rural to urbanized areas (McKinney, 2002), with distinct wild communities existing within and adapting to specific ranges of that gradient (McKinney, 2006; Soulsbury & White, 2015). As cities continue to expand and encroach on neighboring wildlands, wild animals will continue to “become encoded in the urban fabric” (Lloro & Hunold, 2020, p. 190), which will lead to increased interactions between humans and wildlife, including coyotes (*Canis latrans*; Bateman & Fleming, 2012; Leong, 2009). Research on human-wildlife interactions typically focuses on negative interactions (Frank, 2016; Soulsbury & White, 2015), leading wildlife managers to concentrate their communications on limiting human-wildlife conflicts instead of encouraging coexistence (Frank, 2016).

Unlike other urban wildlife, and even other urban predators, people are more likely to hold negative perceptions of coyotes without ever having an interaction with a coyote (Gehrt, 2007; Lloro & Hunold, 2020). The literature regarding urban coyotes has mainly focused on ecology, including anthropogenic resource use and behaviors in human-associated areas. In general, coyotes avoid humans in urban environments by traveling at night through corridors of natural habitat (Atwood et al., 2004; Gehrt et al., 2009; Gese & Bekoff, 2004), and coyote attacks on humans are rare (Gehrt 2007; Gompper, 2002; Siemer et al., 2014),

As more coyotes make their way into urban environments, it is increasingly important for wildlife managers to work toward reducing conflicts and promoting coexistence between people and coyotes (Nardi et al., 2020). Understanding people's perceptions of urban wildlife can help managers make informed assessments of how people may feel about certain issues or proposed management actions and develop more efficient communication programs (Bright & Burtz, 2006).

Statement of the Problem

Coyotes are present throughout most areas of the contiguous United States, including in many urban and suburban environments (Bateman & Fleming, 2012; Gehrt, 2007; Hody & Kays, 2018). In Oklahoma, coyotes can be found in every county (M. Howery, personal communication, November 8, 2021). Stakeholders often have varying opinions about urban wildlife based on their experiences with and priorities concerning wildlife and natural areas (Hunold & Lloro, 2019; Manzollillo et al., 2019; Wieczorek Hudenko et al., 2008). It is important for wildlife managers and local officials to understand resident perceptions of wildlife to create management plans and policies that are best for both the human and wildlife populations (Wieczorek Hudenko et al., 2008).

Purpose of the Study

The purpose of this study was to explore how residents view the presence of coyotes in Oklahoma. Interactions with coyotes in urban spaces has increased in recent years, yet research on people's perceptions of this increase is lacking. In Oklahoma, much of the research on the ecology and behavior of coyotes is outdated (Warren-Bryant, 2017). Studies related to human perceptions of Oklahoma coyotes focus on perceptions of coyote management actions (Warren-Bryant, 2017). This study aims to provide a better understanding of Oklahoma residents' perceptions of coyotes, particularly in relation to human-associated areas.

Conceptual Framework

The conceptual framework for this study was derived from the themes of public perceptions of urban coyotes described by Hunold and Lloro (2019). The authors indexed community Facebook pages of neighborhoods in Philadelphia, Pennsylvania, and Chino and Chino Hills, California, to discover what community residents were saying about coyotes in their areas. Analysis of comments in these Facebook groups led to the formation of six main themes: coyote sightings and identification, coyotes and human safety, coyotes and pet safety, legitimacy of coyotes' presence in the neighborhood, coyote welfare, and coyotes and renegotiating the urban/wild divide. Coyote sightings and identification included comments about seeing or hearing coyotes. Coyotes and human safety included comments about coyote threats to humans. Coyotes and pet safety included comments about coyote threats to pets. Coyote welfare included concerns about coyotes' health, appearance, and availability of niche resources. Legitimacy of coyotes' presence included comments on native status of coyotes and tensions regarding presence in human-associated areas. Renegotiating the urban/wild divide included comments on coyotes' rights to the land. Each of these themes represents possible opinions that shape a person's overall perceptions of coyotes.

Research Question

In Q methodology, the research question will guide the sorting procedure as the condition of instruction. The research question for this study is "How do residents perceive the presence of coyotes in Oklahoma?" The condition of instruction is used to guide participants as they perform the Q sort (Watts & Stenner, 2012). The condition of instruction for this study was, "What are your thoughts about coyotes in human spaces?"

Assumptions

The following assumptions were made in this study:

1. Oklahoma residents have some amount of knowledge of or experience with coyotes.
2. Participants will sort statements according to their true opinions of coyotes.

Terminology

Concourse: A collection of opinions, typically self-referential statements, representing the complete thoughts and beliefs surrounding a topic (Stephenson, 1986).

Condition of instruction: A statement or question used to direct a participant in completing a Q sort (Brown, 1993).

Factor array: A composite Q sort representing a single factor's viewpoint, used as a basis for factor interpretation (Watts & Stenner, 2012).

Factor loading: A representation of the magnitude of a participant's sort association with a factor (McKeown & Thomas, 2013).

P set: The participants who complete a Q sort (Watts & Stenner, 2012).

Q methodology: A methodology developed by William Stephenson to systematically investigate human subjectivity (Brown, 1980).

Q set: A representative sample of statements derived from the concourse for participants to sort (Watts & Stenner, 2012).

Q sort: The process by which a participant rank-orders the items in the Q set (Brown, 1993).

Urban: Areas containing a large group of people and their accompanying infrastructure, typically encompassing at least one town or city (Gehrt, 2010).

Wildland-urban interface: Areas where man-made habitat and natural habitat intertwine (Stewart et al., 2007).

Wildland vegetation: Any vegetative cover (i.e., trees, shrubs, grasses, etc.) that occurs naturally; does not include vegetation that is planted and maintained for agriculture, landscaping, property beautification, or other anthropogenic purposes (Stewart et al., 2007).

CHAPTER II

REVIEW OF LITERATURE

The purpose of this study was to explore how residents view the presence of coyotes (*Canis latrans*) in Oklahoma. This chapter examines the relevant body of literature surrounding this topic. The growth of cities and urban areas has led to increased overlap between human communities and wildlife communities. To understand Oklahoma resident perceptions of coyotes, it is important to understand the factors that influence these perceptions and how the wildlife behave and utilize resources in human-associated areas. This chapter includes background on the following foundations of Oklahoma residents' perceptions of wildlife: the wildland-urban interface, urban residents, urban wildlife, coyotes in Oklahoma, human-wildlife interactions, and management of urban wildlife.

The Wildland-Urban Interface

The wildland-urban interface (WUI) is an important part of the growing urban ecosystem (Bar-Massada et al., 2014; Bright & Burtz, 2006; Hammer et al., 2009), but it is relatively unresearched in terms of many of its effects (Bar-Massada et al., 2014). The definition of the WUI has changed over time, but the definition always includes three main components: (a) human presence, (b) wildland vegetation, and (c) a distance for which the human presence could affect the natural lands nearby (Stewart et al., 2007). Specific definitions of each of these components vary. One definition of the WUI that is used often comes from a 2001 Federal

Register report that explains these characteristics in more detail (Office of the Federal Register, National Archives and Records Administration, 2001). For an area to be categorized as WUI, it must first contain at least one housing unit per 40 acres of land in a census block (Radeloff et al., 2005; Stewart et al., 2007). A census block is defined as an area “bounded by visible features such as roads, streams, and railroad tracks, and by nonvisible boundaries such as property lines, city, township, school district, county limits and short line-of-sight extensions of roads” (Rossiter, 2011, para. 1). In metropolitan areas, a census block typically coincides with city blocks bounded by roads; in suburban and rural areas, the size and shape of census blocks are more irregular (Rossiter, 2011). The WUI is further defined by splitting it into two categories: intermix WUI and interface WUI. Intermix WUI is characterized by having more than 50% of the land in a census block containing wildland vegetation (Stewart et al., 2007). Interface WUI is characterized by having less than 50% of the land in a census block containing wildland vegetation, but the block itself is within 1.5 miles of a large area containing more than 75% wildland vegetation (Stewart et al., 2007).

The WUI has been operationalized for wildland fire research and preparedness planning for many years (Stewart et al., 2007). In Oklahoma, the Firewise program works to educate community leaders on protecting neighborhoods and homes in the WUI from potential fire hazards (Oklahoma Forestry Services, 2022). However, impacts of the WUI on the environment beyond wildland fire are poorly understood (Bar-Massada et al., 2014). Focusing on wildland fire in the WUI “fails to account for most of the effects that human settlements in the WUI impose on their surrounding wildlands” (Bar-Massada et al., 2014, p. 430).

WUI areas can be found across the contiguous United States, but they are most prominent in eastern states such as North Carolina, which has a high total WUI coverage due to its intermediate housing and vegetation densities throughout the state (Radeloff et al., 2005; Zhang et al., 2008). States with intensive agriculture often have less total WUI area because there is less

wildland vegetation in these states (Radeloff et al., 2005). However, Oklahoma has repeatedly been one of the top states for greatest proportion of WUI expansion (Theobald & Romme, 2007; U.S. Forest Service, 2018). In 1990, Oklahoma was estimated to have 9,934 km² of total WUI area. By 2000, the estimated WUI area grew to 11,726 km², and by 2010 had reached 13,684 km², an increase of 37.7% over that 20-year period. Around the same time, Radeloff et al. (2005) estimated a total of 6.5% of Oklahoma land to be part of the WUI. Of this, 74.9% was considered intermix WUI and 25.1% interface WUI. This study also quantified the number of housing units in each WUI category in Oklahoma. A total of 531,799 Oklahoma housing units (35.1%) were located in WUI areas. Of these, 199,771 (37.6%) were in the intermix WUI and 332,028 (62.4%) were in the interface WUI.

Wildlife utilize all parts of urban environments, from more natural WUI areas to highly developed urban cores (Bar-Massada et al., 2014; McKinney, 2006). There is no consensus on exactly what constitutes an urban area, and there are differences in how species of wildlife “define” and utilize urban environments (Gehrt, 2010; Parker et al., 2018; Soulsbury & White, 2015). Some research claims all urban habitats are highly similar because cities are designed to meet specific, narrow human needs (McKinney, 2006). Gehrt (2010), however, claims no two cities have the same physical characteristics, which therefore leads to differences in environments and ecological processes between cities of similar size or location. In contrast to early urbanization efforts, “many new suburban areas are designed with larger lots such that houses are separated by trees and other native vegetation...[which] creates wildlife habitat (travel corridors, hiding cover, forage, etc.) where little existed previously” (Ditchkoff et al., 2006, p. 6).

There are several characteristics common to most urban areas that affect wild animals’ abilities to survive in more urbanized environments. The climate of urban cores is typically characterized by lower humidity, less sunshine, and increased ambient temperature (Gehrt, 2010; McKinney, 2006). These climate differences can affect the temperature and climate of suburban

and rural areas surrounding the city. Most urban areas are associated with at least one significant body of water, which may be a significant resource for wildlife in dry environments (Bateman & Fleming, 2012; Gehrt, 2010; Radeloff, Hammer, & Stewart, 2005). Light and noise in urban environments are very different from rural environments (Gehrt, 2010). Artificial city lights typically shine constantly over a 24-hour period, and noises in urban areas vary in intensity throughout the day and are often louder from reflecting off buildings. Light and noise pollution have been known to affect rural wildlife in many ways, but it is unclear if these effects are the same for urban wildlife or if urban wildlife have adapted to function with these differences (Gehrt, 2010). Urban and suburban development lead to fragmentation of wildlife habitat, which leaves wildlife populations with only patches of usable habitat separated by roads and human activity (Bar-Massada et al., 2014; Forman & Alexander, 1998; Gehrt, 2010). Urban areas are also characterized by different flora and fauna than rural areas, with an increase in non-native plants and domesticated animals in the city (Gehrt, 2010; McKinney, 2006). There is a higher potential for injury, illness, and death of wildlife in urban areas due to more vehicle traffic, more pollution, and increased risk of parasites and disease (Bateman & Fleming, 2012; Ditchkoff et al., 2006; Gehrt, 2010). Sociopolitical boundaries also affect urban wildlife, as resources are often not allocated evenly across the urban landscape and the ways people interact with wildlife differs between residents in different areas of the urban landscape (Bateman & Fleming, 2012; Gehrt, 2010). For example, Gehrt (2010) notes a person's resources or political influence can impact how they respond to carnivores in urban areas.

Urban Residents

In the 1990s, eight million housing units were added to the WUI in the United States (Hammer et al., 2009). This increase came from more housing units being built in the WUI (Radeloff, Hammer, & Stewart, 2005) as well as rural areas with increasing populations being reclassified as WUI (Hammer et al., 2009). However, the area where human settlement

intertwines with natural areas is larger than the previously described WUI (Bar-Massada et al., 2014).

Most counties in the U.S. are considered rural, especially in states with intensive agriculture, but the majority of the U.S. population lives in urban and suburban counties (Gehrt, 2010; Parker et al., 2018). Since 2000, the populations of urban counties have grown by 13%, suburban counties by 16%, and rural counties by 3% (Parker et al., 2018). Overall, populations in many rural counties are decreasing in all regions of the U.S. (Parker et al., 2018). The older adult population (65+) has grown in each county type in the past two decades. The biggest growth of this population is in suburban counties (Hammer et al., 2009; Parker et al., 2018), but rural counties have a higher proportion of 65+ adults than suburban or rural counties (Parker et al., 2018).

Urban residents tend to be more Democratic or Democratic-leaning whereas rural residents tend to be more Republican or Republican-leaning (Parker et al., 2018). These political differences have an impact on how residents in each type of community view various social issues, such as how to manage urban wildlife (Bright et al., 2007; Marcuse, 2009; Nardi et al., 2020; Parker et al., 2018). Nardi et al. (2020) found that “attention to news about urban wildlife does not impact attitude toward urban coyotes for political conservatives, but attention to this news is related to an increase in positive attitudes toward urban coyotes for political liberals and to a lesser extent for political moderates” (p. 413).

Urban Wildlife

Most urban residents agree that they enjoy seeing wildlife in their neighborhoods (Elliot et al., 2016) and many actively participate in managing for and against different wildlife species in their areas (Conover, 1997). Human settlement in the WUI has been shown to facilitate the introduction of both plant and animal species (Bar-Massada et al., 2014). Since human influences

are central to the urban ecosystem (Gehrt, 2010), this increase of wildlife in urban areas could have lasting effects on both human and non-human residents of urban areas. The urbanization of wildlife has come from both cities expanding and removing natural habitat and wildlife purposefully moving into urban areas (Bateman & Fleming, 2012). Much research has been conducted on the urban environment, yet the ways wild animals become part of the urban landscape is not well understood (Lloro & Hunold, 2020). Wildlife that benefit from human-associated resources, such as food or shelter, are considered subsidized species (Bar-Massada et al., 2014). Predator species commonly considered as subsidized include raccoons (*Procyon lotor*), skunks (Family Mephitidae), coyotes, and crows (*Corvus* spp.; U.S. Department of Agriculture, 2019). In the WUI, the subsidization of wildlife impacts an ecosystem through alteration of wildlife behavior, reproductive characteristics, and predator-prey interactions (Bar-Massada et al., 2014; Ditchkoff et al., 2006). The availability of alternative food sources in urban areas can limit a subsidized species' dependence on natural food sources and can greatly impact their survival rates (Bar-Massada et al., 2014; Ditchkoff et al., 2006).

The characteristics of urban wildlife are often viewed in terms of the urban-rural gradient, which describes the physical, social, and environmental differences that occur as you transition from a rural to an urban environment. In general, species diversity decreases as human development increases, with the urban core having half the number of species as rural environments (McKinney, 2002; Soulsbury & White, 2015). Suburban areas with moderate human development can have higher species diversity than more natural preserves due to homeowners choosing to put a variety of plants and other resources on their property (McKinney, 2002). This higher diversity can be seen with many taxa of wildlife, including mammals, birds, butterflies, bees, ants, lizards, and plants (McKinney, 2002). However, studies have also shown the opposite effect, where less-altered rural areas have a higher diversity of wildlife than suburban areas (McKinney, 2002). The physical environmental changes along the urban-rural

gradient affect which species are able to survive in certain areas, and wildlife tend to form consistent communities across the gradient rather than sporadic populations (McKinney, 2006). Urban wildlife, especially carnivores, often shift to more nocturnal activity than their rural counterparts to avoid human activity (Ditchkoff et al., 2006). Since carnivores mainly rely on hunting prey for food, this can have significant impacts on their ability to find food and reproduce efficiently in urban environments (Ditchkoff et al., 2006).

Many carnivores have become habituated to urban life, including coyotes, red and gray foxes (*Vulpes vulpes* and *Urocyon cinereoargenteus*), racoons, bears, skunks, and opossums (*Didelphis virginiana*; Bateman & Fleming, 2012). Some species are more noticeable in urban environments due to their widespread distribution (e.g., racoons) or their high level of adaptability (e.g., red foxes; Bateman & Fleming, 2012). The carnivores that do best in urban environments typically have generalist, omnivorous diets (Bateman & Fleming, 2012; Fuller et al., 2010). This can lead to negative interactions with people if they are feeding the carnivores regularly, whether intentionally or unintentionally (Fuller et al., 2010). Urbanized environments provide an abundance of potential food sources for carnivores, including garbage/refuse, crops, prey (e.g., rodents, domesticated pets, and livestock), roadkill, and anthropogenic food sources (Bateman & Fleming, 2012). Anthropogenic food sources, such as pet food that is left outside, have a higher energy content and can be more reliable than natural food sources, which vary in availability depending on the season, weather changes, and other factors (Bateman & Fleming, 2012). Carnivores that are able to successfully utilize these alternative food sources are likely to have higher population densities than rural carnivores limited to natural, seasonal food sources (Bateman & Fleming, 2012). However, when wildlife become habituated to humans and developed areas, people perceive those animals either as friendly, wanting to interact with them, or as nuisances (Abrams et al., 2020).

The use of anthropogenic structures varies among urban carnivores. Some species choose to use buildings and other man-made structures over natural alternatives for shelter whereas others avoid human-associated areas as much as possible (Bateman & Fleming, 2012). Those that avoid man-made structures are able to survive in urban landscapes by utilizing patches of connected habitat throughout the city (Bateman & Fleming, 2012). Proximity to roads provides additional food sources for urban carnivores through roadkill (Bateman & Fleming, 2012), however it also puts the carnivores at higher risk of being hit by a vehicle while traveling or feeding (Bateman & Fleming, 2012; Gehrt & Riley, 2010; Moss et al., 2016).

North America has seen a rapid expansion of coyote range in the last century (Hody & Kays, 2018). This is a result of less predation after wolves and cougars (*Puma concolor*) were extirpated from much of eastern North America, a decrease in forests and increase in agricultural landscapes, and hybridization with wolves and domestic dogs (Gese & Bekoff, 2004; Gompper, 2002; Hody & Kays, 2018). Research has shown coyotes survive best in open landscapes such as grasslands, deserts, and agricultural lands, but the species has adapted to become a top predator in many environments, including cities (Gehrt, 2007; Hody & Kays, 2018). Accounts of historical coyote range differ, but analysis of known coyote locations since the Holocene indicates historic populations were present throughout Oklahoma, as well as further north and east of the state (Hody & Kays, 2018).

Coyotes are highly adaptable (Atwood et al., 2004; Warren-Bryant, 2017), but little is known of their urban ecology (Bateman & Fleming, 2012; Gompper, 2002; Grindler & Krausman, 2001). Coyotes are considered ‘urban adapters,’ meaning they are able to utilize human-associated resources but do not specifically seek out or thrive in urban environments (McKinney, 2002). The ecological benefits of urban coyotes can include population control of numerous wildlife species (e.g., rodents [Order Rodentia], deer [*Odocoileus* spp.], and geese [Family

Anatidae]) and feral cat removal, which can lead to increased urban songbird populations (Gehrt, 2007; Gehrt & Riley, 2010; Gompper, 2002; Henke & Bryant, 1999; Soulé, 2007).

Coyotes form packs and defend territory in both urban and non-urban settings, and urban areas also see some solitary coyotes looking to join a new pack or create their own territory (Bateman & Fleming, 2012; Gehrt, 2007; Warren-Bryant, 2017). Urban coyote packs often occupy and defend small territories (i.e., roughly three square miles), whereas solitary urban coyotes occupy larger home ranges (i.e., roughly 25 square miles) they do not defend (Gehrt, 2007). The home range size of urban coyotes varies, but within the urban matrix, coyotes tend to have larger home ranges in more highly developed areas (Atwood et al., 2004; Gehrt et al., 2011; Gehrt & Riley, 2010; Mueller et al., 2018). The territories of urban coyote packs are typically smaller than those of rural coyotes (Atwood et al., 2004; Gehrt, 2007; Gehrt & Riley, 2010). Multiple packs of coyotes may form territories in the same downtown or urban core area using patches of natural habitat, but the way the coyotes defend their territories leads to little overlap in territory ranges and lower population densities (Gehrt, 2007; Gehrt et al., 2011).

As with other urban carnivores, urban coyotes alter their diets from being pure carnivores to being generalists, allowing them to take advantage of the most available food sources (Gehrt, 2007). Despite common beliefs, pets and human refuse are not the most common food sources for urban coyotes, though evidence of both has been found in urban coyote scat (Bateman & Fleming, 2012; Gehrt, 2007; Gehrt et al., 2011; Gehrt & Riley, 2010). Rather, urban coyote diet consists mainly of small rodents, deer, and fruit (Bateman & Fleming, 2012; Gehrt, 2007; Gehrt et al., 2011; Warren-Bryant, 2017).

Urban coyotes have higher survival rates than rural coyotes, but most typically die within two years in either environment (Gehrt, 2007; Gehrt et al., 2011; Gehrt & Riley, 2010). The most frequent cause of death for urban coyotes is vehicle collisions (Gehrt, 2007; Warren-Bryant,

2017). Other causes include hunting, malnutrition, and disease (Bateman & Fleming, 2012; Gehrt, 2007; Gehrt & Riley, 2010; Moss et al., 2016). Although urban coyotes are at higher risk for vehicle-related deaths, the nature of urban environments reduces other risks of death (Bateman & Fleming, 2012). For example, Bateman and Fleming (2012) found that only 9% of urban coyotes die from hunting and 10% die from competition with other carnivores, compared to 22% and 25% of rural coyotes, respectively.

Coyotes tend to avoid areas of human activity by restricting most activity to night hours and utilizing natural areas within urban environments for travel and shelter (Atwood et al., 2004; Gehrt et al., 2009; Gehrt et al., 2011; Gehrt & Riley, 2010; Gese & Bekoff, 2004; Grinder & Krausman, 2001). While restricting activity to night hours can affect coyotes' ability to find prey (Ditchkoff et al., 2006), it also decreases their risk of encountering humans or being hit by a vehicle while crossing roads (Gehrt & Riley, 2010). According to Gehrt (2007), people usually do not see coyotes directly, but howling, tracks, and scat are the main indicators of their presence in urban areas.

Coyotes in Oklahoma

Little research has been done on the ecology and behavior of coyotes in Oklahoma in the recent years (Warren-Bryant, 2017). Older research showed Oklahoma coyotes tended to be solitary rather than forming packs (Litvaitis & Shaw, 1980). The average home range size for adult female coyotes in Oklahoma was 68.7 km², compared to 33.9 km² for adult males (Litvaitis & Shaw, 1980). Coyotes with adjacent territories did have overlapping home ranges in many cases (Litvaitis & Shaw, 1980).

The diet of Oklahoma coyotes is similar to that of coyotes in other regions. Rodents and rabbits make up a large portion of coyote diet (Best et al., 1981; Litvaitis & Shaw, 1980). Seeds and insects have also been found in many samples of coyote scat (Best et al., 1981; Litvaitis &

Shaw, 1980). Best et al. (1981) found that cattle were an important food source year-round for coyotes in Oklahoma. However, Litvaitis and Shaw (1980) found cattle made up only a small proportion of coyote diets, and when they did feed on cattle it was mainly in the spring and fall.

In comparison with other wildlife, Oklahoma residents prefer coyotes the least (Mincolla, 1977). A 2017 survey found that 83% of Oklahoma residents have at some point had either a direct or indirect experience with coyotes (Warren-Bryant, 2017). Nearly half (47%) of these experiences were labeled as neither positive or negative, but there were more labeled as positive (36%) than negative (17%; Warren-Bryant, 2017). Mincolla (1977) reported that Oklahoma residents who were highly involved in outdoor recreation had more positive perceptions of coyotes than residents who did not regularly participate in outdoor recreation. The 2017 study by Warren-Bryant did not include outdoor recreation as a demographic factor.

Oklahoma has a year-round, no-limit season for hunting coyotes (Oklahoma Department of Wildlife Conservation, 2021). Residents and nonresidents can hunt coyotes as long as they have a valid Oklahoma hunting license, but they cannot use artificial lights or sight dogs to hunt at night (Oklahoma Department of Wildlife Conservation, 2021). Oklahomans have mixed views on whether hunting and other lethal management actions are the best methods to control the coyote population (Warren-Bryant, 2017). A majority of Oklahomans believe educating residents on how to prevent human-coyote conflicts could replace lethal management methods, but many still support hunting as an acceptable management method (Warren-Bryant, 2017). Residents also recommend relocating coyotes to more suitable habitats and altering the hunting regulations to prevent over-hunting (Warren-Bryant, 2017).

Human-Wildlife Interactions

The effects of urbanization on plant and animal population densities are often delayed from the time of initial urbanization, so the effects of recent urban sprawl in the United States is

not yet fully known (Radeloff, Hammer, & Stewart, 2005). Human settlement has both direct and indirect effects on habitat fragmentation, which leads to increased interactions between humans and wildlife (Bar-Massada et al., 2014; Soulsbury & White, 2015). Direct effects come from converting natural wildlands into developed environments (Bar-Massada et al., 2014). Indirect effects are a result of human activities and processes near those developed wildlands (Bar-Massada et al., 2014). Research shows the development of road networks has a bigger impact on habitat loss and fragmentation than the building of homes (Forman & Alexander, 1998; Hawbaker et al., 2006).

People's perceptions of wildlife in urban areas are affected by where they believe wildlife should be and how wildlife should act (Leong, 2009). Urban wildlife can be viewed as either tools or immigrants, categories which "highlight an important strategy used in maintaining other techniques for both human and nonhuman groups, (1) the denial of sentience and (2) the defining of urban space as human-only or -first, respectively" (Shingne, 2020, p. 6). According to Shingne (2020), an animal is often viewed as a tool any time it is beneficial to humans, and an immigrant when the animal's presence is seen as potentially damaging to mankind's health, safety, or economic or social systems. Urban coyotes often fall in the immigrant category (Ditchkoff et al., 2006).

Human-wildlife interactions are often thought of in the sense of negative conflicts rather than positive or neutral interactions. There is no set term for positive human-wildlife interactions, but negative interactions have been termed human-wildlife conflicts for many years, reflecting the overall negative representation in the literature (Soulsbury & White, 2015). Using the word conflict, rather than interaction, leads wildlife managers to focus on preventing negative interactions instead of increasing positive interactions and fostering coexistence between people and wildlife (Frank, 2016). Additionally, what is viewed as a conflict in one context may not be viewed the same in a different context (Soulsbury & White, 2015; Wiczorek Hudenko et al.,

2008; Wieczorek Hudenko et al., 2010). Factors that affect people's views of urban wildlife include the species, location, the person's culture, and other socio-economic and political factors (Frank, 2016; Soulsbury & White, 2015).

Wieczorek Hudenko et al. (2010) outlined six categories of impacts urban carnivores can have on people. Ecological impacts include effects on other wildlife or ecosystems caused by interactions between humans, wildlife, and the environment. Economic impacts are any monetary costs associated with the presence of carnivores in urban environments. Health and safety impacts include direct threats on human safety. Psychological impacts include ways in which urban carnivores affect a person's or group's psychological well-being. Social impacts are times when urban carnivores cause people to gather in a social setting. Secondary impacts include any impacts caused by management actions meant to control a species or reduce human-wildlife interactions.

Negative Interactions

The frequency of conflicts between humans and wildlife is growing as a result of suburban sprawl and increasing size of wildlife populations (Ditchkoff et al., 2006). Human-wildlife conflict often is not a conflict between people and wildlife directly, but a conflict between what people believe are appropriate reactions to wildlife in different situations (Frank, 2016). Human-wildlife conflict can increase when people feel the needs of wildlife are placed before their own needs and values (Madden, 2004). An essential part of managing potential human-wildlife conflict in urban environments lies in knowing the ways people and communities respond to urban wildlife and how that impacts the urban ecosystem (Soulsbury & White, 2015).

The potential for human-wildlife conflict varies based on multiple factors, including human density. Some species have increased conflict in areas with larger human populations, whereas other species have decreased conflict in areas with larger populations (van Bommel et

al., 2020). For example, van Bommel et al. (2020) analyzed human conflict with both black bears (*Ursus americanus*) and cougars (*Puma concolor*) in an urban setting. The probability of conflict with bears grew as road density increased and was highest in areas of intermediate human density. In contrast, cougars had a higher probability of conflict in forested urban areas and lower probability of conflict as human density increased. Overall, the study found human-carnivore conflicts with these species mainly occurred within the wildland-urban interface (van Bommel et al., 2020). While conflict between humans and wildlife are expected in these areas – which have both recreational uses for people and value for wildlife – educating the public about how to tolerate wildlife presence can help ease the conflict (Soulé, 2007; Soulsbury & White, 2015).

People believe urban wildlife to be a nuisance based on either past experience or a general perception of the species causing disturbances, although most damage caused by urban wildlife is minor (Soulsbury & White, 2015). Human conflict with urban carnivores can include increased risk of disease transmission, damage to residential areas, and attacks, which can occur when urban carnivores become habituated to human presence and lose their fear of humans (Bateman & Fleming, 2012; Soulsbury & White, 2015). Most conflict between people and urban carnivores is a result of “animals attempting to satisfy their needs for food, shelter, or breeding opportunities, rather than animals practicing predation” (Curtis & Hadidian, 2010, p. 201). For some carnivores, the primary factor that leads to conflict with humans in the WUI is access to anthropogenic food sources (Wieczorek Hudenko et al., 2010; Wilbur et al., 2018). Attacks by urban wildlife on people are rare, and very few that do occur result in serious injury or death (Soulsbury & White, 2015).

The main ecological impact of urban environments on carnivores is the risk of population decline due to human disturbances (Soulsbury & White, 2015; Wieczorek Hudenko et al., 2010). Economic impacts of urban carnivores include costs associated with damage to commercial or residential property and costs of disease treatment and prevention for pets, livestock, and other

wildlife (Wieczorek Hudenko et al., 2010). The economic costs from urban wildlife are difficult to calculate, but the greatest costs are associated with control and maintenance of wildlife diseases (Soulsbury & White, 2015). Urban carnivores impact human health and safety by transmitting diseases or causing injury to humans and pets (Wieczorek Hudenko et al., 2010). An increased urban wildlife presence leads to more exposure to vectors and non-human disease hosts, which can have a great impact in areas with higher densities of humans and domesticated animals (Soulsbury & White, 2015). Psychological impacts of urban wildlife can result from commercial or residential property damage, injury or loss of pets or livestock, and perceived threats to human safety (Gompper, 2002; Soulsbury & White, 2015; Wieczorek Hudenko et al., 2010). Urban wildlife cause social impacts by inciting conflict between various population groups or concerns of wildlife affecting a person's or group's way of life (Wieczorek Hudenko et al., 2010). Human-wildlife conflicts are often not fully understood by managers and others who experience such conflicts regularly, making adequate communication to address the conflicts with people who do not experience these conflicts regularly even more important (Madden, 2004).

Positive Interactions

Urban green spaces have been noted as important cultural aspects of an ecosystem, but the cultural value of the urban wildlife within them has not been studied much (Soulsbury & White, 2015). Studies on the benefits associated with human-wildlife interactions typically focus on indirect benefits, such as personal well-being or recreational value (Soulsbury & White, 2015) rather than economic benefits. Positive ecological impacts of urban carnivores include ecosystem services to humans, such as predation of nuisance wildlife or mesopredators (Soulsbury & White, 2015; Wieczorek Hudenko et al., 2010). Urban wildlife provide economic benefits in that they generate revenue from hiking, photography, and other recreational activities (Wieczorek Hudenko et al., 2010). These recreational activities also produce psychological benefits through the personal satisfaction of participating in them (Wieczorek Hudenko et al., 2010).

Interactions with Coyotes

Urban coyotes are viewed differently than other urban wildlife (Hunold & Lloro, 2019; Lloro & Hunold, 2020), often being reported as a nuisance without actually causing any damage, but rather for being in the presence of people (Gehrt, 2007). Many people have positive attitudes about coyotes as an abstract concept but are not welcoming to the presence of coyotes within their neighborhoods (Elliot et al., 2016). Simply the knowledge of them being nearby impacts people's perceptions of coyotes (Lloro & Hunold, 2020). A study comparing perceptions of urban coyotes and urban foxes found respondents perceived urban foxes as positive and beneficial to the area whereas coyotes were perceived to be more of a risk or danger (Nardi et al., 2020).

Coyotes and humans typically have little interaction compared to other urban wildlife due to coyotes mainly traveling at night through habitat fragments (Gehrt et al., 2011; Gehrt & Riley, 2010; George et al., 2016), but they are seen more often in suburban areas than in urban areas (Manzolillo et al., 2019). Residents in areas with a shorter history of coyotes are less likely to have positive attitudes and more likely to have higher concern regarding coyotes (Wieczorek Hudenko et al., 2008) because a newly settled coyote population attracts attention from the media and speculation from the public about how the coyotes will affect the public (Hunold & Lloro, 2019). Residents in areas with a longer history of coyotes are less likely to be concerned about coyote presence, but the concerns they do express are more likely to be about threats to pets than threats to people (Wieczorek Hudenko et al., 2008). Manzolillo et al. (2019) also found that while the majority of people in both urban and suburban areas did not believe coyotes posed a threat to humans, the majority in both did believe there was a threat to pets.

The way the media presents a story about human-coyote conflicts may impact the effect it has on people's perception of the potential for future conflict (Hunold & Lloro, 2019; Siemer et al., 2009; Siemer et al., 2014). Residents of urban and suburban areas mainly get information

about coyotes through the media, which usually focuses on conflicts such as pet attacks (Gehrt, 2007; Siemer et al., 2014). One of the most common attractants of coyotes to urban and suburban areas is leaving pets outside unattended (Elliot et al., 2016). Coyotes attack cats more than dogs, either for food or to remove competing predators (Gehrt, 2007; Gehrt & Riley, 2010). If coyotes do attack dogs, it is more likely to be small dogs not accompanied by a human (Gehrt, 2007; Gehrt & Riley, 2010). Large dogs are typically only attacked during coyotes' breeding or mating season, when they are most protective of their territories (Gehrt, 2007; Gehrt & Riley, 2010). Coyote attacks on people are rare and rarely serious (Gehrt, 2007; Gompper, 2002; Siemer et al., 2014), but attacks on domestic pets increase residents' fears of attacks on people (Gompper, 2002).

Another common attractant of urban coyotes is intentional or unintentional feeding by humans (Gehrt, 2007; Gehrt & Riley, 2010). A lack of knowledge about coyotes and people's unwillingness to scare coyotes away during an encounter indicate a need for resident education on coyotes (Elliot et al., 2016). Gehrt (2007) outlined steps people can take to avoid conflict with urban coyotes: (a) avoid feeding coyotes, intentionally or unintentionally; (b) avoid letting pets run loose, especially at night; (c) do not run from a coyote; (d) use repellents or fencing to deter coyotes from residential areas; and (e) report aggressive or fearless coyotes to wildlife managers immediately. While human-coyote interactions and conflicts in urban and suburban areas are not well-researched (Gese & Bekoff, 2004), increasing residents' knowledge of coyote ecology and how to act in a coyote encounter can lead to less habituation of coyotes and therefore less conflict with urban residents (Elliot et al., 2016; Gehrt, 2007).

Management of Urban Wildlife

Conservation and management of wildlife in any setting primarily focuses on "preserving or enhancing positive impacts and mitigating or eliminating negative impacts in an effort to strike

an ecologically and socially sustainable balance” (Wieczorek Hudenko et al., 2010, p. 22). One method of achieving this goal in urban areas is removal or relocation of nuisance animals, which are animals deemed by community members as causing any problem for the community (Gehrt, 2007). Relocation of specific nuisance animals can be an effective management action, but it does not always work (Curtis & Hadidian, 2010). Attempting to remove or relocate specific nuisance animals can be challenging because it is difficult to find the one(s) that have caused disturbances (Curtis & Hadidian, 2010). Relocating animals is rarely effective because most relocated individuals make their way back to their original territory, or they die trying (Gehrt, 2007). When a coyote becomes habituated to an urban environment and is an immediate threat to humans, the management strategy often involves removing the coyote (Curtis & Hadidian, 2010; Gehrt, 2007). However, people who believe coyotes are a natural part of the urban ecosystem are less likely to favor coyote removal (Manzollilo et al., 2019). Coyote researchers recommend targeted removal of nuisance coyotes rather than broad removal of an entire urban coyote population (Curtis & Hadidian, 2010; Gehrt, 2007). Removal of a nuisance coyote, along with educational programs for residents, has been shown to effectively reduce human-wildlife conflicts (Gehrt et al., 2011).

Residents understanding urban ecology can aid wildlife conservation by creating a more well-informed public, which can be important for promoting conservation of native species (Gehrt, 2007; McKinney, 2002; Sillero-Zubiri & Switzer, 2004). Informational materials about living with urban coyotes are often distributed by state and federal wildlife agencies, which the public views as experts on wildlife management (Reiter et al., 1999). These materials typically share facts about coyotes in an attempt to educate the public on how coyotes behave, but it may be more effective to distribute information about which human behaviors are attracting coyotes so the public can learn what they can do to reduce the potential for conflict (Elliot et al., 2016; Gehrt, 2007; Gehrt & Riley, 2010). Additionally, wildlife agencies in the same area sometimes

distribute conflicting messages about the dangers of coyotes and what people should do about them (Gompper, 2002). While management agencies are important resources, collaboration between multiple organizations, such as gardening and landscaping suppliers, veterinarians, and pet stores, to promote educational materials about coyotes can increase the effectiveness of these messages (Elliot et al., 2016). Educational programs cannot be effective without conducting evaluations to ensure the programs are achieving the desired results (Curtis & Hadidian, 2010). An organization may run an educational program on reducing food attractants, but the program alone does not mean people will change their behavior in response (Curtis & Hadidian, 2010; Dietsch et al., 2018).

Media portrayals of wildlife have varying effects on people's perceptions, but these effects have not been studied in-depth. Siemer et al. (2009) found that exposure to print media about black bears had less of an impact on consumer perceptions of black bears than their personal experiences and basic beliefs. However, this study also found an association between high rates of television viewing and concerns for safety in areas where black bears were present. The researchers called for further research on this topic but noted this effect could have been attributed to inaccurate information being portrayed on television or to inherent differences in risk perceptions of heavy television viewers in comparison with light television viewers. Another study found people are skeptical about environment-related information in televised news and are more trustworthy of written news and interviews with experts (Monroe & Nelson, 2010). In today's social media environment, the abundance of pictures of coyotes in urban areas has begun to normalize their urbanization to an extent (Lloro & Hunold, 2020).

Because media coverage of wildlife can be inconsistent or inaccurate, it is important for wildlife managers to effectively communicate information to the public. In some cases, information intended to educate consumers can have a negative effect, causing a person who did not know much about a species' presence in an area to have increased risk perceptions (Dietsch et

al., 2018). Communication from wildlife managers to the public has often focused on the management actions being taken rather than the end goal(s) of those actions (Gore et al., 2009). Response to such messaging is inconsistent, as people will respond differently based on their priorities, how much they care about the topic, or how the management action might impact them negatively (Dietsch et al., 2018). Managers need to be aware of how both the format and content of communication materials can impact an individual's response to the messaging (Gore et al., 2009). Fear affects people's perceptions of coyotes (Elliot et al., 2016), but fear messaging alone is not always effective at creating attitude or behavior changes (Abrams et al., 2020). For example, using persuasive messaging that highlights personal benefits of not feeding wildlife or giving wildlife adequate space is effective at changing these behaviors (Abrams et al., 2020; Dietsch et al., 2018; Gore et al., 2009). Information about human-wildlife interactions and conflicts needs to be made widely available and kept up to date to improve communication and build trust between wildlife managers and the public (Madden, 2004).

Many researchers agree the best management action for maintaining urban wildlife populations is to reduce habitat fragmentation and preserve as much natural wildland as possible (McKinney, 2002; Sillero-Zubiri & Switzer, 2004; Soulé, 2007), although this does increase the potential for human-wildlife interactions and conflicts (Madden, 2004). Compensation programs to assist landowners with the costs of preventing or recovering from damage caused by urban wildlife can also be helpful (Sillero-Zubiri & Switzer, 2004). Aversive conditioning (i.e., making human-associated food taste bad) can provide short-term help with specific problem animals, but this strategy does not have long-term effectiveness (Curtis & Hadidian, 2010). For livestock producers, keeping vulnerable mothers and their offspring in secure buildings and properly disposing of livestock carcasses can help reduce the potential for conflict with carnivores (Curtis & Hadidian, 2010). Overall, a combination of management, communication, and policy work in

coordination with local communities are needed to promote sustainable coexistence between people and urban wildlife (Madden, 2004; Sillero-Zubiri & Switzer, 2004).

Understanding what urban residents think and feel regarding urban wildlife is essential for wildlife management to be effective (Bright & Burtz, 2006; Bright et al., 2007; Sillero-Zubiri & Switzer, 2004; Wieczorek Hudenko et al., 2008; Wieczorek Hudenko et al., 2010; Yee et al., 2021). Not considering public interest when making management decisions can lead to political and social backlash for wildlife managers (Reiter et al., 1999), and gaining the public's acceptance prior to making a management decision is better than responding to negative public reactions after the fact (Curtis & Hadidian, 2010). The public may be accepting of the overall management objectives but may disagree with certain management actions involved in meeting those objectives, such as those that are costly or could cause pain and suffering to the animals (Bright et al., 2007; Curtis & Hadidian, 2010). Wildlife managers gather information on human-wildlife conflicts through voluntary reporting, but not much is known about when and why people choose to report this information (Wilbur et al., 2018). When managers solicit information from residents, they are more likely to hear from residents who are satisfied with current management practices (Wilbur et al., 2018). In contrast, unsolicited information is more likely to come from dissatisfied residents looking for a change in management strategies (Wilbur et al., 2018). Wildlife managers who are aware of resident perceptions of wildlife are able to target messages to specific groups of the population that will be most receptive to them (Bright & Burtz, 2006; Bright et al., 2007; Monroe & Nelson, 2010). The long-term success of urban wildlife management programs lies in managing the behaviors of both wildlife and people, including people's perceptions of wildlife and conflicts with wildlife (Curtis & Hadidian, 2010).

People hold different opinions of the values of wildlife, but "people with different value systems can have a mutual understanding of the importance and urgency of working to conserve nature" (Yee et al., 2021, p. 371). Q methodology offers the opportunity to diversify the research

within agricultural communications (Leggette & Redwine, 2016) and human dimensions of wildlife (Johnson & Sciascia, 2013) and explore these opinions in depth. Rust (2017) conducted a mixed methods study utilizing both the Delphi and Q techniques to look at people's perceptions of carnivore management actions. The Delphi study showed participants agreed the first steps to reducing human-carnivore conflicts were to train people to reduce conflicts with carnivores and educate the public about carnivore conservation. Within this agreement, the subsequent Q methodology study highlighted two distinct groups – one which preferred the use of non-lethal methods to reduce conflict and one which was fine with using lethal methods (Rust, 2017). Within the realm of conservation, Q methodology has been used to study people's perceptions of wildfires (Ray, 2011), natural resource management (Schall et al., 2018; Steelman & Maguire, 1999), science communication (Bond, 2016; Jakopak et al., 2021), anthropogenic effects on the environment (Newth et al., 2019; Szerenyi et al., 2011), human-wildlife coexistence (Read et al., 2019), and human-carnivore conflicts (Bavin et al., 2020; Bredin et al., 2015; Rust, 2017).

CHAPTER III

METHODOLOGY

The purpose of this study was to explore how residents view the presence of coyotes in Oklahoma. This chapter explains why Q methodology is an appropriate method for studying this topic as well as details of the instrument development, plans for recruitment of participants, and data collection.

Rationale for Q Methodology

Q methodology, introduced by William Stephenson in 1935, provides a way to measure people's subjective perceptions of the world around them (Brown, 1993; McKeown & Thomas, 2013; Watts & Stenner, 2012). Through Q methodology, participants sort a set of opinion statements according to a specified condition of instruction. These sorts are then correlated to each other and factor analyzed to identify diverse perspectives toward a topic (McKeown & Thomas, 2013). A Q study typically has a relatively small number of participants because, in contrast to other social science methodologies, the participants are not the population of the study; rather the statements being sorted are a sample of a concourse of opinions people hold about the topic (Brown, 1980). The results of a Q study are not generalizable back to the population of the participant group because the participants are merely the instrument sorting the sample of statements. However, generalizations can be made about concourse of opinions (Thomas & Baas, 1992) and used as a basis for further inquiry or to add to the existing research

base on a topic (Leggette & Redwine, 2016). In addition, a Q study does not incorporate validity and reliability in the same ways as other methodologies (Watts & Stenner, 2012). Because Q is the study of people's subjective thoughts and beliefs, those thoughts and beliefs cannot be validated for accuracy by someone else (Brown, 1980). Similarly, the reliability of the Q sorts cannot be measured because repeated sorting by the same person indicates the reliability of the person doing the sorting rather than the reliability of the statements being sorted (Watts & Stenner, 2012).

Instrument Development

A Q study begins with the development of the concourse, which is defined as “the flow of communicability surrounding any topic” (Brown, 1993, p. 94). In essence, the concourse consists of all the thoughts and opinions that might arise regarding the topic at hand. These statements can be found from a variety of places: existing literature on the topic, comments made in discussions with peers, social media and other online forums, or structured interviews (McKeown & Thomas, 2013). The goal in developing the concourse is to collect as many statements as possible which represent the breadth of opinions about the topic. The concourse is then reduced to a more manageable number of statements, typically 40-60, while still representing the diversity of opinions (Brown, 1980). One way to do this is by using an existing theoretical or conceptual framework to separate the concourse into groups and then selecting the most dissimilar items within each group to create a final set of statements (McKeown & Thomas, 2013; Watts & Stenner, 2012). The goal of this reduced sample, or Q set, is to “cover all the ground smoothly and effectively without overlap, unnecessary repetition or redundancy” (Watts & Stenner, 2012, p. 59).

The concourse for this study was developed using statements found in the existing body of literature, news articles about coyotes, posts and comments on social media, and comments

that came up in daily conversation. The concourse consisted of 117 statements. In order to sample for the Q set, the concourse was reduced using a conceptual framework adapted from a study by Hunold and Lloro (2019) that examined Facebook posts and comments about coyotes in two cities with relatively new urban coyote populations. This study identified six themes of public opinions regarding the presence of coyotes in urban spaces: (a) coyote sightings and identification, (b) coyotes and human safety, (c) coyotes and pet safety, (d) coyote welfare, (e) legitimacy of coyotes' presence in the neighborhood, and (f) coyotes and renegotiating the urban/wild divide (Hunold & Lloro, 2019). For the present study, the concourse of 117 statements was separated based on these themes and the statements that were the most dissimilar within each conceptual category were then selected, leading to the final 38 statement Q set.

Examples of statements in the sightings and identification category include, "The number of coyotes in Oklahoma is getting out of control," which stemmed from a personal contact. Another statement, "Coyotes deserve respect as intelligent animals," stemmed from a news article.

Statements regarding human safety include, "The presence of coyotes limits the number of outdoor activities I am able to participate in," which stemmed from a news article. Another statement, "I am especially worried about the coyotes that are not afraid of people" stemmed from a personal contact.

Statements regarding pet safety include, "It must be completely safe to leave pets unattended outside where coyotes are present, as long as they are in a fenced yard," which stemmed from a peer-reviewed research article. Another statement, "In Oklahoma, I only worry about coyotes attacking small, domesticated animals," stemmed from a personal contact.

Coyote welfare statements include, "People who hunt coyotes in Oklahoma are more of a nuisance than the actual coyotes," which stemmed from a peer-reviewed research article. Another

statement, “Relocating coyotes away from heavily populated areas is a better solution than trying to kill every coyote around people,” stemmed from a personal contact.

Statements about the legitimacy of coyotes’ presence include, “I would feel more comfortable with coyotes around if I knew exactly where they are and how they act,” which stemmed from a peer-reviewed research article. Another statement, “This land belonged to wildlife first, so it is their right to make a home in it,” stemmed from a peer-reviewed research article.

Examples of statements in the urban/wild divide category include, “I’m a fan of coyotes, but not a fan of them on my land,” which stemmed from a personal contact. Another statement, “Oklahoma never had a coyote problem when there were more fields than housing additions,” stemmed from a news article.

After the Q set was developed, a record sheet was created for participants to sort the 38 statements according to those most like and most unlike their opinions. The record sheet contained an 11-column, forced-choice grid with the condition of instruction, “What do you think about coyotes in human spaces?” written at the top (Appendix A).

Participants

The statements and procedures for this study were approved by the Oklahoma State University Institutional Review Board on December 3, 2021 (Appendix B). In contrast with the more widely known R methodology, Q methodology requires only a small number of participants since the Q set is considered the sample and the participants are the variables (Brown, 1980). Watts and Stenner (2012) recommend the minimum number of participants to be at least half of the number of statements in the Q set. However, the participant group, or P set, is still chosen using a specified set of criteria to select people who are relevant to the topic being studied (Brown, 1980). The P set for this study consisted of adult residents of Oklahoma. This P set was

broadly defined to be able to include both short- and long-term residents in different types of communities (city, suburb, town, and rural). For this study, participants were recruited using convenience and snowball sampling. Most participants were recruited from face-to-face conversation or via email. Additionally, participants who indicated other Oklahoma residents who might be interested in participating were asked to share an approved recruitment flyer.

Data Collection

Once an individual expressed interest in participating in the study, a meeting was scheduled for them to complete the Q sort, either in-person or over Zoom. Each participant received a packet of materials which included a participant information form; a bag containing 38 square slips of paper, with each statement of the Q set numbered and printed on them; and a record sheet and demographic questionnaire.

Before beginning the sort, each participant was given time to read the participant information form, which included information about IRB approval, study procedures, and confidentiality. Following procedures detailed in Watts and Stenner (2012) and McKeown and Thomas (2013), participants were asked to read the condition of instruction at the top of the record sheet, “What are your thoughts about coyotes in human spaces?” Participants then sorted the set of 38 cards into three piles – one containing the statements ‘most like’ their response to the question; one containing the statements ‘most unlike’ their response; and a third pile containing the statements they did not have strong feelings about. Participants sorted each statement based on how they interpreted the meaning of that statement. Participants were encouraged to comment aloud with any thoughts or questions they had regarding the statements throughout the sorting process. The researcher took field notes and answered questions as needed while participants completed the sort.

Beginning with the “most like” pile, participants chose the two statements that were most like their opinions and placed them in column 5 of the record sheet. They then chose the two statements from their “most unlike” pile which were most unlike their opinions and placed them in column -5 of the record sheet. Participants then returned to their “most like” pile and selected the next three statements that were most like their opinions and placed them in column 4. Each participant continued this back-and-forth process until all 38 statements had been placed on the record sheet. Once all the statements were placed, participants were allowed time to rearrange the cards until the arrangement best represented their opinions. After finishing the sort, participants recorded the number of each statement in the corresponding boxes on the record sheet.

After completing the sort, participants were asked to complete the optional demographics questionnaire and add any additional comments (Appendix C). The questionnaire included typical demographic questions such as age, gender, ethnicity, and economic status. Also included were questions regarding how long the person had lived in Oklahoma, what type of community they lived in, what types of animals they owned, where they received information about coyotes, and their experiences with coyotes. The questionnaire included a place to leave a name and phone number if they were willing to participate in a follow-up interview. Participants who completed the sorts virtually were asked to take photos or scan the documents to send back to the researcher electronically.

Data Analysis in Q Methodology

Data from Q studies are analyzed using specific software packages designed for the type of factor analysis utilized in Q. For this study, data was analyzed using the qmethod package (Zabala, 2014) in R (R Core Team, 2021). Watts and Stenner (2012) outline the steps of analyzing Q data. The first step involves correlating all Q sorts to each other followed by factor analysis and rotation to determine how many factors to extract, or the number that describes the

most variance in the data. Next, the correlation between each sort and the extracted factors is calculated to determine which sorts are significantly correlated to each factor. The significance level used is calculated using the formula $2.58 * 1 \div \sqrt{n}$, where n is the number of statements in the Q set (Brown, 1980). The sorts that are significantly correlated to only one factor are considered defining sorts for that factor, and those defining sorts are used to create factor arrays for each factor. A factor array is a composite Q sort representative of the factor as a whole and is created using weighted averages of where the defining sorts on a factor placed each statement in their individual sorts (Watts & Stenner, 2012). These factor arrays, along with demographic data and comments from participants during the sorts and in post-sort interviews, are interpreted by the researcher to uncover and explain the perspective captured by each factor (Watts & Stenner, 2012).

CHAPTER IV

FINDINGS

The purpose of this study was to explore how residents view the presence of coyotes in Oklahoma. This chapter presents the description of the people who participated in the study, details the statistical analysis, and interprets the findings of the data analysis to describe the perceptions Oklahoma residents hold about coyotes.

Participants

Thirty-one Oklahoma residents participated in this study. Twenty-four participants have lived in Oklahoma for more than 11 years; two have lived in Oklahoma for 6-10 years; two have lived in Oklahoma for 1-5 years; and two have lived in Oklahoma for less than one year. The age of the sorters ranged from 20 to 73 and included 17 men and 14 women. Nine participants indicated they lived in a city; nine lived in a suburb; 11 lived in a town; and one lived in a rural community. Definitions of these community types were not provided; rather, the participants selected the option which they felt best represented where they lived. The majority of participants had owned at least one animal in the past three years, with the most common being dogs, both large and small. Three participants owned zero animals in the past three years. When asked how often they had seen coyotes in Oklahoma in the past three years, 12 participants indicated they had seen coyotes more than a few times/regularly; eight had seen them a few times; ten had seen

coyotes once or twice; and one participant had not seen a coyote in Oklahoma. The most common way participants received information about coyotes was through personal experience and talking with other people. Some participants also received information about coyotes from news reports. Four participants added they receive information from wildlife officers, official training and field guides, or other expert sources. Nine participants reported they do not receive any information about coyotes.

Data Analysis

Data analysis was conducted using the qmethod package (Zabala, 2014) in R (R Core Team, 2021). The Q sorts were analyzed using principal components analysis and varimax rotation at a significance level of 0.42, which produced two factors defined by 20 sorters. The correlations between each Q sort and the factors are the factor loading scores, which are listed in Table 1. While each sort loads on all factors, only sorts that load at or above the .42 significance level on only one factor are considered defining sorts for that factor. Thirteen sorts loaded significantly and defined Factor A and seven sorts loaded significantly and defined Factor B. Ten sorts were confounded, meaning they loaded significantly on both factors. One sort did not load significantly on either factor.

Table 1*Factor Matrix*

Q Sort	Gender	Age	Lives in:	Has seen/heard coyotes:	Factor A	Factor B
1	Male	56	Town	Regularly	0.85	0.12
5	Male	51	Suburb	A few times	0.58	0.40
8	Male	53	City	A few times	0.71	0.11
11	Male	30	City	Once or twice	0.76	0.36
13*	Male	38	City	Regularly	0.87	0.12
15*	Male	67	Suburb	Regularly	0.87	0.23
17	Male	32	Town	A few times	0.82	0.32
21	Male	57	Suburb	Regularly	0.70	0.17
22	Male	54	Town	Regularly	0.80	0.09
24	Female	23	City	Regularly	0.58	0.27
26	Female	20	Town	Once or twice	0.68	0.26
27*	Male	30	Town	A few times	0.87	0.01
29	Male	25	Suburb	Regularly	0.82	0.23
2	Female	52	Suburb	Once or twice	0.18	0.74
6*	Male	35	City	Once or twice	0.16	0.70
7	Female	63	City	Once or twice	0.21	0.57
12	Female	73	Town	Regularly	0.24	0.63
16	Female	59	Town	Never	0.06	0.71
20	Male	57	Suburb	Once or twice	0.17	0.62
31*	Female	21	City	Once or twice	-0.08	0.70
4	Female	42	Suburb	Regularly	0.45	0.61
9	Female	55	Suburb	A few times	0.53	0.52
10	Female	44	Town	Regularly	0.45	0.45
14	Female	24	City	A few times	0.48	0.42
18	Male	36	Town	Once or twice	0.63	0.50
19	Female	38	Town	A few times	0.72	0.48
23	Female	37	Rural	Regularly	0.60	0.45
25	Female	22	Rural	Once or twice	0.64	0.42
28	Male	24	Town	Once or twice	0.42	0.61
30	Male	22	Suburb	Regularly	0.55	0.49
3	Male	51	Suburb	A few times	0.34	0.22

Note. Defining sorts are listed in bold for each factor.

* Participated in a post-sort interview.

Factor scores for each statement in the Q set were calculated in Program R to develop composite factor arrays for each factor. Those arrays, along with field notes and post-sort interviews, were used to interpret the two factors.

Interpretation of Factors

This study identified two perspectives defined by 20 sorts. The first perspective was defined by 13 sorters and the second perspective was defined by seven sorters. Post-sort interviews were conducted with five participants to elaborate on the concepts identified in data analysis and the subsequent factor arrays. Overall factor interpretation was completed using the factor arrays, post-sort interviews, field notes taken during sorts, and comments written on demographics sheets. The two perspectives identified are the Content Advocate and the Cautious Urbanite.

Factor Array A: The Content Advocate

The Content Advocate is defined by 13 sorts, 11 male and two female. The sorters' ages ranged from 20 to 67. Four sorters lived in a city, four lived in a suburb, and five lived in a town. Ten sorters have lived in Oklahoma for more than 11 years. All sorters have owned at least one pet or other domesticated animal in the past three years. Seven sorters indicated they had seen coyotes in Oklahoma more than a few times/regularly in the past three years; four had seen coyotes a few times in the past three years, and two had seen coyotes once or twice. All sorters noted they do receive information about coyotes in their area, primarily through personal experiences and talking with others.

The Content Advocate can be understood by four areas of similar statements: appreciation, coexistence, comfortable, and limited danger. The “most like” and “most unlike” statements for the Content Advocate, the statements placed in the far right and left columns, are listed in Table 2.

Table 2*Most like and most unlike statements for the Content Advocate*

No.	Statement	Array Position
Most Like Statements		
2	Coyotes are a valuable part of the environment in Oklahoma.	+5
18	Living near open space means I have to accept wild animals also being in that space.	+5
22	This land belonged to wildlife first, so it is their right to make a home in it.	+4
26	Coyotes deserve respect as intelligent animals.	+4
32	Coyotes have a right to live in their natural space.	+4
Most Unlike Statements		
24	The coyote problem in Oklahoma is caused by coyotes invading residential areas, not cities expanding into natural areas.	-4
15	Letting children play on school or public playgrounds in Oklahoma is too dangerous with coyotes around.	-4
34	It is unfair that I have to adjust my lifestyle to accommodate coyotes.	-4
1	The presence of coyotes limits the number of outdoor activities I am able to participate in.	-5
37	There is no such thing as a good coyote.	-5

Note: Distinguishing statements are listed in bold.

Appreciation

The first idea establishing the title for the Content Advocate is a strong appreciation and respect for coyotes. This respect is tied to coyotes' ability to survive great habitat loss and adapt to living in new environments to remain a top predator, as indicated by the placement of statement 7. Sorters in this perspective enjoy spending time outdoors and are welcoming to all parts of nature. In a post-sort interview, sorter 15 (male, 57, suburb) explained his view of nature, "I think they're all a part of the food chain and they're where they need to be." Sorters in this perspective are appreciative of the role coyotes play in reducing populations of nuisance wildlife, but they also agreed that all species of wildlife have value and are an important part of the

environment. They believe coyotes sometimes get a bad reputation, but this can be resolved by communicating the roles coyotes play in the environment and how people can avoid conflict with coyotes. Statements supporting this concept are listed below, with distinguishing statements listed in bold:

No.	Statement	Array Position
2	Coyotes are a valuable part of the environment in Oklahoma.	+5
7	Coyotes are the ultimate American survivor.	+3
9	I'm a fan of coyotes, but not a fan of them on my land.	-2
26	Coyotes deserve respect as intelligent animals.	+4
29	I am grateful that coyotes are taking care of the rodent problem in Oklahoma.	+2
37	There is no such thing as a good coyote.	-5

Coexistence

Rather than finding a solution to keep coyotes out of residential areas, the Content Advocate believes humans and coyotes should coexist in their shared spaces. Sorters in this perspective can see that coyotes have been left with limited habitat due to human expansion. They believe coyotes have just as much right to the land as people and have no issues seeing coyotes in human-associated areas. The Content Advocate understands wildlife lived on this land before humans, and feel coyotes willingly stay away from people if they are given enough space. On his demographics sheet, sorter 17 (male, 32, town) wrote, “There should be a balance between managing populations for human convenience and maintaining a respect for coyotes as part of the larger ecosystem.” While sorters in this perspective emphasize coexisting with coyotes, they also understand there are some places they prefer coyotes avoid. “I have unused land and used land. So, some of the land I don't care if they go on – but they don't go on that land,” said sorter 26 (female, 20, town) while performing the sort. Sorters in this perspective believe they are different from people who do not understand and appreciate the overlap of human habitats and wildlife habitats. Sorter 17 (male, 30, town) wrote on his demographics sheet, “People should stop trying

to ‘fix’ nature.” Statements supporting this concept are listed below, with distinguishing statements listed in bold:

No.	Statement	Array Position
5	People just need to let coyotes survive in what little land they have left.	+3
9	I’m a fan of coyotes, but not a fan of them on my land.	-2
18	Living near open space means I have to accept wild animals also being in that space.	+5
21	I have no issues seeing a coyote in my backyard.	+2
22	This land belonged to wildlife first, so it is their right to make a home in it.	+4
32	Coyotes have a right to live in their natural space.	+4
35	I am shocked if I see a coyote within my town or city limits.	-3
36	Seeing a coyote in the woods near my house is much better than seeing one in my neighborhood.	0

Comfortable

The Content Advocate is comfortable with the current coyote population and are not concerned it will become a problem. Because of this, they do not have strong opinions about the best management methods to reduce coyote populations, shown by the placement of statements 3 and 20 in the middle column of the record sheet. The sorters in this perspective are not particularly afraid of coyotes, even when a coyote does not appear to be afraid of people. They continue to participate in outdoor activities without fear of conflict with coyotes. The Content Advocate believes the natural limits of the environment will prevent the population from growing beyond what the land can support. Sorters in this perspective feel they have no reason to worry about coyotes because they are native to and present throughout Oklahoma yet do not appear to be habituated to humans like coyotes in other states, such as California. However, sorter 22 (male, 54, town) believes there was a coyote problem many years ago, but it has since resolved. Statements supporting this concept are listed below, with distinguishing statements listed in bold:

No.	Statement	Array Position
1	The presence of coyotes limits the number of outdoor activities I am able to participate in.	-5
3	I am unsure of the best way to deal with the Oklahoma coyote problem.	0
4	I am concerned that coyotes will become a major problem in my area.	-3
8	I wish my local officials would provide us with more information about how to keep ourselves safe with coyotes around.	-1
10	I would feel more comfortable with coyotes around if I knew exactly where they are and how they act.	-1
14	The number of coyotes in Oklahoma is getting out of control.	-3
20	Relocating coyotes away from heavily populated areas is a better solution than trying to kill every coyote around people.	0
23	Most Oklahomans perceive the coyote problem to be a lot worse than it actually is.	+2
27	I am especially worried about the coyotes that are not afraid of people.	-1
28	I have a bigger problem with raccoons and skunks than I do with coyotes.	+1

Limited Danger

Since sorters in this perspective believe coyotes will stay away from people most of the time, they are not concerned about coyote attacks. This perspective feels they are well-informed about coyotes and know how to be safe in areas where coyotes are present. The Content Advocate believes that as urban sprawl continues and more coyote habitat is destroyed, there will be an increase in negative interactions between people and coyotes. Sorters in this perspective understand coyotes are wild animals and people need to be cautious around them, but they do not live in fear of the possibility of an attack. When this perspective does consider coyotes to be dangerous, it is typically regarding animal safety. They believe it is safe for children to play outdoors in areas where coyotes are present. The placement of statements 12 and 17 near the middle of the record sheet indicate that while this perspective believes coyotes present more danger to animals than people, they are not very concerned with this danger either. During his sort, sorter 21 (male, 57, suburb) said, “I don’t have a big issue with [seeing a coyote in my backyard], but I’m not super welcoming because I have pets.” Sorter 13 (male, 38, city) said in a

post-sort interview, “There’s always a possibility of a cattle farmer losing cattle to a coyote, a chicken farmer losing chickens to a coyote, a residential person losing a dog or cat to a coyote.”

Statements supporting this concept are listed below:

No.	Statement	Array Position
6	The coyotes in Oklahoma are more aggressive than coyotes in other states.	-2
8	I wish my local officials would provide us with more information about how to keep ourselves safe with coyotes around.	-1
12	It must be completely safe to leave pets unattended where coyotes are present, as long as they are in a fenced yard.	-2
15	Letting children play on school or public playgrounds in Oklahoma is too dangerous with coyotes around.	-4
17	In Oklahoma, I only worry about coyotes attacking small, domesticated animals.	+1
27	I am especially worried about the coyotes that are not afraid of people.	-1

Factor Array B: The Cautious Urbanite

The Cautious Urbanite is defined by seven sorts, two male and five female. The sorters’ ages ranged from 21-73. Four sorters lived in a city, one lived in a suburb, and two lived in a town. Six sorters have lived in Oklahoma for more than 11 years. All sorters have owned at least one pet or other domesticated animal in the past three years. Six sorters indicated they had seen coyotes in Oklahoma once or twice in the past three years; one had seen coyotes more than a few times/regularly; and one had not seen a coyote in Oklahoma. Three sorters noted they do not receive information about coyotes in their area.

The Cautious Urbanite can be understood by four areas of similar statements: uncertainty, solution-focused, tolerance, and concern. The “most like” and “most unlike” statements for the Cautious Urbanite, the statements placed in the far right and left columns, are listed in Table 3.

Table 3*Most like and most unlike statements for the Cautious Urbanite*

No.	Statement	Array Position
Most Like Statements		
3	I am unsure of the best way to deal with the Oklahoma coyote problem.	+5
20	Relocating coyotes away from heavily populated areas is a better solution than trying to kill every coyote around people.	+5
30	The best thing people can do to reduce the coyote problem is get educated on how to deter coyotes from residential areas.	+4
10	I would feel more comfortable with coyotes around if I knew exactly where they are and how they act.	+4
18	Living near open space means I have to accept wild animals also being in that space.	+4
Most Unlike Statements		
15	Letting children play on school or public playgrounds in Oklahoma is too dangerous with coyotes around.	-4
1	The presence of coyotes limits the number of outdoor activities I am able to participate in.	-4
21	I have no issues seeing a coyote in my backyard.	-4
34	It is unfair that I have to adjust my lifestyle to accommodate coyotes.	-5
13	The only people in Oklahoma who complain about coyotes are naïve city dwellers who move to the suburbs.	-5

Note: Distinguishing statements are listed in bold.

Uncertainty

The Cautious Urbanite believes there is a coyote problem but is uncertain of the extent of the problem. They do not think the Oklahoma coyote population is getting too large, but they are not sure how aggressive or dangerous Oklahoma coyotes are compared to coyotes in other states. Participants in this factor do not know much about coyotes in general and receive little to no information about coyotes in their area. However, they do not let the potential coyote problem prevent them from participating in outdoor activities. Statement 13 is a distinguishing statement between the two factor arrays, but no sorters who defined this factor commented on that

statement. The placement of statement 13 in combination with statement 23 indicates sorters in this perspective believe it is not just city dwellers who complain about the coyote problem; rather, they believe most people throughout Oklahoma overexaggerate the coyote problem. Some people in this factor believe coyotes are more of a problem in rural communities “where there is a more tangible effect of coyotes” (sorter 6, male, 35, city) but are not concerned about coyotes in urban areas. On her demographics sheet, sorter 16 (female, 59, town) wrote, “[I’m] not knowledgeable about coyotes. I am guessing the fear is greater than reality warrants.” Statements supporting this concept are listed below, with distinguishing statements listed in bold:

No.	Statement	Array Position
1	The presence of coyotes limits the number of outdoor activities I am able to participate in.	-4
4	I am concerned that coyotes will become a major problem in my area.	-3
6	The coyotes in Oklahoma are more aggressive than coyotes in other states.	-1
13	The only people who complain about coyotes are naïve city dwellers who move to the suburbs.	-5
14	The number of coyotes in Oklahoma is getting out of control.	-3
23	Most Oklahomans perceive the coyote problem to be a lot worse than it actually is.	+2
37	There is no such thing as a good coyote.	-2

Solution-focused

While the Cautious Urbanite feels coyotes are a problem, they do not know the best way to solve that problem. The main priority for this perspective is to figure out what the best solution is. Sorters in this perspective feel strongly that relocating coyotes away from human-associated areas and educating residents are effective management actions to solve the coyote problem. In a post-sort interview, sorter 6 (male, 35, city) said, “I do believe there is a solution. I think we also need more substantial or long-term data and/or data collection to know what to focus on.” The placement of statement 11 and comments regarding it suggests sorters in this perspective do think Oklahoma wildlife managers are handling the coyote problem but are unsure of what exactly is

being done or if it is enough. They are relatively uninformed about coyotes and desire to be given more information about coyote ecology and behavior. Statements supporting this concept are listed below, with distinguishing statements listed in bold:

No.	Statement	Array Position
3	I am unsure of the best way to deal with the Oklahoma coyote problem.	+5
8	I wish my local officials would provide us with more information about how to keep ourselves safe with coyotes around.	+2
10	I would feel more comfortable with coyotes around if I knew exactly where they are and how they act.	+4
11	The State of Oklahoma is not doing enough to handle the growing coyote problem.	-1
20	Relocating coyotes away from heavily populated areas is a better solution than trying to kill every coyote around people.	+5
30	The best thing people can do to reduce the coyote problem is get educated on how to deter coyotes from residential areas.	+4

Tolerance

Whereas the Content Advocate was pleased to actively coexist with coyotes, the Cautious Urbanite exhibits more of a passive tolerance. The Cautious Urbanite understands wild animals are part of nature and have a right to certain parts of the land, but they feel there should be a clear line separating human habitat and wildlife habitat. They accept coyotes being in natural or forested areas near human habitat but have issues with coyotes crossing that line into their yards or other human-owned spaces. In a post-sort interview, sorter 6 (male, 31, city) said he believed there is a clear boundary between human and wildlife habitat but this may vary according to urban and rural concerns, meaning the boundaries are a little more blurred in rural areas. This perspective believes coyotes would not exist if they were not important to the environment and assume coyotes will leave people alone as long as people leave them alone. Sorter 12 (female, 73, town) wrote on her demographics sheet, “I have a love/hate and respect/disgust for coyotes. [I]

grew up in coyote country where they preyed on baby calves. Became a huge problem.”

Statements supporting this concept are listed below, with distinguishing statements listed in bold:

No.	Statement	Array Position
9	I'm a fan of coyotes, but not a fan of them on my land.	+2
18	Living near open space means I have to accept wild animals also being in that space.	+4
21	I have no issues seeing a coyote in my backyard.	-4
25	Seeing the occasional coyote in my yard is a small price to pay for all the nature I see every day.	0
26	Coyotes deserve respect as intelligent animals.	0
32	Coyotes have a right to live in their natural space.	+1
36	Seeing a coyote in the woods is much better than seeing one in my neighborhood.	+3

Concern

The final concept representing the Cautious Urbanite is a concern for the safety of pets in the presence of coyotes. This perspective believes the main threat posed by coyotes is toward pets or other domesticated animals, but they are not very concerned about threats to human safety. In a post-sort interview, sorter 6 (male, 35, city) said, “The only reason I feel that way is because I am a pet owner and it would be a concern...From what I've seen and experienced, the biggest risks and the biggest concerns would be animals and livestock.” Sorter 31 (female, 21, city) commented about her previous neighbor who often fed coyotes from their backyard and believed this was a positive reinforcement for the coyotes to come back to their neighborhood. This sorter also had a dog who was presumably eaten by a coyote in that same neighborhood. The Cautious Urbanite does not worry much about the safety of people, including children, in areas where coyotes are present because they have not experienced coyotes causing harm to humans. They do feel some concern for the safety of people when coyotes are approaching or not acting afraid of people because it makes them think the coyote might have rabies or another disease. Statements supporting this concept are listed below:

No.	Statement	Array Position
12	It must be completely safe to leave pets unattended outside where coyotes are present, as long as they are in a fenced yard.	+1
15	Letting children play on school or public playgrounds in Oklahoma is too dangerous with coyotes around.	-4
17	In Oklahoma, I only worry about coyotes attacking small, domesticated animals.	+3
27	I am especially worried about the coyotes that are not afraid of people.	0

Consensus Statements

The composite factor arrays contained 11 consensus statements, or statements for which the two perspectives had similar placements. While factors may sort statements in a similar way, it does not always mean they do so for the same reasons (Brown, 1980). The consensus statements and their array positions for each perspective are listed in Table 4.

Table 4*Selected Consensus Statements*

No.	Statement	Array Position	
		Content Advocate	Cautious Urbanite
1	The presence of coyotes limits the number of outdoor activities I am able to participate in.	-5	-4
4	I am concerned that coyotes will become a major problem in my area.	-3	-3
6	The coyotes in Oklahoma are more aggressive than coyotes in other states.	-2	-1
11	The State of Oklahoma is not doing enough to handle the growing coyote problem.	-2	-1
14	The number of coyotes in Oklahoma is getting out of control.	-3	-3
15	Letting children play on school or public playgrounds in Oklahoma is too dangerous with coyotes around.	-4	-4
18	Living near open space means I have to accept wild animals also being in that space.	+5	+4
19	Coyotes in Oklahoma are more afraid of people because they are hunted year-round.	0	-1
23	Most Oklahomans perceive the coyote problem to be a lot worse than it actually is.	+2	+2
29	I am grateful that coyotes are taking care of the rodent problem in Oklahoma.	+2	+1
38	I feel bad for coyotes being forced to come into residential communities to find food.	+1	+1

The placement of statement 18 indicates both the Content Advocate and the Cautious Urbanite understand wild animals are part of nature and will be present in those areas even if humans are around. The Content Advocate enjoys spending time outdoors and seeing wildlife wherever they are. Sorter 13 (male, 38, city) said in a post-sort interview, “My thought is that, with all animals, it’s truly their space first.” They believe that since coyotes have been in Oklahoma for a long time, they will continue to be an important part of the ecosystem and do not want that ecosystem to change. The Cautious Urbanite also appreciates the natural environment

but prefers a little more separation between human habitat and wildlife habitat. During his sort, sorter 16 (male, 35, city) said, “All animals are important to the environment, or they wouldn’t be here.” However, many sorters in this perspective agreed they prefer coyotes to not be in human-associated areas.

Both perspectives do not seem very concerned with the Oklahoma coyote population becoming a major issue, based on the placement of statements 4 and 14. The Content Advocate knows coyotes are native throughout Oklahoma and has “no problem with them continuing to grow” (sorter 13, male, 38, city). They believe the coyote population cannot grow too large to become problematic because resource availability and other environmental factors will prevent the population from growing beyond what can be sustained. While the Cautious Urbanite does believe the coyote problem needs to be addressed, they are also aware that “it is not the main problem” (sorter 16, male, 35, city). This perspective believes coyotes cause more of a problem in rural areas, and therefore are not concerned about coyotes becoming a major problem in their areas.

Statements 1 and 15 represent a similar consensus between the two perspectives. The Content Advocate does not believe coyotes in Oklahoma are much of a threat to humans and therefore continues to live without fear of being attacked by a coyote. Many sorters in this perspective commented on the danger of coyotes only in relation to pets and livestock. On his demographics sheet, sorter 17 (male, 32, town) wrote, “I know that they can be a predator, but I have had little to no problems with them. The neighbor’s dogs get to my chickens more than a coyote ever has.” This living without fear extends to children because this perspective feels coyotes prefer to avoid humans as much as possible, regardless of size. On the other hand, the Cautious Urbanite also does not feel coyotes are a huge threat to humans, but this is based more on a lack of knowledge about coyotes. Sorter 16 (female, 59, town) said during her sort, “I wish I knew if coyotes were generally shy or aggressive.” This perspective has had less experience with

coyotes than the Content Advocate. Based on their few experiences, the Cautious Urbanite has no reason to believe coyotes are a direct threat to humans, but they are more vigilant in situations where coyotes are present.

Similarly, neither perspective thinks Oklahoma coyotes are different or more dangerous than coyotes in other states (statements 6 and 19). The Content Advocate believes Oklahoma coyotes are less dangerous than the human-habituated coyotes found in California, where the majority of coyote attacks occur. They see coyotes as a regular part of the Oklahoma environment, just as they are part of the environment across the rest of the country. The Cautious Urbanite's lack of knowledge about coyotes extends to all coyotes, not just those in Oklahoma. They see coyotes as a carnivore, all of which can become dangerous in certain situations. In a post-sort interview, sorter 31 (female, 21, city) said, "I kind of group them in with wolves because I don't know what the difference is between them... Wolves and coyotes are dangerous."

CHAPTER V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

The purpose of this study was to explore how residents view the presence of coyotes in Oklahoma. This chapter presents a summary of the findings, conclusions, and implications for research and practice.

Summary of the Findings

This study found two perspectives of Oklahoma residents regarding coyotes in human spaces: the Content Advocate and the Cautious Urbanite. Both perspectives believe coyotes are an important part of the environment. They do not live in fear of coyotes or let coyotes' presence prevent them from participating in outdoor activities because they believe coyotes are not a major threat to people's safety.

The Content Advocate has a deep respect for nature and the environment. This perspective enjoys seeing all wildlife, including coyotes, wherever they are and is happy to coexist with coyotes in residential and urbanized areas. Coexistence occurs "when the interests of humans and wildlife are both satisfied, or when a compromise is negotiated to allow the existence of both humans and wildlife" (Frank, 2016, p. 739). They consider themselves well-informed about coyotes and have few concerns about coyotes causing damage to people, their pets, or their property.

The Cautious Urbanite is more hesitant when it comes to coyotes. They do not know much about coyotes in general and have had fewer experiences with coyotes than the Content Advocate. They understand that coyotes will be present in natural areas adjacent to residential and urban areas, but they prefer coyotes stay in those natural areas rather than entering human spaces. This reflects a tolerance of, rather than coexistence with, coyotes among people in this perspective. Frank (2016) explains tolerance of wildlife can be expressed “by not acting against a species or by not directly opposing management and conservation programs...Tolerance can also be the result of adjustment – for instance, when local residents would be willing to accept damage caused by wildlife up to a threshold” (p. 740). This perspective desires more information about coyotes and specific management actions being taken to keep coyotes and humans separate.

Conclusions

Participants in this study are aware that as cities continue to expand, there will be an increase in interactions between humans and wildlife (Bateman & Fleming, 2012; Lloro & Hunold, 2020). The findings of this study show that while many Oklahoma residents are comfortable with the presence of coyotes and current management practices, there is another group that feels more concerned. Similar with prior research, participants in this study believe coyotes are more of a threat to pets than to people (Manzolillo et al., 2019). However, previous research also showed people inherently have negative perceptions of coyotes (Gehrt, 2007; Hunold & Lloro, 2019), but that does not seem to be the case with this study. There are distinct differences in the values affecting how people view coyotes (Yee et al., 2021). The Content Advocate values nature and sees coyotes as an important part of that, and the Cautious Urbanite values more awareness of coyotes and boundaries between people and coyotes. The differences in experience with and knowledge of coyotes between the two perspectives found in this study also seems to play a role in their perceptions. Previous research has shown people with less knowledge

and experience with coyotes tend to see coyotes as more problematic than those with more knowledge and experience (Gehrt, 2007; Lloro & Hunold, 2020).

This study also indicates there is a communication gap when it comes to coyotes in Oklahoma. Several participants indicated they do not receive any information about coyotes in their area. Of those who do receive information, most reported receiving that information mainly from personal experiences and talking with others. Only four participants indicated they receive information about coyotes from wildlife officers or other expert sources. This indicates there is a gap in information received by Oklahoma residents from the people influencing and making coyote management decisions.

Implications for Research

This study highlights how knowledge, experience, and other factors affect how Oklahoma residents view coyotes. Similarly, Leong (2009) found people's perceptions of wildlife are impacted by where they believe those species belong in the urban landscape. Currently, there is not much research on how or why these factors impact perceptions. In addition, people with less experience or who have lived in areas with coyotes for shorter amounts of time have more concern for risk than those who have been around coyotes longer (Wieczorek Hudenko et al., 2008). The Cautious Urbanite had considerably less experience with coyotes than the Content Advocate, and their values and perceptions related to coyotes were different because of that. As Oklahoma coyote populations grow and adapt to urban environments, and more human-coyote interactions occur, it would be beneficial to better understand these dynamics between experience, values, and beliefs affect resident perceptions of wildlife.

Previous studies have shown media representation of coyotes and other urban carnivores can have an effect on people's perceptions of and concerns with those species. Television news about coyotes tends to lead to more concern or skepticism among people (Siemer et al., 2009).

Print news stories about coyotes and televised interviews with experts are felt to be more reliable (Monroe & Nelson, 2010). Social media seems to be normalizing the existence of coyotes in urban environments (Lloro & Hunold, 2020). While this study did not investigate perceptions based on specific media messaging, the varied perspectives found could indicate some groups of Oklahoma residents are receiving different messages and/or interpreting them differently. Future research could expand on this study's findings by evaluating local media portrayals of coyotes and their impacts on Oklahoma resident perceptions of coyotes.

Implications for Practice

Wildlife managers need to understand their publics' perceptions of wildlife and associated management actions as well as concerns these publics may have (Bright & Burtz, 2006; Sillero-Zubiri & Switzer, 2004; Wieczorek Hudenko et al., 2010; Yee et al., 2021). While neither perspective had particularly strong feelings about Oklahoma's coyote management actions (statement 11; Appendix D), the Cautious Urbanite desires more information about where coyotes are and how they act (statement 8). The lack of information available on Oklahoma coyotes likely affects these feelings. Wildlife managers and other Oklahoma residents with a lot of knowledge and experience with coyotes may not see coyotes as a problem needing to be addressed, but that does not diminish the residents who have less knowledge of coyotes and do believe they are becoming a problem. Consistent and up-to-date information about wildlife helps the public stay informed and also builds a trusting relationship between the public and wildlife managers (Madden, 2004). It is important for wildlife managers to understand the thoughts and opinions of everyone in the community in order to create the most effective and satisfactory coyote management plan (Wilbur et al., 2018). If some residents have questions or are concerned about coyotes, then it is something that should be addressed by wildlife managers. Urban areas in Oklahoma will continue to expand, and residents will experience more interactions with coyotes

as a result. Oklahoma wildlife managers can use these findings as a basis for evaluating their current communication methods to address this gap.

Understanding public perceptions of coyotes can also benefit city planners and housing developers. The differences in demographics between urban, suburban, and rural areas are well-researched and are known to play a role in social issues and outcomes in those areas (Parker et al., 2018). Management of wildlife is one social issue that is impacted by these demographic factors (Bright et al., 2007; Marcuse, 2009; Nardi et al., 2020). As more residential areas are added to the wildland-urban interface (Hammer et al., 2009; Radeloff, Hammer, & Stewart, 2005), it will be important to understand the demographic makeup and values of residents in these areas when proposing new developments. They need to understand there are varied perceptions about coyotes and other wildlife. Some people might be in favor of a lot of natural space included in their neighborhood, while others might prefer a physical boundary to keep certain species of wildlife out. These are important factors to consider with any new development projects in areas where humans and wildlife are connected.

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APPENDIX B

IRB Approval



Oklahoma State University Institutional Review Board

Date: 12/03/2021
Application Number: IRB-21-502
Proposal Title: Perspectives on the Presence of Coyotes in Oklahoma: A Q Methodology Study

Principal Investigator: Lauren Whitmire
Co-Investigator(s):
Faculty Adviser: Angel Riggs
Project Coordinator:
Research Assistant(s):

Processed as: Exempt
Exempt Category:

Status Recommended by Reviewer(s): Approved

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in 45CFR46.

This study meets criteria in the Revised Common Rule, as well as, one or more of the circumstances for which continuing review is not required. As Principal Investigator of this research, you will be required to submit a status report to the IRB triennially.

The final versions of any recruitment, consent and assent documents bearing the IRB approval stamp are available for download from IRBManager. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be approved by the IRB. Protocol modifications requiring approval may include changes to the title, PI, adviser, other research personnel, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
3. Report any unanticipated and/or adverse events to the IRB Office promptly.
4. Notify the IRB office when your research project is complete or when you are no longer affiliated with Oklahoma State University.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact the IRB Office at 405-744-3377 or irb@okstate.edu.

Sincerely,
Oklahoma State University IRB

APPENDIX C
Demographic Survey

1. How old are you? _____ years
2. What is your gender? _____
3. Please check the item that best describes your ethnicity. Check all that apply.
 African American Asian American
 Hispanic/Latino(a) American Indian
 White Other, please specify: _____
4. Which of the following best describes your economic status?
 Low income Middle-high income
 Low-middle income High income
 Middle income
5. About how many years have you lived in Oklahoma?
 - a. Less than 1 year
 - b. 1-5 years
 - c. 6-10 years
 - d. 11+ years
 - e. I am not sure

6. What type of community best describes where you live?

- a. City
- b. Suburb
- c. Town
- d. Rural

7. What animals(s) have lived in your household in the past 3 years? (Check all that apply)

- | | |
|--|--|
| <input type="checkbox"/> Dog, greater than 40 pounds | <input type="checkbox"/> Bird, rabbit, or other primarily indoor pet |
| <input type="checkbox"/> Dog, less than 40 pounds | <input type="checkbox"/> Livestock or poultry |
| <input type="checkbox"/> Cat, primarily indoor | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> Cat, primarily outdoor | <input type="checkbox"/> I have not had any pets in the past 3 years |

8. Where do you get information about coyotes in your area? (Check all that apply)

- From news reports about coyotes
- By talking with other people (friends, family, neighbors, etc.)
- Through personal experience (hearing or seeing a coyote)
- I do not get any information about coyotes
- Other: _____

9. How many times have you seen a coyote in Oklahoma in the past 3 years?

- a. Once or twice
- b. A few times (3-4)
- c. More than a few times/regularly

10. What experiences have you had with coyotes in your area? Please explain.

11. What else would you like to say about the ideas on the statements you sorted?

APPENDIX D

Q Set with Data

No.	Statement	Array Position	
		Content Advocate	Cautious Urbanite
1	The presence of coyotes limits the number of outdoor activities I am able to participate in.	-5	-4
2	Coyotes are a valuable part of the environment in Oklahoma.	+5	+3
3	I am unsure of the best way to deal with the Oklahoma coyote problem.	0	+5
4	I am concerned that coyotes will become a major problem in my area.	-3	-3
5	People just need to let coyotes survive in what little land they have left.	+3	0
6	The coyotes in Oklahoma are more aggressive than coyotes in other states.	-2	-1
7	Coyotes are the ultimate American survivor.	+3	-2
8	I wish my local officials would provide us with more information about how to keep ourselves safe with coyotes around.	-1	+2
9	I'm a fan of coyotes, but not a fan of them on my land.	-2	+2
10	I would feel more comfortable with coyotes around if I knew exactly where they are and how they act.	-1	+4
11	The State of Oklahoma is not doing enough to handle the growing coyote problem.	-2	-1
12	It must be completely safe to leave pets unattended outside where coyotes are present as long as they are in a fenced yard.	-2	+1
13	The only people in Oklahoma who complain about coyotes are naïve city dwellers who move to the suburbs.	+1	-5
14	The number of coyotes in Oklahoma is getting out of control.	-3	-3
15	Letting children play on school or public playgrounds in Oklahoma is too dangerous with coyotes around.	-4	-4
16	People who hunt coyotes in Oklahoma are more of a nuisance than the actual coyotes.	0	-2
17	In Oklahoma, I only worry about coyotes attacking small, domesticated animals.	+1	+3

18	Living near open space means I have to accept wild animals also being in that space.	+5	+4
19	Coyotes in Oklahoma are more afraid of people because they are hunted year-round.	0	-1
20	Relocating coyotes away from heavily populated areas is a better solution than trying to kill every coyote around people.	0	+5
21	I have no issues seeing a coyote in my backyard.	+2	-4
22	This land belonged to wildlife first, so it is their right to make a home in it.	+4	0
23	Most Oklahomans perceive the coyote problem to be a lot worse than it actually is.	+2	+2
24	The coyote problem in Oklahoma is caused by coyotes invading residential areas, not cities expanding into natural areas.	-4	-2
25	Seeing the occasional coyote in my yard is a small price to pay for all the nature I see every day.	+3	0
26	Coyotes deserve respect as intelligent animals.	+4	0
27	I am especially worried about the coyotes that are not afraid of people.	-1	0
28	I have a bigger problem with raccoons and skunks than I do with coyotes.	+1	-1
29	I am grateful that coyotes are taking care of the rodent problem in Oklahoma.	+2	+1
30	The best thing people can do to reduce the coyote problem is get educated on how to deter coyotes from residential areas.	+2	+4
31	Oklahoma never had a coyote problem when there were more fields than housing additions.	0	-3
32	Coyotes have a right to live in their natural space.	+4	+1
33	I would rather see coyotes than wolves in Oklahoma.	-1	+2
34	It is unfair that I have to adjust my lifestyle to accommodate coyotes.	-4	-5
35	I am shocked if I see a coyote within my town or city limits.	-3	0
36	Seeing a coyote in the woods near my house is much better than seeing one in my neighborhood.	0	+3
37	There is no such thing as a good coyote.	-5	-2
38	I feel bad for coyotes being forced to come into residential communities to find food.	+1	+1

VITA

Lauren Whitmire

Candidate for the Degree of

Master of Science

Thesis: PERSPECTIVES ON THE PRESENCE OF COYOTES IN OKLAHOMA: A Q
METHODODOLOGY STUDY

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