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RESEARCH ARTICLE

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Integrating moral norms and stewardship identity into the theory of planned behavior to understand altruistic conservation behavior among hunters in southwestern Utah (USA)

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ABSTRACT

We integrate moral norms and stewardship identity into the Theory of Planned Behavior (TPB) to predict the use of non-lead ammunition in the California condor recovery zone of southwestern Utah. Data were collected from licensed hunters via an online survey. Structural equation models of the TPB without and with the moral norms and stewardship identity constructs were compared to evaluate the utility of integrating these constructs into the TPB. Moral norms did have a significant direct influence on hunters' behavioral intentions. Both moral norms and stewardship identity had significant indirect influences on behavioral intentions via the core constructs of the TPB. The inclusion of moral norms and stewardship identity into the TPB marginally improved model fit and predictive power. Managers can emphasize a moral obligation to use non-lead ammunition and tap into hunters' desire to steward the landscape and the hunting tradition in their communication and outreach efforts.

KEYWORDS

California condor; conservation; non-lead ammunition; wildlife

Introduction

Wildlife managers are faced with the ongoing challenge of balancing the needs of human and nonhuman actors within the systems they manage. Management approaches to these challenges can include direct (e.g., population control through hunting) or indirect (e.g., habitat management) interventions with the wildlife species in the system (Manfredo et al., 2009). Because many of the challenges faced by wildlife managers are rooted in human behaviors which lead to undesirable outcomes for wildlife (Brown et al., 2010; Miller, 2019), there is a growing recognition that long-term solutions benefitting both humans and wildlife should be focused on changing those human behaviors (Baruch-Mordo et al., 2009; Manfredo et al., 2009). There are a variety of strategies managers can use to influence these

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behaviors, ranging from sanctions (e.g., fining or prosecuting those who use lead ammunition), to incentives (e.g., providing vouchers for free or reduced-cost non-lead ammunition), to persuasive communication. Persuasive communication strategies are often the most cost-effective and politically viable strategy; they can also be tailored to the demographics, attitudes, beliefs, opinions, and values of an intended audience (Jacobson & McDuff, 2009).

Communication strategies grounded in a strong theoretical foundation are significantly more effective at changing behavior when compared to those that are not (Lessard et al., 2021; Teel et al., 2015). The Theory of Planned Behavior (TPB) has been widely used by wildlife managers to inform persuasive messaging related to resource conservation, visitors' experiences, mitigating environmental impacts, and improving the safety of hunters (Daigle et al., 2002; Hrubes et al., 2001; Newth et al., 2022; Shrestha & Burns, 2016; Shrestha et al., 2012; Triezenberg et al., 2016). The TPB is a generalizable theory intended to explain all types of volitional behaviors. The Theory asserts the most proximate predictor of behavior is one's intention to engage in that behavior, which itself is explained by one's attitude toward the behavior, the degree to which they perceive control over the behavior, and their subjective norms (or beliefs about whether most people important to them approve or disapprove of the behavior) (Ajzen, 1991). The TPB has been effective in predicting behavioral intentions as well as observed/reported behaviors, generally being more predictive of the former than the latter (Armitage & Conner, 2001). The TPB is noted for its parsimony, predictive ability, and adaptability to different contexts (Armitage & Conner, 2001; Conner & Armitage, 1998; Miller, 2017). Given this, the TPB can be used to craft communication strategies designed to influence and promote desirable human-wildlife interactions.

The goal of this research is to assess and potentially improve upon the ability of the TPB to predict a conservation behavior – the use of non-lead ammunition – for the purposes of informing the development of persuasive messages. We incorporate two additional constructs into the TPB, moral norms and stewardship identity, which may be particularly relevant within the context of altruistic conservation behaviors. While the TPB is a parsimonious model, it does allow for the incorporation of additional components. We examine the relationship between moral norms, stewardship identity, the core TPB constructs, and hunters' intention to use non-lead ammunition. Our findings can be used to inform the development of persuasive messages targeted at hunters in southeastern Utah.

Literature Review

Theory of Planned Behavior Overview

The TPB postulates there are three primary determinants of behavioral intentions: attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991). An attitude toward a behavior is the degree of favorability the individual holds toward it and is preceded by behavioral beliefs. The subjective norm is the social component, where an individual evaluates the perceived attitudes of their social group(s) toward an object and feels a certain external pressure to perform or not perform the behavior. Finally, perceived behavioral control refers to individuals' perceptions of their ability to perform a given behavior (Ajzen, 1991).

Efficacy of TPB

The TPB is often used in efforts to influence behaviors and has been shown through many studies and meta-analyses to be an effective predictive tool. Armitage and Conner (2001) found the TPB explained an average of 27% of variance in behavior, and 39% of behavioral intention across a meta-analysis of 185 independent studies. Kaiser et al. (2005) found the core constructs of the TPB predicted 76% of behavioral intention, and intention explained 95% of the variance in conservation behavior. Sutton (1998) summarized the findings of several meta-analyses of TPB (and its predecessor, the Theory of Reasoned Action [TRA]), determining 40–50% of the variance in behavioral intentions can be explained by the TPB/TRA. The variance in actual behavior explained was smaller (19–38%), but effect sizes for both relationships were medium to large. While these numbers may seem low, they are quite high in comparison to typical effect sizes in the behavioral sciences (Sutton, 1998).

The TPB not only provides a relatively high explanatory power for behavioral intentions (and subsequent behaviors), but its utility also comes from its adaptability (Miller, 2017). The theory can be applied to a variety of behaviors and can incorporate other theoretical constructs relevant to the specific behavioral context being examined (Ajzen, 2020). The TPB's simplicity makes for easier explanations and applications for non-scientists, such as wildlife managers (Miller, 2017). Finally, the utility of the TPB also stems from its ability to better understand behavioral antecedents and leverage that understanding to alter behaviors more effectively toward conservation outcomes.

Moral Norms, Stewardship Identity, and the TPB

We examine the utility of integrating moral norms and stewardship identity into the TPB. Moral norms can be defined as "personal feelings of moral obligation or responsibility to perform [. . .] a certain behavior (Ajzen, 1991, p. 199). Ajzen (1991) argued these moral obligations would be expected to influence behavioral intentions, along with the core constructs of the TPB. The moral norm construct consists of beliefs held by an individual regarding whether an action is right or wrong, irrespective of what others think (Schwartz, 1977). It is a self-imposed sense of moral obligation that is not captured by the traditional subjective norm component of the TPB (Schwartz, 1977). Several studies have shown moral norms can increase the predictive power of the TPB when altruistic behaviors (such as those that benefit wildlife) are targeted (Conner et al., 2003; Corbett, 2005; Harland et al., 1999; Thøgersen, 2002). Notably, Fishbein and Ajzen point out that "[w]hen . . . moral norms have been included as additional predictors in [the] theory, they have generally been found to increase the proportion of explained variance in intentions (Fishbein & Ajzen, 2010, p. 284). Fishbein and Ajzen go on to point out that despite moral norms improving the predictive power of TPB, they have not been integrated as a "core" or "standard" part of the TPB as they are not "relevant beyond a limited range of behaviors" (Fishbein & Ajzen, 2010, p. 284). A review by Manstead (2000), shows how moral norms have improved the predictive power of the TPB for certain behaviors such as those that are: altruistic; illegal, antisocial, or dishonest; performed by employees; related to business ethics; sexual; or related to eating or drinking.

Stewardship identity can be defined as the extent to which an individual's identity is related to the stewardship of a natural system, species, or landscape (Lute & Gore, 2014).

Individuals are believed to develop social identities based on intergroup comparisons. Individuals will hold a stronger stewardship identity if they first have access to that identity (e.g., "I can be a steward because I am a hunter"), and if it offers comparative (e.g., "no other group is responsible for stewarding hunting, so I must be") and normative (e.g., "all hunters are stewards of the activity") differentiation relative to other social identities (see Hornsey (2008) for a discussion of the social identity perspective). Stewardship identity is associated with a feeling of personal responsibility to take care of a particular place or landscape, and can influence personal motivation to engage in behaviors that benefit the environment, which affirms those self-identified roles (Landon et al., 2021). Previous research on behaviors outside wildlife conservation (particularly agricultural behaviors) has found social identity constructs to be useful supplements (alongside the core constructs of the TPB) to predicting behavioral intentions (Lu et al., 2022).

Moral norms and stewardship identity are particularly intriguing within the context of altruistic behaviors, as these types of behaviors often pit self-interest and other interests against each other and therefore have a moral component (Conner et al., 2003). Because of this, models incorporating morally-focused constructs have been useful in the analysis of altruistic behavior (Kaiser et al., 2005; Van Liere & Dunlap, 1978). The integration of moral norms and stewardship identity into an established behavioral model like the TPB could provide a more holistic understanding of how altruistic behaviors (such as the use of non-lead ammunition) are shaped by the constructs of the TPB *as well as* morally-focused constructs.

Previous research suggests hunters tend to believe they are stewards of the game species they target and the landscapes on which they hunt (Epps, 2014; Holsman, 2000; Kaltenborn et al., 2013; Landon et al., 2021). Williams et al. (2019) recognized stewardship identity can be operationalized by wildlife managers and that hunters can be a useful management tool when their identity as stewards can be engaged. This identity is associated with responsible behavior and is part of a self-perception amongst many hunters as positive, law-abiding actors in the ecosystems in which they hunt (Holsman, 2000; Kaltenborn et al., 2013).

Although hunters may report dissatisfaction with specific management decisions (such as the restoration of predator species in certain areas), they support the general conservation of habitats and native species (Heffelfinger et al., 2013). Research has also suggested hunters may even view themselves as stewards of non-game predator species, if given the opportunity to hunt those species (Bruskotter & Fulton, 2012; Treves & Martin, 2011). Gamborg et al. (2018) found wildlife care and management is a primary motivator for hunting, behind only being motivated by the opportunity to interact with nature and other people.

While the literature shows hunters tend to hold strong moral norms and identify as stewards (as expressed in self-reports, behavior, and the structure of conservation funding models) hunters are not homogenous. Holsman (2000) found hunters sometimes engage in behaviors that do not align with wildlife management objectives, suggesting quantifying moral norms and stewardship identity could be particularly useful in research targeting the behavior of a particular regional group of hunters. These generalizations should not be assumed based on literature from other areas, but these studies can inform the questions to be asked and elucidate possible psychological constructs to be targeted by conservation communication strategies.

Methods

Study Site and Context

The recovery of the California condor (condor) (*Gymnogyps californianus*) is an iconic conservation success story. Its population dwindled to only 22 individuals in 1982 (Finkelstein et al., 2012), primarily due to anthropogenic causes such as infrastructure development (i.e., power lines), poisoning of pest species that were food sources for condors, and lead poisoning from bullet fragments in game carcasses (Rideout et al., 2012). A captive breeding and release program helped the species begin to rebound, and the current global population is over 500 individuals, more than half of which can be found in free-flying wild populations within Arizona, California, and Utah (USA) and Baja California (Mexico) (Walters et al., 2010).

The ingestion of lead from spent ammunition in carcasses remains the leading cause of mortality among condors (Finkelstein et al., 2012; Sieg et al., 2009). There have been multiple studies linking lead ammunition use by hunters to lead toxicosis and death among condors. Parish et al. (2006) confirmed condors are ingesting lead, which is also evidenced by the perennial chelation treatments given to an average of 20% of the condor population in California each year (Finkelstein et al., 2012). Hauck (personal communication, 04/05/22) confirmed lead poisoning from ingested ammunition was also the greatest cause of fatalities in the Arizona/Utah population, with 53% of diagnosed deaths attributed to lead toxicosis. Research shows non-lead ammunition use within the condor's foraging range will need to be nearly 100% if the condor population is to remain independently stable without captive releases or intensive health monitoring and treatment (Finkelstein et al., 2012; Sieg et al., 2009).

Many attempts have been made to increase the use of non-lead ammunition nationwide. These have included regulatory bans on lead ammunition in California, communication campaigns, and voucher programs for free non-lead ammunition in western states with condor populations such as Arizona and Utah (Epps, 2014). The evidence suggests regulatory bans on non-lead ammunition have not been effective in reducing lead exposure to condors (Epps, 2014; Finkelstein et al., 2012). International studies have also shown bans are often ineffective, due to poor compliance, lack of enforcement, and their partial nature. For example, in areas where lead ammunition has been banned from big-game hunting, it is still being allowed for target shooting, small game or nuisance species hunting (Arnemo et al., 2016). Many of the advocates for a regulatory ban point to the success of the federal ban on lead ammunition for waterfowl hunting. However, this is not analogous to big game hunting for several reasons: the precision needed for big game rifles makes users more sensitive to changes in bullet specifications; there are far more rifle calibers than shotgun (which are generally used for waterfowl); and the dispersed and backcountry areas associated with big game hunting makes enforcement more difficult (Epps, 2014). The primary target of efforts to minimize the use of lead ammunition should be high velocity rifles used for big game, since these are the types of bullets which produce the most fragmentation within the carcass (Epps, 2014).

Non-lead ammunition use in the Zion hunting unit of Utah (part of the nesting and foraging range of the southwest population of the condor) has been increasing, with most recent self-reported survey data showing it approaching 70% in the last five years (Richards & Smith, 2021). The Utah Division of Wildlife Resources (DWR), which regulates hunting

activity within the region, has made concerted efforts to encourage the use of non-lead ammunition. These efforts include a voucher program that allows hunters to receive free non-lead ammunition, raffles for non-lead ammunition, and communication campaigns specifically targeted at hunters within the region. The relevant literature supports a voluntary strategy through communication campaigns to achieve their target number, as opposed to top-down hunting regulations (Epps, 2014; Sieg et al., 2009).

Data Collection

We administered an online survey via e-mail to all 6,453 hunters who drew a permit to hunt deer in the Zion hunting unit from 2017–2021. E-mail addresses were provided by the DWR. The survey was administered via the Qualtrics online survey platform. The survey was first sent to everyone in the sample on November 5, 2021, with four follow up e-mails sent over the next three weeks. A total of 1,845 respondents agreed to participate via the initial consent form. Data from respondents under 18 ($n = 12$) were removed from the dataset. A total of 86 participants did not answer any questions after agreeing to participate, so were dropped from subsequent analyses. In total, we received 1,752 valid responses with usable data. The overall response rate was 27.2%. Studies using similar electronic sampling methods tended to have lower response rates (13–23%) unless a preliminary interaction occurred either in-person or via mailed survey invitation (Dybsand & Stensland, 2022; Lessard et al., 2021; Leszek, 2015; Martin & McCurdy, 2009; Williams et al., 2019).[1]

Measures

The instrument was divided into five sections: 1) recent Zion area hunting behavior; 2) information sources and ammunition preferences; 3) previous non-lead ammunition use; 4) perceptions about using non-lead ammunition; 5) and sociodemographic questions. Questions regarding hunting behavior, information sources, and ammunition preferences were based on similar instruments found in the literature (Chase et al., 2015; Duda, 2004; Seng, 2005) and input from the DWR and other project partners. In total, the instrument included a total of 43 questions or statements.

All psychometrics were measured on a 7-point Likert-type scale. Response options for the attitude statements ranged from *not at all* (−3) to *extremely* (+3). Response options for all other statements (subjective norms, perceived behavioral control, stewardship identity, and moral norms) ranged from *completely disagree* (−3) to *completely agree* (+3). See Table 1 for complete listings of response option labels.

Attitudes toward the use of non-lead ammunition were measured with four statements asking the respondent if they found using non-lead ammunition to be good, pleasant, favorable, or poor (Hrubes et al., 2001; Kaiser et al., 2005; Miller, 2019).

Subjective norms toward the use of non-lead ammunition were measured with four statements asking about the perceived opinion of a variety of groups: "people who I respect," "people important to me," "other big game hunters in the Zion area," and "wildlife managers." These groups were adapted to our study context from similar research (Harland et al., 1999; Hrubes et al., 2001; Kaiser et al., 2005; Miller, 2019; Parker et al., 1995).

Perceived behavioral control was measured using four statements regarding the respondent's perceived ability to use and acquire non-lead ammunition. These items were also

Table 1. Descriptive statistics for psychometric statements.

Dimension and Scale Items (Code used in models)	*M*	*SD*	α	α if item deleted	Factor Loading
Attitude (ATT)			.853		
For me, using non-lead ammunition would be good[a] (ATT_1)	4.87	1.76		.770	.92
For me, using non-lead ammunition would be favorable[a] (ATT_2)	4.75	1.74		.762	.94
For me, using non-lead ammunition would be pleasant[a] (ATT_3)	4.62	1.65		.776	.89
For me, using non-lead ammunition would be poor[a,c] (ATT_4)	3.36	1.73		.916	.46
Subjective Norm (SN)			.793		
People who I respect use non-lead ammunition[b] (SN_1)	4.41	1.59		.675	.84
People who are important to me think I should use non-lead ammunition[b] (SN_2)	4.00	1.62		.697	.85
Other big game hunters in the Zion use non-lead ammunition[b] (SN_3)	4.49	1.41		.729	.67
Wildlife managers want me to use non-lead ammunition in the Zion area[b] (SN_4)	5.79	1.30		.830	.43
Perceived Behavioral Control (PBC)			.783		
If I wanted to, I could easily use non-lead ammunition on my next big game hunt in the Zion area[b] (PBC_1)	5.10	1.78		.751	.68
Acquiring non-lead ammunition is easy[b] (PBC_2)	3.51	1.93		.746	.61
Using non-lead ammunition is simple[b] (PBC_3)	4.82	1.76		.718	.78
My ability to use non-lead ammunition is totally in my control[b] (PBC_4)	4.93	1.90		.705	.67
Stewardship Identity (SI)			.830		
I consider myself a steward of the hunting tradition for future generations[b] (SI_1)	6.07	1.10		N/A	.83
I consider myself a steward of the natural landscape where I hunt[b] (SI_2)	6.22	0.92		N/A	.86
Moral norm (MN)			.924		
When choosing ammunition, I feel morally obligated to prioritize using non-lead ammunition[b] (MN_1)	4.50	1.81		.915	.84
I would be a better person if I used non-lead ammunition[b] (MN_2)	3.46	1.94		.897	.89
I feel morally obligated to purchase non-lead ammunition regardless of what others say[b] (MN_3)	3.64	1.94		.884	.92
I would feel guilt if I used lead ammunition while hunting big game in the Zion area[b] (MN_4)	3.32	1.95		.909	.85
Behavioral Intention (BI)			.917		
I intend to use non-lead ammunition on my next big game hunt in the Zion area[b] (BI_1)	5.19	1.78		.861	.88
I will try to use non-lead ammunition on my next big game hunt in the Zion area[b] (BI_2)	5.36	1.69		.888	.87
I am determined to use non-lead ammunition on my next big game hunt in the Zion area[b] (BI_3)	4.89	1.84		.892	.88

n ≥ *1,033*.

[a]These items were measured on a 7-point Likert-type scale, where −3 = *not at all (good/pleasant/favorable/poor)*, 0 = *neutral*, +3 = *extremely (good/pleasant/favorable/poor)*.

[b]These items were measured on a 7-point Likert-type scale, where −3 = *completely disagree*, −2 = *disagree*, −1 = *slightly disagree*, 0 = *neither agree nor disagree*, 1 = *slightly agree*, 2 = *agree*, 3 = *completely agree*. These items were coded on a scale of 1–7 for analysis.

[c]ATT_4 was a negative descriptor of non-lead ammunition, meaning *M* < 4.0 is considered a positive attitude. This was reverse coded prior to analyses.

taken from similar research and adapted to the current behavioral context (Hrubes et al., 2001; Kaiser et al., 2005; Miller, 2019; Parker et al., 1995).

Behavioral intention was measured by the level of agreement with the phrases "I intend . . . ," "I will try . . . ," and "I am determined . . . " "to use non-lead ammunition on my next big game hunt in the Zion region" (Hrubes et al., 2001; Kaiser et al., 2005).

The moral norm statements assessed hunters' moral obligation to use or purchase non-lead ammunition (Harland et al., 1999; Kim & Seock, 2019; Schwartz, 1977). Four statements were used: "when considering ammunition, I feel morally obligated to prioritize using non-lead ammunition," "I would be a better person if I used non-lead ammunition," "I feel morally obligated to purchase non-lead ammunition regardless of what others say," and "I would feel guilt if I used lead ammunition while hunting big game in the Zion area."

Stewardship identity statements were adapted from Landon et al. (2021). Similar statements have been used to measure the norm constructs within the Value-Belief-Norm model (Lessard et al., 2021). There were two scale items measuring the extent to which hunters identify with a need to steward "the hunting tradition for future generations" and "the natural landscape where [they] hunt."

Data Analysis

Stata 16.0 statistical software was used for descriptive statistics, internal reliability analyses, exploratory and confirmatory factor analysis (EFA), and structural equation modeling.

Exploratory Factor Analysis

All scale items were recoded from −3/+3 to + 1/+7 scale for analysis. The items used to measure moral norms and stewardship identity were taken from research measuring a variety of other constructs in addition to these two. This necessitated an EFA to determine if the measurement items for these two constructs were measuring distinct constructs. Prior to conducting the EFA, we evaluated the sampling adequacy of the six statements using the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity; the *factortest* command in Stata 16.0 was used (Azevedo, 2006). For the EFA, we used a principal components specification with varimax rotation through the *factor* command in Stata 16.0 (StataCorp, 2019a). Components with Eigenvalues greater than 1.0 were extracted as distinct latent constructs.

Confirmatory Factor Analysis

CFA was performed to assess the fit of these data to the constructs in our measurement model. The CFA was also used to determine convergent and divergent validity of the measurement model. Convergent validity between items and constructs was determined by an Average Validity Extracted (AVE) value greater than 0.50 while discriminant validity was determined if the square root of the AVE was greater than the squared correlation between constructs (Fornell & Larcker, 1981). We calculated AVE and squared correlations between constructs using the *condisc* command in Stata 16.0 (Mehmetoglu, 2015).

Model fit was determined with fit statistics criteria used in similar research. These criteria include χ^2/df value less than 5.0, root mean square error of approximation (RMSEA) below 0.10 (<0.05 indicates excellent fit), comparative fit index (CFI) and Tucker-Lewis index (TLI) greater than 0.90 (≥0.95 indicates excellent fit) (Hu & Bentler, 1999; Miller, 2019; Smith et al., 2012). If good model fit is determined, coefficients between the latent variables within the structural model can be estimated.

A minimum cutoff of 0.40 for standardized factor loadings was used to determine each statement item's inclusion in the final model; this value has been used widely in human dimensions of wildlife research (Lessard et al., 2021; Manfredo et al., 2009). We also used the conventional threshold of 0.65 to evaluate the internal reliability of all constructs; this is considered an acceptable value in human dimensions of wildlife research (Vaske, 2019).

Structural Equation Models

Assuming our measurement models fit these data well, the structural coefficients between latent variables can be estimated with a maximum-likelihood with missing values estimation procedure (StataCorp, 2019b). A SEM was used to measure the relationship between the TPB constructs and the addition of the moral norm and stewardship identity constructs. The models without and with the moral norm and stewardship identity constructs were estimated sequentially. We compared the model fit statistics with a χ^2 difference test to determine if the moral norm and stewardship identity constructs resulted in a decrement to model fit.

Results

Sample Characteristics

The sociodemographic characteristics of our sample are reported in the Supplementary Material. Our sample was primarily male (88.3%). The age structure of respondents had a normal distribution, with a mean of 49.7 years and a range from 18 to 88.[2] The modal income category was between $100,000–$149,000. More than four-fifths (82.2%) of respondents were residents of Utah, with another 12.4% coming from other western states (e.g., Arizona, California, and Nevada). Respondents tended to be experienced hunters, having hunted for an average of nearly 30 years (mean = 29.8, SD = 16.7). Two-thirds of respondents (65.9%) had used non-lead ammunition in the Zion unit in the previous 12 months, and 69.0% of respondents reported using non-lead ammunition at some point in the past while hunting in the Zion unit. Two-fifths (40%) of hunters indicated they intended to use non-lead ammunition but were unable to find it in their preferred caliber. A complete breakdown of descriptive statistics for all questions in the survey can be found in the project's technical report (Richards & Smith, 2021).

Exploratory Factor Analysis

The Kaiser-Meyer-Olkin (KMO) of .781 indicated a sampling adequacy between "middling" (>.70) and "meritorious" (>.80) (Kaiser & Rice, 1974). Bartlett's test of sphericity was also significant ($\chi^2 = 4{,}287.49$, $df = 15$, $p < .001$). Both statistics suggest the scale items were suited for factor analysis. Two components were extracted from the six items used to measure moral norms and stewardship identity, and these two components accounted for 84.0% of the variance among those items. The four items intended to measure moral norms were highly correlated (≥.68) with the first extracted component, and the two items intended to measure stewardship identity were highly correlated with the second extracted component (.72).

Descriptive Statistics of Psychometric Statements

Descriptive statistics for individual statements within the TPB, as well as the moral norms and stewardship identity constructs and the behavioral intention measures are shown in Table 1. Generally, items measuring the standard components of the TPB were positive (means >4.00). Stewardship identity items were exceptionally high (means >6.00) with

a lower standard deviation (1.10 and .92) indicating strong positive agreement with the statements and less variation than response items measuring other constructs. A full 89.4% of respondents said they "agree" or "completely agree" with the statement "I consider myself a steward of the natural landscape where I hunt." This percentage only dropped to 80.7% for the statement "I consider myself a steward of the hunting tradition for future generations." Moral norm items had lower means relative to the other constructs, with three out of four items being rated negative (mean <4.00). Finally, behavioral intention items were also very positive (means ≥4.89).

High factor loadings between survey items and their latent constructs suggests the statements are good measures of their intended latent constructs. All items met our established minimum threshold value of .40. Internal reliabilities among items measuring each latent variable were also sufficient (Cronbach's alpha ≥ .783).

A CFA was performed for our measurement model which included the traditional components of the TPB as well as our two constructs measuring moral norms and stewardship identity. All fit statistics for the measurement model indicated the model fit these data well. Fit statistics for the measurement model were: $\chi^2 = 620.44$, $df = 125$, $\chi^2/df = 4.96$; $p < .001$; RMSEA = 0.053; CFI = 0.957; TLI = 0.948. AVE values ranged from 0.50 to 0.77, confirming convergent validity between items and constructs. The square root of AVE was greater than the squared correlations between latent variables. The correlations between latent constructs was ≤ .49., confirming discriminant validity.

Structural Model

The two structural models (without and with the moral norms and stewardship identity latent constructs) both fit these data well. The differences in fit statistics between the structural models without and with the moral norms and stewardship identity latent constructs were marginal, indicating that the addition of the moral norm and stewardship identity constructs did not result in a decrement in model fit (Table 2). Both models explained roughly 60% of the variance in hunters' intention to use non-lead ammunition. A difference test of the two models was significant ($\Delta\ \chi^2 = 562.66$, $\Delta\ df = 121$, $p < .001$), suggesting the inclusion of the additional constructs improved model fit.

Estimated coefficients for the structural model with moral norms and stewardship identity included are shown in Table 3, all significant direct effects are visualized in

Table 2. Model fit comparison.

	χ^2	*df*	χ^2/df	*p*	CFI	TLI	RMSEA	R^2
Initial Model *Behavioral intentions predicted with the TPB constructs (attitudes, social norms, perceived behavioral control) and socio-demographic controls (age, gender, income, state of residence)*	555.47	128	4.3	<.001	.958	.945	.042	.597
Model with Moral Norms and Stewardship Identity *Behavioral intentions predicted with the TPB constructs (attitudes, social norms, perceived behavioral control), moral norms, stewardship identity, and socio-demographic controls (age, gender, income, state of residence). The TPB constructs also predicted by moral norms and stewardship identity.*	1118.13	249	4.5	<.001	.943	.933	.043	.607

n = 1,922.

Table 3. Direct and indirect effects of model constructs on behavioral intention to use non-lead ammunition.

Response	Predictor	Standardized Path Coefficient	*p*-value
Direct Effects			
Behavioral Intention	Attitudes	.389	≤ .001
	Subjective Norms	.268	≤.001
	Perceived Behavioral Control	.197	≤.001
	Moral Norms	.166	≤.001
	Stewardship Identity	.014	.740
	Age	−.002	.499
	Gender	−.016	.774
	Income	.018	.233
	State of Residence	−.091	.165
Attitude	Moral Norms	.645	≤.001
	Stewardship Identity	.163	.001
Subjective Norm	Moral Norms	.588	≤.001
	Stewardship Identity	.146	.001
Perceived Behavioral Control	Moral Norms	.426	≤.001
	Stewardship Identity	.154	.001
Indirect Effects			
Behavioral Intention	Moral Norms	.492	≤.001
	Stewardship Identity	.133	≤.001
Total Effects			
Behavioral Intention	Moral Norms	.658	.002
	Stewardship Identity	.147	≤.001

n = 1,922. Model estimated with maximum likelihood with missing values specification [method(mlmv) option in the sem command in Stata 16.0].

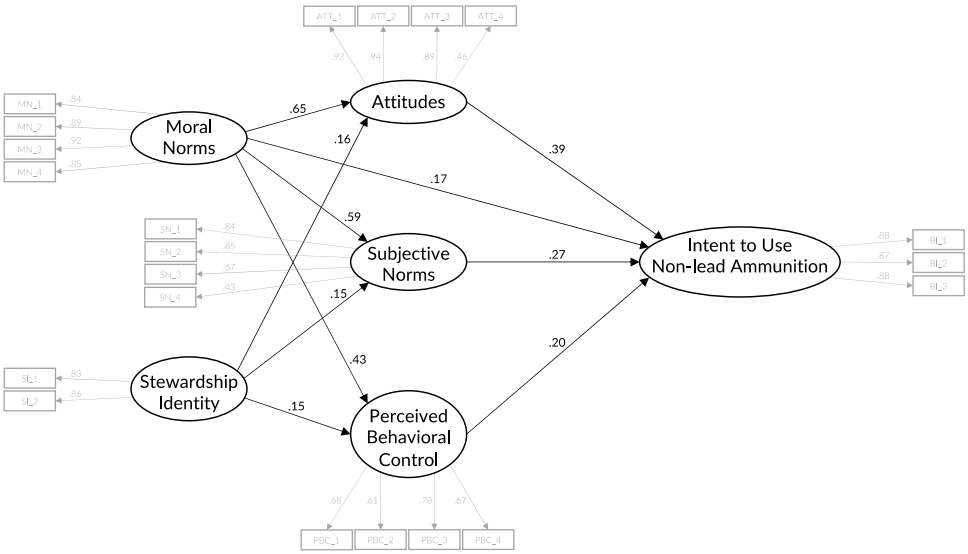

Figure 1. Structural model which includes the addition of the moral norm and stewardship identity constructs.Note. Only significant structural direct effects shown. See table 1 for corresponding variable codes.

Figure 1. Moral norms (coef. = 0.166, $p \leq .001$) had a significant and direct effect on hunters' behavioral intentions. The core constructs of the TPB, attitudes (coef. = 0.389, $p \leq .001$), subjective norms (coef. = 0.268, $p \leq .001$), and perceived behavioral control (coef. = 0.197, $p = .013$), were also all significantly related to behavioral intentions. Moral norms also had a significant direct effect on attitudes (coef. = 0.645, $p \leq .001$), subjective norms (coef. = 0.588, $p \leq .001$), and perceived behavioral control (coef. = 0.426, $p \leq .001$). Stewardship identity also had a significant direct effect on attitudes (coef. = 0.163, $p = .001$), subjective norms (coef. = 0.146, $p = .001$), and perceived behavioral control (coef. = 0.154, $p = .001$). Both the moral norms construct (coef. = 0.492, $p \leq .001$) and the stewardship identity construct (coef. = 0.133, $p \leq .001$) had a significant indirect effect on behavioral intentions via the core TPB constructs. Moral norms had the largest total effect on hunters' intentions to use non-lead ammunition (.658); they were followed by attitudes (.389), subjective norms (.268), perceived behavioral control (.197), and stewardship identity (.147).

We also included several sociodemographic characteristics (age, gender, income, and state of residency) into the structural models to control for any influence these characteristics might have on behavioral intention. The analysis revealed these characteristics were not significantly related to behavioral intentions in either the model without or with the moral norms and stewardship identity constructs included (coef. ≤0.018 and p-values >0.165).

We also compared model fit and estimates generated from the maximum likelihood with missing values specification with those from a maximum likelihood specification where cases were deleted listwise if any variable in the model was missing. Model fit and estimates were consistent across both specifications (see the Supplemental Material), supporting the assumption any missing data are missing at random. We report the results from the maximum likelihood with missing values specification here, given imputation is generally preferable to listwise deletion (Allison, 2003).

Discussion

Theoretical Implications

Our findings align with previous research showing hunting behaviors are significantly related to the core TPB constructs (Daigle et al., 2002; Hrubes et al., 2001; Newth et al., 2022; Shrestha & Burns, 2016; Shrestha et al., 2012; Triezenberg et al., 2016). The three core constructs of the TPB alone were able to explain nearly 60% of Zion deer hunters' intention to use non-lead ammunition. The two additional constructs of moral norms and stewardship identity added little (1%) to the predictive power of the model. This suggests the core constructs of the TPB can perform quite well by themselves in predicting the altruistic hunting behavior of using non-lead ammunition. The finding also suggests the core constructs of the TPB may contain some actual or perceived level of moral normativity and self-identity. More simply put, evaluations of statements like "For me, using non-lead ammunition would be good" (a measure of attitudes) or "People who I respect use non-lead ammunition" (a measure of subjective norms) may be interdependent with individuals' perceptions of morality and/or their personal identity.

Our expanded model showed moral norms and stewardship identity can be parsed from the core constructs of the TPB (i.e., the model still fit the data well with the inclusion of

these additional constructs) *and* that moral norms and stewardship identity do shape hunters' attitudes, perceived behavioral control, and subjective norms associated with an altruistic hunting behavior (i.e., both constructs had significant indirect and total effects on behavioral intention). This finding sheds some light on the cognitive mechanisms underlying altruistic hunting behaviors. Previous scholarship has treated the constructs of moral norms and self-identity as factors wholly independent from the core TPB constructs (Conner et al., 2003; Corbett, 2005; Harland et al., 1999; Thøgersen, 2002). Here, we show they can be parsed from, and are significant precursors to, the core constructs of the TPB. It is unclear whether this cognitive mechanism would persist in other *non*-altruistic hunting behaviors.

Our findings also demonstrate the first evidence hunters' stewardship identity plays a significant role in their hunting behaviors. Hunters in our study held very strong beliefs they were stewards of the landscapes on which they hunt. This finding alone was not particularly surprising, given the strong moral underpinnings of hunting in the United States (Organ et al., 2012). However, it is noteworthy to document the pathways by which one's feeling of being a steward over the landscape and the hunting activity translate into their intent to engage in altruistic hunting behaviors – via the three core constructs of the TPB.

Our findings are also consistent with the understanding injunctive norms (those that involve perceived obligations or sanctions) tend to be stronger predictors of behavioral intentions relative to subjective norms (beliefs about what others think you should do), descriptive norms (others' behavior, or evidence of others' behavior), and attitudes (preferences and expectations) (Cialdini et al., 1990; Heywood, 2002, 2011; Heywood & Murdock, 2002). We found moral norms toward using non-lead ammunition to have the largest total effect on hunters' intentions to use non-lead ammunition, more so than attitudes and subjective norms. If the use of lead ammunition in the Zion hunt region were illegal, and had we asked about hunters' belief that using non-lead was the right thing to do because the failure to do so could result in fines or criminal prosecution, it is highly likely these sanctioning injunctive norms would be even more predictive of behavioral intentions. Future TPB-based hunting research is encouraged to explore the relative importance of sanctioning injunctive norms in addition to the obligatory injunctive norms which we have explored here.

Collectively, the strong and pervasive morality and stewardship beliefs that underpin modern hunting, at least in the United States, may be a fundamental precursor to hunters' attitudes, subjective norms, and perceived behavioral control over altruistic hunting behaviors. Data from this study would support this argument, and also lend credence to persuasive communication strategies that focus more squarely on the morality of hunting behaviors and hunters' stewardship identity more so than any of the core constructs of the TPB alone.

Management Implications

Tapping into Moral Norms and Stewardship Identity in Persuasive Communication

In our investigation, the strongest predictors of hunters' intention to use non-lead ammunition were moral norms. Consequently, it may be useful for wildlife managers to actively seek out ways to integrate moral norms into communication strategies aimed at increasing

the use of non-lead ammunition amongst hunters. Our data suggest over half of hunters believed they are "morally obligated to prioritize using non-lead ammunition." Messages that have used appeals to moral norms include phrasing such as "If not you, who? (It's the right thing to do)" (Brown et al., 2010) activate internalized personal obligation (Harland et al., 1999) and emphasize the feeling of guilt that one may expect to experience after performing an action that contradicts those norms (Parker et al., 1995). Messages that have used appeals to hunters' stewardship identity could include phrases such as "preservation of this landscape is up to you: use non-lead to protect native species," "the stewardship of this land and its wildlife is in your hands," or "responsible hunters use non-lead ammunition to protect this landscape and its wildlife." These messages emphasize a moral obligation to use non-lead ammunition and tap into hunters' strong desire to be stewards over the land and the hunting tradition. These potential messages should be tested and refined with the target audience (hunters who use the Zion hunt unit) before widespread dissemination.

Tapping into the Beliefs Shaping the Core TPB Constructs

Our findings also revealed the core TPB constructs were also statistically significantly correlated with hunters' intent to use non-lead ammunition. Consequently, messaging can tap into hunters' beliefs about the result of using non-lead ammunition (the behavioral beliefs underlying attitudes), beliefs about what other individuals and groups important to hunters think about using non-lead ammunition (the normative beliefs grounding subjective norms), and beliefs about how hunters can obtain non-lead ammunition (the control beliefs grounding perceived behavioral control).

With regards to behavioral beliefs, persuasive messaging that speaks to the positive outcomes associated with the use of non-lead ammunition (i.e., behavioral beliefs) may be positively received amongst hunters (Schulz et al., 2022). Ancillary data from our survey show the majority (72.7%) of hunters who do use non-lead ammunition belief it is "just as accurate as lead ammunition." Similarly, 67.1% of the hunters that use non-lead ammunition believe it "is just as lethal for killing game as lead ammunition" (Richards & Smith, 2021). These data points can be highlighted by wildlife managers in their communication efforts to emphasize the positive outcomes many hunters in the region associate with the use of non-lead ammunition.

With regards to the normative beliefs, messages presented from the perspective of other hunters in southwestern Utah are likely to me more effective than messages presented from the perspective of other individuals/groups like the state DWR or local outfitters/retailers. Ancillary analysis of the survey data reported on here revealed that 32.5% of respondents believe other hunters who have hunted in the area before are reliable sources of information about hunting opportunities in the region (Richards & Smith, 2021).

With regards to control beliefs, wildlife managers could refine their communication efforts so that all hunters who obtain a hunting license in the region are made aware of the state's current voucher program to offer non-lead ammunition to hunters who obtain a hunting license in the Zion region. Not all hunters in our sample were aware of the program (11% had not heard of it) (Richards & Smith, 2021).

Collectively, this research provides numerous in roads through which wildlife managers can communicate with hunters in the Zion area about the use of non-lead ammunition. Efforts that target moral obligations (moral norms) and behavioral beliefs (attitude) are particularly worth pursuing given these constructs have a substantially larger effect on

behavioral intentions than any of the others we investigated. While this analysis suggests communication efforts should prioritize moral obligations and behavioral beliefs, future efforts should also attempt to integrate normative and control beliefs as well, as their associated TPB constructs were also significantly related to behavioral intentions.

The above discussion is not intended to imply that persuasive communication is *the only* way wildlife managers can, or should, interact with hunters. Rather, persuasive messages delivered through state agency websites, printed materials, and on-site signage are the most common method that agencies use to try an effectuate desirable behavioral change. More "engaging" methods, which a large body of literature suggests can be more effective, include transactional decision making and co-management approaches (Lauber et al., 2012). It is unclear how effective these more engaging methods would be within the context of an altruistic behavior like the use of non-lead ammunition. More research on this front would be warranted, particularly if managing agencies are considering more authoritative management actions (e.g., making the use of lead ammunition illegal).

Limitations

Like all research, this work has limitations. First, our survey was directed only at deer hunters in the Zion area. While this was intentional to capture the largest big-game hunting group in the region, there are other hunters in the area that could introduce lead on the landscape, such as coyote or elk hunters. These groups should be included in future research, as they may have different behaviors, and communication strategies directed at them should be informed by their specific characteristics.

Second, this research was also performed during the COVID-19 pandemic, which had substantial impacts on supply chains worldwide. These external factors created a unique economic context that impacted ammunition availability. The percentage of hunters who were unable to purchase non-lead ammunition for their hunt in the Zion unit due to supply shortages was 22% for the 2017 hunt; this increased to over 46% for the 2021 hunt.

Third, while we did survey every deer hunter who had hunted within the Zion hunting unit from 2017–2021, only 27.2% responded. This is consistent with, if not slightly higher than, similar research using online surveys to assess hunters' behaviors. However, it is likely these data are only representative of hunters who actively use non-lead ammunition, are interested in the topic, or are willing to complete an online survey from the DWR and their university partner. We did compare the sociodemographic characteristics of our sample against those available in the DWR's license database and found some differences. Consequently, we cannot say these data and results are reflective of all deer hunters in the Zion region.

Conclusion

Many wildlife conservation behaviors can be described as "altruistic," since they benefit wildlife at the expense of the individual. This study has shown the use of non-lead ammunition amongst hunters in the Zion region of southwestern Utah is influenced by hunters' moral norms and stewardship identity as well as the core TPB constructs. Efforts to get more lead off the landscape through strategic communication efforts targeted at hunters holds the promise of hastening the slow, steady, recovery of the California condor

population. Through this research, we have provided recommendations for how wildlife managers can develop persuasive messaging grounded in both the enduring constructs of the TPB as well as the constructs of moral norms and stewardship identity.

Notes

1. Surveys, regardless of mode, have seen response rates consistently decline for decades (Groves, 2011; Stedman et al., 2019). Future researchers utilizing online surveys are encouraged to utilize best practices within the field to maximize the quality and representativeness of survey data (Wardropper et al., 2021).
2. Comparison with known demographic information from the DWR shows our sample is slightly older relative to all license holders in the area (mean age for sample = 49.7, mean age for population = 40.8). Our sample is also more likely to be male relative to all license holders in the area (sample = 88.3% male, population = 78.1% male) (Phil Gray, Wildlife License Coordinator, DWR, personal communication, 14 February 2022).

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Data availability statement

All data reported in this manuscript are publicly available and can be accessed by contacting the corresponding author.

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