Tolerance for Carnivore Behavior and Management Action Acceptance in Idaho

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Natalie T. Redmond

Approved by:
Major Professor: Kenneth E. Wallen, Ph.D.
Committee Members: Todd Thorsteinson, Ph.D.; Heidi Kretser, Ph.D.; Sophie Gilbert, Ph.D.
Department Administrator: Jaap Vos, Ph.D.

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Abstract

Coexistence is a consistent management concern in the American West, as human-wildlife interactions become more common and the extent of shared landscapes between humans and wildlife increase. In this context, it is crucial that terrestrial carnivore management and conservation is not only informed by ecology but also by what is socially feasible. To address social feasibility of carnivore management, this study surveyed a random sample of Idaho residents to identify thresholds of tolerance for wildlife behaviors and acceptability of subsequent management actions for black bears (*Ursus americanus*), mountain lions (*Puma concolor*), and grey wolves (*Canis lupus*) via linear regression models, as well as the Return Potential Model (RPM) and a Potential for Conflict Index (PCI) analysis. Segmentation variables of rural/urban identity and emotions, values, personality traits, previous experiences, and perception of risk for each species were measured to analyze patterns associated with tolerance and acceptability levels. Findings suggest resident's tolerance levels are driven overall by their previous experiences with carnivores, their perceptions of risk posed by the species, and the emotions they have when thinking about carnivores. These drivers varied, however, when the sample of Idahoans was segmented by objective and subjective identification as a rural or urban resident. Additionally, acceptance for lethal versus nonlethal management actions in response to nuisance behaviors varied depending on the species being considered, the valence of emotions residents felt when thinking about carnivores, and the amount of risk perceived as being posed by black bears, mountain lions, and grey wolves. Such results are important to inform wildlife management and conservation in Idaho, particularly as a western state with a high rate of human population growth and healthy populations of these adaptable carnivore species. With these data, wildlife management agencies have additional knowledge of the social acceptability of wildlife behaviors and which behaviors residents believe warrant specific management actions.

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Dedication

To my friends, family, and every dog I have interacted with in the last two years.

CH / KS / KR / MD / PL / EH / GL / GP / MG

WCA

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Chapter 1: Introduction

In the American West, continued population growth contributes to the increasing frequency and intensity of human-wildlife interactions (HWI). Traditional wildlife management prioritizes predator control and game management, which is an approach that tends to exclude the necessary human dimensions of wildlife management, particularly considerations and measures that are involved in managing HWI. The inclusion of tolerance and acceptance considerations and measures, specifically in the context of carnivore management, as part of research and engagement can provide wildlife agencies with crucial insight into socially feasible and ecologically successful management decisions. Such human dimensions insights and science-based decisions increase the likelihood of coexistence between humans and wildlife. To date, HWI research in the context of the human dimensions of carnivore management has not been conducted in Idaho, and thus, is the purpose of this study.

Tolerance: concept and definition

Historically, the idea of (in)tolerance arose as a concept to understand and find solutions to irreconcilable differences, especially religious conflicts (van Doorn, 2014). While now documented, or at least considered, in many settings, the scope of the concept remains consistent: "tolerance comes into play when beliefs are controversial and intergroup relationships conflictual" (van Doorn, 2014, p 907). The relationship between conflict and tolerance highlights the practical and scientific importance of identifying levels of tolerance and how they can be managed or altered. The study of tolerance can also elucidate the evolutions of societal norms and expectations. For example, 20th century political tolerance research focused mainly on racial diversity and discrimination, while the aftermath of the 9/11 attacks in New York brought forth concerns of religious tolerance (primarily Islam) that were represented in a parallel shift of political tolerance research (van Doorn, 2014).

Tolerance is a complex and often muddied concept that manifests as attitudinal (internal beliefs) or behavioral (external actions). Empirical research on tolerance is most common in the political science field, within contexts of identifying political tolerance for other individuals, groups, or acts. Research is commonly concerned with identifying

antecedents of political tolerance, i.e., accompanying attitudes and consequences, and trends of political tolerance (Mondak & Sanders, 2003). Religious and political tolerance is well documented but our understanding of tolerance in other disciplines, contexts, and in reference to non-human species is lesser known, reflecting the general complex nature of the concept.

Tolerance for and acceptance of wildlife

Evaluating the state of coexistence and tolerance between social groups of humans can be practically analogous to identifying necessary components for coexistence and tolerable interactions between humans and wildlife, particularly carnivore species that tend to elicit polarizing opinions among the public. Following van Doorn's (2014) general scope of the concept of tolerance, negative interactions between carnivores and humans becomes an issue of tolerance due to contradictory beliefs and attitudes regarding conflictual intergroup relationships (between humans and wildlife populations). Furthermore, the complexity and disconnect between abstract concepts of tolerance and acceptance in applied and practical situations is paralleled in the research of HWI, with much of the literature in this field being conceptual in nature rather than practically applied (Lute & Carter, 2020). The growth of applied research in the HWI field is critical to the success and persistence of carnivore populations and precipitates the need for a better understanding of the role of tolerance in the socioecological setting of HWI (Brenner & Metcalf, 2019; Bruskotter et al., 2015).

In studying wildlife behavior and interaction with humans, *tolerance* and *acceptance* are often considered parallel lines of inquiry (Bruskotter et al., 2015) or even used as interchangeable terms (Lute & Carter, 2020; Brenner & Metcalf 2019; Slagle et al., 2013). Inskip and colleagues (2015, p. 2) acknowledge one common definition of tolerance as "passive acceptance of a wildlife population" and, thus, use the terms synonymously. Acceptance is one operationalization of tolerance used in this study and these terms will be used as parallel measures. Additionally, the human dimensions of wildlife conservation, behavior, and conflict or interaction literature is variable; a large proportion of research focuses on ecological dimensions, without addressing human-human conflict (HHC) and disagreements (Canney et al., 2022), or has been largely qualitative in an an attempt to identify and understand behavior (Marshall et al., 2007). Here, I use the return potential

model (Jackson 1966), its derivative, the potential for conflict index (Manfredo, Vaske, & Teel 2003), and linear regression modeling as a multi-pronged quantitative methodology to examine carnivore tolerance and acceptance, specifically black bear (*Ursus americanus*), mountain lion (*Puma concolor*), and grey wolf (*Canis lupus*), among Idaho residents.

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Chapter 2: Idaho Residents' Tolerance for Carnivore Nuisance Behaviors

Introduction

As shared landscapes, resource competition, and human population growth encroach and expand into wildlife habitat, human-wildlife interactions (HWI) become more common. When negative or conflictual, HWI can be detrimental to overall human tolerance for wildlife (Kimmig et al., 2020; Lischka et al., 2020). Coexistence between humans and wildlife is important to understand for effective wildlife management, as many conflicts that arise are dependent on human tolerance for wildlife, in general, or specific species or behaviors (Bruskotter et al., 2015). Human tolerance for interaction and coexistence with wildlife is also a crucial element in successful conservation efforts overall, and for threatened and endangered species (Frank 2016). Similarly, resolving human-wildlife conflicts and increasing tolerance for coexistence is key for the survival of large carnivores with a history of human persecution (Miquelle et al., 2005; Wilson 2008).

Tolerance for wildlife is a multi-faceted concept with many underpinning elements. Maintenance or increases in tolerance cannot be made unless there is first an understanding of what drives (in)tolerance (Bruskotter & Wilson 2014). As conservation goals have shifted from utilitarian management to those that are more strongly guided by ecological and intrinsic concerns (Western & Waithaka 2005), there has been an increase in research regarding the cognitive, behavioral, and attitudinal precursors of human tolerance for wildlife (e.g., Ghasemi et al., 2021; Kimmig et al., 2020; Landon et al., 2020; Struebig et al., 2018). Wilson (2008) acknowledges this shift in the realization that conservation and management goals are more successful when they consider social objectives, public attitudes, and human cognitions.

Attempts to predict tolerance often include many different components and are typically more successful when multiple variables are considered, as opposed to a single factor (Knopff, Knopff, & St. Clair 2016). The potential to explain or predict tolerance must acknowledge that variations in tolerance may be explained by different geographic or residential contexts. As human populations continue to grow and expand, much of this growth in the U.S. means population shifts from rural to suburban and urban areas, as well as the density of human populations consuming previous rural areas. Thus, there is a need to

understand how tolerance-driven management can integrate into its science-based assessments different communities and cultures, land usage and industries, and exposure and experiences with wildlife (Morzillo, de Beurs, & Martin-Mikle 2014). For example, various lines of research have assessed differences in attitudes, beliefs, and perceptions between people who identify as rural or urban residents, especially in the context of wildlife management (e.g., Drake et al., 2020; Elliot, Vallance, & Molles 2016; Woodroffe 2000).

Methodologically, human dimensions assessments of cognitive, attitudinal, and behavioral factors must consider the criteria involved in designating an individual or community as rural or urban. Much of the socially conflicting opinions on wildlife management are based in ties to a community identity, especially seen as trends toward urbanization are contrasted with rural identities and values to conserve the associated livelihoods and heritage of their communities (Woodroffe et al., 2005). These identity-driven groups achieve value and force through the existence of a compared group with differing values; an example of which is the rural/urban divide (van Eeden et al., 2019). Human-wildlife conflict for these communities is often centered on these group identity-based values (van Eeden et al., 2019), indicating the importance of assessing self-identified designation to a rural or urban community, beyond a geographic or objective designation.

This study aims to investigate Idaho residents' tolerance for problematic or controversial behaviors from three native, large-bodied carnivores, as well as to assess the potential of identity-based and individual factors to predict those levels of tolerance. Such an assessment of Idaho residents' preferences for coexisting with carnivores can be critical information for wildlife managers and agencies who aim to create policy and management strategies that are both ecologically sound and socially acceptable.

Literature review

Tolerance

Tolerance measurements are uniquely informative in understanding human impact on species populations, especially endangered or controversial species (Bruskotter et al., 2015). The measurement of attitudes of stakeholders and the general public is crucial to producing informed and successful wildlife management (Brenner & Metcalf 2020). Understanding

attitudes can help managers identify conflicts, areas of concern, and possibly predict stakeholder behavior where needed. There are few studies in the field of wildlife conservation that measure tolerance as an attitude that can be variable in different cognitive and situational contexts. Furthermore, within these studies there exists varying understandings or operationalizations of tolerance as an attitude. Some authors identify tolerance as positive attitudes in the face of damage caused by wildlife (Kansky, Kidd & Knight, 2016), while others consider a full possible range of extreme intolerance to extreme tolerance (Lewis et al., 2012), and some conceptualize metrics of tolerance through passivity versus action (Bruskotter & Fulton 2011). In this study, I conceptualize tolerance as the willingness to accept and coexist alongside certain behaviors of wildlife.

Objective/subjective geographic residency

Assessing the views of rural and urban communities separately in the context of carnivore management is not necessarily a new concept in the human dimensions of wildlife literature, but the changing demographics of rural and urban communities in Idaho and the U.S. overall necessitate continued acknowledgement of these communities and their differences. Common conclusions include the idea that "rural" communities, in general, have lower reported fear of wildlife but tend to bear more of the burden of HWI and its economic impact and are, therefore, less tolerant of coexisting with wildlife (Pinheiro, Rodrigues, & Borges-Nojosa 2016; Roskaft 2003). "Urban" communities, on the other hand, tend to be more likely to be advocates of wildlife protection, though they experience fewer interactions and tend to have less knowledge about wildlife behavior overall (Castillo-Huitrón et al., 2020). Woodroffe et al (2005) identifies the disparity in management considerations for rural and urban populations as a "patchy distribution of conflict"; this entails certain individuals or communities bearing an unequal impact of the consequences of coexisting with wildlife.

In addition to the disparities between geographically separate communities, individual identification as a resident of a rural or urban area is also relevant to assessing tolerance for carnivores, as social identity and intergroup conflict theories (Tajfel 2010) suggest that this type of self-identification and ascription to a group may be more important or indicative of an individual's beliefs and group relations than an objective geographic designation. For

example, van Eeden and colleagues (2020) used a social identity approach to assess predator management intentions by livestock producers. The authors found that social identity was a useful metric to predict and understand management behavior in wildlife contexts, and noted that self-ascription to a group can influence behavioral intentions, attitudes and norms. In this study, both objective and subjective measures of residential identity were taken to compare their impact in predicting tolerance.

Prior experience

It has been hypothesized in human-wildlife conflict research that the amount of prior experience an individual has with a particular species can influence their overall perception of the species (Hill 1998), especially when the geographic context of the experience is considered (Drake et al., 2020). Direct experiences with an animal or wildlife-related scenario can be a significant modifier of attitudes toward that same entity in the future (Heberlein 2012). These could be experiences by way of recreational choices (e.g., hunting, hiking), entertainment (e.g., zoos or aquariums) or even by accident or unexpected HWI. Likewise, humans tend to store emotional reactions and perceptions from an experience, and this guides our interpretation and decision-making in future experiences (Izard 2009), highlighting the potential for fundamental differences in attitudes toward wildlife from individuals with different backgrounds and experiences (Castillo-Huitrón et al., 2020). While certain kinds of experiences lend themselves to the retention of distinctly positive or distinctly negative attitudes, greater number of experiences with an animal, species, or wildlife overall have been shown to lead to positive attitudes, in general, toward that object, and even to reduce existing phobias (Pinheiro et al., 2016). This study assessed Idaho residents' prior experience with carnivores to evaluate the relationship between these experiences and residents' tolerance for carnivores.

Risk

Perceptions of risk or potential hazards posed by wildlife, especially large carnivores, have been well studied as an important consideration for tolerance and coexistence (Riley & Decker 2000; Knopff et al., 2016; McGovern & Kretser et al., 2015). Risk perception is

commonly assessed as an element of human-wildlife coexistence and interaction (Riley & Decker 2000; St. John, Mason, & Bunnefeld 2020; Landon et al., 2020), often because of its role in informing attitudes and reactions to hazardous scenarios (Visschers & Siegrist 2008). In the context of large carnivores such as mountain lions, black bears, and wolves, several studies indicate that humans faced with carnivore coexistence consistently overestimate the risks posed by living alongside these species, often because of our inability evaluate the risks and benefits of such a scenario consistently and logically (Bruskotter & Wilson 2014; Slovic 1987). Instead, humans tend to rely on mental shortcuts that are less burdensome to inform our attitudes and actions; because of this, our reactions to a potential hazard or impact often heighten our perception of risk beyond that which is actually likely (Knopff et al., 2016). Support for recovery and coexistence with wildlife has been found to be inversely related to measures of risk in many contexts, and such studies have indicated that improved risk mitigation and communication is a potential avenue for increasing tolerance for coexisting with wildlife (McGovern & Kretser et al., 2015; Riley & Decker 2000; Knopff et al., 2016).

Affect and emotion

Affect and emotions, as individual reactions to a thought or experience, have also been shown to impact decision making and behavior in an environmental context (Wilson 2008; Slovic et al., 2002) and tend to be strong contributors in protective attitudes toward nature (Kals & Maes 2002) as well as drivers or risk and management preferences (St. John et al., 2021). A review of academic databases regarding wildlife and human emotions by Castillo-Huitrón et al. (2020) found that large predators, such as bears, wolves, and large felids most often evoke feelings of fear, anger, and sometimes disgust from most social groups, while others experience feelings of happiness because of the value placed on the existence of these species. As an important element of decision making and forming perceptions, assessing emotions of the affected public toward wildlife conservation and coexistence is a crucial factor in the success of these efforts (Vining & Tyler 1999; Drake et al., 2020; Castillo-Huitrón et al., 2020).

Personality

The core traits of an individual's personality, or their composite personal characteristics—commonly categorized into traits of openness, conscientiousness, extraversion, agreeableness, and emotional stability within the Big Five (Five-Factor Model) framework (McCrae & Costa 1987)—are considered generally stable and partial indicators of attitudes (Brick & Lewis 2016). Researchers have measured core personality traits in individuals to predict attitudes in reference to conservation cooperativeness (Hilbig et al., 2013), concern for the environment (Hirsh 2010), knowledge about environmental issues (Ige, Jita & Jita 2019), and acceptability of sustainable policies (Kim et al., 2014). In a meta-analysis of research regarding pro-environmental attitudes and behaviors, Soutter, Bates & Mottus (2020) identified the measurement of personality traits within the Big Five model framework, particularly the trait of openness to experiences, as well-suited for understanding the adoption of attitudes within environmental contexts.

Values

Within the practice of environmental social sciences, values, particularly the common core of biospheric, altruistic, and egotistic dimensions, are considered primary predictors of attitudes and are often studied in contexts involving pro-environmental behaviors and attitudes (e.g., van Riper et al., 2020; Knackmuhs, Farmer & Knapp 2019; Steg 2016). Such studies have also identified that conservation goals are ultimately more successfully accepted and reached when they are informed by the values of an affected public (Bright & Manfredo 1996), which highlight any desirable goals or principles an individual may think of when evaluating a conflict or scenario to inform their attitudes or decisions (Steg 2016). Levels of tolerance in most contexts, in fact, tend to be informed by a multitude of values held by an individual, the ranking of any competing values, as well as the pliability of values considered relevant (Peffley, Knigge & Hurwitz 2001). Values dimensions are commonly studied in assessing attitudes toward wildlife and their management (e.g., Hartel, Carlton & Prokopy 2015; Jacobs, Vaske & Sijtsma 2014; Loyd & Miller 2010; Steg 2016; van Riper et al., 2020) and can be especially helpful when attempting to understand public tolerance for controversial species. Only the biospheric dimension was included as a relevant variable

when evaluating proenvironmental behaviors and attitudes, as it has been supported in previous studies (Steg 2016; van Riper et al., 2020).

Research questions

Based on the relevance of these concepts in terms of their ability to explain an individual's level of tolerance toward coexisting with carnivores, as well as the continued shift to growing urban landscapes in Idaho, this study's guiding research questions are the following:

1. To what extent do (a) number of experiences, (b) perceived risk, (c) positive and negative emotions, (d) openness to experience personality characteristics, and (e) biospheric values work together to predict tolerance for a common behavior among large carnivores in Idaho?
2. How does segmentation by an *objective* urban-rural strata change the influence of independent variables and overall model predictions?
3. Does segmentation by a self-reported, *subjective* urban-rural identification change the influence of independent variables and overall model predictions?

Methods

Study Context

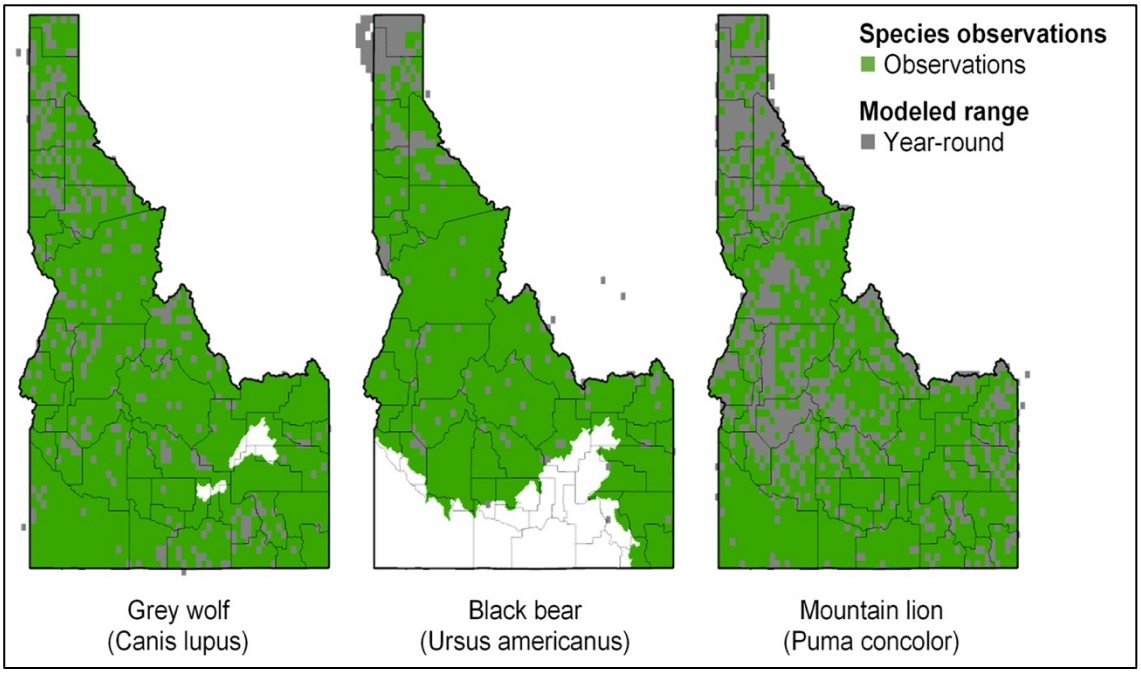
This study was conducted in Idaho, USA to explore tolerance of three large bodied, terrestrial carnivores that have a significant probability of interacting with humans. Black bears (*Ursus americanus*), mountain lions (*Puma concolor*), and grey wolves (*Canis lupus*) all occupy habitat ranges that cover most of Idaho (Idaho Species Catalog) (Figure 2). Opportunity for interactions increases as urban areas grow, and though Idaho is a traditionally rural state, the percentage of the population that is considered urban has grown nearly 17% since 1970, with now 70.6% of the population being considered urban (U.S. Census Bureau, 2010). The changing composition of the state makes wildlife management more challenging, as overlap occurs between wildlife and humans living in urban environments who are increasingly disconnected from natural environments and experience

with wildlife, while rural residents, who still make up a significant portion of the geographic area of the state, can be underrepresented (Elliot et al., 2016).

Literature on carnivore conservation in the United States is ample and highly variable, and often reflects the difficult and controversial nature of the management of carnivores itself. Continued research on human-wildlife interactions specific to carnivores is necessary for several reasons. There exists an historical competition between humans and carnivores over food and space, and as human populations continue to grow and expand, potential for negative human-wildlife interaction does as well (Treves & Karanth 2003). Negative interactions are escalated by continued alteration of carnivore habitat and clashes over what could be considered shared resources. As the importance of carnivores to their ecosystem becomes more understood, continued re-evaluation of coexistence of humans and carnivores on shared landscapes requires continual assessment of human tolerance for these species (Lute & Carter 2020).

Figure 2.1

Visual representation of year-round range and individual observations of black bears, mountain lions, and grey wolves (from left to right) (Idaho Species Catalog).



Participants and sampling

The research design was a cross-sectional, quantitative design. The target population was Idaho residents 18 years or older. A random sample of 7,986 residents stratified by urban and rural residency based on US Census Bureau criteria was selected from an address-based sample frame purchased from Marketing Systems Group (MSG), who appended telephone and email contact information. The sample was further narrowed to include survey residents whose email was appended to their residential address; the final sample size was 4,491 residents (urban = 2,349, rural = 2,142). Next, a block sampling design was used wherein one-third of the sample was randomly assigned to receive a questionnaire that referenced one of three carnivore species (black bear: n = 1,498, mountain lion: n = 1,495, and wolf: n = 1,498). All questions were aligned such that species was the only differences between samples.

A mixed-mode survey distribution started in August 2021 and ended January 2022. Following a tailored design protocol (Dillman, Smyth & Christian 2014), participants were first contacted by email on August 9, 2021 to complete the survey online via Qualtrics, with reminder emails sent August 12 and August 18; emails were followed by a postcard augmentation sent on September 18. At this point, solicitation did not garner sufficient response, so a paper version of the survey was mailed in October to those in the sample who had not yet participated and who were not successfully reached by email.

Materials and Measures

Primary data was collected from a survey instrument that consists of closed-ended questions designed to identify participants' tolerance for a spectrum of wildlife nuisance behaviors among three target species: black bear, mountain lion, and grey wolf.

Tolerance

Level of tolerance was measured by asking the participant to rate the tolerability of a hypothetical scenario that involved a common but distanced behavior by each species. Participants who received the black bear questionnaire were asked to rate their tolerance for the behavioral scenario of: "the animal goes through trash in your area". Participants who

received the mountain lion or grey wolf questionnaire were asked to rate their tolerance for: "the animal is seen along a popular hiking trail". These behaviors were considered "distanced" scenarios because the behavior is a cause for concern, but without the animal directly engaging with a person or personal property. Tolerance ratings were scored on a six-point bipolar scale with responses ranging from 1 (Highly Intolerable) to 6 (Highly Tolerable).

Subjective geographic identity

In addition to geographic strata assigned to participants based on U.S. Census Bureau criteria, a subjective measure of urban or rural identity was collected. To understand subjective geographic identity, participants were asked, "how would you describe the area where you currently live?". Response categories were "big city", "suburban area", "small town", and "rural area". The first two response options were collapsed into "urban" and the latter two into "rural" for subsequent analyses.

Prior experience

Prior experience was measured with a closed-ended question allowing respondents to report 0, 1, 2, 3, 4, or 5 or more "direct experiences" with the referent species.

Perceived risk

Perceptions of risk were measured by asking participants to evaluate the level of risk they believed the referent species posed in the context of human safety, personal property, pets, and livestock. Participants indicated their perceived risk on a six-point scale ranging from 1 (no risk at all) to 6 (a very great risk). Ratings across the four contexts were indexed to create a composite variable of overall risk perception.

Emotions

Emotions were measured using the Discrete Emotions Questionnaire (DEQ) (Harmon-Jones et al., 2016). Modifications were made to the DEQ to align with the current study context and reduce response burden. The emotional dimensions that were removed

from the existing scale include Disgust, Sadness, Relaxation and Desire. The dimensions of Anger, Fear, Anxiety and Happiness were kept, and an additional dimension of Pride was included.

Participants rated the extent to which they experience a specific emotion when thinking of the referent species on a six-point unipolar scale ranging from 1 (not at all) to 6 (an extreme amount). Six items (anger, rage, panic, fear, dread, and anxiety) were indexed to create a "Negative Emotion" composite variable and four items (happy, enjoyment, pride, and respect) to create a "Positive Emotion" composite variable.

Personality characteristics

Personality was measured via the ten-item personality measure (TIPI) (Gosling, Rentfrow & Swann 2003). Participants rated the extent to which each item applies to them on a 6-point scale ranging from 1 (strongly disagree) to 6 (strongly agree). The ten-item encompassed the "Big Five" personality traits: extraversion, agreeableness, conscientiousness, emotion stability, and openness to experiences. Openness was the only trait used in analyses given its correlation with pro-environmental attitudes and behavior (Brick & Lewis 2016; Soutter, Bates & Mõttus 2020).

Values

Values were measured using a 12-item scale derived from van Riper et al. (2020), which encompasses elements of value-belief-norm theory (Stern 2000) and the theory of human values (Schwartz 1994). Participants were asked to what extent they consider 12 value items to be important as a guiding principle in their life on a 6-point scale ranging from 1 (not important) to 6 (extremely important). Items were indexed into four value composites (hedonic, egoistic, biospheric, and altruistic) but only biospheric was included in subsequent analyses because of its increased relevancy to pro-environmental behaviors (Steg 2016; van Riper et al., 2020).

Data Analysis

Multivariate linear regression and prerequisite assumption checks were used to assess the extent to which prior experience, perceived risk, positive emotion, negative emotion, openness personality, and biospheric values (independent variables) predict variance in levels of tolerance (dependent variable) for the "distanced" behavior of the three referent species. Cronbach's alpha was used to evaluate reliability and Pearson's correlations were used to evaluate relationships between dependent and independent variables. Prior to regression analyses, independent t-tests and one way analysis of variance (ANOVA) were used to determine whether the measure of experience with a species could be treated as a dichotomous (i.e., no experience and any experience) or continuous variable (1-5+ experiences). Where significant differences were found in the test of experience as a continuous variable, post hoc contrast tests were used. Analyses were conducted using IBM SPSS 26.0 and overall model fit and significance were the main considerations for interpretation.

Results

Participant Characteristics

Of the 4491 surveys administered, 103 were undeliverable by mail and 606 complete surveys were returned (urban = 291, rural = 305; black bear: n = 196, mountain lion: n = 198, and wolf: n = 218); an effective response rate of 13.8%. Using a conservative estimate of sample proportion, unweighted data, and a 95% confidence interval, the total margin of sampling error for the survey was +/- 4% (Dillman et al., 2014).

Participants were primarily middle-aged and older (M = 58.9, SD = 15.4), long-term residents of Idaho (M = 39.3 years, SD = 24.2), and men (58.5%). Nearly all participants reported finishing high school (97.2%), and a majority continued on to pursue a higher education or vocational degree (75.7%). Twelve percent of participants identified as politically liberal, while 53% identified as conservative, and the remainder identified as moderate or wrote in an unlisted option. In correspondence with the geographic strata census designations, 50.8% of participants listed as rural residents and 48.6% listed as urban

residents. Based on self-reporting, 34% of participants identified themselves as urban residents, and 66% identified as rural residents. All demographic measures taken are shown in Table 2.1.

Table 2.1
Sociodemographic Characteristics of Participants

	Pooled		Urban		Rural	
	n	%	*n*	%	*n*	%
Age						
18-24	41	6.9	17	5.9	23	7.7
25-34	32	5.4	17	5.9	15	5.1
35-44	76	12.8	38	13.2	37	12.5
45-54	87	14.7	46	16.0	41	13.8
55-64	123	20.8	59	20.5	64	21.5
65-74	14	24.5	65	22.6	75	25.3
75+	88	14.9	46	16.0	42	14.1
Subjective geographic identification						
Big city	68	11.8	67	23.8	1	0.3
Suburban area	128	22.2	106	37.6	22	7.6
Small town	140	24.3	81	28.7	57	19.7
Rural area	240	41.8	28	9.9	209	72.3
Gender						
Woman	225	39.6	115	41.2	108	38.2
Man	332	58.5	159	57.0	169	59.7
Prefer not to say	11	1.9	5	1.8	6	2.1
Ethnicity						
American Indian or Alaska Native	5	0.9	4	1.4	1	0.4
Asian	6	1.1	6	2.2	-	-
Black or African American	1	0.2	1	0.4	-	-
Hispanic or Latino	11	2.0	6	2.2	4	1.4
White	520	92.9	250	89.9	265	96.0
Other	17	3	11	4.0	6	2.2
Education						
High school	121	21.4	57	20.6	61	21.6
2-year college degree	73	12.9	32	11.6	40	14.2
4-year college degree	173	30.6	86	31.0	85	30.1
Vocational or trade school degree	81	14.3	38	13.7	43	15.2
Graduate degree	101	17.9	57	20.6	44	15.6
Other	16	2.8	7	19.8	9	3.2
Political Ideology						
Very liberal	15	2.7	10	3.6	5	1.8
Liberal	52	9.3	29	10.5	22	7.9

Table 2.1 continued						
Moderate	161	28.8	97	35.1	62	22.4
Conservative	228	40.8	104	37.7	124	44.8
Very conservative	68	12.2	22	8.0	44	15.9
Other	35	6.3	14	5.1	20	7.2

Note. Instances of rural/urban sample populations not adding up to pooled sample population values are indicative of missing data from respondents.

Table 2.2

Means and Standard Deviations of Primary Survey Items

	Pooled		Urban		Rural	
	M	*SD*	*M*	*SD*	*M*	*SD*
Tolerance for distanced behavior[a]						
Black bear	2.90	1.32	3.09	1.50	2.73	1.10
Grey wolf	3.90	1.56	4.04	1.46	3.81	1.61
Mountain lion	3.66	1.45	3.81	1.33	3.52	1.55
All species	3.50	1.51	3.65	1.49	3.37	1.51
Perceived risk[b]						
Black bear	3.03	1.04	3.11	1.14	2.94	0.92
Grey wolf	3.62	1.19	3.37	1.16	3.83	1.19
Mountain lion	3.27	0.98	3.18	0.92	3.37	1.03
All species	3.32	1.10	3.22	1.08	3.41	1.12
Positive emotion rating [c]						
Black bear	3.51	1.29	3.63	1.31	3.38	1.27
Grey wolf	2.68	1.53	2.99	1.42	2.41	1.59
Mountain lion	3.48	1.35	3.47	1.45	3.48	1.03
All species	3.20	1.45	3.36	1.42	3.05	1.47
Negative emotion rating [c]						
Black bear	1.55	0.81	1.54	0.86	1.55	0.75
Grey wolf	1.91	1.14	1.65	0.87	2.11	1.29
Mountain lion	1.74	0.83	1.76	0.81	1.73	0.85
All three species	1.74	0.96	1.66	0.84	1.81	1.03
Openness to experience [d]	3.64	0.72	3.68	0.71	3.61	0.73
Biospheric values [e]	4.83	0.99	5.02	0.97	4.66	0.99

[a] Variable coded on a 6-point scale from 1 (Very intolerable) to 6 (Very tolerable).
[b] Variable coded on a 6-point scale from 1 (No risk at all) to 6 (A very great risk).
[c] Variable coded on a 6-point scale from 1 (Not at all) to 6 (An extreme amount).
[d] Variable coded on a 6-point scale from 1 (Strongly disagree) to 6 (Strongly agree).
[e] Variable coded on a 6-point scale from 1 (Not important) to 6 (Extremely important).

Assumptions

To determine if the measure of prior experiences with a species would be analyzed as a dichotomous variable or as a continuous variable, an independent t-test and a one-way ANOVA test were run to check for differences in tolerance between groups based on

measurement level (for dichotomous: no experience or some experience; for continuous: 0, 1, 2, 3, 4, 5+ experiences). The independent t-test did not find any significant difference in tolerance levels between participants who reported no experience with the species (M = 3.39, *SD* = 1.47) when compared to the tolerance levels of those who had one or more experiences with the species (M = 3.58, *SD* = 1.52); $t(563) = -1.53$, $p = .126$. The ANOVA test identified significant differences in tolerance within groups when evaluating prior experience as a continuous variable, $F(5, 559) = 5.449$, $p < .001$. Given the intention to evaluate prior experience as a potential predictor of variance in tolerance levels, prior experience was used as a continuous measurement for all further analyses.

Reliability

Cronbach's alpha testing for construct reliability (Table 2.3) revealed strong reliability scores for four of the five composite variables within the conceptual framework: perceived risk (four items; $\alpha = .85$); negative emotion (six items; $\alpha = .88$); positive emotion (four items; $\alpha = .91$); and biospheric values (three items; $\alpha = .84$). The fifth composite variable, the personality characteristic of openness to experience, revealed a poor reliability score (two items; .33) but this level of reliability is consistent with the capability of the scale to measure a construct with only two items. Following Gosling et al., (2003), content validity was used to justify its inclusion as an independent variable. Corrected item total correlations were above .6 for all items in each associated scale, with the exception of the openness to experience measurement.

Table 2.3
Construct Reliability for Latent Composite Variables (Pooled Sample)

	item-total r	α	*M*	*SD*
Risk [a]		.85		
…to human safety	.70		2.82	1.21
…to personal property	.57		2.70	1.35
…to pets	.78		3.79	1.37
…to livestock	.71		3.96	1.40
Negative emotion [b]		.88		
Anger	.48		1.54	1.17
Rage	.55		1.30	0.89
Panic	.79		1.73	1.21
Fear	.74		2.20	1.31

Table 2.3 continued				
Dread	.83		1.72	1.30
Anxiety	.77		1.95	1.30
Positive emotion [b]		.91		
Happiness	.85		2.89	1.58
Enjoyment	.87		3.04	1.61
Pride	.79		2.72	1.69
Respect	.66		4.16	1.68
Openness to Experience [c]		.33		
Open to experiences, complex	.20		4.66	1.07
Conventional, uncreative [d]	.20		4.38	1.18
Biospheric Values [e]		.84		
Unity with nature	.72		4.76	1.18
Protecting the environment	.75		4.98	1.05
World of beauty	.64		4.75	1.20

[a] Variable coded on a 6-point scale from 1 (No risk at all) to 6 (A very great risk).
[b] Variable coded on a 6-point scale from 1 (Not at all) to 6 (An extreme amount).
[c] Variable coded on a 6-point scale from 1 (Strongly disagree) to 6 (Strongly agree).
[d] Reverse coded
[e] Variable coded on a 6-point scale from 1 (Not important) to 6 (Extremely important).

Correlation

To identify any relationships between tolerance and the potential predictors, a Pearson's r test for correlation was run (Table 2.4). Perceived risk ($r(545) = -.32$, $p < .01$) and negative emotion ($r(532) = -.25$, $p < .01$) were found to be significantly, negatively correlated with tolerance. Biospheric values ($r(527) = .13$, $p < .01$) and positive emotion ($r(544) = .20$, $p < .01$) were also significantly correlated with tolerance, but with a positive relationship.

Table 2.4
Descriptive Statistics and Correlations for Study Variables

Variable	*M*	*SD*	1	2	3	4	5	6
1. Tolerance	3.50	1.51	—					
2. Experience	1.35	1.71	-.08	—				
3. Perceived risk	3.31	1.10	-.32**	.02	—			
4. Negative emotion	1.74	0.96	-.25**	-.03	.47**	—		
5. Positive emotion	3.20	1.45	.20**	.02	-.42**	-.26**	—	
6. Openness	3.64	0.72	.02	-.07	-.09*	-.02	.07	—
7. Biospheric	4.83	0.99	.13**	-.08	-.14**	-.05	.32**	.02

* p < .05. ** p < .01.

Regression Models

Model 1 tested experiences with the species, perceived risk, negative and positive emotions toward the species, openness to experience as a personality characteristic, and possession of biospheric values as independent variables to predict tolerance among the pooled sample of all participants (Table 2.5). Results indicated these predictors were able to explain 12.3% of the model's variance, and significantly predict tolerance (R^2 = .123, F(6,491) = 12.62, p<.001). Number of experiences (β = -.092, p = .030), negative emotions (β = -.129, p = .008), and perceived risk (β = -.129, p <.001) were significant predictors driving the model's ability to explain variance in tolerance levels. Each significant predictor was shown to have a negative relationship with levels of tolerance for the behavior in consideration.

Table 2.5
Model 1: Tolerance for Distanced Behavior (Pooled Sample)

	B	*SE*	*β*	*t*	*p*	95% CI	
						LL	*UL*
Experience	-.08	.04	-.09*	-2.17	.03	-.15	-.01
Perceived risk	-.31	.07	-.21**	-4.26	<.01	-.45	-.17
Negative emotion	-.21	.08	-.13**	-2.68	<.01	-.36	-.06
Positive emotion	.07	.05	.06	1.28	.20	-.04	.16
Openness	.07	.09	-.03	-0.64	.52	-.24	.12
Biospheric	.11	.07	.08	1.70	.09	-.02	.25

Note. Constant = 4.42, F(6,491) = 12.62**, p <.01, R = .37, Adj. R^2 = .12; *LL* = lower limit; *UL* = upper limit.

*p < .05. **p < .01.

Models 2 and 3 tested the same independent variables as predictors of tolerance segmented by the U.S. Census designations of rural or urban residency. The results of Model 2 (rural strata; Table 2.6a) identified perceived risk (β = -.154, p = .046) and negative emotion toward the species (β = -.218, p = .003) as significant negative predictors of tolerance. The results of Model 3 (urban strata; Table 2.6b) found perceived risk (β = -.283, p =.003) and positive emotion (β = .154, p <.001) to be significant predictors of tolerance, but with opposing negative and positive effects on tolerance, respectively.

Table 2.6a
Model 2: Distanced Behavior Tolerance by Objective Rural Identity

	B	*SE β*	*β*	*t*	*p*	95% CI	
						LL	*UL*
Experience	-.07	.05	-.08	-1.31	.19	-.17	.03
Perceived risk	-.21	.11	-.15*	-2.01	.05	-.42-	.00
Negative emotion	-.33	.11	-.22**	-3.04	<.01	-.54-	.12
Positive emotion	-.02	.07	-.02	-.32	.75	-.17	.12
Openness	-.19	.13	-.09	-1.46	.15	-.44	.07
Biospheric	.14	.10	.09	1.42	.16	-.05	.33

Note. Constant = 4.86, F(6,244) = 5.87**, p <.01, R = .36, Adj. R2 = .11; *LL* = lower limit; *UL* = upper limit.

*p < .05. **p < .01.

Table 2.6b
Model 3: Distanced Behavior Tolerance by Objective Urban Identity

	B	*SE β*	*β*	*t*	*p*	95% CI	
						LL	*UL*
Experience	-.09	.06	-.10	-1.65	.10	-.21	.02
Perceived risk	-.41	.10	-.28**	-4.10	<.01	-.60-	.21
Negative emotion	-.03	.11	-.02	-.30	.77	-.26	.19
Positive emotion	.16	.07	.15*	2.26	.03	.02	.31
Openness	.01	.13	.01	.10	.92	-.25	.28
Biospheric	.07	.10	.05	.71	.48	-.12	.26

Note. Constant = 4.20, $F(6,234) = 7.12^{**}$, p <.01, R = .40, Adj. R^2 = .13; *LL* = lower limit; *UL* = upper limit.

*p < .05. **p < .01.

Models 4 and 5 tested the same independent variables segmented by *subjective* rural or urban residency, as identified by the participant. Model 4 (rural identity; Table 2.7a) indicated only negative emotion (β = -.247, p <.001) as a negative significant predictor of tolerance. The results of model 5 (urban identity; Table 2.7b) found perceived risk (β = -.454, p <.001) and number of experiences (β = -.156, p = .049) to be significant predictors, also with a negative impact on tolerance.

Table 2.7a

Model 4: Distanced Behavior Tolerance by Subjective Rural Identity

	B	*SE β*	*β*	*t*	*p*	CI	
						LL	*UL*
Experience	-.04	.05	-.05	-.93	.35	-.13	.05
Perceived risk	-.11	.09	-.08	-1.19	.24	-.28	.07
Negative emotion	-.38	.10	-.25**	-3.98	<.01	-.57	-.19
Positive emotion	.07	.06	.07	1.13	.26	-.05	.20
Openness	-.15	.12	-.07	-1.24	.22	-.38	.09
Biospheric	.16	.09	.10	1.81	.07	-.01	.33

Note. Model 4 Constant = 4.11, F(6,312) = 7.46**, p <.01, R = .35, Adj. R2 = .11; *LL* = lower limit; *UL* = upper limit.

*p < .05. **p < .01.

Table 2.7b

Model 5: Distanced Behavior Tolerance by Subjective Urban Identity

	B	*SE β*	*β*	*t*	*p*	CI	
						LL	*UL*
Experience	-.14	.06	-.16*	-2.30	.02	-.26	-.02
Perceived risk	-.68	.11	-.45**	-6.00	<.01	-.90	-.45
Negative emotion	.05	.12	.023	.40	.69	-.20	.30
Positive emotion	.11	.08	.11	1.38	.17	.05	-.27
Openness	-.09	.14	-.04	-.63	.52	-.37	.19
Biospheric	.04	.11	.03	.37	.71	-.17	.25

Note. Constant = 5.63, $F(6,162) = 10.26^{**}$, $p < .01$, $R = .53$, Adj. $R^2 = .25$; *LL* = lower limit; *UL* = upper limit.

*p < .05. **p < .01.

Discussion

The human dimensions of wildlife management and conservation literature, particularly that of large-bodied terrestrial carnivores, highlights a multitude of cognitive and situational elements to consider in the context of human-wildlife interactions, tolerance, and coexistence. This study contributes an assessment of attitudes, experiences, and other cognitive and social correlates as potential drivers of tolerance with further exploration of differences among segments of urban and rural populations to better understand tolerance across landscapes and communities. Based on a survey of 606 Idaho residents, I found that

their levels of tolerance were primarily explained by (a) an individual's prior experiences with black bears, grey wolves, or mountain lions, (b) their perceptions of risk posed by those species, and (c) the nature of the emotions they feel toward a species. The current study substantiates the importance of acknowledging and measuring perceived risk, emotion, and prior experiences as potential factors an individual considers when forming judgments of their own tolerance for carnivores, not only in scenarios regarding a direct human-wildlife interaction, but also in instances of more distanced behavior from carnivores that may be considered a nuisance or problematic. Additionally, these primary drivers varied when evaluating tolerance levels of urban and rural populations separately, designated by both geographic and subjective rural or urban identification.

An analysis of Idaho residents, irrespective of geography, identified prior experiences, perceptions of risk, and reported negative emotions to be the strongest predictors of Idaho residents' tolerance for a referent species. Each of these drivers also had a negative relationship with tolerance; more specifically, higher occurrences of prior experience with the species, increased levels of perceived risk, and stronger negative emotions were related to lower levels of tolerance. This aligns with existing findings of previous, similar studies that have assessed and identified different drivers of tolerance for carnivores (e.g., Ghasemi et al., 2021; Drake et al., 2020; McGovern & Kretser 2015; Pinheiro et al., 2016). These studies similarly measured tolerance for a carnivore species in a specific context; perceived risk, negative emotions, and prior experience are among the resulting drivers of tolerance in these and other studies in the field. For example, Ghasemi et al. (2021) assessed the socio-psychological factors behind public support for the recovery of large carnivores in Illinois; in this study, the authors identified residents' reliance on their emotions, trust in management, and perceptions of risk in forming their attitudes toward tolerating coexistence with large predator species. Additionally, Drake et al. (2020) evaluated the predictability of North Carolina residents' tolerance for coyotes in urban areas by assessing their city of residence (whether there were significant natural elements present), their affectual connections to coyotes, and the existing knowledge and experiences residents had regarding the species.

Urban and rural subpopulation models, based U.S. Census Bureau designation, identified different drivers of tolerance; the models revealed the differing considerations that

individuals of these subpopulations consider when forming their attitudes toward coexisting with carnivores. The rural subpopulation of the sample exhibited tolerance levels driven by the negative emotions (fear, anger, and anxiety) that they reported experiencing toward a carnivore species, with higher reported negative emotions resulting in lower tolerance. This relationship between emotions toward wildlife and tolerance for their presence is supported by many authors who have identified emotion as a crucial element of support for wildlife conservation (Wilson 2008; Castillo-Huitrón et al., 2020), as well as the role that emotions have in informing an individual's tolerance for coexisting with carnivores (Sponarski et al., 2016; Jacobs et al., 2014). The directionality of the relationship identified in this study between negative emotions and tolerance is also supported by existing human dimensions of wildlife research; for example, Jacobs et al. (2014) found that reports of stronger negative emotions predicted increased preference for lethal control of wolves in Canada.

Risks posed by the species was the second strongest driver of tolerance levels for the rural subpopulation and had a negative impact on tolerance. The role of risk perceptions toward wildlife is well-studied in its impact on coexistence and conservation of wildlife and has long been a concept associated with carnivores like wolves and mountain lions. Literature on human-wildlife coexistence rarely omits the consideration of risk; it has been identified as the primary driver of low tolerance in many contexts (e.g., Knopff et al., 2016; Crook 2019). The urban subpopulation of the sample exhibited tolerance levels primarily driven by a negative relationship with perceived risk, but also showed a secondary driver in positive emotions they experienced toward the species; this secondary variable had a positive impact on their tolerance levels. This result is somewhat intuitive; it is understandable that individuals who reported strong positive emotions (happiness and enjoyment) toward carnivores would be more tolerant of the less desirable impacts of coexisting with those carnivores. For example, Slagle et al. (2012) found that positive emotions or affectual dispositions toward wolves had a strong positive association with an individual's intentions to support wolf recovery and their beliefs about positive outcomes regarding wolves.

Participants' self-reported identity as a rural or urban resident of Idaho (subjective geographic identity), regardless of census designation, demonstrated the importance of its consideration as a segmentation variable. Models predicting tolerance levels showed differential drivers for these subjective subpopulations. The subjective rural population

showed only negative emotion to be a significant driver of tolerance levels, with a negative impact on tolerance. The subjective urban population exhibited only perceived risk as a primary driver of tolerance, also with a negative directionality. Existing literature on social identity theory (Tajfel 1982) supports this result and the difference between these self-identified populations. Self-identification and group ascription (such as to a residential group identity) allows individuals within a group to adhere to a set of norms or expectations that are homogenous and tied to the specific group identity, as well as to distance themselves from those considered to be part of the "out group" when conflicting attitudes arise. Van Eeden et al. (2019) used the rural/urban divide as an explicit example of social identity-based conflict, exploring the perceptions that self-identified rural residents have about self-identified urban residents and vice versa. Such perceptions include rural residents believing "city folk" have little knowledge about the environment and rural lifestyles, while they also perceive farming and other rural livelihoods to be lacking regard for animal welfare, or harmful to the environment.

There are a few patterns worth noting in the tolerance levels for this residency segmentation. Prior experiences, elicited emotions, and perceptions of risk make up the primary drivers of tolerance levels for each of the subpopulations that were investigated. While prior experiences are not an element of tolerance that could be adjusted or changed, identifying the "average" Idahoan's prior experiences with carnivores may provide an indication of the individual's current or future thoughts on carnivore tolerance or coexistence. Similarly, while there may not be a simple way to change the emotions an individual feels when thinking about a species, especially considering emotions are largely informed by prior experiences (Izard 2009), conservation efforts may find more success in identifying emotional reactions of the affected public and adjusting tactics and decisions to reflect or tackle these emotions. Perceived risk, another identified driver of tolerance for this sample of Idaho residents, is a cognitive element of tolerance that could be more malleable. When considering hazardous but unlikely situations or events, such as interactions with a potentially dangerous animal, humans are more likely to overestimate the risk posed by the encounter. Given this inclination and the verdict of perceived risk strongly and negatively driving Idaho residents' tolerance for carnivores, Idaho wildlife management agencies might

find that pointedly addressing the perceived risks posed by wildlife would have an impact on overall tolerance for their presence.

The varied results from each model segmentation are also important to note. Each subpopulation exhibited tolerance levels that were driven by different considerations. Rural Idaho residents relied much more on negative emotions that they felt toward the species, which negatively impacted their tolerance levels. Urban Idaho residents experienced more positive emotions toward the species which increased their tolerance levels, but also exhibited significant concern about risks, and their perceptions of risk had a stronger impact on tolerance, driving it down. Given the variance in assessing tolerance of these subpopulations, it is clear that a management strategy for coexistence that doesn't take these subpopulations into account would ultimately be insufficient.

These results have implications for assessing the tolerance Idaho residents' overall, as the inclusive model highlights these variables as a sort of spotlight on different routes for wildlife managers to potentially change or manage tolerance levels if needed, which is a constant consideration as humans interact with carnivores with increasing frequency. Additionally, the significant variation in each of the models identifying predictors of tolerance levels highlights the necessity of agencies to not approach wildlife management with a "one size fits all communities" strategy. The results of this study and those with similar objectives can provide management agencies with justification for the inclusion and acknowledgement of prior experiences, perceptions of risk, and the emotional attitudes of the affected public toward carnivore species.

Conclusion

Beyond identifying the predictors of tolerance for carnivores in Idaho, this study ultimately supports the growing importance of incorporating social and cognitive elements of human dimensions into wildlife management decisions. Conservation and management efforts have been shown to be more successful when public attitudes and social factors are considered, and the results of this study support the basis of that finding. Further research to assess tolerance in a similar fashion but in other contexts is crucial to improve carnivore management and conservation globally.

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Chapter 3: Idaho Residents' Acceptance of Wildlife Management Actions

Introduction

Carnivore management in the United States, and in Idaho specifically, is a consistent source of challenges and controversy. As the state of Idaho continues to grow in terms of population and urbanization, previously rural areas and landscapes primarily considered wildlife habitat have begun to change in the face of encroachment. Under these new and emerging circumstances, carnivore interactions and wildlife management are fast becoming a salient issue among affected publics. While the ecological significance of carnivores to their ecosystem is understood, conflict between various groups and communities persists or has intensified particularly in the presence of constituencies that support carnivore recovery and reintroduction, or their extermination (Treves & Karanth, 2003). Historically, large-bodied terrestrial carnivore species have been considered a threat to humans and livestock, predators of game species, and even an element of the wilderness to be subdued (Kellert et al., 1996). As many have observed and noted, much of what is termed human-wildlife conflict (HWC) – which is more appropriately termed human-wildlife interaction (HWI) (Peterson et al., 2010) – is often more a conflict between humans and their conflicting interests, i.e., human-human conflict (HHC) (Marshall, White, & Fischer, 2007). Because varied constituencies or affected public hold differing opinions and expectations for wildlife management, evaluation and reconsideration of carnivore management policy and actions is necessary to address HWI and HHC.

The presence of HWI or HHC reinforces the principle that conservation efforts are most successful when they are guided or informed by the values and beliefs of local communities and affected publics (Wilson, 2008). Differences in these values and beliefs of an affected public tend to be found at the root of many conservation conflicts, with opposing views only adding to the difficulty of the already precarious process of carnivore conservation and management (St. John, Mason, & Bunnefeld, 2020). Identification of public opinions on carnivores and their management is necessary for wildlife management agencies to create and implement effective policy. Several studies have found significant variance in group perceptions and acceptance of carnivore management strategies, with attribution given to different views and opinions on anticipated impact of wildlife behavior (Jacobs et al.,

2014), the type of management action (Bruskotter, Vaske, & Schmidt, 2009), the referent species (Liordos et al., 2017), and the perception of the efficacy of management (Eklund et al., 2020). The consideration of lethal control of a carnivore species is an additional factor that can induce HHC; several studies have found that this issue is the point of divergence for consensus on acceptable management action (Koval & Mertig, 2004; Jacobs et al., 2014; Lute et al., 2018).

Empirical evidence of an affected public's acceptance of carnivore management is essential for management agencies to be able to implement effective policies and systems. Without this information, managers are susceptible to promoting management strategies that the public will not support, and who may voice their disagreement with noncompliance, political action, or legal efforts (Jacobs et al., 2014). Similarly, identifying antecedents of public acceptance for carnivore management will highlight areas of conflict or situations where public preferences are not aligned with management strategy from agencies that is guided by the best available wildlife science and understanding. For example, Don Carlos et al. (2009) found within two Colorado communities that the public strongly preferred relocation of "problem" black bears over a highly disapproved of lethal control option. The authors note, however, that only 15% of North American wildlife managers believe this is an effective strategy in response to negative interactions between black bears and humans, and that the likelihood of successful relocation is low (often resulting in a fatal outcome for the individual bear). Similarly, Liordos et al. (2017) identified a preference among their sample for a nonlethal action to prevent nutria (*Myocastor coypus*), a non-native semiaquatic rodent, from depredating crops in Greece. Among several proposed management options, individuals preferred the measure that involved planting river and canal banks as an alternative food source, as opposed to nonlethal methods or no action at all. However, it was also noted that this is an expensive strategy that must be implemented over a significant area and is ultimately ineffective. Ensuring this type of information is communicated successfully from management personnel to the affected public will help to steer public support in a more actionable direction (Koval & Mertig, 2004).

The aim of this study is to identify patterns of similarity of difference among relevant segments of Idaho residents' preferences for potential management actions in response to a spectrum of carnivore behaviors, specifically those of black bear (*Ursus americana*),

mountain lion (*Puma concolor*), and grey wolf (*Canis lupus*). The identification of marked or statistically significant patterns of consensus or conflict within or between affected publics will be crucial to implement conservation and management efforts supported by Idahoans. Additionally, the human dimensions research represented by this study provides wildlife managers with necessary empirical evidence to inform their decision-making processes; subsequently, those decisions are more likely to be accepted and supported by the affected publics given their opinion and feedback was solicited.

Literature Review

Conflict and consensus

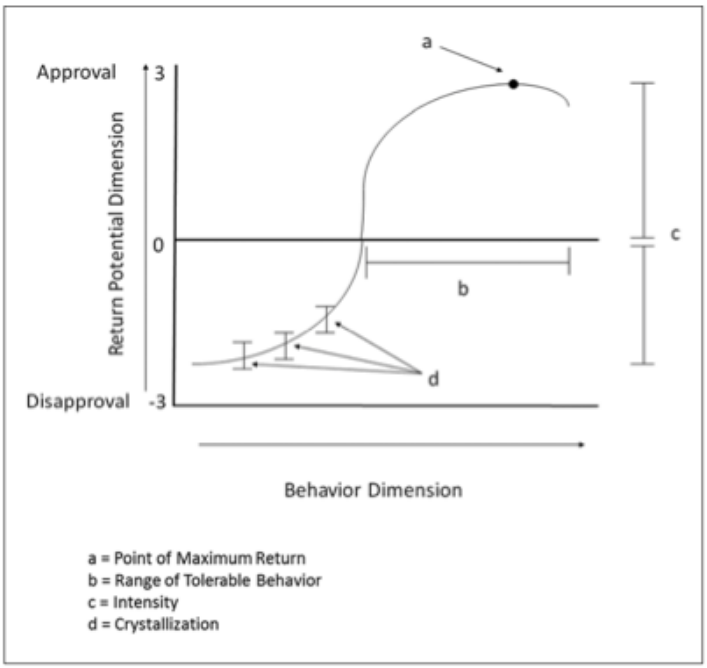
Public acceptance of wildlife management policies is typically driven by what an individual or community believes is an appropriate or adequate response to a particular situation (Morzillo, de Beurs, & Martin-Mikle, 2014). As such, different contexts generate different evaluative standards or expectations, sometimes referred to as "norms" (Zinn et al., 1997). Acceptability judgements of wildlife management actions can be assessed with a normative approach that provides management agencies with a better understanding of policies that may be more socially acceptable and garner more support than others (Vaske & Whittaker, 2004). Such an approach provides both descriptive and evaluative information about the acceptability standards being assessed, and thus has utility for management and managers (Vaske, Donnelly, & Shelby, 1993).

The tradition of normative approaches in environmental psychology and human dimensions of wildlife management literature serves as an avenue to empirically assess conflict and consensus. For example, in following other researchers such as Nolan (2015), Vaske et al., (2010), and Kneeshaw et al., (2004), this study presents a quantitative approach to an inclusive examination of public preferences in the context of interaction with and management of wildlife. Using the return potential model (RPM) (Jackson, 1966) and its derivative, the potential for conflict index (PCI) (Manfredo, Vaske, & Teel, 2003), as a two-pronged analytical methodology, I apply a quantitative approach to examine acceptability of management actions within the relationship between wildlife and humans.

Return potential model

The RPM was originally proposed by Jackson (1966) as a conceptual model for the measurement of norms and roles and has since been adapted to natural resources issues (Vaske & Whittaker, 2004; Nolan, 2015; Wallen & Kyle, 2018; Heywood, 2002). The model includes a behavioral spectrum (X-axis) and a "return potential" dimension (Y-axis) to map a return potential curve in the 2-dimensional space (Figure 3.1). The behavioral dimension, or spectrum, allows for a range in frequency of behaviors or for the consideration of discrete behaviors or actions, while the potential return dimension shows potential for approval-disapproval response toward the behavior or action in consideration (Jackson, 1966). The curve presents four outputs: a point of maximum/minimum return, range of tolerable behavior, intensity and crystallization. The *point of maximum return* (a) represents the maximally accepted behavior or action; the *range of tolerable behavior* (b, all data points above the X-axis) shows the threshold of behavior that will be tolerated/accepted; *intensity* (c) represents the full range of the data/response; and *crystallization* (d) refers to the strength of the curve, often interpreted as the degree of consensus (Wallen & Kyle, 2018). Calculation and analysis of these outputs provides critical information surrounding the acceptability (or other potential return) for the dimension of behavior on the x-axis. In the context of this study, the curve is a graphical representation of the acceptability of several behaviors and management actions, and analysis of this curve could help to identify any acute variances in acceptance from the public regarding these behaviors and actions.

Figure 3.1
Return Potential Model graph (from Nolan 2015).



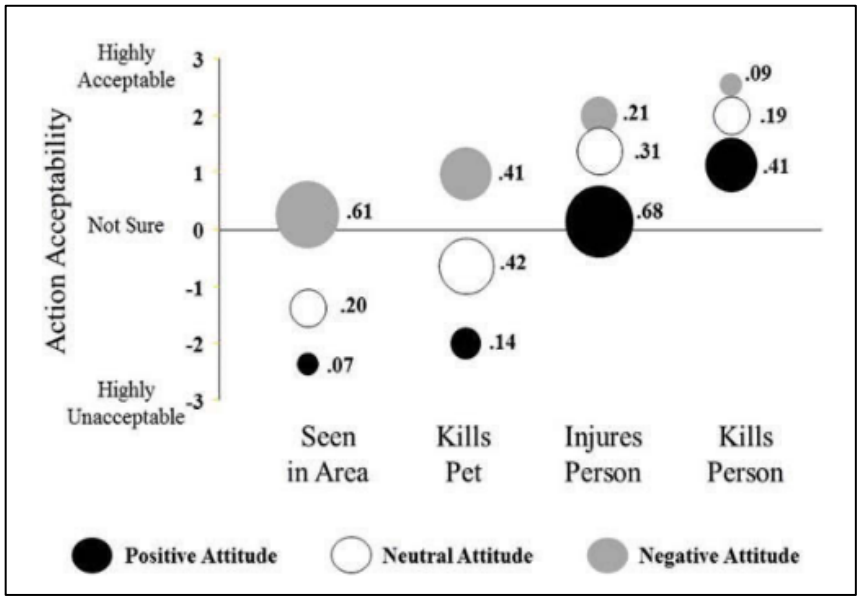
Beyond simply identifying the nature and strength of acceptance judgements among the affected public for wildlife management strategies, potential areas of conflict between these judgements are also critical for managers to be aware of, as "human-wildlife conflict" tends to present more often in actuality as conflicts between humans (i.e., HHC) with differing opinions and objectives for wildlife management issues. Effective management of natural resources is largely dependent on the affected public's willingness to participate and comply with necessary policies (Røskaft et al., 2003), and this objective can be difficult to obtain when there is a lack of consensus on such policies among the individuals whose compliance is needed. The most significant polarization between groups of the involved public on matters of wildlife management tends to surround decisions regarding lethal control of individual wild animals or populations (Lute et al., 2018), but Marshall, White, and Fischer (2007) identified three additional elements of most sources of conflict among humans in wildlife management conflicts, beyond an individual's basic assessment of a particular management action or response: their perceptions of any conflict-related issues; their perceptions of each other; and the perceived barriers to consensus within the debate or conflict at hand. Their review of conflicts among humans in the context of wildlife decision-

making also emphasized the importance of understanding such social elements involved in implementing successful wildlife management strategies. Additionally, conflict management strategies regarding the affected public are necessarily becoming a larger aspect of wildlife management, as conservationists and managers become more and more cognizant of the importance of public support in achieving successful management goals (Messmer, 2000).

Potential conflict index

The PCI is a measurement/computation tool developed by Manfredo, Vaske, and Teel (2003) to calculate and visualize conflict among humans in natural resource realms, including leisure, recreation, and managerial concerns (Vaske et al., 2010). The PCI is especially useful in reporting findings because of its visual nature; once calculated, the index results are shown as bubbles "where the size of the bubble depicts the magnitude of the PCI value and indicates the extent of potential conflict (or consensus) regarding acceptance of a particular issue" (Vaske, 2018). The larger the two-dimensional bubble, the greater the potential for conflict (and lower consensus). The placement of the bubble on the graph depicts mean evaluative response. Figure 3.2 shows a graphical representation of attitudes toward lethal management of mountain lions. For this study, my data will be represented similarly. The PCI will allow me to show any presence of conflict within the response for acceptability of nuisance behaviors and resulting management actions.

Figure 3.2
Acceptance of lethal management of mountain lions for different attitude groups



Note. Mean acceptance (middle of bubble) and PCI values showing consensus (size of bubble) associated with lethal management of a mountain lion for different attitude groups across four different scenarios (from Vaske, 2018).

Rural-urban divide

The physical and cultural separation of rural and urban communities is a commonly studied element of wildlife management (e.g., Loker, Decker, & Schwager, 1999; Morzillo et al., 2014; Lute & Gore, 2014) and can provide information for wildlife management that would ultimately make statewide or cross-boundary objectives difficult to implement. The separation of these communities is often shown in their respective attitudes toward wildlife, especially carnivores, as their different lifestyles, livelihoods, and physical environments differ significantly. The sociocultural elements of this separation are important to consider when assessing acceptance levels of wildlife management, because an individual's own identification as a "rural" or "urban" resident is often an indicator of how their values and beliefs may occur in reference to, or in alignment with, their community (van Eeden et al, 2019; Brunson, 1996). This identification with a particular community or group can provide a framework for forming opinions and making decisions and has been shown to inform wildlife management preferences and acceptance levels. For example, self-identification or

ascription to a residential community (urban or rural) has been identified as a factor in several scenarios relevant to wildlife management, including predicting opposition for coexisting with wildlife (Knopff, Knopff, & St. Clair, 2016), assessing cultural perceptions of carnivores (Woodroffe et al., 2005), identifying sources of conflict among prioritization of wildlife management (Marshall et al., 2007), the influence of regular exposure to wildlife on advocacy motivations (Pinheiro, Rodrigues, & Borges-Nojosa, 2016; Woodroffe et al., 2005), and how differing economic interests influence wildlife conservation preferences (van Eeden et al., 2019).

Existing literature, as well as intuitive knowledge, on perceptions of wildlife suggest that residents of urban and rural communities will feel differently about coexisting with wildlife and how they are managed (Reiter et al., 1999). Individuals who have more experience coexisting with wildlife, as is usually the case for rural residents, are typically found to have less fear toward them but also tend to perceive higher levels of risks posed by wildlife (Røskaft et al., 2003). Similarly, rural communities can simultaneously exhibit more appreciation for wildlife while also reporting more utilitarian values and preferences in reference to the consumption or use of wildlife (Messmer, 2000). Also, an important element when evaluating preferences between rural and urban communities for wildlife management is the cultural or symbolic foundations these preferences are rooted within. Skogen and Krange (2003) note that human-wildlife conflicts are increasingly revolving around the social, economic, and cultural differences between rural and urban communities, including the trending image of united rural communities standing united against “vermin” wildlife and the “urban romantics” who have lost their connection to the land and are not interested in accommodating rural interests.

Risk and emotions

Bruskotter et al. (2009) identifies two primary elements of cognitive factors that influence acceptance judgments – beliefs about the impacts of a particular wildlife behavior or management strategy, and the general attitudes held toward a species. In the context of carnivore-specific management, concern regarding impacts of wildlife behavior is often operationalized as an individual’s perceptions of risk posed by a species, typically to the

individual's own personal safety or to their family, property, or livelihood (Drake et al., 2020; Bruskotter & Wilson, 2014; Riley & Decker, 2000).

General "attitudes" toward wildlife are often measured in terms of the emotions elicited by a species or individual animals in response to their behavior or potential management options (Slagle, Bruskotter, & Wilson, 2012; Don Carlos et al., 2009). This is theoretically supported by the role of emotions in the formation of attitudes (Azjen, 2005), and thus is relevant to public attitudes toward wildlife management. Emotions and emotional states have the potential to influence an individual's decision-making and behavior, and wildlife can evoke strong emotions in humans that vary in strength and quality. These emotions can be generated and influenced by a wide array of processes: acquired learning and knowledge, individual experiences, evolutionary response, cultural development and/or unconscious mental dispositions, among an array of other factors (Jacobs, 2009).

Cognitive elements such as risk perception and emotions have been studied for their relevance in attitudes toward wildlife and their conservation or recovery (e.g., Knopff et al., 2016; Castillo-Huitrón et al., 2020; Crook, 2019), but have recently become a more regular consideration in assessing public acceptance of carnivore management strategies. Previous studies have assessed the emotional dispositions and perceptions of risk of stakeholders and other groups of the affected public and have found evidence for the relationship between these cognitive elements as they relate to wildlife, and public preferences for wildlife management (St. John et al., 2020; Ghasemi et al., 2021).

Species and situation-specific

Bruskotter (2009) also highlighted the importance of contextual factors in assessing acceptance judgments of wildlife management. Under the umbrella of "contextual" factors, both the severity of the management response and the type of species being hypothetically managed have been found to be relevant considerations in predicting public acceptance of management actions in response to conflictual or problematic wildlife behavior (Decker, Jacobson, & Brown, 2006; Diaz, Simonetti, & Zorondo-Rodriguez, 2020; Liordos et al., 2017; Sponarski, Vaske, & Bath, 2015).

Species that are large, conceptually visible, and perceived to be dangerous are most likely to be the recipients of antagonism or hostility in reference to how they are managed in

the context of conflict with humans (Dickman, 2010). Perceptions of these species, such as bears, wolves, and big cats are difficult to change once ingrained, often resulting in a lasting antagonism by particular communities despite management efforts or attempts to change how they are perceived. Hostility toward these charismatic carnivores is especially problematic both because they have been historically persecuted in attempts to protect humans, domesticated animals, and livestock, and because their slow reproduction rates and low density make them particularly vulnerable to eradication (Treves & Naughton-Treves, 2005). Additionally problematic is the underlying assumption of most carnivore management efforts, that reducing the presence or density of the species is the most effective way to reduce conflict or damage (Treves, Krofel, & McManus, 2016). Black bears, grey wolves and mountain lions are all examples of species that show behavioral variability in individuals, because they occupy higher trophic levels and can be ecosystem generalists (Swan et al., 2017). This individual variation makes selective management of problem animals within a population an attractive option as a "quick-fix", or a means of appeasing communities on the receiving end of conflict with the animal. There is evidence to show that selective removal of problem individuals from a population can be successful in deterring future damage or conflicts, by preventing the conflictual behavior from socially spreading to other conspecifics and potentially selecting for non-conflictual behavior in the species over time (Swan et al., 2017).

Additionally, there is significant evidence to suggest that public preferences and perspectives regarding management strategies vary depending on the severity of both the behavior or conflict involved, and the potential management response (e.g., Liordos et al., 2017; Loker, Decker, & Schwager, 1999; Frank, Johansson, & Flykt, 2005).

Research Questions

Based on the methodology of RPM/PCI and evidence that supports social and cognitive factors relevant to understanding public acceptance of wildlife management, this study asks the following research questions:

1. What are Idaho residents' levels of acceptance for management actions in response to a spectrum of behaviors from referent carnivore species?

2. How do these levels of acceptance vary among segments based on: species, geographic identity, emotion, and perceived risk?
3. Where does consensus and conflict emerge among and between segments?

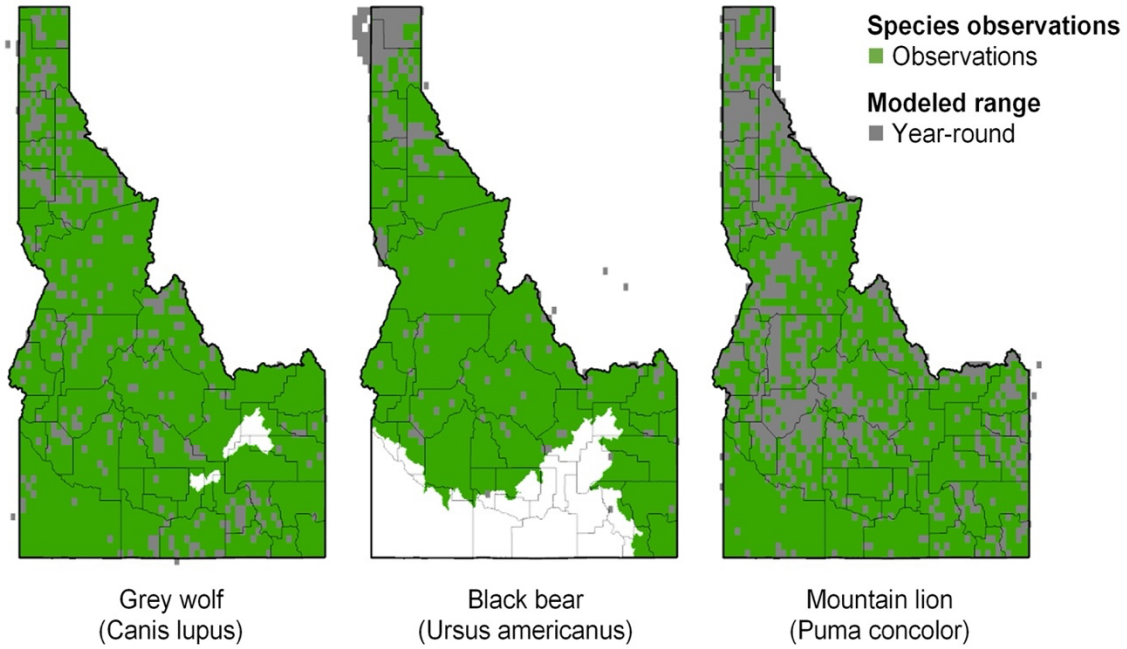
Methods

Study Context

This study was conducted in the state of Idaho, regarding the management of three large bodied, terrestrial carnivores that have a significant probability of interacting with humans. Black bears, mountain lions and grey wolves all occupy habitat ranges that cover most of the state of Idaho and different landscapes, spanning rural and urban regions alike (Idaho Species Catalog; Figure 3.3). While populations of these carnivores are often found in higher concentrations in rural areas with more habitat connectivity, both urban and rural communities are inhabited by carnivore species at least in part due to conservation efforts and recognition of the importance of large predators to their habitat, with over 60% of urban and suburban households in the US experiencing conflict with wildlife (Messmer, 2000).

Opportunity for interactions increases as urban areas grow, and though Idaho is a traditionally rural state, the percentage of the population that is considered urban has grown nearly 17% since 1970, with now 70.6% of the population being considered urban (U.S. Census Bureau, 2010). The changing composition of the state makes wildlife management more challenging, as overlap occurs between wildlife and humans living in urban environments who are increasingly disconnected from natural environments and experiences with wildlife, while rural residents, who still make up a significant portion of the geographic area of the state, can be underrepresented (Elliot et al., 2016).

Figure 3.3
Visual representation of year-round range and individual observations of black bears, mountain lions, and grey wolves (Idaho Species Catalog).



Participants and Sampling

The research design was a cross-sectional, quantitative design. The target population was Idaho residents 18 years or older. A random sample of 7,986 residents stratified by urban and rural residency based on US Census Bureau criteria was selected from an address-based sample frame purchased from Marketing Systems Group (MSG), who appended telephone and email contact information. The sample was further narrowed to include survey residents whose email was appended to their residential address; the final sample size was 4,491 residents (urban = 2,349, rural = 2,142). Next, a block sampling design was used wherein one-third of the sample was randomly assigned to receive a questionnaire that referenced one of three carnivore species (black bear: n = 1,498, mountain lion: n = 1,495, and wolf: n = 1,498). All questions were aligned such that species was the only differences between samples.

A mixed-mode survey distribution started in August 2021 and ended January 2022. Following a tailored design protocol (Dillman, Smyth, & Christian, 2014), participants were first contacted by email on August 9, 2021 to complete the survey online via Qualtrics, with

reminder emails sent August 12 and August 18; emails were followed by a postcard augmentation sent on September 18. At this point, solicitation did not garner sufficient response, so a paper version of the survey was mailed in October to those in the sample who had not yet participated and who were not successfully reached by email.

Materials and Measures

Primary data was collected from a survey instrument that consists of closed-ended questions designed to identify participants' perceptions of the acceptability of a range of wildlife management actions by appropriate management agencies in response to specific wildlife behaviors among three target species: black bear, mountain lion, and grey wolf. The questionnaire assessed acceptability of the proposed management action with responses ranging from very unacceptable (coded as -3) to very acceptable (coded as +3).

Acceptability

Acceptance judgements regarding management strategies in response to problematic wildlife behaviors were measured by asking participants to report how acceptable or unacceptable they found each of four different management strategies to be, in the context of five scenarios involving particular behaviors from black bears, mountain lions, and grey wolves. The five hypothetical scenarios were chosen as a spectrum of behaviors with increasing salience and severity. The first behavior on the spectrum is considered a "distant, but common" behavior and was the only scenario that was not identical across the three species in consideration. Respondents who received surveys regarding black bears were asked to consider the behavioral scenario of: "the animal goes through trash in your area". Respondents who received surveys regarding mountain lions or grey wolves were asked to consider the scenario of: "the animal is seen along a popular hiking trail". These behaviors were considered "distanced" scenarios because the behavior is a cause for concern, but without the animal directly engaging with a person or personal property. The second through fifth scenarios on the behavioral spectrum were the same for all three versions of the questionnaire: "the animal enters your property"; "the animal attacks a pet"; "the animal attacks livestock"; and "the animal attacks a human".

Participants were asked to report their own acceptability judgements of four potential management options as the *primary management response* to each of the five hypothetical scenarios (e.g., "How acceptable or unacceptable do you find each of the following management actions in response to a black bear entering your property?"). The options presented included: "Monitor the animal"; "Capture and relocate the animal"; "Frighten the animal away with non-lethal practices"; and "Kill the animal". The questionnaire assessed acceptability of the proposed management actions on a six-point bipolar scale with possible responses ranging from very unacceptable (coded as -3) to very acceptable (coded as +3).

Identity

As part of the address-based sampling for this study, respondents were categorized into rural and urban geographic strata based on census data. In addition to this designation, a subjective assessment of urban or rural identity was collected via a closed-ended question prompting respondents to independently identify as an urban ("big city" or "suburban area") or rural ("small town" or "rural area") resident of Idaho.

Risk perception

Risk perception is commonly assessed as an element of human-wildlife coexistence and interaction (Riley & Decker, 2000; St. John et al., 2020; Landon et al., 2020), often because of its role in forming attitudes and reactions to hazardous scenarios (Visschers & Siegrist, 2008). For this study, perceptions of risk were measured by asking respondents to evaluate the level of risk they believed that the species in question (black bear, mountain lion, or grey wolf) posed to four different considerations: human safety, personal property, pets, and livestock, on a six-point scale ranging from 1 (no risk at all) to 6 (a very great risk). Ratings of the four items in this study were indexed to create a variable of overall risk perception.

Emotion/affect

Elements of emotion were measured using the Discrete Emotions scale, with some adjustments to the included dimensions (Harmon-Jones et al., 2016). To best address the

current study context, I chose to drop some dimensions from the established scale and include the anger, fear, anxiety, and happiness dimensions, with an added dimension of pride. Using Harmon-Jones and colleagues' lexicon of emotions exemplary of these dimensions, survey participants were asked to what extent they experience each emotion from my provided list when thinking about the relevant species. The scale for responses was a six-point scale ranging from 1 (not at all) to 6 (an extreme amount). For inclusion in the study's conceptual model and subsequent analysis, six items of the amended scale (anger, rage, panic, fear, dread, and anxiety) were indexed to create a "Negative Emotion" variable. Similarly, the remaining four items of the amended scale (happy, enjoyment, pride and respect) were indexed to create a "Positive Emotion" variable. To best identify any relationship between reported emotions and acceptance of management choices, only responses that involved above average, "strong" emotions (emotion ratings above the median) were included for analysis and visual representation.

Data Analysis

Five different behavioral scenarios were evaluated for their effect on the acceptance of four potential management responses. The generated return potential models were visually examined as a graphical representation of the acceptability of several behaviors and management actions. Following the methods of Vaske (2018), PCI_2 graphics were created and visually interpreted to identify mean acceptance responses for each of the different behavioral scenarios and possible management responses, as well as to evaluate the agreement or consensus of these responses among the pooled sample and for individual segmentations of the sample.

Results

Participant Characteristics

Of the 4491 surveys administered, 103 were undeliverable by mail and 606 complete surveys were returned (urban = 291, rural = 305; black bear: n = 196, mountain lion: n = 198, and wolf: n = 218), an effective response rate of 13.8%. Using a conservative estimate of

sample proportion, unweighted data, and a 95% confidence interval, the total margin of sampling error for the survey was +/- 4% (Dillman et al., 2014).

Respondents (n = 590) were primarily middle-aged and older (*M* = 58.9, *SD* = 15.4), long-term residents of Idaho (*M* = 39.3 years, *SD* = 24.2), and men (58.5%) (Table 3.1). Nearly all respondents reported finishing high school (97.2%), and a majority continued on to pursue a higher education or vocational degree (75.7%). 12% of respondents identified as politically liberal, while 53% identified as conservative, and the remainder identified as moderate or wrote in an unlisted option. Based on self-reporting, 34% of respondents identified themselves as urban residents, and 66% identified as rural residents.

Table 3.1
Sociodemographic Characteristics of Participants

	Pooled		Urban		Rural	
	n	%	*n*	%	*n*	%
Age						
18-24	39	6.6	9	4.6	29	7.6
25-34	32	5.4	11	5.6	21	5.5
35-44	76	12.9	26	13.3	49	12.9
45-54	87	14.7	35	17.9	52	13.6
55-64	123	20.8	39	20.0	79	20.7
65-74	145	24.6	43	22.1	99	26.0
75+	88	14.9	32	16.4	52	13.6
Subjective geographic identification						
Big city	67	11.6	67	34.4	-	-
Suburban area	128	22.2	128	65.6	-	-
Small town	140	24.3	-	-	140	36.7
Rural area	241	41.8	-	-	241	63.3
Gender						
Woman	225	39.6	79	41.1	143	39.4
Man	332	58.5	109	56.8	213	58.7
Prefer not to say	11	1.9	4	2.1	7	1.9
Ethnicity						
American Indian or Alaska Native	5	0.9	2	1.1	3	0.8
Asian	6	1.1	3	1.6	3	0.8
Black or African American	1	0.2	1	0.5	-	-
Hispanic or Latino	11	2.0	3	1.6	8	2.2

Table 3.1 continued						
White	520	99.2	175	92.1	332	93.0
Other	17	3.0	6	3.2	11	3.1
Education						
High school	121	21.4	32	16.7	85	23.7
2-year college degree	73	12.9	25	13.0	46	12.8
4-year college degree	173	30.6	68	35.4	101	28.1
Vocational or trade school degree	81	14.3	22	11.5	58	16.2
Graduate degree	101	17.9	40	20.8	60	16.7
Other	16	2.8	5	2.6	9	2.5
Political Ideology						
Very liberal	15	2.7	10	5.3	5	1.4
Liberal	52	9.3	22	11.6	29	8.1
Moderate	161	28.8	62	32.6	95	26.6
Conservative	228	40.8	71	37.4	153	42.9
Very conservative	68	12.2	13	6.8	52	14.6
Other	35	6.3	12	6.3	23	6.4

Note. Instances of rural/urban sample populations not adding up to pooled sample population values are indicative of missing data from respondents.

As a general trend, the acceptability of each nonlethal management strategy decreased as the severity of the wildlife behavior scenarios increased along the spectrum, while the opposite was true for the lethal management option (Scenario 5); acceptability of killing a black bear, grey wolf, or mountain lion as a management response increased as the severity and proximity to humans of each wildlife behavioral scenarios increased (Table 3.2; Figure 3.4). Respondents' overall acceptance ratings for *monitoring* a problem animal were highest for Scenario 2 ("the animal enters your property"), but acceptance levels then decreased as the severity of the behavioral scenarios increased (M= 0.30). The same trend was observed for *frightening away* a problem animal (M = 0.81) and for *capturing and relocating* a problem animal (M = 1.18). The lethal control management option showed the opposite trend, with respondents rating it as the most unacceptable option for Scenario 1 (the distanced/common behavior) and Scenario 2, then increasing in acceptability to become the most accepted management action for the most severe behavior, Scenario 5 ("the animal attacks a human") (M = -0.11). The management action and behavior scenario with the most consensus, or least potential for conflict, was relocating a problem animal in response to its

presence on someone's property (M = 1.62, PCI_2 = 0.34). The action with the least consensus was capturing and relocating an animal that had attacked a human (M = 0.27, PCI_2 = 0.79).

Table 3.2

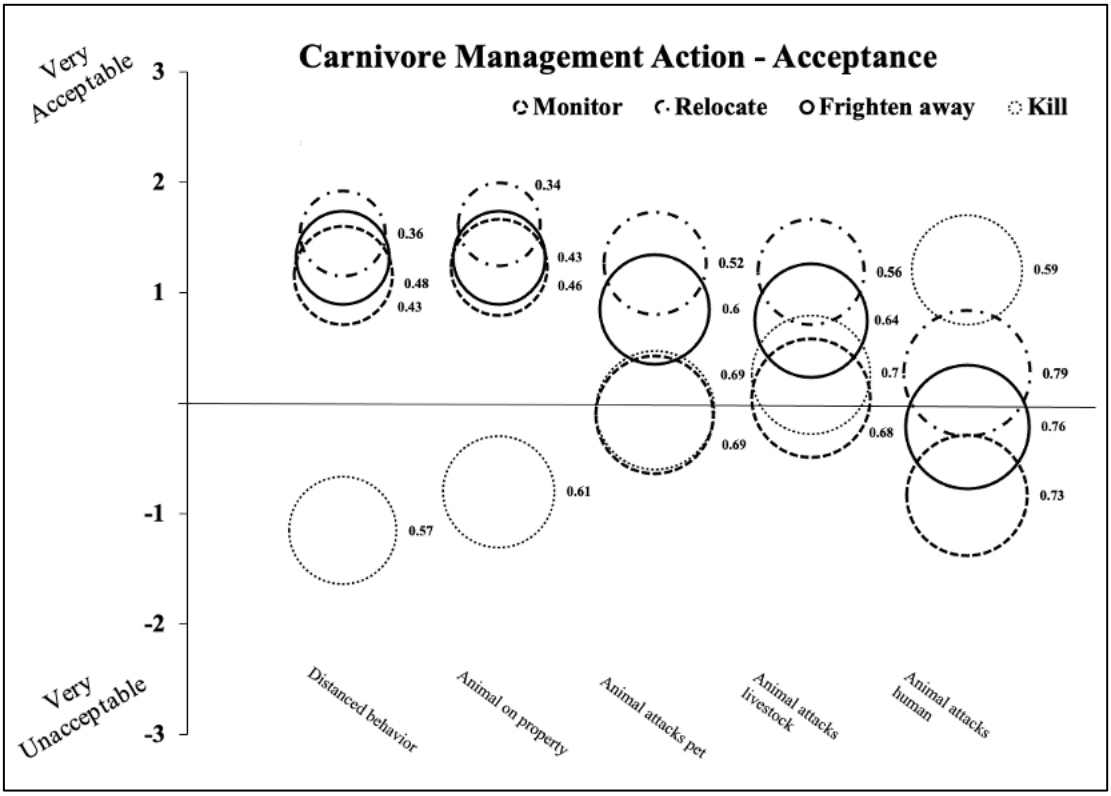
Acceptability ratings of management actions for five behavioral scenarios (pooled sample)

	Distanced behavior		On property		Attacks pet		Attacks livestock		Attacks human	
	M	SD	M	SD	M	SD	M	SD	M	SD
Monitor	1.16	1.96	1.23	1.94	-0.10	2.36	0.05	2.37	-0.83	2.47
Relocate	1.54	1.73	1.62	1.70	1.27	2.10	1.19	2.17	0.27	2.57
Frighten	1.32	1.87	1.32	1.87	0.85	2.22	0.75	2.30	-0.21	2.51
Kill	-1.15	2.15	-0.80	2.22	-0.06	2.37	0.26	2.36	1.21	2.23

Note. Acceptance variable responses coded on a 6-point scale from 1 (Very unacceptable) to 6 (Very acceptable).

Figure 3.4

Carnivore management acceptance



Note. Potential for conflict index graphic depicting acceptance of four management actions in response to five behavioral scenarios of black bears, grey wolves, and mountain lions.

Species Segmentation

PCI visuals and index scores were calculated by species in accordance with the block sampling protocol (Table 3.3; Figure 3.5a, 3.5b, 3.5c.). For respondents who reported management preferences in reference to black bears (n = 191), killing a problem bear was significantly more unacceptable than any of the three nonlethal choices in both Scenario 1 and 2 (S1: M = -1.57, p <.001; S2: M = -1.32, p <.001). For Scenarios 1 through 4, relocation was the most acceptable option (S1: M = 1.99; S2: M = 1.99; S3: M = 1.92; S4: M = 1.79). Only in Scenario 5 was lethal control the most acceptable option (M = 0.91). The action with the most consensus (M = 1.99, PCI_2 = 0.18) was the acceptability of relocating a problem bear in response to it entering someone's property. The action with the least consensus (M = -0.46, PCI_2 = 0.78) was the unacceptability of monitoring a bear that had attacked a human (Figure 3.5a).

Table 3.3

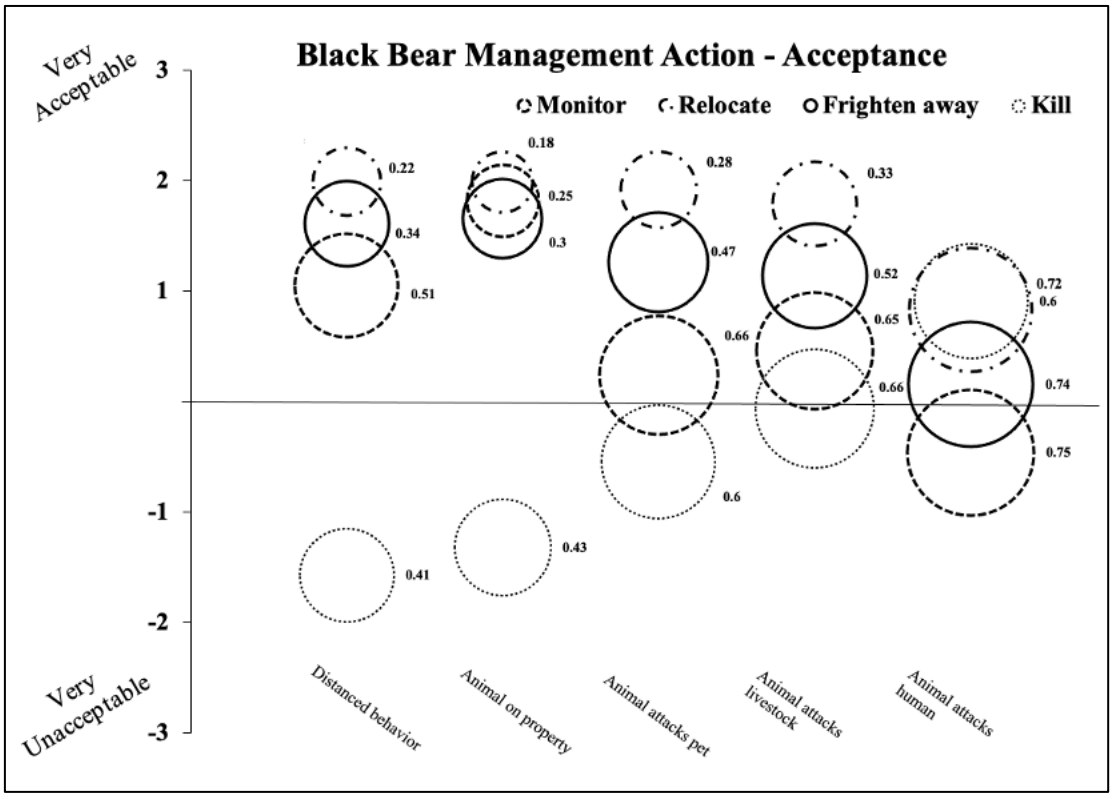
Acceptability ratings of management actions for five behavioral scenarios, segmented by species

	Distanced behavior		On property		Attacks pet		Attacks livestock		Attacks human	
	M	SD	M	SD	M	SD	M	SD	M	SD
Black Bear (n = 191)										
Monitor	1.05	1.99	1.82	1.44	0.24	2.31	0.46	2.30	-0.46	2.51
Relocate	1.99	1.40	1.99	1.33	1.92	1.62	1.79	1.74	0.83	2.47
Frighten	1.61	1.66	1.66	1.60	1.26	2.00	1.14	2.06	0.16	2.47
Kill	-1.57	1.84	-1.32	1.83	-0.54	2.17	-0.06	2.31	0.91	2.24
Mountain Lion (n = 186)										
Monitor	1.61	1.63	1.14	1.91	-0.02	2.38	0.10	2.35	-0.96	2.44
Relocate	1.83	1.50	1.87	1.47	1.61	1.88	1.62	1.90	0.53	2.56
Frighten	1.63	1.66	1.51	1.70	1.10	2.12	0.96	2.21	-0.22	2.53
Kill	-1.50	1.92	-1.14	2.05	-0.20	2.41	-0.01	2.37	1.15	2.31
Grey Wolf (n = 213)										
Monitor	0.88	2.12	0.77	2.21	-0.47	2.34	-0.36	2.41	-1.05	2.42
Relocate	0.88	1.98	1.06	2.03	0.39	2.37	0.27	2.42	-0.47	2.52
Frighten	0.79	2.10	0.85	2.15	0.27	2.38	0.23	2.49	-0.51	2.49
Kill	-0.47	2.42	-0.03	2.46	0.51	2.39	0.78	2.33	1.52	2.12

Note. Acceptance variable responses coded on a 6-point scale from -3 (Very unacceptable) to 3 (Very acceptable)

Figure 3.5a

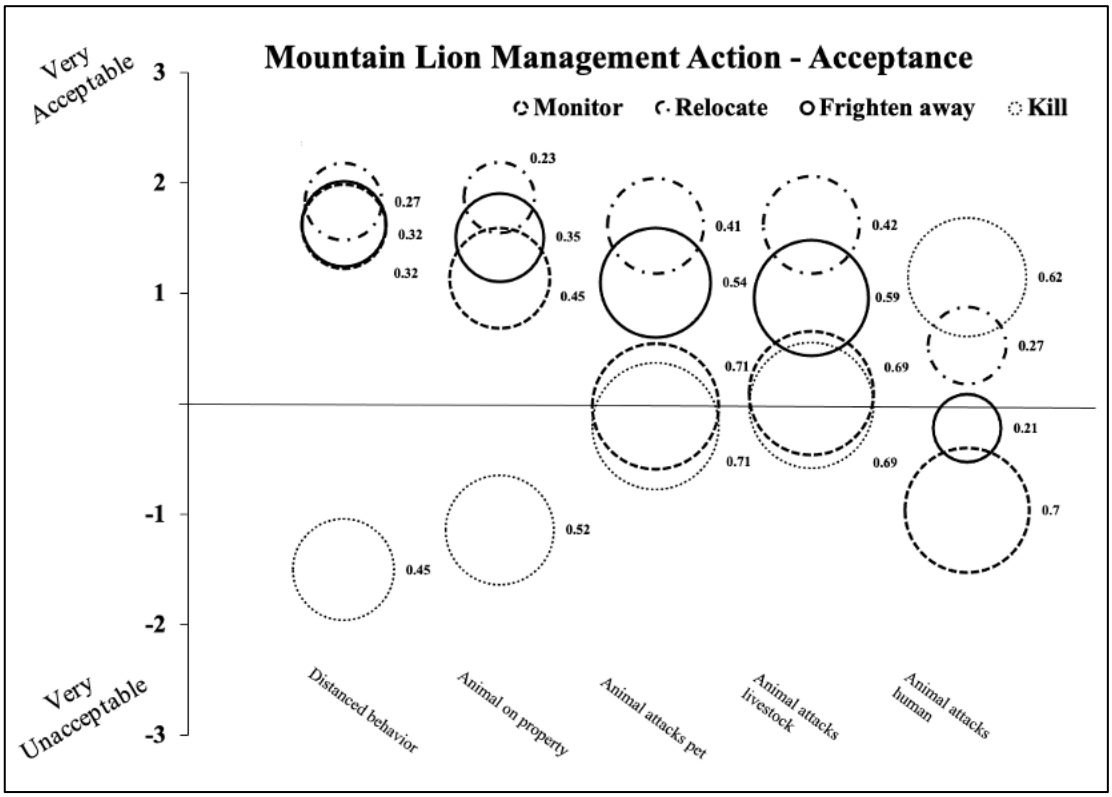
PCI_2 Visualization of Black Bear Management Acceptance



Note. Potential for conflict index graphic depicting acceptance of four management actions in response to five behavioral scenarios of black bears.

PCI visuals for mountain lions (n = 186) followed similar trends. Killing a problem mountain lion was significantly more unacceptable than any nonlethal strategies in both Scenario 1 and 2 (S1, lethal control: M = -1.50, p <.01; S2, lethal control: M = -1.14, p <.01). Relocation was observed to be the preferred action for Scenarios 1 through 4 (S1: M = 1.83; S2: M = 1.87; S3: M = 1.61; S4: M = 1.62), and as was the case with the black bear management preferences, lethal control was not only acceptable in solely Scenario 5, but it was the most acceptable choice for a mountain lion that had attacked a human (M = 1.15). The action with the most consensus was the unacceptability of frightening away a problem lion with nonlethal techniques in response to an attack on a human (M = -0.22, PCI_2 = .21). The actions with equally low consensus were the weak unacceptability of monitoring a lion that had attacked a pet (M = -0.02, PCI_2 = 0.21), and of killing a lion that had attacked a pet (M = -0.20, PCI_2 = 0.21) (Figure 3.5b).

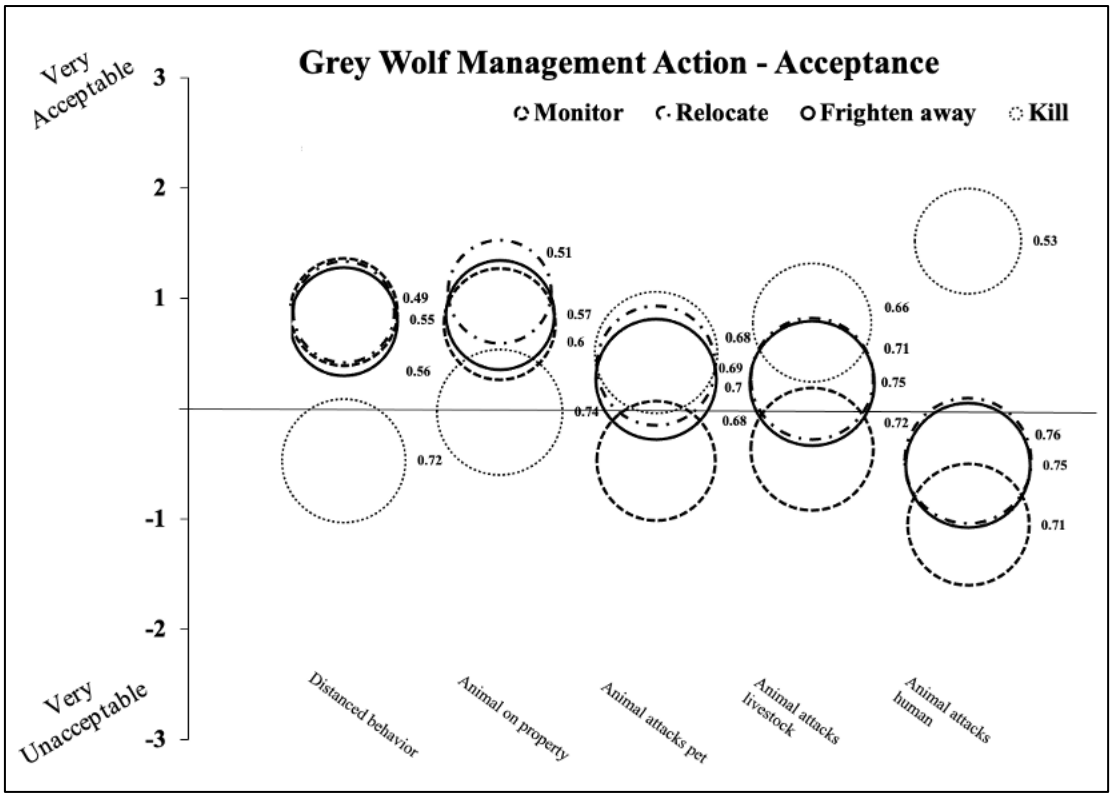
Figure 3.5b
PCI_2 Visualization of Mountain Lion Management Acceptance



Note. Potential for conflict index graphic depicting acceptance of four management actions in response to five behavioral scenarios of mountain lions.

Grey wolf (n = 213) diverged from black bear and mountain lion trends. Acceptability ratings for lethal control were significantly higher in each scenario for grey wolves than for either mountain lions or black bears (overall M = 0.46, p <.01). Lethal acceptance was also the preferred management action in Scenarios 3, 4, and 5 (S3: M = 0.51; S4: M = 0.78; S5: M = 1.52). Additionally, the proposed management actions for grey wolves showed less consensus on these issues overall, and therefore an increased potential for conflict. Relocating a problem wolf seen from a popular hiking trail had the most consensus, though still potentially conflictual (M = 0.88, PCI_2 = 0.49). The least agreed upon action for grey wolves was the unacceptability of relocating a problem wolf that had attacked a human (M = -0.47, PCI_2 = 0.76) (Figure 3.5c).

Figure 3.5c
PCI_2 Visualization of Grey Wolf Management Acceptance



Note. Potential for conflict index graphic depicting acceptance of four management actions in response to five behavioral scenarios of grey wolves.

Residency

Past research and conventional wisdom would presume a difference in acceptability judgments between urban (n = 195) and rural (n = 381) residents. However, PCI visualizations do not highlight noteworthy differences between these segments of the Idaho population (Table 3.4; Figure 3.6a, 3.6b). Both segments exhibit acceptance levels with anticipated general trends, i.e., as the severity and proximity of carnivore behavior increases, the nonlethal control options become less acceptable as the primary management response, while lethal control increases in acceptance to become the preferred option in Scenario 5 for both groups (urban residents: M = 1.07; rural residents: M = 1.27).

Table 3.4

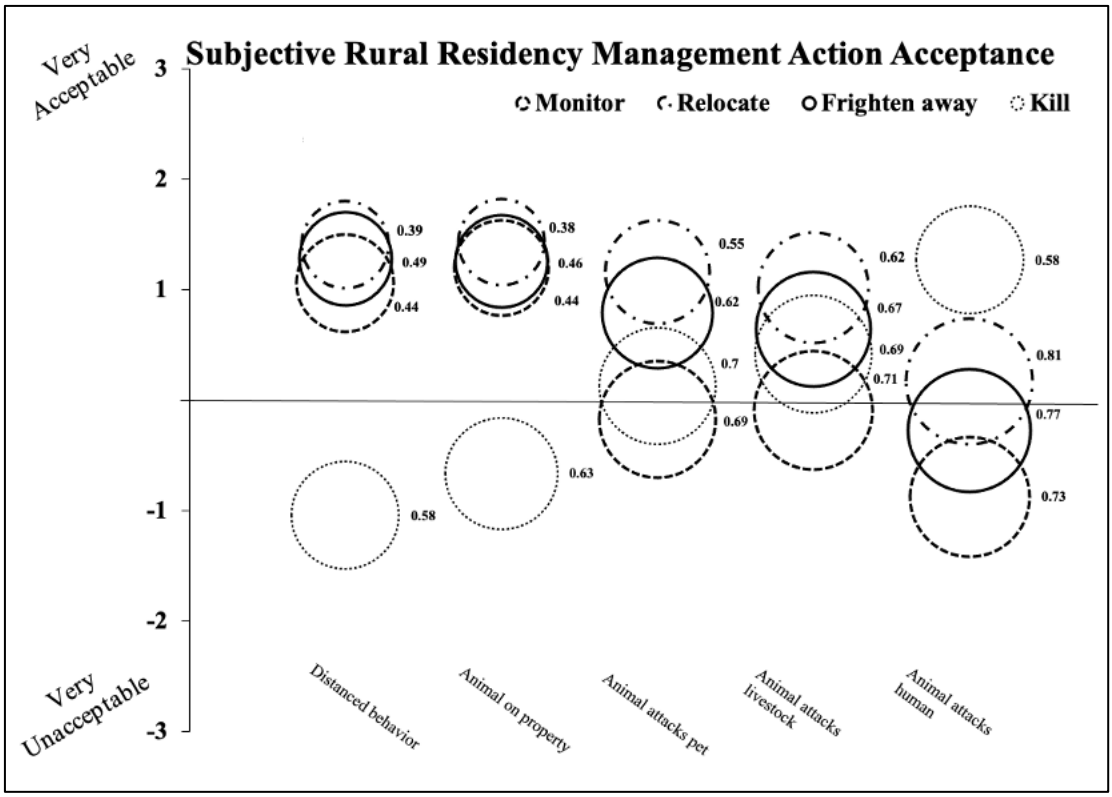
Acceptability ratings of management actions for five behavioral scenarios, segmented by urban and rural self-identified residency

	Distanced behavior		On property		Attacks pet		Attacks livestock		Attacks human	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Rural Residents										
Monitor	1.06	1.97	1.20	1.94	-.17	2.37	-0.09	2.40	-0.87	2.47
Relocate	1.41	1.79	1.43	1.79	1.16	2.16	1.02	2.27	0.17	2.62
Frighten	1.28	1.90	1.26	1.91	0.79	2.27	0.64	2.36	-0.27	2.53
Kill	-1.04	2.17	-0.66	2.24	0.13	2.37	.42	2.39	1.27	2.23
Urban Residents										
Monitor	1.46	1.85	1.36	1.86	0.15	2.32	0.43	2.28	-0.63	2.49
Relocate	1.81	1.57	2.03	1.40	1.65	1.83	1.66	1.79	0.58	2.44
Frighten	1.48	1.72	1.50	1.73	1.09	2.07	1.09	2.11	-0.01	2.46
Kill	-1.50	1.99	-1.17	2.09	-0.51	2.27	-0.11	2.26	1.07	2.20

Note. Acceptance variable responses coded on a 6-point scale from 1 (Very unacceptable) to 6 (Very acceptable).

Figure 3.6a

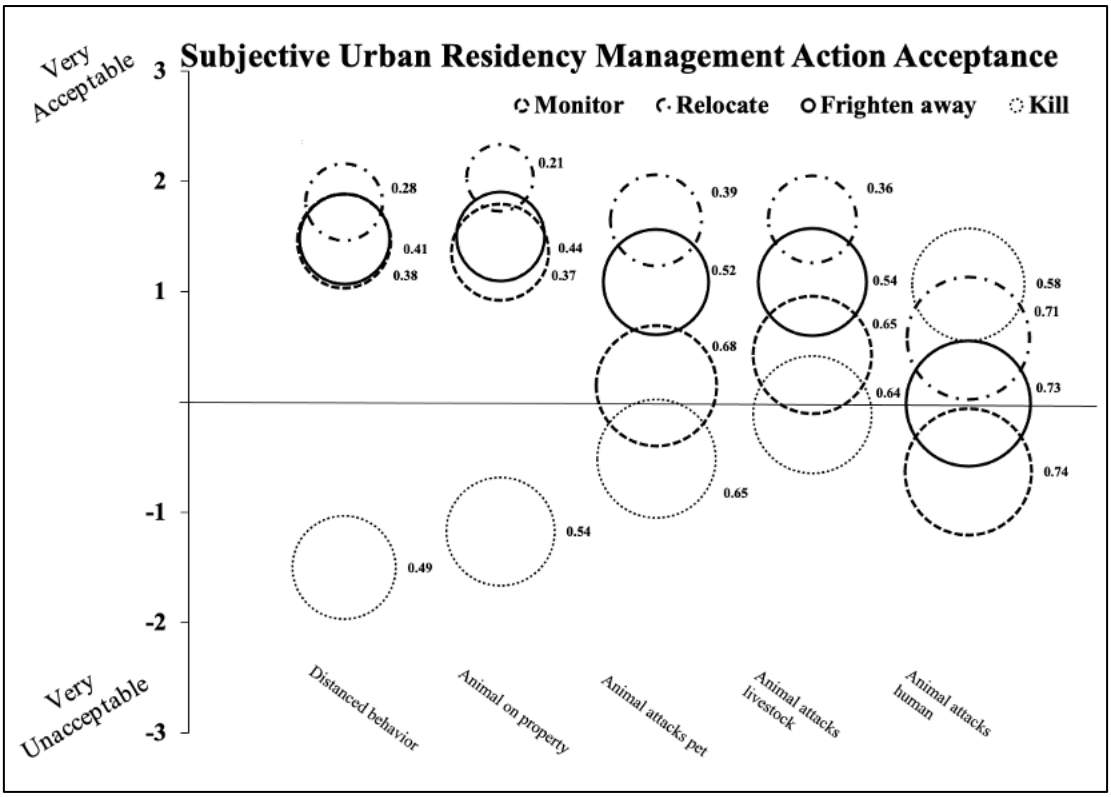
PCI_2 Visualization of Rural Resident Carnivore Management Acceptance



Note. Potential for conflict index graphic depicting acceptance of four management actions in response to five behavioral scenarios of carnivores from rural residents.

Figure 3.6b

PCI_2 Visualization of Urban Resident Carnivore Management Acceptance



Note. Potential for conflict index graphic depicting acceptance of four management actions in response to five behavioral scenarios of carnivores from urban residents.

Risk Perception

Segmenting the sample of respondents by their reported perception of risks posed by the species in question shows strong divergence among acceptance levels for management of carnivores (Table 3.5; Figure 3.7a, 3.7b). Individuals who felt as though black bears, mountain lions, and grey wolves do not pose significant risks (n = 306) to property or elements of personal safety reported a strong overall disapproval for lethal control (overall M = -0.71), with only the instance of a human being attacked garnering any level of acceptance for killing a problem animal (M = 0.73). Nonlethal control options were considered acceptable among this low risk perception segment in every scenario except the choice to monitor a problem animal that had attacked a human (M = -0.17). PCI_2 values for this group increased steadily as the behavioral spectrum grew in severity, with the most consensus and least potential for conflict seen for frightening away an animal on personal property (M =

1.73, PCI_2 = .27), and the lowest consensus seen for monitoring an animal that had attacked a human (M = -0.17, PCI_2 = .74).

Table 3.5

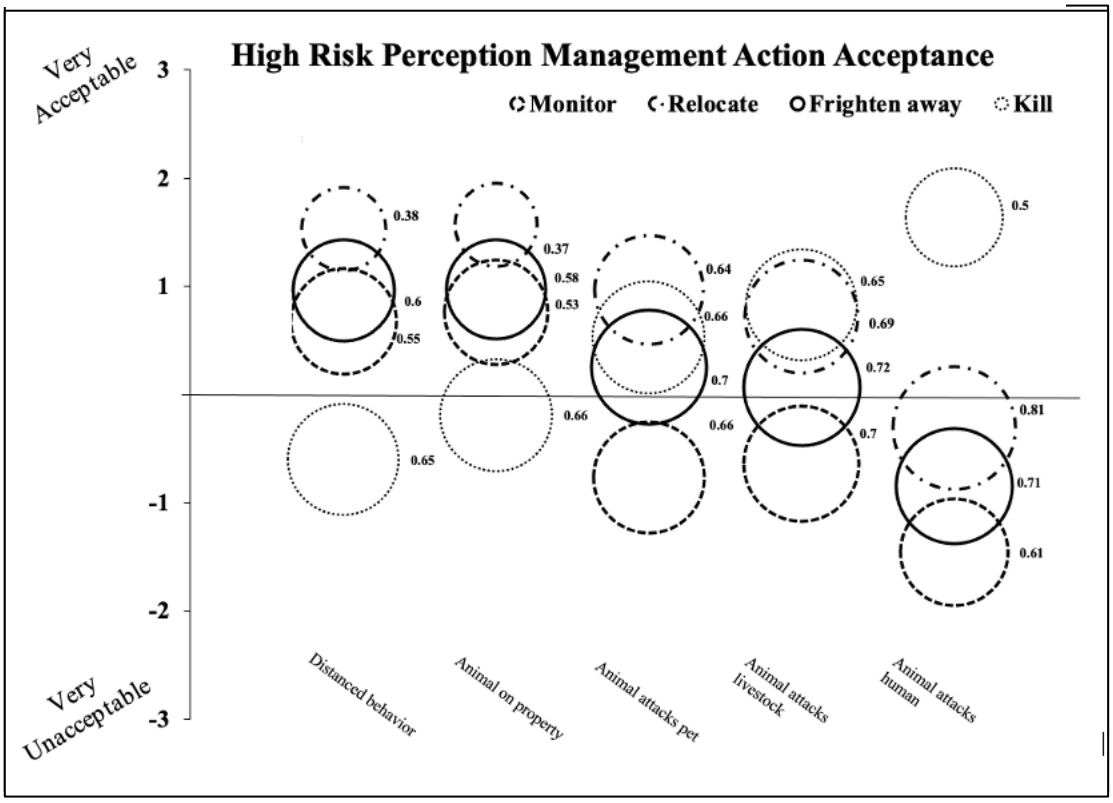
Acceptability ratings of management actions for five behavioral scenarios segmented by high and low levels of risk perception

	Distanced behavior		On property		Attacks pet		Attacks livestock		Attacks human	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Low Risk										
Monitor	1.67	1.55	1.74	1.52	.67	2.15	0.80	2.12	-0.17	2.47
Relocate	1.58	1.67	1.68	1.56	1.64	1.75	1.74	1.69	0.93	2.36
Frighten	1.75	1.49	1.73	1.54	1.58	1.75	1.54	1.85	0.52	2.38
Kill	-1.76	1.83	-1.45	1.93	-0.69	2.22	-0.37	2.24	0.73	2.29
High Risk										
Monitor	0.68	2.17	0.76	2.15	-0.77	2.32	-0.64	2.38	-1.46	2.29
Relocate	1.53	1.79	1.57	1.82	0.97	2.32	0.72	2.41	-0.31	2.62
Frighten	0.96	2.08	0.97	2.07	0.25	2.38	0.07	2.44	-0.85	2.45
Kill	-0.60	2.28	-0.19	2.30	0.53	2.34	0.83	2.32	1.64	2.08

Note. Acceptance variable responses coded on a 6-point scale from 1 (Very unacceptable) to 6 (Very acceptable).

Figure 3.7b

PCI_2 Visualization of High Risk Perception Carnivore Management Acceptance



Note. Potential for conflict index graphic depicting acceptance of four management actions in response to five behavioral scenarios of carnivores, from residents who perceived these species as posing a high risk.

The high risk segment (n = 266), conversely, was overall more willing to accept lethal control of a problem animal (overall M = 0.44), compared to low risk, with Scenario 1 and 2 being the only contexts in which this group did not find lethal control acceptable (S1: M = -0.60; S2: M = -0.19). Though the high risk segment generally indicated lethal control to be more favorable overall and as an acceptable strategy for Scenario 3 (M = 0.53), 4 (M = 0.83) and 5 (M = 1.64), it was not the most accepted or preferred option until the behavioral spectrum reached Scenario 4 and 5. The action with the most consensus for this group was relocating an animal on personal property (M = 1.57, PCI_2 = .37). The least consensus was observed for relocating an animal that had attacked a human (M = -0.31, PCI_2 = .81).

Emotions

The final segmentation of survey respondents was based on a discrete emotions scale. Respondents who reported strong emotions (their rated strength of emotion was above the sample median) were separated into groups by valence; PCI visuals were created for respondents reporting strong positive emotions and for respondents reporting strong negative emotions when thinking about black bears, grey wolves, and mountain lions (Table 3.6; Figure 3.8a, 3.8b).

Table 3.6

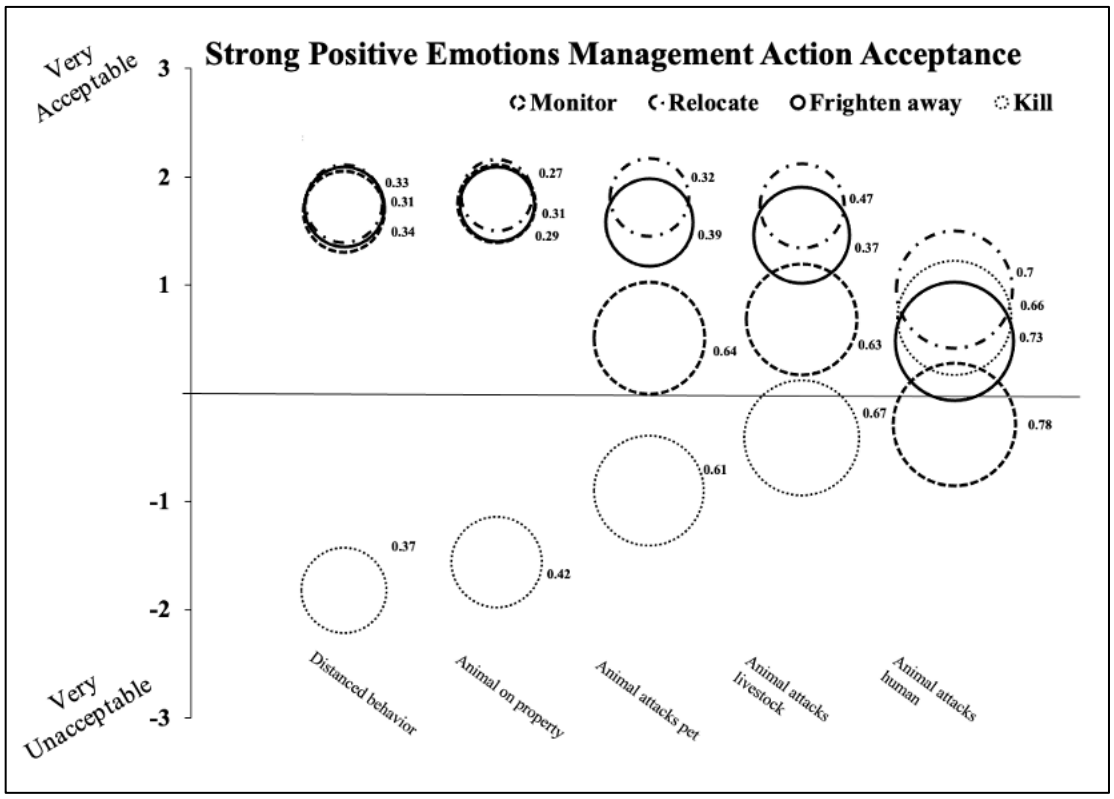
Acceptability ratings of management actions for five behavioral scenarios, segmented by self-reported strong positive and negative emotions toward species

	Distanced behavior		On property		Attacks pet		Attacks livestock		Attacks human	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Strong Positive Emotion										
Monitor	1.68	1.68	1.75	1.59	0.51	2.28	0.68	2.27	-0.29	2.57
Relocate	1.75	1.62	1.83	1.55	1.81	1.70	1.73	1.78	0.96	2.43
Frighten	1.72	1.67	1.75	1.58	1.58	1.85	1.46	1.99	0.48	2.46
Kill	-1.82	1.76	-1.56	1.87	-0.90	2.22	-0.41	2.31	0.70	2.35
Strong Negative Emotion										
Monitor	-0.32	2.26	0.00	2.38	-1.30	2.26	-1.03	2.28	-2.07	1.87
Relocate	1.00	2.20	1.12	2.30	0.19	2.68	0.14	2.69	-0.74	2.73
Frighten	0.07	2.40	-0.09	2.50	-0.53	2.64	-0.84	2.62	-1.31	2.42
Kill	-0.07	2.51	0.19	2.54	0.89	2.42	1.05	2.37	1.84	2.08

Note. Acceptance variable responses coded on a 6-point scale from 1 (Very unacceptable) to 6 (Very acceptable).

Figure 3.8a

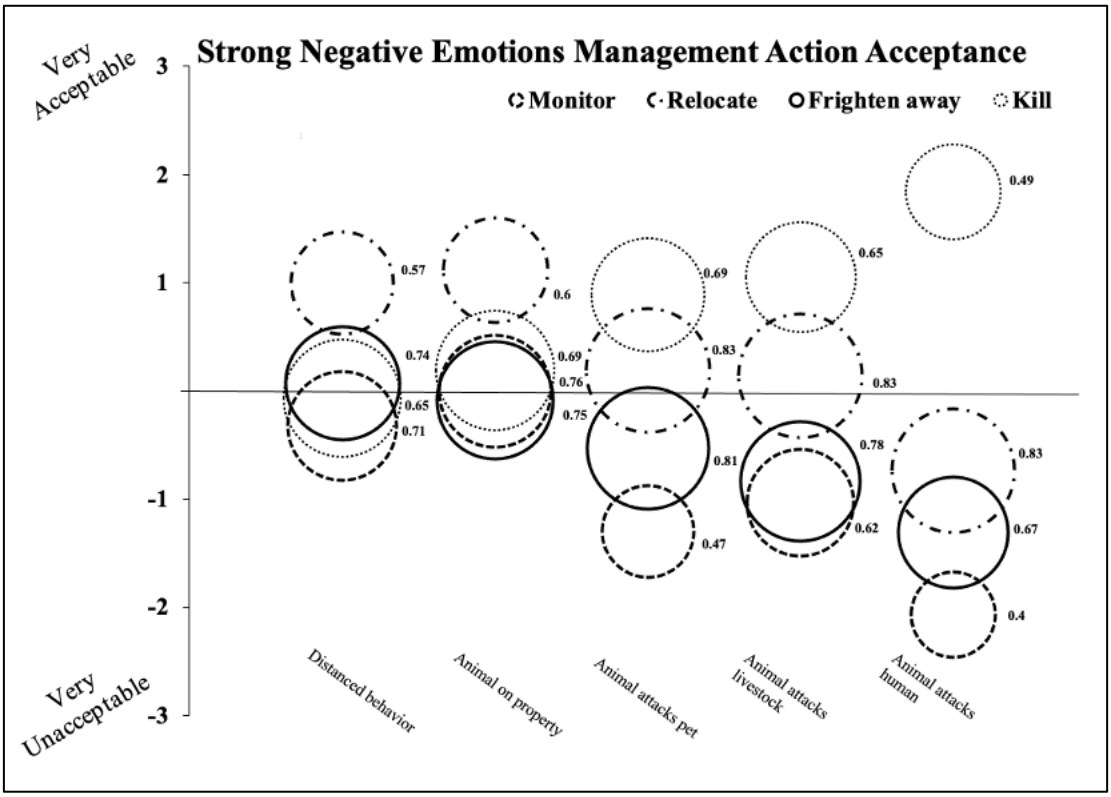
PCI_2 Visualization of Positive Emotion Carnivore Management Acceptance



Note. Potential for conflict index graphic depicting acceptance of four management actions in response to five behavioral scenarios of carnivores, from residents who reported feeling strong positive emotions about these species.

Figure 3.8b

PCI_2 Visualization of Negative Emotion Carnivore Management Acceptance



Note. Potential for conflict index graphic depicting acceptance of four management actions in response to five behavioral scenarios of carnivores, from residents who reported feeling strong negative emotions about these species.

Residents reporting strong positive emotions (n = 279) exhibited stronger judgments of unacceptability toward lethal control (overall M = -0.80), and only crossed the threshold of accepting lethal control as a management response in Scenario 5 (M = 0.70). This group also identified all nonlethal management options as acceptable in all scenarios, with the exception of monitoring an animal that had attacked a person (M = -0.29). Relocation was also the most preferred action in each of the five scenarios for this positive emotion group (M = 1.62). The action that exhibited the most agreement was relocating an animal on personal property (M = 1.83, PCI_2 = 0.27), and the least consensus was seen for monitoring an animal that had attacked a human (M = -0.29, PCI_2 = 0.78).

Respondents who reported strong negative emotions (n = 58) exhibited converse trends of acceptance. This population segment was accepting of lethal control as a

management response in four of the five scenarios, with the exception of a weak level of unacceptability for killing an animal for the distanced/common behavior (M = -0.07); this group was generally accepting of lethal control overall otherwise (overall M = 0.78). Additionally, this group identified killing a problem animal as the most accepted or preferred management response for Scenario 3 (M = 0.89), 4 (M = 1.05), and 5 (M = 1.84). The action that received the most consensus was the unacceptability of monitoring an animal that had attacked a human (M = -2.07, PCI_2 = .40), and the least consensus was shown for relocating an animal in Scenario 3 (M = 0.19, PCI_2 = 0.83), 4 (M = 0.14, PCI_2 = 0.83), and 5 (M = -0.74, PCI_2 = 0.83).

Discussion

This study assessed Idaho residents' acceptance levels for four potential HWI management actions to a spectrum of nuisance behaviors from three native, large-bodied carnivore species: black bears, grey wolves and mountain lions. Several noteworthy patterns were observed in reference to the study's research questions but also in terms of the broader HWI literature. First, results identified somewhat expected trends of management action acceptance; respondents generally preferred nonlethal control of carnivores in more distanced HWI scenarios but were more accepting of lethal control as interactions involved attacks on pets and livestock. Second, lethal control was most accepted and often the preferred management option in scenarios that reference an attack on humans. These trends largely held steady for black bears and mountain lions individually upon segmenting the acceptance responses by species, but this was not the case for the grey wolf, which showed consistently higher levels of lethal control acceptance across all scenarios. Third, while some literature and previous research indicates expected differences between rural and urban populations (by a subjective identity measure), results did not reveal any significant differences between these populations in Idaho. Fourth, segmentation of residents by high/low risk perception and strong positive/negative emotions suggests these are important factors that warrant further consideration when assessing public preferences. Fifth, PCI metrics and visualization demonstrate a wide range of consensus among the populations and segments assessed, indicating several potential areas of conflict or disagreement, depending on the HWI scenario. Sixth, though the study design intended to assess the acceptance of management

actions of increasing severity, results suggest that respondents may have instead treated the spectrum of potential management actions as a dichotomy along a lethal versus nonlethal divide. Finally, it was observed that in most of the HWI scenarios, respondents indicated that capture and relocation was their preferred resolution to HWI, which can be counter to the preferences and experiences of wildlife professionals, particularly in regard to the welfare and survival of wildlife during capture and relocation.

General Findings

Several studies have evaluated management preferences of communities and individuals affected by human-wildlife interactions, with the caveat that different human-wildlife contexts generate different evaluative standards for acceptable management strategies. Despite different contexts for evaluation, trends have emerged in the consideration of carnivore management. For example, preferences for nonlethal control over lethal control is observed in most contexts (Bruskotter, Vaske, & Schmidt, 2009; Jacobs et al., 2014; Koval & Mertig, 2004) but with an increase in acceptability of lethal control as interaction scenarios become more severe or with direct consequences to human safety (e.g., Liordos et al., 2017; Decker, Jacobson, & Brown, 2006). The management preferences for black bears, grey wolves and mountain lions in Idaho as indicated by this study's survey respondents follow these expected patterns. For example, nonlethal management options (monitoring a problem animal, capture and relocation, frightening away) were more acceptable to respondents for scenarios that were less severe and involved further proximity to humans (Scenario 1 – bear seen going through trash/wolf or lion seen from popular hiking trail; Scenario 2 – animal seen on your own property). However, lethal management (killing a problem animal) increased in acceptability as the hypothetical scenarios began to involve attacks on other animals (Scenario 3 – animal attacks a pet; Scenario 4 – animal attacks livestock). Respondents were most accepting of lethal control and preferred it as the primary management response for the most severe behavioral scenario (Scenario 5 – animal attacks a human).

These results largely align with other similar studies in different contexts, in which lethal control has been consistently found to not be a preferred option for the management of carnivores where an alternative, non-lethal option is available (e.g., Lute & Attari, 2007;

Martínez-Espiñeira, 2006; Messmer, 2000). Wildlife management in the United States has seen a recent move away from generalized, non-selective lethal management options such as culling or eradication of a species, but even selective lethal management in general has become less acceptable in more contemporary trends of preferred wildlife management (Swan et al., 2017). A study by Reiter, Brunson, & Schmidt (1999) identified 7 factors that American reported considering when assessing the acceptability of different management options, ranked by level of importance: human safety; animal suffering; effectiveness; environmental impacts; severity of the problem; and ability to target the specific problem animal. Given the two most important factors of consideration illustrated by this study, human safety and animal suffering, it is understandable that lethal control of a problem animal is often considered inhumane but necessary when a human is endangered, which is echoed by the results of this study.

Despite a general trend from affected publics to find lethal control unacceptable in many HWI scenarios, the possible benefits of lethal control make it a significant source of conflict and controversy. Killing a problem animal in response to a predation conflict or incidence of damage can eliminate a potential future threat, it can prevent illicit killing by individuals who choose to take lethal control into their own hands, and it is possible that selective removal can provide directional selection of conspecifics that are more behaviorally avoidant of humans and conflictual scenarios (Treves et al., 2005). Opposing perspectives on lethal control of wildlife often arise between groups with different conceptual approaches to wildlife management. The spectrum of backgrounds and perspectives toward wildlife that are relevant to an individual or community's management preferences creates a significant space for conflict, and there are many social factors that can drive conflict intensity between involved groups (Dickman, 2010). For example, groups with utilitarian or anthropocentric approaches to management are more likely to accept or support lethal control as a solution to human-wildlife conflict, whereas those who are more motivated by conservation or recovery incentives exhibit the opposite preferences (Fernandez-Gil et al., 2016). This potential for disagreement among stakeholders is confirmed by the large PCI_2 values seen in Figure 3.4; these values illustrate a generally high potential for conflict within Idaho residents' preferences for carnivore management; the large values for lethal control specifically

illustrate the disagreement that proposed lethal control can cause, but also that lethal control receives the most consensus in the scenario involving an attack on a human.

Human dimensions of wildlife management research also tends to observe consistent potential for disagreement or conflict for carnivore management between and even within populations' preferences for carnivore management (e.g., Marshall, White, & Fischer, 2007; Don Carlos et al., 2009). Widely accepted carnivore management has become more difficult to obtain as the demographics of different communities diversify, species attempt to recolonize their historical ranges that humans now occupy, and as carnivore management in general is forced to adjust from simply managing wildlife populations to needing to also incorporate societal values and preferences into management decisions. As contemporary management operates in an environment that is regularly reshaped by political, economic, and social forces, there is ample opportunity for conflict to arise within and among affected publics, as well as between the public and wildlife management agencies (Messmer, 2000). This study's assessment of the consensus around management preferences largely reflects this overall trend, with certain segmentations of the study sample (specifically those by species, risk perception, and emotions) identifying hotspots of particularly high potential for conflict among certain groups of survey respondents. Using a visual methodology such as the PCI_2 creates an interpretable presentation of consensus within and among groups; though not necessarily generalizable across contexts, it provides a simple and interpretable snapshot of potential areas of conflict within a particular dataset or sample.

Finally, though the main distinction in management preferences from respondents seems to fall along the line of nonlethal vs. lethal management responses, there is also a trend of respondents identifying capture and relocation as the most preferred action across a majority of the behavioral scenarios. This is likely because the public perceives this response as the most humane and the least problematic because it is imagined that removal of a problem animal will not cause harm to the animal (Reiter et al., 1999). However, relocating a problem animal often fails for several reasons, including a high mortality rate due to stress or failure to thrive in a new environment, the potential for an animal to attempt to return to their original habitat, or the problem behavior continuing among the remaining original population (Swan et al., 2017).

Species

Beyond the main trends of acceptance within the multi-species pooled sample, further segmentations by species highlighted several other noteworthy patterns. The block sampling design allowed assessment and interpretation of Idaho residents' preferences for "carnivore management" comprehensively, conceptualized as a combination of these three common native species and without the survey response burden of a within-subject design that would require each respondent to indicate their preferences for all three species, but also the simultaneous assessment and interpretation of individual species management preferences. Levels of acceptance among black bear and mountain lion respondents did not differ from the overall carnivore management preferences. However, grey wolf survey respondents' preferences were noticeably different, which highlights the importance of assessing species-specific management preferences. A main divergence among grey wolf respondents was higher levels of acceptance for lethal control in less severe scenarios than black bears or mountain lions, including the animal simply being seen on personal property.

In this respect, these results align with other research that compares wolf management to the management of other species in similar studies (e.g., van Heel et al., 2017; Fernández-Gil et al., 2016). Wolves regularly face unique burdens to public support for coexisting with wolves, or tolerance for their presence at all, driven by a multitude of factors that include disproportionately negative media coverage (Fernandez-Gil et al., 2016; Killion et al., 2016), levels of hostility that do not correlate to actual instances of conflict or problematic behaviors (Treves & Naughton-Treves, 2005), and deeply entrenched cultural biases (Kellert et al., 1996). Such social and cultural factors informing public opinions toward wolves can make achieving noncontroversial management nearly impossible. In addition to these social factors, the context of wolves in Idaho and their history in the state may shed light on these unique management preferences for grey wolves; reintroduction efforts in 1995 as well as the species being delisted from the Endangered Species Act in 2009 have had massive impacts on how Idahoans perceive wolves (Killion et al., 2016). Though conducted in a different state, a longitudinal study of attitudes toward wolves from 2001-2009 by Treves, Naughton-Treves, & Shelley (2013) suggests public preferences for grey wolf management have been trending downward in recent decades, and this is seen in often low or declining public tolerances for coexisting with wolves despite lack of conflict, as well as preferences for lethal

control or other forms of removal. This trend is noticeable in Idaho now that wolves have been reintroduced to their historic range. For example, Stone et al., (2017) notes that despite wolf predation on livestock in Idaho being only a small fraction of overall livestock mortality events (less than 4.1% of all losses in 2012), public response to these instances of predation are often met with significant conflict and calls for lethal control of individuals and packs of wolves. Recent legislative efforts in Idaho have confirmed such views toward wolves regardless of the presence of conflict by allowing the taking of wolves by hunters year-round, and without a tag purchase limit (S.B. 1211, ID 2021).

Given such circumstances surrounding public perception of grey wolves, it is not surprising that participants of this study indicated similar preferences for their management. But also of note are the high PCI_2 values for management of grey wolves when compared to black bears and mountain lions. Respondents' preferences for the proposed management actions in different scenarios generated significantly less consensus overall, with even the most "agreed upon" strategy for a particular behavior (relocating a problem wolf seen from a popular hiking trail) receiving a high PCI_2 value. These high PCI_2 values indicate disagreement among participants in their preferences for grey wolf management in different scenarios. While there is no standardized measure of what range of PCI_2 values constitute "low" or "high" conflict, comparison of these values within a single data collection indicates a significantly higher potential for instances of conflict among the public when considering their preferences for the management of grey wolves. Identifying high potential for conflict between groups of Idaho residents regarding the management preferences of individual species is pertinent information for wildlife management agencies who may need to prioritize conflict mitigation efforts by species or context.

Residency

The absence of significant differences between the rural and urban respondents of this sample may be explained by recent changes in population composition as Idaho and the United States continue to see increased population growth and urbanization. Emigration from rural communities due to dwindling economic opportunities has been met with an opposing influx of urban residents to rural areas as an escape from burgeoning cities (Messmer, 2000). As these previously socially and culturally distinct communities diversify, it is possible that

previous assumptions about social elements such as perception of wildlife may be more heterogenous and more difficult to predict, despite the existing expectation that people living in different geographic areas will have contrasting perspectives and attitudes toward wildlife (Reiter et al., 1999).

Though this study did not find a significant difference between self-identified rural and urban residents in their acceptance for carnivore management, previous applications of social identity theory and in/out-group dynamics suggest that this segmentation is an important distinction to acknowledge in assessing public attitudes toward wildlife conservation efforts (van Eeden et al., 2019).

Risk Perception

Assessing respondents' perceptions of risk toward black bears, grey wolves and mountain lions identified a significant separation of survey respondents in their management preferences, based on whether they perceived the species to pose "low" or "high" risks to personal property, pets, livestock, and human safety. Participants interpreting high levels of risk from the three carnivore species reported general acceptance of lethal control in more, and less severe, behavioral scenarios than did those who felt these species did not pose significant risks to their property, pets, livestock and personal safety. It is reasonable, and potentially expected, that individuals who perceive themselves or their property to be at high risk would be more willing to accept drastic measures as a means of reducing that risk.

This result is in alignment with existing research on the impact that perceived risk can have on public attitudes toward wildlife and their conservation (e.g., Crook, 2019; Sponarski et al., 2016; Nardi et al., 2020), a concept that has become more well-studied as carnivore management becomes increasingly difficult in human-dominated landscapes. Perceptions of risk from the public can be difficult to assume, as they can be formed by intuitive judgments, cognitive assessments of the probability of a risk, and/or elicited emotions or anticipation of a potential threat (Landon et al., 2020). The difference found in this study between groups that reported feeling low or high levels of risk suggests that investigation of the public's perceptions of risk would provide insight into their overall management preferences as well.

Emotion

The relevance of experienced emotions to an affected public's perceptions of wildlife and their management is reiterated in the results of this study. Idaho residents who reported feeling strong positive emotions (enjoyment, happiness, pride and respect) toward black bears, grey wolves and mountain lions found lethal control to be unacceptable in more scenarios much more so than did those who reported feeling strong negative emotions (fear, dread, anxiety, anger, rage, and panic), and were only willing to accept lethal control of these species in the instance that a human had been attacked. Opposingly, those who reported negative emotions were much quicker to accept lethal control in any conflictual scenario that could be considered outside the realm of "normal" wildlife behavior, or in close proximity to humans, pets, or livestock. Additionally, those who felt negatively toward the species chose lethal control as the preferred action for managers to take in any scenario that involved a carnivore attack. Lethal control was not a preferred action from managers in any scenario for those who felt positively about the species. While these results may be intuitive, the crucial inference to be made is in the stark segmentation differences, particularly in the contrast between levels of lethal control acceptance. In the context of wildlife management, HHC typically arises from disagreements of this nature – the result of a disagreement between affected public groups on management decisions or outcomes (Swan et al., 2017), and resolving these disagreements can be equally as important to the success of wildlife management objectives as relevant ecological factors. Conflict management strategies for stakeholder group disagreements are becoming more common as a consideration in wildlife management (Messmer, 2000), and the opposing views of individuals in this study exemplify a potential hotspot of disagreement among Idaho residents in their preferences for how carnivores are managed in the state. Despite the complex nature of emotions, research on and measure of emotional reactions and affective dispositions toward wildlife can be incredibly informative to our general understanding of the human-wildlife relationship (Manfredo, 2008). Given the tendency of HWI and HHC to be emotionally charged situations (Hudenko, 2012) and the centrality of emotions to individual thoughts and actions, assessing emotional responses to wildlife and carnivores in particular could create an important opportunity to communicate valuable information for more informed wildlife management (Jacobs, 2009).

This segmentation of the study population also highlighted an unusual trend of conflict among the individuals who reported feeling strong negative feelings toward carnivores. PCI_2 values for responses within the strong negative emotions segment *decreased* as the severity of the wildlife behavior increased, suggesting that the individuals in this group became more homogenous in their acceptance of management options as the behavioral spectrum progressed, as opposed to their preferences becoming more polarized, which is the trend seen in other groupings of this study sample. This may be an example of the potential for common social factors within a group leading to similar views, in this case about preferences for wildlife management (Dickman, 2010). It is possible that the individuals in this sample experiencing strong negative emotions toward carnivores are connected by another common factor, such as a natural resource-based occupation, a high incidence of conflicts with wildlife, or shared value orientations toward wildlife (e.g., utilitarian or anthropocentric value orientations). Such other commonalities could explain why this particular group has more homogenous views where higher conflict may be expected (Swan et al., 2017). More research is needed to determine if negative emotions toward wildlife is a standalone factor in explaining this group's unexpected levels of consensus on management decisions.

Limitations and Future Research

While this study provides insights into the management preferences of residents for both general carnivore management and species-specific carnivore management in Idaho, there are some limitations to be considered before such generalizations are made. First, survey response rate was relatively low and required a modification of the sampling protocol and survey distribution to improve response rate. Second, while the random sampling protocol was address-based and stratified to represent rural and urban residents, data were not weighted on population-level demographic factors given the multitude of segmentation analyses presented. Additionally, there is some indication of measurement error in the form of respondents treating potential management action options as a dichotomous choice between non-lethal and lethal actions, as opposed to the intended continuous spectrum. Further research to assess preferences among only lethal and non-lethal management responses may be necessary to better understand the salience of this response phenomena,

which could be considered similar to common sources of survey measurement error, e.g., straight-lining or Christmas tree response strategies. Finally, the methodology and sampling procedure intended to gather statistically valid sample sizes to make simultaneous assessments and inferences of residents' perspectives for individual native carnivore species and those as a representation of preferences for overall carnivore management in Idaho. The use of both a stratified random sample (based on urban and rural residency) in combination with block sample design (based on the three species) added additional complexity to data collection and data analysis, and the efficacy of this approach to obtain both multi-species and individual species HWI data via RPM and PCI methodologies should be further evaluated.

Conclusion

By investigating the Idaho public's perspectives on the acceptability of wildlife management choices and strategy, researchers have the opportunity to gather input that is crucial to inform wildlife management that is both ecologically sound and socially acceptable. The political and cultural environment of contemporary wildlife management would suggest that acceptability of grey wolf management would look different than for black bears or mountain lions, and this result was confirmed in my study by stronger levels of acceptance for lethal control of wolves in Idaho, as well as overall acceptance of lethal control in less severe conflict scenarios. Additionally, segmentation by both respondents' perceptions of risk posed by these species and the emotions they reported to experience when thinking about these species were shown to be successful in identifying strong distinctions in management preferences. Future research would benefit from utilizing a multi-species approach to assessing preferences for carnivore management, in addition to taking cognitive factors like risk perception and emotions into account when attempting to gather information that will guide socially acceptable wildlife management.

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Chapter 4: Conclusion

As a public trust resource, wildlife management and conservation is subject to the preferences of affected public and reliant on public support (Lute & Attari, 2017). Decker and colleagues (2009) identify the need for management-focused, empirical research that investigates the causes and effects of human-wildlife interactions (HWI), as well as an understanding of the frequency and characteristics of interactions. Public tolerance for HWI and acceptance of management actions in response to HWI is a research domain that guides the evaluation of actual and potential interactions. That research, subsequently, provides a means to communicate the practical implications of human dimensions research to management agencies and staff through the inclusion of public perceptions of their management policies and actions (Manfredo et al., 2003). This exploratory study used a statewide survey of Idaho residents to predict tolerance for a common behavior of black bear (*Ursus americanus*), mountain lion (*Puma concolor*), and grey wolf (*Canis lupus*) from a suite of relevant affective, behavioral, and cognitive independent variables (Chapter 2). The study also evaluated residents' acceptance of management responses to a broader spectrum of common problematic behaviors, and potential conflict among relevant segments of Idahoans (Chapter 3).

In Chapter 2, I aimed to identify correlates and possible predictors of respondents' tolerance for a spectrum of nuisance behaviors from black bears, mountain lions, and grey wolves. I also explored the role of different geographical, cognitive and experiential factors in moderating their tolerance levels. Results indicated significant positive correlations between biospheric values and positive emotions toward the referent species, while perceived risk and negative emotions were found to be significantly correlated with tolerance, but with a negative relationship. Regression models and analyses identified previous experience, negative emotions, and perceived risk as significant predictors of respondents' tolerance for the spectrum of nuisance behaviors from carnivores. Further segmentation of the survey sample revealed different predictors of tolerance for urban and rural residents, as designated by U.S. Census data. Perceived risk and negative emotions were significant predictors of decreased tolerance for rural residents, while urban residents' tolerance levels were negatively driven by their perceptions of risk, but positively driven by their positive emotions toward the carnivores. Segmenting the sample by self-identified rural and urban identity

identified different predictors of tolerance as well; self-identified rural residents' tolerance was negatively driven by their negative emotion toward the species only, while self-identified urban residents' tolerance was negatively driven by the number of prior experiences they had with the species and their perceptions of risk. These findings highlight the importance of assessing perceptions of wildlife between rural and urban populations and using these assessments to guide the creation of policy that will best reflect the needs and preferences of the populations these policies will apply to.

In Chapter 3, I investigated Idaho residents' acceptance of potential management actions in response to a spectrum of nuisance behaviors from carnivores and generated visual depictions of the overall conflict or consensus among residents on such evaluations. Similar to the first chapter, I segmented residents' responses by their identified geographic identity, the referent species, their reported perception of risk, and by the strength of their positive or negative emotions toward carnivores. The overall trends for acceptance of lethal and nonlethal management actions showed intuitive results; residents' acceptance of nonlethal management techniques decreased as the carnivore behavior increased in severity. Opposingly, residents' support for lethal management of a problem animal increased in acceptability as the hypothetical behaviors became more severe, and lethal management was largely only accepted in a scenario that involved a human being attacked. Additional segmentations of the sample, however, allowed me to identify scenarios in which acceptance levels diverged from this expected trend. Segmenting the study sample by species, emotions, and perceived risk elicited several findings of note. I was able to corroborate that grey wolves are subject to more persecution than black bears and mountain lions, shown in residents' willingness to accept, and prefer, lethal control of wolves in far less severe scenarios than was shown to be the case for bears and lions. The controversial nature of managing grey wolves in Idaho was also confirmed by substantial PCI_2 values, indicating a high potential for conflict. Segmentation by strong negative and positive emotions toward carnivores also resulted in a divergence of preferences for management. Residents who felt strong positive emotions when thinking about carnivores were far less willing to accept lethal control in nearly every scenario, and never reported lethal control as their preferred management response. Those who reported strong negative emotions toward carnivores, however, found lethal control to be acceptable in all behavioral scenarios and reported it as their preferred

response in three out of the five scenarios. Finally, segmentation by perceived risk similarly resulted in a divergence from the original trend. Residents who perceived high levels of risk were more willing to accept lethal control in less severe scenarios than those who perceived little risk from carnivores, who only supported lethal control in the most severe behavioral scenario, where a human had been attacked. The diversity of acceptance levels within these segmentations highlights the importance of considering and assessing preferences for carnivore management with multi-species and cognitive approaches.

The exploratory nature of this research acts as a potential roadmap for further assessing and understanding Idaho residents' opinions and preferences regarding the management of carnivores in the state. My findings provide empirical evidence for justifying the inclusion of cognitive, situational, geographical, and multi-species factors into further research regarding the human dimensions of wildlife and carnivore management specifically.

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