Human Dimensions of Wildlife: An International Journal

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/uhdw20

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Published online: 30 Sep 2010.

To cite this article: Mae A. Davenport , Clayton K. Nielsen & Jean C. Mangun (2010) Attitudes Toward Mountain Lion Management in the Midwest: Implications for a Potentially Recolonizing Large Predator, Human Dimensions of Wildlife: An International Journal, 15:5, 373-388

To link to this article: http://dx.doi.org/10.1080/10871209.2010.507564

Human Dimensions of Wildlife, 15:373–388, 2010

ISSN: 1087-1209 print / 1533-158X online
DOI: 10.1080/10871209.2010.507564

Routledge
Taylor & Francis Group

Attitudes Toward Mountain Lion Management in the Midwest: Implications for a Potentially Recolonizing Large Predator

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*Mountain lion (*Puma concolor*) confirmations in the Midwest have increased considerably, indicating a potential recolonization event. Although the ecological, social, and economic implications of recolonization are of considerable interest to managers and the general public, no studies have yet assessed human attitudes toward mountain lion management in the region. We surveyed Kentucky and North Dakota residents and found differences in their mountain lion experience histories, beliefs, trust in information, and support for mountain lion management options. North Dakota respondents' support for mountain lion protection appeared to be a function of their basic normative beliefs, while Kentucky respondents were influenced more so by affective responses. Hunters in both groups were more likely to support mountain lion control than protection. As managers address potential recolonization of mountain lions in the Midwest through adaptive management strategies, targeted and proactive communication with diverse groups will be critical.*

Keywords attitudes, wildlife management, mountain lions

Although mountain lions (*Puma concolor*) have been largely absent from Midwestern North America for more than 100 years, mountain lion confirmations (i.e., carcasses, DNA, photographs, video) have increased dramatically in the last two decades (Nielsen, Dowling, Miller, & Wilson, 2006). The Cougar Network, a non-profit organization dedicated to studying cougar potential east of their established range, reports more than 300 mountain lion confirmations in the Midwest between 1990 and 2008 (Cougar Network, 2010). Wildlife biologists agree this increase is substantial given the local extirpation of the species. Many Midwest mountain lion confirmations have been based on the identification

This project was supported by The Shared Earth Foundation and The Cougar Network. The authors also would like to acknowledge Harley Shaw, Chuck Anderson, Mark Dowling, Ken Miller, and Bob Wilson for their assistance with project development, as well as four anonymous reviewers for their insight and suggestions on the manuscript.

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of subadult males killed by vehicles, trains, or hunters. Subadult males are the primary dispersers in mountain lion populations (Anderson, Bowden, & Kattner, 1992; Sweanor, Logan, & Hornocker, 2000) and can travel exceptionally long distances, up to 1,067 km (Sweanor et al., 2000; Thompson & Jenks, 2005). It is possible that mountain lions may be starting to recolonize the Midwest via dispersal from western populations, especially the Black Hills population, which some argue is at ecological carrying capacity (Nielsen et al., 2006; Thompson & Jenks, 2005; Thompson, Fecske, Jenks, & Jarding, 2009). Although lack of female dispersal may slow recolonization (Maehr, Kelly, Bolgiano, Lester, & McGinnis, 2003), enough suitable habitat and dispersal corridors exist in the region to sustain mountain lion populations (LaRue & Nielsen, 2008).

The ecological, social, and economic implications of this large predator recolonizing the Midwest are of considerable interest to conservationists, outdoor recreationists, agricultural producers, and the general public (Bolgiano, Lester, & Maehr, 2000; Nielsen et al., 2006; Tischendorf, 2003). Public awareness and interest in the mountain lions' eastern expansion is likely to increase given recent national media attention in both the *Smithsonian* (Kemper, 2006) and *National Geographic* (Silver, 2009).

Human dimensions research was listed as one of nine priority research needs in the recent Cougar Management Guidelines report (Cougar Management Guidelines Working Group, 2005). Policy makers and wildlife managers acknowledge that conservation decisions for large carnivore populations must consider human attitudes toward the species (Naughton-Treves, 2003). Information on human beliefs, affective responses, and attitudes associated with wildlife contributes to a more in depth understanding of social-ecological systems (Kleiven, Bjerke, & Kaltenborn, 2004) and may enhance communications between wildlife managers and local residents. Although past social science research has investigated the human dimensions of mountain lions in areas where established populations exist (Casey, Krausman, Shaw, & Shaw, 2005; Riley & Decker, 2000; Teel, Krannich, & Schmidt, 2002; Zinn & Pierce, 2002), research conducted in areas of potentially recolonizing mountain lion populations is significantly lacking.

Adaptive planning strategies are needed that investigate and address the implications of mountain lion recolonization for social-ecological systems in the Midwest. While human communities near long-established mountain lion populations have learned to live with the predator, it is unclear how communities where mountain lions have long been extirpated will respond and adapt to the species' recolonization. Insight into human beliefs, affective responses, and attitudes associated with mountain lions and their management prior to potential recolonization is crucial for adaptive planning and management to be effective. Examination of public attitudes toward potential management options, and an assessment of psychosocial characteristics that potentially drive those attitudes, will be most helpful to wildlife managers, policy makers, and environmental educators in planning education campaigns, outreach programs, and policy actions around future mountain lion management.

We surveyed residents in two Midwest states, North Dakota and Kentucky, which provide an interesting contrast in terms of their history with mountain lions. North Dakota has recently confirmed a breeding population of mountain lions in the western portion of the state with more than 150 confirmations recorded between 1990 and 2008 (Cougar Network, 2010), and is positioned at the eastern edge of potential range expansion by mountain lions. Conversely, Kentucky has had no recorded mountain lion confirmations since before 1900 (Cougar Network, 2010). We expected that the states' relative geographic positions and differing mountain lion histories would influence residents' beliefs and affective responses associated with mountain lions, and their attitudes toward mountain lion management

options. We anticipated that North Dakotans, who are more likely to have an experience history with mountain lions, would be less supportive of mountain lion protection than Kentuckians.

Related Literature

Research in states with established breeding populations of mountain lions has documented varying attitudes toward mountain lions and levels of support for mountain lion management. Past studies have shown that sociodemographics, behavioral characteristics, values, beliefs, and affective responses can influence attitudes toward mountain lion management.

Researchers have investigated antecedents of attitudes toward mountain lion hunting practices with somewhat different results. Teel et al. (2002) surveyed Utah residents and found general opposition to mountain lion hunting. Men, younger respondents, those with lower levels of formal education, longtime rural residents, and hunters were more supportive of various mountain lion hunting practices than their counterparts. Similar to Teel et al., a survey of residents living near Saguaro National Park in Arizona documented general opposition to mountain lion hunting on both public and private land; men in particular were more supportive of hunting practices than women (Casey et al., 2005). In contrast to Teel et al., older respondents were more supportive of controlling mountain lions than younger respondents. Mountain lion experience history (i.e., having observed a mountain lion in the past) increased respondents' support for mountain lion protection. Williams, Ericsson, and Heberlein's (2002) study of public support for wolves/wolf (*Canis Lupus*) reintroduction, however, revealed that experience history had a negative influence on attitudes.

Other researchers have focused on beliefs, perceived risk, and attitudes toward mountain lions. Riley and Decker (2000), for example, found that beliefs about current population levels, perceptions of risk, and attitudes were important predictors of mountain lion acceptance among Montana residents. Those who had positive attitudes toward mountain lions, who perceived low levels of risk, and who believed populations were decreasing had higher acceptance of future increases in mountain lion populations. In this study neither gender nor mountain lion experience history had a significant influence on mountain lion acceptance. Zinn and Pierce (2002), however, revealed that women and respondents with children living at home perceived greater risk than their counterparts in Colorado. Despite perceiving higher risk, women were more supportive of mountain lion protection than men. This finding suggests that risk perceptions may not be indicative of support of mountain lion management.

Wildlife value orientations, basic beliefs, and affective responses may shape attitudes toward predators and their management. Zinn and Pierce (2002), for example, found significant differences between respondents expressing varying wildlife value orientations. Respondents who expressed utilitarian or wildlife use values favored mountain lion control more than those expressing protectionist or wildlife rights values. Bright and Manfredo (1996) examined Colorado residents' attitudes toward wolves and wolf reintroduction and revealed that symbolic beliefs about the importance of wolf existence in the state and affective responses to wolves were associated with attitudes toward the species more than factors such as knowledge about wolves or perceptions of reintroduction outcomes. As personal relevance of the issue increased, the association of symbolic beliefs and affective responses with attitudes toward wolves was strengthened. Although wolves have played a different role than mountain lions in U.S. cultural and literary history, these findings are relevant to

the present study because they offer insight into residents' attitudes toward a species that had been extirpated in their state.

Research in Illinois lends further insight into the human dimensions of mountain lions in the Midwest. Although Illinois has no established breeding populations of mountain lions, three mountain lions have been confirmed in the state since 2000 (Cougar Network, 2010). Media attention and local lore have roiled public interest in the predator, especially in southern Illinois where most of the state's public lands and suitable mountain lion habitat exist (Nielsen, 2006). Dodson (2004) conducted key informant interviews with 14 southern Illinois residents about their perceptions of mountain lions and wildlife management in the region. Seven of the 14 study participants reported past encounters with or observations of mountain lions in the wild. Several of the livestock owners, equestrians, and hunters interviewed expressed concern about the possibility of mountain lion attacks on humans and livestock. A few participants were skeptical about the origination of the mountain lions in Illinois and expressed a belief that wildlife managers have "transported [mountain lions] in from out west." Symbolic beliefs about the mountain lion's right to exist in southern Illinois varied. Several participants claimed that they would tolerate the species if human life was not threatened.

Altogether, past human dimensions research in regions with breeding populations of mountain lions supports the notion that sociodemographics, as well as human behavioral characteristics, value orientations, beliefs, affective responses, and trust in information provided by wildlife managers may shape the public's attitudes toward mountain lions and support for management actions. Given the varying effects of these variables on attitudes and management support, however, questions remain about how Midwest residents may respond to mountain lion recolonization.

Research Questions

This study was conducted to gain insight into the social context for mountain lion recolonization in the Midwest and to compare two Midwestern populations with varying geographic positions and mountain lion histories. We assessed respondents' sociodemographic and behavioral characteristics, beliefs, affective responses, trust in information, and support for management actions associated with mountain lions. Based on the literature reviewed and in light of the states' distinct mountain lion histories, we developed three research questions:

Research Question 1. Do North Dakota and Kentucky respondents differ in their behavioral characteristics, descriptive and normative beliefs, affective responses, trust in information, and support for management actions associated with mountain lions?

Research Question 2. What is the relationship between respondents' sociodemographic and behavioral characteristics, descriptive and normative beliefs, affective responses, and trust in information and their support for mountain lion protection?

Research Question 3. How does the relative importance of predictors of support for mountain lion protection differ between North Dakota and Kentucky respondents?

Methods

The overall study design coupled a probability sampling technique with a self-administered mail survey data collection method to assess North Dakota and Kentucky residents' beliefs, affective responses, and support for management actions associated with mountain lions.

Data Collection

A random sample of households stratified by urban and rural counties in North Dakota and Kentucky was drawn to ensure geographically representative data. Four counties were targeted in these states and were selected to represent a cross-section of residents living in urban and rural counties. An urban county was defined as having more than 100,000 people (U.S. Census, 2005) and more than 50 people/mile^2; a rural county was defined as having less than 100,000 people and less than 50 people/mile^2. The two urban counties contained metropolitan areas (50,000 or more people) and the rural counties did not.

Five hundred surveys were distributed to a random sample of households in each county ($n = 2{,}000$). To enhance response rates, data collection procedures generally followed Dillman (2000) and included an initial survey with a cover letter explaining the study, a reminder postcard, and a replacement survey package. Following Groves (2006), we compared our respondent sociodemographic estimates with 2000 U.S. Census data to analyze nonresponse bias.

Survey development was informed by a literature review, discussions with wildlife scientists and managers, a pilot study of Illinois stakeholders' perceptions of mountain lions (Dodson, 2004), peer and institutional reviews of draft instruments, and instrument pretests. Previously tested scale items and fixed-choice questions were adapted and used when available. Several scale items (Tables 1 and 2) were adapted from Corona Research

Table 1
Respondents' sociodemographic and behavioral characteristics by state

		Percent		
	n	ND	KY	χ^{2a}
Gender (female)	632	27.2	29.9	.535
Highest level of formal education	573			5.968
8th grade or less		5.1	6.9	
Some high school, no diploma, or GED		2.6	5.0	
High school graduate or GED		31.5	30.9	
Some college, no degree		19.0	17.9	
Associate degree		12.2	10.7	
Four year degree		18.3	14.5	
Some graduate school		3.2	3.1	
Masters, Ph.D., or professional degree		8.0	11.1	
Sources of most information about mountain lions during the past 12 months[b]	565			221.147**
Local news media		43.8	1.6	
Family, friends, or neighbors		17.5	8.4	
None of the above		8.6	44.8	
Television nature programs		7.6	22.4	
Own livestock	651	16.8	24.0	5.247*
Hunted in past 12 months	590	50.6	36.7	11.220**
Past experience with a mountain lion	651	47.9	22.5	43.624**

[a]Pearson's chi-square.
[b]Only top four sources are reported here.
*$p \leq .05$, **$p \leq .001$.

Table 2
Beliefs, affective response, and support for management actions by state

		M (*SD*)			
	n	ND	KY	*t*-value	eta-squared
Descriptive beliefs about mountain lion abundance in state					
[a]How common are mountain lions in the state?	642	3.30 (0.74)	2.46 (0.86)	12.08**	.212
Descriptive beliefs about encounters with mountain lions					
[b]Likelihood of respondent or household member encountering a mountain lion in the wild	572	1.96 (0.80)	1.57 (0.79)	−5.81**	.056
Normative beliefs about mountain lion existence					
[c]Mountain lions should have the right to exist wherever they may occur	606	3.76 (2.07)	3.82 (2.25)	0.30	.000
Affective response to mountain lions					
[d]In general, do you dislike or like mountain lions?	647	2.16 (0.64)	1.96 (0.74)	3.51**	.008
Trust in information about mountain lion existence in state					
[e]To what extent do you trust in information provided by wildlife managers about mountain lion presence in state?	646	3.19 (0.93)	2.92 (1.07)	−3.36**	.018
Agreement with mountain lion management actions (italicized mountain lion control items given negative values in index)					
[c]*Allow people to kill mountain lions threatening them or their families*	623	6.52 (1.05)	6.55 (1.21)	0.24	.000
Take action against individual mountain lions that are dangerous to people	620	6.39 (1.09)	6.16 (1.43)	−2.18*	.008
Require or expect people that live in mountain lion habitat to learn about mountain lions and take reasonable actions to reduce their risk	613	6.01 (1.34)	5.78 (1.75)	−1.81	.006
Reduce mountain lions in areas where mountain lions have been involved in recurring conflicts with humans	610	5.99 (1.35)	6.20 (1.44)	1.79	.005
Allow people to kill mountain lions threatening their pets	613	5.94 (1.45)	6.22 (1.38)	2.37*	.009

Support and/or conduct research to learn more about mountain lion populations	605	5.94 (1.26)	5.47 (1.82)	−3.53**	.023
Allow people to kill mountain lions threatening their livestock	616	5.93 (1.54)	5.97 (1.66)	0.29	.000
Require or expect livestock owners in mountain lion habitat to learn about mountain lions and take reasonable actions to reduce risk to their livestock	619	5.91 (1.46)	5.84 (1.77)	−0.55	.001
Work with local governments to plan development to minimize human/wildlife conflict	600	5.76 (1.48)	5.64 (1.79)	−0.91	.001
Maintain opportunities to hunt mountain lions	598	5.45 (1.66)	4.16 (2.24)	−7.76**	.100
Develop programs to compensate livestock owners for financial losses related to mountain lion attacks	600	5.41 (1.74)	5.69 (1.69)	1.92	.006
Work with other agencies to restrict human activities where mountain lions have been unusually active	593	4.96 (1.94)	5.36 (1.96)	2.45*	.010
Overall index score (cases with missing data excluded)	510	−2.45 (7.68)	1.48 (9.56)	1.22	.003

[a]Responses based on 5-point scale from 1 (they do not exist in the state) to 5 (very common).
[b]Responses based on 4-point scale from 1 (no likelihood) to 4 (high likelihood).
[c]Responses based on 7-point scale from 1 (strongly disagree) to 7 (strongly agree).
[d]Responses based on 3-point scale where 1 is "dislike," 2 is "neutral," and 3 is "like."
[e]Responses based on 5-point scale from 1 (not at all) to 5 (extremely much).
*$p \leq .05$, **$p \leq .001$.

(2006), Bright and Manfredo (1996), Riley and Decker (2000), and Casey et al. (2005). In addition to demographic variables, we inquired about multiple behavioral characteristics thought to increase personal relevance including ownership of livestock, participation in hunting in the past 12 months, and past experience with a mountain lion. These behavioral variables were converted to dummy variables. The latter variable, adapted from Riley and Decker (2000), was created by combining responses to three questions associated with experiencing a mountain lion: (a) respondent, family member, friend, or neighbor observed a mountain lion within the community, (b) respondent's pet or livestock threatened by a mountain lion, and (c) respondent observed a mountain lion in the wild. A "yes" response to any one of these items translated into a "yes" response on the mountain lion experience variable. Source of information about mountain lions during the past 12 months was measured with 11 potential sources and an "other" response.

We also measured beliefs about the abundance of mountain lions in the state and the likelihood that the respondent or a household member would encounter a mountain lion in the wild. One item, adapted from Riley and Decker (2000), represented normative beliefs about mountain lion existence in the state. This variable was measured on a 5-point scale from "they do not exist" to "very common." The likelihood of encountering a mountain lion variable was measured on a 4-point scale from "no likelihood" to "high likelihood." Both beliefs items included an "unsure" option.

Affective responses to mountain lions were measured using a 3-point scale adapted from Bright and Manfredo (1996) that asked respondents if they, in general, dislike, are neutral, or like mountain lions. This question attempted to elicit an affective, evaluative expression that is current and may be influenced by current conditions such as an individual's mood or a recent media story.

Several questions addressed sources of and trust in information. Respondents were asked to report on the extent to which they trust *information provided by wildlife managers* about mountain lion presence in their state. Trust in information was measured on a 5-point scale from "not at all" to "extremely much." Finally, we included a list of 12 mountain lion management action options adapted from Corona Research (2006) and developed in collaboration with biologists and wildlife managers. Support for the management options was measured on a 7-point scale from "strongly oppose" to "strongly support." Six of the management options represented strategies that would control mountain lion populations (e.g., allow people to kill mountain lions threatening them or their families and maintain opportunities to hunt mountain lions) and six of the management options represented strategies intended to protect mountain lions (e.g., require or expect people that live in mountain lion habitat to learn about mountain lions and take reasonable action to reduce their risk and work with other agencies to restrict human activities where mountain lions have been unusually active). The options represented a range of aggressive and passive management tactics.

Data Analysis

Chi-square, *t*-tests, and correlations (eta-squared) were used to determine if North Dakota and Kentucky respondents differed on the variables of interest. To test our second and third research questions, we created a mountain lion protection index (MLPI) score by summing the response values of the 12 mountain lion management action items (Table 3). Items representing actions that *protect* mountain lions were scored as positive values, while items representing actions that *control* mountain lions were scored as negative values in the index. MLPI scores could range from +36 (highest support for mountain lion protection) to −36 (lowest support for mountain lion protection). Four nested multiple regression

Table 3
Nested multiple regressions of support for mountain lion protection

	β[a]	R^2_{adj}	*F*-change	*n*
Equation 1		.013	3.901*	434
Female	.105*			
Age	.084			
Equation 2		.110	16.791**	431
Female	.019			
Age	.020			
Own livestock	−.049			
Hunted in last 12 months	−.303**			
Mountain lion experience history	−.063			
Equation 3		.113	1.602	429
Female	.019			
Age	.014			
Own livestock	−.048			
Hunted in last 12 months	−.288**			
Mountain lion experience history	−.043			
Descriptive belief abundance in state	−.003			
Descriptive belief encounter likelihood	−.085			
Equation 4		.272	32.231**	426
Female	.045			
Age	.068			
Own livestock	.030			
Hunted in last 12 months	−.262**			
Mountain lion experience history	−.030			
Descriptive belief abundance in state	−.021			
Descriptive belief encounter likelihood	−.073			
Normative belief right to existence	.195**			
Trust in information	.076			
Affective response toward mountain lions	.256**			

[a]Standardized multiple regression coefficient (beta weight).
*$p \leq .05$, **$p \leq .001$.

equations examined the relationship between the independent variables: age, gender (a dummy variable), behaviors (dummy variables), descriptive beliefs, normative beliefs, affective responses, and trust and the dependent variable: MLPI. The adjusted R^2, change in *F*-statistic, and beta weights were calculated for the first four nested equations. We then examined how well the variables that were significant predictors in the nested equations predicted MLPI scores across three groups: all respondents, North Dakota respondents, and Kentucky respondents. To enable comparisons of the effects of the independent variables on MLPI scores across the three sample groups, unstandardized multiple regression coefficients were reported along with beta weights, *t*-values, *F*-values, and R^2 (Bohrnstedt & Knoke, 1994).

Results

Of our original random sample of 2,000 households, 651 questionnaires were completed and returned. Four surveys were returned undeliverable for a final response rate of 33%.

North Dakotans (38%) were more likely to respond to the survey than Kentuckians (28%). Two-fifths (42%) of the respondents lived in a zip code that intersected or was adjacent to a metropolitan area. To assess potential non-response bias, we examined respondents' sociodemographic profile based on 2000 U.S. Census data for the four counties represented in the study. Some differences were noted. For instance, males comprised from 49 to 51% of the population in the study counties; our sample had a higher proportion of males (69%). The census reported residents' median age ranging from 32 to 41, while survey respondents' median age was 55. The census reported from 3 to 6% of the counties' population over the age of 25 had a bachelor's degree or higher. In our study, however, 29% of respondents over the age of 25 had a bachelor's degree or higher. Based on these differences, study respondents were more likely to be male, older, and potentially had higher formal education levels than non-respondents. These limitations should be considered when generalizing study findings to the larger population of residents in these counties.

Research Question 1

No significant differences were observed between the two states' respondents in age (North Dakota $M = 55$, Kentucky $M = 54$), gender, or level of formal education (Table 1). North Dakota and Kentucky respondents, however, varied in their behavioral characteristics. Kentucky respondents were more likely than North Dakota respondents to own livestock ($p \leq .05$), while North Dakota respondents were more likely to have hunted in the past 12 months ($p \leq .001$) and to have had a past experience with a mountain lion ($p \leq .001$). Differences were also observed in respondents' sources of most information about mountain lions during the past 12 months ($p \leq .001$). North Dakota respondents' primary sources of information about mountain lions were local news media (44%), and family, friends, or neighbors (18%), whereas Kentucky residents' primary sources were "none of the above" (45%), indicating they had not received information from any of the sources listed during the past 12 months, and television nature programs (22%).

Significant differences were found between respondent groups in their descriptive beliefs about mountain lions (Table 2). When compared to Kentucky respondents, North Dakota respondents believed mountain lions to be more common in their state ($p \leq .001$) and that they or members of their household are more likely to encounter a mountain lion in the wild ($p \leq .001$). Twenty-one percent of the variation in beliefs about the abundance of mountain lions in the state and almost 6% of the variation in beliefs about the likelihood of encountering mountain lions in the wild can be accounted for by respondents' state of residence. Respondent groups did not differ statistically in their agreement with the normative belief that mountain lions should have the right to exist wherever they may occur. Responses overall to this item, however, were highly variable ($SD > 2.00$). Other statistically significant differences that had important relationships with state of residence included trust in information provided by state wildlife managers, support for research and support for maintaining opportunities to hunt mountain lions. On average, both groups "moderately trusted" information provided by wildlife managers about the presence of mountain lions in their state. North Dakota respondents were more trusting than Kentucky respondents of information about mountain lions provided by state wildlife managers ($p \leq .001$), and about 2% of the variance in trust can be attributed to state of residence.

Across both groups the mountain lion management options that garnered the highest and lowest agreement were "allow people to kill mountain lions threatening them or their families" and "work with other agencies to restrict human activities where mountain

lions have been unusually active," respectively (Table 2). The greatest disparities between groups were found in the actions associated with maintaining opportunities to hunt mountain lions and supporting or conducting research about mountain lions ($p \leq .001$). North Dakota respondents agreed to a greater extent than Kentucky respondents with initiatives that maintain opportunities to hunt mountain lions and that support mountain lion research. State of residence accounted for about 10% and 2% of the variation in these items, respectively. The MLPI score in which negative values suggest overall support for mountain lion *control* and positive values suggest overall support for mountain lion *protection* revealed no significant statistical difference between the two groups. Both groups scored close to neutral on the index.

Research Question 2

To understand the relationship between the independent variables and the dependent variable, MLPI, four multiple regression models were examined (Table 3). Model 1 examined the effects of demographic characteristics on support for mountain lion protection. Demographic characteristics alone explained less than 2% of the variance in support for mountain lion protection. Gender and age were significant predictors in this model; female and older respondents were more likely to support mountain lion protection than younger males. Model 2 added behavioral characteristics, which significantly increased the relationship between the independent variables and support for mountain lion protection ($p \leq .001$), although this relationship explained only 11% of the variance in the MLPI. The only significant indicator of support for mountain lion protection was hunting participation ($p \leq .001$). Participation in hunting at least once in the last 12 months significantly decreased respondents' support for mountain lion protection. Mountain lion experience history was not a significant predictor.

Model 3 added two descriptive belief variables, perceptions of mountain lion abundance in the state and likelihood of encountering mountain lions in the wild, neither of which had a significant effect on support for mountain lion protection; participation in hunting was the only significant predictor. Addition of the descriptive belief variables did not significantly improve model fit. Model 4 included all of the predictor variables and explained 27% of the variance in support for mountain lion protection. As with Models 2 and 3, participation in hunting was the strongest predictor variable, but the normative belief and affective response variables also had significant and positive relationships with support for mountain lion protection. Respondents who "like" mountain lions and who believe mountain lions should have the right to exist wherever they may occur expressed higher support for mountain lion protection. Model 4 produced the biggest change in overall model fit ($p \leq .001$).

Research Question 3

To test for differences between the effects of predictor variables on MLPI, regression equation was examined for all respondents, North Dakota respondents, and Kentucky respondents. The final model included all significant independent variables identified in the previous nested models (Table 4). The final model explained 26% of the variance among all respondents, 22% of the variance among North Dakota respondents, and 31% of the variance among Kentucky respondents. Participation in hunting was the strongest predictor overall and was significant in predicting support for mountain lion protection among both North Dakota and Kentucky respondents. Hunting participation reduced the MLPI

Table 4
Final multiple regression for samples of all respondents, North Dakota respondents, and Kentucky respondents

	B^a	β^b	t-value	R^2_{adj}	F	n
All				.263	41.786**	458
Intercept	−9.469		−7.591**			
Female	.831	.042	.996			
Hunted in last 12 months	−5.061	−.297	−7.112**			
Normative belief existence	.800	.202	4.398**			
Affective response	3.107	.256	5.525**			
ND				.218	19.595**	268
Intercept	−7.063		−4.445**			
Female	.085	.005	.080			
Hunted in last 12 months	−5.291	−.343	−5.973**			
Normative belief existence	.877	.236	3.931**			
Affective response	1.946	.172	2.847*			
KY				.310	22.244**	190
Intercept	−12.392		−6.178*			
Female	1.400	.064	1.051			
Hunted in last 12 months	−4.561	−.235	−3.761**			
Normative belief existence	.609	.145	1.963			
Affective response	4.766	.365	4.900**			

[a]Unstandardized multiple regression coefficient.
[b]Standardized multiple regression coefficient (beta weight).
*$p \leq .01$, **$p \leq .001$.

score by almost 5 points on average; hunters were more supportive than non-hunters of controlling mountain lions.

Affective responses toward mountain lions also had a highly significant positive relationship with support for mountain lion protection with both groups, although this variable's effect was stronger for Kentucky respondents. While a one unit increase in positive affective responses about mountain lions raised Kentucky respondents' MLPI score almost five points, the same increase raised the North Dakota respondents' score only about two points. North Dakota respondents' support for mountain lion protection also was influenced significantly by the normative belief that mountain lions should have the right to exist wherever they occur. This variable, however, was not a significant predictor of Kentucky respondents' support for mountain lion protection. Among Kentucky respondents, non-hunters who had positive affective responses toward mountain lions were most supportive of mountain lion protection. In contrast, predicting North Dakota respondents' support for mountain lion protection was more complex. Non-hunting North Dakota respondents, who believed in mountain lion existence value and had positive affective responses toward mountain lions, were most supportive of mountain lion protection.

Discussion and Implications

As predicted, North Dakota and Kentucky respondents differed in many of the variables examined. Given their differences in geographic positions and mountain lion status, we

were not surprised to find that respondents in North Dakota were more likely than those in Kentucky to report an experience history with mountain lions. Similarly, North Dakota respondents were more likely to believe that mountain lions are common in their state and that they or their family members may encounter a mountain lion in the wild. State of residence did not appear to have a strong relationship with affective responses to mountain lions or normative existence beliefs. While both respondent groups had near "neutral" affective responses toward mountain lions on average, a high level of variability about the mean existed. Respondent groups did not differ significantly over the right of mountain lions to exist wherever they occur; responses to this normative belief overall were neutral. North Dakota respondents expressed more trust in information about mountain lions provided by wildlife managers. We anticipated that respondents' support for mountain lion management actions would vary by state. While this was the case for two individual mountain lion management action items (e.g., North Dakota respondents were more supportive of hunting practices and of mountain lion research), the respondent groups did not vary significantly in their overall support for mountain lion protection.

The demographic and behavioral variables we anticipated would influence support for mountain lion protection had mixed effects. When compared to previous studies in western states where mountain lions have long been part of the social-ecological landscape, we found some interesting contrasts. Unlike Teel et al. (2002), Zinn and Pierce (2002), and Casey et al. (2005), gender, age, and level of formal education ultimately had no effect on our Midwest respondents' overall support for mountain lion protection. Casey et al. (2005) found that mountain lion experience history (i.e., having previously observed a mountain lion) increased Arizona respondents' support for mountain lion protection. Yet our study revealed no relationship between experience history and support for mountain lion protection much like Riley and Decker (2000). Riley and Decker (2000) showed that descriptive beliefs about population levels and risk associated with mountain lion encounters influenced mountain lion acceptance. While we did not measure perceived risk associated with mountain lions, we found that descriptive beliefs about the abundance of mountain lions in the state and the likelihood of encountering mountain lions were not indicators of support for mountain lion protection. Perhaps the relative novelty of mountain lion presence in the Midwest explains the lack of influence of these demographic and behavioral variables on support for mountain lion protection.

The variable that had the most influence on respondents' support for mountain lion management options was hunting participation. For both groups, hunters were more likely to agree with management policies that control rather than protect mountain lions. These findings are confirmed by other studies that establish substantial differences between hunter and non-hunter wildlife value orientations and fundamental beliefs (Fulton, Manfredo, & Lipscomb, 1996; Hrubes, Ajzen, & Daigle, 2001). Those who hunt or support hunting tend to express values aligned more strongly with utilitarian or dominionistic values than wildlife rights. They are more likely to hold beliefs that humans should use wildlife for human benefit or express dominance over wildlife (Fulton et al., 1996; Hrubes et al., 2001). According to the value-attitude-behavior cognitive hierarchy theory, values and fundamental beliefs are primary drivers of attitudes and behaviors. The normative belief assessed directly in our study, that mountain lions should have the right to exist wherever they may occur, is consistent with wildlife existence or symbolic values. This variable emerged as a powerful indicator of support for mountain lion protection among North Dakota respondents. Interestingly, this existence belief had no effect on Kentucky respondents' support for mountain lion protection. The predictive ability of existence beliefs may be a function of a populations' experience with potentially recolonizing

predators and as Bright and Manfredo (1996) demonstrated, the personal relevance of the predator.

The respondent groups differed in the variables that predicted attitudes toward mountain lion management actions. Among the North Dakotans, support for mountain lion protection was complex, though primarily a function of the basic normative belief that mountain lions should have the right to exist wherever they occur. Affective responses (i.e., liking or disliking mountain lions) were related to attitudes toward mountain lion management, although somewhat less pronounced than existence beliefs. In contrast, Kentuckians' support for mountain lion protection was more straightforward, resting largely on the current emotional appeal of the animal—simply whether residents like or dislike mountain lions. These findings partially support Bright and Manfredo (1996) who concluded that both symbolic existence beliefs and affective responses to another large predator, the wolf, were strong predictors of attitudes toward wolf reintroduction. The effects of these variables are amplified when personal importance of the topic (e.g., importance of keeping current on wolf reintroduction) is high (Bright & Manfredo, 1996).

Despite the recent increase in both established mountain lion populations and confirmations of individual mountain lions in the Midwest (Cougar Network, 2010), the personal relevance of mountain lions or the need for strong attitudes about how the species might best be managed have not diffused broadly across the region. Study respondents were generally in agreement with all of the management actions listed regardless of the actions underlying intent—to control or protect the species—which resulted in neutral mountain lion protection index scores. These findings also are supported by studies of public attitudes toward another large predator, wolves (Williams et al., 2002). It is likely that as the potential for mountain lion confirmations or recolonization in a particular state or community increases, the need for residents to consider the implications will intensify, and the personal relevance of the mountain lion management will elevate. In turn, residents' attitudes toward the species and its management may become stronger, more complex, and potentially increasingly polarized (see Williams et al., 2002 for discussion).

As managers address potential recolonization of mountain lions in the Midwest as well as a new social-ecological reality for human communities, targeted communication with diverse groups will be critical. Our study implies a contrast of public attitudes toward mountain lions in two Midwestern states, not in their direction but in their antecedents or sources. Hunting was a major predictor variable for both groups. Given hunters' propensity to hold basic values associated with human dominance over wildlife and that basic values are typically difficult to change, traditional hunter information and education programs may not be effective (Fulton et al., 1996). It may be more important to highlight the linkages between mountain lion protection and utilitarian values such improving the health of deer and other game populations.

Some interesting differences between the two states also emerged. Public attitudes toward mountain lion management in North Dakota, where established populations of mountain lions exist, appear to be deep-rooted, founded predominantly on existence beliefs but also shaped somewhat by affective responses to the predator. However, in Kentucky, where no mountain lion presence has been confirmed, public attitudes toward mountain lion management appear to be driven chiefly by affective responses toward mountain lions. Affective responses may be an expression of stable underlying evaluative tendencies toward the attitude object, in this case mountain lions (Eagly & Chaiken, 2007). However, they may instead be a function of current context such as recent media coverage or an individual's mood. At this early stage of potential recolonization, Kentucky residents' support for mountain lion protection may be more impressionable than that of North Dakota

residents given that affective responses are less stable than attitudes based in fundamental values, as suggested by the cognitive hierarchy theory (Fulton et al., 1996).

Overcoming residents' limited trust in information managers provide about the presence of mountain lions in their state may be difficult. Wildlife managers may be reticent to initiate a dialogue about the possible presence of mountain lions in states like Kentucky for fear of alarming residents. In Dodson's (2004) exploratory study of key stakeholder perceptions of mountain lions in southern Illinois, however, the lack of credible information from wildlife managers only spurred misconceptions, prompted conspiracy theories, and charged emotions through local "myth-building." In this Illinois study, the socially constructed reality of mountain lions ranged from ecological possibility to impending calamity because of a variety of unsubstantiated local accounts, publication of mountain lion lore in popular local media, and story-telling about mountain lion sightings often prompted by unintended misidentification of bobcats or house pets.

Where attitudes toward large predators are relatively weak or neutral, they may strengthen or change quite swiftly (Williams et al., 2002). We recommend that policy makers, managers, and environmental educators in Midwestern states act preemptively in the dissemination of information about mountain lions and their potential recolonization. Rather than forcing residents to rely on television nature programs, like many of our Kentucky respondents did for their information about mountain lions, local wildlife managers, and environmental educators can provide critical and balanced information on mountain lion identification, behavior, ecology, and management options. It should be recognized that the apparent time period for the most effective dissemination of information about large predators coincides with the earliest stages of potential recolonization, while the prevailing public predisposition to the species remains neutral.

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