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How Urban Identity, Affect, and Knowledge Predict Perceptions About Coyotes and Their Management

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ABSTRACT Globally, the number of humans and wildlife species sharing urban spaces continues to grow. As these populations grow, so too does the frequency of human–wildlife interactions in urban areas. Carnivores in particular pose urban wildlife conservation challenges owing to the strong emotions they elicit and the potential threats they can present to humans. These challenges can be better addressed with an understanding of the different factors that influence public perceptions of carnivores and their management. We conducted mail surveys in four cities in North Carolina (n =721) to explore how (a) city of residence, (b) affectual connections to coyotes (*Canis latrans*), and (c) biological knowledge predicted perceptions of the danger posed by coyotes, the support for wild coyotes living nearby, and the support for lethal coyote removal methods. Our results provide the first assessment of how public perceptions of carnivores and their management vary between cities of different types. Residents from a tourism-driven city were more supportive of coyotes than residents from an industrial city and less concerned about risk than residents from a commercial city. We found affectual connection to coyotes and city of residence were consistent predictors of coyote perceptions. Respondents' knowledge of coyote biology was not a significant predictor of any perceptions of coyotes despite the relatively high statistical power of the tests. Affectual connection to coyotes had

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the greatest effect on predicting coyote perceptions, suggesting efforts to promote positive emotional connections to wildlife may be a better way to increase acceptance of carnivores in urban areas than focusing on biological knowledge.

Keywords: affect, *Canis latrans*, coyotes, urban identity, wildlife knowledge

As human populations worldwide have urbanized, cities have emerged as major sites of human–wildlife interactions and governance (Grimm, Grove, Pickett, & Redman, 2000; Shochat, Warren, Faeth, McIntyre, & Hope, 2006). Since 2007, the majority of the world's population has resided in urban areas, and by 2020 all net human population growth may occur in cities (Davis, 2003). Concurrently, certain carnivores have proven to be successful colonizers of urban areas, and every terrestrial carnivore family has at least one representative associated with urban areas (Bateman & Fleming, 2012). In urban areas with high human densities, wildlife governance is driven by social issues just as much as it is by ecological realities (Rosenzweig, 2003; Decker, Riley, & Siemer, 2012). Within cities, human and wildlife populations are integral parts of what Lefebvre (2003) called a city's "organic whole." Contemporary cities do not take a single form but instead possess unique identities (Brenner & Schmid, 2015) and landscapes that are defined by a unique balance of intertwined factors, ranging from economics to politics to land use. At an individual level a person's "place-identity," or the sense of self that an individual derives from their surroundings (Lalli, 1992), is influenced by the presence of nature in their city (Clayton, 2003). An individual's place-identity, in turn, establishes the personal and group norms which guide environmental perceptions (Terry, Hogg, & White, 1999).

Understanding the drivers of human perceptions of carnivores in these areas has become an increasingly important research topic (Koval & Mertig, 2004; Zinn, Manfredo, Vaske, & Wittmann, 1998) and is critical for city managers working to promote carnivores as part of urban landscapes. As carnivores elicit strong reactions from humans (Gehrt, Riley, & Cypher, 2010) and are important indicators of biodiversity across lower trophic levels (Sergio, Newton, Marchesi, & Pedrini, 2006), a growing body of literature has begun to explore the socio-psychological drivers of carnivore perceptions in urban areas. Among urban carnivores in North America, coyotes (*Canis latrans*) are perhaps the most well-known and wide-spread, making them an excellent study organism for exploring perceptions of urban wildlife. Their dramatic range expansion throughout the 20th century has brought coyotes into close proximity with the majority of the continent's urban population, and all indicators suggest that coyote populations will persist in urban areas (Gehrt et al., 2010).

Perceptions of and attitudes towards wildlife are known to vary spatially at regional and national levels, though it is unclear what the smallest unit of meaningful spatial variation is for urban populations (Gangaas, Kaltenborn, & Andreassen, 2013; Piédallu et al., 2016). Within the context of urban wildlife, cities are the functional geographic unit and it is of paramount importance to understand how perceptions of wildlife vary between cities. Urban identity is best viewed through the ideology of urban "organicism" (Mehmood, 2010), a holistic outlook in which the overwhelming complexity of a city is framed as an organic whole. Within this school of thought, cities and their natural environment are inexorably connected and grow into a unique "organism" with its own place identity. These place identities take their character from cultural, historic, political, environmental, and social factors and can affect an individual's behaviors, especially when related to location specific issues, such as interactions with wildlife (Belanche, Casaló, & Favián, 2017). Even within a single American state, urban centers vary

in their specific location, population size, major industries, or gross domestic product, producing unique place identities and possibly affecting the perspectives on wildlife held by citizens of each city.

Recent studies of interactions with wildlife often use a cognitive hierarchy model wherein values and value orientations shape attitudes, behavioral intentions, and ultimately behaviors towards wildlife (Vaske & Donnelly, 1999). Affect, positive or negative emotional connections with wildlife, helps bridge the gap between values and attitudes in several ways (Jones, Shaw, Ross, Witt, & Pinner, 2016). First, the most well-known value orientations toward wildlife, mutualism, and domination (Manfredo, Teel, & Dietsch, 2016) are clearly related to affect (Schwartz, 2006). Second, owing to the primacy effect (Zajonc, 1980) people often make decisions using mental shortcuts based on emotions rather than rationally thinking through potential costs and benefits of decisions (Slagle, Bruskotter, & Wilson, 2012). The tendency to rely on affect can become more important in contexts where risks and benefits are less tangible, as in the case of interactions with urban predators that are rare and sometimes hypothetical rather than experienced in person on a regular basis (Bruskotter & Wilson, 2014). Sponarski, Miller, and Vaske (2018) noted this pattern in Chicago where support for lethal coyote management rose with increasing perceptions of affective risk or the concern of potential hazards from coyotes.

Within studies using cognitive hierarchy models to understand human relationships with wildlife, demographic variables and knowledge levels often shape attitudes and behavioral intentions (Vaske, Donnelly, Williams, & Jonker, 2001; Vaske, Jacobs, & Sijtsma, 2011). Of these demographic metrics, gender, age, education, ethnicity, pet ownership, and urban/rural upbringing location have emerged as the characters most related to wildlife values and perceptions. Gender is one of the strongest determinants of wildlife preferences, with females having stronger positive affect for animals and fear of predators whereas males are often willing to exploit wildlife and less likely to possess mutualist value orientations (Gamborg & Jensen, 2016; Kellert & Berry, 1987; Tucker & Bond, 1997). Kellert (1985) determined that young urbanites had a more positive affectual connection to wildlife, and college education consistently correlated with a greater appreciation of animals. High educational achievement, however, may not reflect uniformly high knowledge about nature (Tikka, Kuitunen, & Tynys, 2000). For instance, highly educated urbanites may be relatively unfamiliar with wildlife species that are familiar to people living in less educated, rural communities (Ambarli, 2016). Thus, accounting for species-specific knowledge may be important to avoid attributing spurious effects to education level or urban identity and to determine whether emotion or objective knowledge drives wildlife perceptions.

We build upon previous research on perceptions of wildlife with a study in North Carolina, evaluating how urban identity, affect, and coyote knowledge predict three major components of coyote perception: support for wild coyotes as part of the natural landscape; perception of risk caused by coyotes in urban areas; and support for lethal management techniques. Coyotes occupy all 100 counties in North Carolina and have colonized cities with diverse sizes, geographic regions, and city identities. The presence of a common carnivore species throughout a range of city types makes North Carolina an ideal location for exploring the differences in carnivore perceptions both within and among cities. We tested nine novel hypotheses: coyote perceptions vary among cities, with urban centers that have major industries connected to nature showing (1) more support for coyote presence, (2) lower coyote risk perception, and (3) less support for lethal coyote management than other cities; positive affectual connection to coyotes is (4) positively related to support for coyote presence and (5) negatively related to

coyote risk perception and (6) support for lethal coyote management; higher biological knowledge of coyotes is (7) positively related to support for coyote presence and (8) negatively related to coyote risk perception and (9) support for lethal management.

Methods

This study was approved by the Human Subjects Internal Review Board of North Carolina State University (protocol #5798).

Study Site

We conducted our survey in four metropolitan areas in North Carolina's three main geographic regions (Mountains, Piedmont, and Coastal Plain): Asheville, Charlotte, the Triangle, and Greenville (Figure 1). Asheville's (pop. 88,512) identity reflects a tourism-driven economy focused on nature and a sense of small community despite being a true urban center (US Census Bureau, 2014). Located in North Carolina's Mountains region, Asheville's proximity to Great Smoky Mountains National Park, Pisgah National Forest, and numerous historic sites have made tourism Asheville's defining industry, reflected in the city's Location Quotients (LQs) of 1.31 in the accommodations and food services sector and 1.14 in the art, entertainment, and recreation sector (Strom & Kerstein, 2015; US Bureau of Labor Statistics, 2016). For the purposes of this paper, LQs are given as the percentage of total jobs within a focal city that a given industry represents divided by the percentage of total jobs within North Carolina that the same industry represents (Isserman, 1977). Of Asheville's adults 52.6% were college educated (Associate's degree or higher) and the city had a mean household income (MHI) of $44,077 with a 15.1% poverty rate (US Census Bureau, 2014). The city branded itself the "Land of the Sky" and its marketing focused on exploring the Blue Ridge Parkway, fall colors, and craft beer brewing.

Within the Piedmont region, Charlotte is the largest city in North Carolina (pop. 827,097) and has built its identity on being a cosmopolitan and globally relevant commercial center. In the mid-1990's, Charlotte changed dramatically from a culturally homogenous city to a multicultural "Global City" (Lassiter, 2010), attracting a high level of international immigration and becoming one of the nation's fastest growing cities (Furuseth, Smith, & McDaniel, 2015). Charlotte is home to numerous large companies and is a major banking center in the US (Finance and insurance LQ: 1.55, Management of companies [county level] LQ: 2.16) (US

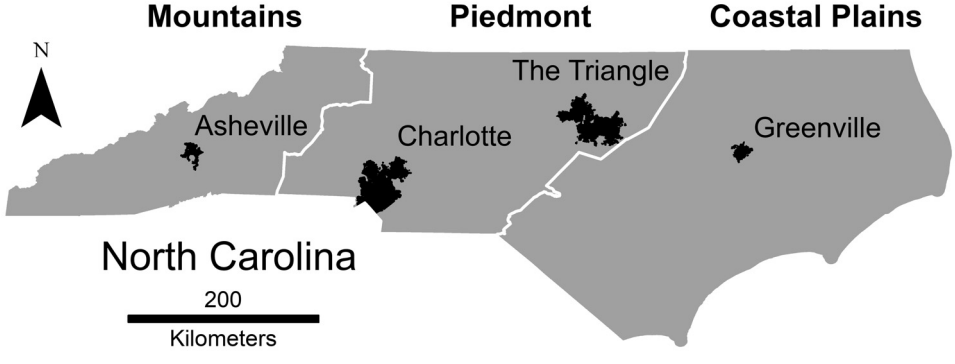

Figure 1. Map of North Carolina illustrating the four study cities (black polygons) and the state's three main geographic regions (white outlines) in 2015.

Bureau of Labor Statistics, 2016). Charlotte has a MHI of $53,274, a 12.7% poverty rate, and an adult population that is 47.8% college educated.

Also in the Piedmont, the Triangle is comprised of the proximate cities of Raleigh, Durham, and Chapel Hill (Raleigh: pop. 451,066, MHI = $54,581; Durham: pop. 257,636, MHI = $49,585; Chapel Hill: pop. 59,568, MHI = $62,620). The Triangle's identity is built upon a diverse and educated community that has been drawn to the city by numerous universities and technology companies (Raleigh: Professional and technical services LQ = 1.78, Educational services LQ = 0.98; Durham-Chapel Hill: Professional and technical services LQ = 1.82, Educational services LQ = 2.76) (US Bureau of Labor Statistics, 2016). The Triangle is home to three major universities (North Carolina State University, Duke University, and University of North Carolina Chapel Hill) and the Research Triangle Park, one of the world's largest research parks. Also, the Triangle has seen a rapid period of growth and grew 30% between 2000 and 2010 (Metzger, McHale, Hess, & Steelman, 2016), making it the second largest metro region in our study. Within the Triangle as a whole, 56.1% of adults hold a college degree and the poverty rate is 11.9%.

Greenville (pop. 90,597, MHI = $35,225), in the Coastal Plains region of North Carolina, is a city identity defined by a history of large-scale industry and the working communities that grew alongside it. Traditionally focused on tobacco processing, Greenville's economy is now based on manufacturing and health care (Health care and social assistance LQ: 1.16, Manufacturing: 0.91) (US Bureau of Labor Statistics, 2016). Greenville's city branding focuses on agritourism, the arts, and recreation on coastal waterways. Of our study sites, Greenville has the highest poverty rate of 16.8% and the lowest percentage of college-educated adults at 47%.

Data Collection

We used self-administered mail surveys to measure residents' perceptions of coyotes in the four study cities. We purchased a sampling frame representative of the four metropolitan areas from Survey Sampling, Inc., of Fairfield, Connecticut, who used a combination of drivers' licenses, property records, and phone registries (landline and cell) to achieve an approximately 76% coverage for the sample frame. Municipal boundaries which adjoined the focal cities were included as part of the metropolitan area from which the samples were drawn. We randomly selected 1,400 residents from each metropolitan area for a total sample of 5,600 residents. Recipients were contacted four times over a five-week period in July and August 2015 via mail, following the tailored design method (Dillman, Smyth, & Christian, 2014). The mailings included a letter of intent, survey packet, reminder postcard, and another survey packet. Survey packets included an information letter, informed consent document, questionnaire, and self-addressed return envelope. We received 856 returned questionnaires: a response rate of 13.6% (after accounting for 89 being undeliverable).

Questionnaire Development

We used expert elicitation with three North Carolina Wildlife Resources Commission biologists to ensure the knowledge scale items were factually correct and relevant, and to evaluate overall question clarity. We pre-tested the instrument in a single mailing to 300 urban residents evenly split among the four study areas. We used the pretest and responses from interviews with biologists to revise the questionnaire for clarity.

We explored three sets of dependent variables, all of which were measured with questions employing a 1–5 response scale. Respondents were asked how much they agreed with four statements to gauge support for wild coyotes at the state, city, neighborhood, and

Table 1. Summary of sociodemographic information for respondents and comparison to census estimates of four cities in North Carolina.

Factor	Respondents	2014 American Community Survey 5-year Estimates	t/χ^2	*df*	*p*
Female	44.7%	52.9%	20.2	1	< 0.001
Mean age (± *SD*)	53.9 (16.0)	46.8	12.2	724	< 0.001
With a college education	76.4%	47.2%	256.3	1	< 0.001
Caucasian	89.9%	62.7%	209.7	1	< 0.001
Pet Owners	65.4%				
Geographic Background (Rural Area, Small Town, Large Town, Small City, Large City)	178, 217, 167, 98, 86				
Respondents by city (Asheville, Charlotte, Triangle, Greenville)	242, 166, 212, 126				
n	746				

Table 2. Average responses to knowledge and affectual connection questions in North Carolina, 2015. The correct knowledge question responses were summed to create the knowledge index. Affectual question responses were summed to create the affect index.

Coyote Knowledge (True/False questions) (Cronbach's α = 0.22)	**Percent Correct**
Coyotes are omnivorous meaning they eat meat and vegetable matter	83.4%
An average coyote weighs 20–30 pounds	70.2%
Coyotes occasionally eat pets	89.6%
Coyotes can be found from Central America to Alaska	93.2%
Coyotes are native to the American Midwest	80.2%
Coyotes pair for life	58.6%
Mean Correct Responses (Knowledge index)	4.7 ± 1.0
Affectual Connection (1 "strongly disagree" to 5 "strongly agree") (Cronbach's α = 0.88)	**Mean ± *SD***
I like coyotes	2.84 ± 1.27
I enjoy watching coyotes	2.80 ± 1.36
The presence of coyotes in NC increases my overall quality of life	2.38 ± 1.26
Sum of affectual question responses (Affect Index)	8.02 ± 3.50

home property levels (1 = Strongly Disagree, 5 = Strongly Agree). Similarly, respondents were asked how concerned they were about five different coyote issues to measure perceptions of risk associated with coyotes (1 = Not Concerned, 5 = Very Concerned). Lastly, respondents' support for lethal methods of coyote removal was measured by asking about the acceptability of shooting coyotes in five different scenarios (1 = Highly Unacceptable, 5 = Highly Acceptable) (Table 3).

Six demographic factors were extrapolated from the questionnaire. We measured respondents' gender (Are you male or female?), age (In what year were you born?), whether the respondent possessed a two-year college degree (What is the highest level of schooling/

Table 3. Mean responses (± *SD*) to three sets of dependent variables in North Carolina, 2015. All responses were given on a 1–5 scale. Responses within each set were summed to create the Support, Concern, and Shoot indices. Question phrasing as it appeared in the survey is given for each variable set.

Question	Mean ± *SD*
Support for Wild Coyotes (Cronbach's α = 0.91) How much do you agree or disagree with the following statements?	
I support having wild coyotes in North Carolina	3.26 ± 1.34
I support having wild coyotes in the [respondent's] metro area	2.51 ± 1.34
I support having wild coyotes within roughly a mile of my property	2.46 ± 1.37
I support having wild coyotes on my property	1.97 ± 1.28
Support Index	10.16 ± 4.72, *n* = 701
Risk Perception (Cronbach's α = 0.91) In the [respondent's] metro area, how concerned are you with the following coyote issues?	
Potential risk to myself in a face-to-face encounter with a coyote	1.75 ± 1.16
Coyotes attacking children	2.22 ± 1.38
Coyotes attacking pets	2.69 ± 1.42
Having coyotes near your home	2.22 ± 1.33
Coyotes causing damage to your property	1.74 ± 1.18
Concern Index	10.59 ± 5.57, *n* = 707
Support for Lethal Coyote Removal (Cronbach's α = 0.93) For the following scenarios, please indicate the acceptability or unacceptability of each management option	
If coyotes are living in [the respondent's city], killing the coyotes would be …	2.35 ± 1.33
If coyotes are living in your neighborhood, killing the coyotes would be …	2.40 ± 1.40
If you are approached or followed by a coyote in [the respondent's city], killing the coyote would be …	2.69 ± 1.52
If a pet is threatened or attacked by coyotes, killing the coyotes would be …	3.09 ± 1.54
Officials shooting coyotes would be …	2.74 ± 1.46
Shoot Index	13.31 ± 6.38, *n* = 671

education that you have completed?), ethnicity (What is your race or ethnicity?), pet ownership (Do you own any cats or dogs?), and the size of the respondent's home town (Which of the following best describes where you spent the most time before the age of 18?: Rural area (pop. < 10,000), small town (10–50,000), large town (50–250,000), small city (250–1,000,000), or large city (> 1,000,000)) (Table 1). Also, multiple questions were used to gauge respondents' knowledge of coyote biology and affectual connection to coyotes. To measure affect, respondents were asked to score their agreement on a 1–5 scale with three statements about their emotional connection to coyotes. Similarly, respondents' knowledge was measured with six true/false questions about coyote biology and life history (Table 2).

Data Analysis

All analyses were conducted using the survey package (Lumley, 2004) in program R 3.1.2 (R Core Team, 2014). We tested for non-response bias by comparing four demographic variables with data from the 2014 American Community Survey 5-year estimates for the combined study sites (US Census Bureau, 2014). Chi-square tests of independence were used to

compare gender, ethnic makeup, and proportion of college-educated individuals, and a one-sample *t*-test was used to compare mean age. Survey respondents differed from census estimates in all variables tested (Table 1). Survey data were weighted by age, gender, and college education for each city to mitigate any latent sampling biases. As we had few responses in the youngest age category, respondents aged < 25 (n = 10) were excluded from the sample to prevent them from biasing variance estimates.

Three sets of ordinary least squares models were constructed to explore the relationship between socio-demographic factors and dependent variables. In creating these models, a binary variable of whether the respondent possessed a college degree (Associate's degree or above) was created from survey responses about education. Responses from the three affect questions (Cronbach's α = 0.881) and the number of correct responses to knowledge questions (Cronbach's α = 0.159) were summed to create indices for affect and knowledge. Cronbach's α (Cronbach, 1951) is a measurement of internal consistency among index components, reflecting the covariance between items. The low alpha score for the knowledge metric was expected, as knowledge is a formative indicator, representing several composite factors, and not a unidimensional scale (Diamantopoulos & Winklhofer, 2001). Responses from the dependent variable sets were similarly summed to create separate indices for support of coyotes (Cronbach's α = 0.91), risk perception (Cronbach's α = 0.91), and support for lethal control (Cronbach's α = 0.93). These indices are hereafter referred to as "Support," "Concern," and "Shoot," respectively. Responses were removed from the dataset when demographic information was incomplete to facilitate model comparisons.

A full linear model was constructed for each of the three dependent variables incorporating the affect and knowledge indices as well as city of residence and the six demographic factors as model components. The Akaike Information Criterion (AIC) of each possible reduced model permutation was then used to identify the best fit model for each dependent variable. The model with the smallest AIC value was selected as the best fit model and any models within 2 ΔAIC were considered as competing models. Standardized coefficients were then calculated for each best fit model. To facilitate the standardization of model components, binary factors were created out of the ethnicity (Caucasian vs. non-Caucasian) and city (Asheville vs. Others) variables.

Results

Respondents (n = 856, 13.6% response rate) were predominately male (55.4%), college educated (76.4%), and pet owners (65.4%). Respondents were 90.6% Caucasian, 6.8% African American, 1.5% Asian, 1.1% Hispanic or Latino and primarily raised in urban areas (32.4% rural area, 3.8% small town, 30.4% large town, 17.8% small city, 15.6% large city). Mean age was 53.9 ± 16.0 years old. By city, 32.4% of our respondents were from Asheville, 22.2% from Charlotte, 28.4% from the Triangle, and 16.9% from Greenville (Table 1). Respondents answered an average of 4.7 ± 1.0 knowledge questions correctly and had a mean affect score of 8.0 ± 3.5 (Table 2). The mean level of Support was 10.16 (SD = 4.72, n = 701). The Concern index had a mean of 10.59 (SD = 5.57, n = 707) and Shoot had a mean of 13.31 (SD = 6.38, n = 671). All three indices had high levels of internal consistency as assessed by Cronbach's alpha coefficient (Support = 0.91, Concern = 0.91, Shoot = 0.93) (Table 3).

We detected support for hypotheses 1 and 2, as city was included within all three best fit models (Table 4) and emerged as a significant predictor within the Support and Concern models (Table 5). Within the Support model, Greenville respondents had 1.048 lower levels of

Table 4. Akaike information criteria (AIC)-based model selection for predicting Support, Concern, and Shoot with demographic, knowledge, and affect variables in North Carolina, 2015. All models with < 2 ΔAIC reported.

Candidate Model	AIC	ΔAIC	Akaike Weight	Evidence Ratio
Support for Wild Coyotes (Support)				
City+Affect+Ethnicity+Knowledge+College	3479.06		0.66	1
City+Affect+Ethnicity+Knowledge+College+Age	3480.42	1.36	0.34	1.97
Risk Perception (Concern)				
City+Affect+Ethnicity+Age+Pet Ownership+ Hometown Size	4586.70		0.63	1
City+Affect+Ethnicity+Age+Pet Ownership+ Hometown Size+Knowledge	4587.78	1.08	0.37	1.72
Support for Lethal Removal (Shoot)				
City+Affect+Ethnicity+Pet Ownership+ Hometown Size+Gender	4144.96		0.55	1
City+Affect+Ethnicity+Pet Ownership+ Hometown Size+Gender+Knowledge	4145.34	0.38	0.45	1.21

support for coyotes than Asheville respondents. In the Concern model, Charlotte respondents differed from Asheville respondents and had 1.653 higher perceptions of risk posed by coyotes. The standardized coefficients of the city factor (given as Asheville vs. all other cities) had similar absolute values in the Support and Concern models at 0.236 and –0.220, respectively. Though the intra-city patterns in responses changed slightly between response variables (Figure 2), Asheville respondents generally displayed higher Support and lower Concern and Shoot than respondents from other localities.

In support of hypotheses 4–6, affect emerged as a significant predictor in the best Support, Concern, and Shoot models. As predicted, increasing affect was related to higher levels of Support and lower levels of Concern and Shoot. Moreover, affect was consistently the model component that explained the most variation within each best fit model, as reflected by its large standardized coefficients (Table 5). Within the Support model, affect was the only component with an absolute standardized coefficient greater than one at 3.814. Within the Concern and Shoot models, affect's standardized coefficients of –2.580 and –3.640 were still 0.97 and 2.298 larger, respectively, than the next largest components.

Knowledge was only included in the best fit Support model, in which it was not a significant predictor (Table 5). As such, we did not find support for hypotheses 7–9. A post-hoc power test of the knowledge scores revealed that its effect was exceedingly small and a sample size of 2,536 would have been required to detect it with 0.800 power.

The ethnicity component was driven by differences in perceptions between Caucasian and Hispanic respondents and it appeared in all best fit models. Compared with Hispanic respondents, the only group from which they differed significantly, Caucasian respondents had higher levels of Support, lower levels of Concern, and higher levels of the Shoot metric (Table 5). When Caucasians respondents were compared with all other respondents, ethnicity had moderate standardized coefficients of 0.241, –0.802, and –0.219 for the Support, Concern, and Shoot models, respectively. Rural background, additionally, proved to be a significant

Table 5. Parameter estimates of best fit ordinary least squares models predicting support for wild coyotes, risk perception, and support for lethal control in North Carolina, 2015. Binary variables were created multi-level model components (city and ethnicity) in which 1 = Asheville/Caucasian and 0 = other levels. Standardized coefficients were calculated using these variables.

Independent Variable	Coefficients	*SE*	*p*-value	Standardized Coefficients
Support: Support for Wild Coyotes (R^2 = 0.68)				
City (Asheville)				0.236
(Charlotte)	–0.578	0.391	0.140	
(Greenville)	–1.048	0.373	**0.005**	
(Triangle)	–0.297	0.373	0.425	
Affect	1.094	0.034	**< 0.001**	3.814
Ethnicity (Caucasian)				0.241
(Asian)	–0.053	0.748	0.943	
(African American)	–0.636	0.533	0.234	
(Hispanic)	–2.122	0.576	**< 0.001**	
College Education	0.366	0.295	0.215	0.178
Knowledge	–0.203	0.131	0.122	–0.222
Concern: Risk Perception (R^2 = 0.29)				
City (Asheville)				–0.220
(Charlotte)	1.653	0.714	**0.021**	
(Greenville)	–0.375	0.966	0.698	
(Triangle)	1.030	0.617	0.095	
Affect	–0.759	0.076	**< 0.001**	–2.580
Ethnicity (Caucasian)				–0.802
(Asian)	1.910	1.819	0.294	
(African American)	1.499	1.505	0.319	
(Hispanic)	8.286	2.420	**< 0.001**	
Hometown Size (Rural)				0.120
(Small Town)	–0.926	0.684	0.177	
(Large Town)	0.744	0.845	0.379	
(Small City)	–0.171	0.854	0.842	
(Large City)	–2.58	0.954	**0.007**	
Age	0.100	0.017	**< 0.001**	1.610
Pet Ownership	1.173	0.607	0.054	0.774
Shoot: Support for Lethal Management (R^2 = 0.42)				
City (Asheville)				–0.564
(Charlotte)	0.812	0.632	0.199	
(Greenville)	1.026	0.838	0.221	
(Triangle)	1.183	0.654	0.071	
Affect	–1.050	0.061	**< 0.001**	–3.640
Ethnicity (Caucasian)				0.219
(Asian)	0.988	2.221	0.657	
(African American)	0.456	1.675	0.786	
(Hispanic)	–4.063	1.248	**0.001**	
Hometown Size (Rural)				0.807
(Small Town)	–1.820	0.695	**0.009**	
(Large Town)	–1.935	0.745	**0.010**	
(Small City)	–0.105	1.045	0.920	
(Large City)	–3.667	0.938	**< 0.001**	
Pet Ownership	–0.786	0.568	0.166	–0.540
Male Gender	2.843	0.497	**< 0.001**	1.342

Significant *p*-values in bold.

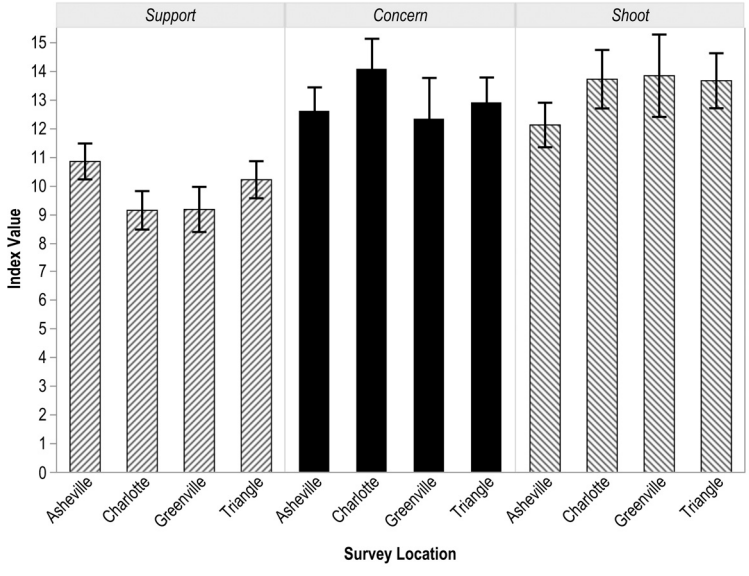

Figure 2. Mean responses to the Support, Concern, and Shoot indices by city, with 95% confidence intervals, in North Carolina, 2015. Support responses ranged from 4 to 20. Concern and Shoot responses ranged from 5 to 25.

predictor within the Concern and Shoot models. Respondents who grew up in rural areas had 2.58 higher mean levels of Concern than respondents originally from large cities. Within the Shoot model, respondents from a rural background uniformly had higher support for shooting than all other respondents. Additionally, the hometown size component had a larger effect size within the Shoot model than the Concern model, with standardized coefficients of 0.807 and 0.120, respectively, for the two models.

Age and gender emerged as significant predictors in two best fit models (Table 4). When predicting Concern, response estimates increased by 1.610 for every standard deviation rise in age (Table 5). Estimates of Shoot were 1.342 (standardized) higher among male respondents. Both age and gender had the second largest standardized coefficients within their models, after affect, and fit the directionality suggested by previous studies. Pet ownership was included in the best fit Concern and Shoot models and college education was included in the best fit Support model, but neither were significant predictors of coyote perceptions.

Discussion

Our results provide preliminary evidence that city identity can shape support for urban coyotes and risk perceptions. We found that city of residence is associated with an individual's perceptions of wildlife to a greater degree than four socio-demographic factors, including gender, college education, pet ownership, and hometown size. These findings highlight the potential value of future research exploring which aspects of a city's identity most relate to key wildlife conservation views, including support for specific species, risk perceptions, and management preferences. Past studies on urban identity have linked place identity with willingness to support pro-environmental initiatives and behaviors that maintained the local setting (Belanche et al., 2017; Stedman, 2002). However, to our knowledge this study represents the first effort to link

urban identity to perceptions of wildlife. Within our study, Asheville's location in a montane region and prominent industries focused on eco-tourism may establish a group norm of coyote tolerance and acceptance. These norms in turn may explain why respondents in Asheville were more supportive and less fearful of coyotes than other respondents.

The link between affectual connection to coyotes and discrete coyote perceptions is best explained by the primacy effect. Zajonc (1980) suggests that affectual judgements can have "primacy" and occur prior to cognitive judgements. These affectual assessments are an integral part of risk comprehension, guiding what Slovic, Finucane, Peters, and MacGregor (2004) labeled the "affect heuristic," or the mental short cut of using affect as a cue for important judgements. When an individual has a positive affectual connection to a stimulus, they are inclined to perceive the object as less risky and more beneficial than similar objects (Finucane, Alhakami, Slovik, & Johnson, 2000). Among this study's respondents, individuals with a highly positive affectual connection to coyotes are likely not to perceive coyotes as a threat and to infer an environmental benefit from the presence of coyotes. As such, these respondents are likely to support the presence of wild coyotes and not to support the lethal removal of coyotes. Similar evidence of the connection between affect and support for carnivores has been noted in previous research on carnivores, including wolves (Slagle et al., 2012; Sponarski, Miller, Vaske, & Spacapan, 2016). Our study supports previous research that cognitive variables better predict perceptions of wildlife than demographic variables (Manfredo et al., 2016). However, our study extends upon these previous findings by suggesting affect plays a central role in how urbanites perceive and prefer to manage coyotes. Indeed, affect may be undertheorized and understudied relative to other cognitive variables such as attitudes (Sponaski, Vaske, & Bath, 2015).

Contrary to our hypotheses, knowledge does not appear to be a predictor of coyote perceptions. Though some past studies have suggested a relationship between biological knowledge and carnivore perceptions (Draheim, Patterson, Rockwood, Guagnano, & Parsons, 2013; Engel, Vaske, Marchini, & Bath, 2017), our evidence suggests that once emotional connections to wildlife and urban identify are accounted for, impacts uniquely associated with knowledge may be minimal. This finding supports research by Slagle et al. (2012), suggesting affect and emotion better explain support for wolf recovery than knowledge and analytical reasoning. The relationship between knowledge and wildlife perceptions can be confounded by demographic factors such as participation in hunting (Ericsson & Heberlein, 2003) or gender (Kellert & Berry, 1987), but an effect of knowledge on wildlife perceptions may be apparent when examining a single demographic at a time. For example, Ericsson and Heberlein (2003) noted that perceptions of wolves became more positive with higher wildlife knowledge when hunters and non-hunters were viewed individually. However, they also observed that hunters had the greatest overall knowledge as well as the most negative wolf perceptions. Though knowledge was not an important predictor in our study, past research suggests that scientific knowledge matters more in contexts where affective and ideological domains are not involved (Stevenson, Lashley, Chitwood, Peterson, & Moorman, 2015). As such, caution must be taken when using education as a tool for assuaging wildlife conflict. Simply teaching biological facts to individuals may not prove effective unless they are paired with an effort to change emotional and ideological connections to wildlife.

City managers hoping to promote livability and sustainability in relation to urban carnivore management would benefit from developing an understanding of urban identity and affectual relationships to wildlife in their metro areas. Our findings suggest the variable rates of reported

coyote conflicts across large scale landscapes (Poessel, Gese, & Young, 2017) may relate as much to the unique tolerance levels and risk perceptions urban residents have for coyotes as to actual numbers and types of interactions with coyotes. The appropriate management responses to these conflict issues may vary at an even finer spatial scale. Even within a single state, the level at which wildlife policy is often established, differences in wildlife acceptance and risk perceptions appear between cities. In cities without industries directly connected to nature, managers may face greater challenges in promoting coexistence between human and carnivore populations simply because of the lack of support for wild carnivores intrinsic to their urban identity. Additionally, wildlife managers should take caution when extending findings on wildlife perceptions from one city to another. Given significant variation in wildlife perceptions among cities within a single state, it is probable that even greater differences in perceptions may occur between cities that are more geographically or ideologically disparate (Elliot, Vallance, & Molles, 2016).

Finally, despite "education" being a universal recommendation in many conservation studies, our findings suggest targeting emotional connections to animals will be more effective in increasing support for wildlife than attempts to increase biological knowledge among residents. Future research may explore how affectual connections to wildlife are formed and which modes of outreach are most effective in increasing affectual connections to carnivores. The ability to assess urban identity and affectual connections to wildlife will be key to maintaining tolerance for carnivores in the urban landscape.

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Conflicts of Interest

The authors state there are no conflicts of interest.

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