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Volume 7 | Issue 2

Article 7

11-6-2014

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Recommended Citation

Siemer, William F.; Decker, Daniel J.; Shanahan, James E.; and Wieczorek Hudenko, Heather A. (2014) "How do Suburban Coyote Attacks Affect Residents' Perceptions? Insights from a New York Case Study," *Cities and the Environment (CATE)*: Vol. 7: Iss. 2, Article 7.

Available at: <http://digitalcommons.lmu.edu/cate/vol7/iss2/7>

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How do Suburban Coyote Attacks Affect Residents' Perceptions? Insights from a New York Case Study

Understanding the human dimensions of human-coyote conflicts in metropolitan areas has taken on greater importance as coyotes (*Canis latrans*) have established themselves as the top predator in many urban ecosystems across North America. Though uncommon, coyote attacks on humans do occur in metropolitan areas and often receive widespread media coverage. Little research has been done to clarify how media coverage of these uncommon events may influence urban residents' attitudes toward coyotes. In 2010, two children in Westchester County, New York, were injured in coyote attacks. In fall 2010 and winter 2011, the authors replicated a 2006 telephone survey in two areas of Westchester County, to assess possible changes in residents' coyote-related experiences, attitudes, and risk perceptions. We documented a substantial, short-term increase in local newspaper coverage about coyotes immediately after the attack. Over 90% of local residents were aware of July 2010 attacks and nearly all residents with awareness reported exposure to media coverage of the attacks (supporting the hypothesis that such media coverage can have an agenda-setting effect). In comparison to 2006 levels, we documented an increase in concern about problems coyotes may cause, concern about coyote-related safety threats to children, and a decline in the proportion of local residents who believed that coyote-related risk to children was acceptably low. The 2006-2010 data comparisons provide support for a media framing hypothesis (i.e., that exposure to media coverage about the attacks made thoughts of human safety more salient, contributing to at least a short-term influence on concern about coyotes). Yet, in early 2011, months after local media coverage of coyotes had returned to background levels, concern about coyotes and coyote-related threats to children remained significantly higher than 2006 levels (i.e., effects continued after media priming ceased). This result suggests that factors other than media priming are needed to explain elevated levels of concern. We hypothesize that awareness of a new impact associated with coyotes (i.e., safety risk to children) may have driven change in resident's perceptions of coyote-related risk and tolerance for coyote presence. Findings suggest that interventionists with interests in promoting wildlife conservation in urban ecosystems have a window of opportunity in which coyote-related messages may be attended to by local residents. Through efforts to enhance self-efficacy and teach residents how they can reduce the likelihood of a negative interaction with coyotes, interventionists can help human residents learn to live with this mesopredator in urban ecosystems.

Keywords

coyote, media priming, risk perception, human safety, wildlife attacks

Acknowledgements

Gordon Batcheller and other personnel within the New York State Department of Environmental Conservation personnel contributed to research planning and oversight. Paul Curtis and Daniel Bogan (Cornell University) aided with the identification of study areas in 2006. Jeanne Wilcox and Jim Lee (Cornell Cooperative Extension of Westchester County) and Jeff Main and Beth Herr (Westchester County Department of Parks, Recreation and Conservation) contributed an important connection to our study communities in 2006. Funding for this study was provided by the New York Federal Aid in Wildlife Restoration Grant WE-173-G-19. This research also was supported by the Cornell University Agricultural Experiment Station federal formula funds, Project No. NYC-47433 received from the National Institutes for Food and Agriculture (NIFA,) U.S. Department of Agriculture. Any opinions, findings, conclusions, or

recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.

INTRODUCTION

The coyote (*Canis latrans*) has successfully colonized much of North America (Gompper 2002) and now occupies major metropolitan areas such as greater Los Angeles, Chicago, Boston, and New York. Research in the Chicago metropolitan area suggests that coyote densities and survival rates in some suburban landscapes may actually exceed that of surrounding rural areas (Gehrt et al. 2011). The ascendance of coyotes as the top terrestrial carnivore in suburban and urban landscapes in the northeastern U.S. will likely produce a range of positive and negative impacts on humans and ecosystems (Gompper 2002; Wieczorek Hudenko et al. 2010). Governmental and nongovernmental organizations will need to fill a range of information gaps to identify those impacts and achieve conservation and management goals in and around urban ecosystems.

Wieczorek Hudenko et al. (2010) outline a range of human dimensions information needs related to urban carnivore management. One set of such needs relates to improving the understanding of risk perceptions related to urban carnivores. Of concern to natural resource managers and wildlife conservationists is how perceived threats to human health and safety may affect public behavior and support for wildlife conservation (Decker et al. 2010, 2011, 2012). Coyote attacks on humans are uncommon, the human injuries that result are typically not life threatening (unless the animal has rabies), and coyote-related human fatalities are exceedingly rare. Nevertheless, researchers have speculated that coyote attacks on humans may affect public tolerance for coyote presence in urban ecosystems and tolerance for restoration of other carnivores (e.g., lynx, wolves) (Gompper 2002).

Media coverage of human-coyote conflicts, in addition to the conflicts themselves, also may influence public attitudes, given that suburban and urban residents are more likely to read or view stories about such conflicts than they are to experience them personally. Stories about negative human-wildlife interactions have news value (Corbett 1992) and coverage often increases after a dramatic event (e.g., a fox [*Vulpes vulpes*] attacking a child [Cassidy and Mills 2012]). Gompper (2002) notes that coyotes have received considerable media attention in recent years, in part because of an increase in coyote attacks on humans in suburban areas (Baker and Timm 1998; Timm et al. 2004) and relatively recent coyote dispersal into areas of high human population. More than a decade ago, Gompper (2002) speculated that coyote attacks on pets and humans in the northeastern U.S. – and media coverage of those attacks – would increase and could generate public intolerance for urban coyotes. White and Gehrt (2009) provide examples from the Chicago metropolitan area that are consistent with those predictions. They reported a twenty-fold increase in media coverage of coyotes in the Chicago area between 1985 and 2005, a period when coyotes were rapidly colonizing the area. In 2001 alone, over 30 articles about coyotes were published in major Chicago-area newspapers. They noted that in the same year, a survey of Chicago residents (Miller et al. 2001) found that residents rated coyotes as the wildlife species that posed the greatest threat to human health and safety in the area. No analysis was conducted to determine whether those perceptions were explained by media exposure, but a media-effects hypothesis is plausible.

An improved understanding of coyote-related concerns and risk perceptions among suburban stakeholders is of high interest in New York State, where wildlife managers have noted an increase in reports about problem interactions with coyotes (Bogan 2012). In particular,

wildlife managers are interested in research to clarify how communication about coyote attacks may affect concerns about human safety threats posed by coyotes in urbanized landscapes. Such research has management implications for any metropolitan area where human and coyote densities make some problem interactions inevitable.

In 2006, we collected data on risk perceptions related to coyotes in two study sites within Westchester County, New York, a county in which reports to wildlife managers about human-coyote interactions were comparatively common and increasing (Bogan 2012). In July 2010, two children in the same county were injured in attacks by coyotes. Recognizing this as a unique opportunity for pre-post comparisons, we resurveyed a sample of residents in the original study areas in fall 2010 and again in winter 2011, to assess whether awareness of coyote attacks in their county may have had any sustained relationship with residents' risk perceptions. In this paper we discuss findings from that series of surveys in relationship to hypotheses about media agenda-setting, framing, and priming and risk perceptions associated with human-coyote interaction in residential areas.

CONCEPTUAL BACKGROUND

Communication scholars have proposed at least three interrelated processes to explain how messages communicated by mass media sources may affect audiences: framing, agenda setting, and priming. We collected time series data, with a natural quasi-experimental field design, that allow us to shed light on whether framing, agenda setting, or priming were influencing coyote-related risk perceptions in a very specific case. Here we briefly define media framing, agenda setting, and priming, then follow with discussion of our research hypotheses.

Media framing refers to the way journalists and other communicators present news stories (Kim et al. 2002), including their language choices and the perspective from which a story is presented (Shah et al. 2002). A few efforts have been made to characterize language choices in newspaper stories about carnivores, including cougars (*Puma concolor*) in California (Wolch et al. 1997) and coyotes in Canada (Alexander and Quinn 2012). For example, Wolch et al. (1997) analyzed articles published in the *Los Angeles Times* between 1985 and 1995 to document how descriptors of cougars changed following a statewide ban on cougar hunting in California (cougar attacks on humans in California increased following the hunting ban). She found that as cougar-human interactions and attacks increased, "images of cougars as charismatic and proud wild animals at home in nature were replaced by terms conjuring danger, death, and criminal intent" (Wolch et al. 1997:110).

A *media frame* is a central organizing idea or story line that provides meaning to an event or series of events (Gamson and Modigliani 1987). In part, media frames are used to craft stories that will be meaningful and interesting to the intended audience, because they resonate with existing belief systems (cognitive schema) held by members of that audience (Scheufele and Tewksbury 2007). Media frames often include assertions about why particular events/problems occur and how those problems should be solved (Gamson and Modigliani 1989). Entman (1993:52) defined media framing as a process of selective presentation, designed to make some portions of reality more salient than others, "in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item

described.” Media frames are thought to influence how consumers of news media think about and interpret events (Scheufele 1999; Kim et al. 2002; Shah et al. 2002; Scheufele and Tewksbury 2007), because salient information is more likely to be processed and committed to memory (Fiske and Taylor 1991; Entman 1993; Valkenberg et al. 1999).

The practice of media framing and its potential influence on public perceptions of human-canid interactions is well illustrated by Peace (2001 2002) in his critical analysis of media portrayals of dingos (*Canis lupus dingo*) on Fraser Island, in Queensland, Australia. Fraser Island is home to one of the only remaining genetically-intact populations of dingos, and also is a popular international eco-tourism destination. In the 1980’s, dingos were portrayed as benign residents of island beaches; seeing dingos was promoted as part of a safe and accessible wilderness experience. But as tourism increased, dingos became increasingly habituated to, and food-conditioned by, island visitors. By the mid-1990s, repeated incidents of dingos harassing or biting tourists were being reported by park officials and local media. In particular, an incident in April 1998, where an infant was bitten by a dingo, received extensive media coverage (Peace, 2002). Newspaper quotes from interviews with island residents and scientific authorities raised public awareness that food-conditioned dingos had become “less wild” (Peace 2002:17). Previous human dingo conflicts, including the infamous 1978 disappearance of an infant on Fraser Island (Marcus 1989) were re-framed in a different narrative about dingos.

Peace posits that a confirmed dingo-related human fatality in 2001 was the final step that led to re-framing of dingo behavior. Media portrayals of dingos rapidly transformed into negative anthropomorphism. Dingos were demonized as “thugs,” “gangsters,” and “natural born killers” (Peace 2002, 18). Even though the dingo was classified as an endangered species, Queensland Parks and Wildlife Service officials culled 30 dingos (about one third of the adult population) on Fraser Island soon after the 2001 human fatality.

Agenda setting refers to the relationship between the amount of media coverage devoted to an issue and the relative importance that audiences place on that issue (McCombs and Shaw 1972). The agenda-setting model suggests that news media influence or “set the agenda” for political discourse; that is, through repetition, news media tell people what to think about (Cohen 1963). By extension, other media may also influence the salience of issues on the public agenda.

Priming refers to the psychological phenomenon whereby mention of one concept has the ability to activate related thoughts. Priming is seen as a relatively short-acting and short-lived phenomenon. Effects due to priming are expected to recede in quick order. However, multiple exposures to stimuli may result in more “chronic” accessibility (Bargh et al. 1986) of images derived from exposure; these may be longer-lasting than effects from single primes. Both agenda setting and priming are theorized to operate through memory-based modes of information processing. Simply mentioning a topic may be enough to produce some cognitive processing by an individual and raise the salience of that topic in the individual’s mind. Thus, mere exposure to media content may be sufficient to produce agenda setting and priming effects (Scheufele and Tewksbury 2007).

Effects have been theorized for all three phenomena. Agenda-setting effects are those observed when salience of an issue is related to (or more appropriately, caused by) media exposure. Increases in awareness of an issue when media coverage increases would be an example. Framing effects are changes in the perceptions of the attributes of an issue that correspond with media coverage. Changes in perceptions of the quality of a person, issue, or being would be an example. Priming effects are those that emerge in the short term from direct exposure to a stimulus. Short-term attitude change would be an example. Following this logic, it is reasonable to hypothesize that repeated exposure to stories about coyote attacks may communicate that coyotes, and the attacks associated with them, are an important issue (agenda setting), and those exposed to such stories may be prompted to think about human safety when asked to make evaluative judgments about coyotes and coyote-related risks (framing). Short-term effects (those that dissipate) would be more consistent with priming.

Some scholarship has been conducted on agenda setting, framing or priming effects in the context of the public discourse about gray wolf (*Canis lupus*) reintroductions. Enck and Brown (2002) documented a relationship between media exposure and negative attitudes toward wolf reintroduction in the Adirondack region of northern New York among the region's residents. Duda et al. (1998) documented that public attitudes towards wolf reintroduction in the Adirondack region became less favorable after extensive media coverage about the possible effects of reintroduction. These would be consistent with framing effects. Houston et al. (2010) completed a computer-aided content analysis of 6,144 newspaper articles on wolves published in the U.S. and Canada between 1999 and 2008. They found that discourse about wolves became increasingly negative over the decade and that articles published in states or provinces with new wolf populations had significantly more negative evaluative expressions about wolves than articles published in other states or provinces. They also found evidence of an increase in negative attitude statements in states within a federal wolf recovery zone, even if wolves were not yet present in the state. They noted that most discussion about wolves focused on whether wolves should be killed to minimize threats to livestock, pet, and human safety. These effects would be consistent with changes in media frames.

Hypotheses

H₁: A spike in local media coverage about coyotes will occur after a coyote attacks a human, but media coverage will quickly dissipate.

Carnivore attacks on humans have news value and often receive widespread media coverage. For example, Wolch et al. (1997) found that articles on cougars published in the *Los Angeles Times* between 1985 and 1995 peaked twice (in 1987 and 1995), in both cases following high-profile cougar attacks on humans. Communication research repeatedly demonstrates a pattern of rapid increase and rapid decline in many kinds of stories after issue-related "focusing events" in the United States (Shih et al. 2008; Daw et al. 2013). Given those findings, we anticipated that local media coverage of coyote-related topics would rapidly decline after media coverage about the attacks on children in July, 2010 (H₁). Part of the aim of this study is to demonstrate the pattern of media coverage for the coyote issue, as a basis for hypothesizing media effects.

H₂: Awareness of coyote presence in a local area will increase among area residents after a widely-publicized coyote attack on a person.

We also hypothesized that if media coverage of coyotes increased, area residents would become more aware of coyote presence (i.e., an agenda-setting effect would be observed) (H₂). When reporting on hazards to human health, journalists tend to focus on events and short-term consequences rather than deeper issues and long-term consequences (Singer and Endreny 1994). Events that threaten human health and safety (e.g., natural disasters, wildlife attacks) often serve as focusing events that receive media attention and briefly stimulate public discussion of deeper issues (e.g., climate change, human land use and carnivore conservation). Downs (1972) characterized this phenomenon as an “issue attention cycle” with five stages. Communication scholars have critiqued and recast many of the ideas proposed by Downs (1972). For example, McComas and Shanahan (1999) proposed the presence of a three-stage process of issue attention (i.e., a waxing phase, maintenance phase, and waning phase). Our study was not designed to explore agenda-setting effects in detail, but one aim of the study was to determine whether public awareness of coyotes was raised, and thus the potential for an agenda-setting effect was created.

H_{3.4}: Negative attitude toward coyote presence (tolerance) (H₃) and concern about any threat coyotes pose to small children (affective risk perception) (H₄) will increase among local residents following a widely-publicized coyote attack involving injury to a local child.

H₅: The proportion of local residents who believe that the likelihood of a coyote-related injury to young children in the county is acceptably low (cognitive risk perception) will decline following a widely-publicized coyote attack involving injury to a local child.

H₆: Coyote-related tolerance and risk perceptions among local residents will return to background levels within a few months after media coverage about coyotes declined.

We were interested in determining whether data in our series of three studies provided evidence consistent with framing or priming. We hypothesized that negative attitude toward coyote presence (tolerance) (H₃) and concern about any threat coyotes pose to small children (affective risk perception) (H₄) would increase following the occurrence of a widely-publicized coyote attack involving injury to a child. Such changes would be most consistent with framing, as they concern changes in qualities attributed to coyotes. We also hypothesized that the proportion of residents who believed that the likelihood of a coyote-related injury to young children in the county was acceptably low (cognitive risk perception) (H₅) would decline (i.e., again, one will observe changes in resident’s perceptions consistent with a media-framing effect). Moreover, we hypothesized that those coyote-related tolerance and risk perceptions would return to background levels within a few months after media coverage about coyotes declined, consistent with a drop in coyote-related media coverage predicted by Down’s (1972) theory of the issue attention cycle (H₆) (i.e., perception changes will fade quickly after issue attention dissipates and media primes end)

METHODS

Study Areas

Our study areas were located in Westchester County, New York, which is part of the New York-Northern New Jersey-Long Island, NY-NJ-CT-PA combined metropolitan statistical area (CMSA). This is the most populous CMSA in the U.S., with over 19 million residents.

We defined two study areas within Westchester County, which represented two different configurations of open space and residential development density that the study team believed might influence human experiences with coyotes and their related attitudes and perceptions of coyotes, as well as coyote behavior (for study area map, see Supplemental File A). Both study areas are within 50 miles of Manhattan and have a suburban character, but they differ from one another in several key respects. The northern study area was defined as the adjacent towns of Somers and Yorktown (the 2010 population of this study area was approximately 56,000 people; approximate density 300 persons/km²). The southern area was defined as the adjacent towns of Mount Pleasant and Greenberg. These towns were more heavily developed than the northern towns and had less green space, a higher median income, and a higher population density (the 2010 population of this study area was approximately 131,000; approximate density 500/km²). The study areas were maintained as separate units of analysis.

Survey Instruments

2006 survey. During the initial phase of the inquiry, semi-structured, face-to-face interviews were conducted with 40 Westchester County informants to identify saliency of topics identified *a priori* as the focus for a survey. Interviews were conducted between June 1 and July 21, 2006. Findings from that inquiry (Wieczorek Hudenko et al. 2008a, 2008b) were used to develop a telephone survey instrument to assess residents' coyote-related experiences and attitudes. Following internal review, the instrument was pretested with a few county residents and staff of the study's cooperating partners (New York State Department of Environmental Conservation, Cornell Cooperative Extension of Westchester County, and Westchester County Department of Parks, Recreation and Conservation). The final survey instrument (available in Wieczorek Hudenko et al. 2008b) contained 44 questions covering personal experience related to coyotes, attitudes, risk perceptions, behaviors, and respondent background characteristics (i.e., sex, age, educational attainment, children in home, dog in home, cat in home, feeding birds/wildlife, hunting in past 5 years, and area where the respondent lived [town or city, suburban area, outside of town]). The Cornell University Committee on Human Subjects approved the questionnaire and research protocol (Protocol ID# 06-05-045).

2010 and 2011 surveys. We designed an instrument nearly identical to the 2006 instrument, dropping a few questions not needed for hypothesis testing, and adding a few items to measure awareness of coyote attacks on two youth in Westchester County. The final instrument (available in Siemer and Decker 2011) contained 41 questions covering the same content addressed in 2006. The Cornell University Committee on Human Subjects approved the questionnaire and research protocol (Protocol ID# 1006001472).

Short vs. long surveys. The instrument included a routing rule that directed interviewers to use an abbreviated or full form of the survey instrument, depending on response to an item on attitude toward coyotes. Respondents who enjoyed coyotes without worry or had no opinion on coyotes in Westchester County completed the abbreviated form, which contained questions focused on residents' awareness and extent of experience with coyotes. Respondents who worried about coyote-related problems or regarded coyotes as a nuisance completed the full questionnaire, which contained a more extensive set of questions about coyote-related interests, concerns and experiences. Questions about awareness of the 2010 coyote attacks in Westchester County were placed at the end of the interview.

Sampling and Survey Implementation

Interviews were completed by the Survey Research Institute (SRI) at Cornell University. SRI obtained a listed sample of Westchester County residents in the four study townships from commercial sampling firms (Genesys Sampling Systems in 2006, The Marketing Systems Group in 2010 and 2011). The sampling approach was identical for all surveys (i.e., the same census tracks were sampled by the same sampling firms in all three studies).

Data collection occurred between October 10 and November 3, 2006 (Fall 2006), August 30 and October 17, 2010 (Fall 2010), and between January 18 and March 2, 2011 (Winter 2011). In each survey, contacts with area residents continued until the target of approximately 600 completed interviews was reached in each study area.

Analysis

We used the Statistical Package for Social Science (SPSS 20.0) to aid statistical analyses. We used chi-square tests to assess differences between groups. Differences are reported at the $P < 0.05$ level of significance.

For purposes of hypothesis testing we created three variables: overall attitude toward coyotes, affective risk perception, and cognitive risk perception. We assessed attitude toward coyotes with the question, "Which of the following statements best describes your feelings about coyotes in Westchester County?" (response options: "I enjoy knowing coyotes are around, and I do not worry about problems coyotes may cause"/ "I enjoy knowing coyotes are around, but I worry about problems coyotes may cause"/ "I do not enjoy knowing coyotes are around and I regard them as a nuisance"/ "I have no particular opinions on coyotes in Westchester"). Given our focus on how concerns (risk perceptions) affect attitudes, we created a dichotomous variable by collapsing categories into enjoy without worry/no opinion and enjoy but worry/do not enjoy coyotes.

We assessed affective risk perception with response to the question, "How would you describe your level of concern about the threat coyotes might present to small children in your area?" (response options: "no concern," "some concern," and "a great deal of concern"). We created a dichotomous variable by collapsing categories into "no concern"/"some concern" or "a great deal of concern."

We assessed cognitive risk perception using agreement with the statement, “The likelihood that a person in Westchester County will be injured by a coyote is acceptably low” (response options: “agree strongly,” “agree,” “disagree,” “disagree strongly,” and “unsure”). We created a dichotomous variable by collapsing categories into “agree strongly”/ “agree” and “disagree strongly”/ “disagree.” Respondents who were unsure were not included in the analysis.

Newspaper Article Count

As an index of event media coverage, we used electronic databases to count coyote-related articles in three newspapers read by residents in the study areas. We used LexisNexis Academic to identify articles in the *New York Post* and the *New York Daily News*. We searched the electronic archive of the *Westchester Journal News* (WJN) to identify coyote-related articles in that regional newspaper. We removed articles that mentioned the word coyote in reference to athletics, immigration, migrant labor, restaurants and dining, or entertainment. We generated article counts by season and year.

RESULTS

Newspaper Coverage Before and After Coyote Attacks

We identified 237 coyote-related articles published by the *Westchester Journal News* (WJN) between the years 2002 and 2010. Frequency of coyote-related articles followed a consistent annual pattern between 2003 and 2009. The number of articles ranged from 14 to 29, with a mean of 23.3 articles per year. In 2010, 72 coyote-related articles were printed in WJN, including 43 articles during the July-September period (about 10 times the average frequency for coyote-related articles in WJN during that season) (Figure 1). We found that most of the 43 articles printed by WJN during that period reported on some aspect of the coyote attacks in Westchester County in July, 2010.

Few coyote-related articles appeared in the *New York Post* in 2008, 2009, or 2010. But the number of coyote-related articles was higher in 2010 (4 articles in 2008, 6 articles in 2009, 14 articles in 2010). Similarly, the *New York Daily News* ran few articles on coyotes, but comparatively more articles appeared in 2010 (0 articles in 2008, 5 articles in 2009, 10 articles in 2010). The increase in articles was attributable to coverage of the coyote attacks in Westchester. The coyote attacks also were reported in local television news broadcasts and in articles that appeared in the regional section of the *New York Times*. Summarizing, the Westchester paper devoted a lot of attention to these attacks, in a way entirely consistent with previous theorizing about issue cycles. The issue became salient enough to make it into the larger regional and national papers, though of course coyote attacks could never dominate coverage in the same way for these papers.

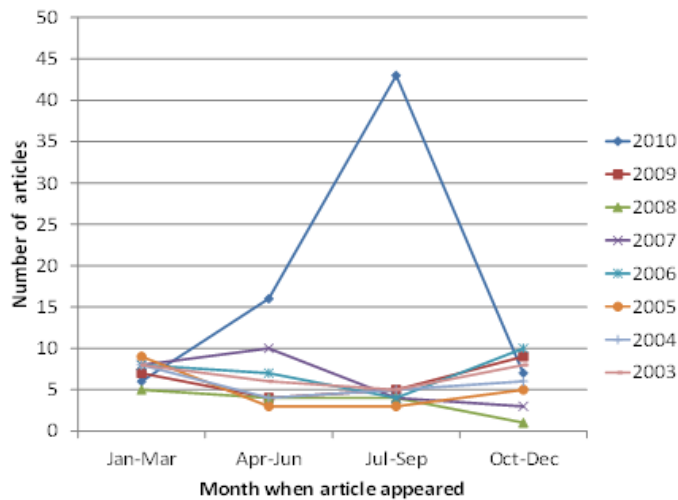


Figure 1. Coyote-related articles published in the Westchester Journal News by season, 2003 to 2010.

Response and Respondent Characteristics

Approximately 1,200 interviews were completed in each year of survey implementation. Eighty-seven percent of those contacted ($n=3,560$) consented to an interview (i.e., 4,091 people were contacted at least once; 531 declined to be interviewed) (Table 1).

Table 1. Summary of Survey Research Institute contacts with members of the sample group during the 2006, 2010 and 2011 Westchester County resident telephone surveys, by study area.

	Northern study area			Southern study area		
	2006 (n)	2010 (n)	2011 (n)	2006 (n)	2010 (n)	2011 (n)
Total completed	580	600	600	580	600	600
Full interview	287	384	370	310	387	366
Short interview	293	216	230	270	213	234
Number not in service	224	207	193	259	261	218
Unable to respond (ill, language barrier)	49	26	24	55	45	33
Refused to participate	110	115	84	60	73	89
Not reached, ≥ 1 attempts	2037	1552	1482	1445	1674	1400
Total	3000	2500	2383	2399	2653	2350

Respondents' personal traits and patterns of involvement in wildlife-related activities were similar across studies, increasing our confidence that the datasets were generated from comparable samples of residents in the study areas (Table 2). In both the northern Westchester and southern Westchester study areas, the samples drawn were similar in gender, education, years of residence in Westchester County, pet ownership, participation in bird/wildlife feeding, and mean age.

Table 2. Comparison of demographic characteristics and household traits for survey respondents, by study area and year (2006 and 2010).

	Northern study area			Southern study area		
	2006 (n) %	2010 (n) %	2011 (n) %	2006 (n) %	2010 (n) %	2011 (n) %
Gender	(580)	(600)	(600)	(580)	(600)	(600)
Female	52.2	50.7	52.5	55.5	56.3	51.7
Male	47.8	49.3	47.5	44.5	43.7	48.3
Education	(564)	(581)	(588)	(573)	(584)	(591)
< High school	0.7	1.7	1.7	0.9	1.5	1.2
HS or GED/trade school	16.6	14.1	11.6	9.7	10.3	12.9
Some college/2-yr degree	19.9	18.0	16.8	13.7	12.4	16.9
4-year degree	27.8	31.8	33.2	29.7	30.8	29.8
Graduate school	34.9	34.3	36.7	46.1	45.0	39.3
Description of area where you live	(576)	(597)	(598)	(577)	(598)	(599)
Town or city	7.8	11.2	14.7	12.7^a	20.7^a	20.2
Suburban area	55.4	57.0	57.7	71.8	67.4	65.8
Outside of town	36.8	31.8	27.6	15.6	11.9	14.0
Children in home	(575)	(592)	(594)	(577)	(596)	(597)
Yes	17.6^a	11.8^a	12.5	14.9	13.6	10.9
Dog in home	(577)	(594)	(598)	(580)	(597)	(598)
Yes	32.6	35.7	38.8	27.2	31.3	30.3
Cat in home	(577)	(594)	(599)	(580)	(596)	(598)
Yes	26.7	24.2	19.7	21.6	21.3	18.2
Feed birds/wildlife	(576)	(595)	(599)	(579)	(594)	(598)
Yes	48.3	51.1	47.4	38.0	35.7	40.3
Hunted in past 5 years	(578)	(594)	(599)	(563)	(580)	(598)
Yes	4.3	6.4	5.8	2.9	2.2^a	5.7^a

Columns with the same letter (a-a) are significantly different at $p < 0.05$.

There were four minor differences among respondent groups when groups were compared by year of data collection (Tables 2-3). In the northern area, more respondents had children in the home in 2006 when compared to 2010 (17.6% vs. 11.8%, $\chi^2_1 = 7.687$, $P = 0.006$). In the southern area, fewer respondents hunted in 2010 when compared to 2011 (2.2% vs. 5.7%, $\chi^2_1 = 9.586$, $P = 0.002$). In the southern area, fewer respondents lived in a town or city in 2006 when compared to 2010 (12.7% vs. 20.7%, $\chi^2_2 = 15.223$, $P < 0.001$). In the southern area, mean age of respondents differed between 2006 and 2010, and between 2010 and 2011. We chose not to adjust the datasets to address these minor differences.

Table 3. Age of study participants, by study area and year (2006 - 2011).

Study area	Year	N	Mean age	SD	t	df	p-value
North	2006	555	53.96 ^a	15.935	-2.892	1127	0.004
	2010	574	56.58 ^{ab}	14.447	2.083	1149	0.038
	2011	577	54.80 ^b	14.569			
South	2006	546	54.77	14.013	1.654	1118	0.098
	2010	574	53.33	15.065	0.796	1155	0.426
	2011	583	52.62	15.201			

Columns with the same letter (a-a) are significantly different at $p < 0.05$.

Awareness of and Interactions with Coyotes

In 2006, most respondents were aware that coyotes lived in New York, including Westchester County. The proportion aware of coyotes increased slightly between 2006 and 2010 in both study areas. Compared to 2006, respondents in both study areas in 2010 were (a) more likely to be aware that coyotes were present in New York State, (b) more likely to be aware that coyotes lived in Westchester County, and (c) more likely to report that they became aware of coyotes from news media. Personal experience with coyotes was unchanged between Fall 2006 and Fall 2010.

We found fewer differences in awareness between 2010 and 2011. In the northern study area, we found no significant differences between Fall 2010 and Winter 2011 on awareness of coyotes or sources of that awareness. In the southern study area we found two differences: fewer 2011 respondents had become aware of coyotes in the county via news reports (75.7% vs. 85.6%, $\chi^2_1 = 4.034$, $P = 0.045$) and more 2011 respondents had become aware of coyotes in the county through personal experience (60.2% vs. 51.5%, $\chi^2_1 = 8.413$, $P = 0.004$).

The proportion of respondents who said they had experienced a problem interaction with a coyote did not change between 2006 and 2011 (Table 4). In contrast, the proportion of respondents who said they had been in a situation in which they perceived that a person was threatened by a coyote increased slightly between 2006 and 2010 in both study areas (Table 4).

Table 4. Experiences with coyotes, by study area and year (2006 and 2010).

	Northern study area			Southern study area		
	2006 (n) %	2010 (n) %	2011 (n) %	2006 (n) %	2010 (n) %	2011 (n) %
Have seen a coyote:						
in their county	(497) 66.0	(561) 62.4	(555) 62.3	(480) 56.3^a	(539) 46.6^{ab}	(544) 54.4^{ab}
near their residence	(325) 67.7^a	(350) 76.9^a	(346) 79.8	(265) 71.3	(249) 67.1	(293) 74.4
Have had a problem with coyotes	(328) 7.9	(350) 10.3	(346) 12.4	(270) 6.7	(251) 9.6	(296) 6.1
Have reported a an interaction to officials	(328) 7.7	(350) 11.7	(346) 11.3	(267) 15.0	(251) 16.3	(296) 14.5
Have been in a situation:						
perceived as pet threat	(282) 19.5	(384) 22.9	(370) 24.1	(301) 20.3	(386) 15.5	(366) 19.9
perceived as human threat	(282) 7.4^a	(384) 13.8^a	(370) 14.3	(306) 7.2^a	(387) 13.7^a	(366) 16.9

Columns with the same letter (**a-a**, **b-b**) are significantly different at $p < 0.05$

Awareness of July 2010 Coyote Attacks

Awareness of the coyote-related attacks on children in Westchester County in July, 2010 was very high in fall 2010 and winter 2011 (Table 2). Nearly all of those who were aware of the events said that they became aware of the events through exposure to news reports; awareness was more likely to have been generated by media coverage than by interpersonal communication (Table 5).

Table 5. Awareness of coyote-related attacks on children in 2010 in Westchester County (Township of Rye), by study area and year (2010 and 2011).

Event awareness and source of awareness		Northern study area		Southern study area	
		2010 %	2011 %	2010 %	2011 %
Were aware that two children in the Town of Rye, New York had been injured by coyotes	(n)	(493)	(425)	(472)	(415)
	Yes	94.1^a	90.4^a	91.7	90.6
	No	5.9	9.6	8.3	9.4
Made aware of 2010 attacks from media exposure	(n)	(463)	(383)	(433)	(374)
	Yes	97.4	98.2	98.6	98.7
	No	2.6	1.8	1.4	1.3
Made aware of 2010 attacks from other people (e.g., friends, family, neighbors)	(n)	(463)	(383)	(432)	(375)
	Yes	43.2	45.4	45.4	49.9
	No	56.8	54.6	54.6	50.1

Columns with the same letter (**a-a**) are significantly different at $p < 0.05$.

Change in Attitudes and Perceptions

A measure of overall attitude toward coyotes served as a screening question to route respondents to a full or abbreviated interview. The item had two response categories that indicated no concern about coyotes (i.e., “I enjoy knowing coyotes are around, and I do not worry about problems coyotes may cause” and “I have no particular opinions about coyotes in Westchester”). The other two response options implied a measure of concern (i.e., “I enjoy knowing coyotes are around, but I worry about problems coyotes may cause” and “I do not enjoy knowing coyotes are around and regard them as a nuisance”).

About half of all respondents indicated some concern about coyotes or regarded coyotes as a nuisance in Fall 2006. The percentage of respondents in those categories rose significantly in Fall 2010. In the northern area the proportion of respondents who worried about coyote-related problems climbed from 49.0% to 64.0% ($\chi^2_1 = 26.750$, $P < 0.001$); in the southern area the proportion of respondents who worried climbed from 53.0% to 65.0% ($\chi^2_1 = 17.640$, $P < 0.001$). There were no significant differences on this question in either study area between Fall 2010 and Winter 2011; the extent of concern did not seem to wane (Table 6).

Table 6. Attitude toward coyotes and affective and cognitive risk perception in Westchester County, New York, by study area and year (2006-2011).

Attitude or perception statements	Northern study area			Southern study area		
	2006 (n) %	2010 (n) %	2011 (n) %	2006 (n) %	2010 (n) %	2011 (n) %
Attitude toward coyote presence in Westchester County, NY	(575)	(600)	(599)	(574)	(595)	(599)
Enjoy without worry/No opinion	51.0 ^{ab}	36.0 ^a	38.2 ^b	47.0 ^{ab}	35.0 ^a	38.9 ^b
Enjoy but worry/Do not enjoy	49.0 ^{ab}	64.0 ^a	61.8 ^b	53.0 ^{ab}	65.0 ^a	61.1 ^b

Columns with the same letter (**a-a**, **b-b**) are significantly different at $p < 0.05$

Acceptability of risk to people. The proportion of respondents who expressed great concern about threat to small children increased between Fall 2006 and Fall 2010 in both study areas (north: 37.0 vs. 49.9%, $\chi^2_2 = 13.929$, $P = 0.001$; south: 37.9 vs. 49.1, $\chi^2_2 = 10.236$, $P = 0.006$). The proportion of respondents who expressed great concern about threat to small children was not different between 2010 and 2011 measures, in either study area (north: 49.9 vs. 45.4; south: 49.1 vs. 49.5) (Figure 2).

As we expected, residents who reported having experienced a coyote-related problem in the past (2006: $n=28$; 2010: $n=53$; 2011: $n=48$) were more likely than residents who had not experienced a coyote-related problem (2006: $n=278$; 2010: $n=346$; 2011: $n=334$) to report “a great deal” of concern about threats to small children. Nevertheless, the pattern in proportion of respondents who expressed a great deal of concern between measurements was the same in both groups (i.e., in both groups the concern level increased between 2006 and 2010, and was unchanged between 2010 and 2011) (Figure 2).

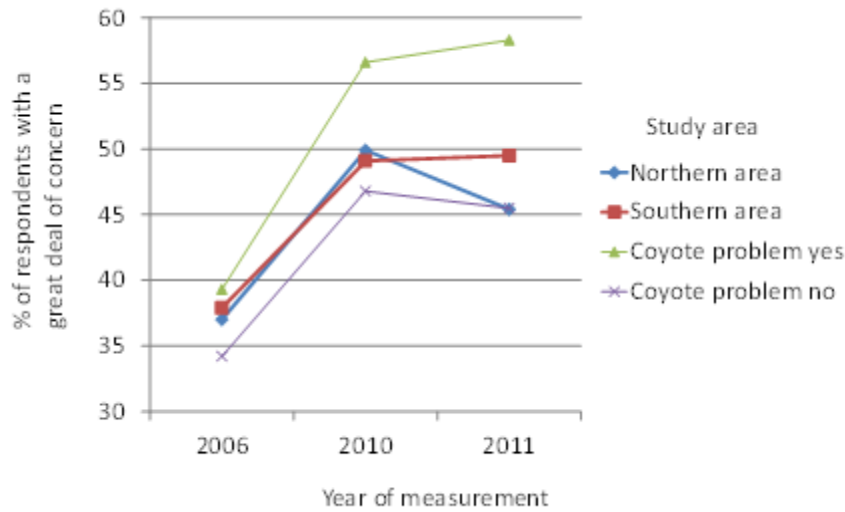


Figure 2. Percentage of respondents in 2006, 2010, and 2011 surveys who responded “a great deal of concern” when asked how concerned they were about the threat coyotes might present to small children in their area (response options: no concern, some concern, a great deal of concern).

Respondents who worried about problems coyotes may cause were asked whether they perceived coyote-related risks to people as acceptably low. This question represented a measure of wildlife-stakeholder acceptance capacity (Carpenter et al. 2000) related to coyote presence. The proportion of respondents who agreed that the risk to people was acceptably low declined between Fall 2006 and Fall 2010 in both study areas (northern area: 72.3% vs. 50.0%, $\chi^2_1 = 30.84$, $P < 0.001$; southern area: 69.4% vs. 48.9%, $\chi^2_1 = 26.95$, $P < 0.001$). We found no significant change between Fall 2010 and Winter 2011 on acceptability of risk to humans (north: 50.0 vs. 56.8; south: 48.9 vs. 49.7) (Figure 3). Similar patterns were observed in male-only and female-only comparisons (Figure 3), suggesting that the findings by study area and year were not an artifact of differences in the gender across study areas or year.

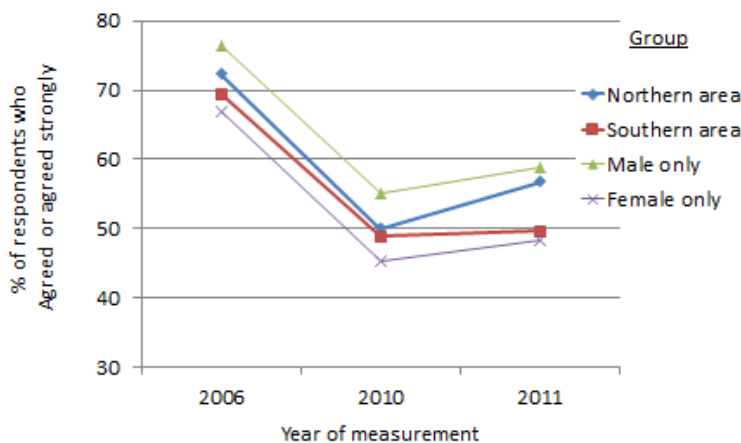


Figure 3. Percentage of respondents in 2006, 2010, and 2011 surveys who agreed or agreed strongly with the statement, “The likelihood that a person in Westchester County will be injured by a coyote is acceptably low” (response options: agree strongly, agree, disagree, disagree strongly, or unsure).

DISCUSSION

We confirmed our assumption that local news coverage about coyotes increased in mid-2010 and returned to background levels by 2011 (i.e., H_1 was supported). We also documented that a very high proportion of study area residents (about 90%) were aware of that coverage. These findings are the foundation that must be established before it is reasonable to suggest that some media effect could have taken place.

We argued that wildlife-related events covered by the news media at the level observed in this case have the potential to influence public perceptions about wildlife-related problems and how those problems might be managed. We hypothesized that media coverage of coyote attacks in Westchester would have framing effects on residents' perceptions, making human safety salient and thus raising concern about human safety in an area occupied by coyotes. The changes in concern, risk perceptions, and acceptability of risk to humans that we observed between Fall 2006 and Fall 2010 were consistent with those hypotheses (H_3 – H_5).

On the other hand, we hypothesized that elevated concerns and risk perceptions would decline in Winter 2011, as memories of the July 2010 incidents faded (H_3). A media priming effect is expected to fade with time (Josephson 1987; Grant and Logan 1993; Roskos-Ewoldsen et al. 2002a, 2002b) ending shortly after cues cease (in the case of media priming, ending soon after media attention to a subject ceases). Though we observed a few results consistent with that hypothesis, most of the data suggest that concerns and risk perceptions persisted at the higher, Fall 2010 levels. This leads to an alternative hypothesis: residents' awareness that threats to children were real (rather than a hypothetical possibility), created a new psychological impact (i.e., worry about risks to children), and elevated concern and risk perceptions to a new norm. Objectively, people were experiencing the same level of interactions with coyotes (e.g., the proportion who saw coyotes or had problem interactions with coyotes remained about the same between Fall 2006 and Winter 2011), but with new information presented in the media some residents' perceptions of coyotes may have changed to include threats to child safety. Our ideas are consistent with Roskos-Ewoldsen et al.'s (2002a) proposal that, "priming influences how later information is interpreted by influencing the type of mental model that is constructed to understand the situation" (Roskos-Ewoldsen et al. 2002a:112). We hypothesize that residents of the locale where the coyote attacks occurred revised their mental model of coyotes to include the belief that coyotes do present a low, but real threat to the safety of young children.

We also found evidence that some residents began to evaluate their experiences differently (i.e., more reported that they felt they had been in a situation that could threaten human safety). We hypothesize that having new information about the safety threats associated with human-coyote interactions in the county led them to re-interpret the risk associated with their experiences with coyotes. New information gives people a new filter through which to view a coyote-related event or interaction.

Our findings of a media effect on risk perceptions contrast with those from the only other research we know of that examined risk perception before and after a carnivore attack on a human. Gore et al. (2005) investigated risk perceptions using statewide surveys conducted five months prior to, and three weeks after a black bear fatally attacked an infant in the Catskill

region of New York State. They documented that the event received widespread media coverage and that the majority of those surveyed were aware of that coverage. The statewide mail survey conducted prior to the attack (Siemer and Decker 2003) documented that the majority of New York State residents believed that bear attacks on humans are very rare. Gore et al. (2005) found that those risk perceptions did not increase in New York after the bear-related human fatality. The survey research was accompanied by media content analysis, which documented that media content after the incident emphasized the rarity of the attack. Gore et. al. (2005) concluded that risk perceptions may have remained stable because media reinforced resident's low risk perceptions. In the Westchester County case, media coverage made local residents aware that two coyote attacks had occurred in quick succession. We believe that may have contributed to changes in beliefs about the likelihood of coyote attacks on humans. Media coverage of the attacks made people aware that coyotes could pose a threat to human safety, and may have made them change their beliefs about the chances that such an incident would occur in their neighborhood.

The findings we report here are valuable as a real-world example of how media coverage of wildlife-related threats to human safety may influence perceptions of wildlife in urban ecosystems. To our knowledge, no other study has documented such an effect in a wildlife management context. We encourage future investigators to build upon this research to expand understanding of the role of mass media in shaping public perceptions of urban carnivores. In particular, we believe that agencies and organizations interested in urban carnivore conservation could benefit greatly from applied research programs that address the following research questions:

- When they occur, how widespread are media effects on carnivore-related risk perceptions in developed landscapes?
- To what degree do problem-prevention behaviors change in local areas after carnivore attacks on humans in developed areas?
- How do media effects on carnivore-related risk perceptions vary by carnivore species (e.g., how do the affects compare when the attack is by a coyote vs. a mountain lion)?

Two limitations associated with study design must be acknowledged. The original 2006 survey, on which 2010 and 2011 study replications were based, was designed as a screening process to find individuals who were experiencing coyote-related problems, and repeated use of the instrument was not foreseen. That design choice, which exempted many respondents from the full battery of questions, precluded use of analytical tools (e.g., regression analyses, structural equation modeling) that would have shed light on the relative contribution of demographic characteristics on risk perception. Future studies of risk perception before and after carnivore attacks should be designed to allow for such analyses.

A second limitation relates to the timing of the final follow-up survey in study. One critique that might be levelled at our conclusions is that the 2011 follow-up study occurred too soon to effectively test media effects hypotheses. We argue that the timing of the 2011 study occurred sufficiently after the peak of coyote-related media coverage to provide a test of our priming hypothesis. Moreover, the final post-attack survey occurred six months after the coyote attacks on children in Westchester County and months after the 2010 measurement—ample time

for any media effects to have faded between measures. The fact that such an effect was documented months after the event, and long after the peak of news coverage, is noteworthy. Though funding constraints prevented us from doing so, we believe it would be useful in future investigations to plan longer-term follow-up surveys to document how long media framing may influence wildlife-related risk perceptions. Additional replications of our study could be used to determine whether the changes we observed in coyote-related risk perceptions have faded in the study areas over time.

Implications for communication interventionists. There is one collateral effect of coyote attacks on urban pets or people that could be viewed positively; they create a window of opportunity for communication about coyote-problem prevention. Coyote attacks often become focusing events that draw public attention to coyote presence. Because these events raise public awareness about exposure to a previously unrecognized threat, they create a brief window when local residents near the attack site actively seek out, or are receptive to, information that can help them understand and manage this threat. If prepared, wildlife agencies and other entities (e.g., nongovernmental organizations) can seize these opportunities to reach community residents with problem-prevention information. Information and education (“I & E”) interventions are frequently recommended as a management response to problem interactions with urban coyotes (Way 2011), because such interventions offer a *potential* means to give urban residents the knowledge and skills necessary to reduce negative interactions with coyotes.

Communication interventionists should set realistic expectations for I & E programs, recognizing that careful planning and sustained implementation will be necessary to achieve changes in coyote-problem prevention behaviors. The value of I & E interventions depend partly upon their ability to promote personal behavior change (e.g., the degree to which they reduce behaviors that attract or food-condition wildlife). Yet, modifying even routine household behaviors, like the timing of when urban residents curb their trash for disposal, can prove difficult (for examples related to black bear management, see Gore et al. [2008] and Baruch-Mordo et al. [2011]). To be most effective, I & E programs should be: (1) targeted toward specific audiences, (2) grounded in education, communication and behavior-change theory, and (3) monitored, evaluated and modified as necessary to achieve incremental changes in behavior. Through efforts to enhance self-efficacy and teach residents how they can reduce the likelihood of a negative interaction with coyotes, communication interventionists can help human residents learn to live with this mesopredator in urban ecosystems.

Conclusions

We hypothesized that media coverage of coyote attacks in Westchester County, New York would have framing effects on residents’ perceptions, making human safety salient and thus raising concern about human safety in an area occupied by coyotes. The changes in concern, risk perceptions, and acceptability of risk to humans that we observed among county residents between Fall 2006 and Fall 2010 were consistent with those hypotheses, and led us to conclude that a media framing effect did occur at a local geographic scale.

The finding that elevated risk perceptions persisted after media coverage of coyote-human interactions ceased, led us to reject the hypothesis that changes in risk perception were

associated with media priming. Our findings instead lead to an alternative hypothesis: we propose that residents' awareness that threats to children were real (rather than a hypothetical possibility), created a new psychological impact (i.e., worry about risks to children), and elevated concern and risk perceptions to a new norm. We argue that residents of the locale where the coyote attacks occurred revised their mental model of coyotes to include the belief that coyotes do present a low-level (low-probability), but real threat to the safety of young children.

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