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Drivers of support: The case of species reintroductions with an ill-informed public

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ABSTRACT

Successful rewilding of large carnivores depends on public acceptance, but the public frequently has little awareness about wildlife and specific reintroduction proposals. This article evaluated the determinants of public support for grizzly bear reintroduction in California to understand how value orientations, political ideology, and demographics predict attitudes when the public has little species-specific knowledge. We surveyed 980 Californians, showing that value orientations, awareness, and perceptions of costs and benefits shaped attitudes toward grizzly reintroduction, even when only one-quarter of the respondents knew that grizzly bears were extirpated from California. Almost two-thirds of respondents were supportive of reintroduction, rationalizing their support with assessments of societal and ecological costs and benefits. Lack of public awareness, perceptions of personal threats, and willingness to rationalize stated preferences provide cautionary notes to managers. Our results suggest that managers should offer early articulation of costs, benefits, and threats before reintroductions become politicized and opposition becomes entrenched.

KEYWORDS

Grizzly bear; cognitive hierarchy; public opinion; reintroduction; wildlife management

Introduction

In areas from nanotechnology (Scheufele & Lewenstein, 2005) to nuclear energy (Stoutenborough, Sturgess, & Vedlitz, 2013), people form opinions regarding policies about which they have very little knowledge. Because policymakers are often responsive to public opinion, this can influence whether a policy is successful (Daniels, Krosnick, Tichy, & Tompson, 2012). Wildlife policies are no exception: people have little knowledge and awareness about wildlife (Kellert, 1984; Wilson & Tisdell, 2005) and public opinion can stop or stall management (e.g., Selge, Fischer, & van der Wal, 2011). This article used the case of grizzly bear (*Ursus arctos*) reintroduction as an example of a low knowledge environment to examine predictors of attitudes toward policy. Understanding the correlates of attitudes prior to a specific proposal can allow managers to predict where reintroduction may be supported versus problematic and inform how they engage with the community to build support for reintroductions.

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The Cognitive Hierarchy, Value Orientations, and Policy Attitudes

The cognitive hierarchy has been used to understand how social cognitions from abstract values to value orientations to specific attitudes and beliefs influence behaviors (Fulton, Manfredo, & Lipscomb, 1996; Whittaker, Vaske, & Manfredo, 2006). Values occur at the bottom of the cognitive hierarchy (Fulton et al., 1996). They define what is important to us, how we think about ourselves, and how we fit into broader society (Allport, 1961; Bardi & Schwartz, 2003; Rokeach, 1973). They shape the goals and motivations that influence people's behavior (Schwartz, 2010) and are characterized as being deeply held, abstract, and changing little over a person's lifetime (Roccas, Sagiv, Schwartz, & Knafo, 2002; Rokeach, 1973; Schwartz & Bardi, 1997). Values have broad empirical support as predictors of policy attitudes (Schwartz, 2010; Schwartz, Caprara, & Vecchione, 2010) and can be measured consistently across people and even nations (de Groot & Steg, 2007; Schwartz, 2003; Schwartz, Lehmann, & Roccas, 1999).

Value orientations are patterns of beliefs about general objects, like the environment, that help link abstract values to attitudes, norms, and behaviors (Fulton et al., 1996; Vaske & Donnelly, 1999; Vaske, Donnelly, Williams, & Jonker, 2001). While previous research has considered value orientations specific to wildlife (Fulton et al., 1996; Kellert, 1984, 1994), we integrated the study of wildlife with broader characterizations of environmental value orientations (Kusmanoff et al., 2016; Schwartz, 2003; Schwartz et al., 1999). Environmental value orientations are similar to the "protection-use" wildlife value orientation continuum and can be characterized on a spectrum from anthropocentric to biocentric (Gagnon Thompson & Barton, 1994; Vaske & Donnelly, 1999; Whittaker et al., 2006). Three value orientations have been shown to be associated with attitudes toward environmental issues more generally: egoism, altruism, and biospherism (de Groot & Steg, 2007; Kusmanoff et al., 2016; Stern & Dietz, 1994; Vaske et al., 2001). Egoism is a person's concern for self (which is anthropocentric), altruism is a person's anthropocentric concern for others, and biospherism is a person's concern for non-human species. Altrusim and biospherism often predict support for environmental policies, whereas egoism typically predicts opposition to environmental policies (Schwartz, 2003; Schwartz et al., 1999).

Attitudes describe how individuals feel about specific issues and are influenced by value orientations and other factors. They are formed when a person evaluates an object, such as the reintroduction of grizzly bears. General environmental value orientations, like the ones measured here, predict general attitudes toward environmental actions better than specific attitudes (Whittaker et al., 2006). However, evaluating how general value orientations relate to specific attitudes toward reintroductions contributes to broader theory of natural resource decision-making and a more specific understanding of attitudes and behaviors toward wildlife.

Factors outside the cognitive hierarchy are also likely to influence attitudes. People may rely on cues from political elites to determine their support for a policy (Gilens & Murakawa, 2002; Sniderman, Brody, & Tetlock, 1991). Liberals are generally more supportive of pro-environmental policies, including wildlife policies, than conservatives (Daniels et al., 2012). Demographic characteristics are also likely to be important predictors of attitudes toward policy. For example, age, race, education, and income are important predictors of support for climate change policies (Dietz, Dan, & Shwom, 2007; Holian & Kahn, 2015). Urban voters are generally more supportive of environmental

initiatives than their non-urban counterparts (Bath, 1989; Williams, Ericsson, & Heberlein, 2002). Perceptions of societal costs and benefits and evaluations of personal threats may also shape attitudes toward policy. For example, perceived benefits and costs influence activism around air pollution policies (Lubell et al., 2006).

Policy Support Predictors in Environments with Low Species-Specific Knowledge

Knowledge and awareness about specific policies can shape how people form attitudes. The public knowledge environments surrounding policy can be characterized on a continuum from general awareness to detailed and specific knowledge (Trevethan, 2017). Wildlife policy and management generally occur in a low knowledge environment where people have particularly low awareness of wildlife (Kellert, 1984). For example, a study in the UK found people were interested in marine environmental issues, but awareness about specific issues was low because of limited availability of information (Fletcher, Potts, Heeps, & Pike, 2009). In the Southwest US, awareness of mountain lion presence and impacts is very low even in places bordering where mountain lions are common (Casey, Krausman, Shaw, & Shaw, 2005). Policies to reintroduce species are becoming increasingly common, but there is a general lack of knowledge about wildlife, reintroductions, and their consequences (Reading, Clark, & Kellert, 1991).

Increasing awareness can shape support for a management practice. For example, as people have learned more about prescribed fires, they have become more supportive of prescribed burn policies (Loomis, Bair, & Gonzalez-Caban, 2001) and more knowledge about manatees is associated with greater support for conservation measures (Aipanjiguly, Jacobson, & Flamm, 2003). Awareness of an issue shapes the way people form their attitudes, but the way this information is taken in and synthesized into an attitude is influenced by both abstract value orientations, political orientations, social norms, and other factors (Fishbein & Ajzen, 1975; Zelezny, 1999). When awareness is low, individuals may not know what the more specific norms are, so value orientations may predict their attitude toward a wildlife issue. We assessed whether value orientations, political ideology, and demographics can predict policy attitudes prior to broad public awareness of the issue.

Case Study: Reintroduction of Grizzly Bears to California

The possible reintroduction of the grizzly bear to California provides a useful case study for assessing whether typical predictors of support for policy, such as value orientations, political ideology, and demographics, can be used to predict public attitudes prior to broad public awareness of any reintroduction proposal. Despite its extirpation in the 1920s, the California grizzly is still an important cultural symbol that is recognizable to the California public in images from the state flag to university mascots. In 2014, the Center for Biodiversity (CBD) petitioned the United States Fish and Wildlife Service (USFWS) to list California as part of the native range of grizzlies, thereby extending the range of possible recovery areas (Center for Biological Diversity, 2014). However, the USFWS rejected this petition and there are currently no plans to reintroduce the grizzly to California. Given that the species is absent from the state and the CBD petition was rejected, we hypothesize that awareness of grizzly bears in California is low.

As a result, we expect that the public's attitudes will be influenced by more general factors such as value orientations, political ideology, and demographics. This makes grizzly bear reintroduction a good case study to understand what shapes public support for reintroductions in a low knowledge environment. While value orientations are likely to shape reintroduction support, the lack of politicization may mean that the public does not have clear and well-identified preferences on the issue that correspond to political ideology. Opinions on the issue are also likely to be a function of demographics; elderly, rural, and lower income Americans have been found to be less supportive of bear conservation measures (Kellert, 1994). Women are likely to be more supportive of reintroduction than men, given the tendency of males to have stronger utilitarian and dominionistic attitudes toward wildlife (Kellert & Berry, 1987).

The low knowledge environment also has implications for how people assess the societal costs and benefits. If people have high information about a policy and well-formed expectations about its costs and benefits, we expect that responses about perceived costs and benefits of reintroduction will group together to reveal more nuanced patterns related to constructs such as federal control or ecological benefits. However, people in a low knowledge environment may instead respond with post-hoc rationalizations of their stated preferences on reintroductions. If so, statements about costs may group together on a single factor while statements about benefits may group on a separate factor. Assessments of costs and benefits collected after people state their support for reintroduction are likely to correlate with support for grizzly reintroduction, whether based on well-formed expectations or post-hoc rationalizations.

Finally, perceived personal threats and risk perceptions may influence attitudes (Gore, Knuth, Curtis, & Shanahan, 2007; Lubell et al., 2006). Perceptions of individual species, their cultural and aesthetic significance, and the risks they pose have been shown to influence attitudes toward conservation practices (Kellert, Black, Rush, & Bath, 1996). Evaluations of personal threats, such as consequences for recreation or livelihoods, likely affect the strength of support for reintroduction. Based on prior public responses to wolf (*Canis lupus*) reintroduction and recolonization efforts (Karlsson & Sjöström, 2007; Williams et al., 2002), rural Californians and those living closer to proposed reintroduction sites are likely to be less supportive of reintroduction than their urban, suburban, and more distant counterparts.

Methods

Survey Design, Representativeness, and Weighting

Using the Qualtrics online platform, we surveyed a 980 Californians between February 22 and March 16, 2017, with sampling stratified by party identification and household income measures to help ensure a representative sample. The respondents were members of a panel who had volunteered to complete online questionnaires in exchange for compensation.[1] Because grizzly bear reintroduction would have the most immediate impact on rural residents, we oversampled rural residents to ensure that our statistical models could produce robust estimates of their preferences.

Online Table S1 provides descriptive statistics for demographics of respondents and California benchmarks from the 2016 US Census American Community Survey. The sample

slightly overrepresented women, highly educated Californians, and Whites, so all results include sample weights for gender, rural/urban, education, and ethnicity, estimated using the "survey" (Lumley, 2018), "weights" (Pasek, Tahk, Culter, & Schwemmle, 2016), and "anesrake" (Pasek, 2016) packages in R, version 3.5.0 (R Development Core Team, 2018). Regression models were estimated using "svyglm" function in the "survey" package (Lumley, 2018) to generate standard errors that account for the loss of precision when using weighted data.

The survey instrument measured support for grizzly bear reintroduction, species awareness, value orientations, political ideology, demographic characteristics, and perceptions of the costs, benefits, and personal threats of reintroduction. It included a survey experiment using National Parks as a proxy for distance to reintroduction as, for most Californians, National Parks are in distant locations.[2] Approximately half the sample received a message indicating that proposed grizzly bear reintroduction would occur in California National Parks, while the other half of the sample received the same message, but without specifying a location. The treatment and control groups were balanced on observable covariates. We estimated the Average Treatment Effect (ATE) of the National Parks experiment with a difference-in-means estimator because the treatment was randomly assigned (Imbens & Rubin, 2015).

Measuring Support for Grizzly Bear Reintroduction

To evaluate predictors of attitudes, the dependent variable is a 7-point scale reflecting whether the respondent supports efforts to reintroduce grizzly bears into California, with responses from *strongly oppose* to *strongly support*. Respondents are first told "As you may know, grizzly bears once lived throughout much of the state, but the last grizzly in California was killed in 1922. There have been some proposals to reintroduce grizzly bears to [a number of national parks in] California." The portion in brackets is included for the national parks treatment condition.

Species Awareness

We measured awareness of grizzly bears, black bears (*Ursus americanus*), bald eagles (*Haliaeetus leucocephalus*), bison (*Bison bison*), and wolves in the wild in California. Respondents who correctly identified species presence or absence received a score of one for each species, and respondents who were incorrect or did not know received a zero.[3] These responses are used to approximate wildlife awareness in two ways. First, we collapsed these species-specific measures into a single additive index measuring general awareness of species existence, where more correct answers indicated higher wildlife awareness. Second, we paired species-specific awareness of grizzly bear absence in California with an index of awareness about the other species. Species awareness was measured before the treatment was assigned and before support – though asking whether respondents supported grizzly reintroduction required stating that grizzly bears are not currently in California.

Because grizzly bear awareness may be important for understanding public support for reintroduction, a logistic regression estimates the relationship between the indicator for specific grizzly bear awareness and demographic variables, political ideology, and generic species awareness to examine correlates of grizzly bear awareness. The logit estimator accounts for

the dichotomous dependent variable by estimating the probability that the dependent variable is observed. Logit guarantees that estimated probabilities are between zero and one, which may not be true near the tails of the distribution when using the linear model.

Value Orientations, Political Ideology, and Demographic Measures

We measured altruism, egoism, and biospherism with the Portrait Values Questionnaire (PVQ; Schwartz, 2003) using the mean score across four self-evaluations of how much a hypothetical person described in the survey is like the respondent on a 5-point scale ranging from *Not like me* to *Very much like me*. For example, one of the four descriptions measuring altruism asked respondents how much they are like a person described as "It's very important to him [her] to help the people around him. He[she] wants to care for other people." with pronouns matched to the gender of the respondent. This method has been proven stable across different countries, ages of respondents, and types of people (de Groot & Steg, 2007).

Political ideology was measured by asking respondents to place themselves on a 7-point scale ranging from *extremely liberal* to *extremely conservative*. A suite of standard demographic variables included the respondent's age, sex, education level, income, race/ethnicity, and urban versus rural residence. Respondents placed themselves into ordinally ranked education and income categories. Education was recoded as an indicator variable with bachelor's degree and above coded as one. Race was coded as one for White respondents and zero otherwise. Rural residence was measured by asking respondents to state whether they lived in an urban (coded 1), suburban (2), or rural (3) area (see online Table S2 for mean comparisons).

Societal and Ecological Cost and Benefit Measures and Personal Threats

Agreement with 13 statements (eight framed positively and five negatively) assessed evaluations of the societal and ecological costs and benefits of the policy, including how individuals thought grizzly reintroduction might affect the health of ecosystems, the survival of grizzly bears, property rights, local control, tourism, outdoor recreation, rural and urban residents, and a variety of livelihoods. For example, respondents were asked whether they agreed with the statement that "Grizzly bear reintroduction would harm agricultural producers" on a 5-point scale from *strongly disagree* to *strongly agree*. These responses were analyzed using Principal Components Analysis (PCA) with varimax rotation using singular value decomposition (SVD) to identify how responses grouped together. Parallel analysis (Horn, 1965) determined the number of components to retain, and the scores resulting from the components were used in the regression models. The personal threat measures asked whether respondents anticipated needing to change their recreational behavior and whether respondents agreed or disagreed that grizzly bear reintroduction would threaten their safety and their livelihood on the same 5-point scale.

Regression Analysis and ANOVA

For ease of interpretation, three ordinary least squares (OLS) regression models examined correlates of support for reintroduction. The dependent variable is support for grizzly bear

reintroduction in California. Model 1 included the composite awareness measure, value orientations, political ideology, demographic variables, and a dummy variable indicating National Park treatment status as independent variables. Model 2 included the grizzly-specific awareness measure in place of the composite awareness measure. Model 3 included both the grizzly-specific awareness measures and the awareness composite excluding grizzly bears. Model 3 also included the components identified in the PCA and responses to the three questions about personal threats. ANOVA was used as a test of significance for factor variables with more than one level (Online Table S3).

Results

Grizzly Bear Presence

The most common response for questions about each species in California *except* grizzly bears was to correctly identify the current presence or absence (Figure 1). Twenty-six percent of respondents correctly reported that grizzly bears were absent from California, but nearly half incorrectly believed that grizzly bears were present in the wild in California and the rest were unsure (see Table 1). Between 38% and 75% of respondents correctly identified the presence or absence of the other species in

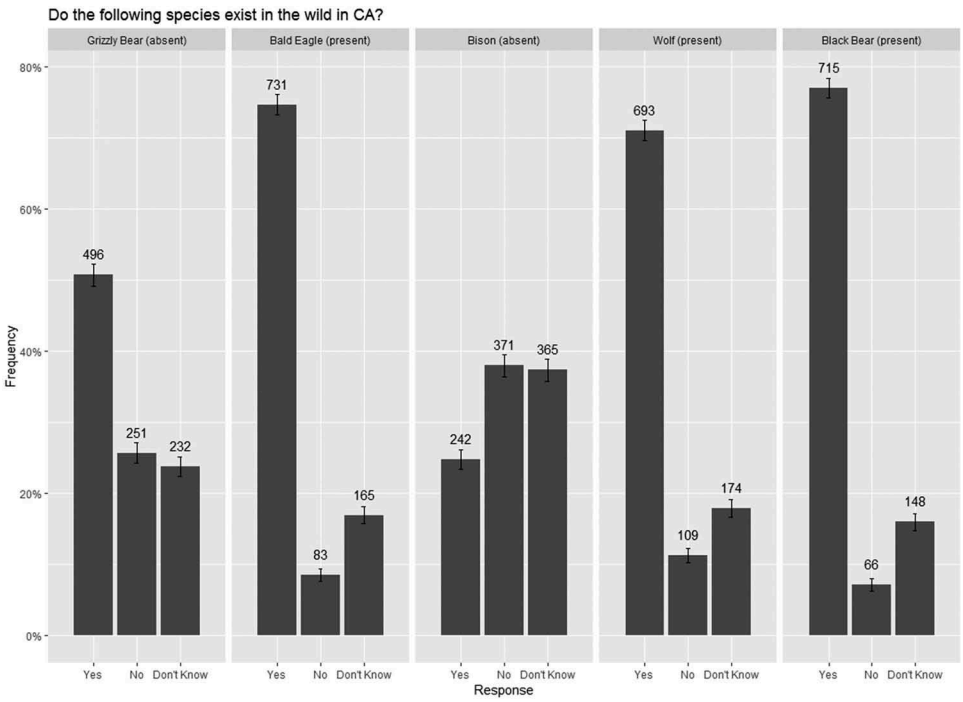

Figure 1. Respondent awareness of wildlife presence in California. Black bears, bald eagles, and wolves are present in the wild in California; bison and grizzly bears are not. Vertical bars represent standard errors. Numbers above the bars represent total number of responses for each category. Total responses for each species were 929 for black bears, 979 for bald eagles, 976 for wolves, 978 for bison, and 979 for grizzly bears.

Table 1. Summary Statistics.

Variable	Median	Mean	Min	Max	St. Dev.
Support for Grizzly Reintroduction	5 (Somewhat Support)	5.05	1	7	1.57
Species Awareness	3	2.56	0	4	1.01
Grizzly Presence Indicator	0	.25	0	1	.44
Benefits Component	0.005	0	−3.27	2.39	1
Costs Component	−0.095	0	−3.27	2.86	1
Altruism	4.33	4.16	1.67	5	0.67
Biospherism	4	4	1	5	0.71
Egoism	3.33	3.16	1	5	0.88
Recreation	2 (Somewhat likely to continue)	2.5	1	5	1.34
Threat to Safety	3 (Neither agree nor disagree)	2.78	1	5	1.27
Threat to Livelihood	2 (Somewhat disagree)	2.24	1	5	1.24
Ideology	4 (Moderate)	3.68	1	7	1.70

Note. Support for reintroduction is measured on a 7-point scale. Species awareness is a composite indicator of awareness of all species except for grizzly bears. Grizzly presence is the indicator variable for whether a respondent correctly predicted grizzly bear presence. This is different from the categorical variable measuring grizzly bear awareness that is used to predict support for reintroduction (Table 4), where the variable's levels correspond to not knowing whether grizzlies are present, believing they are present, or correctly identifying that they are not present (see Figure 1). Benefits and costs components are PCA scores. Altruism, biospherism, and egoism are continuous measures of each value orientation. Recreation, threat to safety, and threat to livelihood are measured on a 5-point scale, and ideology is a 7-point scale.

California. Taken together, these confirm that grizzly bear reintroduction proposals exist in a low knowledge environment.

As Table 2 with logit estimates for predictors of grizzly bear awareness shows, respondents with higher general awareness scores were more likely to correctly know that grizzly bears are absent (*odds ratio* = 1.22; p = .03). Additionally, older respondents were more likely to correctly indicate that grizzly bears were not in the state (*odds ratio* = 1.02; p = .004). Living in a suburban area relative to an urban area or a rural area increased the odds of correctly predicting grizzly bear presence by 1.65 ($p < .001$; see online Table S4 for comparison of rural, suburban, and urban). When only eagles and black bears are in the measure of awareness (online Table S5), the coefficient was no longer significant (*odds ratio* = 0.87; p = .26).

Table 2. Predicting Awareness of Grizzly Bear Presence.

Variable	*B*	*SEB*	*Odds Ratio*
Constant	−3.40***	0.53	0.03
Age	0.02***	0.02	1.02
Female	−0.16	0.18	0.85
College Graduate	0.19	0.19	1.21
Income	0.05	0.04	1.05
Rural	0.50***	0.12	1.65
Ideology	0.03	0.05	1.03
Awareness Score	0.20**	0.09	1.22
Pseudo R^2	.06		
N	769		

Note. *$p < .1$; **$p < .05$; ***$p < .01$

Note. Logistic regression. Dependent variable is grizzly-specific awareness indicator variable coded as 1 if the respondents answered *no* and 0 they responded either *yes* or *don't know*.

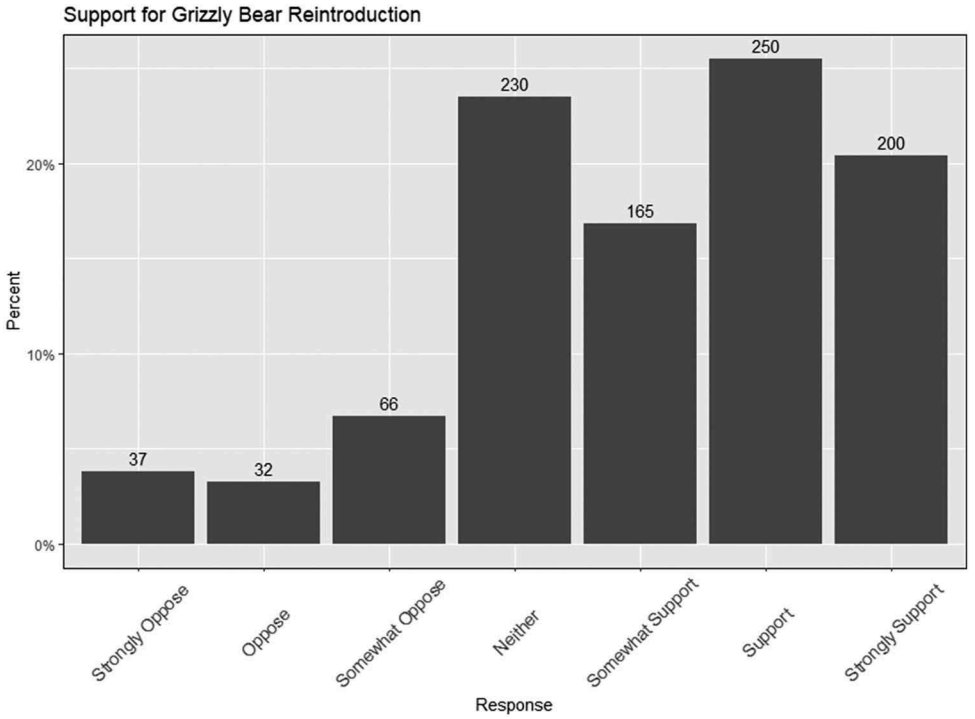

Figure 2. Respondent support for grizzly bear reintroduction in California on a 1-7 scale. Mean support level is somewhat supportive (5.05). Numbers above the bars represent the total number of responses in each category.

Support for Reintroduction

Sixty-three percent of respondents were at least somewhat supportive of reintroduction, with median and mean support levels of approximately five (*somewhat support*) on a 7-point scale (Table 1), and about a quarter were neither opposed nor supportive of reintroduction (Figure 2).

Other Descriptive Statistics

Respondents had median scores of 4.33, 4.00, and 3.33 on scales of one to five on the altruism, biospherism, and egoism measures, respectively. The median respondent indicated that they were somewhat likely to continue recreating in areas they commonly visit if grizzly bears were reintroduced, that they neither agreed nor disagreed that grizzly bear reintroduction would pose a threat to their personal safety, and that they somewhat disagreed with the statement that reintroduction would pose a threat to their livelihood.

National Parks (Distance) Experiment

There was no difference in support between those who received the National Parks treatment and those who did not ($ATE = -0.03$; $p = .77$; online Table S6). There was no evidence for the presence of heterogeneous treatment effects by political party, rural residence, or grizzly awareness (online Table S7; Table S8; Table S9). When the 7-point grizzly reintroduction

Table 3. Principal Components Analysis.

	Component 1	Component 2	Cronbach's α
Benefits			.89
People have a responsibility to ensure the survival of grizzly bears	**.60**	−.08	
Grizzly bear reintroduction would help make California forests healthier.	**.81**	−.14	
Grizzly bear reintroduction would benefit the California economy by increasing tourism.	**.76**	−.01	
Grizzly bear reintroduction would benefit other species.	**.79**	−.12	
Grizzly bear reintroduction would help prevent their extinction.	**.64**	−.13	
Grizzly bear reintroduction would benefit outdoor recreation.	**.79**	−.05	
Grizzly bear reintroduction would benefit urban residents.	**.74**	.16	
Grizzly bear reintroduction would benefit rural residents.	**.80**	.04	
Costs			.76
Grizzly bear reintroduction would lead to an increased role for the federal government.	.14	**.52**	
Grizzly bear reintroduction would threaten property rights on private lands	−.20	**.81**	
Grizzly bear reintroduction would reduce local control over public lands.	.18	**.70**	
Grizzly bear reintroduction would negatively impact ranchers.	−.35	**.74**	
Grizzly bear reintroduction would harm agricultural producers.	−.18	**.76**	

Note. Loadings from PCA with varimax rotation. Loadings greater than .5 are bolded.

support measure was collapsed to three categories indicating support, neutral, or opposition, the ATE remained small and insignificant ($ATE = -0.01$; $p = .86$; online Figure S1; Table S10).

Principal Components Analysis

Parallel analysis (Horn, 1965) of principal components indicated that patterns in the cost and benefit statements could be captured by two principal components, with one component reflecting positive statements and the other reflecting negative statements (Table 3). Personal threats did not load with the societal costs and benefits.

Generalized Awareness Model 1

Table 4 includes results from three regressions. Model 1 showed that general species awareness was not significantly associated with support for reintroduction. Value orientations and demographics, however, did significantly predict support. The coefficients for altruism and biospherism were positive and significantly associated with support ($p = .02$ and $p = .003$, respectively). A one-unit increase was associated with an increase in support of 0.38 and 0.36 points respectively on the 7-point scale for reintroduction support. Older respondents were less supportive of reintroduction ($p < .001$), and White respondents were more supportive of reintroduction than non-Whites ($p = .03$). Substantively, an additional 50 years of age was associated with a decrease in support for reintroduction of 1 point and being White is associated with an increase in support for reintroduction of 0.30 points. Surprisingly, there was no difference in support between rural and non-rural residents. Liberals were not more supportive of reintroduction than conservatives.

Table 4. Measuring Support for Reintroduction.

	Model 1		Model 2		Model 3		
Variable	*B*	*SE B*	*B*	*SE B*	*B*	*SE B*	*β*
Constant	2.93***	0.75	3.28***	0.77	5.36***	0.64	
Species Awareness	0.05	0.055	-	-	0.00	0.04	0.00
Grizzly Existence (No)	-	-	−0.80***	0.15	−0.38***	0.11	−0.20
Grizzly Existence (Don't Know)	-	-	−0.37**	0.15	−0.18*	0.11	−0.25
Benefit Component	-	-	-	-	0.85***	0.06	0.53
Cost Component	-	-	-	-	−0.30***	0.06	−0.13
Altruism	0.38**	0.16	0.39**	0.16	0.23*	0.14	0.11
Biospherism	0.36***	0.12	0.30**	0.12	−0.14*	0.09	−0.08
Egosim	0.02	0.08	0.01	0.08	0.06	0.06	0.05
Recreation	-	-	-	-	−0.27***	0.04	−0.21
Threat to Safety	-	-	-	-	0.05	0.05	0.03
Threat to Livelihood	-	-	-	-	−0.12***	0.05	−0.13
Ideology	−0.04	0.04	−0.05	0.04	0.02	0.03	0.00
College Graduate	−0.07	0.13	−0.05	0.13	−0.08	0.09	−0.04
Rural	−0.04	0.09	0.03	0.09	0.02	0.06	0.00
Female	−0.22	0.13	−0.24*	0.13	−0.03	0.10	−0.29
Age	−0.02***	0.00	−0.02***	0.00	0.00	0.00	0.00
Income	0.03	0.04	0.04	0.03	0.02	0.02	0.00
White	0.30**	0.14	0.29**	0.13	0.08	0.10	0.03
Treatment	−0.11	0.12	−0.12	0.12	−0.03	0.09	−0.01
R^2	.16		.19		.60		
N	770		769		764		

Note. *p< .1; **p< .05; ***p< .01.

Note. Dependent variable is a 7-point scale for support of Grizzly bear reintroduction in California. Standardized coefficients for Model 3 are located under the column titled β.

Grizzly-Specific Awareness Model 2

Model 2 exchanged the general awareness measure for a grizzly-specific awareness measure but kept all other variables the same. Grizzly-specific awareness was a significant predictor of support in Model 2. Individuals who thought that grizzly bears were not present were 0.80 (p = .02) points less supportive of reintroduction relative to those who believed that grizzly bears were present in California. Respondents who did not know their current status prior to the survey were 0.37 (p < .001) points less supportive of reintroduction than those who believed they existed. All other variables remain of the same sign and significance as in Model 1.

Full Model 3

The third model expanded on the first two by including personal threats and societal cost-benefit estimates from the PCA. It also included both grizzly-specific awareness and the composite awareness measure without grizzly bears.[4] Those who perceived higher societal benefits from grizzly reintroduction were more supportive (B = 0.85; p < .001). Conversely, individuals who perceived greater costs to reintroduction were significantly less supportive of it (B = −0.3; p < .001). A 1-point increase in agreement that the respondent would have to change their recreational activities or in agreeing that grizzly bear reintroduction would be a threat to their livelihoods decreased support by −0.27 (p < .001) and −0.12 (p = .01), respectively. Remaining results were similar to Models 1 and 2, except that demographic characteristics were no longer significant predictors of support.[5] Additionally, the p-values for altruism and biospherism fell to p = .09 and p = .1 respectively.[6,7] Grizzly-specific awareness

remained of the same sign and significance as Model 2, and general species awareness remained insignificant. An additional model with an index of personal cost statements in place of threat to safety, threat to livelihood, and continued recreation shows that the index significantly predicted support ($B = -0.11$; $p < .001$; online Table S14). All other results remained the same.

Discussion

Broadly speaking, the majority of a sample of Californians supported grizzly reintroduction, but only about one-quarter of respondents knew that grizzly bears are not present in the wild in California. This places the question of grizzly bear reintroduction in a low knowledge environment. In this low knowledge environment, those who inaccurately thought grizzlies were still present in the state, representing nearly half of the respondents, were more supportive of reintroduction than respondents who thought grizzlies were absent. This could be because people who realized that grizzlies were absent were more aware of potential problems associated with reintroduction. For example, rural respondents were more aware of grizzly bear absence than urban respondents and might well have a better understanding of the consequences of reintroduction. Alternatively, it could be because people responded to the awareness question on the basis of what they want to be true. Regardless of which mechanism is at play, the relationship between awareness and lack of support for reintroduction means that managers must be careful not to assume that the provision of information alone will result in public support for reintroduction proposals. Indeed, there are many public policy examples where education alone has not resulted in increased policy support (e.g., Lieu, Glauber, Fuentes-Afflick, & Lo, 1994 on vaccines). People do not assimilate information in unbiased ways (Corner, Whitmarsh, & Xenias, 2012); instead, information can be polarizing – entrenching people in their prior positions (Lord, Ross, & Lepper, 1979).

In the low knowledge environment surrounding grizzly bear reintroduction, respondents' attitudes toward reintroduction were associated with their value orientations, particularly the degree to which they were altruistic or biospheric, but not their political ideology. This suggests that respondents do not conceptualize grizzly bear reintroduction as a political issue, perhaps because the issue itself has not become politicized. On the one hand, this means that managers may be able to avoid the polarization that can occur when attitudes are shaped by ideology. On the other hand, the value orientations that they rely on are slow to change, which may in turn make these attitudes difficult to change.

When personal threats are included in the model, the relationships between value orientations and attitudes weaken, suggesting that the day-to-day consequences of reintroduction play a larger role in attitude formation. When individuals feel that their recreational activities or personal livelihood will be affected by reintroduction they are less supportive of it, and more abstract cognitive factors, such as value orientations, become less important. These same day-to-day consequences are easier to change than attitudes, especially as attitudes toward wildlife become more positive (George, Slagle, Wilson, Moeller, & Bruskotter, 2016; Manfredo, Teel, & Henry, 2009). Managers considering reintroductions may find it useful to consider presenting ways to mitigate the possible livelihood and recreational effects before attitudes toward reintroduction become entrenched or politicized.

After respondents reported their support for reintroduction, their responses to questions about societal costs and benefits may be rationalizations of their reported stances. Questions framed as benefits loaded separately from questions framed as costs, with the former being associated with increased support and the latter being associated with decreased support. This grouping of cost statements and benefit statements suggests that respondents were rationalizing their previously stated support or opposition to grizzly bear reintroduction rather than reflecting more nuanced concepts such as trust in wildlife management agencies, general attitudes toward bears, and risk perception (Booth & Ryan, 2016; Heneghan & Morse, 2018). Many reintroductions are framed solely in terms of the costs to stakeholders and individuals (Braczkowski et al., 2018), but this suggests that it is at least as important to communicate the benefits from a reintroduction program (Zajac, Bruskotter, Wilson, & Prange, 2012).

Conclusion and Implications

Social buy-in is very important to successful reintroduction, so understanding how to manage not just the habitat, but the public, is critical. With the increasing recognition that habitat availability is only one a piece of the reintroduction landscape (Dunham, White, Allen, Marcot, & Shively, 2016), there are at least four lessons to be drawn for managers and for researchers.

First, the demonstrated lack of awareness about the absence of grizzly bears in California suggests broader challenges with reintroductions. Grizzly bears are charismatic megafauna and we would expect relatively high awareness of their absence. Yet we observe low awareness. Managers considering reintroductions of lesser-known species should expect even lower awareness. Understanding what shapes attitudes in this low knowledge environment is critical to predicting support and to communicating effectively with the public.

Second, the received wisdom regarding reintroductions – that locals are likely to oppose them (Siegler, 2018) – does not necessarily hold, at least in the period before a reintroduction has become politicized. Controlling for their greater awareness of grizzly bears, rural residents were not less supportive of grizzly bear reintroduction. In addition, respondents who were told that grizzly bears would be reintroduced in National Parks (likely far from them) were not more supportive. This is in contrast to the finding in wolf reintroduction in the US (Bath, 1989) and wolf recolonization in Europe (Karlsson & Sjöström, 2007) that larger distances from recolonization result in higher support. This suggests that managers need to refine our understanding of the political geography of reintroductions.

Third, managers and researchers can expect that value orientations, which shape attitudes toward many issues, pertain to proposed reintroductions. Value orientations are slow to change, so public outreach on reintroduction issues should instead emphasize mitigation of the threats of proposed reintroduction and possible benefits, particularly to people who perceive threats to their livelihoods or recreational activities. Framing reintroduction in terms of the ecological benefits gained may be important for those with biospheric value orientations. For those with altruistic and egoistic value orientations, emphasizing social or personal benefits may be more important for facilitating support.

Fourth, that respondents rationalized the ecological and social costs and benefits of reintroduction suggests that managers and researchers should develop information about reintroduction costs and benefits as early as possible (Clark, Huber, & Servheen, 2002), perhaps even prior to introducing management proposals. Even in low knowledge

environments, the public appears willing to express opinions that may be difficult to change, especially after they have rationalized those attitudes with consideration of the societal and ecological costs and benefits. A focus on communicating benefits, as opposed to mitigating risk, can be an important tool in increasing tolerance for predators (Bruskotter & Wilson, 2014; Slagle, Zajac, Bruskotter, Wilson, & Prange, 2013). Moreover, media messaging about human-wildlife conflict can influence awareness and perceived risks (Bhatia, Athreya, Grenyer, & Macdonald, 2013). Managers are in a position to provide early information that would allow the public to rely on a well-informed assessment of the potential impacts of reintroduction.

Notes

1. Sampling methodology and other supplemental information is available at https://www.calgrizzly.com/aisuppmat.
2. Sixty-nine percent of Californians live in the 19 coastal counties, while most of the National Parks are in the interior eastern portion of the state (United States Census Bureau., 2010).
3. Black bears are present throughout California, can be brown in color like grizzly bears, and are morphologically different. Bald eagles are currently present in California. Bisons are not present in the wild in California, but there is a small, managed herd on Santa Catalina Island. Wolves have migrated in and out of the state; during the time of this survey, wolves were present.
4. A robustness check with an ordered logit (see online Table S11) yielded roughly the same estimates, except that respondents who did not know if grizzlies existed in California were not significantly different from those who thought they do exist.
5. Removing value orientations and ideology and treating rural as an indicator variable investigated whether collinearity masked the effect of rural residence. There remained no significant relationship between rural residence and support for reintroduction (online Table S12).
6. When value orientations were replaced with a measure of environmentalism from the New Environmental Paradigm (NEP; Dunlap, 2000), environmentalism was negatively related to support (B= −0.10; p= .07). The NEP scale ranges from 1 to 5, and a one unit increase in environmentalism was associated with a − 0.10 decrease in support, which is very small (online Table S13).
7. When each PCA estimate and personal threat measure was added sequentially into the model, the benefits component and recreation measure reduced the significance of value orientations to $p < .05$. The other measures did not substantially change the significance of the value orientation measures.

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