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Assessing Illinois Residents' Support for Natural Recolonization of Apex Predators

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Abstract
Understanding sources of difference in public attitudes toward wildlife is critical for the design of effective policy instruments. In this article we explored the role of wildlife value orientations and stakeholder group membership (general public versus agricultural producers) in shaping residents support for the natural recolonization of apex predators (black bear, cougar, gray wolf), in Illinois, USA. Results demonstrate differences in attitudes toward recolonization as a function of residents' basic beliefs about the human-wildlife relationship and stakeholder group membership. Results revealed varying degrees of opposition and/or antipathy toward recolonization of apex predators across wildlife values types and stakeholder groups. Individuals that were identified to hold utilitarian beliefs about wildlife (traditionalist orientation) and agricultural producers were found to exhibit the most negative attitudes toward natural recolonization, compared to individuals that believe wildlife have intrinsic rights (mutualist orientation) or members of the general public. Individuals' attitudes toward the recolonization of black bears were found to differ according to their wildlife value orientations, stakeholder group membership, and the combination of the two factors.

Keywords Wildlife value orientations · Attitudes toward predators · Natural recolonization · Wildlife management

Introduction

Humanity's tolerance for predators has implications for the long-term sustainability of predator populations (Treves and Karanth 2003; Treves and Bruskotter 2014). Understanding the factors that shape the publics' attitudes toward predators has proven critical for the design of effective policy (Saunders et al. 2006). Growth in predator numbers in areas of high human use and occupation is a concern for agencies tasked with managing wildlife populations and attending to perceived risks of public stakeholders (Chavez et al. 2005). Illinois, USA, has seen an increase in the incidence of predators within its boundaries, including black bears (*Ursus americanus*), cougars (*Puma concolor*), and gray wolves (*Canis lupus*). The potential recolonization of these predators presents an opportunity for restoration toward a more complete assemblage of mammalian fauna, and the realization of associated ecosystem functioning benefits (Beschta and Ripple 2009; Ritchie et al. 2012). From a political perspective, however, prospects of recolonization present potential conflict as different stakeholders, and individuals within stakeholder groups, may hold different attitudes toward the recolonization of these species (Toledo et al. 2011; Wald and Jacobson 2014).

Heterogeneity in basic beliefs about wildlife within and between stakeholder groups may highlight differences in higher order evaluations (e.g., attitudes, behaviors) of issues related to conservation, including the restoration of apex predators (Kellert 1985; Zinn et al. 2000; Bright et al. 2002). Individuals occupying different stakeholder groups in society may also evaluate proposed policies and changing ecological conditions differently as a function of perceived costs and benefits (Marshall et al. 2007; Gore and Kahler 2012; Hermann et al. 2013). In this study, we draw on cognitive hierarchy theory (Fulton et al. 1996; Vaske and Donnelly 1999) to understand support for the recolonization of apex predators in Illinois. We characterize basic beliefs about wildlife using the wildlife value orientations scale, and explore differences in values and support for the natural recolonization of gray wolves, black bears, and cougars among individuals in two stakeholder groups within the

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state of Illinois (agricultural producers and the general public). Results of this work inform the development of management plans for these three species directed by the state legislature in the face of growing numbers of observations and rising public concern.

Study Context

Wolves, black bears, and cougars have garnered attention from wildlife managers throughout the Midwestern U.S. due to increased sightings. As of 2014, no breeding populations of these species were present in Illinois, however, nearby states had growing populations. Bear and wolf populations in neighboring Wisconsin are assumed likely sources of individuals found in Illinois, whereas the nearest populations of cougars are located in the Dakotas and Nebraska. Regardless of source, observations of all three species have increased in Illinois.

The Illinois Department of Natural Resources (IDNR) has confirmed sightings of three black bears since 2008, four cougars, and 11 wolves since 2002. In most cases the individuals were young males, suggesting that they were likely juveniles in search of new territory. Although habitats for black bears, cougars and gray wolves are limited in the state, the increased presence of these species encouraged state legislators to pass SB 3049, a bill that mandated IDNR to add all three to the list of species protected under the Illinois Wildlife Code (beginning January 1, 2015). Different stakeholders throughout the state have voiced both concerns and support for their recolonization. The IDNR has endeavored to evaluate public support for alternative courses of action to manage black bears, cougars and wolves, and address potential conflicts between different stakeholders. This study was conducted with these concerns in mind.

Conceptual Model: The Cognitive Hierarchy

Attitudes toward specific objects such as bears, wolves, or cougars exist in a cognitive hierarchy rooted in basic personal values (Schwartz 1994; Schwartz and Bilsky 1987). This hierarchy has been described by some as an inverted pyramid whereby a few enduring values sit at the bottom and many, increasingly specific and context dependent attitudes and behaviors exist at the top (Fulton et al. 1996; Vaske and Donnelley 1999; Jacobs et al. 2014). Values are abstract and characterized as trans-situational beliefs about "desirable end states or modes of conduct" (Schwartz 1994, p. 20). These fundamental values, in turn, influence basic beliefs about general classes of attitude objects such as wildlife, and basic beliefs influence more specific beliefs, norms, attitudes, emotions and behaviors (Whittaker et al. 2006).

Wildlife value orientations are patterns of beliefs about the relationships between humans and wildlife. Fulton et al. (1996 p. 28) suggest that WVOs "provide consistency and organization among the broad spectrum of beliefs, attitudes, and behaviors regarding wildlife," and serve as evaluative criteria for individuals to judge, think, and act toward wildlife. WVOs are potentially important predictors of individuals' evaluations of apex predators and their recolonization (Jacobs et al. 2014), and provide a mechanism for characterizing stakeholder responses to proposed policies and the design of public education campaigns that attempt to garner support.

Drawing on research exploring the dimensionality of WVOs (e.g., Fulton et al. 1996), Teel and Manfredo (2009) hypothesize that there are four dimensions of basic beliefs about wildlife that reflect two over-arching value orientations: domination and mutualism. A mutualism orientation is defined by beliefs about caring and social affiliation with wildlife. Individuals who possess a strong mutualism orientation believe that wildlife and humans are part of one community, that wildlife are deserving of similar rights as humans, and have a positive emotional bond with wildlife. Alternatively, a domination orientation is characterized by a utilitarian ethos, and reflected in positive beliefs about hunting and the appropriate use of wildlife to fulfill human needs[1]. Individuals who possess a domination orientation believe that it is appropriate for wildlife to be used in a manner benefitting humanity, and that humans exist apart from nature.

Individuals can be further categorized into "types" by the strength of their acceptance of these two orientations (Teel and Manfredo 2009), as orientations can be interpreted as group level variables reflecting patterns of shared beliefs (Pratto 1999). Individuals who possess both high mutualism and high domination wildlife values have been referred to as pluralists, referencing the diversity in their beliefs about human-wildlife interactions. Individuals who hold strong mutualism beliefs and weak domination beliefs have been referred to as mutualists, whereas individuals who hold strong domination beliefs and weak mutualism beliefs have been referred to as traditionalists, referencing a utilitarian view of the value of wildlife, and emerging trends in the growth of mutualism among the American public (Manfredo et al. 2017). By contrast, individuals who have weak beliefs on both orientations are said to be distanced from wildlife, and are not likely to hold strong or stable attitudes toward wildlife (Fig. 1). This typology has utility in exploring within group and between group differences in

[1] It should be noted that the WVO scale is most applicable to western society. Native cultures, for instance, likely have a different view of wildlife generally, and how hunting fits within cultural norms.

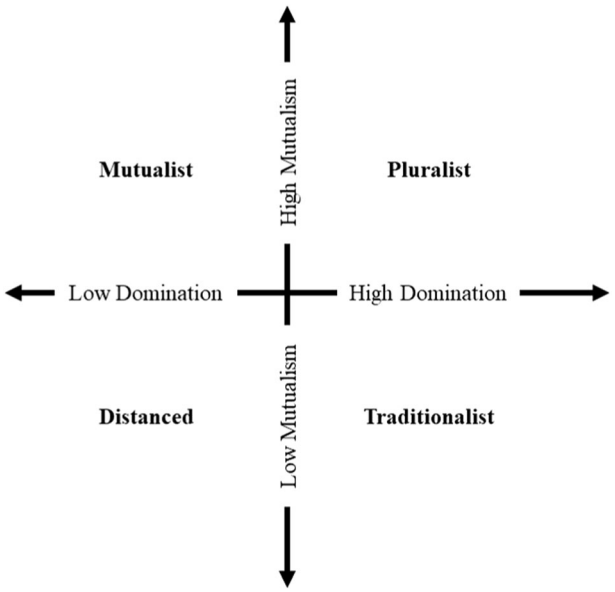

Fig. 1 Wildlife value orientation types. Types are determined by scores on mutualism and domination orientations

basic beliefs about wildlife, and subsequent evaluations of more salient wildlife related issues (Manfredo et al. 2017).

Past research has found that WVOs can explain meaningful variance in stakeholders' attitudes toward wildlife and its management. Studies have documented relationships between WVOs and support or opposition for the lethal management of wildlife (see, for example, Dougherty et al. 2003; Whitaker et al. 2006; Sijtsma et al. 2012; Jacobs et al. 2014). Whereas others have explored the role of WVOs in shaping attitudes toward the reintroduction of controversial ungulates and predators (Hermann et al. 2013), ecosystem restoration (Bright et al. 2002), and the publics' evaluations of wildlife related messages (Miller et al. 2018). Generally, studies have found that mutualists are less accepting of the lethal management of wildlife, and are more tolerant of controversial species like wolves and bison, whereas the opposite has been found among individuals with a domination orientation. Although past research has demonstrated that WVOs are strong predictors of public attitudes toward wildlife, fewer studies have explored relationships between WVOs and attitudes toward reintroduction/recolonization of predators, or how patterns of WVOs vary between stakeholder groups (Kellert 1985; Hermann et al. 2013).

Patterns of beliefs, however, differ both within and between stakeholder groups. Value differences, in part, provide mechanisms for the formation of in-group identity, and thus, points of contrast in beliefs associated with individuals who identify with different social groups (Wildavsky 1987; Brewer 1991). Stakeholder groups may share values, and identification with a group may influence specific attitudes and reinforce underlying beliefs (Pratto 1999). This is important when examining how different groups in society respond to proposed conservation policies and changing ecological conditions; especially when different stakeholder groups have vested interests in outcomes that influence their evaluations (Marshall et al. 2007). The social context and the influence of one's social group can shape belief structures as individuals seek to conform to prototypical patterns of thought and behavior associated with in-group identities (Tajfel 1982). Individuals within stakeholder groups may also have more similar evaluations of predators as a function of the perceived costs and benefits associated with the outcomes of conservation management decisions, in addition to holding shared patterns of beliefs about wildlife that exist across the spectrum of stakeholder interests (Lischka et al. 2008; Bruskotter et al. 2009; Gore and Kahler 2012; Hermann et al. 2013). In the context of this study, for instance, the perceived risk burden stemming from a cougar population perceived to be growing in Illinois is likely very different for a Chicago urbanite than it is for an agricultural producer with livestock (Riley and Decker 2000). Given these distinctions, the dominant value orientation of one stakeholder group may not be the same as another, and differences in stakeholder roles and belief structures can manifest in preferences for policy alternatives.

Understanding sources for difference in public evaluations of changes in predator populations will aid in the development of responsive and acceptable public policy, and reveal mechanisms for targeted education and outreach activity associated with policy proposals (Saunders et al. 2006; Heberlein 2012). In this article we explore support for the natural recolonization of apex predators among residents in Illinois, USA. Of specific interest to this study is the differences in WVOs between agricultural producers and members of the general public, as past work has demonstrated substantive difference between these stakeholder groups and their evaluations of predator management (Lute and Gore 2014; Hermann et al. 2013; Bruskotter et al. 2009). Agricultural producers exhibit particularly negative attitudes toward predators (Bruskotter et al. 2009), and have a strong vested interest in predator management decisions. Specifically, we hypothesize that individuals' attitudes toward the recolonization of three predator species in Illinois are a function of two factors; a) their wildlife value orientations and b) stakeholder group membership. Additionally, we test for interaction effects to explore whether stakeholders with certain value orientations will exhibit particularly positive or particularly negative attitudes toward the natural recolonization of apex predators.

Methods

Data Collection

Data were drawn from a statewide assessment of Illinois stakeholders' attitudes, beliefs, and behaviors associated with apex predators. The study was conducted November 2015 through February 2016. A random sample of 12,501 Illinois residents was selected as the sample frame. The sample was purchased from the firm Survey Sampling International (SSI, Fairfield, CT) and was stratified by stakeholder groups; agricultural producers ($n = 5001$) and members of the general public ($n = 7500$). These two samples were further stratified by the five geographic administration regions for the Illinois Department of Natural Resources. The sample, therefore, is geographically representative of the state of Illinois, but not weighted by population density. Individuals in the general public sample were randomly selected from a list of postal addresses of single family homes. That is, no residents of multi-unit dwellings were included in the sample. Agricultural producers were drawn from the USDA Census of Agriculture and sampled proportional to the number of acres the individual reported farming. An even distribution of individuals in both stakeholder groups was mailed a questionnaire focused on one of the three species; black bear, cougar, gray wolf. Questionnaires were aligned such that the only differences in wording were the specific species, allowing for direct comparisons. Survey instruments were administered through postal mail using a repeat mail design. Each participant was mailed a survey packet (cover letter describing the study, questionnaire, and stamped return envelope) followed 2 weeks later with a postcard reminder to non-respondents. Three complete mailings of survey packets and postcard reminders were conducted. A total of 2193 usable responses were obtained from individuals in the general public sample for an effective response rate of 34%. 2810 questionnaires sent to agricultural producers were returned usable, which resulted in a 58% response rate after accounting for non-deliverable mail. Due to limitations on funding, no checks for non-response bias were conducted. Respondents in the agricultural producer sample were 70.8% male with an average age of 62.4 years. Whereas respondents in the general public sample were slightly younger (56.6), and the sample comprised of a greater proportion of females (65.2% male).

Measurement

Stakeholders' basic beliefs about wildlife were operationalized using the wildlife value orientations scale (Fulton et al. 1996; Teel and Manfredo 2009). Four dimensions of beliefs—appropriate use, hunting, social affiliation, and caring—were measured. Appropriate use beliefs were measured with 6 items, hunting and social affiliation beliefs were measured with 4 items, and caring beliefs were measured with 5 items. WVO items were assessed on a 7-point bipolar scale where 1 = strongly disagree, 7 = strongly agree, and 4 = neither. Residents' attitude toward the natural recolonization of apex predators was measured with a single item; "I would support Illinois DNR allowing [black bears, cougars, wolves] to naturally recolonize Illinois." Attitude was measured on 5 point bi-polar scale where 1 = strongly disagree, 3 = neutral, and 5 = strongly agree.

We used confirmatory factor analysis to examine the validity of the hypothesized factor structure of the WVOs scale. Analysis was conducted in the statistical software Stata v 15 (StataCorp 2017). Models were estimated using the full information maximum likelihood method to account for missing values. Model fit was compared to criteria recommended by Hu and Bentler (1999) (Root Mean Square Error of Approximation (RMSEA) ≤ 0.07; Comparative Fit Index (CFI) ≥ 0.95; and Non-Normed Fit Index (NNFI) ≥ 0.95). Results indicated that a model testing 4 correlated belief dimensions was an acceptable, albeit low, fit for the data ($\chi^2_{142} = 3662.7$; $p < 0.01$; RMSEA = 0.07; CFI = 0.91; NNFI = 0.89), after allowing 4 pairs of indicator error terms to co-vary (Byrne et al. 1989). One item, "we should strive for a world where there is an abundance of fish and wildlife for hunting and fishing," measuring hunting beliefs was dropped from the scale due to an inadequate factor loading ($\lambda < 0.4$) (Brown 2015). Scale reliabilities for the 4 belief dimensions were found to be acceptable following established criteria (Cronbach's $\alpha =$ 0.72–0.79; Composite Reliability = 0.77–0.89) (Raykov 1997; Vaske et al. 2016). Scale reliabilities for the value orientations of domination ($\alpha = 0.75$) and mutualism ($\alpha =$ 0.87) were also found to be acceptable. Values for the Average Variance Explained (AVE) for all latent variables exceeded the threshold of 0.5 recommended by Hair et al. (2010) (Table 1).

Scale variables for mutualism and domination orientations were created from mean values of the two underlying belief dimensions (domination = appropriate use and hunting; mutualism = social affiliation and caring). Respondents were assigned to one of the four WVO types (pluralist, mutualist, traditionalist, or distanced) based on mean scores on the mutualism and domination scales. Mean scores of ≥4.5 on mutualism and domination were coded as "high", and <4.5 as "low" (Fig. 1). Individuals that possessed high mutualism and high domination were categorized as pluralists. High mutualism and low domination was categorized as mutualist. Individuals with high scores on domination and low scores on mutualism were categorized as traditionalists. Low scores on both dimensions yielded a categorization of distanced. Factor variables were also created

Table 1 Confirmatory factor analysis results, descriptive statistics, scale reliabilities, and average variance explained

	Mean (SD)	λ (SE)*
Appropriate Use ($\alpha = 0.75$; $\rho = 0.88$; AVE = 0.56)		
Humans should manage fish and wildlife populations so that humans benefit	4.34(1.90)	0.59(0.01)
The needs of humans should take priority over fish and wildlife protection	4.40(1.84)	0.74(0.01)
It is acceptable for people to kill wildlife if they think it poses a threat to their property	4.61(1.86)	0.58(0.01)
It is acceptable for people to kill wildlife if they think it poses a threat to their life	5.81(1.51)	0.71(0.01)
Fish and wildlife are on earth primarily for people to use	3.56(1.91)	0.63(0.01)
It is acceptable to use wildlife in research even if it may harm or kill them	3.80(1.85)	0.37(0.01)
Hunting Beliefs ($\alpha = 0.76$; $\rho = 0.78$; AVE = 0.52)		
We should strive for a world where there is an abundance of fish and wildlife for hunting and fishing	5.98(1.34)	–
Hunting is cruel and inhumane to the animals—reverse coded	6.02(1.57)	0.79(0.01)
Hunting does not respect the lives of animals–reverse coded	5.77(1.58)	0.77(0.01)
People who want to hunt should be provided the opportunity to do so	6.11(1.23)	0.60(0.01)
Social Affiliation Beliefs ($\alpha = 0.77$; $\rho = 0.83$; AVE = 0.56)		
We should strive for a world where humans and fish and wildlife can live side by side	5.34(1.63)	0.47(0.01)
I view all living things as part of one big family	3.96(1.80)	0.81(0.01)
Animals should have rights similar to the rights of humans	3.10(1.80)	0.77(0.01)
Wildlife are like my family and I want to protect them	4.20(1.70)	0.71(0.01)
Caring Beliefs ($\alpha = 0.85$; $\rho = 0.89$; AVE = 0.62)		
I care about animals as much as I do other people	3.80(1.54)	0.70(0.01)
It would be more rewarding to me to help animals rather than people	2.87(1.69)	0.54(0.01)
I take great comfort in the relationships I have with animals	4.97(1.54)	0.78(0.01)
I feel a strong emotional bond with animals	4.51(1.64)	0.83(0.01)
I value the sense of companionship I have with animals	5.05(1.51)	0.76(0.01)
"I would support Illinois DNR allowing [black bears, cougars, wolves] to naturally recolonize Illinois."	2.76(1.45)	–

α Cronbach's alpha, ρ Composite Reliability, *AVE* average variance explained

*all factor loadings (λ) significant at critical value ≤ 0.001

representing each of the stakeholder groups (general public and agricultural producers), and species (black bears, gray wolves, cougars) for use in analysis.

Analysis

We first compared the proportion of individuals subscribing to each of the four WVO types by stakeholder group using a chi-squared test. Next, we used analysis of variance (ANOVA) to test the effects of wildlife value orientation, stakeholder group membership, and their interactive effects on individuals' support for natural recolonization of apex predators in the state of Illinois. We estimated separate models for each of the three species. The Type-III sum of squares was used to examine interaction and main effects in models with unbalanced cell frequencies (Shaw and Mitchell-Olds 1993). Where significant main-effects were observed, simple differences were further tested using post-hoc mean contrasts. ANOVA models were estimated in SPSS version 21 (IBM 2012).

Results

We found significant differences in the proportion of individuals subscribing to each of the four WVO types by stakeholder group; revealed by a chi-squared test ($\chi^2 = 384.74$ $p < 0.01$, Cramer's $V = 0.28$). A much greater proportion of mutualists (21%) were found in the general public sample as opposed to agricultural producers (6%). Conversely, agriculture producers (66%) were more likely to hold a traditionalist view of wildlife than were the general public (43%). In both stakeholder groups, a traditionalist orientation was the most common. Results for the general public sample, which is broadly representative of the population of Illinois residents as a whole, mirrors the

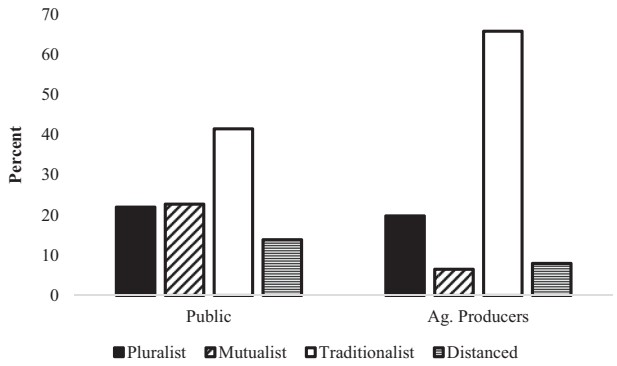

Fig. 2 Distribution of WVO types by stakeholder group

Table 2 ANOVA model results for Illinois residents attitudes toward the natural recolonization of predators by Wildlife Values Orientation (WVO) type and stakeholder, by species

Species	Factor	*df*	*F*-value	*p*-value	η^2	R^2
Black Bear	Model	7	38.88	<0.01	–	0.15
	WVO	3	29.95	<0.01	0.05	
	Stakeholder	1	80.89	<0.01	0.05	
	WVO × Stakeholder	3	2.81	0.038	0.00	
Cougar	Model	7	54.47	<0.01	–	0.19
	WVO	3	58.06	<0.01	0.09	
	Stakeholder	1	62.34	<0.01	0.03	
	WVO × Stakeholder	3	0.87	0.454	–	
Gray Wolf	Model	7	62.47	<0.01	–	0.21
	WVO	3	58.48	<0.01	0.09	
	Stakeholder	1	85.08	<0.01	0.04	
	WVO × Stakeholder	3	2.50	0.058	–	

proportions of WVO types found in previous statewide assessments in the American west (Teel and Manfredo 2009). Fewer individuals were found to have a distanced orientation; although, a slightly greater proportion of the general public (13%) was found to hold this WVO type than were agricultural producers (8%). The proportion of pluralists found in both the general public (23%), and agricultural producer (21%) was not vastly different (Fig. 2).

On average, across both stakeholder groups, attitudes toward the natural recolonization of black bears ($M = 2.8$, SD = 1.4), cougars ($M = 2.6$, SD = 1.4), and gray wolves ($M = 2.5$, SD = 1.4), were slightly negative (a value of 3 is neutral). However, ANOVA results revealed that residents' attitudes toward recolonization vary as a function of their relative stakeholder group and WVO (Table 2). Main effects for WVO and stakeholder groups were statistically significant in each of the three models that we tested. Partial eta-squared (i.e., the proportion of the variance explained in the dependent variable attributable to the independent variable) ranged from 0.03 to 0.09 for WVO. Stakeholder group explained a slightly smaller proportion of the variance, in attitude toward natural recolonization of apex predators with values of partial eta squared ranging from 0.03 to 0.05. We did not find an interaction effect between WVO and stakeholder group for models testing support for the recolonization of cougars or wolves (Table 2). We did find a significant interaction between WVO and stakeholder group in respondents support for the natural recolonization of black bears. This interaction, however, explained a small proportion of variance in the dependent variable (partial eta-squared = 0.0). The variance explained in attitudes toward recolonization (14–21%) was modest in all three models.

Levene's test revealed that the data did not possess homogeneity of variance across factor levels. Given this observation, within-factor simple mean contrasts were conducted using non-parametric Games-Howell tests across WVO types following one-way ANOVA. Bootstrapped independent samples *t*-tests with 1000 draws were used to compare attitudes by stakeholder group. In each of the three models mutualists reported the least opposition to the natural recolonization of apex predators (Table 3). In fact, their attitudes were neutral to slightly positive toward the prospects of recolonization. Whereas traditionalists reported the greatest opposition. Respondents characterized as traditionalists ($M = 2.57$) did not possess significantly different attitudes toward the recolonization of black bears than "distanced" individuals ($M = 2.78$). Pluralist and distanced respondents were found to hold similar attitudes toward the recolonization of cougars and wolves (Table 3). All other within factor mean contrasts were found to be statistically significant with 95% confidence. Agricultural producers (Table 4) reported higher levels of opposition than members of the general public in reference to all three species. Descriptively, attitudes toward the recolonization of each of the three species differed. The potential recolonization of black bears was evaluated less negatively than wolves or cougars, whereas wolves received the least support. For instance, traditionalists, on average, disagreed that they would support IDNR allowing wolves to recolonize Illinois.

Discussion

This study endeavored to determine the influence of Illinois residents' WVOs and stakeholder group membership on evaluations of the potential natural recolonization of apex predators in the state. Results revealed substantive differences in attitudes as a function of these social psychological variables. Research in natural resource policy contexts continues to find utility in WVOs as a means to predict public response to issues of wildlife management concern (Jacobs et al. 2014). Our results mirror these studies that have found positive associations between the mutualism

Table 3 Post-hoc analysis of Illinois residents' attitudes toward recolonization of predators by Wildlife Values Orientation (WVO) type

	Wildlife value orientation type			
	Pluralist ($\overline{X}$)	Mutualist ($\overline{X}$)	Traditionalist ($\overline{X}$)	Distanced ($\overline{X}$)
Black Bear	$3.11^{b,c,d}$	$3.52^{a,c,d}$	$2.57^{a,b}$	$2.78^{a,b}$
Cougar	$2.91^{b,c}$	$3.60^{a,c,d}$	$2.31^{a,b,d}$	$2.70^{b,c}$
Gray Wolf	$2.79^{b,c}$	$2.54^{a,c,d}$	$2.24^{a,b,d}$	$2.74^{b,c}$

Superscripts indicate significant mean differences read from left to right at critical value of 0.05. Games-Howell non-parametric contrasts based on one-way anova for WVO factor. All one-way models significant at alpha < 0.05

Table 4 Bootstrapped independent samples *t*-tests for attitudes toward the natural recolonization of apex predators by stakeholder, by species

	General public		Ag. producers		
	($\overline{X}$)	95% C.I.	($\overline{X}$)	95% CI	*p*-value
Black Bear	3.30	(3.20, 3.40)	2.42	(2.34, 2.52)	<0.01
Cougar	3.12	(3.01, 3.22)	2.22	(2.14, 2.30)	<0.01
Gray Wolf	3.06	(2.96, 3.16)	2.10	(2.03, 2.18)	<0.01

C.I. = 95% confidence interval from bootstrap analysis based on 1000 draws

WVO domain and support for biodiversity conservation initiatives, and conversely, the domination WVO domain and opposition to the recolonization of predators (Dougherty et al. 2003; Whitaker et al. 2006; Sijtsma et al. 2012; Jacobs et al. 2014).

Our extension of past work found that stakeholder groups differ both in terms of their basic beliefs about wildlife, as evidenced by the distribution of WVO types between groups, and attitudes toward recolonization. Post-hoc analyses revealed that agricultural producers held greater opposition to the recolonization of all three species than the general public (Table 4). These results support previous findings that differences in the evaluation of predators is a function of stakeholder group, and highlight the need to understand multiple stakeholder groups to discern beliefs and attitudes toward natural resource policies (Bruskotter et al. 2009). We can conclude that different stakeholders hold different attitudes toward predators. This relationship is, in part, a function of individuals' WVOs, but also stems from other factors associated with stakeholder group membership. An individual's WVO and stakeholder group contribute to their attitude formation independently, but the distribution of individuals subscribing to different beliefs associated with wildlife vary as a function of the stakeholder group with which they are associated.

We did not find that agricultural producers with different WVOs held especially positive or negative attitudes toward natural recolonization of wolves or cougars compared with individuals with similar WVOs in the general public. Even in the case of attitudes toward the recolonization of black bears, where we observed a statistically significant interaction, the amount of variance explained by the interaction was minimal. We cannot offer a concrete explanation for why we only observed an interaction effect of WVO and stakeholder group on residents' attitude toward the natural recolonization for black bears. However, the data suggest that bears are perceived differently than are wolves or cougars. Black bears, for instance, are less likely to take certain livestock (e.g., cattle) than are wolves or cougars. They may also be perceived as a potential future hunting opportunity, a belief in-line with a domination orientation.

Understanding sources of difference in beliefs between stakeholder groups is an area in need of future research. Given that WVOs are hypothesized to be a function of personal values (Fulton et al. 1996), it may be that individuals in these groups have different value structures that influence their beliefs about the human-wildlife relationship, and that these values develop through differential patterns of socialization (Schwartz and Bilsky 1987). More work is warranted to understand these phenomena and their implications for biodiversity conservation policy, particularly with regard to predators.

There are several limitations to this study that warrant further discussion. Most importantly, the samples of agricultural producers and the general public are skewed in their demographic composition relative to the study populations. For instance, the US Department of Agriculture (2012) reported that there were 75,087 farms in the state of Illinois, and that more than 90% of these farms were operated by a male, with an average age of ~58. Our sample of agricultural producers contained nearly 30% females, and had an average age slightly over 62. The general public sample was around 65% male with an average age of 56.6. We can safely assume that the population of Illinois is close to 50% male, when gender is measured on binary. That is, our sample of the general public contains a higher proportion of men than the population. Given that our sample of the general public included only homeowners age 18 and over, the average age of the sample frame is unknown. We do know, however, that this group is likely older than the average Illinoisan. This may have implications for the results, and the results should be interpreted with these limitations in mind. For instance, Kellert and Berry (1987), in an earlier study, documented differences in stakeholders'

attitudes toward wildlife as a function of gender. Women, in this study, were more likely to hold a mutualist orientation toward wildlife and express greater concern for wildlife than were males. The distribution of WVO types in our samples may, therefore, be influenced by gender. Despite recognized biases in the study sample demographics, we document meaningful associations between WVO, stakeholder group membership, and attitudes toward large carnivores, and feel confident that these relationships are real. Our two study samples also contained a similar proportion of men. If biases do exist relative to the gender of the general population, they do not likely have a large influence on our estimates of differences of attitude as a function of stakeholder group membership. Future research should seek to characterize how stakeholder attitudes toward large carnivores vary as a function of a broader set of demographic characteristics, and attempt to correct for sample biases in analysis.

Management Implications

Our findings have a number of practical implications for the development of policies intended to manage these species; especially outreach efforts that accompany new policy proposals. First, differences in support/opposition for each of the three species warrants consideration in setting policy. Wolves were more negatively evaluated than black bears or cougars. Therefore, these species should receive individual attention when developing plans for management. This point is particularly salient given that wolves are the most likely of three to continue venturing into Illinois, due in part to the proximity of viable breeding populations. Moreover, if at some point in the future, wolves establish a breeding population in Illinois they will come under existing federal regulations. Second, values are stable constructs that are resistant to change (Manfredo et al. 2016). This is important to note in considering attempts to garner support for management efforts. Although WVOs were revealed to be the most important variable shaping public attitudes toward recolonization by predators in our models, managers should not seek to change values as these are deeply rooted and not likely influenced by information campaigns. Policy makers should respond to concerns that individuals with different values orientations may have with respect to the re-emergence of predators on the landscape. This is particularly important considering the level of opposition reported by many individuals in this study. Traditionalists, for instance, reported the greatest opposition to recolonization and were also revealed to be the most common WVO type among respondents; although the proportion of traditionalists found in each sample varied. Efforts to frame management solutions for these species must consider how they will be evaluated by varied stakeholders.

Third, stakeholder groups were found to hold different WVOs, and levels of support/opposition to recolonization. Recolonization is not likely a salient issue for most people in Illinois as individual animals of these species are not widely distributed, limiting potential interactions and leading to the development of a more abstract concept among the public. Further, such individuals do not have frequent interactions with wildlife or major vested interests (e.g., livestock) in the outcomes of management plans, compared to agricultural producers, for instance. The level of opposition stemming from different stakeholder groups and the source of that opposition in terms of values and beliefs should inform managers and guide interactions with stakeholders in attempts garner support or seek input on management decisions for these species. It may be that greater attempts need to be made to understand and allay the concerns of agriculture producers given their relative opposition, if a course of management actions allow these populations to increase; this understanding is especially relevant with respect to wolves. It should be noted, however, that stakeholder groups are not homogenous with respect to attitudes toward predators or in their WVOs.

Finally, it remains unknown how stakeholder's attitudes will translate into support or opposition for specific proposed management actions, or may influence overt behavior toward predators. The lowest mean value measuring stakeholders attitudes toward recolonization was found among traditionalists regarding wolves ($M = 2.24$). Even this value, however, fell somewhere between "disagree" and "neutral" on the measurement scale. Low salience of predator recolonization among stakeholders may be a sufficient condition for the adoption of policies that support predator recolonization. However, further research is needed to confirm this proposition.

Predator habitats and populations are imbedded in a larger social-ecological context. For better or worse, their fates are in part intertwined with the needs and preferences of society. Understanding stakeholder preferences for management of predator species can lead toward acceptable solutions. Results of this article characterize some of the heterogeneity in individuals' support for the natural recolonization of three important predator species in Illinois. In particular we found that residents' evaluative response to changing predator populations are a function of their WVOs and relative stakeholder group membership. Although more work is needed to determine level of support for management protocols as they are implemented, this study serves as a starting point for the design of policies that work within the belief structures of society to affect positive conservation outcomes, and furthers our understanding of the distribution of basic beliefs about wildlife among groups in society.

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